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1  jBEAM Tutorial

What's new in this jBEAM-Help version (jBEAMHelp7.2.2)?

- Support of Complex values: e.g. new functions in **Formula Editor** and new calculation **Complex channel extractor**.
- **Turbocharger Map Matrix calculation**: speed ranges can be manually adjusted.
- **Quickview with Dual-Cursor**: new functions.
- Interactive table: **new column type** for controlled images/LEDs.
- Via context menu, **diagram settings** can be copied and pasted to several other diagrams.
- **Data Mining**: procedures for clustering, association analysis and prediction of chronological changes.

**jBEAM-Help** is divided mainly into two topic areas:

- the **Tutorial** with the topics **Basics**, **Usage** and **Examples** and
- the **Reference** with detailed functional descriptions, structured according to the jBEAM menus

### 1.1  jBEAM – Architecture

The software jBEAM is designed object oriented and consists of a producer - consumer structure. Used information is stored in a data item, events inform consumers regarding status changes.

![jBEAM Architecture Diagram](image-url)
Example: Data-Import

You have a file with measurement data. In this example it is a data file in diadem format. In jBEAM you create a new instance of the class diadem import. This class contains all the information concerning how a diadem file is read and how to produce data items in jBEAM. In example 2 the diadem importer generates data items of the type double channel that means channels in floating-point format. Thus the importer is a producer who "produces" data items.

As example for a data consumer we create a graphic object of type universal 2D graph. In this graph we define a "XY graph"-type chart whose input is now data item 1. The measured values from the diadem file are automatically drawn as a curve. The second data item can be shown in a second diagram of the type "XY" curve in the same graph, or a second graph is defined and the measured values are shown as diagram of the type XY-curve in this second graph.

Automatic Update

If the existing instance of the diadem importer is modified, a dialog box opens with parameters for import. One parameter is the file itself. If a different diadem file is chosen and confirmed, the following process proceeds:

1. The content of the new file is loaded and stored in data items. If the channel name or type fit, the existing data objects will be filled with new data.

2. The data items inform all their consumers (in this case the graphic objects) by event about the fact that the content has changed.

3. It is now up to the consumer to react to this information. In our case, the graphics provoke redrawing.

Therefore the user can always be sure, that the current visible status in jBEAM is correct without invoking any auto sequence.

Branches and Calculations

Now, if the read measurement channel is to be converted with a formula or if a FFT analysis is to be made, we define an instance of the class "Formula Editor". The formula itself is one of the parameters of the instance and can be entered in the editor.
Example: Data-Import with calculation

This calculation is now both, consumer as well as producer. It consumes the "Data Item 1" and produces the "Data Item 3". The automatic update also works in case the output file is exchanged:

1. The content of the new file is loaded and stored in data item 1 and 2. If channel name or type fit, the existing data objects will be filled with new data.
2. The data items inform all their consumers (both the calculation as well as the graphic objects) by event about the fact that the content has changed.
3. The calculation knows that the input data has changed, and executes the calculation with the new data. The data item 3 is now informing its components, in this case XY graph 1.
4. It is now up to the consumers to react to this information. In our case, the graphics provoke redrawing.

External CEA components

jBEAM is an ASAM-CEA compatible framework that can be extended with external plug-in components corresponding to the ASAM-CEA standard.
These external ASAM-CEA components work in jBEAM as if they were internal jBEAM components. Due to the fact that they are compiled, a maximum processing speed is reached. If you are interested in developing your own CEA components, please contact the AMS. Specific documents will be provided for you.

**Object - Architecture: Classes - Instances**

The object oriented software jBEAM allows intuitive operation. Nevertheless, there is a pitfall into which users consistently blunder, who do not know the correlation between classes and instances.

Referring to IT technology, each importer, each calculation, each graph corresponds to a class. This class includes all the logics that are important for these components. When creating e.g. a new calculation by means of the menu, an instance of this class is formed. This instance contains parameters that can be different in each instance. For example, five formula editors can be created. These are five different instances of the same class. Each of these five different formula editors can have different formulas or different input channels, which are stored in the different instances.

When choosing the formula editor via the menu, a new instance is created. The dialog box opens automatically and the instance can be parameterised there. If the user wants to modify the already defined formula editor again, he must call the list of existing instances via "Modify". Upon returning to the menu item "Formula Editor", a new formula editor (new instance) is created and the user is surprised that the parameterisation dialog is set to the initial settings and all of his entries are gone.

Thus, if an existing component has to be changed, you have to go to the list of existing instances via "Modify".

### 1.2 jBEAM-specific File Formats

jBEAM uses different file formats to store the information needed for the respective application.

**jBEAM Project File (*.jbeam, *.jbs)**

A project file contains all relevant information needed to reopen the project. This includes imported data, calculations and graphics. Videos only are stored separately due to their file size. Thus, only one file has to be transmitted to inspect or process the results in another place.

After reopening a jBEAM project file, all components are reloaded as objects as if each component parameter had been changed. The inherent automatism updates the whole system.

In a project file complete analyses can be stored. When reopening a project where the imported data of an import component has changed meanwhile, the analysis is completely executed with the new data.

Each import component remembers the date of the last modification of the imported data. While the project file is loaded, the date of the last modification is checked automatically. If the file has a newer date than the stored date, the user is asked whether the data shall be updated.
jBEAM Project Template (*.jbt)
In a jBEAM project template are stored, similarly to the project file, all information necessary to reopen the project, such as graphics and calculations. However, the template does not store file references or data of importers.

jBEAM Layout File (*.blf)
In a jBEAM layout file, complete graphic pages (e.g. for protocols) are stored in XML format (exported). The resulting layout files can be viewed with any XML viewer, such as Windows Internet Explorer.

A jBEAM layout file is created via menu File→Export Layout→XML (jBEAM). There are two kinds of layout exports: layout files (*.blf - also templates or main layouts) and sublayout files (*.slf - also graphic template). A stored jBEAM layout file can be inserted in another project via menu File→Import Layout→XML (jBEAM).

A jBEAM layout file is used to store the graphic aspects of a jBEAM project. This includes:

- window arrangement
- printer information
- all graphic elements of the exported windows
- graphic data (images, graphic object generators)

jBEAM layout files are used e.g. for report generation where usually a data record is displayed via layout template.

jBEAM Graphic Template (*.slf - Sublayout File)
A jBEAM graphic template (formerly sublayout) contains definitions of graphic elements (e.g. tables, diagrams, logos), but no information about pages or windows. It is stored in XML format with the extension *.slf (SubLayout File).

Graphic templates are used to store graphic elements which are frequently used in several projects with certain settings and arrangements. Thus, templates for headers and footers or an impressum with predefined texts and logos can be created once and made available to all employees of a company.

The graphic templates can be assigned to different categories and inserted in the graphic window via menu Extra→General Services→Template Manager. They can also be inserted by Drag&Drop from the Windows Explorer into the graphic window.

jBEAM Component Template (*.ctf)
Component templates are used to store and summarize in one file calculations, groups of calculations or calculation chains, as well as graphic objects, which are used in several projects with certain settings. They can be used, for instance, to reapply even complex calculations and representations easily or to display only certain result values of long calculation chains. The component templates are stored in XML format with the extension *.ctf (Component Template Format).
Component templates can be assigned to different categories and inserted in the graphic window via menu Extra→General Services→Template Manager. They can also be inserted by Drag&Drop from the Windows Explorer into the jBEAM window.

**jBEAM Graphic File (*.bge)**

In a jBEAM graphic file graphic elements are stored in binary format. A graphic file can be inserted by Copy&Paste or by Drag&Drop from the Windows Explorer into the graphic window. Imported graphic files create a new graphic element with the same parameters as the original. Even data object references are restored if possible. Files in BGE format can form a library for parameterized graphic elements.

**jBEAM Level File (*.jbSOL – Set Of Levels)**

For diagrams with isolines, such as Engine Map Diagramm, individual Sets of Isolines can be defined. The settings can be stored and reloaded via level file.

**jBEAM Selection File (*.jbsel)**

The settings of the View Selection Manager can be stored and reloaded via selection files.

1.3 Using jBEAM

After a successfully installing and opening jBEAM the following user interface appears. In the standard display the menu bar and the three main windows Spreadsheet, Explorer and Graphic as well as the Toolbox for a fast access to functions are displayed. As from jBEAM version 7 the handling of the windows is significantly changed.
Organization of the jBEAM user interface:

The **Menu Bar** is used to organize and process data.

Data objects and their data content are displayed in the **Spreadsheet**. Information on the data and the different types of contents is displayed in the tabs.

All defined components are shown in the tree structure in the **Explorer**.

The **Graphic window** is used for displaying all visual depictions. There are three independent Graphic windows.

### 1.3.1 Menu Bar

![Menu Bar Image](image)

The menu bar has been restructured in jBEAM7. Now all main menu items have symbols. In the **Graph Editor** menu, the former menu item **Text & Tables** has been splitted into separate menu items **Text Elements** and **Tables**. The **3D-Axis Charts** have been united with the **2D-Axis Charts** to the menu item **2D/3D-Axis Charts**. On the one hand, all 2D-graphs which have diagrams included in the Universal-2D-Graph have been removed, and on the other hand, only the 3D-OpenGL-Graph of the 3D-graphs is supported anymore.

The menus can be adapted individually via the **Preferences**, as well as the toolbars (Standard and Graphic) and the Toolbox.

There are two toolbars, the **Standard** toolbar (top or left side of window) and **Graphics** toolbar (bottom or right side of window). The toolbars can also be dragged into a separate window.

**Standard toolbar**

- Creates a **new jBEAM project** (Ctrl+N).
- **Opens a jBEAM project** from the filesystem (Ctrl+O).
- **Saves** all jBEAM data into an existent binary file (Ctrl+S).
- Import of multiple files as **data sources**.
All file/URL based import components reload data.

**Printer Setup.**

**Print** contents of graphic windows (**Ctrl+P**).

**Undo** (**Ctrl+Z**): The last action that can be undone is displayed.

**Redo** (**Ctrl+Y**): The last action that can be redone is displayed.

**Cut**: Copies active graphic objects to clipboard and deletes them (**Ctrl+X**).

**Copy** active graphic objects or spreadsheet content to clipboard (**Ctrl+C**).

**Paste** clipboard as new graph (**Ctrl+V**).

**jBEAM Help** (**F1**): Information about the software (start page). Click any topic in directory tree.

Context sensitive help. Click and move mouse on item (**Shift+F1**). If the clicked item (graphic object, window) has a help topic attached, this is directly displayed. Otherwise the start page appears.

Synchronize selection in Spreadsheet and Explorer window (inactive / active). Active: The data object selected in the Spreadsheet is simultaneously selected in the Explorer, and vice versa.

Sets default size and position of the windows.

Limits the default display to the Spreadsheet, Explorer and the Graphic Window.

Limits the default display to the Graphic Window.

Graphic frames are stacked.

Activates the draw of the ruler.

Change the unit of the ruler: Switches between centimetres (cm) and inches (inch).

Activates the draw of the page borders (inactive / active).

Activates the draw of the page grid (inactive / active).

Shows the document in actual size (inactive / active).

Zooms the document to display a complete page in the window (inactive / active).

Zooms the document that the page width is adapted to the window width (inactive / active).

Exit the jBEAM program (**Ctrl+Q**).

**Graphics toolbar**

[Image of toolbar]

Mark Objects.
Creates a Line: Draw start and end point of the line with the mouse in the graphic window.

Creates a Rectangle: Span a rectangle with the mouse in the graphic window.

Creates a Circle: Span a rectangle as border of the circle or ellipse with the mouse in the graphic window.

Creates a Speechbox: Span a rectangle as border of the Speechbox with the mouse in the graphic window.

Creates a textbox with plain multiline text: Span a rectangle for the textbox with the mouse in the graphic window.

Quick-Finder-Button Line curve: Span a rectangle for the Line curve with the mouse in the graphic window. The dialog for configuration of the diagram opens. If a data object has been selected beforehand in the Explorer, this data object is preselected in the dialog.

Quick-Finder-Button Bar Chart curve: Span a rectangle for the Bar Chart curve with the mouse in the graphic window. The dialog for configuration of the diagram opens. If a data object has been selected beforehand in the Explorer, this data object is preselected in the dialog.

Quick-Finder-Button Box Whisker curve: Span a rectangle for the Box Whisker curve with the mouse in the graphic window. The dialog for configuration of the diagram opens. If a data object has been selected beforehand in the Explorer, this data object is preselected in the dialog.

Quick-Finder-Button Bubble Chart curve: Span a rectangle for the Bubble Chart curve with the mouse in the graphic window. The dialog for configuration of the diagram opens. If a data object has been selected beforehand in the Explorer, this data object is preselected in the dialog.

Quick-Finder-Button Engine Map curve: Span a rectangle for the Engine Map curve with the mouse in the graphic window. The dialog for configuration of the diagram opens. If a data object has been selected beforehand in the Explorer, this data object is preselected in the dialog.

Quick-Finder-Button Engine Map curve with Contour Areas: Span a rectangle for the Engine Map curve with Contour Areas with the mouse in the graphic window. The dialog for configuration of the diagram opens. If a data object has been selected beforehand in the Explorer, this data object is preselected in the dialog.

Quick-Finder-Button 3D-Surface Chart curve: Span a rectangle for the 3D-Surface Chart curve with the mouse in the graphic window. The dialog for configuration of the diagram opens.

Quick-Finder-Button Legend As Table: Span a rectangle for the Line curve with the mouse in the graphic window. The dialog for configuration of the diagram opens. The nearest suitable graphic object is automatically preselected in the dialog. The graphic object can be selected via selection list. The currently selected graphic object is highlighted in the graphic window.
1.3.2 Spreadsheet

The Spreadsheet displays data objects and their content in charts. Numerical values and properties of numerical data objects are by default displayed in columns.

The Spreadsheet shows all data in 5 distinct charts.

Components: Shows the utilized components with additional parameters.
Maps: Shows semantic data in maps (key-value-objects), each object possesses 2 columns.
Values: Single value objects, one line is used for one object.
Channels: One dimensional objects, one column (rotate: one line) per object. The channel view can be toggled between the display of values and statistical data.
Matrices: One table per object.

The data object’s name and sometimes metadata are visible in the individual column header. Double clicking the column header (or row header in case of Values) calls the modification dialog of the respective producer (importer, calculation,...).
Tab Components

All utilized components are shown in this list and can be filtered by specific criteria. After applying a filter only those components whose name contains the stated string are displayed in the Spreadsheet.

Columns and rows can be rotated.

Toolbar:

**All** Shows all nodes. The filters defined in the filter configuration dialog are not applied.

**filtered** Shows filtered nodes only. The filters defined in the filter configuration dialog are applied.

Changes the filter configuration. The dialog Explorer Tree Filter Configuration opens.

Rotates the display of the properties. By default, each column represents a component. With rotated display, the properties of a component are displayed in a row.

Tab Maps

This tab shows semantic data in maps with a key value combination.
Tab Values

This tab displays the name, value, Unit and data type of all single value objects.

Tab Channels

Each column (respective row, if rotated) shows a one dimensional object. The order of the displayed channels can be changed (in unfiltered display only) by clicking a channel and dragging it to a new position.

Either all or only the filtered channels can be displayed. Criteria for filtering are defined in the Dataobject Filter which is opened by clicking the Filter button.

Columns and rows can be rotated.

The channel view can be toggled between the display of values and statistical data.
Toolbar:

- **Bold / italic style**
- **Scientific format**
- **Increases / decreases number of decimal digits.**
- **Changes the format to the next available format. Holding the Shift key reversed the direction.**
- **Align to left / center / right**
- **Shows / hides the channel unit in the column header.**
- **Switches the display mode of the producer in the column header. The modes are: Automatic (as defined in Preferences) – Producer (producer name always displayes) - Import Description (file name is displayed).**
- **All** Shows all channels. The filters defined in the filter configuration dialog are NOT applied.
- **filtered** Shows filtered nodes only. The filters defined in the filter configuration dialog are applied.
- **Changes the filter configuration. The Dataobject Filter dialog opens.**
- **Rotates the display of values / properties. By default, each column represents a channel. With rotated display, the values /properties of a channel are displayed in a row.**
**Tab Matrices**

In the tab Matrices the matrices of the project can be selected in the combo box. The input field next to the combo box defines the level of the matrix. The name of the selected level is displayed in the field below. If the matrix contains errors, a respective note is displayed below. Additional statistical values are displayed for every level:

- **min/max**: Minimum and maximum value of the level of the matrix.
- **N**: Number of values, as well horizontal (→), vertical (↓) as also levels (↑).
- **Xo**: Starting point.
- **ΔX (DeltaX)**: Difference between the values.

Increases / decreases number of decimal digits.

A double click on the column header opens the dialog box for modifications of the corresponding producer (e.g. importer, calculation).

In case that the chart is larger than the window a horizontal and vertical scroll bar appears that facilitates the navigation in the chart. The column size can be changed by using the mouse.

The matrix view can be toggled between the display of values and statistical data.
1.3.3 Explorer

All defined components and their internal data structure are shown in the tree structure in the Explorer. When a component is selected a preview appears in the Data-object Preview. Components are, among others, Producers and their data objects as well as their consumers. Small icons in front of the components represent the kind of object (e.g. graphic).

_toolbar:

- **P** = Producer view: Shows result items of components in all tree levels.
- **C** = Consumer view: Shows input items of components in all tree levels.

If neither the option P nor the option C is selected, only the result items of components in the tree level 1 (e.g., the producer list) are shown. See also Overview of Producer and Consumer Views.

The filter input field can be used to filter for certain objects. The Text Filter Type can be selected via Explorer toolbar configuration. With mode Plain Text all objects are displayed which contain the entered string. Several filter criteria are divided by semicolons.
Sort in ascending alphabetical order
Sort in descending alphabetical order
Sort by component or item type
Sort in manually defined order (reorder nodes via drag & drop and save this manual order)
Save the current node order as manual defined order

All
Shows all nodes. The filters defined in the filter configuration dialog are not applied.
filtered
Shows filtered nodes only. The filters defined in the filter configuration dialog are applied.

Changes the filter configuration. The dialog Explorer Tree Filter Configuration opens.
Changes the explorer frame configuration. The dialog Explorer tool bar configuration opens.

Producerlist
The first list shows all current data object producers. These might be importer, database or calculation components.

Data objects (=response) produced by their corresponding Producers are displayed on the second level.
On the third level, there are the data objects’ consumers (components that are used by the corresponding data object). Calculations as well as graphic elements can be consumers. If a calculation is the consumer of a data object, this calculation will additionally appear as a producer on the first level.

CEA-Services
All available data objects on the jBEAM data bus are listed.

Items on CEA-Bus
All data objects available on the jBEAM data bus (CEA-bus) are listed. On the second level dependent consumers such as calculations and graphic elements are displayed.

Desktop
All open Graphic windows (1..3) are listed in the first level. The second level shows header and footer areas as well as all graphic elements of the respective window when canvas mode is active. In case of activated page view, the generated pages are shown with their contained graphic elements listed in the third level.
The order of the pages can be changed directly in the project tree of the Explorer window via Drag&Drop. Even several pages can be selected and shifted simultaneously.

The new order is automatically adopted in the actual order of the pages in the project. Automatic page numbering is updated accordingly.

Via context menu, the settings or base properties of graphic elements can be directly modified. Graphic elements can also be displayed, i.e. highlighted, in the graphic window.

Diagrams, axes and cursors are displayed in the tree as subcomponents of the Universal-2D-Graph.

Thus axis properties can be copied from one diagram to several other diagrams in a single operation.

The context menus of the individual graphic elements are mainly similar to the context menus of the same elements in the graphic window.

When several graphic elements are selected, the context menu shows only entries which apply to all marked elements.

Filtered List

The user can filter the data objects currently available in jBEAM depending on different criteria. The filtered list only contains the data objects that agree with the defined conditions. The filter supports the check for letter combinations as well as formulas which get a Boolean value. It is possible to combine several filter conditions, e.g. Data item name contains and Formula.

If there is no active filter, next to the available data objects on the bus, all command items are displayed as well.

The Dataobject Filter is called by clicking the Modify button.
**Data-object Preview**

This window displays the selected data objects from the directory tree (left) as a preview. The data objects cannot be dragged from the preview into the graphic window.

**General**

Data objects can be placed into the Graphic window via Drag & Drop. A graphic element for visually representing the data object is automatically generated. Some graphic elements also support Drag & Drop. Thus, a numeric data object can be dragged into a Cartesian line chart where it will be displayed as a new curve.

Producers or even the whole Producerlist can be dragged into the Graphic window via Drag & Drop. All contained data objects will then be displayed in correspondent graphics. Similar data objects are depicted in a common graphic object. If there are many data objects, they will be divided into several data objects if necessary. A Universal 2D-Graph, for example, will take up to 9 curves automatically. Manually, any number of curves can be added. In case of videos and their associated numeric data the appropriate video player and shortcuts are automatically set.

Selected components can be modified by clicking the buttons or deleted, if they haven’t been used so far.

**Modify:** The modification dialog box for the selected components is opened.

**Delete:** If a data object of a selected component possesses no consumer, the component can be deleted.

**Duplicate:** A copy of the selected component is created and the dialog box for modifications is opened.

**Update:** The Explorer is automatically updated when adding or deleting data objects. Manually updating the Explorer is also possible.

If the list of components is larger than the Explorer window, a horizontal and vertical scroll bar for navigation appears. The display of the levels of the tree structure can be changed by clicking + or -. 
Context Menu

The functions **Modify**, **Copy**, **Duplicate** and **Delete** can also be called upon right-click via the context menu. Depending on the selected component or components the context menu displays further menu entries:

**Rename**: The component’s list entry changes to an input field where the component name can be edited.

**Save as subproject**: Opens the dialog box for saving the project. The selected component/components are either saved as jBEAM project file or jBEAM project template. All selected components are saved in a jBEAM project file, i.e. importer, generators, calculations etc.

**Context menu of components:**

<table>
<thead>
<tr>
<th>Function</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rename</td>
<td>F2</td>
</tr>
<tr>
<td>Modify</td>
<td>Alt+Eingabe</td>
</tr>
<tr>
<td>Copy</td>
<td>Strg+C</td>
</tr>
<tr>
<td>Duplicate</td>
<td></td>
</tr>
<tr>
<td>Save as subproject ...</td>
<td></td>
</tr>
<tr>
<td>Copy name</td>
<td></td>
</tr>
<tr>
<td>Group components</td>
<td></td>
</tr>
<tr>
<td>Replace Data ...</td>
<td></td>
</tr>
<tr>
<td>Save as component template</td>
<td></td>
</tr>
<tr>
<td>Delete</td>
<td>Löschen</td>
</tr>
</tbody>
</table>

**Context menu of data objects:**

<table>
<thead>
<tr>
<th>Function</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select graph by data object</td>
<td>Strg-Umschalt+G</td>
</tr>
<tr>
<td>Modify</td>
<td>Alt+Eingabe</td>
</tr>
<tr>
<td>Copy name</td>
<td></td>
</tr>
<tr>
<td>Group channels...</td>
<td></td>
</tr>
<tr>
<td>Open Quick View</td>
<td></td>
</tr>
</tbody>
</table>

**Select graph by data object**: All graphic elements are searched that use the selected data object. The dialog box **Select Graph by Data Object** opens.

**Show in graphic window**: The selected graphic component is highlighted in the graphic window. If necessary, the display changes to the respective window/page.

**Copy name**: The name of the selected component is copied as text.

**Group components**: Several selected components (calculations, graphic objects) can be summarized to a group of components. The dialog **Grouping of Calculations/Graphics** opens which can also be reached via menu **Math→Conversions→Grouping of Calculations/Graphics**. Components that are not selected but dependent on other components to be be grouped (e.g. parts of a calculation chain) are also grouped. If only the first and last calculations of a calculation chain are selected, all other calculations of the chain are also grouped.

**Dissolve component group**: The selected group of components is dissolved and the original components are individually listed, i.e. calculations under **Producerlist** and graphic objects under **Desktop**.

**Group values / channels / matrices / maps**: Several selected single values / channels / matrices (2D) or maps can be summarized to a group of values / channels/ matrices / maps. The dialog **Grouping data objects/Graphics** opens which can also be reached via menu **Math→Conversions→Grouping data objects**. The type of group is already set to the respective type and the selected data items are predefined in the dialog. There, further settings can be done.
Replace Data: Input data of the selected components can be replaced in the dialog Input Replace that opens. The dialog can also be reached via menu Graph Editor→Replace Data.

Save as component template: The selected group of components or individual calculation is saved as component template. If it is stored in a folder that is specified as template folder in the Preferences it can later be used in other projects via Template Manager.

Dissolve component template: A component template that has been previously saved or inserted via Template Manager can be dissolved.

Reload component template(s): The selected component template is reloaded from its storage location.

Explorer Tree Filter Configuration

Data item filters

Data item name contains: Only the data items are listed the names of which contain the defined string. Several strings can be defined, separated by semicolons (for Plain text filter only). If
the option **Case sensitive** is activated, only the names with the string in exact upper and lower cases are listed.

**Text filter type:** Text filter type of the text typed into the tool bar search text field.

**Data item type:** The following groups of data object types as well as all individual types can be selected:

- All numeric types
- All numeric values
- All numeric channels
- All numeric matrices
- All numeric 2d matrices
- All numeric 3d matrices
- All numeric reference items
- All event objects

**Formula:** The formula can be edited manually or by means of the Formula Editor. It should yield a Boolean result and not contain an '@' at the beginning and the end. The variable "CurrDataItem" refers to the data items in the formula. Sample: "Max(CurrDataItem) > 15"

**Show unused data items only, i.e., data items that are not consumed by a component**

**Show data items with errors only**

**Component filters**

**Apply component filters to:** Producers or Consumers of filtered data items.

If at least one item and one component filter is activated, one can choose whether the component filters should be applied to a producer or consumer of a filtered data item.

Example: The data item name should contain "Dat" and Component name should contain "Formula". If "Producers" is selected, all data items are found whose name contains "Dat" and whose producer component name contains "Formula". In contrast, if "Consumers" is selected, all data items are found whose name contains "Dat" and one of the consumer names contains "Formula".

**Component name contains:** Only the components are listed the names of which contain the defined string. Several strings can be defined, separated by semicolons (for Plain text filter only). If the option **Case sensitive** is activated, only the names with the string in exact upper and lower cases are listed.

**Component type:** The following groups of component types as well as all individual types can be selected:

- All calculations
- All data bases
- All generators
• All importers
• All measurement modules
• All sequences
• All service producers
• All transport modules
• All trigger modules
• All workers

**Formula:** The formula can be edited manually or by means of the **Formula Editor**. It should yield a Boolean result and not contain an '@' at the beginning and the end. The variable "CurrComponent" refers to the components in the formula. Sample: "PropValue(CurrComponent, "PropertyName")"

**Formula Editor:** The **Embedded Formula Editor** is opened via this button.

**OK:** The list of displayed elements is filtered according to the defined options and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

 deste button. The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Explorer tool bar configuration**

**Text filter type:** Defines the Text filter type of the text typed into the tool bar search text field. **Plain text:** The search text is exactly contained in the found result.
**Example: Dat** matches *DatGen* and *SecondDatGen*

**Wildcard text (?, *):** In addition to Plain text, ? specifies an arbitrary character and * specifies a number of characters. In order to find a string exactly at the beginning or end of the search text, the expressions "xyz* or *xyz" can be used.

**Example: D?t or D*G** matches *DatGen* and *DtGen*; "Dat" matches *DatGen* but not *SecondDatGen*

**Regular expression:** Flexible specification of search text. Selected regular expression constructs:

**Character classes**
- **x** Matches character x
- **[abc]** Matches characters a, b, or c
- **[^abc]** Matches all characters except a, b, or c
- **[a-zA-Z]** Matches all characters a through z or A through Z
- **[a-z&[def]]** Matches characters d, e, or f (intersection)
- **.** Matches any character
- **\d** Matches a digit [0-9]
- **\D** Matches a NON-digit [^0-9]
- **\s** Matches a whitespace character
- **\w** Matches a word character [a-zA-Z_0-9]
- **\** Escape character for matching special characters, such as *, ?, ( or )

**Quantifiers and logical operators**
- **X?** X exists once or not at all (X is a character or a character class)
- **X*** X exists zero or more times
- **X+** X exists one or more times
- **X{m}** X exists at least m times but not more than m times
- **XY** X followed by Y
- **X|Y** Either X or Y
- **(X)** Grouping of X

**Example: D[ab]tGen~?\d* matches DatGen, DbtGen~1, or DatGen12 among others, but not DatG or DatGen12x.**

A comprehensive explanation of the customary syntax for regular expressions can be found here: [https://docs.oracle.com/javase/tutorial/essential/regex/index.html](https://docs.oracle.com/javase/tutorial/essential/regex/index.html)

**Case sensitive:** If activated, only the names with the string in exact upper and lower cases are listed.

**Number of expanded search results:** Maximum number of search results that are expanded in the explorer tree. All search results are listed in the search result node Filtered list.
**Maximum search depth:** Maximum search depth of the textual search. The depth of a component in the producer list or a visual component in a page is defined to be 1. The search depth of an input or result item of such a component is 2, etc.

**Number of search results:** Maximum number of search results that are displayed.

**Delay of search after filter change:** Defines a delay time between an input of a filter condition and start of the search. The explorer tree is only updated if the filter condition is not changed within the stated delay. A delay of 0 ms means that the explorer tree is updated on each filter change. This option is useful for large jBEAM projects with long-running explorer tree searches. For example, the delay is set to 200 ms. When the filter text "abc" is entered the explorer tree search starts 200 ms after 'c' is typed, as long as the duration between the input of 'a', 'b', and 'c' is lower than 200 ms.

**Show command and action items as input and result items of components:** If this option is activated, command and action items (e.g. generated by services or control elements) are displayed in the list.

**Show maps as input and result items:** If this option is activated, map (e.g. of importers) are displayed as data objects in the list.

**Expand new producer components:** As soon as a new producer is generated, the list with its data items is shown at once.

**Update data object preview during measurement:** Optionally, the preview images of data items can be refreshed permanently during measurement. In case of data intensive measurements this may cause delays in the display. Then, this option should be deactivated. The preview shows a sand-glass symbol. As soon as the measurement is terminated, the preview image is refreshed automatically.

### 1.3.4 Graphic Window

The Graphic Window is used for the display of the graphic objects. These graphic objects are arranged page-oriented. jBEAM comprises three independent Graphic windows. Each window can consist of several (printed) pages.

Rulers, grids (yellow) and page limits (green) help to layout the page and can be activated/deactivated via symbols in the tool bar. If the graphic mode **Editable** is deactivated, rulers, grids and page limits are automatically hidden. The unit for the rulers and grids can be switched from centimetre to inch or vice versa.

The Graphic window can be displayed in different views (33 – 400 %), ruler and graphic elements will then be accordingly rescaled.

Printing the Graphic window’s content is carried out in high-resolution and without the window’s grid, so as to get top quality print-outs. The graphic pages can also be exported by using the **Export Report** function. Available formats are for example SVG-File, PDF document, Word document, PowerPoint presentation or HTML-File.

Single graphic objects can be pasted directly into other applications like Word or PowerPoint by Drag & Drop.
The Graphic window’s visible content is shown on a white background, non-visible on a grey background. The visible content is page-oriented, that means it is displayed on a whole multiple of a printed page. The printed page’s size and orientation is defined in the menu item Printer Setup.

1.3.5 Handling of windows

The arrangement of the windows can be individually adapted. For a fast setting of standard displays the following symbols of the toolbar can be used:

- Display and arrangement of the windows are set to default, i.e. Spreadshee, Explorer, Graphic Window and Toolbox are displayed.

- Display and arrangement of the windows are limited to Spreadshee, Explorer and Graphic Window.
- Only the Graphic Window is displayed.
- All Graphic Windows are displayed overlapping.

The size of the windows can be adjusted manually by shifting the horizontal and vertical slider bars. The other windows are then automatically adjusted so that they do not overlap.

The upper right corner of each window contains the following symbols that change the arrangement of the windows:
- This window is moved to a **new jBEAM window**.
- This (separate) window is moved to its previous frame.
- This window is maximized.
- This window is reset to its previous size.
- This window is closed.

The individual windows can be shifted within the jBEAM window via Drag&Drop. For this, the window header is clicked with the left mouse button and the window dragged to the new position in the jBEAM window with the mouse button pressed. Depending on the mouse position the current arrangement of the window is indicated by a highlighted rectangle. The arrangement and size of the other windows is adjusted accordingly.
If a window is dragged completely on top of another window, both windows are displayed in a shared window separated in individual tabs.

If a window is dragged outside of the jBEAM window, it is displayed in a separate new jBEAM window.

New jBEAM window

The relocation of individual windows in a new jBEAM window offers more flexibility for the arrangement of windows, whether on one monitor or spread over several monitors. There are different ways to relocate windows:

1. Via the symbol in the upper right corner.
2. Via the menu item Extract of the context menu which opens via right-click in the window header.
3. Via Drag&Drop: Left-click into the window header and drag the window to a position outside of the existing jBEAM window. As soon as the mouse button is released, a new jBEAM window is created at the mouse position.
Not only the three main windows can be relocated to separate jBEAM windows but also other windows such as Toolbox or Blockdiagram. An individual jBEAM window can be created for each of three (resp. four) graphic windows as well as for the respective headers and footers.

Several windows can be dragged into one external jBEAM window and arranged within this window as in the main window via Drag&Drop.

A relocated window can be placed within the main window again by Drag&Drop. For this, click into the header of the part window but not the header of the jBEAM window. This only shifts the jBEAM window as a whole but does not integrate it in the main window.

Alternatively, the relocated window can be placed within its previous window by is moved to its previous frame via the symbol in the upper right corner.

If a symbol of the standard display settings is clicked in the toolbar, all relocated windows are integrated in the main window or closed automatically.
1.4 Examples

1.4.1 Creating a Channel

jBEAM is open but empty. As an easy example, we can choose creating a channel. For that purpose, the following path is selected:

**Extra→Generators→Numeric Channel**

Then the Generator’s parameter dialog box opens. The Generator can be named and the type of data can be set by using the given functions (e.g. sine). The user chooses the number of values, the initial value of \( x \) (Offset \( X \)), the values’ distance (Delta \( X \)) and if need be the unit. Further settings are the determination of the Datatype and the choice of Storage.

In this example, the default settings were used unchanged.
As soon as the channel is generated, the data is shown in the Spreadsheet tab Channels.

The newly generated data object (DblChan) is also listed in the Explorer. If the object is selected, its preview is shown on the right side of the Explorer.

To display the data object in the Graphic window, DblChan only needs to be clicked on and dragged into the Graphic window.
The data can be further processed e.g. via arithmetic calculations with the formula editor (menu item: \texttt{Math→Arithmetic→Formula Editor for numeric Channels (Line by Line)}).

In the dialog of the Formula Editor the relevant data objects can be selected under \textbf{Input Data}. They are assigned to the variables \texttt{A} to \texttt{J}.

The calculation specification that is to be used on the data object(s) is defined in the Formula line.

The Functions tab offers well-established functions for calculating.

The generated formula is added to the Spreadsheet and the Explorer.

Upon dragging \textbf{Formula} from the Producerlist (Explorer) into the Graphic window on the already existing diagram, both graphs will appear in the same coordinate system.

Otherwise \textbf{Formula} will be displayed separately.
The Blockdiagram is invoked when choosing the menu item

Windows → Blockdiagram.

In this diagram components are displayed in blocks. The user gets an overview of the data's relations. The colors provide information on the type of the depicted elements. More information about this can be found in the Reference.

1.4.1.1 Changing data

If need arises to change settings (because of unfitting configurations, altered calculation specifications or the like), it is no problem at all to do some adjustments. Settings can be changed.

To change the settings of the generated channel, simply right-click on DblChan in the Explorer. Choose Modify and the generator's parameter dialog box opens. The settings defined earlier can be changed now.
Double clicking **DblChan** in the Spreadsheet’s header also opens the generator’s dialog box.

Changing the **Formula** works in the same way: Right-click **Formula** in the Explorer and choose **Modify**. Then the **Formula Editor** opens again with the already existing settings which can be adjusted now.

For changing the graph right-click the graphic representation and choose **Modify**. The graphic object’s editor opens. The editor can also be opened by double clicking the graph.

As can be seen in the example of the **Universal 2D-Graph** there are various possibilities for working on the graph. Elements can be deleted, the visual representation altered, filters set and axes adjusted.

For more information on the functions see **Reference**.
1.4.2 Importing Data to jBeam

For the second example already existing data will be imported to jBEAM. As sample data we use ASCII data.

1. A new ASCII importer function is defined via File→Import Values→ASCII

The corresponding dialog box for configurations is opened.
2. The data that are to be imported are chosen in the configuration dialog box. At the same time a name can be allotted to the import (default = <name of the imported file>).
3. In the next tab the separation character is determined as well as the line in which the values start (in this example: tab, line 8).

4. Then the header is defined. In this example, we take the data object’s **name** from line 3, the **date** from line 1 and **Delta X** from line 2. Information can also be entered manually on the left
side. Manually entered values can be adopted for all channels or entered for each channel individually.

5. In the last tab the columns’ data types are defined. jBEAM suggests a data type on the basis of the detected data but the data type can also be altered manually. By clicking on a column a specific channel is activated and the type selected in the drop-down menu **Channel Status** can
be changed. In this example the data is unambiguous so that the data type is determined correctly.

After setting all parameters correctly the data can be imported from the file by selecting **Open**.
1.4.3 Video

jBEAM cannot only play videos, but has also a lot of application-specific features that allow a wide range of video applications.

Video Sources

There are a number of video formats. jBEAM uses the technology DSJ (DirectShow for Java) on Windows machines. It supports all video codecs which are defined in the Windows operating system. The Java video technology is supported by all operating systems but is technically limited and supports just a few video codes.

In addition to the "real" video files, other techniques may also be used as a video:

1. Animated GIFs - an image format that has internally stored multiple images.
2. A sequence of images in a folder with images having the same size.

The videos can either be controlled by a time controller, which is integrated in the player or by an external time object.

Synchronization

In many use cases, video recordings should be played synchronously with other videos or measurement data. For this, the videos have to be synchronized. Therefore, the index of every image in the video has to be convertible into a time or vice versa. The first problem is that the videos with slow motion images contain a wrong image rate and a wrong offset time. This is done in order to play the slow-motion images with the Windows Mediaplayer. A video with 1000 images per second receives the information 25 images per second for slow playback. For a synchronous display this is of course a hindrance.

Therefore, the jBEAM video importer allows the setting of a new image rate as parameter for each imported film, as well as the definition of a certain image as the "zero image". Now every image can be accessed properly.

Video Presentation

The presentation of multiple videos via one player should allow the playback of all videos synchronously. For this every player can have either an own time controller or an external time signal is provided. In figure 1 player 1 generates a time object and provides it with the actual time of the currently played image. This time object is the input item of player 2 and synchronizes itself to it. With this technique, the first player controls all the other players. The time object can also be displayed as the time in the graphic element "Digital display". Another common application is to control an axis cursor (which defines a point in a time diagram) with this time signal.
Due to the flexible producer consumer structure, quite different structures can be built:

1. The axis cursor generates a time object, which controls all existing players. The user can now move the axis cursor via mouse and is automatically provided with the appropriate image from the movies.

2. A graphic element "time generator" can be defined (see figure 2). On the graphical interface, the user can click on a variety of fields like "Forward", "Backward", "One step forward", "To the end" and so on.

All videos can be displayed with the aid of the graphic element "Video Player". The dynamic images have an own object of representation, "Dynamic Images".

**Video Images with Time Stamps**

In addition to the numerical data, more and more experiments are recorded as video today. However, it is difficult to integrate these videos into a printed or PDF test report. For this a list of video images with time stamp can be created in jBEAM.

This list can be represented as diagram with time-based measurements in the universal 2D graph. Every image from the list is displayed at the top of the graph. On the left side there is a vertical line which corresponds to the associated time.
1.4.4 The Usage of Control Events

By using the calculation **Append Values (Input Values)** the usage of controlling events (action events) is demonstrated.

To simulate an alterable input value the graphic object **Slider** is used. A measurement channel or another data object could be utilised as well.
A distinct name should be entered in the input box **Name** in order to facilitate the selection of the input data object.

The next step is the creation of different buttons via the graphic object **Button** that represent the control events.

One button gets the name **New Value** and the assigned action is **START** which is selected from the list of predefined action labels. Two more buttons are created: one with the name **Delete**
Last and the action DELETE LAST and one with the name Delete All and the action CLEAR. The following image shows the created graphic object in the Graphic window.

![Slider graphic object](image)

Now, the calculation Append Values (Input Values) is called. The calculation receives the slider value as input data object. The control events are allocated via the combo box according to their functions. The predefined name of the result channel Slider-V-V can be changed manually.

![Append Values to Channel dialog](image)

This results into the generation of the channel Slider-V-V. When clicking the button New Value the value currently set in the slider is appended to the channel. When clicking the button Delete Last the last appended value is deleted, the button Delete All deletes all values of the channel.

### 1.4.5 Depiction of a Frequency Spectrum with Adjustable Bandpass

The following example uses the data source manager for loading recorded measured data from several BEAM files. A frequency spectrum is calculated and displayed in the diagramme. A bandpass filter can be set on the input signals via slider. In this case the spectrum is immediately adjusted.

At first, the data source manager is opened:
In the combo box **Data Formats** the format BEAM is selected and **Load file(s)** is clicked on.

The importer for **BEAM files** opens.
The desired files are selected and settings may be determined in the tabs **Value-File Option** and **Channel Names** if necessary. A condition for multiple file selection is the same structure of the files as the first selected file determines the possible settings of the following tabs. The selected files are displayed in the data source manager and the import dialog closes upon clicking **Open** in the tab **Channel Names**.

The settings can be modified as desired. By clicking **OK** they are imported into the data source. A group of channels is generated that will be displayed in the **Spreadsheet tab Matrices**.
Next, two sliders are generated that will be used later on for the setting of the upper and lower limit frequency of the bandpass filter. The dialog for creating the slider is reached via the menu item Graph Editor→Controls→Slider.

A distinct name should be entered in the input box Name in order to easily recognise the slider for later usage. A second slider is created analogue to the first with the name “lower limit frequency”.

Reference and Tutorial jBEAM
Version: jBEAMHelp7.2.2
In the next step a bandpass on all channels is generated whose passband is controlled by the slider values of upper and lower limit frequency.

The filtered data from the bandpass are used as input data for the FFT spectrum to be calculated.
In the last step the calculated spectrum is depicted in a Universal 2D graph.

The individual levels of the matrix (respective channels of the group) are defined as individual diagram via the index. The option Stacked A prompts a stacked display of the individual diagrams. The limit frequencies of the bandpass filter can be changed via the sliders and the display of the spectrum is automatically changed.

### 1.4.6 Configuration of a Table of Contents

**Insertion of titles into the table of contents**

To list a graph element in the table of contents this functionality has to be specified individually for each graphic element. Click right onto the graphic element to open the context menu. Select **Properties** to modify the basic properties of the element. The subsection **Table of Content**
offers the option **ToC Level** that decides about the element’s appearance and level in the table of contents.

It is possible to insert a graphic element without title into the table of contents. The corresponding item in the list just stays empty (Image 1). For better identification a label is recommended. Even the table of contents itself can be listed (Image 2).

<table>
<thead>
<tr>
<th>Table of Contents</th>
<th>Table of Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image 1" /></td>
<td><img src="image2.png" alt="Image 2" /></td>
</tr>
</tbody>
</table>

**Configuration of levels**

The table of contents is created and individually configured via **Graph Editor→Tables→Table of Content.**
In jBEAM, a table of content may have six different levels of numbering. A higher number of levels represents a more detailed categorization.

Table of Contents

1  Level 1 .............................................................. 1  
  1.1  Level 2 .......................................................... 1  
    1.1.1  Level 3 ...................................................... 1  
    1.1.1.1  Level 4 .................................................... 1  
    1.1.1.1.1  Level 5 .................................................. 1  
    1.1.1.1.1.1  Level 6 ............................................... 1  

The option *Numbering up to level ...* offers the possibility to exclude lower levels from numbering or to omit numbering completely. The font can be formatted separately for each level. It is possible to configure type, size and color. Additionally, the indent of digit and label and the line spacing can be specified. Thus, lower levels can be indented more for a more clear view. It is also possible to configure the filling between label and page index by dots or lines.

**Individually displaying of numbering**

The table of content’s configuration of the numbering is initially displayed in the heading of each graphic object.
This configuration can be modified independently of the display in the table of content. For this, open the context menu via right click and select **Properties**. In the **Table of Content** section, select a **Visibility** mode.

**Show:** The numbering appears in the title of the graphic element (independent of the table of content’s configuration).

**Hide:** The numbering is not visible in the title of the graphic element (independent of the table of content’s configuration).

**Default:** The configuration of the table of content is adopted for the graphic element.

**Limiting of the displayed levels of a table of contents**

The number of displayed levels in the table of contents can now be limited, independently of the number of levels defined in the individual graphic elements. Thus, it is possible to create several tables of contents showing different numbers of levels within a project. For example, one table of content only shows the first level and another shows all levels.

**Display of first level only**

**Display of all levels**
Splitting a table of content

Large tables of content take much place while they are mostly slim. To avoid a waste of place the table of content can be split into several columns or distributed over several pages. For this, click right onto the graphic element and select **Split Vertical**.

You receive a new column which contains all information that did not fit into the first column. You can control the splitting in the table of content’s dialog by using the option **Keep chapters together**.

When the option is active, a whole chapter will be transferred to the next column as soon as the chapter’s last subsection no longer fits into the first column.

When the option is inactive, the first column will be completely filled before the filling of the second one starts. It does not matter which chapter a section belongs to.
If more than two columns are needed, they can be created in the same way as mentioned above. The settings of the option *Keep chapters together* will be adopted for all further columns. If a column is deleted, the table of content will spread over the remaining columns.

If more than one page is needed, the last part of the table of content can be moved to the next page, e.g. via **Cut** and **Paste** of the context menu.
2 jBEAM Reference

The menu bar collects functional groups to individual menus. Any main entry might contain sub menus.

The jBEAM architecture consists of components and is delivered in different versions. Therefore it may happen that the described menus are not part of the respective customer’s version. Depending on the installed operation system or preferences the jBEAM menu and tool bar might differ slightly.

The main menu consists of:

- **File**: Project and file operations, import, export, print, exit
- **Edit**: Clipboard, preferences, trace logger
- **Measure**: Functions for online data monitoring
- **Extra**: Data base functions, generators, audio and video (in/out) and data view service
- **Services**: System services (template manager, menu service etc.), map services, EnCom, Cluster
- **Auto-Sequences**: Start or modify complete analysis macros (file watcher, protocol generator)
- **Math**: Mathematical analysis functions (formula editor, special functions)
- **Windows**: Window administration
- **Graph Editor**: Creation and modification of graphic elements
- **Help**: Help and system analysis functions

2.1 Menu: File

The File menu consists of the following sub menus:
- **New Project**
- **New from template**
- **Open Project (File)**
- **Open Project (Web)**
- **Reopen**
- **Save Project**
- **Save Project As**
- **Save Project As Template**
- **Data Source Manager (Import)**
- **Import Values**
- **Export Values**
- **Import Multi Media**
- **Export Report**
- **Import Layout**
- **Export Layout**
- **Batch Import**
- **Scriptfile**
- **Printer Setup**
- **Print**
- **Exit**

*File* can be activated by pressing <ALT+D> or <F10>.

### 2.1.1 New Project

Go to

File

→ **New Project**

or press <CTRL+N>

or click on the tool bar icon **New**.

A new, empty jBEAM project is generated.
When a new project is generated, the user will be asked whether the current configuration is to be saved or discarded. Then all instantiated components will be deleted and an empty project is opened.

2.1.2 New From Template

Go to:

File → New From Template

With this operation an already existing template, or a jBEAM project file that can be converted into a template, is loaded.

Favorites: Allows fast access to frequently used folders. The folder selected in Save in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Loadmode: If a file is already open the following options decide how the existing components shall be handled.
Delete all components before loading: All existing components are deleted and only the components of the new template are loaded.

Keep existing components: If components already exist, no new components are created at these positions.

Overwrite existing components: If components already exist, they are overwritten as soon as the new template contains components at the respective positions.

Keep existing and create new components: The components of the template are loaded in addition to the already existing components. The components might be positioned on top of each other.

Edit project template: If this option is selected, the template itself is opened. When saving the project the original template is overwritten. By default, this option is deactivated so that a new project is created with the components of the template. When saving the project a new project name is requested.

Look in: The folder respective drive in which the project is stored is selected in the directory tree. A fast access to specific storage locations can be achieved through the list of favorites and the symbols on the left side.

File name: The selected project is displayed here.

Files of type: In the Files of type combo box the user can choose between an already existing template (*.jbt) and a project file (*.jbs, *.jbeam). A loaded jBEAM project can be saved as template (see also Save Project as Template).

Open: The selected file is loaded with the set options and the dialog is closed.

Cancel: The dialog is closed without loading a file.

2.1.3 Open Project (File)

Go to

File

Open Project (File)

or press <CTRL+O>

or click on the tool bar icon Open.

An already existing project file is opened.

If jBEAM is associated with the filename extension, a jBEAM project file also opens by simply double clicking it. When opening a project in jBEAM the following dialog opens.
By using **Look in** the user can change directories or data storage media. For a fast access of special folders containing jBEAM project files, the user can add **favorite** folders. Items on this list of favorite folders can also be removed again.

There are 4 modes for loading project files.

In the following example the first project was in each case already open and the second project was opened using the different Loadmodes:

1st project:

2nd project:
Delete all components before loading: Before the new project is loaded the current project is closed and all existing producers and graphic objects removed.

Keep existing components: The already existing components are kept and the loaded components are added. Note: If there are producers in the added project that carry the same name as existing producers, they will not be loaded.

Overwrite existing components: If the project that is to be loaded contains producers with the same name as existing producers, the existing producer will be overwritten and replaced by the loaded producer. Generated formulas remain the same, only their results are recalculated on the basis of the new values.
Keep existing and create new components: The components of the loaded project are added to the existing project. If there are double producer names, the loaded producer will be added but renamed.

The selected file’s name appears in the File name area. Clicking the Open button the file is imported. The defined file extensions that are displayed in Files of type are all jBEAM project files. If there are file formats that don’t correspond to any of the listed types, check the list of importable non-native formats to make sure whether the file can be loaded or not (see also Import Values). Cancel closes the dialog without loading a project.

2.1.4 Open Project (Web)

Go to:

File
  ➔ Open Project (Web)

A project file is opened from the web (intranet or Internet).

The following dialog box appears:
This dialog consists of a browser. Enter a valid internet address (URL) in the top centre field and click the Go button or press <ENTER>. The typed address is retrieved and in the dialog box’s centre the content of the HTML pages is displayed. A click on a link to a jBEAM project file (*.jbs) copies the entire path in the File URL field. The content of the centre pane stays unchanged. In case an error occurs, the appropriate information will be show in the info field.

If a link to another web page is activated, the page is loaded and displayed. If a link to a jBEAM project file is activated (file type *.jbs), the entire address is copied into the File URL field. The project file’s content is not shown.

Click the Open button to import the required file. jBEAM creates a local copy of the web based file and loads the local copy. Upon exiting jBEAM the files stored in a temporary directory are deleted.

Files of importable non-native format have to be imported via Import Values.

Cancel closes the dialog without loading a file.
2.1.5 Reopen

Go to:

File
  ➔ Reopen

Each loaded project file is added to the sub menu item **Reopen** which gathers the recently used files. Every user has an own recent projects list.

The list is saved when exiting jBEAM and loaded the next time jBEAM is started.

---

2.1.6 Save Project

Go to:

File
  ➔ Save Project

or press `<CTRL+S>`

or click on the tool bar icon `Save`.

Saves data and settings of the currently used project file.

Using this command with a newly generated project that hasn’t been saved yet, the dialog box **Save Project As** opens automatically. To save data in other formats use **Export Values**.

From jBEAM version 7.2.1.x on, data series contained in the project file are saved ZIP-compressed. Thus, the file size can be reduced by at least 5%.
2.1.7 Save Project As

Go to:

File
   ➔ Save As

or press <CTRL+UMSCHALT+S>

This command is used to save the current settings of a newly generated jBEAM project file.

**Favorites:** Allows fast access to frequently used folders. The folder selected in **Save in** can be added to the favorites list via the button ➔. The button ➔ removes the selected folder from the list of favorites.

**Save mode:** There are several modes for saving data. The settings are identical to those in the preferences. The option selected there is preset here. The option selected here prevails.
**Save modes**

- **Data objects of all producers with values:** If this mode is selected the data of all import components and result objects are saved. Thus, a project file including all data is created. All calculations are saved as well.

  This is needed, e.g. if the project file shall be saved as data file or completely archived.

  Via the **jBEAM Project** importer these project files can also be imported. The calculated channels are then only available if the project file has been saved with in mode.

- **Only data objects of importers with values:** If this mode is selected (standard) only the data of the import components are saved, i.e. calculation components are saved without values. When the project is opened the data files are only reread (on request) if they have been modified since the last save of the project.

  This mode should be selected if an evaluation shall be saved for further processing and shall be independent of the data sources, or if the project file shall be sent to a recipient who has no access to the data.

- **No values, but importer with file references:** If this mode is selected the import components are saved without measured values. Only the file references are saved. When the project is opened again the values are reimported. This reduces the file size compared to the previous mode. This mode is also useful if the data files are usually modified before an evaluation. It requires, however, that the data files are available to all users.

- **Configure password:** Optionally, a password can be defined to protect the project file from unauthorized access. To do this, the **password protection** is clicked to **Active** and a password entered. When later the project file is opened, the password is requested first.

  If the password is wrong an error message is shown. Otherwise the project is opened. If a password-protected project is saved again, the last used password is automatically used again, unless the user has deactivated the password protection. In order to change the settings, the old password has to be entered as authorization. This also applies to saving the project in another folder or as subproject.

- **Save in:** The folder respective drive to which the project is to be saved is selected in the directory tree. A fast access to specific storage locations can be achieved through the list of favorites and the symbols on the left side.

- **File name:** The name of the project is entered here.
Files of type: The project can be saved as jBEAM project file (*.jbs, *.jbeam) or jBEAM project template (*.jbt). The default setting is jBEAM project file. Depending on the set type all existing data are depicted in the determined folder with the corresponding extension.

If data are to be saved as a different format supported by jBEAM the functions Export Values or Export Report have to be used.

Save: Saves the file and closes the the dialog box.

Cancel: Closes the dialog box without saving the file.

2.1.8 Save Project As Template

Go to:

File
- Save Project As Template

Current data and settings are stored to a jBEAM template file with this function.
Favorites: Allows fast access to frequently used folders. The folder selected in Save in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Save mode: Optionally, it can be stated that pictures shall be stored within in the template file. Otherwise (standard) only references are stored.

Save in: The folder respective drive to which the project template is to be saved is selected in the directory tree. A fast access to specific storage locations can be achieved through the list of favorites and the symbols on the left side.

File name: The name of the project template is entered here.

Files of type: The project template can be saved as jBEAM project template (*.jbt) or jBEAM project file (*.jbs, *.jbeam). The default setting is jBEAM project template. Depending on the set type all existing files with the corresponding extension in the selected folder are shown.

Save: Saves the file and closes the the dialog box.

Cancel: Closes the dialog box without saving the file.

2.1.9 Data Source Manager (Import)

Go to:

File

Data Source Manager (Import)

The sub menu contains the item New that opens a new Data Source Manager. If data sources already exist in the project they are listed as well and can be opened for modification.

New import components are administrated, modified and initialised by the Data Source Manager.

The data objects’ graphic depiction of the managed import components can be set without difficulty. The Data Source Manager keeps references to the respective channels of the import components that can be selected in the Cartesian line chart. The depiction of the data (e.g. as line or marker) can be comfortably set in the Data Source Manager’s dialog box.

There are several options for loading data objects. Either, only data objects are considered that appear in all active data sources (intersection) or all data objects that exist at least in one data source (superset). The data objects (selection values) with identical names are grouped and
displayed in the Spreadsheet (Matrices tab) as multi-dimensional data objects (group of channels). The group of channels is named after the selection value.

A selection manager exists in the Data Source Manager, which means that the import data of an importer can be filtered. Only certain importers are supported: ASCII, Gidas, LS-Dyna, LabVIEW (lvm), PAtools (Kratzer) and others.

**Name:** Name of the Data Source Manager. When generating a new Data Source Manager the default name is set to **Datasources** (English version). The Data Source Manager will be displayed in the Explorer with the name chosen here.

**Chart with data sources:** List of the loaded sources

A further description of the dialog is to be found in chapter **Extra→Miscellaneous→Data Source Manager (Import).**
For modifying a project’s data sources, go to **File → Data Sources (Import) → [Data Source Manager’s name]** or right click on the data source in the Explorer and choose **Modify**. In both cases the Data Source Manager will open with the settings made before.

For a practical example of how to use the Data Source Manager, see topic **Depiction of a Frequency Spectrum with Adjustable Bandpass** in the **Tutorial**.

### 2.1.10 Import Values

Go to:

**File**

- **Import Values**

Importing data gets important when there is already existing data in a non-jBEAM format or just part of the test data is to be loaded. Furthermore there is the possibility to import data on standby, i.e. they are just loaded when they are actually used. See also **Common settings**.

Supported formats for import are listed in the sub menu. These formats can contain numerical as well as descriptive test data.
Supported data formats:

- **AFT-4Measure (txt)**: Data logger by AFT Atlas Fahrzeugtechnik GmbH (Schaeffler Group)
- **ASCII**: Universal format with many import options
- **ASCII-Matrix**: ASCII-Matrix format
- **ATF (ASAM-ODS)**: Standardised data format for ASAM-ODS data
- **Basytec**: Basytec- (Paradox-) files
- **BEAM**: Binary files of the AMS Software BEAM
- **CAN Log**: Import of CAN Log messages (ASCII file format)
- **Catman (bin)**: HBM-Catman files
- **Dasylab**: Data format of National Instruments (formerly Dasylab, Monchengladbach)
- **Dbase v3-V**: Import of database files in DBase 3 format
- **DiagRA Vehicle Diagnostics XML**: Diagnostic data from vehicle control units *.xml.
- **DCM (ETAS)**: Data format of INCA Tools for control devices by ETAS.
- **EDAS**: Common file format for road trials, *.EDT
- **Microsoft Excel**: File format *.xls, *.xlsx
- **FAI IGC**: File format for GPS flight data
- **FAMOS**: File format by IMC
- **Gantner Universal-Bin-File**: Binary file format from Gantner Instruments
- **Garmin-Database-File (CRS, HST, TCX)**: *.crs, *.hst, *.tcx
- **Gidas**: VW-proprietary file format
- **VW VENUS-CSV**: VW-specific data format
- **Google (KML)**: File format *.kml
- **GPS Exchange Format (GPX)**: File format for storing GPS data: *.gpx
- **HBM MGCPplus**: File format for internal hard disk measurement files of MGCPplus
- **HBM Perception (pnrf)**: File format of HBM Perception
- **Hioki Hicorder (mem)**: File format by ASM: *.mem
- **AVL iFile**: *.avl
- **INCA CVX**: INCA Calibration Values Exchange format *.cvx
- **ISO13499 MME (Crash)**: Exchange format for test data (especially in the area of crashes)
- **jBEAM Project**
- **Krause/Daimler (XML)**: A customised XML based format by ThyssenKrupp for Daimler: *.xml
- **LS-Dyna**: Format for simulation data by the Livermore Software Technology Corporation
- **LabVIEW (lvm)**: Import of data from a LabVIEW measurement file (*.lvm) by National Instruments
- **Madymo (TNO-Automotive)**: Format for simulation data
- **Matlab**: File format *.mat for Matlab files
- **MDF (v3/v4)**: Data format by INCA Tools for control devices by ETAS.
- **NetCDF**: Scientific file format containing descriptive as well as numerical data. For importing the NetCDF format the Java library netcdf2.jar has to be put into the "..\lib\ext\" folder. For further information see also [http://www.unidata.ucar.edu/packages/netcdf](http://www.unidata.ucar.edu/packages/netcdf).
- **Nicolet (WFT)**: File format for the Nicolet Waveform: *.wft
- **Opel-GPS-CanLog-File**: File format by Opel
- **PAtools (Kratzer):** File format by Kratzer Automation
- **PEMS XML:** File format *.xml for mobile emission measurements
- **Porsche PDS:**
- **Q-DAS:** A special ASCII format by Q-DAS
- **Racelogic Vbox:** File format by Racelogic: *.aft
- **RPCii (MTS):** File format by MTS
- **TEAC:** GX-1 format by TEAC GmbH
- **Tecplot:** File format by Tecplot, Inc. (formerly Amtec Engineering, Inc.)
- **Universal File Format (15 & 58):** File format by National Instruments
- **VW Calibrationdata (ASCII):** File format *.txt
- **VW MDM-Data (XML):** File format *.xml
- **VW Quirl (IDS):** A special file format by VW: *.ids
- **Yokogawa:** File format by Yokogawa
- **Zwick:** File format by Zwick for material testing

**Common Settings**

**Import options:**

Several dialogs support specific import options for loading channels, e.g. if and how values are loaded. It is possible to set a status for every channel:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item will be created, but no values are loaded. The values are just loaded when the values are actually used.
- **Begin:** Only the first 1000 values will be loaded.
- **End:** Only the last 1000 values will be loaded.
- **Overview:** Load 1000 values of the whole channel for an overview. With a channel of 10.000 values every 10th channel would be loaded.
- **Complete:** All values of the channel will be loaded.

**Choose import data format**

Some dialogs support the selection of the data format for the result values. The user can choose between high data precision: double (8 Byte/64 Bit) and low data precision: float (4 Byte/32 Bit) which reduces the amount of data by half.
Storage Mode for imported data

Some importer components work with large data volumes. Because the maximum file size is merely restricted by hardware's memory capacity it is necessary, that some importer components support special storage modes (see also below and also Dealing with large volumes of data).

Auto (memory/disk): By default the import data will be directly stored into RAM. If the available memory will be insufficiently, the data will be stored as file channels on the hard disk.

Only memory (RAM): Data are only stored into RAM.

Only disk (file): Data are stored in channel-based files on the hard disk.

Save Mode for project files and project templates

Many importers support an individual setting of the save mode for project files and project templates. This setting then prevails over the selected option in the preferences.

The options are displayed in a new line after clicking the arrow button behind Datatype.

Save mode:

Project-File:

Standard: The settings are adopted from the preferences.

With Data: The importer is saved with its complete data.

Without Data: The importer is saved only with its file references. When the project is opened the data are reloaded from its source.

Template: Templates can be saved with the options With Data or Without Data (see above).
Default load status

In the preferences, a **default load status** can be defined for all importers supporting load status settings. Then, the channels of an import file are initialized with the defined default load status when an importer is generated via menu or by Drag&Drop of a file. In case the importer does not support the selected load status, the channels are initialized with the **Complete** load status by default.

But the importer themselves also have the opportunity to either apply or to ignore the preferences. This option is displayed in a new line by clicking on the arrow sign behind **Datatype**.

**Consider default load status**: If this option is activated, the channels are initialized with the **Default load status** defined in the preferences when the importer is generated. If the option is deactivated, the preferences settings are ignored.

- If this option is **activated** with an existing importer, the current settings are dismissed and the settings from the preferences applied.
- If this option is **deactivated**, the current settings remain unchanged.

Selective Loading of measuring lines

jBEAM loads either all values or parts of them, e.g. part from ... to ... or each n-th measured line/cycle.

Channel and Unit Mapping

Some dialogs support the use of channel mapping files during import. Channel names and units can be converted to standard names and units by an easily created text file. One global and one local channel mapping file can be defined in the preferences. They can be used by all importers. An additional channel mapping file can be defined in the respective importer. This is only available for this import. See also the tab **Channel Mapping in Edit→Preferences→Import**.
2.1.10.1 AFT-4Measure (txt)

Go to:

File

Import Values

→ AFT-4Measure (txt)

This function imports files in AFT-4Measure-Format (*.txt).

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like **Open** but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign 🔴 in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.
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Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is achieved through the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date, type and load status of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: The supported file format for the AFT-4Measure-Import is listed: *.txt

Tab File Content

The upper part shows file parameters, like number of Channels, Datarate, File size and Comment.

Selective Loading: Defines which measuring lines are loaded.

Load all lines: All measurement data is loaded.

Load line x to y: Only a certain section of the measured data is loaded, with x as starting value and y as end value.
Load only every x-th measured line: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values are loaded. This option is not available in case of group definitions.
- **End**: Only the last 1000 values are loaded. This option is not available in case of group definitions.
- **Overview**: Selected 1000 values of the channel are loaded for an overview. With a channel of 10,000 values every 10th channel is loaded. This option is not available in case of group definitions.
- **Complete**: All values of the channel are loaded.
2.1.10.2 ASCII Import

Go to:

File
  ➔ Import Values
    ➔ ASCII

The internal structure of an ASCII file is not specified. Numerous parameters allow the user to import complex data structures.

The different parameters are defined in 5 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Structure – Definition of separation characters for the columns, setting of the file structure.
3. Meta Data – Optional meta data.
4. Channel Header – Definition of descriptive data of the data objects.
5. Data Formats – Definition of the data formats for the individual data objects.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file.

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and
custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.

preferences: If global and local channel mapping files are set in Preferences → Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.
Create: Creates a new channel mapping file.
Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- File Structure
- Meta Data
- Channel Header
- Data Formats

: Help for navigating from one tab into the next. Tabs can also be switched manually at the top of the import dialog box.

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other
tabs are enabled. If the selected folder contains ASCII profile files (*.aix), they are applied as follows:

**Application of profile files:**

1. The folder of the selected ASCII file contains an ASCII profile file (*.aix) **with the same name**: This profile file is applied to the selected ASCII file immediately. The Open button is enabled, so that it is not necessary to pass all further tabs. However, they can be entered for modification.

2. The folder of the selected ASCII file contains **one ASCII profile file (*.aix) with a different name**: An enquiry appears asking if the profile should be loaded.

   ![Load Profile](image)

   With answer **Yes** the profile is applied to the selected ASCII file immediately. The Open button is enabled, so that it is not necessary to pass all further tabs. However, they can be entered for modification.

   With answer **No** the last used profile is applied. The Open button is only enabled in the **Data Formats** tab.

3. The folder of the selected ASCII file contains **several ASCII profile file (*.aix) with different names** or **no profile file**: If an ASCII file has already been imported in the current jBEAM session an enquiry appears asking if the last used profile should be loaded.

   ![Load Profile](image)

   With answer **Yes** the settings from the last ASCII import are applied to the selected ASCII file. The Open button is enabled, so that it is not necessary to pass all further tabs. However, they can be entered for modification.

   With answer **No** the last used profile is applied. The Open button is only enabled in the **Data Formats** tab.

If there has not yet been imported any ASCII file in the current jBEAM session, no enquiry appears. The tabs use default settings. The Open button is only enabled in the **Data Formats** tab.

In any case, a specific profile can always be loaded using the Load Profile button.

**Files of type**: All supported file formats for the ASCII import (*.txt, *.asc, *.doc, *.csv, *.tab) are listed.
**Character encoding:** The character encoding can either be selected from the list or determined automatically. For the automatic determination, the data set is analysed and searched for a fitting encoding. Some encodings also provide an identifier together with the data. An inappropriately selected character encoding is indicated by nonsensical characters in the imported data. Common character encodings are e.g. UTF-8 and ISO 8859-1.

**Load Profile:** The dialog box **Load ASCII-Import Profile** (file format: *.aix) is opened where the profile file can be selected. An import profile stores all import settings of the individual tabs. Profiles can be saved in the tab **Data Formats**.

**Lines:** Display of the selected file’s content. This helps parameterising the import file as the effects of the settings on the data directly show. Black symbols in the lines indicate special characters (e.g. tab stops) at those positions.

**Tab File Structure**

![Tab File Structure](image)

- **Load meta data:** If enabled (checkmark is set), the meta data is loaded. By setting **First line** and **Last line** the starting and end point of the meta data is defined. The tab **Meta Data** is only enabled if this option is activated.
**Load values:** If this option is not enabled, no values are loaded. The lower half of the dialog box is then disabled. If activated (checkmark is set), the values are loaded from the file. The further settings are enabled to specify the data.

**Values start at line:** The line at which the actual data start is defined. The line is either entered manually into the input field or defined via mouse click (first, the cursor is positioned in the input field and then the line carrying the first value in the preview window is selected via mouse click). The line number will be automatically entered into the input field.

**Values go till:** It is defined whether the data end at the end of file or at a specified line.

**Channel orientation:** A vertical as well as horizontal orientation of the data series is supported. In case of vertical orientation, the values of a channel are arranged below each other in one column.

With horizontal orientation, the values of a channel are arranged in one line. For this, the column at which the data start (Values start at column) can be defined. Moreover, if there is other information above or below the actual data (meta data), the lines in which the channel data start and end can be defined above (Values start at line / Values go till).

**all values quoted by:** If enabled (checkmark is set), the values surrounded by the defined character are loaded without this character.

**for empty cells use last value:** If enabled (checkmark is set), empty cells, i.e. no characters between two separators, are filled with the value of the cell before.

**No-Value String:** A string can be defined which shall be interpreted as No Value (NaN). The automatic format detection will then ignore such a string and only analyse the other values. Thus, a channel will be detected e.g. as double channel even if it contains text. If it, however, contains other strings than the defined, it will automatically be detected as string channel.

**Separation character:** Lists the most common separation characters (Tab, Comma, Semicolon, Blanks) which can be selected. Alternatively, the user can enter a different separation character Manually if the desired character is not listed.

**Fixed widths with blanks:** Instead of separators, a fixed Number of characters can be defined to separate the individual values.

**Load all lines:** All data defined as measurement data is loaded.

**Load line x to y:** Only a certain section of the measured data is loaded, with x as starting value and y as end value.

**Load only every x-th measured line:** The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

**skip lines starting with:** If a line starts with the defined character, the line is not loaded.
Tab Meta Data

<table>
<thead>
<tr>
<th>File Chooser</th>
<th>File Structure</th>
<th>Meta Data</th>
<th>Channel Header</th>
<th>Data Formats</th>
</tr>
</thead>
</table>

- **Meta data is stored in a map named**: If **use Testname** is checked, the test name is used automatically for the data object containing the meta data. Else, any name can be entered.

- **Keys and values are separated by**: Defines the character separating the keys and the corresponding values. The character can be entered directly in the first input field or entered as Unicode in the second input field. To enter a tabulator, the button at the end of the line can be used.

- **Values are quoted by**: Defines a character that may surround the values. This character will then not be loaded.

- **Split only at first separator**: Key and value are only separated at the first occurrence of the defined character in the respective line.
Tab Channel Header

A file may contain other information before the actual measurement data.

**Indication color:** The lines of the file already assigned to the meta data are marked in that color.

**manual / from File:** jBEAM computes the information for each data series listed on the left side, e.g. description, date. This information can be entered manually (the radio button below manual is selected) or read from the file (the radio button below from File is selected).

The column Line lists the line number from which the information is taken. The line numbers can either be entered manually or selected by first clicking into the input field and then clicking into the respective line in the preview table. The line number is automatically entered into the input field.

**Name:** Name of the channel. If the name is taken from the file, it can be specified that the unit is contained in the name cell with brackets (unit in name cell (with brackets)). The content of the brackets is then automatically interpreted as y-unit. This is entered into the channel properties. Activating this option automatically disables the options in line Unit.

**Description:** Description or comment of the channel.

**Date:** Displays the date of the creation day by default. The option includes Time states that the time of creation is contained in the same cell as the date (behind the date without brackets, separated by blanks). The entries are separated and assigned to the respective channel properties. Activating this option automatically disables the options in line Time.
**Time**: Displays the creation time by default.

**Unit**: Displays the unit of the values (y-unit).

**Xo**: Initial value of x.

**ΔX**: Distance of the x values (DeltaX). The option **includes x-Unit** states that the x-unit is contained in the same cell as ΔX. The entries are separated and assigned to the respective channel properties. Activating this option automatically disables the options in line **x-Unit**.

**x-Unit**: Unit of the x-axis.

**Active Channel**: Displays the currently selected channel. The combo box lists all available channels. For the currently selected channel it can be individually specified whether the header information is defined **manually** or loaded from **File**. The **manual** entries are also individual for each channel. The data automatically loaded from **File** is highlighted in the set **Indication color** in the preview.

**Copy to All**: If the settings of a channel shall be applied to all other channels, the button **Copy to All** can be used. Then, all settings whether the information is entered **manually** or loaded from **File** are copied as well as all manual entries except **Name** and **Description**.

**Tab Data Formats**

After separating the columns and correctly assigning the lines the data format has to be determined. jBEAM tries to automatically set the correct data format. Manual changes are possible as well.
Number format

Decimal digits: Defines the separation character of floating-point numbers.

Standard: A standard format of floating-point numbers is used.

User: A user-defined number format can be specified.

Help: Opens the jBEAM help with the description of the different floating point formats.

Date/Time Format

Local: If this option is selected, the local format as displayed in the text field below is used.

International: If this option is selected, the US format as displayed in the text field below is used.

Standard: A standard format for date and time information (Local/International) is used.

Edit: The preset standard format can be modified if needed and can then be used for further imports. If e.g. several files shall be imported with a specified date/time format deviating from the preset standard, it is not necessary to define this format as user again each time. The changed standard format is automatically saved together with the jBEAM preferences and remains Standard as long as it is changed again.
user: A user-defined format can be specified. A preview of the currently entered format is displayed in the text field below.

Help: Opens the jBEAM help with the description of the different date/time formats.

Longitude format:
positive values: The orientation of longitude values can be explicitly defined. Traditionally, positive values are specified in East direction.

Channel status
skipped: The channel data are not read
double (8 Byte): A double channel
float (4 Byte): A float channel
date/time: A date/time channel
d/t-2nd part: A date/time channel in case the ASCII file uses 2 channels (1. Date channel, 2. Time channel). jBEAM merges those two channels.
d/t-3rd part: A date/time channel in case the ASCII file uses 3 channels. jBEAM merges all three channels.
integer: An integer channel
Hex-Int: A hexadecimal channel
Boolean: A Boolean channel (true/false, 1/0)
string: A string channel
Longitude: A channel with geographic longitude data
Latitude: A channel with geographic latitude data
Unix timestamp: A Unix timestamp channel.

set: Applies the selected channel status.

auto detect: Retries to automatically determine the correct data format for each channel.

Save Profile: Saves the settings of all individual tabs in an ASCII import profile (*.aix). Profiles can be loaded in the File Chooser tab and be applied to the current ASCII import.

Lines of Preview: The preview of the formatted data can be limited to the defined number of lines. This number is also used for the automatic detection of the data format of the columns.
Result

After finishing the import, the data are displayed in the Spreadsheet. The channel values are displayed in the **Channel** tab. The meta data are shown in the **Maps** tab.

![Spreadsheet](image)

2.1.10.3 ASCII-Matrix

Go to:

**File**

- **Import Values**
- ASCII-Matrix

**ASCII-Matrix** allows the import of files in ASCII-Matrix format (*.matrix), i.e. text files with rectangular matrix.

The different parameters are defined in 2 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file’s content.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

: A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.
Tab Section:
- File Chooser
- File Content

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

The context sensitive help is activated and the cursor changes to ??. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tab is enabled.

Files of type: All supported file formats for the ASCII-Matrix import are listed: *.matrix
### Tab File Content

This tab displays the file and matrix parameters as well as a preview of the contents.

#### 2.1.10.4 ATF (ASAM-ODS) Import

Go to:

**File**

- Import Values

**ATF (ASAM-ODS)**

ATF (ASAM-ODS) allows the import of ODS files (specification 5) containing measured values.

The different parameters are defined in 5 tabs:

1. **Logging** – Settings for the logging.
2. **File Chooser** – Selection of the file to be imported.
3. **File Content** – Display of the ASAM-ATF file content.
4. **General** – Settings regarding the data to be loaded.
5. **Channel Names** – Selection of the read channels.

Upon clicking **Open** the **imported data** are displayed in the Spreadsheet.

![Import ASAM ODS ATP File](image)

**Testname**: Name of the importer (producer).

**use filename**: The name of the imported file is automatically used as importer name.

**Filepath**: Detailed file path of the selected file

**Created at**: Creation date and time of the selected file.

**Datatype**: The exact labelling of the data type of the selected file.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Name/unit mapping**: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.

**preferences**: If global and local channel mapping files are set in **Preferences → Importer (tab Channel mapping)**, they are applied to the import.

**custom**: Via **Select**, a customised channel mapping file can be selected which is applied only to this import.

- **Select**: Opens the file selection dialog.
- **Create**: Creates a new channel mapping file.
- **Edit**: The selected channel mapping file can be edited via the **CMAP Editor**.
Tab Section:

- **Logging**
- **File Chooser**
- **File Content**
- **General**
- **Channel Names**

**Basemodel version:** The used base model of the ATF/XML file can be recognized from the file information and automatically set by jBEAM. With ATF classic files the user has to determine the used base model manually before importing the files. If this is not done, the latest base model is used automatically which may lead to errors while importing.

**Export to ATF:** The imported file can be exported as an ATF file without being completely read in to jBEAM. This procedure may be helpful when converting classic files into XML files or when removing errors from the imported file (the export eliminates automatically a lot of errors). The base model of the imported file is also used for the export.

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

?q: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab Logging**

The import of an ODS file can be logged.

**disabled:** The logging is disabled by default.

**to console:** The logged information is displayed on the Java console.
to file: The logged information is stored to a text file.

maximum message count: Defines the maximum number of messages.

context filter: Only messages with selected context are logged.

Application Model: Messages linked to the Application Model (e.g. a reference to a missing base objects)

Instances: Messages concerning the instances of the file to be imported

ATF Syntax/Semantics: Messages about general syntax problems

Resources: Messages about missing resources (e.g. data from external files is not available, failed connections to URLs/Internet addresses)

Implementation: Messages about bugs

Status: Status messages (e.g. start measure)

NVH: Messages concerning NVH rules

Base Model: Messages about the base model

level filter: Only messages with the selected level or higher are logged.

INFO: Only informational messages are logged (e.g. status messages).

WARNING: All errors that do not result in information loss but are not conform to the specifications either are logged. The evaluation of the data is not affected.

SEVERE: All errors resulting in information loss are logged. The erroneous file can be read but the information cannot be evaluated.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.
Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the following tabs are enabled.

Files of type: All supported file formats for the ATF import are listed: classic files (*.atf) or XML files (*.atf, *.xml).

Tab File Content

The parameters of the selected import file are displayed.

Tab General

ODS application structure

- **Keep copy of ATF file in memory**: If disabled, the file is reread when opening the modification dialog box.
- **Interpret NVH data**: If the file contains NVH data, the data are evaluated according to NVH rules.
- **Import metadata**: Additionally, meta data can be imported.

Value selection – Selective Loading

- **Load all lines**: All measurement data is loaded.
- **Load line x to y**: Only a certain section of the measured data is loaded, with x as starting value and y as end value.
- **Load only every x-th measured line**: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.
Tab Channel Names

This tab lists the names of the data groups, the respective channels and their import options. For each group or channel, individual import options can be set. The different options are displayed in a table. By clicking in the header of a column the table can be sorted in ascending or descending order. The sorting order is switched with each click (ascending – descending – no sort). A right click in a line or several selected lines opens the context menu where the load status of the respective channel or channels can be set or groups expanded or collapsed.

Name: The list shows all groups contained in the file. The + and – boxes can be used to unfold and fold the groups in order to display or hide the contained channels.

Load data group: The checkboxes can be used to activate or deactivate the individual groups completely or to activate or deactivate the contained channels individually.

Load status: The load status Complete, Standby or Ignored can be assigned to the individual groups or channels by clicking the symbols until the desired option is displayed. If different options are selected within a level, the symbol of the higher level changes to a question mark (Indeterminate).

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

The input fields below the table can be used to filter for special strings (e.g. in the channel names) or properties. Via drop-down list the Text filter type can be selected (Plain text, Wildcard text (? , *) or Regular expression).

In columns with preset options (Load data group, Load status) the texts can be displayed as tooltip by moving the mouse over the input fields.

- Column Name can be searched for characters or strings.
- Column Load data group can be filtered for Yes or No.
• Column **Load status** can be filtered for the load stati **Complete, Indeterminate, Ignored** and **Standby**.

- **Expand all**: All data groups are expanded and their content is shown.
- **Collapse all**: All data groups are expanded and their content is shown.
- **Sets the Load status** (see above) for all channel values.

**Result**

The importer is displayed in the **Spreadsheet** in the **Components** tab and in the **Producerlist of the Explorer**. The import dialog can be reopened via **Modify**. The meta data are displayed in the **Maps** tab and the imported channels in the **Channels** tab of the **Spreadsheet**.

![Spreadsheet](Image)

The internal hierarchic structure (groups) of the data is displayed in the producer list by default. However, this display can also be deactivated in the preferences in the **Explorer** tab.
2.1.10.5 Basytec

Go to:

File
   Import Values
        Basytec

This function imports Basytec-(Paradox-) files (*.db).

The different parameters are defined in 2 tabs:

1. File Chooser – Selection of the file to be imported.
2. Channel Selection – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences → Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.
Create: Creates a new channel mapping file.
Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
• File Chooser
• Channel Selection

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tab is enabled.

Files of type: All supported file formats for the Basytec import are listed: *.db
Tab Channel Selection

This tab lists all available channels of the selected file and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

2.1.10.6 BEAM

Go to:

File
Import Values
BEAM

BEAM allows the import of data from a binary structure file of the data acquisition software BEAM by AMS. Supported files are MGCplus, Spider8, DMCplus or UPM100 by Macintosh or Windows.
In order to generate the same protocol as in BEAM periodical graphic elements are imported. Important calculations are directly adopted as objects from BEAM (not only data channel values). They can be modified in jBEAM.

The different parameters are defined in 4 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **Main-File Options** – Definition of options for importing a BEAM structure file.
3. **Value-File Options** – Definition of the measuring periods to be read of a BEAM value file.
4. **Channel Names** – Setting of the load options for the read channels.

**Testname**: Name of the importer (producer).

**use filename**: The name of the imported file is automatically used as importer name.

**Filepath**: Detailed file path of the selected file
Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

☐: A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.

preferences: If global and local channel mapping files are set in Preferences → Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

☐ Select: Opens the file selection dialog.

☐ Create: Creates a new channel mapping file.

☐ Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- Main-File Options
- Value-File Options
- Channel Names

❖ ❂ ➤ : Help for navigating from one tab into the next. Tabs can also be switched manually at the top of the import dialog box.

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

❖ ❂ ➤ : The context sensitive help is activated and the cursor changes to ❏. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.
Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tabs are enabled. If a BEAM structure file is selected, the tab Main-File Options is enabled. If a BEAM value file is selected, the tab Value-File Options is enabled.

Files of type: All supported file formats for the BEAM import are listed. For easy filtering of a large number of files, each file type is listed separately in the combo box. Supported file types are:
- BEAM Windows Spider8 Structure Files (*.bsr)
- BEAM Windows Spider8 Value Files (*.bvr)
- BEAM Windows Spider8 Extended Value Files (*.bxr)
- BEAM Windows MGCplus Structure Files (*.bsm)
- BEAM Windows MGCplus Value Files (*.bvm)
- BEAM Windows MGCplus Extended Value Files (*.bvm)
- BEAM Windows DMCplus files (*.bsd)
- BEAM Windows DMC9012A files (*.bsn)
- BEAM Windows UPM100 files (*.bsu)

Tab Main-File Options
The tab is only enabled if the selected file is a BEAM structure file.

Selective Loading: Defines which measuring lines are loaded.
Load all lines: All measurement data is loaded.

Load line x to y: Only a certain section of the measured data is loaded, with x as starting value and y as end value.

Load only every x-th measured line: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

Load test parameter: Option to load the test parameters stored in the file.

Load Graphic: Option to load graphics stored in the file. A tabular overview displays available graphic objects. The three graphic windows which can be selected individually are listed with the contained graphic elements (divided into supported and not supported graphic elements). If there are unsupported elements, they may be displayed nevertheless if possible via the option show unsupported graphic elements.

Load Calculations: Available calculations can be loaded as well. Supported and not supported calculations are distinguished.

Tab Value-File Options
The tab is only enabled if the selected file is a BEAM value file.

Version: Displays the versions of value and structure file.
load period no.: Only the defined measuring period is loaded.
load periods: Single measuring periods or sections (separated by semicolon) are loaded.
load all periods: All measuring periods are loaded.
load test parameter: The test parameters stored in the file can optionally be loaded.
Tab Channel Names

This tab lists all available channels of the selected file and their import options. If available, the original names are applied to the channels. Otherwise, a channel name is generated ("Kan" + number).

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values of the channel are loaded.
- **Complete**: All values of the channel are loaded.

**Result**

The imported data is immediately visible in the Spreadsheet. The BEAM importer is displayed in the Explorer and the components can immediately be used for visualisation.
2.1.10.7 CAN Log

Go to:

File
  ➤ Import Values
  ➤ CAN Log

This function imports CAN log messages (ASCII and binary formats).

To initiate the import, a CAN database file (*.dbc) and a CAN log file (*.asc; *.blf) have to be selected. The dbc database file describes the properties of the CAN network as well as the CAN messages and signals. The CAN log file contains the individual messages which can be assigned to the corresponding signals according to the dbc file.

Since jBEAM version 7.1.5 several dbc database files may be selected.

The different parameters are defined in 2 tabs:

1. File Chooser – Selection of the file to be imported.
2. Channel Selection – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** If a CAN log file has been selected, the name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file.

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**: A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.
**CAN database file:** The required CAN database files (*.dbc) are selected via the button.

Since jBEAM version 7.1.5 several dbc database files may be selected. The data structure of all selected files is joined and displayed in a tree in the **Channel Selection** tab.

⚠️ Please note that the individual database files may not contain messages with identical ID. If conflicts are detected an error message is displayed and the databases are not joined.

ертв The selected database file is removed from the list.

Another database file can be selected and added to the list.

**CAN channel (controller):** If this option is selected, a controller can be entered in the input field. Then, only messages from this controller are imported. This option can be activated when a message ID is used by several controllers.

**Tab Section:**
- **File Chooser**
- **Channel Selection**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ⚠️ in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

[target] : The context sensitive help is activated and the cursor changes to ⬤. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Character encoding:** Additionally, the character encoding for the CAN log file can be defined.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected CAN Log file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tab is enabled.

**Files of type:** All supported file formats for the CAN Log import are listed. For easy filtering of a large number of files, each file type is listed separately in the combo box. Supported file types are:
- Vector CAN Log (ASCII) files (*.asc)
- Vector CAN Log (Binary) files (*.blf)

**Tab Channel Selection**

Available and selected signals: The left list shows all available signals in a tree structure. The tree nodes can be opened and closed via the + and – buttons. The required signals can be selected and moved from one list to the other via double-click or the > and < buttons. Already selected signals are highlighted in bold letters in the left list. The arrow buttons below the right list can be used to change the order of the selected signals.

**Result**

The imported data are displayed in the spreadsheet. For each signal an explicit time channel is created because each signal can have its own time base (e.g. DAQ rate).
The internal hierarchic structure (groups) of the data is displayed in the producer list by default. However, this display can also be deactivated in the preferences in the Explorer tab.
2.1.10.8 Catman (bin)

Go to:

File
   ➔ Import Values
       ➔ Catman (bin)

This function imports HBM Catman files (*.bin).

The different parameters are defined in 2 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **Channel Selection** – Setting of the load options for the read channels.
**Testname**: Name of the importer (producer).

**use filename**: The name of the imported file is automatically used as importer name.

**Filepath**: Detailed file path of the selected file

**Created at**: Creation date and time of the selected file.

**Datatype**: The exact labelling of the data type of the selected file.

**File name**

- Uni Weimar
- catman_daten.bin
- catman_daten2.bin
- ceabin2.bin

**Files of type**: Catman files (*.bin)

A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Name/unit mapping**: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences → Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

- Select: Opens the file selection dialog.
- Create: Creates a new channel mapping file.
- Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- Channel Selection

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to ❙. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tab is enabled.

Files of type: All supported file formats for the Catman import are listed (*.bin).
Tab Channel Selection

This tab lists all available channels of the selected file and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

2.1.10.9 Dasylab

Go to:

File
  └ Import Values
      └ Dasylab

This function imports Dasylab files (*.ddf).
The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file’s content.
3. **Channel Names** – Setting of the load options for the read channels.

### Testname:
Name of the importer (producer).

**use filename**: The name of the imported file is automatically used as importer name.

**Filepath**: Detailed file path of the selected file

**Created at**: Creation date and time of the selected file.

**Datatype**: The exact labelling of the data type of the selected file.

### Tab Section:
- **File Chooser**
- **File Content**
- **Channel Names**

**Open**: The selected data are imported with the defined options and the dialog is closed.

**Apply**: Like **Open** but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to ↳. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is achieved through the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date, type and load status of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: The supported file format for the Dasylab import is listed (*.ddf).

Tab File Content

Channels: Shows the total number of channels.

Datarate: States the data acquisition rate in Hertz.

File size: States the file size in byte.

Comment: If the file header contains a comment it is displayed.
Key / Value: The keys (properties) contained in the selected file are displayed together with their respective values.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Complete**: All values of the channel are loaded.

**Result**

The importer is displayed in the Spreadsheet's Components and the Explorer's Producerlist. The import dialog box can be reopened via **Modify**. The imported channels are displayed in the Spreadsheet.
2.1.10.10  Dbase v3-V

Go to:

File

- Import Values

DBase v3-V

This function allows the import of files in the DBase format of versions 3 to 5 (*.dbf).

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.
**Apply**: Like **Open** but the dialog remains open.

**Duplicate**: Another importer is created with the current settings. The original importer remains unchanged.

**Delete**: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the imported data is used by other components.

**Cancel**: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in**: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type**: The supported file format for the dBase import is listed (*.dbf).

**Tab File Content**

This tab displays the file parameters, like number of **Channels**, **Lines**, **File size** and **Last update**, and offers options for selective loading.

**Datarate**: Optionally, a different data acquisition rate can be defined (standard rate is 1 Hz).

**Character encoding**: Additionally, the character encoding for the DBase file can be defined.
Selective Loading: Defines which measuring lines are loaded.

Load all lines: All measurement data is loaded.

Load line x to y: Only a certain section of the measured data is loaded, with x as starting value and y as end value.

Load only every x-th measured line: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- [ ] Ignored: No result item is created for the selected channel.
- [ ] Standby: A result item for the channel is created, but no values are loaded.
- [✓] Complete: All values of the channel are loaded.

Result

The importer is displayed in the Spreadsheet's Components and the Explorer's Producerlist. The import dialog box can be reopened via Modify. The imported channels are displayed in the Spreadsheet.
2.1.10.11 DIAadem v8 & v9

Go to:

File

  Import Values

→ DIAadem v8 & v9

jBEAM supports the formats:

- Diadem version 8 and earlier (*.dat)
- Diadem version 9 and later (*.tdm)
- streamable TDM-version (*.tdms, *.tdms_index)

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file.

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- : A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

**Name/unit mapping:** With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences → Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

- Select: Opens the file selection dialog.
- Create: Creates a new channel mapping file.
- Edit: The selected channel mapping file can be edited via the CMAP Editor.

Load status: The load status of the selected file is displayed immediately.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ▶ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

FAQ : The context sensitive help is activated and the cursor changes to 🤔. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The – button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date, type and load status of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the DIAdem import are listed. Supported types are:

- DIAdem v8 files: *.dat
- DIAdem v9+ files: *.tdm, *.tdms, *.tdms_index
Tab File Content

The upper part shows file parameters, like number of Segments and Channels, File size and Comment, if existing. The display field shows describing data. The text can be edited, e.g. to copy it, but changes are not saved.

Character encoding: If necessary, a different character encoding can be selected from the combo box. An inappropriately selected character encoding is indicated by nonsensical characters in the imported data. Common character encodings are e.g. UTF-8 and ISO 8859-1. This option is only available for version 8 files. In case of version 9+ files this option is not necessary and is disabled.

check for invalid numbers (NANs): If this option is selected, the data to be imported are checked for a possibly defined invalidity value. If such a value occurs, it is set to NaN in the imported data object.

Data precision: Defines the data format of the result values. See also data format.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.
Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

Result

The importer is displayed in the Spreadsheet’s Components and the Explorer’s Producerlist. The import dialog box can be reopened via Modify.

The imported channels are displayed in the Spreadsheet.

The internal hierarchic structure (groups) of the data is displayed in the producer list by default. However, this display can also be deactivated in the preferences in the Explorer tab.
2.1.10.12  DiagRA Vehicle Diagnostics XML

Go to:

File
  Import Values
    DiagRA
      Vehicle
        Diagnostics
          XML

The DiagRA Vehicle Diagnostics XML import allows the reading of DiagRA files with diagnostic data from vehicle control units.

The different parameters are defined in 3 tabs:

1.  **File Chooser** – Selection of the file to be imported.
2.  **Meta Data** – Display and setting of meta data.
3.  **Channels** – Selection of the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- **Name/unit mapping:** A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Name/unit mapping:** With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

  - Select: Opens the file selection dialog.
  - Create: Creates a new channel mapping file.
  - Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- Meta Data
- Channels

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign 🚨 in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to 📖. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tabs are enabled.

Files of type: The supported file format for the DiagRA import is listed: DiagRA Vehicle Diagnostics files (*.xml).
Tab Meta Data

The tab **Meta Data** displays descriptive data of the DiagRA import, e.g. date, file name or comment.

Tab Channels

This tab lists the names of the data groups, the respective channels and their import options. For each group or channel, individual import options can be set. The different options are displayed in a table. By clicking in the header of a column the table can be sorted in ascending or descending order. The sorting order is switched with each click (ascending – descending – no sort). A right click in a line or several selected lines opens the context menu where the load status of the respective channel or channels can be set or groups expanded or collapsed.

**Name:** The list shows all groups contained in the file. The + and – boxes can be used to unfold and fold the groups in order to display or hide the contained channels.
Load status: The load status Complete, Standby or Ignored can be assigned to the individual groups or channels by clicking the symbols until the desired option is displayed. If different options are selected within a level, the symbol of the higher level changes to a question mark (Indeterminate).

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

The input fields below the table can be used to filter for special strings (e.g. in the channel names) or properties. Via drop-down list the Text filter type can be selected (Plain text, Wildcard text (?, *) or Regular expression).

In columns with preset options (Load status) the texts can be displayed as tooltip by moving the mouse over the input fields.

- Column **Name** can be searched for characters or strings.
- Column **Load status** can be filtered for the load status Complete, Indeterminate, Ignored and Standby.

### 2.1.10.13 DCM (ETAS)

Go to:

**File**

- Import Values
- DCM (ETAS)

This function allows the import of ETAS measured data files of the DCM type (*.dcm).

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.
Create: Creates a new channel mapping file.
Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.
Apply: Like Open but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.
Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign 🔄 in the Delete button indicates that the imported data is used by other components.
Cancel: The dialog is closed and changes dismissed.

Tab File Chooser
Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: The supported file format for the DCM-ETAS import is listed (*.dcm).
Tab File Content

This tab displays the file parameters, like **File size** and number of **Channels**.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific **import options** can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Complete**: All values of the channel are loaded.

**Result**

The importer is displayed in the **Spreadsheet’s Components** and the **Explorer’s Producerlist**. The import dialog box can be reopened via **Modify**. The imported data are displayed in the **Spreadsheet** under the **Values, Channels** and **Matrices** tabs.
2.1.10.14 EDAS

Go to:

File
- Import Values
  - EDAS

This function allows the import of EdasWin data files (*.edt).

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.
Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign 🔄 in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to 🌐. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: The supported file format for the DCM-ETAS import is listed (*.dcm).

Tab File Content

File header could be created.

Data precision: Defines the data format of the result values. See also data format.
Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item for the channel is created, but no values are loaded.
- **Begin:** Only the first 1000 values are loaded. This option is not available in case of group definitions.
- **End:** Only the last 1000 values are loaded. This option is not available in case of group definitions.
- **Overview:** Selected 1000 values of the channel are loaded for an overview. With a channel of 10.000 values every 10th channel is loaded. This option is not available in case of group definitions.
- **Complete:** All values of the channel are loaded.
2.1.10.15    Microsoft Excel Import

Go to:

File
  ➤ Import Values
  ➤ Microsoft Excel

This function imports files in the MS Excel format (*.xls, *.xlsx or *.xlsm). The file structure can be defined freely, analogue to the ASCII import.

The conventional *.xls format is supported as well as the newer *.xlsx format and the *.xlsm format for macros files.

Note: This component needs the Apache POI library which can be downloaded from the Internet for free (http://poi.apache.org).

The different parameters are defined in 6 tabs:

1. File Chooser – Selection of the file to be imported.
2. Individual Cells – Definition of individual parts of the file structure to be imported.
3. File Structure – Definition of separation characters for the columns, setting of the file structure.
4. Meta Data – Optional meta data.
5. Channel Header – Definition of descriptive data of the data objects.
6. Data Formats – Definition of the data formats for the individual data objects.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file.

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.

preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.
**custom**: Via **Select**, a customised channel mapping file can be selected which is applied only to this import.

- **Select**: Opens the file selection dialog.
- **Create**: Creates a new channel mapping file.
- **Edit**: The selected channel mapping file can be edited via the [CMAP Editor](#).

**Tab Section**:
- **File Chooser**
- **Individual Cells**
- **File Structure**
- **Meta Data**
- **Channel Header**
- **Data Formats**

**Table preview window**: Displays the file content of the selected file. This serves as support in parameterising the file as the effects of the settings are directly visible.

**: Help for navigating from one tab into the next. Tabs can also be switched manually at the top of the import dialog box.

**Open**: The selected data are imported with the defined options and the dialog is closed.

**Apply**: Like **Open** but the dialog remains open.

**Duplicate**: Another importer is created with the current settings. The original importer remains unchanged.

**Delete**: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the imported data is used by other components.

**Cancel**: The dialog is closed and changes dismissed.

**: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in**: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.
File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. The data contained in the file is shown in the preview window. Moreover, the other tabs are enabled. If the selected folder contains Excel profile files (*.eix), they are applied analog to the ASCII import.

Files of type: All supported file formats for the Excel import are listed (*.xls, *.xlsx, *.xlsm).

Sheet: Selection of the sheet in the Excel file containing the data to be imported.

Columns from ... to...: Selection of the columns in the sheet that are to be imported.

1904-Date: Selection of the 1904-date system for time formats. It is used, for example, for reasons of compatibility or for calculating with negative times. By default, the 1900-date system is used.

Load Profile: Opens the dialog box Load Excel-Import Profile (file format: *.eix). An import profile stores the import settings of all tabs. Profiles can be saved in the tab Data Formats.

Import as: Three import modes can be selected: block of channels (conventional structure), block as matrix and single values providing the selection of a cell range for each result channel or single value item. The corresponding tabs are enabled and show the color of the selection.

Tab Individual Cells

This tab is enabled with the selection of single values.
The list on the left shows all defined cell ranges. The buttons below the list can be used to sort the definitions, or to add, duplicate or delete definitions. For the selected definition, the parameters are shown on the right where they can be edited.

These buttons situated below the list are used to rearrange the order of the definitions in the list: Definition set at first position / one position upwards / one position downwards / at the last position.

: Creates a new cell range definition. The parameters can be set on the right.

: Duplicates the currently selected definition.

: Deletes the selected definition.

**Name:** Name of the cell range definition.

**Dimension:** The cell range may contain only one single value or a channel with several values.

**Datatype:** The cells may contain Double or Integer values or Strings.

**Unit:** Unit of the values in the cell range.

**Cell:** Selection of the cell containing the single value or the first value of the channel. It can be edited or selected by clicking into the respective cell in the table preview below.

**Length:** If the cell range is a channel this value defines the number of values in the channel.

**Sheet name:** Selection of the table sheet in the Excel file. By default, the sheet selected in tab File Chooser is preset.

**Copy selected sheet name:** The sheet name of the sheet selected in tab File Chooser is copied into the text field.

**Save Profile:** The settings of the individual cell range definitions are saved to a profile file (*.eix). This profile can later be loaded again for a new import in tab File Chooser.

[**Table preview**]: The selected cells are highlighted in different colors according to the set Dimension.
Tab File Structure – Block of Channels

Load meta data: If this option is selected, the meta data contained in the Excel file is loaded. The following settings pinpoint the exact location of the meta data. The tab Meta Data is only enabled if this option is activated.

separate sheet: Optionally, a separate table in the Excel file that contains meta data can be selected. Otherwise, the meta data is expected on the top of the same sheet as the data itself. For a preview select metadata sheet behind Show.

First line: Defines the first line containing meta data. It can be edited or selected by clicking into the respective cell in the table preview below. The selected cells are highlighted in the color shown behind.

Last line: The last line containing meta data can be defined either at the end of the file, i.e. the last filled line of the selected table, or at a defined line which is entered manually or via mouse click into the preview window.

Column for keys: Defines the column containin the keys for the meta data. The column next to it automatically is used for reading the corresponding values.

No-Value String: A string can be defined which shall be interpreted as No Value (NaN). The automatic format detection will then ignore such a string and only analyse the other values. Thus, a channel will be detected e.g. as double channel even if it contains text. If it, however, contains other strings than the defined, it will automatically be detected as string channel.

Values load as: If this option is not activated, the lower half of the dialog box is disabled and no values are loaded. If enabled (checkmark is set), the values are loaded from the file.
Values start at line: Defines the first line containing the actual data. It can be edited or selected by clicking into the respective cell in the table preview below. The selected cells are highlighted in the color shown behind.

Values go till: The last line containing data can be defined either at the end of the file, i.e. the last filled line of the selected table, or at a defined line which is entered manually or via mouse click into the preview window.

Show: Either the main sheet containing the values or the metadata sheet is displayed in the preview window. The second option is only enabled if a separate sheet was selected for meta data.

[Table preview]: The selected cells are highlighted in the indicated colors.

Tab File Structure – Block as Matrix

The upper part is as described above.

Values load as: If this option is not activated, the lower half of the dialog box is disabled and no values are loaded. If enabled (checkmark is set), the values are loaded from the file.

X values / Y values: The X / Y values can either be defined explicitly via X0 and ΔX / Y0 and ΔY, or by selecting the column or row containing the X / Y values.

Z values starts: Defines the row or column in which the Z values start.

Z values end: The last line containing data can be defined either at the end of file, i.e. the last filled line of the selected table, or at a defined row which is entered manually or via...
mouse click into the preview window. For the second dimension, the last column containing data can be defined either at the end of line, i.e. the last filled column of the selected table, or at a defined column which is entered manually or via mouse click into the preview window.

Show: Either the main sheet containing the values or the metadata sheet is displayed in the preview window. The second option is only enabled if a separate sheet was selected for meta data.

[Table preview]: The selected cells are highlighted in the indicated colors.

Tab Meta Data

Meta data is stored in a map named: If automatic is selected, the map object containing the meta data automatically receives the name of the importer (Testname). Otherwise, any other name can be entered.

[Table preview]: The selected cells are highlighted in the indicated color.

Tab Channel Header – Block of Channels

Different information can be contained in the file before the actual measured data.
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**Version:** jBEAMHelp7.2.2

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**manual / from File:** jBEAM computes the information for each data series listed on the left side, e.g. description, date. This information can be entered manually (the radio button below **manual** is selected) or read from the file (the radio button below **from File** is selected).

The column **Line** lists the line number from which the information is taken. The line numbers can either be entered manually or selected by first clicking into the input field and then clicking into the respective line in the preview table. The line number is automatically entered into the input field.

If the information is taken from **File**, the defined line applies to all channels. If the information is entered **manually**, the entries are individual for each channel. By default, the **manual** entries are preset with the values of the preselected lines from **File**, even though disabled.

**Name:** Name of the channel. If the name is taken from the file, it can be specified that the unit is contained in the name cell (**includes Unit**). The last part is then automatically interpreted as y-unit. This is entered into the channel properties. Activating this option automatically disables the options in line **Unit**.

**Description:** Description or comment of the channel.

**Date:** Displays the date of the creation day by default.

**Unit:** Displays the unit of the values (y-unit).

**X0:** Initial value of x.

**ΔX:** Distance of the x values (DeltaX). The option **includes x-Unit** states that the x-unit is contained in the same cell as ΔX. The entries are separated and assigned to the respective channel properties. Activating this option automatically disables the options in line **x-Unit**.

**x-Unit:** Unit of the x-axis.
**Active Channel:** Displays the currently selected channel. The combo box lists all available channels. For the currently selected channel, the **manual** entries can be individually edited.

**Copy to All:** If the **manual** entries of a channel shall be applied to all other channels, the button **Copy to All** can be used. Then, all manual entries are copied except **Name** and **Description**.

**Indication color:** The lines of the file already assigned to the meta data are marked in that color.

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**Tab Channel Header – Block as Matrix**

**Indication color:** The lines of the file already assigned to the meta data are marked in that color.

**manual / from File:** jBEAM computes the information for the matrix as listed on the left side, e.g. description, date. This information can be entered manually (the radio button below **manual** is selected) or read from the file (the radio button below **from File** is selected).

If the information is taken from **File**, the fields under **Row** and **Column** define the cells containing the respective information. The numbers can either be entered manually or selected by first clicking into the input field and than clicking into the respective cell in the preview table. The numbers for **Row** and **Column** are automatically entered into the input field.

**Name:** Name of the matrix.

**Description:** Description or comment of the matrix.

**Date:** Displays the date of the creation day by default.

**Unit:** Displays the unit of the matrix values (Z unit).

**x-Unit:** Unit of the x-axis.

**y-Unit:** Unit of the y-axis.

**x-Displayname:** Displayed name of the x-values.

**y-Displayname:** Displayed name of the y-values.
For some header information it can be stated that the respective information is enclosed in **brackets** in the selected cell. If this option is selected, only the content of the brackets is read. For the display names it can be stated that the cell information is read without the bracket content (**remove bracket content**).

**Tab Data Formats – Block of Channels**

After separating the columns and correctly assigning the lines the data format has to be determined. jBEAM tries to automatically set the correct data format. Manual changes are possible as well.

Channel status: Selection of a data type for the selected channel or channels.

- **Skipped**: The channel data are not read.
- **Float (64 Bit)**: A floating-point channel with 64 Bit.
- **Integer (32 / 64 Bit)**: An integer channel with 32 / 64 Bit.
- **Boolean**: A Boolean channel (true/false, 1/0).
- **String**: A string channel.
- **Date/Time**: A date/time channel.
- **d/t-2nd part**: The 2nd part of the date/time values in case the Excel file uses 2 channels (1. Date channel, 2. Time channel). jBEAM merges those two channels.

**set**: Applies the selected channel status. It is also possible to select several channels in the table preview to which the status is to be applied.

**auto detect**: Retries to automatically determine the correct data format for each channel. For this, the values of each channel are analysed and the most encompassing data format is selected. If a channel contains e.g. integer values as well as floating-point values, the data
type is set to floating-point. If the channel contains also strings, a string channel is created. The analysis uses the number lines specified under Lines of Preview.

**Save Profile**: Saves the settings of all individual tabs in an Excel import profile (*.eix). Profiles can be loaded in the File Chooser tab and can be applied to the current Excel import.

**Lines of Preview**: The preview of the formatted data can be limited to the defined number of lines. This number is also used for the automatic detection of the data format of the columns.

**Tab Data Formats – Block as Matrix**

**Channel status**: Selection of a data type for the matrix.

- **Matrix double**: A matrix with floating-point values (DoubleVarColMatrix2D).
- **Matrix integer**: A matrix with integer values (IntegerVarColMatrix2D).

**Save Profile**: Saves the settings of all individual tabs in an Excel import profile (*.eix). Profiles can be loaded in the File Chooser tab and can be applied to the current Excel import.

### 2.1.10.16 FAI IGC

Go to:

**File**

- Import Values
- FAI IGC

This function allows the import of FAI-IGC data files with GPS flight data (*.igc).

The different parameters are defined in 3 tabs:
1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channelgroups** – Setting of the load options for the read channels.

**Testname**: Name of the importer (producer).

**use filename**: The name of the imported file is automatically used as importer name.

**Filepath**: Detailed file path of the selected file

**Created at**: Creation date and time of the selected file.

**Datatype**: The exact labelling of the data type of the selected file.

**Tab Section**:
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

![ Help ]: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type:** The supported file format for the FAI-IGC import is listed (*.igc).
Tab File Content

The upper part shows file information like File size and Comment.

**Load all lines:** All data defined as measurement data is loaded.

**Load line x to y:** Only a certain section of the measured data is loaded, with x as starting value and y as end value.

**Load only every x-th measured line:** The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

Tab Channelgroups

This tab lists all available channels of the selected file and their import options.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:
Complete: All values of the channel are loaded.

Result
The importer is displayed in the Spreadsheet's Components and the Explorer's Producerlist. The import dialog box can be reopened via Modify. The imported channels are displayed in the Spreadsheet.

2.1.10.17  FAMOS

Go to:

File

File Import Values

FAMOS

This function allows to import files in the Famos format (*.dat, *.fam, *.raw).

The different parameters are defined in 3 tabs:
1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.
Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign  in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the Famos import are listed (*.fam, *.dat, *.raw).

Tab File Content

This tab displays the read file parameter.

File size: States the file size in Byte.

Creator: Name of the producer.

Group defs: Definitions of the group.

Channels: Number of channels.

Comment: If the file header contains a comment it is displayed.

Text elements: Preview window.

Tab Channel Names

Dialog in case of file with group definition:
Dialog in case of file without group definition:

This tab lists the names of the component groups, the respective channels and their import options. By enabling/disabling the checkboxes in front of the group names individual groups can be loaded or ignored during the import.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list or below each group, specific import options can be assigned to all or to the selected channels of a group. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item for the channel is created, but no values are loaded.
- **Begin:** Only the first 1000 values are loaded. This option is not available in case of group definitions.
- **End:** Only the last 1000 values are loaded. This option is not available in case of group definitions.
- **Overview:** Selected 1000 values of the channel are loaded for an overview. With a channel of 10,000 values every 10th channel is loaded. This option is not available in case of group definitions.
- **Complete:** All values of the channel are loaded.
2.1.10.18   Gantner Universal-Bin-File

Go to:

File
- Import Values
  - Gantner Universal-Bin-File

This function allows the import of files in the Gantner format (*.dat).

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.
Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: The supported file format for the Gantner import is listed (*.dat).

Tab File Content

This tab displays the file parameters and offers options for selective loading.

Channels: Number of channels.

Datara: Displays the sampling rate in Hz.
**File size:** States the file size in Byte.

**Comment:** If the file header contains a comment it is displayed.

**Selective Loading:** Defines which measuring lines are loaded.

- **Load all lines:** All measurement data is loaded.
- **Load line x to y:** Only a certain section of the measured data is loaded, with x as starting value and y as end value.
- **Load only every x-th measured line:** The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

### Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item for the channel is created, but no values are loaded.
- **Complete:** All values of the channel are loaded.
2.1.10.19 **Garmin-Database-File (CRS, HST, TCX)**

Go to:

File

Import Values

Garmin-Database-File

This function allows the import of **Garmin-Database files** in the formats *.crs, *.hst and *.tcx.

2.1.10.20 **Gidas Import**

Go to:

File

Import Values

Gidas

This function allows the import of files in the **Gidas** format (*.asc, *.asc, *.dat, *.tb).

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

: A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.

Create: Creates a new channel mapping file.

Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the Gidas import are listed (*.asc, *.*_asc, *.dat, *.tb).
Tab File Content

The upper part shows file information like Channels, File size and Comment if available.

The meta data displayed in a Key-Value table can be configured. Initially, the values are automatically read from the file and displayed in grey text. The values can be edited e.g. if they are not contained in the file. The modified values are displayed in black text. They are stored with the importer and can be used as test properties by other components, e.g. Legend as table. The column Action contains a button which can be used to reset the value to the original file value.

The input fields below the table can be used to filter for special strings (e.g. in the channel names) or properties. Via drop-down list the Text filter type can be selected (Plain text, Wildcard text (?, *) or Regular expression).

Load all lines: All data defined as measurement data is loaded.

Load line x to y: Only a certain section of the measured data is loaded, with x as starting value and y as end value.

Load only every x-th measured line: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

Data precision: Defines the data format of the result values. See also data format.
Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific **import options** can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values are loaded.
- **Complete**: All values of the channel are loaded.

**Manual X-channel**: Optionally, an import channel can be manually defined as X-channel. This channel is then assigned to each other channel as independent channel. If this option is deactivated (standard), the X-channel is automatically determined (ABSZEIT if existing, otherwise the first time channel or null).

**Result**

The importer is displayed in the **Spreadsheet’s** Components and the **Explorer’s** Producerlist. The import dialog box can be reopened via **Modify**. The imported channels are displayed in the **Spreadsheet** and the **Explorer**.
2.1.10.21 VW VENUS-CSV

Go to:

File
- Import Values
  VW VENUS-CSV

The importer VW VENUS-CSV loads files in the VENUS-CSV format).

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

: A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.
Create: Creates a new channel mapping file.
Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the Venus-Csv import are listed: *.csv.
Tab File Content

The upper part shows file information like Channels, File size and Comment as well as file parameters in a Key-Value table. The values in the table can be configured. Initially, the values are automatically read from the file and displayed in grey text. The values can be edited e.g. if they are not contained in the file. The modified values are displayed in black text. They are stored with the importer and can be used as test properties by other components, e.g. Legend as table. The column Action contains a button which can be used to reset the value to the original file value.

The input fields below the table can be used to filter for special strings (e.g. in the channel names) or properties. Via drop-down list the Text filter type can be selected (Plain text, Wildcard text (?, *) or Regular expression).

Load all lines: All data defined as measurement data is loaded.
Load line x to y: Only a certain section of the measured data is loaded, with x as starting value and y as end value.
Load only every x-th measured line: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

Data precision: Defines the data format of the result values. See also data format.
Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item for the channel is created, but no values are loaded.
- **Begin:** Only the first 1000 values are loaded.
- **Complete:** All values of the channel are loaded.

**Manual X-channel:** Optionally, an import channel can be manually defined as X-channel. This channel is then assigned to each other channel as independent channel. If this option is deactivated (standard), the X-channel is automatically determined (ABSZEIT if existing, otherwise the first time channel or null).
2.1.10.22 Google (KML)

Go to:

File
   Import Values
   Google (KML)

The importer Google (KML) loads files containing geographical data (KML format).

KML (Keyhole Markup Language) describes geographical data of Google Earth and Google Maps. The KML format is based on the general XML standard and possesses the file extension *.kml.

The different parameters are defined in 2 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.

If Open is selected, the imported data are displayed in the Spreadsheet.
Name: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

Tab Section:
- File Chooser
- File Content

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign 🔴 in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to 🔗. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the second tab is enabled.

Files of type: The supported file format for the Google import is listed (* .kml).

Tab File Content

<table>
<thead>
<tr>
<th>File Chooser</th>
<th>File Content</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Documents:</td>
<td>1</td>
</tr>
</tbody>
</table>

- Document 1: "SAsIwoldMbo"

Generated by GPlses.com http://www.gplses.com/map.do?fileId=jxnnwfxhfgjyby

- 12 single points

The content of the selected file is displayed. By checking the check boxes the components to be loaded can be selected individually.

Result

The importer is displayed in the Spreadsheet’s Components and the imported data is displayed in the Spreadsheet’s Channels. The Explorer shows the importer in the Producerlist and the data objects in the Items on CEA-Bus. The import dialog box is reopened via Modify.
2.1.10.23  GPS-Exchange Format (GPX)

Go to:

File
  Import Values
    GPS-Exchange Format (GPX)

The importer GPS-Exchange Format (GPX) loads files containing geographical data in gpx format.

The different parameters are defined in 2 tabs:

1.  **File Chooser**  – Selection of the file to be imported.
2.  **File Content**  – Display of the selected file's content.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

**Tab Section:**

- **File Chooser**
- **File Content**
**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

![Help icon]: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the second tab is enabled.

**Files of type:** The supported file format for the GPS import is listed (*.gpx).

**Tab File Content**

**Tracks:** The number of contained tracks is displayed.

**load only each x-th point:** If the file contains a very high number of measured points, it can be stated that only every x-th point shall be imported.

The list shows the contained Tracks and their segments with the measured points. The individual tracks can be selected for the import by activating the checkboxes.
Load list of waypoints: If existing, the contained waypoints (Points of Interest) can be imported.

2.1.10.24 HBM MGCplus

Go to:
File
   ➔ Import Values
      ➔ HBM MGCplus

The importer HBM MGCplus allows to import files in the *.mea format generated by the MGCplus measuring amplifier by HBM.

The different parameters are defined in 3 tabs:
1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file’s content.
3. Channel Names – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.
**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ! in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type:** All supported file formats for the MGCplus import are listed (*.mea).

**Tab File Content**

<table>
<thead>
<tr>
<th>File Chooser</th>
<th>File Content</th>
<th>Channel Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comment: CP42.P4.26 SOD with Time and triggered Rate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Parameter of MGCplus file**

- Type of file: 6001
- Number of channels: 5
- Number of signals: 6
- Number of cycles: 24000
- Value format: 125
- Measurement rate: 6308
- Measurement interval: 0.01 s
- Channels: Signals, Diebeskalmen-MGC, Thermoelement, Function_01, Noise_01, Function_02, Noise_02, Time

- **absolute date/time data**
- **UTC**
- **local time:** Mitteleuropäische Zeit

**Comment:** If existing, the comment is displayed.

**Parameter of MGCplus file:** The display window shows the metadata.

**absolute date/time data:** It can be selected whether the time shall be stated as absolute time (date/time of selected time zone) or as relative value in seconds.

- **UTC:** The Coordinated Universal Time (UTC = Universal Time, Coordinated; the primary time standard by which the world regulates clocks and time) is used.
local time: The time zone defined in the system control is used (e.g. European Mean Time).

Tab Channel Names

This tab lists all available channels of the selected file.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By activating or deactivating the checkbox in front of the channel name, this individual channel is loaded respectively ignored during the import.

By using the option buttons below the list, specific import options can be assigned to the channels to be imported:

- Standby: A result item for the channel is created, but no values are loaded.
- Begin: Only the first 1000 values are loaded.
- End: Only the last 1000 values are loaded.
- Overview: Selected 1000 values of the channel are loaded for an overview. With a channel of 10,000 values every 10th channel is loaded.
- Complete: All values of the channel are loaded.
2.1.10.25  HBM Perception (pnrf)

Go to:

File
  ➔ Import Values
  ➔ HBM Perception (pnrf)

This function allows the import of HBM Perception files in the *.pnrf format.

The different parameters are defined in 2 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **Channel Names** – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Open:** The selected data are imported with the defined options and the dialog is closed.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Tab Section:**
- **File Chooser**
- **Channel Names**
**Apply:** Like **Open** but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign 🚭 in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

👀: The context sensitive help is activated and the cursor changes to 🤔. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the ➕ button. The ➖ button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tab is enabled.

**Files of type:** All supported file formats for the HBM Perception import are listed (*.pnrf).

**Tab Channel Names**

This tab lists all available channels of the selected file and their import options. By activating or deactivating the checkbox in front of a group name, this individual group is loaded respectively ignored during the import.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the
symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

### 2.1.10.26 Hioki Hicorder (mem)

Go to:

**File**

→ **Import Values**

→ **Hioki Hicorder (mem)**

The importer **Hioki Hicorder (mem)** allows the import of analog and digital channels of Waveform files generated by the Hioki Recorderscope of type HiCorder (*.mem, *.rec, *.rms, *.xyz, *.fft).

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file.

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the Hioki HiCorder import are listed: *.MEM, *.REC, *.RMS, *.XYZ, *.FFT.

Tab File Content

This tab shows file information.
Tab Channel Names

This tab lists all available channels of the selected file. By activating or deactivating the checkbox in front of the channel name, this individual channel is loaded respectively ignored during the import.

2.1.10.27 AVL iFile

Go to:

File – Import Values

This function allows the import of files in the AVL iFile format.

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file’s content.
3. **Channel Names** – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file.

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

 shortly: A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.
Tab Section:
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

![Help Icon]: The context sensitive help is activated and the cursor changes to ![Help Icon]. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the ![Add] button. The ![Remove] button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type:** All supported file formats for the iFile import are listed: AVL iFile format.

**Tab File Content**

<table>
<thead>
<tr>
<th>File size: 4077389</th>
<th>Test date: Dec 20, 2011 12:35:45 PM CET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creator: 1.4 TSI 103kW EA2</td>
<td>Group defs.: 1</td>
</tr>
<tr>
<td>Text elements: 80.0 mm</td>
<td>Bore: 74.5 mm</td>
</tr>
<tr>
<td>Stroke: 140.0 mm</td>
<td>Volume: 348.7 cm³</td>
</tr>
<tr>
<td>Compression: 9.87</td>
<td></td>
</tr>
</tbody>
</table>

This tab displays the file parameters, like **File size**, **Test Date**, number of **Groups** and **Channels**, and other test parameters.
Tab Channel Names

This tab lists all available channel groups and the contained channels of the selected file. By activating or deactivating the checkboxes in front of the group name, this individual group is loaded respectively ignored during the import. The channels within the group can also be selected or deselected individually via the checkboxes in front of the channel names. For groups with many channels buttons are provided to select (All) or deselect (No) all channels of this group with one click.

Result

The importer is displayed in the Spreadsheet’s Components and the Explorer’s Producerlist. The import dialog box can be reopened via Modify. The imported channels are displayed in the Spreadsheet.
The INCA CVX import allows the reading of INCA map files (INCA Calibration Values Exchange Format).

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **Meta Data** – Display and setting of meta data.
3. **Channels** – Selection of the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Name/unit mapping:** With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.
Create: Creates a new channel mapping file.
Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- Metadata
- Channels

Open: The selected data are imported with the defined options and the dialog is closed.
Apply: Like Open but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.
Cancel: The dialog is closed and changes dismissed.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tabs are enabled.

Files of type: The supported file format for this import is listed: INCA Calibration values exchange format file files (*.csv).
The tab **Meta Data** displays descriptive data of the INCA-CSV import.
Tab Channels

This tab lists the names of the individual channels and characteristic maps and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.
2.1.10.29 ISO13499 MME (Crash)

Go to:

File

- Import Values
- ISO13499 MME (Crash)

The ISO13499 MME (Crash) import allows the reading of complete projects of the standardised exchange format (*.mme, *.iso).

The data to be imported may comprise meta data, channel data, videos and images.

The different parameters are defined in 5 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **Meta Data** – Display and setting of meta data.
3. **Channels** – Selection of the read channels.
4. **Movies** – Selection of the read movies.
5. **Photos** – Selection of the read photos.
**Testname:** Name of the importor (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Name/unit mapping:** With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.

**preferences:** If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.
custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.
Create: Creates a new channel mapping file.
Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- Meta Data
- Channels
- Movies
- Photos

Open: The selected data are imported with the defined options and the dialog is closed.
Apply: Like Open but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.
Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ✧ in the Delete button indicates that the imported data is used by other components.
Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tabs are enabled.

Files of type: All supported file formats for the ISO13499 import are listed. Supported types are ISO13499 header files (*.mme) and *.iso files.
The tab Meta Data displays descriptive data of the ISO import, e.g. the name of the laboratory, contact details, test title/type or date.

**Load channels**: If selected, the channels contained in the ISO file are loaded. The number of channels is listed in the display panel.

**Convert to standard units**: If selected, the units from the imported data are automatically converted to the standard units that are used in the numeric crash analysis.

**Auto offset (with average before 0.0s)**: If selected, an offset is determined out of the average of the values before t0 (zeroing of signals).

**Load movies**: If selected, videos included in the ISO file are loaded. The number of videos is listed in the display panel.

**Load photos**: If selected, the images included in the ISO file are imported. The number of images is listed in the display panel.

**Load values**: Selection between load all values (values of the whole co-domain are imported) and only between (starting and end values of the data to be imported are determined).
Tab Channels

This tab lists all available channels of the selected file and their import options.

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

Tab Movies

This tab lists all available movies of the selected file and their import options. The load options are set as in the Channels tab.
Tab Photos

This tab lists all available photos of the selected file and their import options. The load options are set as in the Channels tab.

Result

The imported channels are immediately visible in the Spreadsheet. The ISO importer is displayed in the Producerlist of the Explorer. The Spreadsheet tab Maps displays descriptive information about the imported data. A single or all import components can be selected in the combo box Metadata map. For each import component the key with the corresponding value is listed. Descriptive information is stored as a data object of the type hash map.
2.1.10.30  jBEAM Project

Go to:

File
Import Values
jBEAM Project

The import jBEAM Project reads selected data from jBEAM project files. In contrast to opening large project files, this importer allows to load only selected channels or data areas.

When using the option Standby the data is only loaded when actually used.

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file’s content.
3. Channel Names – Setting of the load options for the read channels.

Upon clicking Open the imported data is displayed in the Spreadsheet.
**Testname:** Name of the importer (producer).

**Use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

☐: A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**
Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

FAQ: The context sensitive help is activated and the cursor changes to Ⱒ. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the jBEAM project import are listed (*.jbs, *.jbeam).

Tab File Content

The parameters of the selected import file are displayed.
Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values are loaded.
- **Complete**: All values of the channel are loaded.

**Result**

The importer is displayed in the Spreadsheet tab **Components** and the Explorer’s **Producerlist**.
2.1.10.31 Krause/Daimler (XML)

Go to:

File

Import Values

Krause/Daimler (XML)

This function allows the import of Krause/Daimler files in the XML format.

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Result Names – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **FileChooser**
- **File Content**
- **Result Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like **Open** but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign \(\Delta\) in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to \(\text{?}\). The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the \(+\) button. The \(-\) button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the Krause/Daimler import are listed: \(*\).xml.

Tab File Content

This tab displays the file parameters (Metadata) of the selected file.
Data precision: Defines the data format of the result values. See also data format.

Tab Result Names

This tab lists all available channels of the selected file and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values are loaded.
- **End**: Only the last 1000 values are loaded.
- **Overview**: Selected 1000 values of the channel are loaded for an overview. With a channel of 10,000 values every 10th channel is loaded.
- **Complete**: All values of the channel are loaded.
2.1.10.32  LS-Dyna

Go to:

File
  Import Values
    LS-Dyna

This function allows the import of files in the LS-Dyna format (*.dat, *).

The different parameters are defined in 3 tabs:
1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Name/unit mapping:** With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.
**preferences:** If global and local channel mapping files are set in Preferences ➤ Importer (tab Channel mapping), they are applied to the import.

**custom:** Via Select, a customised channel mapping file can be selected which is applied only to this import.

- [ ] **Select:** Opens the file selection dialog.
- [ ] **Create:** Creates a new channel mapping file.
- [ ] **Edit:** The selected channel mapping file can be edited via the CMAP Editor.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign 🔴 in the Delete button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

- [ ] : The context sensitive help is activated and the cursor changes to 📖. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type:** All supported file formats for the LS-Dyna import are listed (*.dat, *).
### Tab File Content

<table>
<thead>
<tr>
<th>Channels</th>
<th>File size</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>317</td>
<td>9,303,036 byte</td>
<td>ts-dyne mpp971s.7500.1224.R2</td>
</tr>
</tbody>
</table>

#### Node | Title
--- | ---
83 |  
230 |  
231 |  
455 |  
456 |  
502 |  
394089 |  
394144 |  
394193 |  
400522 |  
402718 |  
404179 |  
540123 |  
6000001 |  
6000288 |  

- **Load all lines**: All data defined as measurement data is loaded.
- **Load line x to y**: Only a certain section of the measured data is loaded, with x as starting value and y as end value.
- **Load only every x-th measured line**: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

**Data precision**: Defines the data format of the result values. See also [data format](#).
Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values are loaded.
- **Complete**: All values of the channel are loaded.
Go to:

File

Import Values

LabVIEW (lvm)

This function allows the import of measured data files in the LabVIEW format (*.lvm).

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**
Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the LabVIEW import are listed (*.lvm).

Tab File Content
The upper part shows file information like Channels, File size and Comment.

**Load all lines:** All data defined as measurement data is loaded.

**Load line x to y:** Only a certain section of the measured data is loaded, with x as starting value and y as end value.

**Load only every x-th measured line:** The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

**Data precision:** Defines the data format of the result values. See also data format.

### Tab Channel Names

<table>
<thead>
<tr>
<th>Channel Name</th>
<th>Import Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-1</td>
<td></td>
</tr>
<tr>
<td>SinPos</td>
<td></td>
</tr>
<tr>
<td>Time-2</td>
<td></td>
</tr>
<tr>
<td>SinNeg</td>
<td></td>
</tr>
<tr>
<td>Time-3</td>
<td></td>
</tr>
<tr>
<td>CosNeg</td>
<td></td>
</tr>
</tbody>
</table>

This tab lists all available channels of the selected file and their import options.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item for the channel is created, but no values are loaded.
- **Begin:** Only the first 1000 values are loaded.
- **End:** Only the last 1000 values are loaded.
- **Overview:** Selected 1000 values of the channel are loaded for an overview. With a channel of 10.000 values every 10\textsuperscript{th} channel is loaded.
- **Complete:** All values of the channel are loaded.

**Result**

The importer is displayed in the Spreadsheet’s Components and the Explorer’s Producerlist. The import dialog box can be reopened via Modify. The imported channels are displayed in the Spreadsheet.
2.1.10.34 Madymo (TNO-Automotive)

Go to:

File
   Import Values
      Madymo (TNO-Automotive)

This function allows the import of measured data from a file in Madymo format (*.frc, *.lac, *.lvl, *.rds, *.rlg).

The different parameters are defined in 2 tabs:

1. **File Chooser** – Selection of the file or files to be imported.
2. **Options** – Definition of options for the file to be imported.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file.

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

Tab Section:
- FileChooser
- Options

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.
**Duplicate**: Another importer is created with the current settings. The original importer remains unchanged.

**Delete**: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.

**Cancel**: The dialog is closed and changes dismissed.

![?] : The context sensitive help is activated and the cursor changes to ??. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

**Look in**: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the second tab is enabled.

**Files of type**: All supported file formats for the Madymo import are listed (*.frc, *.lac, *.lvl, *.rds, *.rlg).
Tab Options

The read parameters for Header, Groups and Quantities of the selected import file are displayed. For Groups and Quantities Abbreviations can be edited.

2.1.10.35 Matlab Import

Go to:

File
  Import Values
    Matlab

This function allows the import of measured data from a file in Matlab format (*.mat).

Segments containing numerical data according to Matfile format version 7 are supported.
The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.

**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.
Tab Section:

- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

![Help]: The context sensitive help is activated and the cursor changes to 🔢. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type:** All supported file formats for the Matlab import are listed (*.mat).
Tab File Content

This tab displays header information and parameters of the segments.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.

Sort by name: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

Result

The importer is displayed in the Spreadsheet’s Components and the Explorer’s Producerlist. The import dialog box can be reopened via Modify. The imported channels are displayed in the Spreadsheet.
2.1.10.36 MDF (v3/v4)

Go to:

File
   Import Values
      MDF (v3/v4)

The MDF import reads files with measured values of the type MDF (versions v3 and most features of v4) by ETAS.

The different parameters are defined in 4 tabs:
1. File Chooser - Selection of the file to be imported.
2. File Content - Display of the selected file's content.
3. Channel Selection – Setting of the load options for the read channels.
4. Options – Definition of time range and storage information of the values to be loaded.

Upon clicking Open the imported data is displayed in the Spreadsheet and can be visualised as a graphic element.

From jBEAM version 7.2.1.x on, the importer supports 1-Bit channels. They are imported as bit channels (up to now as integer channels). The channels can then be exported as bit channels which enables a conversion from MDF3 to MDF4.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.

preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

Select: Opens the file selection dialog.

Create: Creates a new channel mapping file.

Edit: The selected channel mapping file can be edited via the CMAP Editor.
Tab Section:

- **File Chooser**
- **File Content**
- **Channel Selection**
- **Options**

**load configuration:** An earlier saved configuration file (*.ConfigMDF) in XML format can be selected and the contained settings are reused.

**save configuration:** The current settings are saved in a configuration file (*.ConfigMDF) in XML format.

**load LAB file:** For a preselection of the most important channels a list of labels (LAB file) can be loaded and the defined channel selection is used. The LAB file is applied only once and not saved in the importer. The confirmed channel selection, however, is saved in the importer.

If listed channels are found in the file, it is requested which load status shall be applied for the import (**Complete** or **Standby**).

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like **Open** but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ![warning](https://example.com/warning.png) in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

![Help Button](https://example.com/help.png) : The context sensitive help is activated and the cursor changes to ![help](https://example.com/help.png). The respective help topic is displayed when an area within the dialog is clicked on.

As soon as the settings are finished via **Open** or **Apply**, the import starts. This can take some time depending on the data volume and the selected options. The progress is indicated by a bar.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the [+] button. The [-] button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.
**File name**: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tabs are enabled.

**Files of type**: All supported file formats for the MDF import are listed (*.mdf, *.mf3, *.mf4, *.dat).

### Tab File Content

The upper part shows file information like **Date**, **Time** and **MDF-Version**.

**Data Groups / Channels**: Display of contained data groups and channels. Files in the MDF format can store groups of measuring channels with different sampling rates.

The meta data displayed in a Key-Value table can be configured. Initially, the values are automatically read from the file and displayed in grey text. The values can be edited e.g. if they are not contained in the file. The modified values are displayed in black text. They are stored with the importer and can be used as test properties by other components, e.g. **Legend as table**. The column **Action** contains a button which can be used to reset the value to the original file value.

The input fields below the table can be used to filter for special strings (e.g. in the channel names) or properties. Via drop-down list the **Text filter type** can be selected (**Plain text**, **Wildcard text** (?), *) or **Regular expression**).
Tab Channel Selection

This tab lists the names of the component groups, the respective channels and their import options. For each group or channel, individual import options can be set. The different options are displayed in a table. By clicking in the header of a column the table can be sorted in ascending or descending order. The sorting order is switched with each click (ascending – descending – no sort). A right click in a line or several selected lines opens the context menu where load status and specific properties of the respective channel or channels can be set.

Name: The list shows all groups contained in the file. The + and – boxes can be used to unfold and fold the groups in order to display or hide the contained channels. In addition to the group name also the number of contained channels, comment, number of records (values) and frequency of the respective data group are displayed.

Load data group: The checkboxes can be used to activate or deactivate the individual groups completely or to activate or deactivate the contained channels individually.

Load status: The load status Complete, Standby or Ignored can be assigned to the individual groups or channels by clicking the symbols until the desired option is displayed. If different options are selected within a level, the symbol of the higher level changes to a question mark (Indeterminate).

Ignored: No result item is created for the selected channel.

Standby: A result item for the channel is created, but no values are loaded.

Complete: All values of the channel are loaded.

Custom property: Specific properties of the channels can be set or cleared via checkboxes.

I: Indicates an interpolated channel. If selected, the values will be interpolated if the sampling rate changes. The value of the new grid point is set to the value of the last passed old grid point. Effective only if data are resampled.

IT: (Integer/Text) Indicates channels with e.g. status texts. If selected, the channel is loaded as string channel. If not, only indices are loaded as integer channel.
DT: (Double/Text) Indicates channels with e.g. conversion formulas and status texts. If selected, the channel is loaded as string channel. If not, it is loaded as DoubleChannel.

**Long Signal name:** Long signal names are displayed.

**Channel unit:** The units of the channels are displayed.

**Filter line**

The input fields below the table can be used to filter for special strings (e.g. in the channel names) or properties. Via drop-down list the Text filter type can be selected (Plain text, Wildcard text (?, *) or Regular expression).

In columns with preset options (Load data group, Load status, Custom property) the texts can be displayed as tooltip by moving the mouse over the input fields.

- Columns **Name**, Long Signal name and **Channel unit** can be searched for characters or strings.
- Column **Load data group** can be filtered for **Yes**, No or Pending.
- Column **Load status** can be filtered for the load stati **Ignored**, Standby, Complete and Indeterminate.
- Column **Custom property** can be filtered for True or False.

**Actions**

**Expand all:** All groups are expanded and the contained channels displayed.

**Collapse all:** All groups are collapsed and the contained channels hidden.

**Select group:** The selected groups are activated for the import.

**Clear group:** The selected groups are deactivated for the import.

**Load status:** The selected groups or channels are set to one of the load states Complete, Standby or Ignored. The load status is selected by clicking the symbol until the desired option is displayed.

**Select I:** Interpolation is activated for the selected channels.

**Clear I:** Interpolation is deactivated for the selected channels.

**Select IT:** The selected integer channels are imported as text channels.

**Clear IT:** The selected integer channels are imported as numeric channels.

**Select DT:** The selected decimal channels are imported as text channels.

**Clear DT:** The selected decimal channels are imported as numeric channels.
Behaviour of the channel selection in case of file change

The MDF importer has two modes of behaviour when the import file is changed. They also apply to the import via Multi File Importer or Data Source Manager. Starting point is always a first file. All groups of this file with more than one record are activated and their channels set to **Complete**. Groups with no or only one record are deactivated. These groups have no influence on the automatically determined mode.

The first mode is active when all channels are set to **Complete** (case 1) or at least to **Standby** (case 2). If the file is changed, all new channels are set to **Complete** (case 1) or **Standby** (case 2).

In case 2, all channels with the same name which are set to **Standby** in the old file are also set to **Standby** after file change – as long as they exist.

This mode has two particular features:

1st: If a group is deactivated in the first file because it has not more than one record, it is activated in the second file if it then has more than one record. And vice versa: If a formerly activated group has not more than one record after the file change it is deactivated.

2nd: As the time channels/master channels of the different groups normally have the same name, they are displayed as deactivated after file change. However, if necessary (no constant sampling rate), they are automatically activated again and thus imported.

The second mode is automatically active when at least one channel is set to **Ignored**. When the file is changed, it is again tried to adopt the settings from the first file according to the channel names. In contrast to the first mode however, all new channels are set to **Ignored**.

Another difference applies to groups with not more than one record: They are not deactivated in the second file if they contain at least one channel which has been set to **Complete** or **Standby** in the first file.
Tab Options

Preferred MDF3 Signal Name: This option defines which signal name contained in the channel properties according to the MDF3 specification shall be used as channel name.

- **Long Signal Name**: The long signal names are used. The label in the file is e.g. long_name.
- **Display Name**: The display names are used. The label in the file is e.g. mdf_display_name.
- **Short Signal Name**: The short signal names are used. According to the MDF3 specification, this may be e.g. the first 31 characters of the Long Signal Name. But also individual names may be assigned. The label in the file is e.g. ChannelName or cn_name.

apply Channel Hierarchy: If the MDF file contains a Channel Hierarchy, this will be adopted when the option is activated.

Add name of source to name of channel if it is not unique: Optionally, the SourceNames stored in the file can be added to the channel names. This only applies if the channel names are not unique.

Cut channel names after "\": Channel names containing individual additional information after "\" can be cut at this position to facilitate comparability.
Consider limits of channels: This option is activated by default. It can be deactivated in order to read files with faultily defined limits completely.

load all Values: All values and channels are loaded the way they are stored in the file.

only from: All values of a group that are within the defined time range are loaded. The time range can be modified. The sampling rate is not changed.

intersecting Range: Only the time range contained in each group is loaded. This range is automatically determined via minimum and maximum and cannot be modified. A consistent sampling rate (resample to) is defined for all channels that are to be imported.

total Range: The total time range of all selected groups is loaded. This range is automatically determined via minimum and maximum and cannot be modified. A consistent sampling rate (resample to) is defined for all channels that are to be imported.

manual Range: All values of a group that are within the defined time range are loaded. The time range can be modified. A consistent sampling rate (resample to) is defined for all channels that are to be imported.

resample to: Defines the consistent new sampling rate for the resampling.

Method: The conversion of values to the new grid by means of the new sampling rate (resampling) can be done by the following algorithms (interpolation):

auto average/linear: The method to be applied is automatically determined in case of Double or Float channels and optionally in case of Integer channels. The applied method depends on how many old values lie within the new grid. If the new grid needs more values than the old grid, new values are linear interpolated. However, if the new grid has fewer values than the old grid, the average applies. In case of String or Boolean channels and optionally Integer channels, the method hold last value is applied.

Integer: hold last value: In case of Integer channels either the method auto average/linear (deactivated) or hold last value (activated) can be applied.

linear: In case of Double or Float and optionally Integer channels it is linear interpolated. In case of String or Boolean and optionally Integer channels, the method hold last value is applied.

cubic spline: In case of Double or Float channels the method cubic spline is applied. In case of String, Boolean and Integer channels, the method hold last value is applied.

hold last value: The last value is adopted until a new value appears in the input channel.

Time offset: The time channels can optionally be calculated with an offset.

Storage: Determines how the data is stored. See also storage mode.

Data precision: Defines the data format of the result values. See also data format.

Result
The test series loaded from the MDF file is displayed in the Spreadsheet and can be visualized by means of jBEAM graphic elements.
The internal hierarchic structure (groups) of the data is displayed in the producer list by default. However, this display can be deactivated in the preferences in the Explorer tab.

Display without Data Object Groups

Display with Data Object Groups

The loaded data can be displayed in a xy-graph.
2.1.10.37 NetCDF

Go to:

File
  ➤ Import Values
    ➤ NetCDF

This function allows the import of measured data from a file in NetCDF format (*.cdf, *.nc*) as well as HDF-5 files (*.he5) and Uniplot files (*.nc, *.nc2). These data formats are often used to visualize flow fields in fluid dynamics.

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Name/unit mapping:** With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under **preferences** and **custom**, are applied to the import. If entries with identical names exist in the selected files, the entries of the **custom** channel mapping file prevail.

- **preferences:** If global and local channel mapping files are set in **Preferences → Importer (tab Channel mapping)**, they are applied to the import.

- **custom:** Via **Select**, a customised channel mapping file can be selected which is applied only to this import.

- **Select:** Opens the file selection dialog.
- **Create:** Creates a new channel mapping file.
- **Edit:** The selected channel mapping file can be edited via the **CMAP Editor**.
Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Character encoding: The character encoding can be selected from the combo box. In most cases, the character encoding is automatically recognised and applied accordingly. Sometimes, however, it might be possible that the underlying standard is not complied completely. Then, inappropriate characters may appear in the data. To correct this, a different character encoding can be selected until the data appear appropriate. The most common character encodings are UTF-8 and ISO 8859-1.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the NetCDF import are listed:
- NetCDF files (*.cdf, *.nc)
- HDF-5 files (*.he5)
- Uniplot files (*.nc, *.nc2)
Tab File Content

The file information of the selected file is displayed in categories. The movable separation bar between the categories can be moved up and down by mouse click & move. If a variable is selected, its attributes are displayed in the bottom table.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.

Attributes: As Name of the map data object containing the file properties (Metadata) either always the test name is selected (default setting for new importers) or it can be entered manually in the input field.

Variables to load: In the Active column, the specific import options can be assigned to the individual variables (channels) by clicking on the symbols until the desired option is displayed. Available load options are:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.
The other columns show information on the channels. According to the variable type, settings can be made in the input fields and the dimensions assigned.

**Select All:** All variables are set to **Complete** loading.

**Deselect All:** All variables are set to **Ignore**, i.e. they are not loaded.

**Standby All:** All variables are set to **Standby**, i.e. data objects are created but no values loaded.

**Result**

The importer is displayed in the **Spreadsheet’s** Components and the **Explorer’s** Producerlist. The import dialog box can be reopened via **Modify**. The imported channels are displayed in the **Spreadsheet**.

2.1.10.38 Nicolet (WFT)

Go to:

**File**

- Import Values
- Nicolet (wft)
2.1.10.39 Opel-GPS-CanLog-File

Go to:
File
   ➔ Import Data
       ➔ Opel-GPS-Canlog-File

2.1.10.40 PAtools (Kratzer)

Go to:
File
   ➔ Import Values
       ➔ PAtools (Kratzer)

This function allows the import of measured data from Kratzer PAtools files (*.erg, *.org, *.atf_fu, *.mva).

The different parameters are defined in 3 tabs:
1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
**Testname**: Name of the importer (producer).

**use filename**: The name of the imported file is automatically used as importer name.

**Filepath**: Detailed file path of the selected file

**Created at**: Creation date and time of the selected file.

**Datatype**: The exact labelling of the data type of the selected file.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Name/unit mapping**: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences→Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

- Select: Opens the file selection dialog.
- Create: Creates a new channel mapping file.
- Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:

- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.
Apply: Like Open but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.
Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.
Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to "?. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the PAtools import are listed (*.erg, *.org, *.atf_fu, *.mva).
Tab File Content

The upper part shows file information like **Channels**, **File size** and **Comment** as well as a Key-Value table listing the contained keys.

- **Load all lines**: All data defined as measurement data is loaded.
- **Load line x to y**: Only a certain section of the measured data is loaded, with x as starting value and y as end value.
- **Load only every x-th measured line**: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

Tab Channel Names

This tab lists all available channels of the selected file. By activating or deactivating the checkbox in front of the channel name, this individual channel is loaded respectively ignored during the import.

Result

The importer is displayed in the **Spreadsheet’s** Components and the **Explorer’s** Producerlist. The import dialog box can be reopened via **Modify**. The imported channels are displayed in the **Spreadsheet**.
2.1.10.41 PEMS XML

Go to:

File
  ➔ Import Values ➔ PEMS XML

The PEMS XML file format is used for mobile emission measurements of vehicle engines in road operation (PEMS = Portable Emission Measurement System).

The import is carried out through selection of an *.xml file which has to comply with a specific scheme. The data of the measurement is contained as a tree structure. Further settings are not necessary.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the **[+]** button. The **[-]** button removes the selected folder from the list of favorites.
Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header.

Files of type: All supported file formats for the PEMS XML import are listed (*.xml).

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.1.10.42 Porsche PD5

Go to:

File

Import Values

Porsche PD5
2.1.10.43  Q-DAS

Go to:

File

Import Values → Q-DAS

This function allows the import of files in the Q-DAS format (*.DFQ, *.DFD).

The different parameters are defined in 2 tabs:

1. File Chooser – Selection of the file to be imported.
File Name: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Path: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

File Type: The exact labelling of the data type of the selected file.

Tab Section:
- File Chooser
- Meta Data

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.
**Duplicate**: Another importer is created with the current settings. The original importer remains unchanged.

**Delete**: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ▼ in the **Delete** button indicates that the imported data is used by other components.

**Cancel**: The dialog is closed and changes dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the + button. The – button removes the selected folder from the list of favorites.

**Look in**: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the other tab is enabled.

**Files of type**: All supported file formats for the Q-DAS import are listed:

- Q-DAS Shared Files: *.DFQ
- Q-DAS Description Files: *.DFD

**Tab Meta Data**

Meta data and parameters of the selected import file are displayed.
2.1.10.44  Racelogic VBox

Go to:

**File**  
- **Import Values**  
  - **Racelogic Vbox**

This function allows the import of measured data files in the Racelogic Vbox format (*.vbo).

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

  **use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

- A section opens with extended settings for the **Save mode** of importer data in project file and project template as well as the **Default load status** for channels.

**Tab Section:**

- **File Chooser**
- **File Content**
- **Channel Names**
Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

❓: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the Racelogic import are listed: Racelogic Vbox files (*.vbo).

Character encoding: The used character encoding can either be determined automatically or selected manually out of the combo box.
Tab File Content

The upper part shows file information like Channels, File size and Comment.

**Selective Loading**: Defines which measuring lines are loaded.

- **Load all lines**: All data defined as measurement data is loaded.
- **Load line x to y**: Only a certain section of the measured data is loaded, with x as starting value and y as end value.
- **Load only every x-th measured line**: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.

**Storage**: Determines how the data is stored. See also [storage mode](#).

**Data precision**: Defines the data format of the result values. See also [data format](#).

Tab Channel Names

The lower part shows the channel names and their order.

[Image of the channel names]
This tab lists all available channels of the selected file and their import options.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item for the channel is created, but no values are loaded.
- **Begin:** Only the first 100 values are loaded.
- **End:** Only the last 1000 values are loaded.
- **Overview:** Selected 1000 values of the channel are loaded for an overview. With a channel of 10,000 values every 10th channel is loaded.
- **Complete:** All values of the channel are loaded.

**Result**

The importer is displayed in the Spreadsheet’s Components and the Explorer’s Producerlist. The import dialog box can be reopened via Modify. The imported channels are displayed in the Spreadsheet.
2.1.10.45  RPC III (MTS)

Go to:

File

Import Values  ➔ RPC III (MTS)

This function allows the import of measured data files in the RPC III format by MTS (*.rpc, *.rsp, *.drv).

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. Channel Names – Setting of the load options for the read channels.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **File Chooser**
- **File Content**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like **Open** but the dialog remains open.
**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ▶️ in the Delete button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type:** All supported file formats for the RPCIII import are listed (*.rpc, *.rsp, *.drv).

**Tab File Content**

The upper part shows file parameters.

**Storage:** Determines how the data is stored. See also storage mode.

**Data precision:** Defines the data format of the result values. See also data format.
### Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field.

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values of the channel are loaded.
- **Complete**: All values of the channel are loaded.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Import Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMS1</td>
<td></td>
</tr>
<tr>
<td>HALTER</td>
<td></td>
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<tr>
<td>FLEXAY</td>
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<td>HAKAY</td>
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<td>MOTAY</td>
<td></td>
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<tr>
<td>TEMP1</td>
<td></td>
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<td>DMS2</td>
<td></td>
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<tr>
<td>HAKEN</td>
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<td>TEMP2</td>
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<td>DMS3</td>
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<tr>
<td>MOTAX</td>
<td></td>
</tr>
<tr>
<td>TEMP3</td>
<td></td>
</tr>
</tbody>
</table>
2.1.10.46  TEAC

Go to:

File
   ➤ Import Values
      ➤ TEAC

This function allows the import of measured data files in the TEAC format (*.hdr).

The different parameters are defined in 3 tabs:

1.  File Chooser – Selection of the file to be imported.
3.  Channel Names – Setting of the load options for the read channels.
**File Name:** Name of the importer (producer).

- **use filename:** The name of the imported file is automatically used as importer name.

**Path:** Detailed file path of the selected file.

**Created at:** Creation date and time of the selected file.

**File Type:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **File Chooser**
- **Meta Data**
- **Channel Names**

**Open:** The selected data are imported with the defined options and the dialog is closed.
**Apply**: Like **Open** but the dialog remains open.

**Duplicate**: Another importer is created with the current settings. The original importer remains unchanged.

**Delete**: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the imported data is used by other components.

**Cancel**: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in**: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

**Files of type**: The supported file format for the TEAC import is listed (TEAC header file *.hdr).

**Tab Meta Data**

The header file information is displayed.

Files in the TEAC GX-1 format can store measuring channels with different sampling rates. If the selected file’s channels comprise different sampling rates, the data can be loaded with the original sampling rate via **Original Rates** (the number of measured values is not changed) or expanded with consistent sampling rates via **Expand to Same Rate** (number of measured values is increased).
Note: The different channels can only be set off against each other if the sampling rate is consistent.

Tab Channel Names

This tab displays the individual channels. The channel names can be modified in the input fields.

Result

The imported channels are displayed in the Spreadsheet tab Channels. They can be visualized in the graphic window. The importer is listed in the Explorer’s Producerlist.
2.1.10.47 Tecplot Import

Go to:

File
  ➔ Import Data
    ➔ Tecplot

This function allows the import of measured data files in the Tecplot format, either as ASCII files (*.dat) or as binary files (*.plt). This importer supports the selection of multiple files.

The different parameters are defined in 2 tabs:

1. File Chooser—Selection of the file or files to be imported.
2. Options – Optionally, the data can be imported as channels or as matrix.
**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file.

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

**Tab Section:**
- **File Chooser**
- **Options**

**Open:** The selected data are imported with the defined options and the dialog is closed.

**Apply:** Like Open but the dialog remains open.
**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ⚠️ in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

![Help icon]: The context sensitive help is activated and the cursor changes to 🕵️‍♂️. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

- **Select files from different directories:** This option enables the selection of various files from different directories. Two lists are displayed; on the left all available files in the chosen directory and on the right the list with the selected files.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the second tab is enabled.

**Files of type:** All supported file formats for the Tecplot import are listed. Supported types are ASCII files (*.dat) and binary files (*.plt).

**Tab Options**

This tab defines the import options for one or more files.

**Individual channels:** An individual channel is generated for each column of the imported file.

**All channels in one matrix:** A position matrix is created in which each channel makes up one level.
For each channel one matrix: For each column a positions matrix is generated in which each file makes up one level in each matrix.

Result

The imported data is immediately visible in the Spreadsheet tab Matrices. The Tecplot importer is listed in the Explorer’s Producerlist.

2.1.10.48 Universal File Format (15 & 58)

Go to:

File

• Import Value

• Universal File Format (15 & 58)

This function allows the import of measured data files in the Universal File Format (15 & 58) (*.unv, *.uff). Supported are data sets of types 15, 58, 151 and 164. The data sets can optionally be grouped in matrices.

The different parameters are defined in 3 tabs:

1. File Chooser – Selection of the file to be imported.
2. File Content – Display of the selected file's content.
3. **Channelgroups** – Selection of the read channels for the import either as channels or as matrix.

![Image of jBEAM software interface showing file import options](image)

**Testname:** Name of the importer (producer).

**use filename:** The name of the imported file is automatically used as importer name.

**Filepath:** Detailed file path of the selected file

**Created at:** Creation date and time of the selected file.

**Datatype:** The exact labelling of the data type of the selected file.

[A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.]

**Tab Section:**
- **FileChooser**
- **File Content**
Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the import of Universal File Format files are listed (*.unv, *.uff).
Tab File Content

This tab shows file information of the selected file like File size, Data sets and Comment.

Tab Channel Names

This tab lists all available channel groups and the contained channels of the selected file. By activating or deactivating the checkboxes in front of the group names, this individual group is loaded respectively ignored during the import. The channels of one group can either be imported as separate channels or as a matrix.

Example: The group in the image above can either be imported as 6 separate channels with 800 rows each, or as a matrix with 6 columns and 800 rows.
Result
The importer is displayed in the Spreadsheet’s Components and the Explorer’s Producerlist. The import dialog box can be reopened via Modify. The imported channels are displayed in the Spreadsheet.

2.1.10.49 VW Calibrationdata (ASCII)

Go to:
File
- Import Value
  - VW Calibrationdata (ASCII)
2.1.10.50  VW MDM-Data (XML)

Go to:

File

Import Value

VW MDM-Data (XML)

2.1.10.51  VW Quirl (IDS)

Go to:

File

Import Value

VW Quirl (IDS)
2.1.10.52  Yokogawa

Go to:

File

Import Value

Yokogawa

This function allows the import of measured data files in the Yokogawa format which can be either a *.wdf file or a header file (*.hdr) and separate data file (*.wvf), depending on the used recording instrument.

The various formats are processed as follows:

- Header file (*.hdr) and corresponding data file (*.wvf) are read completely by the jBEAM component.
- *wdf* files generated by the DL850 series are read using the DL 850 Wrapper which is included in jBEAM. This wrapper supports Windows 32- and 64-Bit.
- *wdf* files generated by the DL750, DL9000 and SL1400 series are read using the WDF Wrapper which is included in jBEAM. This wrapper supports Windows 32-Bit.

⚠️ The wrappers may require special Windows DLLs contained in the "Microsoft Visual C++ Redistributable Packages for Visual Studio 2010" (to be downloaded from the Microsoft website if needed). Especially newly installed Windows 10 computer may require additionally the installation of the "Visual C++ 2008 SP1 Redistributable Package (x64)" from the Microsoft website.

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file's content.
3. **Channel Names** – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Name/unit mapping: With this option, channel mapping files can be selected to standardise channel and unit names. All selected channel mapping files, both under preferences and custom, are applied to the import. If entries with identical names exist in the selected files, the entries of the custom channel mapping file prevail.
preferences: If global and local channel mapping files are set in Preferences → Importer (tab Channel mapping), they are applied to the import.

custom: Via Select, a customised channel mapping file can be selected which is applied only to this import.

- Select: Opens the file selection dialog.
- Create: Creates a new channel mapping file.
- Edit: The selected channel mapping file can be edited via the CMAP Editor.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.

Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the DIAdem import are listed:
- data files (*.wdf) file or a
- header files (*.hdr); the corresponding data file (*.wvf) is loaded automatically
Tab File Content

This tab shows file information of the selected file like number of channels, file size and comment.

Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name**: Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Begin**: Only the first 1000 values are loaded.
- **Overview**: Selected 1000 values of the channel are loaded for an overview. With a channel of 10,000 values every 10th channel is loaded.
- **Complete**: All values of the channel are loaded.
Result

The importer is displayed in the **Spreadsheet**’s Components and the **Explorer**’s Producerlist. The import dialog box can be reopened via **Modify**. The imported channels are displayed in the **Spreadsheet**.

![Spreadsheet and Explorer components](image)

2.1.10.53 Zwick

Go to:

**File**

- Import Values
- Zwick

This function allows the import of measured data files in the Zwick result format (*.erg).

![File dialog](image)

The different parameters are defined in 3 tabs:

1. **File Chooser** – Selection of the file to be imported.
2. **File Content** – Display of the selected file’s content.
3. **Channel Names** – Setting of the load options for the read channels.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

Tab Section:
- File Chooser
- File Content
- Channel Names

Open: The selected data are imported with the defined options and the dialog is closed.

Apply: Like Open but the dialog remains open.
Duplicate: Another importer is created with the current settings. The original importer remains unchanged.

Delete: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ▶️ in the Delete button indicates that the imported data is used by other components.

Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to 🤔. The respective help topic is displayed when an area within the dialog is clicked on.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Look in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Look in: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs are enabled.

Files of type: All supported file formats for the Zwick import are listed (*.erg).

Tab File Content

The upper part shows file parameters, like File size, number of Channels and Lines.

Selective Loading: Defines which measuring lines are loaded.

Load all lines: All measurement data is loaded.

Load line x to y: Only a certain section of the measured data is loaded, with x as starting value and y as end value.

Load only every x-th measured line: The number x indicates, the how many-th line of a file is loaded. The lines inbetween are ignored.
Tab Channel Names

This tab lists all available channels of the selected file and their import options.

**Sort by name:** Channels can optionally be sorted alphabetically. By default, the channels are listed in the given order of the project file.

By using the buttons below the list, specific import options can be assigned to all or to the selected channels. The import options can be assigned to individual channels by clicking on the symbols in front of them until the desired option is displayed. It is also possible to use the context menu via right click in the channel name field:

- **Ignored:** No result item is created for the selected channel.
- **Standby:** A result item for the channel is created, but no values are loaded.
- **Begin:** Only the first 1000 values are loaded.
- **Complete:** All values of the channel are loaded.
2.1.11 Export Values

Go to:

File
- Export Values

Available export formats are:

- **ATF (ASAM-ODS)**: standardised format for ATF-data
- **ASAM-MDF**: standardised format for measurement data
- **ASCII**: universal format that can be opened with a simple text editor
- **DIAdem v8(*.dat) & v9(*.tdm)**: a format by National Instruments (formerly GfS, Aachen)
- **Microsoft Excel**: a file compatible with Microsoft Excel (Office Suite) (without the use of COM, DCOM, OLE, ...)
- **Famos**: export as a Famos file
- **Gidas**: export as a Gidas file (crash data survey)
- **VW VENUS-CSV**: export as a VW Venus file
- **GPS-Exchangeformat (GPX)**: data format for saving GPS data
- **ISO13499 (Crash)**: standardised format for the exchange of test data
- **Matlab**: export as a Matlab file
• **NetCDF**: export as a NetCDF file

• **Tecplot**: a data format by Tecplot, Inc. (formerly Amtec Engineering, Inc.)

### 2.111.1 ATF (ASAM-ODS) Export

Go to:

**File**  
→ **Export Values**  
→ **ATF (ASAM-ODS)**

This function exports measurement data to an ASAM-ODS specific ATF file. The dialog enables to select file name and folder as well as the format and options.
Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: Two formats are available for the ATF export:
- ASAM ATF/XML files (*.atfx, *.xml)
- ASAM ATF/CLA files (*.atf)

Options

Store values in component file: If this option is selected, only the metadata are stored in the ATF file. The values themselves are stored in a separate binary file (*.bin). By default, the values are stored in the ATF file behind the metadata.
Export relatively referenced files (External Reference):

**Export**: The selected data are exported with the defined options and the dialog is closed.

**Delete**: After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes dismissed.

*: The context sensitive help is activated and the cursor changes to 🧐. The respective help topic is displayed when an area within the dialog is clicked on.

---

2.1.11.2 ASAM-MDF

Go to:

**File**

- Export Values
  - ASAM-MDF

This function exports measurement data of selected channels to an ASAM-MDF file (*.mf4).

From jBEAM version 7.2.1.x on, the MDF importer supports 1-Bit channels. They are imported as bit channels (up to now as integer channels). The channels can then be exported as bit channels which enables a conversion from MDF3 to MDF4.
Export: Name of the exporter. This name can then be used by other components, e.g. in the graphic object **Variable as text**.

Filepath: The file name and path selected in the **FileChooser** tab is displayed.

**Tab Section:**
- **File Content** – Selection of the channels to be exported.
- **FileChooser** – Definition of the storage location, the file name and file type.

Export: The selected data are exported with the defined options and the dialog is closed.
Delete: After a confirmation prompt, the exporter is deleted and the dialog closed.
Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
Tab File Content

Available channels: Lists all channels that can be exported. By using the arrow buttons (>>, >, <<, <) one or more channels can be selected and moved to Selected Channels or removed from there.

Selected Channels: Lists all channels selected to be exported. By using the arrow buttons below the list the order of the channels can be changed (the selected channel can be moved upwards/downwards or placed at the first/last position).

The input fields above the lists can be used to filter the channels. The list then shows only channel names containing the entered string.

Manual Master Channel: If this option is enabled, the channel selected in the selection list behind is assigned to all channels as uniform X-channel (independent channel). Please note that this option is only useful if all channels have indeed the same X-information.

Selected map: The properties/values of the selected map are exported as well.
Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The – button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extensions for the ASAM-MDF export (*.mf4).
2.1.11.3 ASCII Export

Go to:

File
  ➔ Export Values
    ➔ ASCII

Numerical data are saved as an ASCII file. Before exporting the project data, a dialog box appears in which settings concerning Meta data, Channel data and File chooser can be modified. These settings can be saved and loaded via Export Profiles.

Profile: A menu opens that offers Load and Save options for the configurated ASCII Export Profile (*.aex). In this profile all settings of the complete dialog are saved.

Export: Name of the exporter. This name can then be used by other components, e.g. in the graphic object Variable as text.
**Filepath:** The file name and path selected in the **File Chooser** tab is displayed.

**Tab Section:**
- **Meta data** – Adding of comments and system variables and properties.
- **Channel data** – Selection of the channels to be exported as well as properties and value formats.
- **File Chooser** – Definition of the storage location, the file name and file type.

Help: Help for navigating from one tab into the next. Tabs can also be switched manually at the top of the import dialog box.

**Export:** The selected data are exported with the defined options and the dialog is closed.

**Delete:** After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes dismissed.

Help: The context sensitive help is activated and the cursor changes to ![help_icon]. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab Meta Data**

![Meta data tab](image)

**Comment:** A comment can be written in the text field which is prefixed onto the ASCII data.

**Comment prefix:** The defined character is prefixed onto the comment.
Tab System variables

Several system variables can be written into the export file which can be selected in the Key combo box. Upon selecting a variable its name is displayed under Label. The current value is displayed under Value in the right part of the dialog box. The labels of the system variables can be edited.

**Insert row:** A new line is inserted. If there are no lines yet, the new line is initialised with the first value of all specified system variables. If there already are lines, the new line is initialised with the following system variable.

**Remove row(s):** Deletes all selected lines.

**Standard initialization:** Calls the standard initialisation (in this case Key: Date and Time). All other so far initialized keys are deleted.

**Initialize all keys:** All keys listed in the Key combo box are initialised with their values and appear in the tab System variables.

**Arrow buttons:** The order of the selected line is changed. The selected line can be moved upwards/downwards or placed at the first/last position.

Tab Test properties

Component: ASCII Exporter

**Label:** MenuService, Datenquellen

**Export URL:** ASCII Exporter

**Export File:** ASCII Importer, Formal

**Name:** Excel Exporter 123, Beispiel_ascii_export.fsm, Beispiel_ATF-Export.xml

**Value:** URL: file://C:/Users/Default/BEAM-Samples/Export, File: C:/Users/Default/BEAM-Samples/Export.txt, ASCII Exporter
Component: Depending on the selected Component (project components and system services) different keys appear in the combo box.

The list with Label, Key and Value and the navigation line have the structure as in the System variables tab.

Tab Channel Data

**View:** Definition of the view. 0 is the standard view and always available. By using the View-Selection-Manager more views/selections can be defined. The button opens the View-Selection-Manager out of the ASCII export and new views can be defined.

**Apply to:** The filtering can be limited to only importer channels in order to avoid multiple filtering of data objects, e.g. caused by preceding calculations. By default, the view is applied to all channels.

**Export all channels:** Exports all channels. If this option is selected, the other options of this area are disabled.

**Export all channels of following component:** If this option is chosen, the channels of the selected component are exported. Below this option there is a combo box from which one component is chosen. From the list Available channels additional channels can be selected.
If channels are then listed more than once, this is detected and those channels are exported only once.

**Available channels:** Lists all channels that can be exported. By using the arrow buttons (>>, >, <<, <) one or more channels can be selected and moved to or removed from **Selected Channels.**

The input fields above the lists can be used to filter the channels. The list then shows only channel names containing the entered string.

Moreover, the input field can be used to enter channels which are not listed. For this, the channel has to be defined as follows: [Producer name]#[Channel name], e.g. Datasources#Channel1. Data objects which are currently not available are listed in red in the list **Selected Channels.** This kind of selection is useful when the profile is saved and later be applied to projects which may contain this channel.

**Selected Channels:** Lists all channels selected for the export. By using the arrow buttons below the list the order of the channels can be changed (the selected channel can be moved upwards/downwards or placed at the first/last position).

**Separation character:** Defines a separation character by which the values are separated in the export file. There are some predefined separation characters (Tab, Comma, Semicolon or Blanks) which can be selected or a different character is entered Manually or by shortcut key in the input field.

**Character encoding:** Selection of the character encoding.

- **with BOM:** Is enabled by checkmarking. The ‘Byte order mark’ (Unicode character) is used to indicate the byte order which is useful for some character encodings, e.g. UTF-8 or UTF-16.

**Export channel properties / channel property keys:** If this option is activated, the channel properties / channel property keys can be selected in the list below which shall be exported as well. In the **Key** column the keys can be selected. The **Label** column lists the corresponding names which can be edited. The current value is displayed in the **Value** column.

- **Insert row:** A new line is inserted. If there are not yet any lines, the new line is initialized with the first value of the available channel properties. If there are already lines, the new line is initialized with the next following channel property.

- **Remove row(s):** Deletes all selected lines. Several lines can be selected by keeping the Ctrl-button pressed while clicking in the lines.

- **Standard initialization:** Each standard key is initialized with the corresponding values. All other so far initialized keys are deleted.

- **Initialize all keys:** All keys listed in the **Key** combo box are initialised with their values and appear in the tab System variables.

- **Arrow buttons:** The order of the selected line can be changed. The selected line can be moved upwards/downwards or placed at the first/last position.

**Export values:** Defines whether the values are exported or not.

**Value format:** Defines the format of the exported values.
local: The data is exported in the country-specific format according to the language set in jBEAM preferences.

international: The data is exported in the internationally customary, i.e. English, value format.

with thousand grouping: Optionally, the values can be exported with a thousand grouping separator.

Export running line number as first column: If this option is activated, a line index for the exported channels is created in the first row.

Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

2.1.11.4 DIAdem v8(*.dat) & v9(*.tdm)

Go to:

File
Export Values

DIAdem v8(*.dat) & v9(*.tdm)

This function exports measurement data to a DIAdem-version 8 file (*.dat) or a DIAdem-version 9 file (*.tdm). In the v8 format, the header information is stored to a *.dat file, the values are stored according to their type to separate *.R64, *.R32, *.I64, *.I32 or *.W8 files.

The dialog enables settings regarding Channel data, Test properties and File Chooser.
Export: Name of the exporter. This name can then be used by other components, e.g. in the graphic object **Variable as text**.

Filepath: The file name and path selected in the **File Chooser** tab is displayed.

**Tab Section:**
- **Numerical Data** – Selection of the data objects to be exported.
- **Test Properties** – Selection of the test properties to be exported.
- **File Chooser** – Definition of the storage location, the file name and file type.

: Help for navigating from one tab into the next. Tabs can also be switched manually at the top of the import dialog box.

Export: The selected data are exported with the defined options and the dialog is closed.

Delete: After a confirmation prompt, the exporter is deleted and the dialog closed.
Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab Numerical data**

![Image of Tab Numerical data with options]

**Export all data items (with blacklist):** Exports all data items. However, by using a blacklist, specific data items can be excluded. The data items to be excluded can be selected in the list **All Data Items** and shifted to the list **Excluded Data Items (Blacklist)**.

**Export all data items of selected producers (with blacklist):** Exports all data items of the selected producers, i.e. all producers of the list **Selected Producers** (upper list set).

However, by using a blacklist, specific data items of the selected producers can be excluded. The data items to be excluded can be selected in the list **Data Items of Selected Producers** and shifted to the list **Excluded Data Items (Blacklist)**.
Export selected data items: Exports only selected data items. The data items to be exported can be selected in the list Available Data Items and shifted to the list Selected Data Items.

[left list]: Lists all available data items / producers according to the selected option. By using the arrow buttons (>>, >, <<, <) one or more data items / producers can be selected and moved to the right list or removed from there.

[right list]: Lists all selected data items / producers. By using the arrow buttons below the window the order of the data items / producers can be changed (move upwards/downwards or place at the first/last position).

Tab Test Properties

Export map values: Additionally, test properties from the selected map can be written to the export file. The properties can be selected in the Key combo box. When a property is selected, its name is displayed in the Label column and its current value in the Value column. The labels can be edited.

Insert row: A new row is inserted. If there are no rows yet, the new row is initialized with the first value of all specified properties. If there are rows already, the new row is initialized with the next available property.

Remove row(s): Deletes all selected rows. Several rows can be selected by clicking the rows while keeping the Control button pressed.

Standard initialization: Each standard key is initialized with the corresponding values. All other keys initialized so far are deleted.

Initialize all keys: A row for each available Key is initialized with the corresponding values. All other keys initialized so far are deleted.

Arrow buttons: The order of the selected row is changed. The selected row can be moved upwards/downwards or placed at the first/last position.
Tab File Chooser

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under **Save in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Save in**: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the export file can be chosen or edited.

**Files of type**: The commonly used file extension for the Diadem export is displayed: Diadem DAT files (*.dat) and Diadem TDM files (*.tdm).
2.11.5 Microsoft Excel Export

Go to:

File
  Export Values
    Microsoft Excel

This function exports numerical data to an Excel file. The data are directly exported; no COM/DCOM is used. Neither Excel nor other Office programs are necessary. The export is platform independent, i.e. the Excel file can also be generated on a Linux system for instance.

Note: This component needs the Apache POI library which can be downloaded from the Internet for free (http://poi.apache.org).

The conventional *.xls format is supported as well as the newer *.xlsx format that offers more possibilities at lower memory size.

The dialog enables settings regarding File Content, Channel properties in data sheets, Test properties and File Chooser. These settings can be saved and loaded via Excel Export Profiles.
Profile: A menu opens that offers Load and Save options for the configurated Excel Export Profile (*.eex). In this profile all settings of the complete dialog are saved.

Export: Name of the exporter. This name can then be used by other components, e.g. in the graphic object Variable as text.

Filepath: The file name and path selected in the File Chooser tab is displayed.

Tab Section:
- **File Content** – Selection of the channels to be exported.
- **Channel properties in data sheets** – Selection of channel properties for the respective data sheets.
- **Test properties** – Selection of the test properties to be exported.
- **File Chooser** – Definition of the storage location, the file name and file type.

Export: The selected data are exported with the defined options and the dialog is closed.

Delete: After a confirmation prompt, the exporter is deleted and the dialog closed.

Cancel: The dialog is closed and changes dismissed.

![](image): The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Content**

Available channels: Lists all channels that can be exported. By using the arrow buttons {>>, >, <<, <} one or more channels can be selected and moved to Selected Channels or removed from there.
Selected Channels: Lists all channels selected to be exported. By using the arrow buttons below the window the channels’ order can be changed (the selected channel can be moved upwards/downwards or placed at the first/last position).

For each data type (maps, values, channels, matrices) a sheet with values and a sheet with properties are created. If there are several matrices, groups of channels or groups of maps, a separate sheet is created for each data object.

One sheet for each data source: If this option is enabled, the data objects are grouped according to the data sources. For each data source, a sheet for meta data and a sheet for values are created. Each sheet contains additionally the name of the data source and the units of the channels.

Tab Channel properties in data sheets

Additionally, channel properties can be selected which are written to the respective data sheet. The selected properties are stored within the data sheet with the corresponding values for all selected channels (if available).

Example channel for property values: A channel can be selected, the values of which are displayed as example in the column Property values of selected channel of the list below.

[List of properties]: In the Key combo box the channel properties can be selected. When a property is selected, its name is displayed in the Label column and its current value in the column Property values of selected channel. The labels can be edited.

Insert row: A new row is inserted. If there are no rows yet, the new row is initialised with the first value of all specified properties. If there are rows already, the new row is initialised with the next available property.

Remove row(s): Deletes all selected rows. Several rows can be selected by clicking the rows while keeping the Control button pressed.

Standard initialization: Each standard key is initialized with the corresponding values. All other keys initialized so far are deleted.

Initialize all keys: A row for each available Key is initialised with the corresponding values. All other keys initialized so far are deleted.
**Arrow buttons**: The order of the selected row is changed. The selected row can be moved upwards/downwards or placed at the first/last position.

**Tab Test properties**

Additionally, test properties from the selected maps can be written to the export file. This tab shows in individual tabs all maps selected in the File Content tab. If there is no map selected, this tab is empty.

The properties to be exported can be selected in the **Key** combo box. When a property is selected, its name is displayed in the **Label** column and its current value in the **Value** column. The labels can be edited.

**Insert row**: A new row is inserted. If there are no rows yet, the new row is initialised with the first value of all specified properties. If there are rows already, the new row is initialised with the next available property.

**Remove row(s)**: Deletes all selected rows. Several rows can be selected by clicking the rows while keeping the Control button pressed.

**Initialize all keys**: A row for each available **Key** is initialised with the corresponding values. All other keys initialized so far are deleted.

**Arrow buttons**: The order of the selected row is changed. The selected row can be moved upwards/downwards or placed at the first/last position.
**Tab File Chooser**

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under *Save in* can be added to the favorites list via the **+** button. The **-** button removes the selected folder from the list of favorites.

**Save in**: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the export file can be chosen or edited.

**Files of type**: The commonly used file extensions for the Excel export are listed: Excel files (*.xlsx) and Excel 97-2003 files (*.xls).
2.1.11.6 Famos Export

Go to:

File
  ➤ Export Values
    ➤ Famos

This function exports numerical channels into a Famos file (*.fam, *.dat, *.raw).

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.
Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extension for the Diadem export is displayed (*.dat).

Export: The data are exported and the dialog is closed.

Cancel: The dialog is closed and changes dismissed.

2.11.7 Gidas Export

Go to:

File
- Export Values
- Gidas

This function exports numerical channels into a Gidas file (*.asc, *.dat).

The dialog enables settings regarding File Content, Test properties and File Chooser.
Export: Name of the exporter. This name can then be used by other components, e.g. in the graphic object Variable as text.

Filepath: The file name and path selected in the File Chooser tab is displayed.

Channels per block: Optionally, a maximum number of channels per row can be defined. If a fix number of channels is defined, each time only the maximum number of channels is exported into one row. The remaining channels are written behind this block in new rows.

Tab Section:

- **File Content** – Selection of the data objects to be exported.
- **Test Properties** – Selection of the test properties to be exported.
- **File Chooser** – Definition of the storage location, the file name and file type.

Export: The selected data are exported with the defined options and the dialog is closed.

Delete: After a confirmation prompt, the exporter is deleted and the dialog closed.

Cancel: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
Tab File Content

all channels: Exports all available channels of the project. If this option is selected, the manual selection of channels is disabled.

Available Channels: Lists all channels that can be exported. By using the arrow buttons (>>, >, <<, <) one or more channels can be selected and moved to Selected Channels or removed from there.

Selected Channels: Lists all channels selected to be exported. By using the arrow buttons below the list the order of the channels can be changed (the selected channel can be moved upwards/downwards or placed at the first/last position).

The input fields above the lists can be used to filter the channels. The list then shows only channel names containing the entered string.

Tab Test Properties

Component: Additionally, test properties of the selected component can be written to the export file. The properties can be selected in the Key combo box. When a property is
selected, its name is displayed in the **Label** column and its current value in the **Value** column. The labels can be edited.

**Insert row:** A new row is inserted. If there are no rows yet, the new row is initialised with the first value of all specified properties. If there are rows already, the new row is initialised with the next available property.

**Remove row(s):** Deletes all selected rows. Several rows can be selected by clicking the rows while keeping the Control button pressed.

**Standard initialization:** Each standard key is initialized with the corresponding values. All other keys initialized so far are deleted.

**Initialize all keys:** A row for each available **Key** is initialised with the corresponding values. All other keys initialized so far are deleted.

**Arrow buttons:** The order of the selected row is changed. The selected row can be moved upwards/downwards or placed at the first/last position.

---

**Tab File Chooser**

The combo box allows fast access to frequently used folders. The folder selected under **Save in** can be added to the favorites list via the **+** button. The **-** button removes the selected folder from the list of favorites.

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Save in** can be added to the favorites list via the **+** button. The **-** button removes the selected folder from the list of favorites.

**Save in:** The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.
File name: The name of the export file can be chosen or edited.
Files of type: The commonly used file extension for the Gidas export is displayed (*.asc, *.dat).

2.1.11.8 VW VENUS-CSV Export

Go to:

File
→ Export Values
→ VW VENUS-CSV

This function exports numerical channels into a VENUS-CSV file (*.csv).

The dialog for setting the export options is identical to the Gidas Export except of the Channels per block option.

2.1.11.9 GPS-Exchangeformat (GPX)

Go to:

File
→ Export Values
→ GPS-Exchangeformat (GPX)

This function exports geographical data into a GPX file (*.gpx).

The dialog enables settings regarding File Content, Description and File Chooser.
Export: Name of the exporter. This name can then be used by other components, e.g. in the graphic object **Variable as text**.

Filepath: The file name and path selected in the **File Chooser** tab is displayed.

Tab Section:
- **File Content** – Selection of the data objects to be exported.
- **Description** – Editing of a description.
- **File Chooser** – Definition of the storage location, the file name and file type.

**Export**: The selected data are exported with the defined options and the dialog is closed.

**Delete**: After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes dismissed.

![?] : The context sensitive help is activated and the cursor changes to ![?] . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Content**

**Save data as**: The data can be exported as **GPX-Track** or **GPX-Route**.
Entries of the can be assigned to the labels (Latitude, Longitude, Time, Elevation, Course, Speed). The entries in the combo boxes are channels of the current project.

**Basic schema:** Via the combo boxes the respective channels are assigned to the parameters **Latitude** and **Longitude**. These channels have to be defined in any case.

- **Latitude:** The latitude of the point. This is always in decimal degrees, and always in WGS84 datum.
- **Longitude:** The longitude of the point. This is always in decimal degrees, and always in WGS84 datum.

**Optional elements:** Via the combo boxes the respective channels can be assigned to additional parameters, e.g. **Time** or **Elevation**.

- **Elevation:** Elevation (in meters) of the point.
- **Time:** Creation/modification timestamp for element. Date and time in are in Univeral Coordinated Time (UTC), not local time! Conforms to ISO 8601 specification for date/time representation. Fractional seconds are allowed for millisecond timing in tracklogs.
- **Magn. Variation:** Magnetic variation (in degrees) at the point.
- **Geod. Height:** Height (in meters) of geoid (mean sea level) above WGS84 earth ellipsoid. As defined in NMEA GGA message.

**Name:** The GPS name of the waypoint. This field will be transferred to and from the GPS. GPX does not place restrictions on the length of this field or the characters contained in it. It is up to the receiving application to validate the field before sending it to the GPS.

**Comment:** GPS waypoint comment. Sent to GPS as comment.

**Description:** A text description of the element. Holds additional information about the element intended for the user, not the GPS.

**Source:** Source of data. Included to give user some idea of reliability and accuracy of data. "Garmin eTrex", "USGS quad Boston North", e.g.

**Link:** Link to additional information about the waypoint.

**Symbol:** Text of GPS symbol name. For interchange with other programs, use the exact spelling of the symbol as displayed on the GPS. If the GPS abbreviates words, spell them out.

**Type:** Type (classification) of the waypoint.

**Fix Type:** Fix Type of GPX fix.

**# of Satellites:** Number of satellites used to calculate the GPX fix.

**Horizontal DOP:** Horizontal dilution of precision (HDOP) in m.

**Vertical DOP:** Vertical dilution of precision (VDOP) in m.

**Position DOP:** Position dilution of precision (PDOP) in m.

**Age of DGPS:** Number of seconds since last DGPS update in s.

**DGPS ID:** ID of DGPS station used in differential correction.
Garmin WayPoint Extensions v2: Via the combo boxes the respective channels can be assigned to additional Garmin-specific parameters, e.g. Course or Speed.

- **A-Temperature**: ATEMP in °C
- **W-Temperature**: WTEMP in °C
- **Depth**: DEPTH in m
- **Heart Rate**: HEARTRATE in Bpm/min
- **Cadence**: Cadence in 1/min
- **Speed**: SPEED in m/s
- **Course**: COURSE in °
- **Bearing**: BEARING in °

opens the Filtered Selector of Dataitems. There, conditions for filtering the data objects are defined. See also [here](#).

**Tab Description**

<table>
<thead>
<tr>
<th>File Content</th>
<th>Description</th>
</tr>
</thead>
</table>

The GPS Exchange format GPX:
This format was defined by Topographix (www.topographix.com).
This export supports version 1.1 of GPX.
Data in GPX format can be uploaded and displayed in Google Earth.

In this tab an individual description can be entered.

**Tab File Chooser**

![File Chooser Image]
In this tab the storage location and name of the exported file are chosen.

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under *Save in* can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

*Save in*: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the export file can be chosen or edited.

**Files of type**: The commonly used file extension for the GPS export is displayed (*.gpx).

### 2.1.11.10 ISO13499 (Crash)

Go to:

**File**

- **Export Values**
  - **ISO13499 (Crash)**

This function exports data of crash evaluations into an ISO13499 file (*.mme).
**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Save in** can be added to the favorites list via the **+** button. The **−** button removes the selected folder from the list of favorites.

**Save in:** The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**Folder name:** The name of the export folder where the ISO13499 project is to be stored can be chosen. The folder needs to exist already.

**Files of type:** The commonly used file extension for the Diadem export is displayed (*.dat).

**Export:** The data are exported and the dialog is closed.

**Cancel:** The dialog is closed and changes dismissed.
The following structure is created by exporting a project into the folder **IsoExport**. A new folder is created in this folder with the name coming from the properties: "Customer test ref. Number" if existing, otherwise "Laboratory test ref. Number". If neither exists the folder name is used.

If the folder already contains a folder with this name, the new export can be written into this folder while maintaining the old data on request.

The project information is stored in the *.mme file. The folder **Channel** contains the descriptive *.chn file and the measurement data files whith the channels numbered in order (*.001, *.002 etc.).

### 2.1.11.11 Matlab Export

Go to:

**File**

- **Export Values**
- **Matlab**

This function exports numerical data into a Matlab file (*.mat).

The dialog enables settings regarding **File Content** and **File Chooser**.
**Export:** Name of the exporter. This name can then be used by other components, e.g. in the graphic object **Variable as text**.

**Filepath:** The file name and path selected in the **File Chooser** tab is displayed.

**Tab Section:**
- **File Content** – Selection of the channels to be exported.
- **File Chooser** – Definition of the storage location, the file name and file type.

**Export:** The selected data are exported with the defined options and the dialog is closed.

**Delete:** After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes dismissed.

**: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
**Tab File Content**

- **Header comment**: If activated (checkmark is set), a comment can be entered.
- **all maps, channels and matrices**: If activated (checkmark is set), all data is exported. If deactivated (no checkmark), channels for export can be selected.
- **Available channels**: Lists all channels that can be exported. By using the arrow buttons (>>, >, <<, <) one or more channels can be selected and moved to **Selected Channels** or removed from there.
- **Selected Channels**: Lists all channels selected to be exported. By using the arrow buttons below the list the order of the channels can be changed (the selected channel can be moved upwards/downwards or placed at the first/last position).

The input fields above the lists can be used to filter the channels. The list then shows only channel names containing the entered string.
Tab File Chooser

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extensions for the Matlab export (*.mat).
2.1.11.12 NetCDF Export

Go to:

File

Export Values

NetCDF

This function exports numerical channels into a NetCDF file (*.nc).

The dialog enables settings regarding **File Content**, **Test properties** and **FileChooser**.

**Export:** Name of the exporter. This name can then be used by other components, e.g. in the graphic object **Variable as text**.

**Filepath:** The file name and path selected in the **FileChooser** tab is displayed.

**Tab Section:**

- **File Content** – Selection of the data objects to be exported.
- **Test Properties** – Selection of the test properties to be exported.
- **File Chooser** – Definition of the storage location, the file name and file type.

**Export**: The selected data are exported with the defined options and the dialog is closed.

**Delete**: After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Content**

**all channels**: Exports all available channels of the project. If this option is selected, the manual selection of channels is disabled.

**Available Channels**: Lists all channels that can be exported. By using the arrow buttons (>>, >, <<, <) one or more channels can be selected and moved to **Selected Channels** or removed from there.

**Selected Channels**: Lists all channels selected to be exported. By using the arrow buttons below the list the order of the channels can be changed (the selected channel can be moved upwards/downwards or placed at the first/last position).

The input fields above the lists can be used to filter the channels. The list then shows only channel names containing the entered string.
Tab Test Properties

![Table showing test properties with columns for Label, Key, and Value]

**Component**: Additionally, test properties of the selected component can be written to the export file. The properties can be selected in the Key combo box. When a property is selected, its name is displayed in the Label column and its current value in the Value column. The labels can be edited.

**Insert row**: A new row is inserted. If there are no rows yet, the new row is initialised with the first value of all specified properties. If there are rows already, the new row is initialised with the next available property.

**Remove row(s)**: Deletes all selected rows. Several rows can be selected by clicking the rows while keeping the Control button pressed.

**Standard initialization**: Each standard key is initialized with the corresponding values. All other keys initialized so far are deleted.

**Initialize all keys**: A row for each available Key is initialised with the corresponding values. All other keys initialized so far are deleted.

**Arrow buttons**: The order of the selected row is changed. The selected row can be moved upwards/downwards or placed at the first/last position.
**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under *Save in* can be added to the favorites list via the **+** button. The **−** button removes the selected folder from the list of favorites.

**Save in:** The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the export file can be chosen or edited.

**Files of type:** The commonly used file extension for the NetCDF export is displayed (*.nc).
2.1.11.13  Tecplot Export

Go to:

File
- Export values
  ➔ Tecplot

This function exports numerical channels into a Tecplot text file (*.dat, *.txt).

Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.
Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extensions for the Tecplot export are displayed (*.dat, *.txt).

Export: The data are exported and the dialog is closed.

Cancel: The dialog is closed and changes dismissed.

### 2.1.12 Import Multi Media

Go to:

**File**

- Import Multi Media

Supported imports are:

- **Images**
- **Audio**
- **Movie**
- **DIAS**

Available multimedia formats depend on the current jBEAM version and the installed libraries.

Imported multimedia objects are saved in an internal library. Images are imported with image data and can be displayed as image in a graphics window.

Audio files are saved as integer data objects (one for each audio channel). jBEAM also stores a reference to the original audio file. Audio data can be displayed in a line chart or used for further calculations.

jBEAM stores a reference to video data only. It will be loaded as played. Imported video data might be used for placing single video images or dynamic videos in a Graphic window or to create synchronized image sequences.

Multi Media imports are maintained with the menu item **File→Import Multi Media→Modify**. Like this, imports are always available and existing settings can be changed.
2.1.12.1 Images (GIF, JPEG, PNG, ...)

Go to:

File
  ➔ Import Multi Media
    ➔ Images

Images with different encoding can be imported.

The definition of the parameters is done in three steps: File Choose, Preview and Scaling.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filepath: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

It can be explicitly stated how the data shall be saved in the project file or project template. This setting then prevails over the selected option in the preferences.

Save mode:

Project-File / Template: The data can be saved in the project file or template as follows:

Standard: The settings are adopted from the preferences.
**With Data:** The importer is saved with its complete data.

**Without Data:** The importer is saved only with its file references. When the project is opened the data are reloaded from its source.

**Tab Section:**
- **File Chooser**
- **Preview**
- **Scaling**

**Open:** The selected image is imported with the defined options and the dialog is closed.

**Apply:** Like **Open** but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign △ in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Select files from different directories:** This option enables the selection of various files from different directories. Two lists are displayed; on the left all available files in the chosen directory and on the right the list with the selected files.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is achieved through the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the two other tabs **Preview** and **Scaling** are enabled.

**Files of type:** The supported file formats for the image import are listed:
- *.bmp
- *.gif
- *.ico
- *.jpeg
- *.jpg
Single files as well as folders containing several images can be selected. For loading a whole folder select the folder in the File Chooser without opening it.

**Tab Preview**

![Image showing various settings and options](image)

The selected image is shown in the preview.

**Timezone-correction [h]:** Optionally, a correction value for the timezone can be defined if the images have been recorded in a different timezone than the currently set timezone [-12 ... +12 h].

**Image Load Mode:** Displays the load mode of the selected files / folders.

- **Single image file:** A file with one image has been selected.
- **Multi image file:** A file with several images has been selected.
- **All image files of selected folder:** A folder with several image files has been selected.
- **Multiple files:** Several image files have been selected.

**Options for selected files:** If several files or files / folders with several images has been selected, the following options decide how the images are imported.
only actual image: Only the image shown in the preview box or entered in the input box is imported.

all images in one channel: All contained images are imported in a channel. This channel can be played like a movie in the Dynamic Images Graph.

each image in an own image-item: Each contained image is imported in an own image data item.

Information on the number of pictures in the file or folder is given. Single images as well as animated *.gif files consisting of several images can be loaded.

Run: Starts running the images (in the case of several images).

< / >: Shows the previous/next image (in the case of several images).

See also Dynamic Images.

Tab Scaling

For an axis-related display as a Scaled Image in a Universal 2D-Graph the position and scaling of the image can be defined. The axis values for the upper, lower, left and right border of the image can be entered in the respective input fields. According to the current scaling of the diagram, the image is fitted to these values (see also Scaling Example).

The input fields behind the value input fields (upper and right) can be used to enter an explicit unit. By default, the unit is mm.
Result

The image data item appears in the Producerlist of the Explorer.

For displaying the image data item in a Graphic window, it can be dragged from the Explorer to the Graphic window or inserted via menu Graph Editor→Multi Media→Image.

Image shown in the Graphic window:

For displaying the image data item as a Scaled Image in a Universal 2D-Graph, it can be dragged from the Explorer to an existing Universal 2D-Graph or inserted as a Scaled Image diagram in its dialog.

Image scaling example in a Universal 2D-Graph:
2.12.2 Audio

Go to:

File
  - Import Multi Media
  - Audio

Audio files can be loaded by using the Multi Media import.

The import dialog box consists of File Chooser and Preview.

When loading an audio file jBEAM saves a reference to the file and two channels (if mono file only one) that hold the audio data.
**Test Name**: Name of the importer (producer).

**File Path**: Detailed file path of the selected file

**Created at**: Creation date and time of the selected file.

**File Type**: The exact labelling of the data type of the selected file.

**Tab Section**:
- **File Chooser**
- **Preview**

**Open**: The selected file is imported with the defined options and the dialog is closed.

**Apply**: Like **Open** but the dialog remains open.

**Duplicate**: Another importer is created with the current settings. The original importer remains unchanged.
**Delete**: After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign in the Delete button indicates that the imported data is used by other components.

**Cancel**: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

**Tab File Chooser**

**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

**Look in**: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is achieved through the list of favorites and the symbols on the left side.

**File name**: The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the tab **Preview** is enabled.

**Files of type**: The supported file formats for the audio import are listed:

- Audio files: *.au
- Rich music format: *.rmf
- Musical Instrument Digital Interface: *.mid
- Resource Interchange Format Wave: *.wav
- Audio Interchange File Format: *.aif, *.aiff
The **Preview** tab displays the parameters of the audio file. The selected file can be played. The buttons **Start/Stop** and **Pause/Resume** can be used to control the player. If **Continuously** is checked, the recording will rewind automatically and start playing again. Sliders adjust **Balance** and volume (**Level**).

**Load RMS values:** Loading complete audio files may lead to a high amount of data. Alternatively only RMS values can be loaded which reduces the amount of data dramatically.

**Audio Data:** Shows the resolution of the audio data (**8 Bit, 16 Bit, 32 Bit**) as well as the number of channels (**mono**: only one channel, **stereo**: two channels).

**Sampling:** Shows the frame rate in Hertz; e.g. 16000: 16,000 values per second and channel.
Result

The audio component with its data items appears in the Producerlist of the Explorer.

For displaying the audio component in a Graphic window, it can be dragged from the Explorer to the Graphic window or inserted via menu Graph Editor→Multi Media→Audio-Player.

The audio component shown in the Graphic window:

2.1.12.3 Movie

Go to:

File
  ➔ Import Multi Media
  ➔ Movie

By using this function movies can be loaded. jBEAM uses a reference to the original video file and does not actually import the video data for performance reasons.

The import dialog box consists of the tabs File Chooser and Preview.
Testname: Name of the importer (producer).

use filename: The name of the imported file is automatically used as importer name.

Filename: Detailed file path of the selected file

Created at: Creation date and time of the selected file.

Datatype: The exact labelling of the data type of the selected file.

A section opens with extended settings for the Save mode of importer data in project file and project template as well as the Default load status for channels.

Framerate: High-Speed movies are often saved with a false framerate so that they can be played in slow motion with a standard movie player. This framerate saved in the video file is displayed in the input field as soon as a video has been selected. The Framerate can then be edited and replaced by the true framerate if needed.
**Reference and Tutorial** jBEAM

**Version:** jBEAMHelp7.2.2

---

**Synchronize:** If the video contains a synchronization sign (e.g. flash) the video is played up to this frame and then the **Synchronize** button clicked. jBEAM calculates the **Time Offset** which is assigned to the video.

**Time Offset:** A value can be entered or determined via the **Synchronize** button in order to synchronize several files.

---

**Tab Section:**

- **File Chooser**
- **Preview**

**Open:** The selected file is imported with the defined options and the dialog is closed.

**Apply:** Like **Open** but the dialog remains open.

**Duplicate:** Another importer is created with the current settings. The original importer remains unchanged.

**Delete:** After a confirmation prompt, the importer is deleted and the dialog closed. A warning sign ☢ in the **Delete** button indicates that the imported data is used by other components.

**Cancel:** The dialog is closed and changes dismissed.

+=(?:=)?: The context sensitive help is activated and the cursor changes to \. The respective help topic is displayed when an area within the dialog is clicked on.

---

**Tab File Chooser**

**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the \+ button. The \− button removes the selected folder from the list of favorites.

**Look in:** The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is achieved through the list of favorites and the symbols on the left side.

**File name:** The name of the selected file is displayed. Simultaneously, name, path, creation date and type of the selected file are displayed in the dialog header. Moreover, the tab **Preview** is enabled.

**Files of type:** The supported file formats for the video import are listed:

- `*.avi`
- `*.mpg`
- `*.mov`
- `*.mp4`
Preview

In this tab the video can be displayed and parameters modified. The buttons below can be used to control the player.

Result

The video component with its data item appears in the Producerlist of the Explorer. For displaying the video component in a Graphic window, it can be dragged from the Explorer to the Graphic window or inserted via menu Graph Editor→Multi Media→Video-Player.
The **playable video** is shown in the Graphic window. It is possible to play several videos simultaneously.

In addition to the numerical representation of test data, single video images can be added to a Universal 2D graph. See also [Video→Timed Images](#).
2.1.12.4 DIAS

Go to:

File

Import Multi Media

DIAS

This component imports Infrared camera image files (*.irdx).

2.1.13 Export Report

Go to:

File

Report Export

Single graphic elements as well as whole graphic pages or their layout definitions can be exported. Available Multi Media export formats depend on the current jBEAM version.

Moreover jBEAM graphic elements can be copied directly to other programmes like Word. See also the Tutorial entry Drag & Drop.

Available export formats are:

- **HTML-File**: Exports whole graphic pages.
- **PDF document**: Exports whole graphic pages.
• **Open document**: Exports whole graphic pages.
• **Word-2003 document**: Exports whole graphic pages.
• **PowerPoint presentation**: Exports whole graphic pages.
• **Create video**: Creates a video file.
• **SVG-File**: Exports single graphic elements.
• **jBEAM Graphic-Element**: Exports single graphic elements.

### 2.1.13.1 HTML-File

Go to:

**File**

→ **Export Report**

→ **HTML-File**

The content of an entire Graphic window is exported as an **HTML-File**. The generated files can be viewed in any web browser.
Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extensions for the HTML export are displayed (HTML file: *.html; *.htm; web archives: *.mht; *.mhtml; ZIP archives: *.zip).

Options: The storage format of the contained graphic elements can be stated (PNG, JPEG, BMP or SVG).

put all graphs into one image file: Optionally, all graphs can be stored in one image file (only for SVG files).
Selection: It can be chosen whether all or only printable graphic elements shall be exported. Which graphic elements are printable can be seen in the properties.

Export: The selected data are exported with the defined options and the dialog is closed.
Delete: After a confirmation prompt, the exporter is deleted and the dialog closed.
Cancel: The dialog is closed and changes dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.1.13.2 PDF document

Go to:

File
  Export Report
  PDF document

The content of an entire Graphic window is saved as a PDF document. The exported PDF files can be viewed with the Acrobat Reader.

In order to be able to use the PDF export function, no Adobe products have to be installed on the computer. Only the required library (iText.jar) has to be in the Java Runtime directory.

If the project contains a table of contents or a graphic element with hyperlinks (Plain String), these links can be clicked on in the PDF document. This way, the table of contents can be used to jump directly to the respective pages in the report. Page names are generated as bookmarks which can also be used to jump to a specific position in the report.

The individual graphic elements are stored in the PDF document as vector graphic in high resolution mode by default. Exceptions are image graphs and curves where the color gradation is controlled by a channel. Those are generally exported as pixel graphic. Additionally, for each curve it can be defined individually to export it as pixel graphic. This is especially useful in case of complex graphics when otherwise the report generation consumes too much time or file size. For the generation of the pixel graphics, the resolution defined in the Preferences tab Printing/Report is used.
**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Save in** can be added to the favorites list via the `+` button. The `-` button removes the selected folder from the list of favorites.

**Save in:** The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the export file can be chosen or edited.

**Files of type:** The commonly used file extension for the PDF export is displayed (`.pdf`).

**Options:**

**Graphic windows:** The **Graphic windows** and **Page ranges** can be selected which shall be exported. A graphic window can either be exported completely (All) or only individual
**Pages.** These can be edited as single pages or ranges separated by semicolons. The selection is only active when several graphic windows or pages contain graphic elements.

**Auto page formatting:** Optionally, the pages can be automatically formatted as it is defined in the Page Formatter. This must be previously generated in order to activate this option. Please consider that the Page Formatter is only applicable in canvas mode.

**Export:** The selected data are exported with the defined options and the dialog is closed.

**Delete:** After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes dismissed.

❓ : The context sensitive help is activated and the cursor changes to `?`. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.1.13.3 Open document

Go to:

File
  ➔ Export Report
  ➔ Open document

The content of an entire Graphic window is saved as a Word compliant docx document.
Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extension for the OpenDocument export is displayed (*.docx).

Options:

Graphic window: The Graphic windows and Page ranges can be selected which shall be exported. A graphic window can either be exported completely (All) or only individual
**Pages.** These can be edited as single pages or ranges separated by semicolons. The selection is only active when several graphic windows or pages contain graphic elements.

**Image quality:** The resolution of the images can be defined in the steps **draft (72 dpi)**, **standard (150 dpi)**, **fine (300 dpi)** und **super fine (600 dpi)**.

**Export:** The selected data are exported with the defined options and the dialog is closed.

**Delete:** After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes dismissed.

!: The context sensitive help is activated and the cursor changes to ✉️. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.1.13.4 Word-2003 document

Go to:

**File**

→ **Export Report**

→ **Word-2003 document**

The content of an entire Graphic window is saved as a Word 2003 compliant XML document. Afterwards, the single graphic elements can again be modified in Word. To use the Word export function no Word or other Microsoft Office products have to be installed on the computer.

**Note:** Only Microsoft Word starting from version 2003 can save and load documents in a native XML-format.
Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extensions for the Word export are displayed (*.docx; *.xml).

Options: The Graphic windows and Page ranges can be selected which shall be exported. A graphic window can either be exported completely (All) or only individual Pages. These can
be edited as single pages or ranges separated by semicolons. The selection is only active when several graphic windows or pages contain graphic elements.

**Export:** The selected data are exported with the defined options and the dialog is closed.

**Delete:** After a confirmation prompt, the exporter is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.13.5 PowerPoint presentation

Go to:

**File**

- Export Report
- PowerPoint presentation

The content of an entire Graphic window is saved as *.pptx. Afterwards, the single graphic elements can be modified in PowerPoint.

Each page in jBEAM is represented by one slide in PowerPoint.

To use the PowerPoint export function no PowerPoint or other Microsoft Office products have to be installed on the computer. Only the PowerPoint library is needed.
Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extension for the PowerPoint export is displayed (*.pptx).

Options: The option Export videos as reference states whether the videos contained in the project are stored within the PowerPoint document or only a reference to them. In the latter case, it can be defined whether to Copy videos to export directory or to leave them at the original location reference this location.

Export: The selected data are exported with the defined options and the dialog is closed.
Delete: After a confirmation prompt, the exporter is deleted and the dialog closed.

Cancel: The dialog is closed and changes dismissed.

? : The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

2.1.13.6 Create Video

Go to:

File
  ➔ Export Report
  ➔ Create Video

A video file is created recording the dynamic content of the active graphic window. This component produces two timer data items ('frameTime', 'frameIndex') which can be used to control dynamic graphic elements of jBEAM. This allows creating high resolution videos with exactly synchronized content. The created video file is playable in other movie players without using jBEAM.
**Time Object:** The data object’s name by which it will be displayed.

**Result Data:** Path and Name of the video file to be created. The button opens the dialog box for setting the storage location.

**Export Formats:** Two formats are available: *.mov (Mov (video/mov)) and *.avi (Avi (video/avi)).

**Only applicable formats:** If activated (checkmark is set), only applicable formats are displayed.

**Video Codecs:** Depending on the selected export format different video codecs are available (Mov: PNG, JPEG; Avi: PNG, MJPEG).

**Info:** Information about the selected export format.

**Video Size:** Video size (height x width) in pixels. The set section of the graphic window is marked by a red frame.

**Visible Graphic-Window content:** If activated (checkmark is set), the entire visible content of the Graphic window is recorded.

**Show in video:**

- **Time:** The video’s current time is displayed in the left upper corner.
- **Frame index:** The video’s current frame is shown in the left upper corner.

**Timing:**

- **Offset:** Defines the starting time of the recording.
Duration: Defines the duration of the recording.

Scaling: The video is created with 15 frames per second. The produced data item gets the time of actual frame which is calculated as:

\[ \text{Time} = \text{offset} + (\text{frameIndex} - 1) / 15 \text{ f/s} \times \text{scaling} / 1000 \]

The video speed (normal, slow motion, fast motion) is set by using the slide control.

Record: Button to start/stop the recording process.

Frame: Displays the current frame index of the recorded video.

Record time: Displays the current time of the recorded video.

Delete: The defined settings are dismissed and the dialog is closed.

Close: The dialog is closed.

2.1.13.7 SVG-File

Go to:

File

- Export Report
  - SVG-File

The active Graphic window is saved as SVG-File (Scalable Vector Graphics).
Favorites: The combo box allows fast access to frequently used folders. The folder selected under Save in can be added to the favorites list via the button. The button removes the selected folder from the list of favorites.

Save in: The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

File name: The name of the export file can be chosen or edited.

Files of type: The commonly used file extension for the SVG export is displayed (* .svg).

Export: The selected data are exported with the defined options and the dialog is closed.

Cancel: The dialog is closed and changes dismissed.
2.1.13.8 jBEAM Graphic-Element

Go to:

File
Export Report
jBEAM Graphic-Element

Graphic elements selected in the Graphic window can be saved in various formats:

- *.png
- *.jpeg/*.jpg
- *.svg
- *.emf
- *.pdf
- *.swf
- *.bge
- *.gif
- *.bmp
- *.jbs, *.jbeam
**Favorites:** The combo box allows fast access to frequently used folders. The folder selected under **Save in** can be added to the favorites list via the $+$ button. The $-$ button removes the selected folder from the list of favorites.

**Save in:** The folder or drive where the export file is to be saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name:** The name of the export file can be chosen or edited.

**Files of type:** The available formats for the jBEAM Graphic-Element export are displayed:

- **Portable Network Graphic files (*.png):** Universal graphic format for raster graphics with lossless data compression, often used in the internet.
- **JEPG files (*.jpeg/*.jpg):** Pixel-oriented graphic format with mostly lossy data compression.
- **Scalable Vector Graphics files (*.svg):** Scalable vector graphic.
- **Enhanced Metafile files (*.emf):** Format based on vector graphics.
- **Adobe PDF files (*.pdf):** Universal format for texts, images and tables.
- **Adobe Flash files (*.swf):** Format for displaying multimedia and interactive content.
- **jBEAM Graphic files (*.bge):** jBEAM binary format for graphic elements. Graphic element files imported by Copy/Paste or Drag&Drop create a new graphic element with the same parameters as the original. Even data object references are kept (if possible). Files in the BGE format can form a library for parameterized graphic elements.
- **Graphics Interchange Format files (*.gif):** Fit for lossless compression of images with low color depth.
- **Bitmap files (*.bmp):** Raster graphic format.
- **jBEAM project files (*.jbs, *.jbeam):** Export to a jBEAM project file.

**Export:** The selected data are exported with the defined options and the dialog is closed.

**Cancel:** The dialog is closed and changes dismissed.
2.1.14 Import Layout

Go to:

File

Layout Import

Different layout formats can be imported. Supported formats are:

- XML (jBEAM)
- DIAdem v9
- INCA XDA
- GIDAS-ASCII

**XML (jBEAM)**

XML (jBEAM) is used for describing graphic pages (e.g. for protocols) according to XML standards. XML files can be viewed with any XML viewer (e.g. Windows Internet Explorer). Files can be edited with a standard XML editor or any text editor. The file suffixes for the XML files are *.blf (jBEAM Layout File) for layout files and *.slf (SubLayout File) for graphic templates.

In the layout import dialog box the user can choose between different modes of import. Depending on the selected **Importmode**, different options can be chosen. It is possible to load complete layouts as well as merging several layout files.
**Favorites**: The combo box allows fast access to frequently used folders. The folder selected under **Look in** can be added to the favorites list via the + button. The - button removes the selected folder from the list of favorites.

**Look in**: The folder or drive where the file to be imported is saved is selected in the directory tree. A fast access to specific storage locations is provided by the list of favorites and the symbols on the left side.

**File name**: The name of the selected file is displayed.

**Files of type**: All supported file formats for the layout import are listed: layout files *.blf (jBEAM Layout File) and graphic templates *.slf (SubLayout File).

**Import**: The selected layout is imported with the defined settings and the dialog is closed.

**Cancel**: The dialog is closed and changes dismissed.
Import mode

**base layout:** The previous content of the graphic window is removed completely and replaced by the selected layout. There is a confirmation prompt whether the current content shall be deleted.

**merge:** The template is merged into the current content, i.e. the current content is not influenced but the imported content may overlap it.

**insert:** Inserts a template at a certain position. If there already are graphic elements at this position, they will be positioned after the imported layout. The page and the required space can be customized. Additionally, a page break can be inserted after the imported layout so that the moved existing content starts on a new page.

**append:** The template is added at the end of the document.

**Options** (according to Import mode)

**at page** (Merge, Insert): The template is inserted at the defined position. The currently existing pages of the active graphic window can be selected.

**from window:** This option defines which graphic window of the layout is imported and inserted at a defined position. By default, all contained graphic windows (**All**) are imported and each placed in the same window. Optionally, a contained graphic window can be selected (**1**, **2** or **3**) which can be imported to the **same** or **other** window. In this case only the selected graphic window is overwritten with the new layout according to the selected **Importmode**. The other graphic windows remain unchanged.

**start at new page** (Append): If activated (checkbox is set), the layout is inserted on a new page. **Space** determines the position at which the layout is inserted.

**space (width, height)** (Merge, Insert, Append): The values define the distance to the left and upper page border or to already existing graphic elements.

**append page break** (Insert): If activated (checkmark is set), a page break is set after the imported layout if more graphic elements follow. The content that was moved backwards starts on a new page.

**space (width, height)** (Insert): The values define the distance of the moved graphic elements to the left and upper page border or to already existing graphic elements.

**Templates:**

**extract completely:** The template will be dissolved completely and immediately. Thus, all graphic objects are editable. However, if the original template is changed later, these changes cannot be reloaded.

**reference inner:** Graphic objects of the imported template can be edited. Included subtemplates are imported as referenced templates, i.e. the content of the template is not editable. This content can be refreshed, i.e. changes in the original template are adopted in the imported template.

**reference all:** The imported template and all included graphic templates are embedded in a template container. The content of the templates is not editable, but can be refreshed.
See also Template Manager.

Diadem v9
Layout files of Diadem version 9 (*.tdr) can be imported.

INCA XDA
Layout files of the ETAS INCA tool (*.xda) can be imported.

GIDAS-ASCII
Proprietary format for engine test data protocol (GIDAS).

2.1.15 Export Layout

Go to:

File
 → Export Layout

Supported format:
- XML (jBEAM)
XML (jBEAM)

Complete graphic pages (e.g. for reports) are exported as layout according to the XML standard. XML-Files can be viewed with any XML-Viewer (e.g. Windows Internet Explorer). Files can be edited with a standard XML editor.

jBEAM distinguishes between two kinds of layouts: main layouts (*.blf) and graphic templates (*.slf, formerly sublayouts). The layout type can be selected in the Files of type combo box.
Main layouts

A main layout is used to store all graphic aspects of a jBEAM project like:

- Arrangement of the graphic windows
- Printer settings
- All graphic objects of the windows to export
- graphic data (images, graphic generators)

Main layouts will be used e.g. to generate automatic reports or to display measurement data in a complex layout. The file suffix is *.blf (jBEAM Layout File).

Main layout options

Printerinfo: If activated (checkmark is set), the printer information is exported.

Page parameter: Export of the properties, which are set in the printer setup dialog (Printer Setup), e.g. the paper layout or margins.

Graphic windows to export: All graphic elements of the checked graphic windows are exported as layout.

Layoutfiles: One of the following options has to be selected:

- **One flat file**: All graphic elements are stored in one layout file. No references are exported. The content of contained graphic templates is also embedded directly in the layout file.

- **Nested files (includes)**: All graphic elements which are not part of a graphic template are stored directly in the layout file. The content of contained graphic templates is not embedded. Only references to the graphic templates are stored. When the layout is later imported the referenced templates are automatically imported as well.

  - **Absolute references**: If activated (checkmark is set), the absolute path of the included templates is stated in the exported layout file. Otherwise only the relative path is stored.

Export external graphic data: Defines whether external graphic data (e.g. images, graphic generators) is embedded into the layout file.

Via context menu item **Save as layout**, an individual page of the project can be exported as jBEAM XML-Layout. This menu item is only enabled if **Page View** is active. The above dialog opens, but without options.

<table>
<thead>
<tr>
<th>Save as subproject ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save as layout ...</td>
</tr>
<tr>
<td>Replace Data ...</td>
</tr>
</tbody>
</table>

Graphic templates

A graphic template contains definitions of graphic objects without any information about pages or windows. Graphic templates group several graphic objects for multiple usage in other layouts (e.g. in different pages, header, footer). The file suffix is *.slf.
Interactive graphic elements, such as buttons, slider or axis cursor, can now be operated also in grouped condition (grouping, component group or graphic template).

<table>
<thead>
<tr>
<th>Graphic template options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content:</td>
</tr>
<tr>
<td>All graphs of the current window/page</td>
</tr>
<tr>
<td>All selected graphs</td>
</tr>
<tr>
<td>Layoutfiles:</td>
</tr>
<tr>
<td>one flat file</td>
</tr>
<tr>
<td>nested files (includes)</td>
</tr>
<tr>
<td>Absolute references</td>
</tr>
</tbody>
</table>

**Content:** Choice whether only **all graphs of the current window/page** or **all selected graphs** are exported.

**Layoutfiles:** One of the following options has to be selected:

- **One flat file:** All graphic elements are stored in one layout file. No references are exported. The content of contained graphic templates is also embedded directly in the layout file.

- **Nested files (includes):** Only references to the graphic templates are stored. When the layout is later imported the referenced templates are automatically imported as well.

- **Absolute references:** If activated (checkmark is set), the absolute path of the included templates is stated in the exported layout file. Otherwise only the relative path is stored.

**Export:** Starts the export.

**Delete:** Deletes the settings of the export component.

**Cancel:** Closes the dialog box without exporting a layout.
2.1.16 Batch Import

Go to:

File  
→ Batch Import

By calling this function a batch complying with XML format is loaded. Batches are used to automate data processing.

Batch Import is only available because of downward compatibility. It is recommended to use Scriptfiles instead.

2.1.17 Scriptfile

Go to:

File  
→ Scriptfile

The command opens and executes a script file.

A script file is a source file that is written in a script language. Scripts are used to automate processes.
Available **Files of type** are **BeanShell files (*.bsh)** and **Groovy files (*.groovy)**.

**BeanShell**: is used for short scripts. The syntax is similar to Java 1.4 but until now there are no further renewals.

**Groovy**: is used for longer and more difficult scripts because it creates Java classes. Groovy is a dynamic script language for the Java virtual machine and its syntax is different in comparison to Beanshell (e.g. when initializing fields).

See also [Scripts in jBEAM auf www.jbeam.info](#).
2.1.18 Page Setup

Go to:

File

Page Setup

or the Page Setup icon in the tool bar.

This command is used for defining the page format. The currently set page format also forms the basis for the page size of the Graphic windows.
**Format for:** Selection of the printer for which the format shall be set. The list shows all available printers and devices.

**Paper size:** Selection of the paper format. The list shows all available paper formats of the selected printer.

Especially for the output as PowerPoint presentation or PDF, e.g. the formats **Slide presentation (16:9)** and **Wide screen (16:9)** are useful (available e.g. with Format selection **All Formats**).

**Orientation:** Selection between **Portrait** and **Landscape** format.

**Margins:** The desired values for the page margins can be entered in the input fields.

- **minimum from printer:** If activated, the minimum margins of the selected printer are considered. The values of the input fields are set to these minimum margins if they are smaller. If the option is deactivated, pages can be output without margins, e.g. in case of PDF export. If printed on a physical printer which does not support these page settings a warning will be shown.

**Preview:** The preview window shows the current page settings (outer margins, printable area).
2.1.19 Print

Go to:
File
  ➤ Print
or press <CTRL+P>
or click the Print icon in the tool bar.

Graphs can be printed with high resolution. Before actually printing a printer dialog box appears. The precondition for this is that a printer is installed. Note, that only those Graphic windows are printed that have been selected in the preferences (Edit→Preferences, tab Printing).

OK: Starts the printing process.
**Cancel:** The dialog box is closed without printing the document.

### 2.1.20 Exit

Go to:

**File**

→ **Exit**

or press `<CTRL+Q>`

or click on the **Exit** icon in the tool bar.

Before exiting the programme the user has to confirm whether or not the current project should be saved.

![Exit jBEAM dialog box](image)

**Yes:** The current status of the project is saved and jBEAM closed.

**No:** jBEAM is closed immediately.

**Cancel:** jBEAM is not closed.

**Help:** jBEAM is not closed and the jBEAM help is called.
2.2 Menu: Edit

The Edit menu consists of the following sub menus:

- **Undo**
- **Redo**
- **Cut**
- **Copy**
- **Paste**
- **Duplicate**
- **Select all**
- **Delete unnecessary components**
- **Cleanup Importers**
- **Replace Data**
- **Preferences**
- **Trace Logger**

*Edit* can be called by pressing the keys <ALT+B>.

2.2.1 Undo and Redo

Go to:

**Edit**

- Undo
  or press <CTRL+Z>
  or click on the tool bar icon.

**Edit**

- Redo
  or press <CTRL+Y>
  or click the tool bar icon.

*Undo* enables undoing user actions. When an operation is undone the sub menu item *Redo* is active and the undone action can be redone. jBEAM queues, depending on the actual distribution, at least the last ten user actions. Each of them can be undone individually. The menu entries depend on the actual actions and provide a short description.

Immediately after starting jBEAM no actions are available in the queue and therefore undo and redo are disabled.
If a revocable action is executed the **Undo** entry is enabled. The currently available **Undo** action is listed. In the example the deletion of two components would be undone.

As soon as an action is undone the **Redo** entry is enabled and the undone action can be executed once more. The **Undo** entry changes to the previous action. In the example the two components would be deleted again.

### 2.2.2 Cut

Go to:

**Edit** → **Cut**

or press **<CTRL+X>**

or click on the tool bar icon **Cut**.

This command executes the cutting of objects.

The function **Cut** is only available if a Graphic window is active. A cut object is removed from the Graphic window and stored in the Clipboard. Depending on the object type, the cut object can be pasted in jBEAM or another application.

See also **Copy** and **Paste**.

### 2.2.3 Copy

Go to:

**Edit** → **Copy**

or press **<CTRL+C>**

or click on the tool bar icon **Copy**.

The active component is copied to the Clipboard. Spreadsheet, Explorer and Graphic window content can be copied.
Copying from the Spreadsheet

Any area from the Spreadsheet can be selected (see adjacent example). Clicking on the column header selects the whole column. **Copy** copies the selected area of the chart to the Clipboard.

![Spreadsheet](image)

The format is compatible with Excel, i.e. the Clipboard content can be pasted into other programs like Excel or Word.

Copying from the Explorer

Data can be copied from the Explorer as well. In this example a Channel and a Formula are copied. If the command is executed like this, all data is copied.

![Explorer](image)

The copied data can (similar to the Spreadsheet) be pasted into other programmes like Excel or Word.
Copy from the Graphic window

To copy a graphic object, it has to be selected. For comparison: the upper graphic depiction is not selected, the lower one is. A graph is selected by clicking on it.

When the command Copy is executed, a copy of the selected graph is transferred to the Clipboard. The Clipboard content can be pasted in jBEAM or other programmes. When pasting the copy, a new graphic element of the same type with identical parameterisation is created. When pasting the copy into other programmes (e.g. Word), an image of the graphic element is embedded.

2.2.4 Paste

Go to:
Edit
Paste
or press <CTRL+V>

or click on the tool bar icon Paste.

Cut or copied objects from the Clipboard are pasted into the selected window. Depending on the object type and the selected window there are different options for pasting.

Pasting into the Graphic window

jBEAM Graphic element: The stored graphic element is cloned and configured with the same set of parameters.

Image: The stored element is pasted as an image.

Text: The clipboard content is pasted in a newly generated graphic object of the type text field.

Files:
Text files (*.txt): The Clipboard content is pasted to a new graphic element of the type text field.

Graphic files (e.g. *.png, *.gif, *.jpeg): The content is pasted to a new image graphic element.

jBEAM Graphic element files (*.bge): The content is pasted to a new graphic object with all the stored properties.

Pasting into the Spreadsheet

To paste content into the Spreadsheet, the Clipboard content has to be Excel compatible (e.g. Excel fields, an area of a chart in jBEAM or a text area in Word). Pasted data are immediately visible in the Spreadsheet.

After Paste is chosen the dialog box Clipboard Import opens and further parameters of the new data objects can be specified.

The parameters X0 and delta X define the initial value of the x-axis respectively the distance between the x values (to whom the channel values of the y-axis are assigned). These parameters are relevant when it comes to the settings of the x-axis: auto(x0, xdel).

2.2.5 Duplicate

Go to:

Edit

Duplicate

or press <CTRL+D>

The function is only available if the Graphic window is active. Selected graphic elements are duplicated in the Graphic window.

For this purpose the desired graph has to be selected, to select more than one graphic object press <SHIFT> while selecting further objects.
Two selected graphic objects before duplication.

Graphic objects after duplication.

2.2.6 Select All

Go to:

Edit

→ Select all

or press <CTRL+A>
Selecting all in the Spreadsheet

The command **Select all** selects the whole chart. Afterwards the selected content can be copied.

Selecting all in the Graphic window

All Graphic elements of the active Graphic window are selected.

2.2.7 Delete unnecessary components

Go to:

**Edit**

- **Delete unnecessary components**

The function lists all components and calculations of a project that are not used by a graphic, calculation or an export. These can be selected and deleted directly. Thus, both data volume and process time can be reduced.
The list shows all components that are unnecessary. Via checkboxes, the components to be deleted can be selected.

**Delete selection:** The selected components are deleted.

**Close:** The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.2.8 Cleanup Importers

Go to:

**Edit**

→ **Cleanup Importers**

This function cleans up all contained importers of a project. Optionally, unused data objects can be removed or set to Standby load status in order to reduce the file size of a project. Using the Standby mode, the channels are empty but are still available for later use. Each channel can be set to an individual load status (Complete, Standby or Ignore).
This list shows all importers with the contained channels as well as their use and suggested load status. For each group or channel, individual import options can be set.

By clicking in the header of a column the list can be sorted in ascending or descending order. The sorting order is switched with each click (ascending – descending – no sort). A right click in a line or several selected lines opens the context menu where the load status of the respective channel or channels can be set or groups expanded or collapsed.

**Name:** The list shows all importers contained in the file as a tree structure. The + and – boxes can be used to unfold and fold the importers and groups in order to display or hide the contained channels.

**Load data group:** The checkboxes can be used to activate or deactivate the individual groups completely or to activate or deactivate the contained channels individually.

**In use:** In this column the channels / importers are indicated by a check mark which are actually used in the project.
Load status: Initially, each channel is assigned with a suitable load status. By default, used channels are set to Complete, unused channels to Ignore. This default setting can be modified individually as needed. The set load status is applied to the channel under the condition that the importer supports the respective load status.

The load status Complete, Standby or Ignored can be assigned to the individual groups or channels by clicking the symbols until the desired option is displayed. If different options are selected within a level, the symbol of the higher level changes to a question mark (Indeterminate).

ียว Ignored: No result item is created for the selected channel.

ียว Standby: A result item for the channel is created, but no values are loaded.

怊 Complete: All values of the channel are loaded.

The input fields below the table can be used to filter for special strings (e.g. in the channel names). Via drop-down list the Text filter type can be selected (Plain text, Wildcard text (?, *) or Regular expression).

* Column Name can be searched for characters or strings.

* Column Load status can be filtered for the load status: Ignored, Standby, Complete and Indeterminate. The texts for the selected option can be displayed as tooltip by moving the mouse over the input fields.

Unused data items to StandBy: Optionally, the unused channels can be set to Standby mode. Thus, they will still be available in the project and can be selected. But they will not contain data until they are actually used. This way, the file size can be reduced without removing the channels completely.

Remove unused data items: Optionally, the unused channels can be removed from the importer. Thus, they will not longer be available in the project. They only can be retrieved by modifying the importer.

Customize settings: The settings can be individually adjusted. As soon as a load status is changed in the above list, this option is activated automatically.

Remove further (not listed) data objects: This refers mainly to maps contained in the importers. They are not shown in the list. Unused maps can be removed by this option.
2.2.9 Replace Data

Go to:
Edit
→ Replace Data

This function can also be started via menu Graph Editor→Replace Data.

2.2.10 Preferences

Go to:
Edit
→ Preferences

Preferences consists of the following tabs:

- Language
- ML-Layouts
- Folder
- Dialogs
- Project-File
- Explorer
- Importer
- Graphic elements
- Proxy
- Printing/Report
- Measurement
- Menu settings
- E-Mail Server
- Miscellaneous
Preferences directories: All preferences are stored in the file "jBEAM7.preferences" or "jBEAM.preferences" for older jBEAM versions. The storage location can be set for the local range and optionally the global range.

If the default local preferences file for jBEAM 7 (jBEAM7.preferences) does not exist, jBEAM tries to load the preferences file saved by the previous version jBEAM 6. To save the current preferences, jBEAM creates a new local preferences file without overwriting the jBEAM 6 preferences file in order to allow old jBEAM 6 versions to still load its preferences file.

Global: Preferences can optionally be stored at a global place, e.g. in order to use uniform versions within the enterprise. The dialog box for selecting a folder opens via Select. If a folder is selected that does not contain a file by the name of "jBEAM7.preferences", the folder name is depicted red. The current status of the preferences can be saved via Save. Not all attributes are saved in the global file, e.g. the last used folders are only saved in the local file. However, when a global file is used, it contains more and mainly other information than the local file where less information is saved accordingly. When jBEAM is started both files are combined. If attributes are contained in both files, the ones in the local file prevail over the global file.

Local: By default the preferences are saved to the folder stated here.

Reset to:

Standard: All preferences are set to the default preferences. Both "jBEAM7.preferences" files (global and local) with the individual settings are deleted and created new with the default settings after reloading jBEAM. If writing access is denied in case of the global file, the old data remains.

Global: The local preferences file with the individual settings is deleted. After reloading jBEAM the global preferences file is combined with the default settings and saved to the newly created local preferences file.
Local: The local preferences file is used. The global preferences file is deleted. The data can be protected by limitation of access.

2.2.10.1 Language

In this tab the language of the user interface is determined. Available languages are highlighted and can be activated in this tab. Which languages are available depends on the respective customer’s version.

<table>
<thead>
<tr>
<th>Language</th>
<th>ML-Layouts</th>
<th>Folder</th>
<th>Dialogs</th>
<th>Project File</th>
<th>Explorer</th>
<th>Importer</th>
<th>Graphic Elements</th>
<th>Proxy</th>
<th>Printing/Report</th>
<th>Measurement</th>
<th>Menu Settings</th>
<th>E-Mail Server</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>auto</td>
<td>(Language information from the operation system)</td>
<td>English</td>
<td>Deutsch</td>
<td>français</td>
<td>italiano</td>
<td>español</td>
<td>portugues (Brasil)</td>
<td>Polski</td>
<td>magyar</td>
<td>svenska</td>
<td>norsk</td>
<td>Norwegnian</td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td>EnG</td>
<td>Deutsch</td>
<td>Germen</td>
<td>France</td>
<td>Italien</td>
<td>Spain</td>
<td>Portuguese</td>
<td>Polski</td>
<td>Magyar</td>
<td>Swedish</td>
<td>Norse</td>
<td>Norwegian</td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td>EnG</td>
<td>Russian</td>
<td>Czech</td>
<td>Polish</td>
<td>Hungarian</td>
<td>Spanish</td>
<td>Portuguese Brasil</td>
<td>Polish</td>
<td>Korean</td>
<td>Japanese</td>
<td>Arabic</td>
<td>Hindi</td>
<td></td>
</tr>
<tr>
<td>Auto</td>
<td>EnG</td>
<td>Chinese</td>
<td>Chinese</td>
<td>Korean</td>
<td>Japanese</td>
<td>Arabic</td>
<td>Hindi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Auto: The default setting when starting jBEAM is auto, i.e. the language currently used by the operating system is also used by jBEAM as long as the language is supported (default is English). Before using certain languages (e.g. Asian languages) specific settings of the operating system are necessary in order to support these languages.

Preferred Language: If a language symbol is activated, it is set as preferred language and the symbol is highlighted with colors (in the example above English is the selected preferred language). The jBEAM user interface adopts the chosen language independently from the computer’s operating system language. By clicking on the available language symbols the setting is changed. The setting is applied by clicking OK. The language of the menu bar is immediately changed.

Note: It is recommended to let the setting remain at auto if there are no opposing reasons.

2.2.10.2 ML-Layouts

The language settings for the usage of multilingual layouts are defined here. They determine the depiction of text of the graphic element in the Graphic window.
Available Locales: The list depicts all available respective known languages.

Show strings in GUI language: For the depiction of language dependent strings of graphic elements the language selected in this tab will be used.

Show strings in: Another language can be selected from the list of available locales via arrow button for the display of language dependent strings. If the language is supported by jBEAM, the respective symbol is displayed. Else no symbol will be depicted. Even if the selected language is not available, language dependent strings for the graphic elements can still be created in this language and will be displayed via this option.

Initialize new strings with: Several languages can be selected from the language list in order to set them as basis languages when creating new graphic elements.

OK or Apply applies the settings immediately to all available graphic elements with language dependent strings.

See also the usage of Language Dependent Strings.

2.2.10.3 Folder

The Folder tab offers an overview of preferred folders for file operations.
Default folders for file operations: Via the selection list a category can be selected for which folders for fast access can be defined. These folders are then displayed as standard or favourite folders in the respective file selection dialogs (e.g. Open/Close Project, Import/Export of Images, Audio or Video files). Folders can be entered for the following categories:

- **Projects:** Default folder for e.g. Open/Close Project
- **Project templates:** Default folder for e.g. New from template/Save as template
- **Layout templates:** Default folder for e.g. Import/Export Values or the template manager. In the latter case, the defined folders and all sub folders are searched for templates.
- **Imports:** Default folder for e.g. Import Values.
- **Exports:** Default folder for e.g. Export Values.
- **Multimedia:** Default folder for e.g. Import/Export of images, audio and video files.

The display field shows all defined folders for the selected category. The buttons on the right can be used to add or delete folders or to change their order.

- **Adding a folder:** Another folder is added to the list of default folders in the dialog box **Open**.
- **Deleting a folder:** The selected folder is deleted from the list of default folders.
- **Rearranging folders:** The selected folder is moved up/down by one position in the list of default folders.

Folders can be added to or deleted from the lists also in the respective file selection dialogs by using the + and - buttons.

Component default configuration:

- **Global folder:** Optionally, the folder default settings can be adopted from a global folder, e.g. in order to use uniform templates.
- **User folder:** Optionally, the folder default settings can be adopted from a local folder, e.g. in order to reuse own templates.

Other:

- **Use user-defined temporary directory:** If big amounts of data have to be cached temporarily, the folder to be used can be set here.
- **Use detail view in file chooser dialogs:** Additionally to the file list, file dialogs show also information like size, file type and modification date. This detail view can be predefined here. However, the view type can also be changed directly in the file dialog.
- **Set preferred directory for Project Show:** A folder can be defined from which the project files for the **Project Show** shall be loaded. This folder can be modified also directly in the Project Show editor.

### 2.2.10.4 Dialogs

In this tab the basic settings concerning the display options of the dialogs are defined.
Dialog placement

**top left, top right, center, bottom left, bottom right**: Defines the position of the dialogs upon opening.

**leave gap at bottom of ... Pixel**: Defines a distance (in pixel) to the lower margin of the display.

**Dialogs of graphic elements**: These dialogs can be positioned according to the defined **standard** or **near to the graph**.

**use non modal dialogs if applicable**: If the main window should remain usable while a dialog is open, this option can be selected. Like this, more than one dialog can be modified, new calculations created or data imported/exported. The newly generated data objects can be immediately used in the respective combo boxes.

**Compact layout**: Changes the organisation of some rather voluminous dialog boxes. If enabled (checkmark is set), individual sections of a dialog box are grouped in tabs. If this function is disabled, the content of all tabs is organised in one dialog box.

Window settings

**show toolbox for new projects**: If this option is enabled the toolbox window is automatically displayed when a new project is created.

**Hide tooltip after ... seconds**: This option defines the duration how long the tooltips are displayed. If the option is deactivated, the tooltip is displayed as long as the mouse hovers over the corresponding text. Thus, even longer tooltip texts can be read without problems.

Dataobject chooser component

**only dataitem list at low number of dataitems**: Selecting data items can be done by only one combo box with data item names if the number of data objects is low or, if the number of data objects is rather large, by two boxes. In the latter case the first combo box consists of all appropriate producers and the second one lists the produced data items of the selected producer.
always with producer list: The combo boxes for data objects are depicted with an additional list of their producers by default if the number of 20 data objects is exceeded. If this option is selected, the combo boxes are always displayed with the Producerlist.

Preferred producer combo width: The separation line between the two selection boxes can be moved by using the mouse. This ratio is transferred to the space available in the dialog boxes.

Preslected component: The combo box lists all available components. One of them can be selected to be displayed as default in the dialogs.

one entry for every possible subdimension of a data object: If this option is enabled, each dimension of a data object is listet as an own entry.

Display with deactivated option: The matrix "DblMat" is displayed only once in the list. Via input fields, level, column and row indexes can be entered. "*" selects all indexes of this dimension.

Display with activated option: The matrix "DblMat" is displayed several times in the list. One entry for each dimension is displayed with brackets ([], [], [] or [[]]).

auto check of matrix index in dataitem selectors: Some calculations or graphic objects can use columns of a matrix as input. If the number of columns changes (e.g. by changing imported data) and the option is enabled, the column index of the input field in the respective modification dialog will be reset to the maximum index of the available columns (insofar the used column index is higher than the column index currently available). If this option is disabled, the input field of the respective modification dialog may display an index of the used matrix currently not available (higher). In that case the corresponding graphic will be not displayed or the calculation will be not executed.

Synchronize X-input object in Universal2D Graph automatically: If the selected y data object possesses an independent object for the x values, the x data object is automatically synchronised. If the selected x data object has no direct relation to the y data object, no synchronisation is carried out in case the y data object changes or a synchronisation is only then carried out if the automatic mode [auto(X0, Xdel)] is chosen in the choice box of the x data.

Data View Chooser

Defines if, respectively under which conditions, the selection element for views is shown in the dialog boxes: always visible, not visible or visible if at least one view is present. For more information about View-Selection, see here.
Orientation of result items in importer dialogs

Some importer dialogs support a variable orientation of result items. The items can be arranged either **horizontally** (line by line) or **vertically** (column by column).

2.2.10.5 Project-File

Options concerning the storing and loading of project data can be defined here.

### Storage mode for project file (initial)

- Data objects of all producers with values
- Only data objects of importers with values
- No values, but importer with file references

*Warning:* the mode also during save process of existing projects.

**External Data**

- Open TCP/IP connections when loading project file
- Import changed data files
- Import changed mapping files

**Project templates**

- Load changed template files
- Store pictures in template file

**Backup**

- Create backup file when overwriting project file

**Project History**

- Log status projects in history
- 

---

**Storage mode for project file (initial):** There are 3 possibilities to store result items:

**Data objects of all producers with values:** With this storage mode, the data of all import components and result objects are stored. Thus, a project file with all values is created. All calculations are stored as well.

This is useful e.g. if the project file shall be stored as data file or if the complete project shall be archived.

Via file import **jBEAM project** these project files can be imported. There, the calculated channels are only available with all values when the project file has been saved in this mode.

**Only data objects of importers with values:** With this storage mode (default), only the data of import components are stored, i.e. calculation components are stored without values. When the project is opened the data files are only reloaded (on request) if they have been changed since the last storage of the project.

If an evaluation shall be saved for further processing without being dependent on data sources or if the project file shall be transferred and the recipient has no access to the data sources, this mode should be used.
**No values, but importer with file references:** With this storage mode, import components are stored without values but with their file references. When the project is reloaded, the data is imported again. Thus, the file size is reduced considerably compared to the previous mode.

This mode is also useful if the import files usually change prior to evaluation. Thus, always the latest data is used.

However, this mode requires that all users have access to the import files.

**Use this mode also during save process of existing projects:** If this option is activated, the storage mode of the current project file is overwritten with the mode selected above when the project is saved. By default, this option is inactive. Activate this option if generally all project files shall be stored in this mode. However, this option can be changed for individual projects directly in the file save dialog (File→Save Project As).

**Warning if configuration changed during save:** A warning is displayed if the project file has been modified during the saving process. The options are: Always, Never and Ask.

**Extern data:**

**open TCP/IP connections when loading a project file:** If this option is enabled (checkmark is set), jBEAM will try to create a connection to the external device when loading a project that was created at the acquisition time of measured values. If measurement data is available no connection will be set up. If this option is disabled, jBEAM will not try to connect to external devices when loading a project. This shortens the sometimes long connection times if a connection fails.

**import changed data files:** This option defines the way jBEAM handles modified import files. Modified files are either Always imported or Never, i.e. the original data will be kept. But jBEAM can also Ask whether the modified files are supposed to be imported or not.

**import changed mapping files:** This option defines the way jBEAM handles modified mapping files. Either, modified files are Always imported, i.e. the mapping will be applied again. Or the files are Never imported, i.e. no mapping is applied and the original data remain unchanged. But jBEAM can also Ask whether the modified files are supposed to be imported or not.

**Project templates:**

**Load changed template files:** This option defines the way jBEAM handles modified jBEAM project templates. Modified templates are either Always loaded or Never, i.e. the original template will be kept. But jBEAM can also Ask whether the modified template is supposed to be loaded or not.

**Store pictures in template file:** This option defines whether pictures are also stored in the template or not.

**Backup:** If an already existing jBEAM project is saved again (overwritten), an optional backup file of the original project file can be created. This backup file receives the file extension *.bak.

**Project History:** The project history can optionally be stored. Already saved histories are deleted via the Delete button.
Text filter type: Defines the Text filter type of the text typed into the tool bar search text field.

Plain text: The search text is exactly contained in the found result.

Example: Dat matches DatGen and SecondDatGen

Wildcard text (?, *): In addition to Plain text, ? specifies an arbitrary character and * specifies a number of characters. In order to find a string exactly at the beginning or end of the search text, the expressions "xyz*" or "*xyz" can be used.

Example: D?t or D*G matches DatGen and DtGen; "Dat" matches DatGen but not SecondDatGen

Regular expression: Flexible specification of search text. Selected regular expression constructs can be found in topic Explorer tool bar configuration of the Explorer:

Example: D[ab]tGen~?\d* matches DatGen, DbtGen~1, or DatGen12 among others, but not DatG or DatGen12x.

Case sensitive: If activated, only the names with the string in exact upper and lower cases are listed.

Number of expanded search results: Maximum number of search results that are expanded in the explorer tree. All search results are listed in the search result node Filtered list.

Maximum search depth: Maximum search depth of the textual search. The depth of a component in the producer list or a visual component in a page is defined to be 1. The search depth of an input or result item of such a component is 2, etc.

Number of search results: Maximum number of search results that are displayed.

Delay of search after filter change: Defines a delay time between an input of a filter condition and start of the search. The explorer tree is only updated if the filter condition is not changed within the stated delay. A delay of 0 ms means that the explorer tree is updated on each filter change. This option is useful for large jBEAM projects with long-running explorer tree searches. For example, the delay is set to 200 ms. When the filter text "abc" is entered the explorer tree search starts 200 ms after 'c' is typed, as long as the duration between the input of 'a', 'b', and 'c' is lower than 200 ms.
Show command and action items as input and result items of components: If this option is activated, command and action items (e.g. generated by services or control elements) are displayed in the list.

Show maps as input and result items: If this option is activated, maps (e.g. of importers) are displayed as data objects in the list.

Show data item groups: Many importer data formats, e.g. MDF or ATF, make use of groups or hierarchies to structure their data. If this option is activated, the internal structure is shown in the Data Explorer. For this, the newly created data property "path" is used.

Expand new producer components: As soon as a new producer is generated, the list with its data items is shown at once.

Update data object preview during measurement: Optionally, the preview images of data items can be refreshed permanently during measurement. In case of data intensive measurements this may cause delays in the display. Then, this option should be deactivated. The preview shows a sand-glass symbol. As soon as the measurement is terminated, the preview image is refreshed automatically.

2.2.10.7 Importer

The tab Importer describes the steps of conversion when importing files. First, recognized non-ISO units are automatically converted into their corresponding ISO units (1. Automatic replacement of non-SI units). Values are not converted. Second, user-defined channel mapping files can be utilised to convert channel names and units into standard names and units (2. Automatic replacement of channel names and units). In case of ISO units the values are converted.
Load status: When an importer is generated via menu or by Drag&Drop of a file, the channels can be initialized with the Default load status defined here. However, this applies only to the importers supporting the selected load status. Otherwise, the channels are initialized with the Complete load status by default. But the importer themselves also have the opportunity to either apply or to ignore the preferences (see Default load status).

The following options for the load status can be selected:

- **Ignored**: No result item is created for the selected channel.
- **Standby**: A result item for the channel is created, but no values are loaded.
- **Complete**: All values of the channel are loaded.

Conversion steps during importing

1. Automatic replacement of non-SI units

The table lists possible channel units that might occur in an imported file and states the corresponding standardised ISO units. The list of units is provided by the Unit Service. The filter line beneath the chart can be used to search the table for specific units.

2. Automatic replacement of channel names and units

Here, settings can be defined for replacing channel names and units with standard values. For this a channel mapping file (*.cmap) is needed, a simple text file consisting of entries separated by comma that can be created with a text editor. Thereby the following model has to be met: standard name, standard unit, (any amount of) channel names from the file:

"Standard name", "Standard unit", "Name from File"

"Standard name2", "Standard unit2", "Name from File2", "Name from file3", etc.

As many channel names from the file as wanted can be assigned to the desired standard unit. In case that a standard name shall have no unit, the following model can be applied:

"Standard name3", "Name from File"

Example:

"My Time", "s", "Time", "Date-Time"
"Temperature", "K", "AATI", "TE_Reference", "TG_Reference"
"Engine Speed", "1/min", "Drive", "Motor Speed"
"Engine Torque", "Nm", "EFFMOMT"

Known units in the import file are renamed to the defined target unit and the values are converted if necessary (e.g. mi/h -> km/h). In case of not known units, the unit is not mapped and the original unit remains. Otherwise, unequal units could be renamed but not converted without notice (e.g. mi_p_h -> km/h). Empty or not defined units are mapped to the target unit without value conversion.
Importers supporting the channel names and units mapping supply their result channels with 3 new properties:

**TargetName**: Is the standard name used by the mapping or, if not stated, the channel name from the import file.

**ActiveNameUnitMapping**: Shows whether a mapping has been applied to the channel.

**OrigName**: Is the channel name from the import file.

### 2. Automatic replacement of channel names and units

<table>
<thead>
<tr>
<th>Channel Name</th>
<th>Standard Unit</th>
<th>Channel Names in File</th>
</tr>
</thead>
<tbody>
<tr>
<td>My Time</td>
<td>s</td>
<td>Time, Date-Time</td>
</tr>
<tr>
<td>Temperature</td>
<td>K</td>
<td>AAI, TE_Reference, TC_Reference</td>
</tr>
<tr>
<td>Engine Speed</td>
<td>1/min</td>
<td>Drive, Motor Speed</td>
</tr>
<tr>
<td>Engine Torque</td>
<td>Nm</td>
<td>EFF, COMT</td>
</tr>
<tr>
<td>Index</td>
<td></td>
<td>APIR</td>
</tr>
<tr>
<td>Classification_Torque</td>
<td>kN/m</td>
<td>Classification_Torque</td>
</tr>
</tbody>
</table>

**global / local channel mapping file**: Two channel mapping files can be defined, a global and a local one. If only one is stated, this one will be used. If two are stated, both are applied. In case of double entries, the local file prevails. The respective file can be selected via the Select button. The **Edit** button opens the **CMAP Editor** where entries in the channel mapping file can be edited.

**Map channels case sensitive**: Optionally, the user can choose whether uppercase and lowercase letters should be considered or not. If this option is activated, names with different capitalisation are considered different names and are not converted, e.g. if a channel name in a channel mapping file is entered as "abc", then channel names like "ABC" or "Abc" are not converted from an imported file. If the option was deactivated, those channel names would be converted to "abc" (in case of multiple occurrence with an index [i]).

The preview of the current mapping settings can be changed between two list types: **Standard display** (like the channel mapping file structure) or the **One row for each channel display**.

The **filter line** below the table is used to search the table for certain entries.

Channel mapping is supported by the following importers:

- ASCII
• BEAM
• DIAdem
• Excel
• Gidas
• MDF
• NetCDF and others

**CMAP Editor**

The selected channel mapping file is opened and the entries are displayed in a table. The entries can be directly edited. Entries can be added or removed. The changes are saved in the channel mapping file via **OK**.

![CMAP Editor](image)

- **standard name**: The stated name is used as standard name for all channel names listed under **channel names in file**.
- **standard unit**: The stated unit is used for all channels listed under **channel name in file**. If no unit is stated, the original unit is used.
- **channel name in file**: The listed channel names (separated by semicolon) are mapped to the standard name during the import process. If more than one of the listed channel names exist in the file, the first entry gets the standard name, all further entries receive a suffix "~1", "~2" etc. Each listed channel name is allowed only once in the mapping file, except for the MDF import (see [Extension for MDF Import](#))
Filter Line

The input fields below the table can be used to filter for special strings (e.g. in the channel names). Via drop-down list the Text filter type can be selected (Plain text, Wildcard text (? , *) or Regular expression).

Remove selection: The entries marked by a tick in the checkbox in the first column are deleted.
New entry: A new entry is added.

OK: The changes are saved in the channel mapping file and the dialog is closed.
Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Extension for MDF Import

Channel names are allowed more than once in the mapping file. If this is the case, a copy is generated; i.e. the data of this channel is contained in several channels. If needed, the unit can be mapped to different units.

Example: In a series of measurements the channel "Velocity" is always recorded, whereas the channel "Average velocity" is only sometimes recorded. For further evaluation the channel "Average velocity" shall be used preferentially. If it does not exist, the channel "Velocity" shall be used as default. However, "Velocity" shall be available in any case.

The result of this mapping is that "v1" contains the data of channel "Average velocity" as long as it exists. If not, it contains the data of channel "Velocity" as default. Thus it is guaranteed that "v1" always contains data. Moreover, the data of channel "Velocity" is available as "v2" in any case.
2.2.10.8 Graphic Elements

Initial settings for graphic objects

**Background color & line width**
- **Background**: Defines the standard setting for the background color of graphic objects.
- **Curve line width**: Defines the standard setting for the line width of curves displayed in the graphs.

**Moving graphs**
- **show position lines to neighboring elements**: Optionally, when moving a graphic element, reference lines can be shown as soon as a moved element crosses an outline or centre line of a neighboring element. When the mouse button is released the graphic element snaps to the shown line or lines.
- **show connection lines to original position**: Optionally, when moving a graphic element, reference lines to its original position can be shown.
- **Snap to grid**: Optionally, graphic elements can snap to the grid while they are moved.

**Initial flashing interval**: For graphic elements providing a flashing option, the flashing interval can be predefined.

**Extend existing tables by duplicating page**: Defines the behaviour when pages containing tables or tables of contents are duplicated.
Always: Existing tables or tables of contents are generally extended to the new page, i.e. a split table with continuing content is created.

Never: Existing tables or tables of contents are generally not extended to the new page but also duplicated, i.e. a new element is created.

Ask: A request dialog is displayed when the page is duplicated.

Extend: Tables and tables of contents are split vertically and continued on the new page.

Copy: Tables and tables of contents are completely copied to the new page.

Highlight jump destination: Applies to graphic elements jumped at via table of content or hyperlink (Plain String). The highlighting of the jump destination can be deactivated.

For Curves

own parameters for initialization: Parameters can be assigned to individual curves that deviate from the standard settings. When creating a curve chart these settings are used as initialisation values for the depiction of curves. This depiction can be adjusted in the graph individually and independently from the preferences.

number of curves: Up to 100 curves can be predefined. If the number is increased, the currently defined curves are repeated cyclically, i.e. the first newly defined curve receives the same parameters as the first existing curve etc. The newly inserted number is applied by <TAB>, Apply or OK.

Reset to standard values: All settings are undone via this button and reset to the standard values.

Line: If enabled, the points of the curve are connected by a line with the defined Line color, Line width and Line type.

Marker: If enabled, the points of the curve are drawn with a marker with the defined Stroke and Fill color and Marker type.

Tracking Window

no tracking window: No miniature depiction of the graphic object is shown.

only in zoomed mode: The miniature depiction of the graphic object is shown when an area of the graphic object is zoomed in.

always: The miniature depiction of the graphic object is always shown.

Window size: Defines the size of the miniature depiction. It is calculated in relation to the size of the graphic object.

Line: Defines the curve’s color in the miniature depiction.
**Track frame**: Defines the frame’s color. The frame indicates the area of the graphic object which is currently shown in the zoom view.

**Background**: Defines the miniature depiction’s background color.

**Apply for all existing**: Immediately applies the settings made for the miniature depiction to all already existing graphic objects.

**Show message for unresolved input objects**: Messages regarding unresolved input objects in diagrams can optionally be displayed **Always**, **Never** or **Only in Edit-Mode**.

**Show Crosshair at mouse position in the selected axis system**: Optionally, a crosshairs can be displayed at the mouse position in the currently selected curve graph.

**Keep axis range of invisible diagrams**: Optionally, the space needed for invisible diagrams can be reserved in the axis area (complies with the behaviour of older jBEAM versions). Otherwise, no space is reserved for invisible diagrams.

**Keep axis range of invisible diagrams when opening old project files**: In older jBEAM versions, space needed for invisible diagrams has generally been reserved in the axis area. In order to facilitate the conversion to the new behaviour, i.e. not to reserve space for invisible diagrams, this option can be used to define how to proceed with invisible diagrams when older projects are opened. The following selections can be made:

- **Always**: Space needed for invisible diagrams is generally reserved ("old" behaviour).
- **Never**: Generally, no space is reserved for invisible diagrams ("new" behaviour).
- **Ask**: A request dialog is displayed when the project is opened.

**Legend**: Defines the representation of the symbol in the legend.

**Legend symbol mode**: One of the following symbol modes can be selected:

- **detailed**: A representative miniature of the curve type is shown.
- **simple**: A rough sketch of the curve type is shown.
- **only color**: A rectangle in the defined curve colors is shown.

**Apply for all existing**: Immediately applies the settings for the legend to all already existing legends in the project. Otherwise, the existing legends remain unchanged and the set mode is only applied to future legends.

**Example**: *When generating a Universal 2D Graph the settings defined here are adopted for the depiction of the curves.*
Universal 2D Graph with the settings from the dialog box

Universal 2D-Graph with standard settings above

2.2.10.9 Proxy

A lot of users may have restricted access to use data directly from the internet. The internet access will be only provided by using a proxy server. These proxy information (including authentication) can be entered in jBEAM to communicate directly from jBEAM with the internet using a proxy. Among other things, the communication is needed to get map data (see also Map Services) which will be displayed the universal 2D chart.
2.2.10.10  Printing/Report

Various settings for printing graphs can be defined in this tab.

### Print Graphic Window 1/2/3:
The command File→Print prints all Graphic windows that are selected in this tab.

### Print Background:
Graphic elements can be depicted with a background color but printing the background is deactivated by default to save resources. So if the background needs to be printed as well, Print Background has to be enabled.

### Background color:
A color for printing the background color is selected via the color selection button. The following order is applied when selecting the color that will actually be printed: 1. the preferences, 2. the Graphic window, 3. the page. That means, the background color set on the page weighs more than all other settings and will be printed even if another color is set in the preferences. The color defined in the preferences is only printed if a background color is neither defined the Graphic window nor on the page.

### Always print current page when in page view mode:
If all Graphic windows are set to page view, the current page is always printed in case this option is selected.

### Pixel graphic resolution:
2D diagrams can be exported as pixel graphics when they are printed (setting in diagram options). The desired resolution can be entered here within a range of 10 to 600 dpi. Additionally, the option Reduce also image resolution can be activated. Thus, even image graphs which are not exported as pixel graphics can be printed in lower resolution (otherwise original size).

2.2.10.11  Measurement

This tab defines how existing measurement values are treated before each new measure.

### Always:
The measuring channels are emptied before a new measure without further enquiry.

### Never:
The measuring channels’ values are kept, new values are added.
**Show dialog:** When a measurement starts, the following message is displayed that determines whether the measured values are deleted *(Yes)* or not *(No)*. Furthermore, by enabling the option *Use this as default and do not ask again* this selection is applied to the preferences.

![Show dialog dialog box](image)

### 2.2.10.12 Menu settings

This tab allows the individual setting and configuration of the menu and tool bar.

![Menu settings tab](image)

The modification of this dialog box is described at [Extra→General Services→Menu Service](#).
2.2.10.13  E-Mail Server

User Information: Definition of User name and E-mail address of the E-mail account which shall be used to send the messages.

Server Information: Definition of Outbox server including port. The default port 25 is predefined. Please, check this setting and change it if necessary.

Login Information: Definition of User name and Password for authentication for the E-mail account stated above. The options for the Encryption type are: None, SSL or TLS. Login information is only necessary if the Outbox requires authentication. Otherwise this option can be deactivated.

Login to inbox before sending required: This option is recommended because otherwise error messages, e.g. due to false E-mail addresses, cannot be received.

Inbox: Definition of Inbox server including port. The default port 110 is predefined. Please, check this setting and change it if necessary. The options for Server type are: POP3 or IMAP. If the login settings of the inbox server differ to outbox server settings, they need to be entered here.

Send Test Mail: A test mail is sent with the subject "jBEAM Test Mail" to the E-mail address stated above. If the test fails an error message is displayed below this button.
### 2.2.10.14 Miscellaneous

**Operation mode (only for current session)**

**Manual validation**: The validation of jBEAM components after modifications of calculations is normally carried out automatically after every modification (Preferences: Manual validation disabled). This process may take some time when carried out with large amount of data. If several modifications have to be done at once, the option Manual validation can be activated. This way, the validation is started manually. If used often, it is reasonable to take over the relevant icons to the tool bar (see Menu Service) or to use the hot keys:

- Manual validation deactivated; for switching press <SHIFT+F9>
- Manual Validation activated
- Start Manual validation; or: press <F9>

**Validation in background**: If this option is activated, the validation takes place in the background and in the meanwhile jBEAM can still be used. If the parallel usage leads to problems, this option can be deactivated and jBEAM cannot be used for the time of validation.

**Ruler unit**: The user can decide which unit should be used for display the graphic pages (cm or inch).

**Display messages**: The user can decide if and how messages will be displayed.

- **Information**: Display of information (Always, Never, Ask).
- **Warning**: Display of warnings (Always, Never, Ask).
- **Error**: Display of error messages (Always, Not during this session, Ask).
- **Controller**: Display of controller messages (As Dialog, Never, At Toolbar).

**Rendering**: Optional the rendering of curves, images and text can be enhanced, i.e. the objects will be painted smooth. The activation of the rendering can influence the performance if a high number of data are used.
Preferred Videotechnology: This function makes a preselection of the video technology to be used. By default, the optimal video technology is selected automatically but can also be changed manually. jBEAM supports different technologies: DirectShow for Java (Humatic), Java Media Framework (Oracle), QuickTime 7 (Apple) and higher and GStreamer 1.x. If a video will be displayed in the graphic window, the present video technology is used automatically. However another video player can be chosen via Graph Editor→MultiMedia to display the video, if the necessary library is installed.

Display name for NaN value: Some graphic objects support the using of special display values for NaN values, e.g. Digital Display. The entered text will be displayed instead of the NaN values in the corresponding graphic objects. Using the language selection box and the N / C or D buttons behind the input field the text can be formatted as multi-language text.

Preferred script language: Supported script languages are BeanShell and Groovy. For more information on the script languages see also Scriptfile.

Automatically switch channel storage mode from RAM to File on RAM shortage: If this option is selected, the storage mode of a channel is automatically switched from RAM to File if the channel requests more than 10 % of the available free RAM. Otherwise, the storage mode of a channel is not changed automatically. Deactivating the option may lead to OutOfMemory exceptions.

2.2.11 Trace Logger

Go to:

Edit
  → Trace Logger

The sub menu allows the starting and stopping of the Logger and the definition of settings.

If the trace mode is enabled, notices are shown in the Java standard output dialog. This aids a programmer of external components to ensure correct functioning. For normal use the trace mode should be switched off.

Settings are defined in the jBEAM Logger dialog.
Output: Logger data are displayed on a terminal or saved to a file.

Log level: Defines how precise the data is logged.

Log area: Defines which results are included.

Information to record: Defines which information is shown.
2.3 Menu: Measure

The Measure menu collects online measurement functions and comprises the following menu items:

- Trigger Modules
- Connection Modules
- Measure Modules
- Logger
- Measure Start
- Measure Stopp
- Pause
- Stop all Measures
- Delete meas values

The Measure menu is situated in the menu bar. Alternatively the menu item can be called by pressing <ALT+M>.

2.3.1 Trigger Modules

Go to:

Measure

\[\rightarrow\] Trigger Modules

The sub menu contains the following items:

- Time Trigger
- Data Received

Generated triggers are listed under Modify and can be reopened to change settings.

2.3.1.1 Time Trigger

Go to:

Measure

\[\rightarrow\] Trigger Modules

\[\rightarrow\] Time Trigger

Different triggers that control the measurement timing are listed in the dialog box.
Many measurement modules need a time trigger which controls the acquisition of data from the measurement system. Various devices, e.g. by Gantner or the QuantumX by HBM, provide their own trigger timing but can also be controlled by a time trigger created in jBEAM. The user is responsible for seeing that the defined time base ($\Delta T$) does not exceed the actual possible acquisition rate of the measurement system.

**Result Data:** Name of result data object as it will appear on the bus.

**Start of Measurement:** Start the measurement either pressing $<F5>$ or via a defined date.

**Stop of Measurement:** Stop the measurement either pressing $<F6>$ or via a defined date.

**Timebase ($\Delta T$):** Defines the time interval (sampling rate) with which the data from the measurement module are retrieved.

- **Intermediate Values with $<F12>$:** Manual acquisition of additional values.
- **Framework validation time:** Defines the validation time of the system (jBEAM). If a high acquisition rate is defined, it is recommended to increase the framework validation time to improve the performance.

**Run Options:** The trigger can be run in an own thread (**parallel**) or in the standard thread (**sequential**).

**Result:** The time can be depicted in absolute values (with date and time) or relative values (in seconds). The trigger values can be stored as single value, in a channel (unlimited history) or as ring buffer with defined number of values.
2.3.1.2 Data Received

Go to:

Measure
  ➜ Trigger Modules
  ➜ Data Received

2.3.2 Connection Modules

Go to:

Measure
  ➜ Connection Modules

The menu Connection Modules contains different connection modules to establish a connection to measurement modules:

- TCP/IP (direct)
- COM Server (TCP/IP)
- Modbus-TCP (JAMOD)
- Modbus-TCP (ADAM)
- Serial Port (I)
- Serial Port (II)
- Serial Port (III)

Modify lists all defined connections that can be reopened for changing settings.

2.3.2.1 TCP/IP (direct)

Go to:

Measure
  ➜ Connection Modules
  ➜ TCP/IP (direct)

This module creates a direct connection to a measurement module via TCP/IP port.
**Name of connection**: The name of the connection can be chosen freely but should identify the connection clearly.

**Host name**: If a host name exists, the IP address can be found out by clicking **check host**.

**IP address**: If known, IP address and port can also be entered manually.

**Connection Behaviour**: Different options can be selected for the behaviour of the connection:

- **Continuous open**: The connection is permanently open.
- **Connect for each device**: Each device has its own connection.
- **Connect for each value**: A connection is established for each value, i.e. after each measured value the connection is severed and then established again for the next value.
- **Only simulation**: A connection to the measurement module is only simulated.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: Deletes the connection module and closes the dialog. A warning sign ☢ in the **Delete** button indicates that the module is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ☐. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.3.2.2 COM Server (TCP/IP)

**Go to:**

**Measure**

<table>
<thead>
<tr>
<th>→ Connection Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM Server (TCP/IP)</td>
</tr>
</tbody>
</table>

This module creates a TCP/IP connection to a COM server that is connected to measurement modules via its serial port(s).
Name of connection: The name of the connection can be chosen freely but should identify the connection clearly.

COM Server: The exact type of the COM server is displayed.

IP address: IP address and port are entered manually.

Settings of the Serial Port: The properties of the connection, such as Baud rate and Parity as well as the number of data and stop bits, can be set here.

Connection Behaviour: Different options can be selected for the behaviour of the connection:

- **Continuous open**: The connection is permanently open.
- **Connect for each device**: Each device has its own connection.
- **Connect for each value**: A connection is established for each value, i.e. after each measured value the connection is severed and then established again for the next value.
- **Only simulation**: A connection to the measurement module is only simulated.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: Deletes the connection module and closes the dialog. A warning sign 🔄 in the Delete button indicates that the module is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🎯. The respective help topic is displayed when an area within the dialog is clicked on.
2.3.2.3 Modbus-TCP (JAMOD)

This module creates a TCP/IP connection to the serial communication protocol Modbus using the JAMOD libraries.

**Name of connection**: The name of the connection can be chosen freely but should identify the connection clearly.

**Host name**: If a host name exists, the IP address can be found out by clicking **check host**.

**IP address**: If known, IP address and port can also be entered manually.

**Connection Behaviour**: Different options can be selected for the behaviour of the connection:

- **Continuous open**: The connection is permanently open.
- **Connect for each device**: Each device has its own connection.
- **Connect for each value**: A connection is established for each value, i.e. after each measured value the connection is severed and then established again for the next value.
- **Only simulation**: A connection to the measurement module is only simulated.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: Deletes the connection module and closes the dialog. A warning sign 🔄 in the **Delete** button indicates that the module is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to 🎧. The respective help topic is displayed when an area within the dialog is clicked on.

2.3.2.4 Modbus-TCP (ADAM)

Go to:

**Measurement**

- **Connection Modules**
  - Modbus-TCP (ADAM)

This module creates a TCP/IP connection to the serial communication protocol Modbus using the ADAM libraries.

![ModbusTCP Connection](image)

**Name of connection**: The name of the connection can be chosen freely but should identify the connection clearly.

**Host name**: If a host name exists, the IP address can be found out by clicking `check host`.

**IP address**: If known, IP address and port can also be entered manually.

**Connection Behaviour**: Different options can be selected for the behaviour of the connection:

- **Continuous open**: The connection is permanently open.
- **Connect for each device**: Each device has its own connection.
- **Connect for each value**: A connection is established for each value, i.e. after each measured value the connection is severed and then established again for the next value.
- **Only simulation**: A connection to the measurement module is only simulated.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: Deletes the connection module and closes the dialog. A warning sign 🔴 in the **Delete** button indicates that the module is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.3.2.5 Serial Port

Go to:

Measurement
  Connection Modules
    Serial Port (I) / (II) / (III)

Serial Port (I) - direct connection via one of the PC's own serial ports including the usage of the SUN library.

Serial Port (II) - direct connection via one of the PC's own serial ports, using libraries of SerialIO Inc.

Serial Port (III) - direct connection via one of the PC's own serial ports, using the RXTX libraries.

Name of connection: The name of the connection can be chosen freely but should identify the connection clearly.

Connection: The combo box lists all available interfaces (COM ports) of the PC.

Settings of the Serial Port: The properties of the connection, such as Baud rate and Parity as well as the number of data and stop bits, can be set here.

Connection Behaviour: Different options can be selected for the behaviour of the connection:
  - Continuous open: The connection is permanently open.
  - Connect for each device: Each device has its own connection.
**Connect for each value:** A connection is established for each value, i.e. after each measured value the connection is severed and then established again for the next value.

**Only simulation:** A connection to the measurement module is only simulated.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** Deletes the connection module and closes the dialog. A warning sign in the **Delete** button indicates that the module is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
2.3.3 Measure Modules

Go to:

Measurement

Measure Modules

The menu is divided into the following sub menus:

- Keyboard values
- Online Signalgenerator
- AMS Meas-Server
- Advantech Adam 4000
- Advantech Adam 6000
- Modbus System
- NI DAQ Card
- Gantner IDL/ISM/e-bloxx
- Gantner e/Q-Series
- HBM AED
- HBM QuantumX
- HBM UPM60/UGR60
- Elster DL240
- GPS-Receiver
- Hygrobarograph (W&T)
- HygrologNT (Rotronic)
- Mahr Indicator
- Newport MicroServer
- Matsushita SPS
- OPC Server
- PMA KS 90 Control
- Schott Handylab
- Digitek DT-4000ZC
- Vector CAN XL
- Smart Systems MCM
- Test Meas-Server
- Audi GOM
The sub menu item **Modify** lists all generated measure modules that can be reopened for changes.

### 2.3.3.1 Keyboard values

Go to:

**Measure**

- **Measure Modules**
  - **Keyboard values**

This module supports the logging of keyboard entries. Thus, this module is particularly qualified for measurements realized in changing external conditions. By means of keyboard entries the various events can be assigned to the time scale and included in the subsequent analysis.

For the assignment of hot keys only numerical values can be defined.

![Keyboard controlled Values](image)

**Device Name:** The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.
**Trigger Module:** This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

**Result:** Defines the type of storage used for the values. **As single values** saves a single value, **as channel** creates a channel and **as ringbuffer** saves a specified number of values. When this number is exceeded the values stored first are overwritten.

**Key Relation:** Specifies the value that is stored when a certain numerical key is pressed.

**Change the values during measurement:** If the values assigned to the keys shall be changed during a measurement, the dialog Define a new value opens via pressing simultaneously <F9> and '1'.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The measurement module is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the recorded data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

- The context sensitive help is activated and the cursor changes to 

<table>
<thead>
<tr>
<th>Types of data objects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
</tr>
<tr>
<td>Result data</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Result**
2.3.3.2 Online Signal Generator

Go to:

Measure
Measure Modules
Online Signal Generator

The measurement module Online Signal Generator can generate user-definable signals.

Device Name: The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

Trigger Module: This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate ($\Delta T$) are shown in the lines below. In order to receive proper curves, the sampling rate of the trigger module should be significantly lower than the period of the signal.

Result: Defines the type of storage used for the measured values. As single values saves a single value, i.e. always the current value at the time. The option as ringbuffer creates a channel and saves the values over the specified period of time. When the time is exceeded, the values stored first are overwritten.

Unit: Optionally, a unit can be defined for the measured values. The unit can be entered by its abbreviation or as Unicode.
Tab Permanent Mode

**Function:** Defines the type of the generated signal. The following types are available:

- **Sine:** Creates a Sine-curve.
- **Square:** Creates a square wave that alternates regularly and instantaneously between two levels.
- **Triangle:** Creates a triangle wave with constantly ascending and descending slopes.
- **Constant:** Creates a signal with constant value.
- **Ramp:** Creates a signal that rises up to the value indicated and then remains constant.

**Amplitude:** Defines the maximum amplitude of the generated signal.

**Period:** Defines the period of the generated signal.

**End of ramp:** Defines the end of the ramp of the generated signal (only available with selected Ramp function).

Each of the last three values can be entered manually or selected in the combo box from the available single values.

Tab Sequence Mode

The different signals can also be defined as sequences. The defined steps of the sequence are appended continuously.

<table>
<thead>
<tr>
<th>Name</th>
<th>Signal Type</th>
<th>Period in s</th>
<th>Period in s</th>
<th>Amplitude</th>
<th>Ramp Min</th>
<th>Ramp Max</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal 1</td>
<td>Sine</td>
<td>20.0</td>
<td>10.0</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal 2</td>
<td>Square</td>
<td>10.0</td>
<td>5.0</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal 3</td>
<td>Constant</td>
<td>10.0</td>
<td></td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal 4</td>
<td>Triangle</td>
<td>20.0</td>
<td>10.0</td>
<td>1.0</td>
<td>1.0</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

**Name:** Each of the signal steps can be named individually. A new signal step is automatically activated when a name is entered in an empty field.

**Signal Type:** The signal type can be selected in the combo box. The same types as in Permanent Mode are available.

**Period in s:** Defines the total period of the signal step.

**Period in s:** Defines the period of the selected signal within the signal step.

**Amplitude:** Defines the maximum amplitude of the selected signal.

**Ramp Min / Max:** Defines the start and end value of the ramp with selected Ramp function.
**Option:** The respective signal step can be shifted in the sequence order one position up or down. The signal step can be deleted via the trash symbol.

**Repeat steps:** If this option is selected, the sequence starts again when the last step is finished. Otherwise the sequence is run only once. Afterwards no more values are generated.

**New Signal Step:** The displayed symbols can be used to create new signal steps at the beginning or at the end or to delete all steps.

**Preview Channel:** A separate preview channel is created that contains the values of one sequence as they will be generated later during the measurement.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The measurement module is deleted and the dialog closed. A warning sign in the Delete button indicates that the recorded data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

? : The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.3.3.3 AMS Meas-Server

Go to:

- Measure
  - Measure Modules
  - AMS Meas-Server

An AMS measure server interface.
**Device Name:** The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

**Trigger Module:** This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

**Connection Module:** The available connection modules (TCP/IP (direct)) are displayed in the combo box. The lines below show information about the connection.

**Device #:** Identification number of the module.

**Master Password:** For logging in a password is needed.

**Server Data:** After successful connection the information about the server is displayed.

**Channel Data:** The available channels and the current measured values as requested from the module via Measure button are displayed in the table.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The measurement module is deleted and the dialog closed. A warning sign ▶️ in the Delete button indicates that the recorded data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 📕. The respective help topic is displayed when an area within the dialog is clicked on.
2.3.3.4 Advantech Adam 4000

Go to:

**Measure**

- **Measure Modules**
  - Advantech Adam 4000

Device Name: The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

Trigger Module: This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

Connection Module: The available connection modules (COM Server (TCP/IP)) are displayed in the combo box. The lines below show information about the connection.
**Bus Scan**: The bus is scanned for available devices.

**Display sector**: On the left side, the found devices are displayed in a tree structure. For the selected device, the respective information is shown on the right side.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The measurement module is deleted and the dialog closed. A warning sign in the Delete button indicates that the recorded data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

![Help Button](image)

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.3.3.5 Advantech Adam 6000

Go to:

**Measure**

**Measure Modules**

**Advantech Adam 6000**

This function allows the measuring with data acquisition modules of the Adam 6000 series. The connection from jBEAM to the device is established via Modbus-TCP/IP (JAMOD).
**Device Name:** The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

**Trigger Module:** This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

**Connection Module:** The available connection modules (Modbus TCP/IP (Jamod) with port 502) are displayed in the combo box. The lines below show information about the connection.

**Get Device Data:** The module data are read from the device and displayed in the Module Data sector. Additionally, the current measured values are read from the device and displayed.

**Measure:** The current measured values of the available channels are read from the device and displayed in the Channel Data sector.

**Module Data:** The read Meta information of the module is displayed.

- **Supplier:** The producer of the device.
- **Model:** Exact name of the model.

**Channel Data:** The table shows information about the available channels of the module.

- **Index:** The checkbox indicates whether the channel is activated or deactivated. If a channel is deactivated, neither a data object is created nor measured values stored. For activated channels can be determined whether they are created as single values or channels (with history).
**Name:** The names of the channels as defined in the module contain an abbreviation for the channel type:

- **AI:** Analog Input
- **AO:** Analog Output
- **DI:** Digital Input
- **DO:** Digital Output

**Value:** This field displays the current measured values as requested from the module via [Get Device Data](#) or [Measure](#) buttons.

**Control Object:** The outputs of the module can be controlled via control objects in order to control a connected device. The available control objects are listed in the combo box. The analog outputs may be controlled by an object that delivers analog values, such as a slider, whereas digital outputs need a binary signal which comes e.g. from a switch.

**History:** The measured values can be stored either as channel (with unlimited history from the start of the measurement) or as single values. Furthermore, the storage options for the results stated in the trigger module, i.e. single value, channel or ring buffer, can be applied (configured by trigger module).

**Configuration:** The analog outputs of the module can be set in three predefined value ranges: 0 – 20 mA, 4 – 20 mA und 0 – 10 V. The values delivered by the control object are scaled to the selected range.

**Initial Value:** The defined value is immediately sent to the output so that there is no need to adjust the control object first. For the digital outputs, a checked checkbox signifies the value 1.

**Write outputs only during measurement:** The outputs are only set during an active measurement.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The measurement module is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the recorded data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Help Icon](#) : The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Result data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>analog inputs/outputs</td>
<td>DoubleValue, DoubleChannel</td>
<td></td>
</tr>
</tbody>
</table>
### Result data

<table>
<thead>
<tr>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>digital inputs/outputs</td>
<td>BitChannel depending on the channel definition of the module</td>
</tr>
</tbody>
</table>

### Result

![Graph showing data analysis](image)

### 2.3.3.6 Modbus System

Go to:

**Measure**
- Measure Modules
- Modus System
2.3.3.7 NI DAQ Card

Go to:

Measure

→ Measure Modules

← NI DAQ Card
2.3.3.8 Gantner IDL/ISM/e-bloxx

Go to:

Measure
  Measure Modules
    Gantner IDL/ISM

This function allows the measuring with Gantner modules of the type: IDL data logger, ISM and e.bloxx measuring modules.

The variables defined in the dialog box are read and channels created. The data of the variables are displayed as channel data. Alternatively, the Gantner binary files stored in the data loggers are directly imported into jBEAM later on.

The data logging is triggered by a trigger module. Several modules can be triggered by the same trigger module.

Note: If several modules are accessed via a serial connection module, the sequential measuring process should be selected.

First, a connection module has to be defined. The modules respective loggers can directly be addressed via Ethernet (TCP/IP), a COM server or a COM port.

The correct connection module is selected in the dialog box and the device number of the desired module entered. Then, the device data are readout via mouse click. The variables defined in the module are read and channels are created from them. The variable data is displayed as channel data. The configuration of the modules is carried out via the software of the company Gantner Instruments, i.e. the variables cannot be defined here.

By clicking on Measure the current measured values of the module are retrieved.
Device Name: The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

Trigger Module: This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate ($\Delta T$) are shown in the lines below.

Connection Module: The available connection modules are displayed in the combo box.

Device #: Displays the identification number of the module.

Read Device Data: The data are read from the device.

Supplier: The producer of the device.

Model: Name of the model.

HW-Version: Hardware version of the module.

SW-Version: Software version of the module.

Location: The module location stored in the module.

Serial number: Serial number of the module.

Channel Data: Data of the variables defined in the module.

Index: The channel for jBEAM is selected via selecting the checkbox.

Type: The data type of the channel is displayed (e.g. AI - real -> Analog Input).

Name: The name of the variable as defined in the module.

Value: This field displays the current measured values of the variable.

Unit: The unit of the variable as defined in the module.
**History:** The variables can be generated as single values or data series (with history).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The measurement module is deleted and the dialog closed. A warning sign ▶ in the **Delete** button indicates that the recorded data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Help icon]: The context sensitive help is activated and the cursor changes to "?". The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result data</td>
<td>IntegerChannel, DoubleChannel,</td>
<td>Depending on the channel definition of</td>
</tr>
<tr>
<td></td>
<td>IntegerValue, DoubleValue</td>
<td>the module</td>
</tr>
</tbody>
</table>

**2.3.3.9 Gantner e/Q-Series**

Go to:

**Measure**

**Measure Modules**

**Gantner e/Q-Series**

This function allows the measuring with Gantner modules of the e-Series and Q-Series. A connection from jBEAM to the Gantner device is established via a TCP/IP connection.

After successful connection, the configuration files of the Gantner device are read out via FTP. The configuration is shown in the dialog box of the jBEAM measurement module.

Using a high speed port allows fast measurements in addition to jBEAM-triggered measurements. A jBEAM-triggered measurement allows a sampling rate of up to 10 Hz. If the software of the device is able to support a “fast measurement” via TCP/IP, sampling rates of up to 10 kHz are possible. The entry “fast measurement” is then available in the combo box of the trigger module. The sampling rate has to be configured in the Gantner device.

The transport module has been integrated directly into the component and the enabling/disabling of all channels of the connected devices is possible with one click. The measurement module contains several standard scaling types that can be supplemented by customer-specific scalings. In addition to the physical channels channels with unscaled electrical values can be recorded. The zeroing can be carried out automatically after starting the measurement or at the end of the pause.
Component name: The name of the component can be chosen freely but should identify the module clearly and according to the name used in the module listing.

IP address: Input of the IP-address defined on the Gantner device and port 8001. A connection to the Gantner device is created by clicking on Connect. Upon successful connection the message next to the button changes from not connected (red) to connected (green). Additionally, there is the option to search the network for connected Gantner devices via Search devices.

Trigger Module: This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

If the software of the Gantner device supports a fast measurement (firmware), “Fast Measure” appears additionally in the combo box. For the fast measurement the sampling rate defined in the Gantner device is used.

Config: Opens the software test.Commander by Gantner installed on the computer for configuring the device data.

Read device data: The device data is automatically read from the device after it is connected successfully. Via the Read device data button the data can be read again any time.

Single measurement: The current measured data is retrieved from the Gantner device and depicted in the table of the dialog box.

Supplier: The producer of the device.
**Model:** Name of the model.

**HW-Version:** Hardware version of the module.

**SW-Version:** Software version of the module.

**Location:** The module location stored in the module.

**Serial number:** Serial number of the module.

**Measurement rate:** The measurement rate of the module.

**Zeroing:** Via group processing, several actions can be applied to the groups defined in the table:

- **Group:** The group indicated is manually zeroed via **Zero** button.
- **Auto zeroing on start for group:** The group indicated is automatically zeroed on start of measurement.
- **Auto zeroing after end of pause for group:** The group indicated is automatically zeroed after the end of the pause.

**Tab Section**

The inputs and outputs available in the device are displayed in individual tabs of the devices after the connection has been established and the device configuration read. The **System** tab is always available. The device configuration is read out of the respective files of the Gantner devices via FTP. After successful reading of the Gantner device the channels display builds up according to the configuration.

**Tab System**

![Tab System](image)

This tab shows all variables available in the device. The first variable is always a floating point value representing the time registered in the device, starting on 01/01/1900.
Tabs Device: 1...x

These tabs list all available inputs and outputs as well as additionally defined variables.

**Active:** The checkboxes in this column are used to select the inputs and variables to be measured as well as the outputs to be described.

**Type:** This column indicates the type of the variables:
- **AI:** Analog Input
- **AO:** Analog Output
- **DI:** Digital Input
- **DO:** Digital Output

**Name:** Denomination of the variables.

**Input value:** This column displays the current measured values requested via the Single measurement button. These may be electrical or physical values. The value type is defined in the Gantner device.

**Scaling:** This column displays the currently used scaling. The scaling can be changed via left-click into the respective field. Then the scaling dialog is opened.

**Group 1..3:** If the checkbox is ticked, the respective variable is assigned to the group of this column. Thus, the actions, e.g. zeroing, defined for this group are applied to this variable.

**Zero:** Variables can be zeroed using the context menu (right click) in this column. Via set zero offset, the value currently measured at the sensor is set as zero value. The set zero value is deleted via delete zero offset. If no value is measured it cannot be deleted.

**Display value:** This column displays the value calculated out of measured value, scaling and zero value.

**Control object:** The combo boxes of this column are active when the variable is selected and an analog or digital output (type AO or DO). The control object may be a data object that has been generated by e.g. a slider (analog output) or a switch (digital output). The generated values are assigned to the variables and transmitted to the Gantner device.
Activate all channels / Deactivate all channels: All variables of all available devices can be selected or deselected with one click.

Extra channel with raw values: If this option is selected, raw values are recorded in addition to the standard calculated values. For each selected variable an additional channel (suffix _RV) is created and filled with the unchanged raw values as they are sent from the Gantner device. Neither scaling nor zeroing is applied to these values.

Note! The values may have been scaled already in the Gantner device.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The measurement module is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the recorded data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Scalings

The measured values coming from the Gantner device can be scaled in jBEAM in a number of different ways. The point of scaling is to convert the electrical values from a measuring device into physical values.
Two-Points Scaling

The Two-Points scaling assumes a linear characteristic of the sensor. In the input fields of the first column the points for the input values can be entered manually or by clicking on the Measure button. In the second column of input fields the display values for the respective input values are entered. For the scaled values a unit can be defined.

Factor-Offset Scaling

The Factor-Offset scaling assumes a linear characteristic of the sensor. A unit for the scaled values can be entered in the input field after display value. The display value is calculated out of the y-offset, the factor and the input value: display value = offset + input value * factor.

Compensation Polynomial (3rd Order) Scaling

The scaling via compensation polynomial of 3rd order is applied in case of complex, non-linear characteristics. A unit for the scaled values can be entered in the input field after display value. The scaled values are calculated out of the polynomial function of 3rd order: display value = $x_0 + x_1 \cdot \text{input value} + x_2 \cdot \text{input value}^2 + x_3 \cdot \text{input value}^3$. 
Spline Scaling

The Spline scaling is defined according to EDAG-specific Spline files. Such a file can be imported via the **Load Spline file** button. The **unit** for the scaled values can be entered in the input field below.

**Result**

The component defined above can be found in the producer list of the.

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**2.3.3.10 HBM AED**

Go to:

**Measure**

- Measure Modules
  - HBM AED
2.3.3.11 HBM Quantum X

Go to:

Measure
  → Measure Modules
  → HBM QuantumX

This functionality supports the data acquisition with the universal data acquisition system QuantumX by HBM.

Any number of data acquisition systems of the QuantumX series can be accessed via Ethernet connections. Further information regarding the architecture of the QuantumX data acquisition system is available via the QuantumX documentation on www.hbm.com. A universal measurement amplifier QuantumX allows the data acquisition of e.g. 4 or 8 individually adjustable inputs. The configuration of the measurement amplifier, the measurement, the evaluation as well as the data export can all be realised flexibly and comfortably in jBEAM. The settings of the different sensors (inputs), e.g. bridge type, supply voltage, scaling, filter settings for the signals and further settings supported by QuantumX, can be adjusted individually.

The communication with the QuantumX is realised via TCP/IP connection which allows fast data transfer even over large distances. The data acquisition can be triggered by a jBEAM time trigger or via the QuantumX time control. With that, short- or long-term, periodical or fast measurements can be defined. Several devices can be controlled by the same trigger module.

A 32-Bit version of the Java Runtime Environment is necessary to use this measurement module.

Since jBEAM version 7.0.3 the measurement module can also be used with a 64-Bit version. The firmware 4.0 is now supported.
Settings made in the modification dialog box will be directly applied to the device. If the dialog is closed without pressing **OK** or by pressing **Cancel**, the original configuration is restored.

**Search for Devices**

As soon as the measurement module **QuantumX** is selected in the **Measure** menu, the dialog box **Search for Devices** opens. The user can choose between 3 options:

**Choose all available devices**: If this option is selected, the network is searched for all available devices after pressing **OK**. The findings are listed in the device list. The whole process may take some time.

**Devices in a special network area**: If this option is selected, the defined area of the network is searched for all available devices after pressing **OK**. The findings are listed in the device list. If a fix IP address is edited, the network scan is skipped.

**Manual Selection of available Devices**: Via the Search button, the network is searched for all available devices and the findings are shown in the list below. By activating the checkboxes the desired devices can be selected.

Note: Only devices are found that are located in the same subnet as the PC!

**Network Configuration**: For a selected device, the network configuration can be displayed and edited in a separate dialog.

- **DHCP**: If this option is activated, the IP address is assigned by a server via DHCP.
- **IP Address / Subnet Mask**: The user can define the address manually.

Note: Activating the new settings of the address needs a restart of the module!

**blink LEDs**: In order to identify a specific module when using several devices the user can flash all LEDs of a selected module by clicking the button **blink LEDs**.

**Table Overview**

After selecting the desired devices, the following window opens displaying an overview of the available connections and their configuration.
On the left side the available devices are displayed. For the selected device the settings can be edited on the right side in the tabs Overview, Operating Mode, Scaling and Signals. Additionally, the user can define the settings for the data acquisition via the entry Measurement Configuration. The symbols below the list have the following functions:

- : Opens the dialog Search for Devices.
- : Connects to the selected Quantum module.
- : Disconnects the selected Quantum module.
- : Removes the selected Quantum module from the list.
- : Opens the dialog for Compatibility Settings.

Additional information about the used wrapper version, the framework, the firmware and the hardware version are given in the footer.

Dialog for Compatibility Settings

In case of older projects it may be necessary to rename the signals. The dialog offers two options, either to use the connector names which were used in previous jBEAM versions or to apply the signal names used by HBM.
Measurement Configuration

The first entry of the tree structure on the left side leads the user to the setting of the Measurement Configuration that offers 2 different possibilities for controlling the data acquisition: jBEAM time control or QuantumX time control.

jBEAM time control: A Time Trigger predefined in jBEAM controls the data acquisition. This way, even long-term measurements with long time intervals (hours, days) between the individual measurements are possible.

QuantumX time control: The data acquisition is controlled via QuantumX. Different settings can be defined that are explained further in the following. Depending on the connected measurement amplifier, even very fast measurements are possible.

Note: When starting a measurement, the old measured values in the project are deleted in any case (irrespective of the presettings), as appending measured values is not supported by the QuantumX measurement module.

On the basis of the sampling rates of the selected signals (at least one input signal must be active in the Overview table), the DAQ rate is automatically set to Common DAQ Rate (in case of equal rates) or Use DAQ Rates of signals (in case of different rates). If the selection is switched from Use DAQ Rates of signals to Common DAQ Rate the following warning message is displayed:
Common DAQ Rate: The measured values of all selected signals are captured with the same sampling rate.

Use DAQ Rates of signals: The different sampling rates of the selected signals are used for the data acquisition (see Signal table).

Validate application during DAQ: jBEAM is updated during the measurement. The performance may be affected by high sampling rates because of recurrent redrawing, among other reasons. If disabled, an update of jBEAM is carried out only at the end of the measure.

Periodical Measurement: If enabled, the following settings can be defined for the measurement: Number of Periods, Meas Time per Period, Periodical Interval and a Delay period. At the end of the defined periods the measurement stops automatically. Disabling the periodical measurement leads to a permanent measurement of an unlimited period. In this case the measurement is terminated in jBEAM either manually using the F6 key or via the Stop Trigger.

Number of Periods: The number of periods of the measurement.

Meas Time per Period: Defines the measurement time of a period.

Periodical Interval: Defines the time between the start of the respective periods. The interval has to be at least as long as the measurement time per period.

Delay: Offset of the measurement start.

Total time: The total time of the measurement is displayed.

Ring Buffer: If this option is activated, only the values of the defined period are stored in the channel. The values are shifted, i.e. the oldest values at the beginning are deleted and the new values are appended at the end. This option is not available in case of periodical measurement.

Write value file: If this option is activated, the values are saved in a file. The data is saved in the DIAdem format, i.e. a header file (*.dat) and individual value files for each channel. In case of periodical measurement, new files are created for each period.

Target folder: The folder for the saved value files can be edited or selected via the Select button.

File name expression: An explicit file name for the value files can be edited using expressions that may contain embedded formulas. e.g. "Measurement @CurrDate@ @Index@" or @PropValue(CurrComponent,"PeriodIndex") + 1@

If the field is empty, a name with the device designation is applied. The name appendices for the individual channels are applied automatically in any case.

New file each: If this option is activated, a new value file is started after the defined time.
Flush Interval: New values are written to the file in blocks after the defined time.

Trigger Configuration Start Trigger / Stop Trigger
Different trigger conditions can be defined in the QuantumX module that start or stop the measurement. The two tabs are identical and only enabled if the QuantumX time control is selected.

Note: These conditions are offered by HBM but cannot be processed by Quantum at the moment! Therefore, the functionalities are partly processed in jBEAM, whereas only the trigger connection “AND” is supported, i.e. the data acquisition only starts if all conditions are fulfilled.

Trigger enabled: Activates the respective trigger.
Name: Name of the trigger configuration. If a configuration with the same name already exists, the message ‘The name is already assigned!’ is displayed beside the input field. Additionally, the following warning message is displayed:

Device: Selection of the device which the trigger condition refers to.
Device Channel: Selection of the signal which the trigger condition refers to or which shall be observed.
Constraint: Definition of the trigger condition (see right).
Level / Minimum / Maximum: Limits are defined as trigger condition (depending on condition). If the value exceeds or falls below the limit, the measurement starts.

New: A new trigger is defined.
Delete: The selected trigger is deleted.
Trigger Expression: Shows the active trigger connections.
Pre-Trigger: States a pre-trigger interval. Values before the actual measurement are also considered.

Overview

The signals can be configured in the right table in 4 tabs Overview, Operating Mode, Scaling and Signals. Information to the adjustable parameters can be found in the data sheet of the respective sensor.

Active: Selection of the signal for data acquisition in jBEAM. If the signal is deactivated, no values are recorded.
Name: The name of the signals (channel names) can be edited (left click into the input field). Via right click into the input field, the option blink LEDs can be activated for the respective measurement amplifier.
Type: Display of the input type.
TEDS: If TEDS (Transducer Electronic Data Sheet) are available at the connected device, the information stored there can be used. Via right click 3 options can be selected: TEDS ignore, TEDS use, if available and TEDS required. If TEDS are used the parameters cannot be edited.
Sensor: Display of the sensor type. Via right click the dialog Configure Sensor is opened.
Scaling: Display of the scaling type. Via right click the dialog Configure Scaling is opened.

Value: Display of the value currently measured at the sensor. The unit of the signal can be modified via left click in the input field.

### Operating Mode

<table>
<thead>
<tr>
<th>Active</th>
<th>Name</th>
<th>Supply</th>
<th>Sensor type</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal 1</td>
<td>0 V</td>
<td>Bridge</td>
<td>Half bridge</td>
<td>5-Wire</td>
<td>0.014 kg</td>
</tr>
<tr>
<td></td>
<td>Signal 2</td>
<td>0 V</td>
<td>Voltage</td>
<td>Half bridge</td>
<td>5-Wire</td>
<td>NaN</td>
</tr>
<tr>
<td></td>
<td>Signal 3</td>
<td>0 V</td>
<td>Voltage</td>
<td>Half bridge</td>
<td>5-Wire</td>
<td>NaN</td>
</tr>
<tr>
<td></td>
<td>Signal 4</td>
<td>0 V</td>
<td>Voltage</td>
<td>Full bridge</td>
<td>5-Wire</td>
<td>NaN</td>
</tr>
</tbody>
</table>

This table gives an overview of the existing signals and their operating mode. For each sensor the following settings can be defined:

**Active**: Selection of the signal for data acquisition in jBEAM. If the signal is deactivated, no values are recorded.

**Name**: The name of the signal (channel name) can be modified via left click in the input field. There is the opportunity to let all LEDs blink at the respective input of the measurement amplifier via right click in the input field and click blink LEDs.

**Supply**: Determines the supply voltage of the sensor.

**Sensor type**: The sensor type can be defined via left click in the combo box: Bridge, Inductive bridge, Voltage, Current, Thermo couple, Potentiometer, LVDT.

**Option 1, Option 2**: The different configurations can be set via left click in the combo box (e.g. with sensor type Bridge: Option 1 – full bridge/half bridge/quarter bridge, Option 2 – number of conductors). Via right click the dialog Configure Sensor is opened.

**Value**: Display of the value currently measured at the sensor. The unit of the signal can be modified via left click in the input field.

The sensor configuration is displayed as tooltip if the mouse cursor is positioned over the columns Sensor type, Option 1 or Option 2 (see image above). The configuration can be changed by editing the fields via left click or by opening the dialog Configure Sensor via right click (especially adjusted for each sensor type).
Dialog Configure Sensor – Example: DMS bridge

- Bridge type: full bridge or half bridge
- Circuit type: 3-, 4-, 5- or 6-Wire
- Carrier frequency
- Excitation
- Max. electr. output

Scaling

The table Scaling presents an overview of the scaling settings of the sensors. For each sensor the Scaling type and Scaling configuration can be defined. Different settings are possible depending on the scaling type.

<table>
<thead>
<tr>
<th>Active</th>
<th>Name</th>
<th>Scaling Type</th>
<th>Scaling Configuration</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>Signal 1</td>
<td>LinTable</td>
<td># of scaling points: 2</td>
<td>NaN</td>
</tr>
<tr>
<td>✔️</td>
<td>Weight</td>
<td>LinTable</td>
<td># of scaling points: 2</td>
<td>-0.131 kg</td>
</tr>
<tr>
<td>✔️</td>
<td>Signal 3</td>
<td>Zerospan</td>
<td>Scale: [0.055 mV/V - 0 mm], [0.488 mV/V - 8 mm]</td>
<td>NaN</td>
</tr>
<tr>
<td>✔️</td>
<td>Polynom</td>
<td>LinTable</td>
<td># of scaling points: 2</td>
<td>NaN</td>
</tr>
<tr>
<td>✔️</td>
<td>Gain</td>
<td>LinTable</td>
<td># of scaling points: 2</td>
<td>NaN</td>
</tr>
<tr>
<td>✔️</td>
<td>LinTable</td>
<td>LinTable</td>
<td># of scaling points: 2</td>
<td>NaN</td>
</tr>
<tr>
<td>✔️</td>
<td>LinTable</td>
<td>LinTable</td>
<td># of scaling points: 2</td>
<td>NaN</td>
</tr>
<tr>
<td>✔️</td>
<td>LinTable</td>
<td>LinTable</td>
<td># of scaling points: 2</td>
<td>NaN</td>
</tr>
</tbody>
</table>

Active: Selection of the signal for data acquisition in jBEAM. If the signal is deactivated, no values are recorded.

Name: The name of the signal (channel name) can be modified via left click in the input field. There is the opportunity to let all LEDs blink at the respective input of the measurement amplifier via right click in the input field and click blink LEDs.

Scaling type: The scaling type can be defined via left click in the combo box. The following scaling types are supported: Off, Internal, Zerospan, Polynom, LinTable, Gain, Straingage.

Scaling Configuration: The scaling configuration is displayed.

Value: Display of the value currently measured at the sensor. The unit of the signal can be modified via left click in the input field.
The scaling configuration of a sensor is displayed as tooltip if the mouse cursor is positioned over the columns **Scaling type** or **Scaling configuration** (see image above). The configuration can be changed by opening the dialog **Configure Scaling** via right click (especially adjusted for each scaling type).

### Dialog Configure Scaling – Example: Zerospan

The values of the electrical span and the zero span can be entered directly or calculated via definition of two points. Electrical values can also be measured. The value of the physical span always needs to be entered manually.

### Signals

The table **Signals** offers an overview of the sensors’ filter settings. For each sensor the **Zero value**, **Filter Type**, **Filter Characteristic**, **Filter Frequency** and **DAQ Rate** can be adjusted.

**Active**: Selection of the signal for data acquisition in jBEAM. If the signal is deactivated, no values are recorded.
**Name:** The name of the signal (channel name) can be modified via left click in the input field. There is the opportunity to let all LEDs blink at the respective input of the measurement amplifier via right click in the input field and click **blink LEDs**.

**Zero:** The Zero value of the sensor can be set or deleted via right click in the combo box.

- **set zero offset:** The value currently measured at the sensor is set as zero value.
- **delete zero offset:** The set zero value is deleted.
- **edit zero offset:** The dialog **Zero Offset Configuration** opens.
  
  - **Zero value:** Defines the zero value that is deducted from the measured value for all following measurements.
  - **Target value for zero:** Defines the value that is displayed after zeroing instead of zero.
  - **Inhibited:** If this option is activated, the zeroing of this value is disabled. Thus, unintended overwriting of the zero value, e.g. by zeroing via action buttons, is prevented.

**Filter Type:** The filter type can be defined via left click in the combo box: **off** or **Lowpass**.

**Filter Characteristic:** The filter characteristic can be defined via left click in the combo box, e.g. in case of Lowpass: **Bessel** or **Butterworth**.

**Filter Frequency:** The filter frequency can be defined via left click in the input field.

**DAQ Rate:** The DAQ rate can be defined via left click in the input field or via the combo box. For each signal individual DAQ rates of 1 to 48,000 Hz can be adjusted.

**Value:** Display of the value currently measured at the sensor. The unit of the signal can be modified via left click in the input field.

The filter configuration is displayed as tooltip if the mouse cursor is positioned over the columns **Filter Type**, **Filter Characteristic** or **Filter Frequency** (see image above). If the mouse cursor is positioned over the columns **Active**, **Name** or **Zero** the zero configuration is displayed as tooltip.

---

**Module Adjustment**

When loading a project, the connection to the corresponding devices is automatically reestablished provided that they are available via network. If the settings of the jBEAM project to be loaded deviate from the current configuration of the Quantum at the time when the connection was created, both configurations have to be synchronized.
There are 2 possibilities for the synchronization:

**Configure by jBEAM:** The jBEAM settings are transferred to the selected module and thus are configured by jBEAM.

**Apply the Device Configuration:** The module settings are adopted by jBEAM and the settings of jBEAM are overwritten in the process.

**Execute Functions via Command Button**

*Command Buttons* can be equipped with special functionalities that are used to call or execute functions from a layout. Next to starting and stopping a measurement this includes also the export of data to any format (see *Export Data* in jBEAM), the *Export Report* and the execution of scripts and many other functions.

Special commands for the QuantumX measurement module are the zeroing and the starting/stopping of monitoring the measured values.

### 2.3.3.12 HBM UPM60/UGR60

Go to:

**Measure**

→ Measure Modules

→ HBM UPM60/UGR60

### 2.3.3.13 Elster DL240

Go to:

**Measure**

→ Measure Modules

→ Elster DL240
2.3.3.14 GPS Receiver

Go to:

Measure
  ➔ Measure Modules
  ➔ GPS Receiver

The measure module **GPS-Receiver** supports the standard GPS receiver that uses the standardised NMEA protocol.

A GPS (Global Positioning System) receiver measures the current position as well as derived quantities as speed, course etc.

The communication between jBEAM and the GPS receiver is carried out via COM respective the virtual COM port for USB GPS modules.

This jBEAM function allows for example the evaluation of GPS logging of trial runs in the automotive as well as railway area. Additional video logging is also possible. For the evaluation the route can be equipped with map material and rerun dependent on speed. In this case a dynamic cursor shows the current position.

For the operation of a GPS device a time trigger and a connection module are needed. The time trigger controls the data acquisition rate while the connection module establishes the connection to the device.

**Time Trigger**

The **time trigger** is created with the following settings:

Data acquisition rate: 10 Hz (≈ 100 ms)

**Serial Connection**

The **connection module** is set with standard GPS settings:

- Baudrate: 4800
- No parity
- 8 data bits
- 1 stop bit
Manual start with <F5> und stop with <F6>. The connection is set up via the transparent USB connection which is visible as COM port no. 2.

**GPS Parameter Dialog**

![GPS-NMEA Receiver](image)

After selecting the desired trigger and connection module, the acquisition is started by clicking the button Measure. After receiving the NMEA telegram the dialog is filled with data.

**History**: By checking the history box the data is stored in a channel, so that even history data is available. Otherwise, only objects of measured value data without history are created.
**Satellite Position**

The middle tab displays the sky with all satellites. The colored and numbered values on the right side show the signal/Noise rate of the satellites.

<table>
<thead>
<tr>
<th>Sat-ID</th>
<th>S/N Rate</th>
<th>Sat-ID</th>
<th>S/N Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>27.0</td>
<td>28</td>
<td>39.0</td>
</tr>
<tr>
<td>19</td>
<td>0.0</td>
<td>3</td>
<td>0.0</td>
</tr>
<tr>
<td>14</td>
<td>41.0</td>
<td>15</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>42.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Color: 
- red: not tracking
- orange: 1 - 29
- yellow: 30 - 39
- green: 40 - 49
- white: 60 - ...

**Display**

The display shows a compass rose showing the current heading (course) and the current speed. If the option **North on top** is selected, the North symbol of the compass rose always points to the top and the compass needle turns corresponding to the course. Else, the compass needle always points to the top and the compass turns.

---

**Satellite Position**

The middle tab displays the sky with all satellites. The colored and numbered values on the right side show the signal/Noise rate of the satellites.

<table>
<thead>
<tr>
<th>Sat-ID</th>
<th>S/N Rate</th>
<th>Sat-ID</th>
<th>S/N Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>27.0</td>
<td>28</td>
<td>39.0</td>
</tr>
<tr>
<td>19</td>
<td>0.0</td>
<td>3</td>
<td>0.0</td>
</tr>
<tr>
<td>14</td>
<td>41.0</td>
<td>15</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>0.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>42.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Color: 
- red: not tracking
- orange: 1 - 29
- yellow: 30 - 39
- green: 40 - 49
- white: 60 - ...

**Display**

The display shows a compass rose showing the current heading (course) and the current speed. If the option **North on top** is selected, the North symbol of the compass rose always points to the top and the compass needle turns corresponding to the course. Else, the compass needle always points to the top and the compass turns.
**Interactive Offline Analysis**

All standard jBEAM features can be used to analyze GPS or GPS-dependent data. The example below shows a complete track.

To visualize the acquired data the following graphic elements are used:

1. A Cartesian line graph (top) shows the altitude over time. The crossing cursor (blue) indicates the current time of the time generator. To see the current position the last 20 points are marked red with decreasing transparency.

2. A bar graph (top right) indicates the current altitude correspondent to the time of the time generator. The scaling is equal to the line graph so no extra scaling needs to be determined.

3. The complete track is displayed in a Cartesian line graph with GPS coordinates depicting longitude and latitude (middle left).

4. Another Cartesian line graph shows the same data transformed in rectangular metric UTM coordinates. A red cursor visualises the current position (middle right).

5. A time generator produces simulated times when starting a measure. The speed (time change) can be adjusted online with a slider. Forward and backward time changes are possible (bottom left).

6. Another Cartesian line graph displays the speed over the relative time. A cursor indicates the current simulation time (bottom right).
### 2.3.3.15 Hygrobarograph (W&T)

Go to:

**Measure**

→ **Measure Modules**

→ **Hygrobarograph (W&T)**

This module supports the data acquisition of temperature, humidity or air pressure data with a Web-Thermo-Hygrobarograph by Wiesemann&Theis (W&T).

**Device Name:** The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.
**Trigger Module**: This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

**Connection Module**: The available connection modules (TCP/IP (direct) with port 80) are displayed in the combo box. The lines below show information about the connection.

**Measure**: The current measured values of the available channels are read from the device and displayed in the Channel Data sector.

**Server Data**: The read Meta information of the module is displayed.
- **Supplier**: The producer of the device.
- **Model**: Exact name of the model.

**Channel Data**: The table shows information about the available channels of the module.
- **Index**: The checkbox indicates whether the channel is activated or deactivated. If a channel is deactivated, neither a data object is created nor measured values stored. For activated channels can be determined whether they are created as single values or channels (with history).
- **Name**: This field displays the names of the channels as defined in the module.
- **Value**: This field displays the current measured values as requested from the module via Measure button.
- **History**: The measured values can be stored either as channel (with unlimited history from the start of the measurement) or as single values. Furthermore, the storage options for the results stated in the trigger module, i.e. single value, channel or ring buffer, can be applied (configured by trigger module). It is also possible to select a fix number of values, from 10, 100, 1,000, 10,000 up to 100,000 values.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The measurement module is deleted and the dialog closed. A warning sign in the Delete button indicates that the recorded data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result data</td>
<td>DoubleValue, DoubleChannel</td>
<td>depending on the channel definition of the module</td>
</tr>
</tbody>
</table>

![Data object Preview](image)

Result

2.3.3.16 Hygrolog NT (Rotronic)

Go to:

Measure
  - Measure Modules
    - Hygrolog NT (Rotronic)

2.3.3.17 Mahr Indicator

Go to:

Measure
  - Measure Modules
    - Mahr Indicator
2.3.3.18 Newport MicroServer

Go to:

Measure
  → Measure Modules
  → Newport MicroServer

This module supports the data acquisition with a MicroServer iFPX.

After a connection via TCP/IP is established, this module reads the current counter/frequency (e.g. determination of the current or the total consumption of resources).

The Newport MicroServer iFPX is a counter module offering different configurations for the data acquisition. The Module is able to publish data as rate, frequency, pulse, total, batch or quadrature. Four input channels are available.

Device Name: The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

Trigger Module: This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

Connection Module: The available connection modules (TCP/IP (direct)) are displayed in the combo box. The lines below show information about the connection.
Get Device Data: The module data are read from the device and displayed in the Server Data sector.

Measure: The current measured values of the available channels are read from the device and displayed in the Channel Data sector.

Server Data: The read Meta information of the module is displayed.

  Supplier: The producer of the device.
  Model: Exact name of the model.
  Meas-Mode/Type: The mode for the data acquisition, e.g. as frequency or totalizer, is displayed here. The mode is actually set in the module itself.

  A-B Mode: The mode for the calculation of channels A and B, e.g. + or -, is displayed here. The mode is actually set in the module itself.

Channel Data: The table shows information about the available channels of the module.

  Index: The checkbox indicates whether the channel is activated or deactivated. If a channel is deactivated, neither a data object is created nor measured values stored. For activated channels can be determined whether they are created as single values or channels (with history).
  Name: This field displays the names of the channels as defined in the module.
  Value: This field displays the current measured values as requested from the module via Measure button.
  History: The measured values can be stored either as channel (with unlimited history from the start of the measurement) or as single values. Furthermore, the storage options for the results stated in the trigger module, i.e. single value, channel or ring buffer, can be applied (configured by trigger module).

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The measurement module is deleted and the dialog closed. A warning sign in the Delete button indicates that the recorded data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result data</td>
<td>DoubleValue, DoubleChannel</td>
<td>depending on the channel definition of the module</td>
</tr>
<tr>
<td>Status</td>
<td>IntegerValue, IntegerChannel</td>
<td></td>
</tr>
</tbody>
</table>
Result

2.3.3.19 Matsushita PLC

Go to:
Measure
   Measure Modules
       Matsushita SPS

2.3.3.20 OPC Server

Go to:
Measure
   Measure Modules
       OPC Server

2.3.3.21 PMA KS 90 Control

Go to:
Measure
   Measure Modules
       PMA KS 90 Control
2.3.3.22 Schott Handylab

Go to:

**Measure**
- **Measure Modules**
  - **Schott Handylab**

2.3.3.23 Digitek DT-4000ZC

Go to:

**Measure**
- **Measure Modules**
  - **Digitek DT-4000ZC**

2.3.3.24 Vector CAN XL

Go to:

**Measure**
- **Measure Modules**
  - **Vector CAN XL**

2.3.3.25 Smart Systems MCM

Go to:

**Measure**
- **Measure Modules**
  - **Smart Systems MCM**

The MCM measurement component is a module for the acquisition of measured values and their export to Diadem files.

First, a TCP/IP connection is established between jBEAM and the hardware. Then the MCM measurement component records the incoming data packets. These packets consist of the
message type, the data length and the respective data. The messages are expected in LITTLE-ENDIAN byte order. For more information on the structure of the messages, the documentation 'jBEAM_MCM_Documentation.pdf' can be requested.

**Component Name:** The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

**IP address:** The IP address and port of the hardware is entered in the fields. On clicking the Connect button jBEAM tries to connect to the device. In case of successful establishment of the connection the status display changes from disconnected (red) to connected (green).

**Trigger Module:** This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate ($\Delta T$) are shown in the lines below.

**Export path:** Export folder for the measured data files. On clicking the Select button the dialog for selecting the export folder is opened.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The measurement module is deleted and the dialog closed. A warning sign in the Delete button indicates that the recorded data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

**Help:** The context sensitive help is activated and the cursor changes to help. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

This example shows the steps to carry out a measurement. First, a time trigger is needed. Then the measurement module is created, the values visualised and the measurement started.
1. Create time trigger

The **time trigger** is created with the following settings, e.g.:

- Start and Stop of the measurement: manually with <F5> and <F6>.
- Time base (ΔT) / sampling rate: 0.1 s / 10 Hz
- Result: Save as single values

2. Create measurement module

Via Measure → Measure Modules → Smart Systems MCM the modification dialog of the measurement module is opened.

- Enter IP address and port of the module, e.g. 10.0.0.10, port: 10003.
- Select the created time trigger under **Trigger module**.
- Select the desired export path.
- Click on **Connect**.
- Create the module with **OK**.
3. Publish the values

In order to visualise the measured values, the data object **Smart Systems MCM** is marked and drawn into the graphic window via Drag & Drop. This automatically creates a **Universal cart. 2D-Chart**.

4. Start measurement

The measurement starts by the **Start** command coming from the hardware module.

**2.3.3.26 Test Meas-Server**

Go to:

**Measure**

- **Measure Modules**
  - **Test Meas-Server**

**2.3.3.27 Audi GOM**

Go to:

**Measure**

- **Measure Modules**
  - **Audi GOM**

The Audi GOM Software is designed such that it occupies the client role (usually to control test facilities). Thus, jBEAM has to occupy the server role and to listen to a TCP port. Therefore, jBEAM does not actively connect to the GOM module.

The test sequence is as follows:

- Start jBEAM and instantiate the GOM module.
- GOM module listens to TCP Port 32410.
• GOM Software connects to jBEAM.
• Measurement is configured and started by GOM Software.
• jBEAM GOM component shows current values and enables channel selection.
• Start of measurement on jBEAM side \(\rightarrow\) values are written into the channels.
• Triggering: By default, the GOM module triggers the data recording, i.e. all received values are written to the result channels. Alternatively, a jBEAM time trigger can be used. Then, only the messages are recorded which have been last received at the time of trigger.

**Device Name:** The name of the measurement module (producer) can be chosen freely but should identify the module clearly and according to the name used in the module listing.

**Trigger Module:** This combo box lists all available trigger modules. This may be the GOM System (standard), i.e. all received values are written to the result channels. Alternatively, a jBEAM time trigger can be used. Then, only the messages are recorded which have been last received at the time of trigger. The settings of the selected trigger module for Start/Stop and sampling rate \((\Delta T)\) are shown in the lines below.

**Connection:** TCP-Port 32410 is used by the GOM module. The connection can be terminated by the Close Button.

**Deformation points:** When the connection is established the available channels are listed and current values displayed. The channels can be individually selected and are filled with values as soon as a measurement is started.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
Delete: The measurement module is deleted and the dialog closed. A warning sign ▼ in the Delete button indicates that the recorded data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ❯. The respective help topic is displayed when an area within the dialog is clicked on.

2.3.3.28 Kratzer PARUI

Go to:
Measure
  ➔ Measure Modules
    ➔ Kratzer PARUI

2.3.3.29 Hioki 8860

Go to:
Measure
  ➔ Measure Modules
    ➔ Hioki 8860

2.3.3.30 Beckhoff SPS

Go to:
Measure
  ➔ Measure Modules
    ➔ Beckhoff SPS
2.3.3.31 AVK-Module

Go to:
Measure
  ↓ Measure Modules
    ↓ AVK-Module

2.3.3.32 PSI 9116 Pressure Scanner

Go to:
Measure
  ↓ Measure Modules
    ↓ PSI 9116 Pressure Scanner

This function allows the measuring with a PSI 9116 module. A connection from jBEAM to the Gantner device is established via TCP/IP connection.

After successful connection, the configuration files of the device are read out via FTP. The configuration is shown in the dialog box of the jBEAM measurement module.

A jBEAM-triggered measurement allows a sampling rate of up to 10 Hz.

The transport module has been integrated directly into the component and the enabling/disabling of all channels of the connected devices is possible with one click. In addition to the physical channels, channels with unscaled electrical values can be recorded. The zeroing can be carried out automatically after starting the measurement or at the end of the pause.
Component name: The name of the component can be chosen freely but should identify the module clearly and according to the name used in the module listing.

IP address: Input of the IP address defined in the device and port 9000. A connection to the device is created by clicking on Connect. Upon successful connection the message next to the button changes from not connected (red) to connected (green).

Trigger Module: This combo box lists all available triggers. The settings of the selected trigger module for Start/Stop and sampling rate (ΔT) are shown in the lines below.

Config: Opens the software of the device manufacturer installed on the computer for configuring the device data.

Read device data: The device data is automatically read from the device after it is connected successfully. Via the Read device data button the data can be read again any time.

Single measurement: The current measured data is retrieved from the device and depicted in the table of the dialog box.

Supplier: The producer of the device.

Model: Name of the model.

SW-Version: Software version of the module.

HW-Version: Hardware version of the module.

Zeroing: Via group processing, several actions can be applied to the groups defined in the table:
**Group:** The group indicated is manually zeroed via **Zero** button.

**Auto zeroing on start for group:** The group indicated is automatically zeroed on start of measurement.

**Auto zeroing after end of pause for group:** The group indicated is automatically zeroed after the end of the pause.

---

**Tab Channel Data**

This tab lists all analog inputs available in the device.

**Active:** The checkboxes in this column are used to select the inputs to be measured.

**Type:** This column indicates the type of the inputs:

- **AI:** Analog Input

**Name:** Denomination of the inputs.

**Input value:** This column displays the current measured values requested via the **Single measurement** button. These are physical values.

**Group 1..3:** If the checkbox is ticked, the respective input is assigned to the group of this column. Thus, the actions, e.g. **zeroing**, defined for this group are applied to this input.

**Zero:** Variables can be zeroed using the context menu (right click) in this column. Via **set zero offset**, the value currently measured at the sensor is set as zero value. The set zero value is deleted via **delete zero offset**. If no value is measured it cannot be deleted.

**Display value:** This column displays the value calculated out of measured value and zero value.

**Activate all channels / Deactivate all channels:** All inputs of all available devices can be selected or deselected with one click.

---

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The measurement module is deleted and the dialog closed. A warning sign 🚨 in the **Delete** button indicates that the recorded data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

🔍: The context sensitive help is activated and the cursor changes to 🔎. The respective help topic is displayed when an area within the dialog is clicked on.
2.3.3.33 DigiCon 2000

Go to:

Measure

Measure Modules

DigiCon 2000

Component name: The name of the component can be chosen freely but should identify the module clearly and according to the name used in the module listing.

Connection: Selection of an available interface from the list.

Device Data: Display of the device data of the measuring module.

Configuration: When a connection is established the current settings of the channels is displayed.

Sequences: The sequences can be selected and configured individually.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
Delete: The measurement module is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the recorded data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.3.4 Logger

Go to:

Measure

Logger

The only sub menu item is Measured Data Logger.

Modify lists all generated Logger that can be reopened for modifications.

Measured Data Logger

Values with the defined settings of the time trigger are saved into a file. A particularly advantageous feature of this logger is that it allows the simultaneous display of values in jBEAM and the saving of values to an external file. Especially during long term measurements values are saved like this even if a power breakdown causes an unexpected computer crash.

The Measured Data Logger saves values of channels or single values into an ASCII file. The logger is controlled by a time trigger defined in jBEAM. The logger files are created with the suffix *.jblog. They can be easily imported into jBEAM via ASCII import.

An advantage of this logger is that simultaneously the values are displayed in jBEAM as well as saved into an external text file. Especially during long term measurements the values remain intact even if a power failure causes an unexpected computer crash.
Tab File Chooser

**Favourites:** Allows fast access to frequently used folders. The folder selected in **Look in** can be added to the favourites list via the button ![add](image). The button ![remove](image) removes the selected folder from the list of favourites.

**Look in:** The folder respective drive to which the logfile is to be saved is selected in the directory tree. A fast access to specific storage locations can be achieved through the list of favourites and the symbols on the left side.

**File name:** The name for the logfile can be entered in the input field or an existing file selected from the list above. If the logfile already exists, the new data is added to the file.

**Files of type:** The values are saved in ASCII format: jMess-Logger Files (*.jblog).
Tab Parameter

Result Data: Name of result data object as it will appear on the bus.

Triggered by: This combo box displays all available triggers that can be selected.

Logged items

Available items: The items to be logged are selected from the list of available items (multiple selections are possible). Marked items will be added to the list of selected items via pressing the add button.

Selected items: All selected items are listed. Marked items (multiple selections are possible) are deleted from the list by clicking the remove button. All items are deleted from the list by clicking the clear list button.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: Deletes the logger. jBEAM checks if produced data is used by other objects (if so a warning sign is displayed on the button).

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result data</td>
<td>StringValue</td>
<td>String value</td>
</tr>
</tbody>
</table>
2.3.5  Measure Start

Go to:

**Measure**

→ **Start**

or press `<F5>`

A new measurement is started and the trigger modules are controlled.

When a measurement is started the following dialog box opens. See also the tab **Measurement in the Preferences**.

![clear measurement channels dialog](image)

2.3.6  Measure Stop

Go to:

**Measure**

→ **Stop**

or press `<F6>`

The current measurement is stopped and the trigger modules are controlled.

2.3.7  Pause

Go to:

**Measure**

→ **Pause**

or press `<F5>`

The ongoing measurement is stopped and continues by calling this function again.
2.3.8  Stop all Measures

Go to:

**Measure**
  - **Stop all Measures**

All current measurements are stopped.

2.3.9  Delete measured values

Go to:

**Measure**
  - **Delete measured values**

The values of all measurement channels are deleted.
2.4 Menu: Extra

The Extra menu is reached via the menu bar and consists of the following sub menus:

- Database
- Generators
- Audio
- Video
- Miscellaneous

2.4.1 Database

Go to:

Extra → Database

The menu consists of the following sub menus:

- ODBC (Filereference)
- ODBC (direct)
- ODBC Browser
- ODS Browser
- ODS Services

Modify lists all generated database configurations that can be reopened for modifications.

2.4.1.1 ODBC (Filereference)

Go to:

Extra → Database → ODBC (Filereference)

A connection to an ODBC database (i.e. MS-Access) is created. This database holds references to measurement files. Those files are imported with the import function.
2.4.1.2 ODBC (direct)

Go to:
Extra
  Database
  → ODBC (direct)

A connection to an ODBC database (i.e. MS-Access) is created. The database holds measurement data that can be loaded directly.

2.4.1.3 ODBC Browser

Go to:
Extra
  Database
  → ODBC Browser

This component features data import from an ODBC Database. Tables and columns can be selected for import.

2.4.1.4 ODS Browser

Go to:
Extra
  Database
  → ODS Browser

Universal browser for ASAM-ODS databases. Supports connections of RPC and/or Corba. For RPC connections additional libraries, licensed by HighQSoft, are required.

2.4.1.5 ODS Services

Go to:
Extra
  Database
  → ODS Services
2.4.2 Generators

Go to:

Extra
  ➤ Generators

The menu consists of the following sub menus:

• Actual Time
• Time Channel
• Numeric Channel
• Signal Generator
• Double Matrix
• String Channel
• 2D-Matrix with Strings
• Properties Map
• Graphic objects
• Dialog Configurator
• Performance Test

Modify lists all created generators that can be reopened for modifications.

2.4.2.1 Actual Time

Go to:

Extra
  ➤ Generators
    ➤ Actual Time

The Time generator creates a data object with the current time of the operating system. This object is updated every second.

Result Data: Name of data object as it will appear in the Spreadsheet tab Values.

With validation: If enabled, an automatic validation is carried out every second. That means that all objects using this value, e.g. calculations or graphic displays, are constantly updated. In order to relieve the system it is recommended to disabled this option. Then, the
consumers are not automatically informed if the value changes. That means calculations are updated only when they are executed anew.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

**Delete**: After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>DateTimeValue</td>
<td>Single value as time value</td>
</tr>
</tbody>
</table>

**Example**

The generated data object is displayed in the Spreadsheet tab **Values**.

The Actual Time can be used by graphic objects in the Graphic window, e.g. by the Digital Display or the Chronograph.
2.4.2.2 Time Channel

Go to:

Extra

| Generators | Time Channel |

The Time Channel generator creates a data object containing user defined date/time values.

**Result data**: Name of data object as it will appear on the bus.

**Start time**: Starting time/date for time channel.

**Generate with**: The time channel can be defined by a fixed number of values that are generated or an end date/time up to which the values are generated.

**Time values**: Sets the delta between the values of the time channel.

**Fixed increment**: Set the fixed increment of time values (d-day, h-hour, min-minutes, s-seconds, ms-milliseconds).

**Each Month**: The increment between the values can be each month plus a fixed number of days. The distances within a month are always counted from the 1st of the month.

**Each year**: The increment between the values can be each year plus a fixed number of months. The monthly distances are always counted from the 1st month of each year.

**OK**: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Delete: After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to?. The respective help topic is displayed when an area within the dialog is clicked on.

Example

The result channel is displayed in the Spreadsheet. The first channel (TimGen) has a distance of one minute. The second channel (TimGen~1) has a distance of one year plus every second month.

Types of data objects

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>DateTimeChannel</td>
<td>Channel with date/time</td>
</tr>
</tbody>
</table>

2.4.2.3 Numeric Channel

Go to:

Extra
- Generators
  - Numeric Channel

The data generator for Numeric Channel creates a data object whose values are computed with defined functions like Sine curve, x grid or random numbers. The values can be generated as 64 bit double or 32 bit float values or as Integer value.

Available functions for calculations are:

• Sin(x): Creates a Sine-curve.
- **Sin(x²)/x**: Creates a Sine square x divided by x.
- **Random Generator**: Creates random numbers from -1 to +1.
- **Rainflow Test**: Defines a data row to test the Rainflow algorithm.
- **Rectangle**: Creates square wave that alternates regularly and instantaneously between two levels.
- **Triangle**: Creates a wave with constant ascending or descending slope.
- **Sawtooth (up)**: Creates wave ramping upwards and then sharply dropping.
- **Sawtooth (down)**: Creates wave ramping quickly upwards and then dropping slowly.
- **x-Grid**: Creates a channel with equidistant values. The x values calculated from offset x and delta x are adopted as channel values.

**Result data**: Name of data object as it will appear on the bus.

**Function**: For selecting the function for data creation.

**Number of values**: Defines the number of values to be generated.

**Creation date**: The creation date of the generated channel can either be set to the current time (automatic) or a specific date is entered in the input field (manual).

**Unit**: Optional selection of the unit of y-values (Note: the unit can also be inserted with Unicode).
Offset X: Initial value of the x-values.

Delta X: To calculate the grid points.

X-Unit: Optional determination of the unit of x-values. Note that the unit can be inserted according to its abbreviation or as Unicode.

Datatype: Choice between Float (32 Bit) (creates a float channel), Float (64 Bit) (creates a double channel) and Integer (32 Bit) / (64 Bit) (creates an integer channel).

Storage: Generated channels are stored either in the Memory (RAM) or in temporary files (Disk (File)). Temporary folders are defined in the Preferences.

Set the error status of the result item to: Optionally, an error status can be defined manually in the result channel.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

Delete: After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign⚠️ in the Delete button indicates that the generated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to 🌐. The respective help topic is displayed when an area within the dialog is clicked on.

Example

The generated data are displayed in the Spreadsheet and Explorer. They can be used for calculations and graphic depictions.
Types of data objects

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating-point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/LongChannel</td>
<td>Kanal mit Ganzzahlen</td>
</tr>
</tbody>
</table>

2.4.2.4 Signal Generator

Go to:

Extra

Generators

Signal Generator

The Signal Generator creates a data object whose values are computed with defined functions and simulates signal values of a measurement device. Several parameters like amplitude, time and frequency can be defined.

Available functions for calculations are:

- **Sine**: Creates a Sine curve.
- **Square**: Creates square wave that alternates regularly and instantaneously between two levels.
- **Triangle**: Creates a wave with constant ascending or descending slope.
- **Sawtooth (Up)**: Creates wave ramping upwards and then sharply dropping.
- **Sawtooth (Down)**: Creates wave ramping quickly upwards and then dropping slowly.
Result Data: Name of the generated data object as it will appear in the lists.

Function: For selecting the function for data creation.

Amplitude: Definition of the amplitude

Unit: Optionally, the unit of the y values can be defined. The unit can be stated as an abbreviation or as Unicode.

Total time: Total time for simulating the signal values.

Frequency: Definition of the frequency of the created signal.

Oversampling: Definition of the oversampling rate of the created signal.

Sweep:

Noise: Definition of noise of the created signal.

DC-Offset: Definition of the DC-Offset of the created signal.

Storage: Generated channels are stored either in memory (RAM) or in temporary files. Temporary folders are defined in the Preferences.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

Delete: After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the generated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to 🎨. The respective help topic is displayed when an area within the dialog is clicked on.

Example

The generated data is displayed in the Spreadsheet and Explorer and can be used for calculations and graphic depictions. The line chart displays a simulated Sine signal (blue) with noise (red) and DC offset (green).

![Line chart](image)

Types of data objects

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>DoubleChannel</td>
<td>Channel with floating-point numbers</td>
</tr>
</tbody>
</table>

2.4.2.5 Double Matrix

Go to:

Extra

Generators

Value generator for a **Double Matrix** creates a data object of the type matrix whose values are computed with defined functions.

The individual columns of the generated two- or three-dimensional matrix can be calculated by the following functions:

- $\sin(x)$: Creates a Sine-curve.
- $\sin(\sqrt{x^2 + y^2})$: Creates a Sine-curve with the square root from $x$ squared + $y$ square.
- $x + y$: Creates a curve from the sum of the $x$ and $y$ value.
- Random Generator: Creates random numbers from -1 to +1.
- $x^2 + y^2$: Creates a curve from the sum of $x$ squared + $y$ squared.
Parameter Dialog Box

**Result Data**: Name of the generated data object as it will appear in the lists.

**Dimension**: A two- or three-dimensional matrix can be created.

**Function**: For selecting the function for data creation.

**Unit**: Optionally, the unit of the y values can be defined. The unit can be stated as an abbreviation or as Unicode.

**Number of values**: Defines the number of values to be generated in x and y direction as well as z direction for a three-dimensional matrix.

**Delta X**: Defines the distance between the x values that are used to calculate the selected function.

**X-Unit**: The unit of the x values can be determined optionally. The unit can be stated as an abbreviation or as Unicode.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

**Delete**: After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

**Help**: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
Example

The generated data is displayed in the Spreadsheet tab Matrices and can be used for calculations and graphic depictions. The Spreadsheet and line chart display a two-dimensional matrix that was generated with the function $\sin(\sqrt{x^2 + y^2})$.

Types of data objects

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>DoubleRectMatrix3D</td>
<td>3D-Matrix mit Gleitkommazahlen</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-Matrix mit Gleitkommazahlen</td>
</tr>
</tbody>
</table>

2.4.2.6 String Channel

Go to:

Extra

Generators

String Channel

The function String Channel creates a list of predefined strings which can then be selected in a combo box, for example. This function is suitable for creating evaluation protocols as only the predefined settings from the combo box can
be selected in the protocol. An individual input for each setting is therefore not necessary.

**Parameter Dialog Box**

![Parameter Dialog Box Image]

**Result Data**: Name of the generated data object as it will appear in the lists.

**Size**: Determines the number of predefined strings.

**A**: Input fields for strings.

**Offset X / Delta X**: Optionally, explicit X-values can be defined by Offset and Delta.

**X-Unit**: Optionally, a unit of the X-values can be defined. The unit may be stated as its abbreviation or in the corresponding Unicode notation.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

**Delete**: After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
Example

The example shows 3 combo boxes that offer different possibilities to create a protocol. In the first combo box the staff member who generated the protocol is selected. The other combo boxes define settings concerning the used engine.

<table>
<thead>
<tr>
<th>Types of data objects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
</tr>
<tr>
<td>none</td>
</tr>
</tbody>
</table>

2.4.2.7 2D-Matrix with Strings

Go to:

Extra
Generators
2D-Matrix with Strings

The generator 2D-Matrix with Strings generates a two-dimensional matrix with strings.

Parameter Dialog Box
**Result Data:** Name of the generated data object as it will appear in the lists.

**Size:** Determines the number of lines of the matrix.

**A/B:** Input fields for the values of the matrix (strings).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign⚠️ in the **Delete** button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

??: The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The generated string matrix is displayed in the Spreadsheet tab **Matrices**.

![Spreadsheet dialog](image)

**Types of data objects**

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>StringRectMatrix3D</td>
<td>3D-Matrix with strings</td>
</tr>
</tbody>
</table>
2.4.2.8 Properties Map

Go to:

Extra
  → Generators
    → Properties Map

The generator Properties Map creates a data object the values of which consist of semantic data of a key-value combination.

Functions

The generated map data can correspond to the following functions:

- **Boolean**: Boolean value (true or false).
- **Enumeration**: Label of the data type.
- **String (field)**: Simple text.
- **Date/Time**: Time value.
- **Integer (8/16/32/64 Bit)**: Integer value*.
- **Float (32/64 Bit)**: Decimal number*.
  
  * This data type has no unit. In order to state a unit, use the type Quantity Float or Integer instead.

- **Java Class**: Label of a Java class.
- **File**: Label of a file.
- **URL**: A URL can be entered.
- **jBEAM Component**: Label of a jBEAM component.
- **Quantity (64 Bit Float; 32/64 Bit Integer)**: A value with unit.
- **Multilanguage text**: Multilingual text. Using the N(ew) / C(hange) or D(lete) buttons languages can be defined for multi-language text. The language selection list (std. / de / en / ...) can be used to edit the currently selected language.

- **Data item**: Name of a data item.
**Result Data:** Name of the generated data object as it will appear in the lists.

**Name:** Name/label of the key.

**Type:** Selects the type of the key value from a list of available types.

**Value:** The corresponding value to the selected key.

**Unit:** The value’s unit. The field is enabled if a data type with unit is defined.

**Option:** The sequence of the entries can be changed (upwards/downwards) and entries of the map can be removed by clicking the trash button.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

**Delete:** After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
Example

The generated Properties Map is displayed in the Spreadsheet tab Maps.

Types of data objects

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>BasicMap</td>
<td>Map containing key-value combinations</td>
</tr>
</tbody>
</table>

2.4.2.9 Graphic Objects

Go to:

Extra

Generators

Graphic objects

The Graphic objects generator creates a data object with definable simple graphic objects. They can then be represented in a Graph Objects chart or diagram. In the diagram as part of the Universal 2D graph the graphic objects are scaled according to the set axis values.
A **Graphic object** defined by the generator is made up of its single components. Position and size of the graphic object can be modified by using the mouse. **Modify** (via Extra → Generators → Modify or via the Explorer) allows the reopening of the generator dialog box. Then changes can be made.

**Result Data**: Name of the result data object as it will appear on the bus.

**Tab Actions**

**Create new**

**Line**: Creates a data object of type **line** with defined parameters, displayed in the list

**Text**: Creates a data object of type **text** with defined parameters, displayed in the list.

**Image**: Creates a data object of type **image** with defined parameters, displayed in the list.
Area: Creates a data object of type area with defined parameters, displayed in the list.

Variable: Creates a data object of type variable with defined parameters, displayed in the list.

Symbol: Creates a data object of type symbol with defined parameters, displayed in the list.

Line List: Creates a data object of type line list with defined parameters, displayed in the list.

Selected Object

Duplicate: Selected graphic object is duplicated. The copy is displayed in the list on the right side of the dialog box.

Up: The selected graphic object is moved one up in the list.

Down: The selected graphic object is moved one down in the list.

Delete: Selected graphic object is deleted.

Units

x-Unit / y-Unit: For the defined coordinates, an x- and y-unit can be set.

Filter / Sort

Show all objects: All created objects are displayed in the list on the dialog box's right side.

Show only: Only the selected graphic object types are displayed in the list.

Sorted by: Choice of different sorting methods:

  Z-sequence: The list of the graphic objects is sorted depending on the creation date.
  Type: The list sorted depending on the type.
  X, Y: The list is sorted depending on x1, y1 values, the type will be ignored.
  Y, X: The list is sorted depending on y1, x1 values, the type will be ignored.

Target: The created graph will be added to this library or to a library selected in the combo box. The combo box shows all available data objects.

Delta x/y: Offset for moving the selected graphic object.

Use copy: The selected graphic objects are copied, the original remains unchanged.

Move/Extract: Move is active, if this library is used as Target. The selected graphic objects will be moved within the used library by the defined delta. Extract is active if the combo box is selected as Target. The selected graphic objects will be exported to the chosen library.

[Graphic Objects List]: Is situated on the right side of the dialog box and displays the created objects. A selected graphic object is highlighted and the Properties tab shows its settings.

Formula Editor: Opens the Embedded Formula Editor.

OK: The changes are applied and the dialog is closed.
**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

**Delete**: After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign "⚠️" in the Delete button indicates that the generated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

>: The context sensitive help is activated and the cursor changes to "?". The respective help topic is displayed when an area within the dialog is clicked on.

**Tab Properties - Line**

**Point 1 / Point 2**: Defines the X and Y values of the line's starting point (Point 1) and endpoint (Point 2). The values can be defined via the following options in the combo box:

- **manual**: The value is entered in the input field behind the combo box.
- **Formula**: The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.
- **[data object]**: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.

>: Opens the dialog box [Filtered Selector of Dataitems](#).

**abs. offset**: In addition to the axis-oriented values of Point 1 and Point 2 an absolute offset for X and Y values might be defined (pixel) which is independent of the axis scaling.

**Width**: Curve width in pixels \([0,1Px...50,0Px]\). 3 Pixel = 1 mm.

**Color**: The curve color is defined by using the color button.

**transparent**: Optionally, the line can be transparent. The default transparency is set to 50%.
Tab Properties – Text

Text: Input field for text. Multi-line text can be created by manual line feed (Enter). However, even if the text is automatically wrapped to the next line in the input field, it is not automatically wrapped in the resulting graphic. The text can also contain formulas. To enter a formula, the Embedded Formula Editor can be used.

New / Change / Delete: These buttons can be used to define Language Dependent Strings for the text field. If several languages have been defined in this dialog, the text can be edited in the selected language (std. / de / en / ...) directly in the dialog.

Alignment: Defines the alignment of the text within the text field. The selection list shows the respective text position in relation to the reference point (red dot).

Position: Defines the X and Y values of the text’s reference point (see Alignment). The values can be defined via the following options in the combo box:

  - manual: The value is entered in the input field behind the combo box.
  - Formula: The formula is entered in the input field behind the combo box. For this, the Embedded Formula Editor can be used.
  - [data object]: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.

abs. offset: In addition to the axis-oriented values of Position an absolute offset for X and Y values might be defined (pixel) which is independent of the axis scaling.

Rotation and distance: Defines text rotation in degrees. The values can be defined via the following options in the combo box:

  - manual: The value (from -180° to 180°) is entered in the input field behind the combo box.
**Formula:** The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.

[data object]: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.

**Font:** Defines the style of lettering, size and color. The text can be displayed **bold** and/or **italic**.

filled: Optionally, the text field can be filled with color. The color can be defined via the color button.

**Frame:** Optionally, a frame can be drawn around the text field. The color is defined via the color button. The line width is defined in pixels.

**transparent:** Optionally, frame and background can be transparent. The default transparency is set to 50%.

### Tab Properties – Image

**Paste Image:** Pastes a previously copied image from the clipboard.

**Position:** Defines the X and Y values of the upper left corner of the image. The values can be defined via the following options in the combo box:

- **manual:** The value is entered in the input field behind the combo box.

**Formula:** The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.

[data object]: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.
abs. Offset: In addition to the axis-oriented values of the Position an absolute offset for X and Y values might be defined (pixel) which is independent of the axis scaling.

Scaling: Resizes the image in relation to its original size.

transparent: Optionally, frame and image can be transparent. The default transparency is set to 50%.

Frame: Optionally, a frame can be drawn around the image. The color is defined via the color button. The line width is defined in pixels.

Image: Scaling of the image within the available space. There is a choice between Fit (the image is scaled to the window’s height or width so that its width-to-height ratio corresponds with the original) and Full (the image is scaled to full window size so that there can be an image deformation).

[Preview]: Displays the image.

Tab Properties – Area

Rectangle / Caro / Ellipse / Quadrangle: Selection of the area type to be displayed.

Point 1...4: Defines the X and Y values of the corners/reference points. The number of points depends on the selected area type.
The values can be defined via the following options in the combo box:

**manual**: The value is entered in the input field behind the combo box.

**Formula**: The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.

**[data object]**: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.

: Opens the dialog box [Filtered Selector of Dataitems](#).

**abs. offset**: In addition to the axis-oriented values of **Point 1...4** an absolute offset for **X** and **Y** values might be defined (pixel) which is independent of the axis scaling.

**Line width**: Defines the line width in pixels.

**Line color**: The line color is defined by using the color button.

**transparent**: Optionally, line and background can be transparent. The default transparency is set to 50%.

**Fill color**: Optionally, the created area can be filled with color. The color can be defined via the color button.
Tab Properties – Variable

Dataobject: A data object the value or property of which shall be displayed is selected from the list of available data objects.

: Opens the dialog box Filtered Selector of Dataitems.

Key: Optionally, a key for a property of the data object (e.g. "Name") or, if the data object is a map, a key name can be selected.

with unit: Optionally, the unit of the variable if available can be displayed.

Digits: Optionally, the number of decimal digits can be explicitly defined.

Alignment: Defines the alignment of the text within the text field. The selection list shows the respective text position in relation to the reference point (red dot).

Position: Defines the X and Y values of the text’s reference point (see Alignment). The values can be defined via the following options in the combo box:

manual: The value is entered in the input field behind the combo box.

Formula: The formula is entered in the input field behind the combo box. For this, the Embedded Formula Editor can be used.

[data object]: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.

: Opens the dialog box Filtered Selector of Dataitems.

abs. offset: In addition to the axis-oriented values of Position an absolute offset for X and Y values might be defined (pixel) which is independent of the axis scaling.

Rotation and distance: Defines text rotation in degrees. The values can be defined via the following options in the combo box:

manual: The value (from -180° to 180°) is entered in the input field behind the combo box.
**Formula:** The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.

**[data object]:** The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.

**Font:** Defines the style of lettering, size and color. The text can be displayed **bold** and/or **italic**.

**filled:** Optionally, the text field can be filled with color. The color can be defined via the color button.

**Frame:** Optionally, a frame can be drawn around the text field. The color is defined via the color button. The line width is defined in pixels.

**transparent:** Optionally, frame and background can be transparent. The default transparency is set to 50%.

---

**Tab Properties – Symbol**

![Tab Properties – Symbol](image)

**Position:** The symbol can either be drawn at a definable fix position or be related to a point of a curve in the diagram.

**Fix:** Defines a fix position by the **X** and **Y** values of the center of rectangle or circle or the arrowhead. The values can be defined via the following options in the combo box:

- **manual:** The value is entered in the input field behind the combo box.

**Formula:** The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.

**[data object]:** The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.

[ ] : Opens the dialog box **Filtered Selector of Dataitems**.
**dependent on value of curve**: If the graphic object is displayed in a Universal 2D-Graph, its position can be linked to a point of another curve (1, 2, 3,...) in the same graph. The symbol can be placed at the minimum, maximum or at a defined index.

**Symbol**: Optionally, the display of the symbol can be activated or deactivated. The color can be defined via the color button.

- **transparent**: Optionally, frame and background can be transparent. The default transparency is set to 50%.
- **rectangle / circle / arrow**: Selection of the symbol type.
- **direction**: Active, if arrow is selected. Defines the direction which the arrow-head points at. The values can be defined via the following options in the combo box:
  - **manual**: The value (from -180° to 180°) is entered in the input field behind the combo box.
  - **Formula**: The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.
  - **[data object]**: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.
- **size**: Defines the size of the symbol in points.
- **with frame**: Optionally, a frame can be drawn around the symbol. The color is defined via the color button. The line width is defined in points.

**Label**: Optionally, a label can be displayed. The label can be defined via the following options:

- **fix**: The label text is entered manually in the input field. The text may also contain formulas. For this, the [Embedded Formula Editor](#) can be used.
- **value of point, with ... decimal digits**: Alternatively, the value of the linked point of a curve can be displayed with a definable number of decimal digits. The requirement is that in the dialog above under Position the option dependent on value of curve is selected.

---

**Example for Symbol**: In the Graphic Objects Generator an arrow symbol has been defined which is dependent on a point of curve 1 in the Universal 2D-Graph. The value at index 5 of this curve shall be displayed as label on the arrow.
In the Universal 2D-Graph, curve 1 is a Line/Points-Diagram and curve 2 a Graph Objects-Diagram with the generated graphic object. The arrow is displayed at the defined position (Index = 5) of curve 1.
Tab Properties – Line List

**x-channel / y-channel**: Selection of the data objects containing the x- and y-values of the start and end points of the lines to be drawn. Each set of x- and y-values creates a point. Identical start and end points of several lines only have to be defined once.

**Indices**: Selection of the data objects containing the line indices. Two consecutive values generate a line. The values state the indices of the points to be connected. The connecting lines can be defined in any order.

The values can be defined via the following options in the combo box:

- **manual**: The value is entered in the input field behind the combo box.
- **Formula**: The formula is entered in the input field behind the combo box. For this, the [Embedded Formula Editor](#) can be used.
- **[data object]**: The available data objects are listed. Suitable data objects are numeric single values or maps. In case of maps, the respective key can be selected in the second combo box.
- : Opens the dialog box [Filtered Selector of Dataitems](#).

**abs. offset**: In addition to the axis-oriented values of X and Y, an absolute offset for X and Y values might be defined (pixel) which is independent of the axis scaling.

**Width**: Defines the line width in pixels.

**Color**: The line color is defined by using the color button.

**transparent**: Optionally, line and background can be transparent. The default transparency is set to 50%.

**Decoration**: Optionally, the start and end points of the lines can be drawn with a decoration. The **Type** and **Size** can be selected from the list.

**Tooltip**: Optionally, a text can be defined which is displayed when the mouse moves over the object.
**Example for Line List:** The value channels for the points and line indices have been defined via Interactive table. The generated Line List Graphic Objects has been displayed in the Universal 2D-Graph.

<table>
<thead>
<tr>
<th>List of Points</th>
<th>List of Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>X</td>
</tr>
<tr>
<td>P0</td>
<td>1.00</td>
</tr>
<tr>
<td>P1</td>
<td>5.00</td>
</tr>
<tr>
<td>P2</td>
<td>4.00</td>
</tr>
<tr>
<td>P3</td>
<td>6.00</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Types of data objects

<table>
<thead>
<tr>
<th>Input data</th>
<th>Result data</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>GraphObjectVector</td>
<td>Simple graphics object array</td>
</tr>
</tbody>
</table>

2.4.2.10 Dialog Configurator

Go to:

**Extra**

- Generators
  - Dialog Configurator

The generator **Dialog Configurator** generates a dialog window with definable elements that can be called by the user, e.g. in order to enter needed values. The advantage of this function is that no separate graphic window is needed.
Tab Properties

**Result Data:** Name of the created data object as it will appear in the lists.

**Dialog title:** The title is displayed in the headline of the dialog.

**Background color:** The color for the background of the dialog can be selected via the color button. Alternatively, the standard color (usually light grey) can be set.

**Distance from the edge:** Defines the distance (in Pixel) between the graphic objects and the upper and lower border of the dialog.

**Dialog modal:** If this option is activated, the jBEAM main window cannot be operated as long as the dialog is open. If the option is deactivated, i.e. the dialog is non-modal, the jBEAM main window remains operable. Other dialogs can be opened and modified.

**Live changing of values:** If this option is selected, changes of values, e.g. in case of Value Input, are immediately adopted by subsequent calculations or graphics. The dialog only contains a Close button. If the option is deactivated, changes are only adopted with OK or Apply. The dialog then contains 3 buttons: OK, Apply, Cancel.

**Open user dialog by:** The dialog can be opened by an appropriate control element, e.g. Button.
In this tab, a selection of graphic objects can be created. A right-click within the editor area opens the context menu where the available graphic objects can be selected. The inserted graphic objects can be modified by opening the dialogs via double-click. The following graphic objects are available:

- **Simple Forms:** Line, Rectangle, Circle, Curved Line
- **Text Elements:** Plain String, Plain Text, Formatted Text, MathML Grafik
- **Tables:** Free Table, Interactive Table
- **Multi Media:** Image
- **Controls:** Interactive Table, Switch, Checkbox, Combobox, Radiobuttons, Value Input, Text Input, Slider

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

**Delete:** After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ??. The respective help topic is displayed when an area within the dialog is clicked on.
2.4.2.11 Performance Test

Go to:

Extra
  • Generators
  • Performance Test

This function tests the performance of jBEAM depending on the current environment. Simulated test data will be created and jBEAM checks the accessing of those data.

Result data: Name of data object as it will appear on the bus.

Number of repeats: Number of repeats of the selected operations.

Tests:
- DblArray creation: Generates a double array.
- DblArray write: Determines the time of writing a double array.
- DblArray read: Determines the time of reading a double array.
- DblArray write by function: Determines the time of writing a double array from another calculation.
- DblArray read by function: Determines the time of reading a double array from another calculation.
- DblFileChannel write: Determines the time of writing into a DoubleFileChannel.
- DblFileChannel read: Determines the time of reading from a DoubleFileChannel.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A copy of the current generator is created and the generator dialog box is opened for the copy. The original generator remains unchanged.

**Delete:** After a confirmation prompt, the generator is deleted and the dialog closed. A warning sign ▼ in the **Delete** button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Help button](image)

: The context sensitive help is activated and the cursor changes to ?️. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.4.3 Audio

Go to:

**Extra**

![Audio menu](image)

The menu item consists of:

- **Recording**
- **Converter numerical Channel → Audio**
- **Synthesizer**

**Modify** lists all generated audio components. They can be reopened for changes.

### 2.4.3.1 Recording

Go to:

**Extra**

![Recording menu](image)
2.4.3.2 Converter numerical Channel → Audio

Go to:

Extra
  → Audio
    → Converter num. Channel → Audio

2.4.3.3 Synthesizer

Go to:

Extra
  → Audio
    → Synthesizer

2.4.4 Video

Go to:

Extra
  → Video

The only sub menu item is Videorecording.

2.4.5 Miscellaneous

Go to:

Extra
  → Miscellaneous

The following sub menu items are available:

- Data Source Manager
- View-Selection-Manager
- Scripting
- e-Mail Component
Modify lists all generated components. They can be reopened for changes.

2.4.5.1 Data Source Manager (Import)

Go to:

Extra
  → Miscellaneous
  → Data Source Manager (Import)

The main functionality of the Data Source Manager is the grouping of data sources. A data source is an encapsulation of an importer (e.g. ASCII, Gidas, ...), contains information and parameters for the graphical representation and supports data filtering (selection support) during the data import.

The Data Source Manager provides the supervision of import components, the configuration of their settings and the initialisation of new import components. The settings of the graphical representation of data objects of the import components can be comfortably modified as well. The Data Source Manager provides references to data items of the selected import components which can be chosen in the modification dialog box of a Cartesian line chart. The dialog of the Data Source Manager can be used to set e.g. colors and styles of lines and markers to be applied in a line chart.

With the help of the Data Source Manager all imports can be supervised but only some importers (ASCII, Gidas, LS-Dyna, LabVIEW (lvm), PA-Tools (Kratzer), and other customized data formats) support data filtering (selection support) based on the index or a data object within the Data Source Manager.

There are two options for loading the data objects. Either only data objects are considered that exist in all active data sources (intersection) or all data objects that exist in at least one data source (superset). Data objects (selection values) with the same name are grouped and displayed in the Spreadsheet (Tab Matrices) as multidimensional data objects (Group of channels). The name of the Channel Group corresponds with the name of the selection value.

Example: The following data sources are defined:

<table>
<thead>
<tr>
<th>Datasource</th>
<th>Data objects in the Datasource</th>
</tr>
</thead>
<tbody>
<tr>
<td>Datasource 1</td>
<td>DataObject_X, DataObject_Y, DataObject_Z</td>
</tr>
<tr>
<td>Datasource 2</td>
<td>DataObject_X, DataObject_Z</td>
</tr>
</tbody>
</table>

Case 1 – Only data objects present in all data sources: The Data Source Manager groups both data sources and creates two new multidimensional data objects "DataObject_X" and "DataObject_Z". Each column of the created channel group contains the values of the corresponding data object (channel) from the data source. The data object "DataObject_Y" is ignored because it is only present in Datasource 1 but not in Datasource 2.
Case 2 – Data objects present in at least one data source: The Data Source Manager groups both data sources and creates three new multidimensional data objects “DataObject_X”, "DataObject_Y" and "DataObject_Z" with "DataObject_Y" having only the one column fromDatasource 1.

Special curve properties (e.g. line type, line color, marker type, marker color etc.) can be assigned to each data source that will be used in diagrams for graphical representation of the data source (for further information see also the chapter Applying curve properties of the Data Source Manager in an XY-diagram).

Name: Name of the Data Source Manager as it will appear in the Explorer.

Section: Table with data sources

#: Index of the data source (importer).

Name: Name of the data source (importer). The column can be sorted in ascending or descending order by clicking in the column header.

Format: Format of the data source (importer).

Datasource: Contains the data source file to be imported. Optionally, the file path can be displayed. For this, the checkbox Display file path under Datasource(s) is activated. If a file does not exist its name is displayed in red. The column can be sorted in ascending or descending order by clicking in the column header.

Active: Activates or deactivate the data source. Only activated data sources will be displayed in graphic objects.
Selection range: For each data source, an individual selection range can be defined. This range states which data are actually loaded. The display field shows the current filter settings of the data source as text.

The selection range can be modified in the **Selection definition** dialog which is opened by the Edit button. In this dialog, several selection criteria can be defined.

The definition of a selection range is only available for importers with selection support.

**Selection definition**

Selection value: Selectable options are **indexbased** or the data objects. If there are several data objects, a selection range for each data object can be defined. The individual selection criteria are AND-combined, i.e. only data are imported which fit all criteria.

Selection range: The selection range is entered in the text field. It relates to the selected selection value. Inputs allowed are single numbers and/or numeric ranges. Each part needs to be separated by a semicolon. Positive and negative decimal numbers are accepted, as well as negated inputs which have to start with the character "!". For positive and negative infinity it is possible to type "max" / ">" and "min" / "<" (see also chapter **Example input of the selection range**). Depending on the inputs, the background color of the text field switches (green: correct input, red: wrong input). In addition, the text field contains a tool tip that shows further information concerning correct and incorrect inputs.

**Examples:**

<table>
<thead>
<tr>
<th>Selection value</th>
<th>Selection range</th>
<th>Selection check</th>
</tr>
</thead>
<tbody>
<tr>
<td>indexbased</td>
<td>1-3;7</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>1 - 3; [7 - ∞]</td>
<td>-</td>
</tr>
<tr>
<td>indexbased</td>
<td>1-3;7-[]</td>
<td>+</td>
</tr>
</tbody>
</table>

Selection check: Shows the interpreted entries of column **Selection range**. These are the single values and/or numeric ranges that will be actually imported. The field is only for display, inputs are not allowed.
Another selection range is created. The button is active as long as there are more data objects. Each data object may only be used once. Already used data objects are no longer shown in the list. If indexbased is selected only one selection criteria may be defined.

The respective selection range is removed.

The settings are applied by OK, dismissed by Cancel.

**Curve properties**: Defines the initial curve properties (Line color, Line dash, Marker active, Marker color, Marker type) for the representation of the data sources in a line chart. On creation of a data source, the line color and marker type are set automatically according to the preferences. The marker color is initially set to the same as the line color. This and other settings can be changed by pressing the more button which opens the dialog **Datasource curve properties**.

**Section: Custom Optimization Settings and Datasource(s)**

<table>
<thead>
<tr>
<th>Custom Optimization Settings</th>
<th>Datasources</th>
</tr>
</thead>
<tbody>
<tr>
<td>register datasources</td>
<td>duplicate</td>
</tr>
<tr>
<td>All dataobjects to standby</td>
<td>remove</td>
</tr>
<tr>
<td>Include data objects from datasources if present</td>
<td>common selection value</td>
</tr>
<tr>
<td>![ ] in at least one datasource</td>
<td>![ ] in all datasources</td>
</tr>
</tbody>
</table>

**Custom Optimization Settings**: If this option is enabled, own settings can be defined. If it is disabled, the data sources will not be registered on the CEA bus and all data objects will be set to standby.

**register datasources**: If checked, the data sources (components and data objects) are registered on the CEA bus and become visible in the Explorer’s Producerlist and the Spreadsheet. Otherwise, the data sources are not registered on the CEA bus and are only available for the Data Source Manager. The data sources will then be visible neither in the Explorer’s Producerlist nor in the Spreadsheet.

**All dataobjects to standby**: If checked, all data objects (channels) that are not used are set to standby (provided that the data source supports this). Otherwise, the values of all data objects are loaded.

Note: Data objects with the status **Ignored** are ignored in each case.

**Include data objects from datasources if present**: The data source’s data objects are only included if they are present either **in at least one datasource** or **in all datasources**.

**Datasource(s)**:

**rename by order**: All data sources will be renamed by using the current order. A common prefix can be defined.

**common selection value**: The selection value and selection range of the topmost data source are assigned to all other data sources in the Datasource table.

**duplicate**: The importer settings including selection criteria will be duplicated. The curve properties, however, are initialized with differing settings like every other new source.

**Change file**: Opens the import dialog box of the selected data source or sources. The data source file can be replaced by another file of the same data type in this dialog. After
applying the dialog settings by clicking **OK** or **Apply**, all data of the import file are loaded and all components that are linked to this Data Source Manager are updated.

**Change format**: This function enables to change the importer format of the selected data source or sources. For this, the data format type selected under **Data format** in the section **Create new datasources** is applied. The modification dialog of the corresponding importer is opened where the new file can be selected and further settings configured. When applying the new format, the curve properties remain unchanged whereas importer-specific settings, e.g. selections, are dismissed. When several data sources are selected, all selected sources are replaced by the number of new data sources, i.e. new sources might be added or spare sources removed. Unselected data sources remain unchanged.

**reset curve properties**: The curve properties of all data sources are reset to the default settings.

**change curve properties**: The curve properties of all selected data sources can be changed.

**remove**: The selected data source(s) is/are removed from the Datasource table and the Data Source Manager. Yet, the importer of the data source is kept in the Explorer’s **Producerlist** and can be used for other purposes.

**delete**: The selected data source(s) is/are removed from the Datasource table and the Data Source Manager. The importer of the data source will also be deleted and cannot be used anymore.

**delete all**: All data sources are removed from the Datasource table. The importers of the data sources will also be deleted and cannot be used anymore.

**activate**: Activates the selected data sources.

**deactivate**: Deactivates the selected data sources.

**糖尿**: The selected data sources are moved upwards in the list by one element.

**糖尿**: The selected data sources are moved downwards in the list by one element.

**糖尿**: The selected data sources are moved to the top of the list.

**糖尿**: The selected data sources are moved to the bottom of the list.

**Display file path**: If checked, the import files are displayed with their file path in the column **Datasource** of the table section.

### Section: Take over existing datasources

<table>
<thead>
<tr>
<th>Take over existing datasources</th>
<th>Create new datasources</th>
<th>Common curve properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>All datasources</td>
<td>All data formats</td>
<td>Line color</td>
</tr>
<tr>
<td>All datasources with selection support</td>
<td>All data formats with selection support</td>
<td>Line properties without line color</td>
</tr>
<tr>
<td>Beckman-Coulter (Beckman)</td>
<td>Beckman-Coulter (Beckman)</td>
<td>Marker color</td>
</tr>
<tr>
<td>Accelrys (formerly Mass Spec)</td>
<td>Accelrys (formerly Mass Spec)</td>
<td>Marker properties without marker color</td>
</tr>
<tr>
<td>Agilent (formerly Waters)</td>
<td>Agilent (formerly Waters)</td>
<td>Marker size</td>
</tr>
<tr>
<td>JT Dyna Importer (JTDyna)</td>
<td>JT Dyna Importer (JTDyna)</td>
<td>Marker type</td>
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<td>Elite (ELMONT)</td>
<td>Alpha channel</td>
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<tr>
<td>Elite (ELMONT)</td>
<td>Elite (ELMONT)</td>
<td>Edge color</td>
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</tbody>
</table>

**All datasources**: The list shows all available importers, no matter if they provide a selection support or not.

**All datasources with selection support**: Shows all available importers providing data filtering.
Take over datasources: Adds the selected importers to the Datasource table.

Section: Create new datasources

All data formats: For selecting the import to be loaded. The combo box Data formats lists all data formats.

All data formats with selection support: For selecting the import to be loaded. The combo box Data formats lists only data formats with selection support. Currently supported import formats are: ASCII, Gidas, LS-Dyna, LabVIEW (lvm), PA-Tools (Kratzer), Uniplot-UTX (dat, adl, tdi), VW Venus-Csv and others.

Data format: The combo box lists all data formats according to the selection above.

Load file(s): The import dialog of the above selected data format is opened and a corresponding file can be chosen. Most importers support Multi file selection. Then, several files can be selected and imported using the import parameters of the reference file (selected first).

Section: Common curve properties: Define the basic graphical representation of all data sources present in the data source table.

Line color: If checked, all data sources are displayed with the line color assigned to them. Otherwise the data sources are displayed with the line color set in the XY-Graph.

Line properties without line color: If checked, all data sources are displayed with the line properties assigned to them, thereby ignoring the line color. The line color can be defined separately via the check box Line color. If this option is inactive, the data sources are displayed with the line properties set in the XY-Graph.

Marker color: If checked, all data sources are displayed with the marker color assigned to them. Otherwise the data sources are displayed with the marker color set in the XY-Graph.

Marker properties without marker color: If checked, all data sources are displayed with the marker properties assigned to them, thereby ignoring the marker color. The marker color can be defined separately via the check boxes for Marker color. If this option is inactive, the data sources are displayed with the marker properties set in the XY-Graph.

Marker stroke color / Marker fill color: The stroke and fill color of the markers can be set individually:

as line: The line color is used as marker color and the button for the marker color in the column Curve properties is disabled.

manual: The marker color can be chosen independently from the line color. The button for the marker color in the column Curve properties is enabled.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: After a confirmation prompt, the Data Source Manager is deleted and the dialog closed. A warning sign⚠️ in the Delete button indicates that the produced data is used by other components.
**Cancel**: The dialog is closed and changes are dismissed.

✨: The context sensitive help is activated and the cursor changes to ✨. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The line chart below shows an exemplary depiction of some channels of an importer.

---

**Example input of the selection range**

Example inputs are: 

- "-10--5; 0-3; 10", "0-3,5; 5,2-9,5", "min-10; 20-max", 
- ","<10; 20>", "%20-30;50-60" (complete input will be negated).

**Example 1**: A data source is to import values based on the following index ranges: 10-20 and 50-100. Therefore, the column **Selection value** has to be set to **indexbased** and "10-20; 50-100" has to be entered into the column **Selection range**.

**Example 2**: A data source contains a data object DatX with values in the range of 1 – 1000. Only the data in range 50 < DatX < 150 needs to be imported. Therefore, the column **Selection value** has to be set to DatX and "50>; <150" or "50 - 150" has to be entered into the column **Selection range**.

**Applying curve properties of the Data Source Manager to an XY-diagram**

Upon creating an XY-Graph based on a data object which is assigned to a Data Source Manager, the curve properties of the Data Source Manager are applied automatically and the line type (see following figure) is set to **special**. Thus, the curve is drawn with curve properties defined in the Data Source Manager.

After pressing the button **more** a new dialog box (see following figures) pops up. In this dialog box there is a check box **get from data sources** which can be found in the tabs **Line** and **Marker**.
If this checkbox is selected, the curve properties from the Data Source Manager are used. If the checkbox is deactivated, the user can change the curve properties manually.

2.4.5.2 View-Selection-Manager

Go to:

Extra
  ↓ Miscellaneous
  ↓ View-Selection-Manager

The View-Selection-Manager is used to generate extensive filter conditions for data objects. The definable filter conditions of the different views can be saved in the project file or as a separate selection file.

The desired view can be applied to the data objects in calculations and graphic elements that support the view selection. Furthermore, components not supporting view selection can be provided with filtered data objects via the calculation View on Data objects.

View 0 is the default setting of all supported calculations and graphic elements. If no View 0 is defined or if it does not contain any filter conditions, unfiltered data is used for the calculations.
or the graphic visualisation. Only if another view is selected in the respective component, filtered data is used. So it is usually reasonable to leave View 0 unchanged and create new views for setting filter conditions. If it is desired that the changes of the filter conditions immediately and automatically affect all consumers, View 0 may directly be modified.

Views can also be ‘stacked’. If a View 1 is generated in several selection groups and defined with different filter conditions, all filter conditions are applied to the data object one after the other. The order of processing corresponds with the order of the generated selection groups. Note that the filtering of the respective selection group is always completed first before the filter conditions of the next selection group are executed. Like this, the filter conditions of the following selection group are always used on already filtered data. That means with certain sequences of filter conditions the order of the selection groups may be of great importance and therefore should be considered.

Selection groups: Multiple selection groups with multiple views can be created. Identical views are applied in the order of the selection groups. The selection groups can be saved in the project or in a separate file. The current storage location is displayed. The views contained in the selection list are displayed for the currently selected selection group.

File(s)-Import: Already saved selection files can be imported. jBEAM selection files (*.jbsel) and GIDAS selection files (*.sel) are supported.

File-Export: The selected selection groups are saved as a jBEAM selection file (*.jbsel). The dialog box for saving the file opens.

File change: The selected, imported selection files are removed from the list and the selection files chosen in the file selection window are imported. The file selection window also opens via double click on the name of the selection file in the list.
**Files reload:** All already loaded selection files are updated.

**File -> Internal:** All selected selection groups are saved with the project from now on.

**Create file:** A new selection file is created.

**Create internal:** A new selection group is created. This selection group is saved as a jBEAM project and can be converted to a jBEAM selection file via file export.

**Rename:** The selected selection group can be renamed. The editor field opens also via double click on the name of the selection group in the list.

**Remove:** The selected selection groups are removed. If a selection file is considered, this file is only removed from the selection group list and not deleted.

- **[▲]**: The selected selection groups are moved to the beginning of the list.
- **[▲]**: The selected selection groups are moved one position up.
- **[▼]**: The selected selection groups are moved one position down.
- **[▼]**: The selected selection groups are moved to the end of the list.

**Selections:** Multiple views can be created for each selection group. The list shows the number of the view under View and the label of the view under Comment.

- **Create:** A new view is created. A number following the number of already existing views is automatically given, starting with 0.

- **Remove:** The marked views are deleted.

- **View rename:** The number of the view can be changed. The editor field opens also via double click on the number of the view in the list.

- **Comment rename:** The label of the view can be changed. The editor field opens also via double click on the comment of the view in the list.

**Producers:** The list displays all available producers. The data objects belonging to the selected producers are shown in the list **Producer-Dataobjects**.

**Producer-Dataobjects:** The list displays the data objects belonging to the selected producer. The display of the data objects can be narrowed via Filter. By double clicking on the name of the data object or the arrow button the name of the data object is taken over into the definition field.

The producer names are highlighted with color:

- **green:** The chosen selection can be applied to the data objects of this producer.

- **red:** The selection cannot be applied to the data objects of this producer because no defined data object is contained in the producer or the data object has not the suitable data format or because the definition contains mistakes.

**Static Values:** The listed expressions can be used to create the definition. They are taken over into the definition field by double clicking or via the arrow button.

- **INDEX:** The index of the data object is used.

- **= EACH n:** Only every n-th value is taken over into the filtered data object (n = integral number). Example: INDEX = EACH 2.
LAST - n: This expression relates to the last −n-th values of the data object (n = integral number). Example: INDEX > LAST - 5 means that only the last 5 values of the data object are taken over into the filtered data object.

MAXIMUM: This expression relates to the maximum value of the data object. Example: DatGen < MAXIMUM-5 shows all values of the data object DatGen that are less than the maximum value − 5.

MINIMUM: This expression relates to the minimum value of the data object.

Operators: The listed operators can be used to generate definitions. They are taken over into the definition field by a double click or via the arrow button. Next to the known operators =, ≠ (unequal), +, −, <, >, <= and >= the logic operations And and Or are available. If multiple conditions are defined each on a new line, they are automatically connected with And.

Tolerances can be defined using the operators ±, ±%, In and Out. They define ranges around a value. The range can be absolute (±) or percental (±%). It can also be stated whether all values within (In) or out of (Out) the given range shall be selected. Example: „DRZ IN 1000 ± 50“ or „DRZ OUT 1000 ±% 2“.

The Formula Editor is only available with formula based definition input.

Selection-Definition: The desired definition can be entered into the input field. Data objects, fixed values or operators can be taken over from the upper lists via double click or the arrow button. If the entered definition is erroneous, the areas in question are marked red. The corresponding error message and syntax notes are displayed when hovering over the marked area with the mouse in the field definition check.

Easy definition input (Index starts at 1): The simple definition input can be used for simple definitions via the fixed values defined above and is mostly sufficient. Example: INDEX = EACH 2 results to the values with the indices 1, 3, 5, ...

Formula based definition input (Index starts at 0): The definition input can be changed to a formula based definition input for special definitions, e.g. data objects with producer. Simple definitions can be converted to formula based definitions after an enquiry. But formula based definitions cannot be converted to simple definitions. Example: The simple definition INDEX = EACH 2 is converted to (mod(INDEX+1, 2) = 0) and results to the values with the indices 0, 2, 4, ...

Ascending sorted dataobject: The data objects of the producer that can be used on this selection are sorted in ascending order after the stated data object.

NaN-filter dataobject: If the stated data object holds NaN values, the corresponding lines of the data object on which the selection is applied are removed.

Definition-Check: The entered definition is checked for its validity and possibly occurring errors in the definition check field are displayed. Green letters mean a correct definition, red letters indicate mistakes. The corresponding error message is displayed when the mouse cursor hovers over the text passages that are marked red.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.4.5.3 Scripting

Go to:

**Extra**
  - **Miscellaneous**
  - **Scripting**

The jBEAM **Scripting** component allows executing complex sequences (import, calculation, graphic depiction, export) by using a script. A script file is a source file that is written in a script language. Scripts are used to automate processes.

Two script languages are available: Beanshell and Groovy. Because of their Java syntax, software developers need only a short time to get familiar with the script languages.

**Beanshell** is used for short scripts. The syntax is similar to Java 1.4 but until now there are no further renewals.

**Groovy** is used for longer and more difficult scripts because it creates Java classes. Groovy is a dynamic script language for the Java virtual machine and its syntax is different in comparison to Beanshell (e.g. when initializing fields).

See also [Scripts in jBEAM on wiki.jbeam.info](https://wiki.jbeam.info)

The script to be processed can be imported directly from a file or entered manually into the dialog box. The script can already be tested within the Script-Editor. If the test fails, an error message is displayed.

A script can be executed via command button, button or when validating jBEAM.
Result Data: Name of the Script as it will appear in the Explorer.

Script language: For selecting the script language (BeanShell or Groovy).

Script from file: Imports an already existing script.

Script-Editor: The section Script-Editor is made up of two sections. The upper section contains the script’s source code that will be executed. The lower section shows the result.

Test script: Runs the script as test and shows the result or an error message.

Samples: The user can choose between 3 examples for a test run. The source code of the selected example will be displayed automatically in the section Script-Editor.

Start script action: A script can be executed by means of a certain action, e.g. a button. The available actions are listed in the combo box.

Start script when validating: The script is executed whenever jBEAM is validated, e.g. when creating a new component or when input data change. This option needs the setting of input data objects by using the script.

Script configures user interface: This option is normally activated when the script controls the user interface (e.g. buttons or other graphic elements). Thus, a possible freezing of the application can be avoided. If the option is activated, the script is executed in the UI thread.
**Debug class**: Advanced function for Java developers. A project containing the Java class and using jBEAM as library is created in the development environment, e.g. Eclipse. The Java class has to implement the interface com.AMS.jBEAM.ScriptTestIF. In order to debug the script later on, jBEAM has to be executed from within the development environment (class com.AMS.jBEAM_Extern.jBMain). Then, only the class name has to be stated (without ".java") and the script can be executed.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A copy of the current Script-Editor is created and the editor dialog box is opened for the copy. The original script remains unchanged.

**Delete**: After a confirmation prompt, the map service is deleted and the dialog closed. A warning sign 🛠 in the Delete button indicates that the produced data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

💡: The context sensitive help is activated and the cursor changes to 🛠️. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.5 Menu: Services

The **Services** menu is reached via the menu bar and consists of the following sub menus:

- **System**
- **Map Services**
- **EnCom**
- **Cluster**

#### 2.5.1 System

Go to:

**Services** → **System**

Available system services are:

- **Unit Service**
- **Template Manager**
- **Text Resolver Service**
- **Menu Service**
- **Replace Data**
2.5.1.1 Unit Service

Go to:

Services

→ System

→ Unit Service

The Unit Service allows converting quantities from one unit into a compatible other unit. This service is used by different graphic element’s dialog boxes.

Example

Engine performance data were imported in units of horse power (PS) and displayed in original unit in the left graph. In the graphic object’s axis setting dialog (see below) "kw" was selected from the list of compatible units which, afterwards, was automatically displayed as the new unit (see right graph).
2.5.1.2 Template Manager

Go to:

Services
  System
  Template Manager

The Template Manager supports the integration of Graphic templates (formerly Sublayouts) and Component templates (formerly Calculation templates). Templates are used to reuse already generated components in other projects.

Graphic templates are used to store graphic elements whose specific settings and alignments are frequently used in different projects into a layout file. So, graphic templates for headers, footers, predefined texts and logos can be generated for corporation-wide use. Graphic templates are stored in the XML format with the suffix *.slf (SubLayout File).

Component Templates are used to store calculations, groups or chains of calculations as well as graphic elements, which are used with specific settings in different projects, into a template file. Component templates can be modified so that they only display certain result values of a long chain of calculations. Component templates are stored in the XML format with the suffix *.ctf (Component Template Format).

When starting jBEAM the folders defined in the Layouts field under Edit→Preferences (Tab Folder) are searched for template files. The found template files will be displayed when the Template Manager is called. All template files should always be stored in these folders so that they are automatically found. When adding a folder to the favourite list while saving a template file it will automatically be added to the list in the Preferences.
Extended dialog view

Tab Available templates
In this tab, the needed templates are selected from the available templates.

Reload templates: The template folder is searched for available templates when jBEAM is started. If templates have been changed after this, this button can be used to search the folder again.

Filter: The input field can be used to filter the templates for special characters or strings in their names.

Templates selection: By default, templates are displayed under unspecified, i.e. newly created templates automatically appear in this category. But they can also be assigned to individual categories. Generated categories are shown in the directory tree on the left. The window in the middle shows the templates contained in the selected category which can be selected.

Show: Optionally, either only Graphic templates or only Component templates may be displayed.

Remove from category: The selected template is removed from the current category. If the current category is different from unspecified, the template is shifted to unspecified. If a template is removed from unspecified, it will be deleted completely from the folder after a request when OK or Apply is clicked or a different view is selected.

Paste template into jBEAM: The selected template is pasted into the project. Several templates can be selected (keep CTRL pressed) and pasted simultaneously. For each pasted Component template, the dialog Modify component template is shown.
Templates can also be pasted via the command **Paste template into jBEAM** upon right-clicking the template or directly via Drag&Drop. **Graphic templates** can be dragged into the Graphic window, Component templates into the Graphic window or the Explorer.

Graphic templates and the graphic elements of component templates are inserted into the current Graphic window. Calculation elements of component templates are displayed in the Spreadsheet and the Explorer. Thereby, the dialog **Modify component template** opens where the input data objects can be defined.

**Update thumbnail(s):** The thumbnails can be refreshed in order to show current changes in the templates.

**Template "..." properties:** Selected properties of the selected template are displayed and can be partly edited.

⚠️ **Note:** All modifications in the properties section or shifting between categories are only saved in the respective template files when **OK** or **Apply** is pressed or a different view is selected. Then, a request dialog opens where the changes can be confirmed or dismissed.

**Simple dialog view / Extended dialog view:** This button can be used to change between the dialog views. The **Simple dialog view** is intended for users who only use existing templates without adding templates or changing their structure. The **Extended dialog view** offers additional control elements for the management of the templates in the categories and for editing properties.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

❓: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.5.1.3 Text Resolver Service

Go to:

**Services**

- System
  - Text Resolver Service

or press `<CTRL+R>`
A special feature of jBEAM is the usage of embedded formulas in input fields. The Text Resolver Service helps creating such formulas.

**Formula:** A text box for entering and displaying the formula. If the cursor is positioned within a text field when the Embedded Formula Editor is opened, the text existing there is adopted as follows: If the cursor is within a formula, the complete formula (without @) is adopted. If a part of the text is marked, only the marked part is adopted.

**Clear:** Deletes the input entered in Formula.

**Variables for the test:** Defines variables that can be filled in the formula instead of Index, CurrComponent or CurrDataItem for test runs (Test button).

**Expand...** Opens the dialog box Filtered Selector of Dataitems.

**Test:** When the button is clicked the formula is calculated using the selected variables.

**Result:** Shows the result after running a test. Incorrect formulas or indeterminate results will cause an error message.
Tab Section:
- **Dataitems**
- **Components**
- **Ops & Cons**
- **Logics**
- **Variables**
- **Arithmetic**
- **Trigonometric**
- **String**

**Paste Formula**: Pastes the formula into the text box which the cursor was in when the Embedded Formula Editor was opened. In case of text fields, the @ signs are automatically inserted.

**Copy Formula**: Copies the created formula. The formula is not inserted into a text box.

🔍: The context sensitive help is activated and the cursor changes to 🔍. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab Dataitems**

Current Dataitem (CurrDataItem): Enters the free variable of the current data item into the text box.

**Index**: Enters the free variable of the index into the text box.

**Insert function with dataitem reference**: If checked, the area Dataitem is enabled. If the functions listed below are used while this checkbox is activated, the data item selected in Dataitem is automatically integrated into the functions. The functions will then refer to this data item.
Dataitem (DataItem()): For selecting a data item from the list of available data items. In case of multidimensional data objects, the individual elements (levels, columns, rows) can be specified via the index fields behind.

[button]: Opens the dialog box Filtered Selector of Dataitems.

**Insert**: Inserts the data item selected in Dataitem into the text box.

**Property**: Selection of a property from the combo box. Properties are used by certain functions.

**TestProperty**: Selection of a test property from the combo box.

Min(A): Minimum value of a data item A.

Max(A): Maximum value of a data item A.

NatMin (Nmin(A)): Index at the minimum of the data item A.

NatMax (Nmax(A)): Index at the maximum of the data item A.

XatMin (Xmin(A)): x-value at the minimum of the data item A.

XatMax (Xmax(A)): x-value at the maximum of the data item A.

Median(A): Median of the data item A. Median is the value that is in the middle when all values are sorted according to size.

average(A): Average of the data item A.

stddev(A): Standard deviation of the data item A.

sum(A): Sum of all values of the data item A.

Date(A): Creation date of the data item A.

offsetX(A): Initial value of x of the data item A.

ΔX (deltaX(A)): Distance between the x values of the data item A.

x-Unit (xUnit(A)): x unit of the data item A.

N(A): Number of values of the data item A.

NnotNaN(A): Number of values of the data item A which are defined double values, i.e. not NaNs (Not a Number = undefined).

Unit(A): y unit of the data item A.

Name(A): Name of the data item A.

Display-Name (DisplayName(A)): Display name of the data item A.

Producer-Name (ProducerName(A)): Producer name of the data item A.

Description(A): Description of the data item A.

Property Name (PropKey(A,i)): Name of the i-th property of the data item A. The index of the property selected under Property is automatically preselected as i in the formula.

Property Value (PropValue(A,"key")): Corresponding value of the defined key of the data item A. The property selected under Property is automatically preselected as key in the formula.
**Test Property Name (TestPropKey(A,i))**: Name of the i-th test property of the data item A. The index of the test property selected under **Test Property** is automatically preselected as i in the formula.

**Test Property Value (TestPropValue(A,"key"))**: Corresponding value of the defined key of the data item A. The test property selected under **Test Property** is automatically preselected as key in the formula.

**File Name (DataImpFileName(A))**: Name of the imported file from which the data item A was generated. This function can only be used on imported files.

**File Path (DataImpFilePath(A))**: File path of the imported file from which the data item A was generated. This function can only be used on imported files.

**value(A,i)**: i-th value of the data item A. The index starts at 0. With an index i = -1, the last value of the data item is displayed.

Example: `Value(A,7)` – The 8th value of channel A is shown.

**Last value(A)**: The last value of the data item A.

**percent(A,i)**: Percentage of the i-th value of the data item A in relation to the sum of all values of the data item. The index starts at 0.

Example: `Percent(A,7)` – The percentage of the 8th value in relation to the sum of channel A.

**label(A,i)**: i-th value of an independent channel that is mostly used as string channel. This function can be used e.g. for displaying labels in a pie chart. The index starts at 0.

Example: `Label(A,7)` – The 8th value of the independent channel A.

**Map Key (MapKey(A,i))**: i-th key of a key/value data item A (map).

**Map Value (MapValue(A,"key"))**: Corresponding value of the defined key (selected under Property) of a key/value data item A (map).

**Indep. Item (IndepItem(A))**: This function enables access to the independent channel of data item A.

---

**Tab Components**

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**Current Component (CurrComponent)**: Inserts the current component into the text box.

**Component**: For selecting available components from the combo box.

**Insert**: Inserts the data item selected in Component into the text box.
**Property**: For selecting a property from a list. Properties are needed for using certain functions.

**Name (Name(Component()))**: Name of the selected component.

**File Name (DataImpFileName())**: Name of the imported file from which the selected data item was generated. This function can only be used on imported files.

**File Path (DataImpFilePath())**: File path of the imported file from which the selected data item was generated. This function can only be used on imported files.

**Property Name (PropKey(A,i))**: Name of the i-th property of the component A. The selected Component and Property are automatically preselected in the formula.

**Property Value (Prop(A,"key"))**: Corresponding value of the defined key of the component A. The selected Component and Property are automatically preselected in the formula.

**Tab Ops & Cons**

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</tbody>
</table>

**Operators**

+ : Adds two numbers or concatenates strings.

- : Subtracts numbers.

* : Multiplies numbers.

/ : Divides numbers.

^ : Exponentiates the base number.

² : Squares a number.

³ : A number is raised to the power of 3.

() : Brackets to group expressions.

= : Comparison of two terms: ‘is equal to’

≠ : Comparison of two terms: ‘is not equal to’

< : Relational operator: lesser than, compares numbers and strings

> : Relational operator: greater than, compares numbers and strings
\(|\): OR-function for two integers/Boolean expressions

\&: AND-function for two integers/Boolean expressions

**Constants**

\(\pi\) (Pi): The trigonometric constant (\(\pi=3.14159\ldots\))
\(\text{e}\): The Euler constant (\(e=2.71828\))
\(K\): Freezing temperature of water in Kelvin (273.15 K)
\(c\): Velocity of light (\(2.9979 \times 10^8\) m/s)
\(a\): Avogadro constant (\(6.0221 \times 10^{23}\) Mol)
\(\text{NaN}\): Not defined float (Not a number)
\(\text{true}\): Boolean value (true)
\(\text{false}\): Boolean value (false)

**ProjectFileName()**: The name of the project file.

**ProjectFilePath()**: The file path of the project file.

**LayoutFileName()**: The name of the used layout.

**LayoutFilePath()**: The file path of the used layout.

**jBEAM-Version** (jBEAMVersion): The current jBEAM version.

**Resolver-Version** (ResolverVersion): The current version of the formula resolver.

**Examples:**

\[@3.0 / 2 \times \pi@\]

\[@"ResolverVersion: " + ResolverVersion@\]

ResolverVersion: 1.0

**Tab Logics**

\(\text{if(b, t1, t2)}\): Evaluates a term. \(b\) is a Boolean term. If the term is true, \(t1\) is returned. If the term is false, \(t2\) is returned.

\(\text{onError(t1, t2)}\): If \(t1\) possesses an error condition, \(t2\) is returned in its stead and the error is cleared.
### Tab Variables

<table>
<thead>
<tr>
<th>Dataitems</th>
<th>Components</th>
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<tbody>
<tr>
<td><strong>Index</strong></td>
<td><strong>Current Data Item</strong></td>
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</tr>
<tr>
<td><strong>Current Component</strong></td>
<td><strong>Current Graph</strong></td>
<td><strong>Current Diagram</strong></td>
<td><strong>Input-SubIndex</strong></td>
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<tr>
<td><strong>Component</strong></td>
<td><strong>Diagram</strong></td>
<td><strong>Column</strong></td>
<td><strong>Column value</strong></td>
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<tr>
<td><strong>Date as date</strong></td>
<td><strong>Date string</strong></td>
<td><strong>Time string</strong></td>
<td><strong>Date/Time string</strong></td>
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<tr>
<td><strong>Page Number</strong></td>
<td><strong>Page Name</strong></td>
<td><strong>Number of Pages</strong></td>
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<tr>
<td><strong>Sys Prop Key</strong></td>
<td><strong>System property</strong></td>
<td><strong>GUI-Locale</strong></td>
<td><strong>Layout-Locale</strong></td>
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<tr>
<td><strong>Project filename</strong></td>
<td><strong>Project filepath</strong></td>
<td><strong>Layout filename</strong></td>
<td><strong>Layout filepath</strong></td>
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</tbody>
</table>

- **Index**: Runtime variable, e.g. for the line index in a table graph.
- **Current Data Item** (CurrDataItem): Current data item, e.g. for axis labels.
- **Current Component** (CurrComp): Current component.
- **Current Graph** (CurrGraph): Current graph.
- **Current Diagram** (CurrDiagram): Current diagram.
- **Input-SubIndex** (Subindex(,,)): Sub index of the input object.
- **Component** (Component(A)): Component A. Expects a string (the name) or a data item (a result item) A of the component.
- **Diagram** (Diagram(G, i)): i-th diagram of the curve graph G. The column index i is optional. Startindex = 0.
- **Column** (Column(G, I)): I-th column of the table graph G. Table graph G may be ommitted if formula is defined within the table graph. Column identifier I can either be the columns index or name. Startindex = 0.
- **Column value** (ColumnValue(G, I, r)): r-th value of the I-th column of the table graph G. Table graph G may be ommitted if formula is defined within the table graph. Column identifier I can either be the columns index or name. Row index r may be ommitted if formula is defined within a table column. Startindex = 0.
- **Date as date** (CurrDate): Current date and time as a date object.
- **Date string** (CurrDate$): Current date as a string.
- **Time string** (CurrTime$): Current time as a string.
- **Date/Time string** (CurrDatatime$): Current date and time as a string.
- **Page Number** (PageNumber()): Number of the page on which the graphic object is located. The argument can be a component, a graph or a diagram, e.g. "@PageNumber(CurrDiagram)@".
- **Page Name** (PageName()): Name of the page on which the graphic object is located. The argument can be a component, a graph or a diagram.
**Number of Pages** (NumberOfPages()): Total number of pages of the graphic window.

**Sys Prop Key** (GetSysPropKey(i)): Determines the i-th key of the java environment variable. If i is not defined, it is automatically set to 0.

**System property** (GetSysProp("key")): Determines the object of the key of the Java environment variable.

**GUI-Locale** (GetGuiLocale(i)): Determines the locale (language - country) of the jBEAM user interface. Entering the parameter 0 returns the short form of the description, entering 1 returns the long form. The long form is automatically displayed in the language of the layout locale.

**Layout-Locale** (GetLayoutLocale(i)): Determines the locale (language - country) of the graphic layout. For parameters see **GUI-Locale**.

**ProjectFileName()**: Name of the project file.

**ProjectFilePath()**: File path of the project file.

**LayoutFileName()**: Name of the used layout.

**LayoutFilePath()**: File path of the used layout.

The date/time strings are dependent on the current layout locale.

**Examples:**

@CurrDateTime$@ 05.07.2004 02:46 pm
@CurrTime$@ 05:46 am

Additional date/formats are available using the str() function.

@str(CurrDate, 4)@ 12:46:54
@str(CurrDate, 2)@ 5. Juli 2004

**Tab Arithmetic**

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<tbody>
<tr>
<td>ln</td>
<td>log</td>
<td>exp</td>
<td>sqrt</td>
<td>Square</td>
<td>hypot</td>
<td>mod</td>
<td>int</td>
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<td>Erf</td>
<td>InvErf</td>
<td>Gamma</td>
<td>InvGamma</td>
<td></td>
<td></td>
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</tbody>
</table>

**ln(x)**: Natural Logarithm of term x (base e).

**log(x)**: Logarithm to the base 10 of term x.

**exp(x)**: Exponential function of term x, e^x.
sqrt(x): Square root of term x, √x.

Square (sqr(x)): Square of term x, x².

hypot(x, y): Pythagoras (Hypotenuse) of terms x and y, \( \sqrt{x^2 + y^2} \).

mod(x, y): Term y modulo term y, e.g. mod(2.4, 3) = 2.4 or mod(3.4, 3) = 0.4.

int(x): Integer value of term x, e.g. int(1.4) = 1, int(1.5) = 1, int(-1.5) = -1 or int(-1.6) = -1.

round(x): Closest integer value of term x,
   e.g. round(1.3) = 1, round(1.8) = 2, round(-1.3) = -1 or round(-1.8) = -2.

ceil(x): Rounding-up function of term x,
   e.g. ceil(1.3) = 2, ceil(1.8) = 2, ceil(-1.3) = -1 or ceil(-1.8) = -1.

floor(x): Rounding-off function of term x,
   e.g. floor(1.3) = 1, floor(1.8) = 1, floor(-1.3) = -2 or floor(-1.8) = -2.

abs(x): Absolute value of term x.

Erf(x): Error function of term x.

InvErf (iErf(x)): Inverse error function of term x.

Gamma(x): Gamma function of term x.

InvGamma (iGamma(x)): Inverse Gamma function of term x.

Examples:
@sqrt(26.2)@      5.119
@str(erf(1.31), "0.0000")@   0.9361

Tab Trigonometric

sin(x): Sine function

cos(x): Cosine function

tan(x): Tangent function

asin(x): Arcsine, inverse sine function

acos(x): Arccosine, inverse cosine function

atan(x): Arctangent, inverse tangent function
atan2(x, y): Quadrant conform arctangent function atan(y/x) with x = abscissa and y = ordinate.

\( \sinh(x) \): Hyperbolic sine

\( \cosh(x) \): Hyperbolic cosine

\( \tanh(x) \): Hyperbolic tangent

\( \text{asinh}(x) \): Hyperbolic arcsine

\( \text{acosh}(x) \): Hyperbolic arccosine

\( \text{atanh}(x) \): Hyperbolic arctangent

to Degrees (toDegrees(x)): Converts radians to degrees.
to Radians (toRadians(x)): Converts degrees to radians.

Example:

@sin(toRadians(90.0))@ 1

Tab String

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>str</td>
<td>char</td>
<td>ord</td>
<td>trim</td>
<td>string to function</td>
<td></td>
<td></td>
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<tr>
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<td>length</td>
<td>substring</td>
<td>replace</td>
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<td>toLower</td>
<td>toUpper</td>
<td>escape</td>
<td>unescape</td>
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</tr>
<tr>
<td>startsWith</td>
<td>endsWith</td>
<td>contains</td>
<td>indexOf</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>lastIndexOf</td>
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</tbody>
</table>

\( \text{str}(s1, s2) \): Is used to format text. Object \( s1 \) is converted into text. Depending on the object type of \( s1 \), there are different possibilities for the (optional) parameter \( s2 \) to describe the formatting of \( s1 \). Data type of \( s1 \):

**Number (float, double, integer, long):** \( s2 \) can either be a string containing a formatting pattern or an integer as index of a preset format.

Pattern: The pattern describes the format, e.g. "#,##0.0". For further information about the pattern, see: [Float format syntax](#).

Preset format: \( s2 \) is defined as integer index with the following results:

- if \( s1 \) is of type float or double:
  - 0: Output as rounded integer (without decimal places)
  - 1: Output as standard decimal representation (e.g. 3 decimal places)
- if \( s1 \) is of type integer or long:
0: Standard representation (base 10): \texttt{str(7,0)} -> 7
1: Binary representation (base 2): \texttt{str(8,1)} -> 0b1000
2: Octal representation (base 8): \texttt{str(9,2)} -> 011
3: Hexadecimal representation (base 16): \texttt{str(10,3)} -> 0xa

**Date:** \texttt{s2} can either be a string containing a formatting pattern or an integer as index of a preset format.

Pattern: The pattern describes the date/time format, e.g. "h:mm a" results in "12:08 PM". For further information about the pattern, see: Syntax of Date Time Formats.

**Preset format:** \texttt{s2} is defined as integer index with the following results:

- 0-3: Diverse date formats (medium / long / full date)
- 4-7: Diverse time formats (short / medium / long / full time)
- 8: Combined date/time format (short date + medium time)

**Data Item:** Creates the name of the data item as string.

**Boolean:** Depending on the value, the string true or false is returned.

**char(i):** Creates a character out of Unicode, e.g. \texttt{char(0x79)} -> y

**ord(s):** Returns the position of the character in the ASCII code as a decimal value, e.g. \texttt{ord("r")} -> 114

**trim(s):** Deletes all space characters at the beginning and end of a text.

**string to function (s2f(s)):** Converts a string to a function with the same name.

**val(s):** Converts a string to a float, e.g. \texttt{val("987,98")} -> 98,798 or \texttt{val("-12.4")} -> -12.4 or \texttt{val("25.7°C")} -> -25.7

**ival(s):** Converts a string to an integer. If string \texttt{s} starts with "0x" or "#", it is interpreted as hexadecimal number (base 16, e.g. 0x1f34, 0Xab43, #7fc3), with "0o" or "O" as octal number (base 8, e.g. 0o7623), and with "0b" as binary number (base 2, e.g. 0b011010).

**length(s):** Returns the number of characters of a string.

**substring(s, a, b):** Extracts a part of string \texttt{s} starting from character \texttt{a} to character \texttt{b}. If character \texttt{b} is omitted, the end is automatically set at the end of the string.

**replace (repl(s1, s1, s2)):** Each occurrence of string \texttt{s1} in string \texttt{s} is replaced by string \texttt{s2}.

**toLower(s):** Converts string \texttt{s} to lower case.

**toUpper(s):** Converts string \texttt{s} to upper case.

**escape (esc(s)):** All special characters in string \texttt{s} are converted to their corresponding escape sequences, e.g. Tab -> /t, Enter -> /r.

**unescape (unesc(s)):** All escape sequences in string \texttt{s} are converted to their corresponding special characters, e.g. /t -> Tab, /r -> Enter.

**startsWith(s, s1):** Checks if string \texttt{s} starts with the defined string \texttt{s1}.

**endsWith(s, s1):** Checks if string \texttt{s} ends with the defined string \texttt{s1}.

**contains(s, s1):** Checks if string \texttt{s} contains the defined string \texttt{s1}.
indexOf(s, q, i): Returns the index of the first occurrence of string q in string s after position i. Parameter i may be omitted. Then the search starts at the beginning of string s. Indices are 1-based.

lastIndexOf(s, q, i): Returns the index of the last occurrence of string q in string s before position i. Parameter i may be omitted. Then the search starts at the end of string s. Indices are 1-based.

Examples:
@str(1000 * value(dataitem("HIC-36", "HIC-36-T2")), "0.0")@ ms 79.1 ms
@str(val("3.547") * 1e4, ",#0.0")@ 35,470.0

2.5.1.4 Menu Service

Go to:

Services → System → Menu Service

The component Menu Service supports an individual creation of the menu bar and tool bars.

Starting with jBEAM Version 6 an individual creation of the menu structure and the toolbars will be supported, i.e. the user can define own menu items using the component menu service. This component is accessible via Services → System → Menu Service or via Edit → Preferences (Tab Menu Settings). The Menu Service lists all available menu and tool bar entries.

If a component menu is empty, it will not be displayed in the menu bar even though it may be selected. The created menu structure is stored by default in the Preferences, but can also be saved in a separate menu definition file. If Apply or OK is clicked, the selected menu structure will be adopted in jBEAM and stored automatically to the corresponding file (Preferences or menu definition file). The next time jBEAM is started the new menu structure will be adopted.

Furthermore, predefined menu structure files can be used. They allow the usage of a well-coordinated menu structure for a prevailing type of task throughout the whole company.

Switching between the predefined menu structures can be facilitated by the menu structure switch (Predefined menu chooser) which can be included in the tool bar via the Menu Service.

The switch is inserted into the list on the right side by using the arrow button. Its position is rearranged by using the arrow buttons situated below the list. As a result, the menu structure switch with the defined menu structures is displayed in the tool bar.
If another menu structure is selected via the switch, the jBEAM user interface is immediately adjusted according to the changes.

The stored XML-code menu structure (in the jBEAM preferences or a separate definition file) can be changed manually using several applications like a simple editor. These changes will be applied as soon as jBEAM is restarted or the menu structure refreshed.

**Tab Menus and Toolbars**

On the left side the main menus and tool bars are depicted in a tree structure. If a menu or toolbar element is selected the available (middle list) and already assigned (right list) functions will be displayed. Specific entries can be searched for via the input box of the select list.

- These buttons move the selected/all functions from one list into the other.
- These buttons situated below the list are used to rearrange the order of the assigned functions in the right list: Function set at first position / one position upwards / one
position downwards / at the last position. Available functions in the left list are sorted alphabetically.

- Opens the modification dialog box of the selected menu entry depending on the type: Menu, Component group, Component menu or Component control.

- Creates a new menu item/tool bar element. The type of the new entry can be chosen from the displayed selection menu: Menu, Component group, Component menu or Component control. Menu items can be grouped by using the Separator.

- Deletes the selected function.

**Dialog Menu**

**Std./New/Delete:** These buttons are used to create language dependent menus.

**Label:** Defines the name of the menu.

**Tooltip:** A descriptive text displayed as tooltip can be entered.

**Mnemonic:** Optionally, a letter can be stated as a mnemonic. This letter is depicted underlined upon pressing <ALT> and can be used for the fast calling of the function.

**Shortcut:** Optionally, a hot key can be defined for the fast calling of the function.

**Icon:** A graphic file can be selected via a file chooser dialog box for displaying an icon.
Dialog Component Group

Component category: The select list shows the predefined component categories as well as the option **Customized** that allows changing the order of the contained components.

Available Components: The list shows all available components that are not yet contained in the selected category. Via the input field above a specific entry can be searched.

Selected Components: The list shows the components contained in the component category.

- These buttons move the selected/all functions from one list into the other.

- These buttons situated below the list are used to rearrange the order of the assigned functions in the right list: Function set at first position / one position upwards / one position downwards / at the last position.

Show "Modify" Menu: At the end of the menu the submenu **Modify** can be displayed optionally. In this category the generated data items are listed.

Customized visualisation: The settings of this section are described in the **Dialog Menu**.
Dialog Component Menu

Component type: The select list shows the predefined component types.

Customized Visualization: The settings of this section are described in the Dialog Menu.

Dialog Component Control

Component type: The select list shows the predefined component types.

Prefer customize existing component:

Customized Visualization: The settings of this section are described in the Dialog Menu.
Dialog Toolbox

The dialog box for setting the toolbox differs from the other menu entries. The contained menu entries can directly be adjusted. The left list shows all entries of the toolbox. The selected component can be adjusted in the right field, analogue to the Menu Component Group.

- \( \text{\large \text{Create}} \): Creates a new menu toolbox element in front of the marked entry respective at the end if no entry is marked.
- \( \text{\large \text{Delete}} \): Deletes the selected function.
- \( \text{\large \text{Up}} \), \( \text{\large \text{Down}} \), \( \text{\large \text{First}} \), \( \text{\large \text{Last}} \): These buttons situated below the list are used to rearrange the order of the assigned functions in the right list: Function set at first position / one position upwards / one position downwards / at the last position.

Menu definition file

Use customised menus: If checked, the menu settings can be configured individually.

jBEAM Preferences: The menu structure will be stored to the jBEAM preference file (see Preferences).

Menu Definition file: The menu structure will be stored in a separate menu definition file.

Use predefined: A predefined menu structure file can be chosen. This option also activates the menu structure switch for switching between several predefined menu structures directly in the tool bar. For this, the switch has to be included in the tool bar as described above (no factory setting).

Directory for predefined menus: Determines the folder that contains the predefined menu structure files.
Refresh: Only the separate menu definition file can be reloaded to get the stored configuration of the menu structure and to reverse current changes. If the changes are already confirmed by clicking OK, the changes are stored to the file and cannot be undone.

Factory Reset: Resets the menu structure to the original state of delivery.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.
Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Tab Keys

A couple of menu items can be opened by predefined hot keys. In this index card the hot keys of menu items can be changed manually or new hot key can be added. Via double click on the field hot key the desired hot key can be directly entered via keyboard.

If a hot key already exists for other menu items, the input field of the hot key becomes red-rimmed. In this case the input field cannot be abandoned until a valid hot key is entered or pressing <ESC>. If Escape is pressed the original value will be restored.

The listing of the menu items can be filtered. To do so, a string has to be entered in the input field Filter Name. The menu items are then searched for this string. All entries containing the string are displayed. In the input field Key hot keys can be entered for menu item search. If they are assigned to an entry, the entry will be displayed.
2.5.1.5 Replace Data

Go to:

**Services**

→ **System**

→ **Replace Data** ...

This function can also be started via menu **Graph Editor→Replace Data**.

2.5.1.6 E-Mail Server

Go to:

**Services**

→ **System**

→ **E-Mail Server**

2.5.2 Map Services

Go to:

**Services**

→ **Map Services**

Available map services are:

- **OpenStreetMap (OSM)**
- **Google**
- **HERE**
- **Bing (Microsoft)**

**Modify** lists all generated components. They can be reopened for changes.
2.5.2.1 OpenStreetMap (OSM)

Go to:

**Services**

- **Map Services**
  - **OpenStreetMap (OSM)**

The map service **OpenStreetMap (OSM)** establishes an internet connection to download maps or satellite images from the map provider OpenStreetMap (OSM). The downloaded maps can be visualized in a line chart. In combination with measured data (e.g. from trial runs) demonstrative visualisations and simulations can be created.

**Servicename**: Name of the map service as it will appear in the Explorer.

**automatic**: The component name can be created automatically. This avoids the problem that manual components are possibly not considered when a jBEAM project is opened. Then, maps may not be displayed in the diagrams.
**Servicetype**: Selection of the renderer/service.

- **Mapnik**: Fast renderer for maps.
- **user defined URL**: A specific URL may be entered for another service.

**Tab Repositories**

**RAM Map Repository**: The downloaded maps will be stored in the RAM (Cache) while running the application which improves the performance as the maps don’t have to be loaded repeatedly from the Internet.

- **# of entries**: Displays the number of stored files.
- **Clear RAM Repository**: Deletes all locally stored files in RAM.

**Harddisk Map Repository**: The downloaded maps are stored locally in the user home directory on the hard disk. Like this, the map files are also available if no internet connection is available.

- **Local copy of downloaded map images on disk**: If checked, the loaded maps are stored on the hard disk. Otherwise no copy is created and the maps are no longer available when restarting the programme and have to be loaded again.
- **Path**: A path for storing the maps is defined (e.g. the user home directory).
- **# of files**: Displays the number of stored files.
- **Delete All Files**: All locally stored files are deleted
- **Data import**: Other stored data can be optionally imported, whereas already saved files in the selected directory are overwritten. A directory or ZIP file can be imported.

**Tab Test**

The connection to the selected renderer is tested. If the connection is successful, a map section is shown. Otherwise an error message appears.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: After a confirmation prompt, the map service is deleted and the dialog closed. A warning sign ▶️ in the **Delete** button indicates that the produced data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

✨: The context sensitive help is activated and the cursor changes to ✧. The respective help topic is displayed when an area within the dialog is clicked on.
Example

Note: This service may not be free of charge. Please inquire about current licensing regulations (www.openstreetmap.com).

2.5.2.2 Google

Go to:

Services

Map Services

Google

The map service Google establishes an Internet connection to download maps or satellite images from the map provider Google Map Server.

The downloaded maps can be visualized in a line chart. In combination with measured data (e.g. from trial runs) demonstrative visualisations and simulations can be created.
**Servicename**: Name of the map service as it will appear in the Explorer. In case of **automatic** naming a suffix for the selected **Servicetype** is added to the name.

- **automatic**: The component name can be created automatically. This avoids the problem that manual components are possibly not considered when a jBEAM project is opened. Then, maps may not be displayed in the diagrams.

**Servicetype**: Selection of the renderer/service.

- **Map**: Depiction as a map. Suffix "-Map".
- **Satellite**: Depiction as a satellite photo. Suffix "-Sat".
- **Terrain**: Depiction as a relief. Suffix "-Ter".

**Tab Repositories**

**RAM Map Repository**: The downloaded maps will be stored in the RAM (Cache) while running the application which improves the performance as the maps don’t have to be loaded repeatedly from the Internet.

- **# of entries**: Displays the number of stored files.
- **Clear RAM Repository**: Deletes all locally stored files in RAM.
Tab Test

The connection to the selected renderer is tested. If the connection is successful, a map section is shown. Otherwise an error message appears.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: After a confirmation prompt, the map service is deleted and the dialog closed. A warning sign in the Delete button indicates that the produced data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Example

Note: This service may be not for free. Please inform yourself for licensing regulations (www.google.com).
2.5.2.3  HERE

Go to:

Services
  ➔ Map Services
  ➔ HERE

2.5.2.4  Bing (Microsoft)

Go to:

Services
  ➔ Map Services
  ➔ Bing (Microsoft)

The map service Bing (Microsoft) establishes an Internet connection to download maps or satellite images from the Microsoft map provider Bing. The downloaded maps can be visualized in a line chart. In combination with measured data (e.g. from trial runs) demonstrative visualisations and simulations can be created.
**Servicename:** Name of the map service as it will appear in the Explorer.

  - **automatic:** The component name can be created automatically. This avoids the problem that manual components are possibly not considered when a jBEAM project is opened. Then, maps may not be displayed in the diagrams.

**Servicetype:** Selection of the renderer/service.

  - **Streets:** Depiction as street map.

**RAM Map Repository:** The downloaded maps will be stored in the RAM (Cache) while running the application which improves the performance as the maps don’t have to be loaded repeatedly from the Internet.

  - **# of entries:** Displays the number of stored files.
  - **Clear RAM Repository:** Deletes all locally stored files in RAM.

**Harddisk Map Repository:** The downloaded maps are stored locally on hard disk. This was, the map files are available even without internet connection.

  - **Local copy of downloaded map images on disk:** If checked, the loaded maps are stored on the hard disk. Otherwise no copy is created and the maps are no longer available when restarting the programme and have to be loaded again.
  - **Path:** A path for storing the maps is defined (e.g. the user home directory).
  - **# of files:** Displays the number of already stored files.
  - **Delete All Files:** All locally stored files are deleted.

**Data import:** Other stored data can be optionally imported, whereas already saved files in the selected directory are overwritten. A directory or ZIP file can be imported.
**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: After a confirmation prompt, the map service is deleted and the dialog closed. A warning sign in the Delete button indicates that the produced data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

![Context Sensitive Help Icon](image)
: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### Example

![Universal 2D-Graph](image)

### 2.5.3 EnCom

**Go to:**

**Services**

Available services are:

- **EnCom Server**
- **EnCom Client**
2.5.3.1 EnCom Server

Go to:

Services
- EnCom
  - EnCom Server

The jBEAM EnCom Service allows the communication between distributed systems. jBEAM is able to act as a measurement data server and can provide several distributed client computers with data. Thus, with only one measurement computer several measurement problems are solved and the network can also be monitored. The communication uses TCP/IP. The interfaces are public and can be implemented even by third party programs which may act as a data source. Different use cases are distinguished.

A typical use case is a client jBEAM which receives data from a server side jBEAM which uses its import components to import data files. This data is published to registered clients so that they may subscribe to the desired data channels.

Server Name: Name of the server as it will appear on the bus.
Port: The listening port which is waiting for incoming connections from clients.
Start Server/Stop Server: Starts or stops the data server.
Current Sessions: Shows all connected sessions with IP-address and port.
Delete Sessions: All selected sessions are closed manually by the server.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.
Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?.

The respective help topic is displayed when an area within the dialog is clicked on.

2.5.3.2 EnCom Client

Go to:

Services
   ▼ EnCom
      ▼ EnCom Client

The EnCom Server in jBEAM allows the communication between distributed systems. Because of extensive interfaces the EnCom Clients are allowed to connect to the data server to fetch current channels.

A typical use case is a client jBEAM which receives data from a server side jBEAM. The data is provided by the server’s import components and then published to registered clients that can subscribe to the desired data channels.

As soon as the EnCom Client is connected to the EnCom Server it receives access to available data object and is informed about server side changes.
EnCom Client Dialog Box

Name: Name of the client as it will appear in the Explorer.

EnCom Server: IP address/server name and port for connecting to the server.

Connect/Disconnect: The connection to the server is created/separated. If the connection is established, the following message will be displayed: "successfully connected to..."

Server Items

Online items: Shows all available online items provided by the server on the dialog box’s left side. Items can be added or removed from the list of selected channels with >> or <<. Furthermore the sequence of the selected items can be changed with the help of the arrow buttons below.

Offline items: Shows all offline items, which are no longer available on the server. Items can be added or removed from the list of selected channels with >> or <<. Furthermore the sequence of the selected items can be changed with the help of the arrow buttons below.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: After a confirmation prompt, the EnCom Client is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the produced data is used by other components.
**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to `?`. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.5.4 Cluster

#### 2.5.4.1 Local Cluster Service

#### 2.5.4.2 EnCom Cluster Service

#### 2.5.4.3 EnCom Cluster Service (local)
2.6 Menu: Auto-Sequences

The menu **Auto-Sequences** summarizes functions for automated processing and contains the following submenus:

- **Multi-File Imports**: Automated loading of a selection of files including data analysis.
- **Test Sequence**
- **Protocol Generators**
- **Actions**

2.6.1 Multi-File Imports

Go to:

Auto-Sequences

→ Multi-File Imports

The submenu contains:

- **File Watcher**
- **Statistic of Multiple Files**
- **UIC Section Analysis (Beam-Files)**
- **Vienna-MA29 Ramming Analysis**
- **Bosch Chart Commander**
- **Splitting Tool**

**Modify** lists all generated imports. They can be reopened for changes.

2.6.1.1 File Watcher

Go to:

Auto-Sequences

→ Multi-File Imports

→ File Watcher

The function **File Watcher** supports the automatic monitoring of import data. Defined conditions control the automatic refreshing and the immediate, interactive evaluation. The user can choose between the following monitoring conditions:

- Load at every check
• Changed filesize
• Same file name, newer modify time
• filename counted up, newer modify time
• Any data file with newer modify time
• Any data file with newer modify time from now

As soon as the data of the monitored object changes, different actions can be carried out automatically, e.g. the PDF export of the Graphic windows, the storing of the project with the new data or the printing via default printer.

All monitored files have to be stored in the same folder, i.e. changed files are only searched in the same folder as the originally imported file.

Currently, the following imports are supported as monitoring objects:

• ASAM-ATF
• ASCII
• BEAM
• MS Excel
• Famos
• Gantner-UDB
• Gidas
• MDF
• Patools
• Porsche PD5
• QDAS
**Watcher Name:** Name of the result data object as it will be displayed in the lists.

**Result:** Two result data objects are generated. The time channel (suffix "-T") stores the time of the event. The string channel (suffix "-C") stores the name of the new file.

**Reset Ereignisse:** The data already stored in the result data objects are deleted.

**Watch Item:** Selection of the data object (import) that is to be monitored from a list of available imports.

**Check every:** Defines the time interval that validates the watch item.

**Watch mode:**
- **Load at every check:** The monitored file is newly read in accordance with the defined time interval.
Example: The time interval is set to 60 seconds, i.e. after one minute an update is always carried out even if the monitored file did not change.

Changed filesize: Monitoring of the file size. As soon as the file size of the monitored file changes an update is carried out.

Same filename, newer modify time: If the date of the import file changes (newer date) an update is carried out.

Filename counted up, newer modify time: As soon as a new file is available in the folder that has the same base file name but a newer date an update is carried out.

Example: File of the monitored import: BeamTest.bsr [date:01.08.2012]; New: BeamTest1.bsr [date:02.08.2012])

Any data file with newer modify time: As soon as a file is available in the folder that has a newer date as the monitored object an update is carried out (independent from the file name).

Example: File of the monitored import: Beam.bsr [date:01.08.2012]; New: BeamTest1.bsr [date:02.08.2012])

Any data file with newer modify time from now: Like Any data file with newer modify time but only new files from the the starting time onwards are considered.

Example: The monitored import uses Beam.bsr [date:01.08.2012]. The folder also contains Test.bsr [date:03.08.2012] and BeamData.bsr [date:05.08.2012]. The monitoring is started on 04.08.2012. Even though Test.bsr is newer only BeamData.bsr is used because it was created after the starting time.

Actions:

PDF Report: After an update of the import, the content of the graphic windows is automatically exported to a PDF document.

Standard export directory: The created PDF files are stored in the standard export folder which is defined in the Preferences.

Import data directory: The created PDF files are stored in the folder of the imported data.

Use import file name: The name of the imported file is used as name of the result files.

File name from formula: A formula resolved at runtime or a manually entered text can be used as file name.

Save project: After an update of the import, the current project is automatically saved with the new data, either in the Standard Export directory or in the Import data directory.

Print: After an update of the import, the content of the graphic windows is automatically printed on the printer defined as standard printer.

Open Editor action: The modification dialog of the File Watcher can be opened directly via the button in the graphic window. This enables the modification of the File Watcher out of an existing layout, e.g. when the graphic window is set to the maximum size or only a jBEAM Viewer version is used where no functions are available via Toolbar or Explorer.

Formula Editor: Opens the Embedded Formula Editor.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The file watcher is deleted and the dialog closed. A warning sign⚠️ in the Delete button indicates that the produced data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

❓: The context sensitive help is activated and the cursor changes to❓. The respective help topic is displayed when an area within the dialog is clicked on.

Example: Several tests are carried out at an engine test bench and the data are recorded using BEAM. As soon as the BEAM data is stored and the file watcher of the corresponding import is enabled in jBEAM, the interactive evaluation of the data is immediately carried out.

2.6.1.2 Statistic of Multiple Files

Go to:

Auto-Sequences
  ➔ Multi-File Imports
  ➔ Statistic of Multiple Files

The Statistic of Multiple Files supports the automatic loading of multiple import files with subsequent definable actions, such as PDF export, printing of the graphic pages or execution of a script.

It is possible to define several importer types each with an individual file list and reference configuration which are executed in a common import cycle.

Import files of the same data type are imported subsequently. The settings of the reference import are also applied to the files that follow. No new producer is generated, the existing import is merely modified (exchange of the result data objects of the import).

As the initial importer is modified with each step, differences in the importer settings may occur during execution of the Multi File Import due to e.g. missing channels in one of the import files. When those changes are applied continuously to the next import (old behaviour), once missing channels are omitted from then on even if they exist in the following files. In order to avoid this, a configurated reference setting can be stored in the Multi File Import which is referenced to without changes in each step. Channels predefined in the reference setting but missing in a single file are recorded in a separate result channel.

After each step, several actions can be carried out, e.g. the export of the Graphic windows’ content to a PDF document, the storage of a project file with the data of the respective import or a printout.

The Statistic of Multiple Files generates a multi-action data object StatCtrl which provides the control events TRIGGER and CLEAR. They can be used by calculations to execute defined actions. For instance, data of consecutive tests can be concatenated.
Name: Name of the result component as it will be displayed in the Explorer or the lists. A time channel ("Time") containing the start times of the files and a string channel ("Filename") containing the imported file names are generated as result data objects. Furthermore, action and command items are generated which can control other components on the one hand, and which can be used by other components to control the Multi File Import itself on the other hand.

Importer Section: Several different importers can be selected in individual tabs which shall be executed in the Multi File Import. Thus, it is possible to synchronously import in one cycle measured data coming from different systems with different data formats. The file selection is configured separately for each importer type.

A new tab shall be created for each importer type. For this, the + sign behind the last tab can be used. An existing tab can be deleted via the - sign.

File Importer: Selection of an importer from the list of available, i.e. previously generated importers. The settings of the importer on the basis of a reference file are used as model for further imports of the same data format.

Files: The list shows the currently selected files that will be imported.

File Options: The files for the import can be selected via the following options. The selected option is applied to all importer types, except the option manually.

  all files in folder: All files in the selected folder are selected.

  from importer: The folder of the reference importer is selected.
manually: The folder can be selected manually via the Select directory button. In contrast to the other options, this selection is importer-specific, i.e. the folder is stored individually for each importer type (tab).

include subdirectories: All files of the selected folder as well as its subfolders are selected.

manually selected files: The files to be imported are selected manually. The file selection itself is stored importer-specific. However, the files must be selected manually for each importer type (tab).

Set files: Files can be selected in the dialog box for opening files that are subsequently taken over to the list of files to be imported. All files selected so far are deleted from the list.

Add files: Adds the selected files from the Open dialog box to the already existing list. Double selections are ignored.

Remove selected files: Deletes the selected files from the list.

General Options:

When an importer’s configuration changes: The Multi File Import checks whether the importer configuration has changed whenever it is started or on each loading of a new file from the list or with each single step. For this, the reference importer configuration stored in the Multi File Import is compared with the current configuration in the actual importer. If a difference is detected, e.g. because a channel is missing in the current import file, the following options decide how the Multi File Import continues.

use new configuration: The changed settings of the current importer are stored as new reference configuration in the Multi File Import without further queries. From then on, this configuration is the new stored configuration and is used in the next comparison.

keep stored configuration: The reference importer configuration once stored in the Multi File Import is maintained without further queries, regardless of any changes in the importer’s settings. Thus, in each step, i.e. each check, the same importer configuration is applied. This is useful e.g. to avoid that an incomplete channel list is used as reference. If then a channel listed in the reference list is not found in the file, this is recorded in the result channel "Missing Channels".

notify me: Whenever a change has been detected, a request appears whether the new configuration shall be used or not.

use current importer configurations: This button can be used to explicitly store a changed importer configuration as new stored configuration (reference configuration) for the further processing of the Multi File Import. This change is executed once with the
current settings of the importer. In connection e.g. with the option **keep stored configuration**, this configuration is maintained despite of any new changes of the importer.

**Filename w/o Suffix**: Saves the names of the imported files to the result channel "Filename" without ending.

**Single Step Mode**: When the import cycle is processed, only one file of the list or lists at a time is imported and the respective actions executed. After this, the import cycle stops until a button to succeed is pressed. Then the next file from the list is imported.

**Actions**

- **after each file**: The selected actions are executed after each imported file.
- **once, after last file**: The selected actions are only executed after the last imported file.
- **Execute script**: A previously created script is executed at the selected time. The selection list shows all available scripts.
- **Save project**: At the selected time, a jBEAM project file is saved. The jBEAM project file receives the name of the imported file.
- **Standard export directory**: The generated jBEAM project files are stored in the default export folder that is defined in the preferences.
- **Import data directory**: The generated jBEAM project files are stored in the folder of the imported data.
- **PDF report**: At the selected time, the contents of the Graphic windows are exported to a PDF document. The PDF file receives the name of the imported file.
- **Standard export directory**: The generated PDF files are stored in the default export folder that is defined in the preferences.
- **Import data directory**: The generated PDF files are stored in the folder of the imported data.
- **Print**: At the selected time, the contents of the Graphic windows are printed on the printer set as default printer.
- **Data Export**: At the selected time, the data of the project are exported according to the settings of a previously configurated exporter. The selection list shows all available exporters.

The following actions **Reset Statistic**, **Reset & Import**, **Import All Files** and **Cancel Import** can be triggered by the buttons in this dialog on the one hand, but also via action events on the other hand. These action events are selected via selection lists behind the buttons. Thus, e.g. several Multi File Imports can be started by only one click on an action button.
Corresponding commands to be used by the command buttons are provided as command items. The command buttons can be generated via menu (Graph Editor→Controls→Command button), but also per Drag & Drop directly out of the Explorer into the Graphic Window. In the latter case, the automatically generated command buttons are predefined with the respective commands.

The commands are only visible in the Explorer if the respective option is selected in the Explorer tool bar configuration (symbol):

- **Reset statistic**: Deletes all messages from the window Messages. The result data objects Time and Filename are emptied.

  The component triggers via Multi-Action result data object StatCtrl the control event CLEAR. All calculations using this control event execute the actions defined for it. For instance, the calculation Concatenate Items of Tests can empty its result data objects via this event.

- **Reset & Import**: The same actions as with Reset statistic are carried out. Additionally, the import cycle is started.

- **Import All Files / Import Next File**: The import cycle is started. In case of Single Step Mode this button imports the next file each time.

  The order of the processing is as follows: In the first step, all first files from the lists of the individual importer types are loaded. Then the actions if defined are carried out. In the second step, all second files are loaded, and so on. If files are missing in one of the importer types, the defined actions are not executed.

  In case of automatic generation of the file lists, e.g. if all files of a folder are selected or with multi-file selection, the files are imported in the order given by the operating system (e.g. meas9.mdf prior to meas10.mdf).

  With each new import file, the component triggers via Multi-Action result data object StatCtrl the control event TRIGGER. All calculations using this control event execute the actions defined for it. For instance, the calculation Concatenate Items of Tests can add the data of the current import file to its result data objects via this event.

- **Cancel Import**: The import cycle is terminated at the next possible time.

- **Messages**: Shows the status messages of the executed actions.

- **OK**: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Delete: The statistic of multi files is deleted and the dialog closed. A warning sign in the Delete button indicates that the produced data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Result Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Time&quot;</td>
<td>DateTimeChannel</td>
<td>Channel with the start times of each new import</td>
</tr>
<tr>
<td>&quot;Filename&quot;</td>
<td>StringChannel</td>
<td>Channel with the names of the imported files</td>
</tr>
<tr>
<td>&quot;Missing Channels&quot;</td>
<td>StringChannel</td>
<td>Channel with the names of the channels not found in the respective file</td>
</tr>
<tr>
<td>&quot;StatCtrl&quot;</td>
<td>jbMultiActionEventObject</td>
<td>Multi-Action result data object with the control events TRIGGER and CLEAR</td>
</tr>
<tr>
<td>&quot;Reset statistic&quot;</td>
<td>CommandItem</td>
<td>Command data item for Reset</td>
</tr>
<tr>
<td>&quot;Reset &amp; Import&quot;</td>
<td>CommandItem</td>
<td>Command data item for Reset &amp; Import</td>
</tr>
<tr>
<td>&quot;Import all&quot;</td>
<td>CommandItem</td>
<td>Command data item for Import of all files</td>
</tr>
<tr>
<td>&quot;Cancel Import&quot;</td>
<td>CommandItem</td>
<td>Command data item for cancelling the import</td>
</tr>
</tbody>
</table>

### 2.6.1.3 UIC Section Analysis (Beam-Files)

Go to:

Auto-Sequences

Multi-File Imports

UIC Section Analysis (Beam-Files)

The measurement files created by the data collection software BEAM of up to 5 trial runs are consecutively loaded and analysed. This automated sequence is used for evaluating the driving safety and the vehicle performance of railway vehicles.
2.6.1.4 Vienna-MA29 Ramming Analysis

Go to:

Auto-Sequences
Multi-File Imports
Vienna-MA29 Ramming Analysis

The measurement files created by the data collection software BEAM containing oscillation data of a measurement period are automatically imported and displayed sorted by measurement points.

2.6.1.5 Bosch Chart Commander

Go to:

Auto-Sequences
Multi-File Imports
Bosch Chart Commander

2.6.1.6 Splitting Tool

Go to:

Auto-Sequences
Multi-File Imports
Splitting Tool

The Splitting Tool enables the splitting of complex files of measured values into individual files according to various criteria.
**Importer:** Selection of an importer from the list of available importers. Via the Load button the respective importer dialog opens where the file to be split can be selected. Several settings can be done, e.g. selection of individual channels. The selected import file is displayed in the field below.

**X-Channel:** Selection of a channel as X-channel from the list.

**Split channels:** Selection of one or more channels (up to 4 channels) which provide the values for the splitting criteria. For each combination of different values from the split channels a separate result file is created.

**Test name:** Any name can be defined for the result files. By default the name of the import file is preset. This name receives a suffix with the respective value combination of the split channels as well as the corresponding values of the additional channels.

**Export directory:** Selection of a directory where the result files shall be stored.

**Export formats:** Selection of one or more of the listed export formats.

**Additional channels:** Selection of one or more channels (up to 4 channels) which provide additional information. For each combination of the values from the split channels the corresponding values of the additional channels are added to the names of the result files. Only the value of the first occurrence of the value combination is used as suffix.
Keep editor opened after execution: If several splits shall be executed subsequently, the editor can be kept open by activating this option.

save configuration: The settings of this dialog can be saved in a configuration file. The file receives the extension *.stc (Splitting Tool Configuration).

load configuration: Previously saved settings can be loaded from a configuration file (*.stc).

Start: The splitting process is started. The exporter dialog of the selected export format opens and settings can be made. The left list shows all internal channels (original, sorted and all splits). The left list contains the selected channels which will be stored in the result files. By default all channels of the first split are preselected. The selection can be adapted to the individual requirements and is then adopted for all other splits. Therefore, only channels of the first split should be selected in the dialog.

Apply: The settings are applied, but the splitting process is not yet started.

Cancel: The dialog is closed and the settings are dismissed.

Example: The data file Measurement1 shall be splitted according to two split channels. Splitchannel1 contains the values A and B; Splitchannel2 contains the values 1 and 2, each in random sequence. Out of these settings 4 result files are created. The names are formed as follows: Measurement1_A_1 + Measurement1_A_2 + Measurement1_B_1 + Measurement1_B_2. The file Measurement1_A_1 contains all values of the selected channels where Splitchannel1 has the value A and Splitchannel2 has the value 1 etc.

2.6.2  Test Sequence

Go to:

Auto-Sequences

→ Test Sequence

The submenu contains:

- RTG-Heat Exchanger Test
- SimaticS7 Configurator
- Flender 430kW Configurator
- Siemens Series Production Configurator
- Siemens Spur Geared Drive Test Configurator
- Ford Wind Tunnel Sequence
2.6.2.1 RTG-Heat Exchanger Test

Go to:

Auto-Sequences
  ➔ Test Sequence
    ➔ RTG-Heat Exchanger Test

2.6.2.2 SimaticS7 Configurator

Go to:

Auto-Sequences
  ➔ Test Sequence
    ➔ SimaticS7 Configurator

2.6.2.3 Flender 430kW Configurator

Go to:

Auto-Sequences
  ➔ Test Sequence
    ➔ Flender 430kW Configurator

2.6.2.4 Siemens Series Production Configurator

Go to:

Auto-Sequences
  ➔ Test Sequence
    ➔ Siemens Series Production Configurator

2.6.2.5  Siemens Spur Geared Drive Test Configurator

Go to:
Auto-Sequences
  ➔ Test Sequence
  ➔ Siemens Spur Geared Drive Test Configurator

2.6.2.6  Ford Wind Tunnel Sequence

Go to:
Auto-Sequences
  ➔ Test Sequence
  ➔ Ford Wind Tunnel Sequence

2.6.3  Protocol Generators

Go to:
Auto-Sequences
  ➔ Protocol Generators

The submenu contains:
- NCAP Toolbox
- Numeric Crash Analysis
- UIC
- Quickview of Tests
- Valve Gear Analysis
- Batch Report
- Bosch Sequence Wizard
- jBEAM Project Analyzer
- Fleet Analysis
Modify lists all generated protocols. They can be reopened for changes.

2.6.3.1 NCAP Toolbox

Go to:
Auto-Sequences
  ↓ Protocol Generators
  ↓ NCAP Toolbox

2.6.3.2 Numeric Crash Analysis

Go to:
Auto-Sequences
  ↓ Protocol Generators
  ↓ Numeric Crash Analysis

The Numeric Crash Analysis generates a report for the crash analysis. An already executed calculation of the crash analysis is used.

2.6.3.3 UIC

Go to:
Auto-Sequences
  ↓ Protocol Generators
  ↓ UIC

2.6.3.4 Quickview of Tests

Go to:
Auto-Sequences
  ↓ Protocol Generators
  ↓ Quickview of Tests
With **Quickview of Tests** (Speedchart), tests can be generated by the user beforehand by using the needed channels (values to be depicted) and the corresponding calculations. Alternatively, they can be directly generated and modified from this interface as well.

**Name of quickview:** Determines the component’s name.

**Name of project:** This name can be used later in the layout as title.

**Selected layout:** Selection of a layout. The dialog box for the selecting a layout field is opened via the **Select** button. Some conditions are bound to the layout: it needs to contain two template graphs that can be used as a base for the generation of all graphs.

**Table Section:**
- **Tab Tests**
- **Tab Calculations**
- **Tab Abscissa**
- **Table Ordinate**

The tabs and the table **Ordinates** situated below are separated by a splitter (a movable separation bar). This allows the shifting of usable areas against each other. The splitter has two functions. By using the 2 black arrows one part respectively is hidden completely. If only the ratio has to be changed the splitter is moved by dragging with the mouse. Determined limits are not underrun so that both parts remain visible.
Information Line

In order to generate the diagrammes some entries need to be already made in the dialog box. The information line is depicted in yellow if all the conditions are fulfilled. If a condition is missing it will be stated in the information line depicted red. At the same time the buttons OK and Apply are deactivated.

The conditions are that

- At least one valid test is enabled,
- One layout is selected,
- At least one generic job is defined in the abscissa table and
- At least one x-axis is determined.

Load / Save: Via these buttons the settings of the abscissa and ordinate table as well as the calculation table can be saved and loaded independently from the component and the rest of jBEAM. The files are saved in XML format. The remaining settings, e.g. of the tests and their coloring are not saved as well.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open. All pages are deleted and newly built with the new data.

Both buttons are disabled if not all data is gathered. Which data is missing can be seen in the help text of both buttons (appears whenever the mouse pointer hovers over the button). At the same time the help line displayed above refers to the missing data.

Cancel: The dialog is closed and changes are dismissed.

Tab Tests

If the tab is enabled, tests become visible in the table. All tests that are needed in connection with the generation of diagrammes are gathered in this table. Up to 6 tests can be recorded. Next to the selection of the tests the color of the curve can be set.
Active: If tests are selected, they can (temporarily) be deactivated so that they are not considered when generating the evaluation. The field can only be modified if a test is selected.

Importer: If three dashes are displayed in the combo box, no importer is selected. The selection of the importer is done via a combo box that lists all importers that are currently registered on the CEA bus. The options Active and Color can only be changed if an importer is selected.

All importers created via Import Values are permitted. They are changed in the same menu via Modify. A meaningful naming is especially helpful here.

Modify Importer: The configuration dialog box of the currently selected importer is opened.

Open Importer: The dialog box Selecting the trial file is opened. By pressing Apply the selection is completed and the corresponding importer is automatically selected and generated as new component. The selected file is handed over to the importer and the configuration dialog box of the importer is opened. Depending on the importer specific settings can be captured now. If the dialog box is completed with OK, the new importer is entered in the combo box and selected.

Color: The dialog box for selecting a new color is opened. The color of the curve displayed in the chart later is determined. The field can only be modified if a test is selected. Whether the curve is drawn with markers and whether these markers have the same color as the lines is determined in the layout of the templates.
The buttons **Load** and **Save** leave all settings in the table **Tests** disregarded. In contrast to this when selecting **Save Project** the settings of the table **Test** are stored from the menu **File** and read again when loaded.

**Tab Calculations**

All calculations that can be used in relation with the creation of the diagrammes are captured in this table. Up to 50 calculations can be captured. Next to the selection of the calculation a unit and formula is visible and may be modified.

![Calculation Table](image)

**Calculations:** The calculations of the type **Formula Editor for Numeric Channels (Line by Line)** that are available in jBEAM are listed in a combo box in this column and may be selected. If no calculation is selected, three dashes are displayed in the combo box. Independently from this, the unit and formula can be entered in the other columns.

- **Modify Calculation:** This button is only visible, if a calculation is already selected. The **Modification** dialog box of the calculation is displayed.

- **New Calculation:** A new calculation is generated. If there already are entries in the lines (e.g. unit or formula), these information are attempted to be integrated into the new calculation. This is especially important if a calculation is externally (the dialog box is closed) deleted by mistake. As all important data are still stored in the component the calculation can be reconstructed.

**Unit:** A unit has to be stated for each calculation if it is to be displayed in the chart. The unit is determined independently of the input channels and their units. Determining the unit is the user’s task, no automatic conversion is done.
Example: Channel A = 5 km; Channel B = 3 cm. The calculation using the formula \(<A+B>\) is a purely mathematical calculation and, with the result unit \([m]\), would result in 8 m. The correct result of 5000.03 m is only attained if the formula looks as follows: \(<A*1000 + B/100>\).

**Formula:** The column displays the formula contained in the calculation with the replaced channel name. At the same time, the formula can be edited in this column. If the button for new calculations is displayed in the column **Calculation**, even complete calculations can be inserted in this column.

In contrast to the Formula Editor the formulas used in the table are not addressed by the letters A to J but by the channel names. The channel names are separated from the rest of the formula by inverted commas. Sometimes the producer is also stated in this depiction, before the channel name and separated by the character #. This is only used for the calculation’s output if the channel is not available.

The formula may start with an equals sign =. If the formula cannot be resolved, an **Error code** beginning with >> is put in front. It is checked, whether the number of inverted commas for the marking of the channels and calculations is adequate and whether the number of channels exceed the maximum. The processing of the actual formula is checked as well. If errors occur, again an Error code beginning with >> is put in front. The error has to be corrected by the user in order to parse the formula again. For this reason it is recommended to change the formula only via [Modify Calculation].

If errors occur in the formula (marked by >>), the erroneous formula is not passed on. That means, the characters >> for marking errors have to be considered coercively!

When entering a formula of a **new calculation** the following syntax has to be considered:

The name of the new calculation is determined at the beginning. Inverted commas “” are not allowed in the name. All restrictions in terms of naming in jBEAM have to be followed. If the name already exists in the system, the name is supplemented with ~ and a running number.

The unit can be entered after the name. It is marked by square brackets. If square brackets are also used in the calculation’s name, a unit has to be entered as the last pair of brackets is interpreted as unit.

An equals sign = follows the unit in order to separate the actual formula. Then the formula is captured. All references to other channels or calculations withing the formula are to be marked coercively with inverted commas “”.

The entry is parsed upon completing the entry with <ENTER>. The new calculation is generated and the parsed information is transferred. The new calculation is entered as a choice in the column **Calculation**.

**Example:** INDVERB [ml] = (“Verbrauch01” + „Verbrauch02“)/2 -> The name of the calculation is <INDVERB>. The unit is <ml>. Channel A is <DataSourceTrial#Verbrauch01> if no calculation with the name <Verbrauch01> exists. Channel B is <DataSourceTrial#Verbrauch02> if no calculation with the name <Verbrauch02> exists. The internal formula of the calculation is <(A+B)/2>.
The Usage of Calculations

The option has to be enabled in the column **Using Formula** of the ordinate table in order to recognize the entry as calculation in the **Ordinate Table**. If enabled, the **Measurement channel name** of the first column is interpreted as label of the calculation. Else, the **Measurement channel name** is tried to be retrieved as channel of an importer.

Only calculations created via the **Formula Editor for Numeric Channels (Line by Line)** are allowed. They can be changed, for example, via the menu **Math → Modify**. A meaningful naming is especially helpful here.

All captured calculations are considered in the configuration via the buttons **Load** and **Save**.

Tab Abscissa

This table manages all abscissas that are hold available for the generation of x-axes in charts. Direct insertion and deletion is not possible in this table. This is done indirectly via the table **Ordinate** and its column **active as x-axis**.

Each entry of the **Abscissa** table is assigned to an entry of the **Ordinate** table. The measurement channel name and the calculation options of both entries are identical whereby they can be identified.

Both columns **Measurement channel name** and **Using formula** in the **Abscissa** table are closed against changes. Modifications have to be carried out in the **Ordinate** table. All other columns of the **Abscissa** table can be freely edited.

If an entry is deleted from the **Ordinate** table, the entry is automatically deleted from the **Abscissa** table as well. But if a new row is inserted into the **Ordinate** table, no entry is automatically created in the **Abscissa** table. Only when the column **active as x-axis** in the **Ordinate** table is enabled, a corresponding row is created in the **Abscissa** table. If the checkmark is removed, the corresponding row in the **Abscissa** table is deleted.
Measurement channel name Abscissa: This column displays the name determined in the Ordinate table. Changes are only possible via the Ordinate table. If multiple abscissa of the same name (with different prescaling) are to be generated, the respective number of rows has to be created in the Ordinate table.

Using formula: For this column the information is taken over from the Ordinate table as well. They can only be edited there. This option determines whether the channel is an importer channel (deselected) or whether the data is a result of a calculation (selected).

Display name in the graph: From this column onwards all columns can be edited independently from the Ordinate table. When generating the rows information is taken from the Ordinate table but that information can be edited and changed (in contrast to the before mentioned columns). Using the display name offers the possibility to create a more readable name for the depiction in charts in contrast to the often rather cryptic measurement channel names.

Prescaling: These four columns determine the scaling of the x-axis. They may differ from the settings in the Ordinate table.

Default x-axis: Determines which entry of the Abscissa table is used as x-axis for the generation of all charts through a 1-out of-n-selection. 1-out of-n-selection means that among all entries only one of them needs to be enabled.

All settings of the table Abscissa are considered in the configuration by the buttons Load and Save.
Tab Ordinate

This table manages all ordinates that are hold available for the generation of y-axes in charts. Every entry will later be “one” chart containing curves of all active tests. By using specific statements in the column Position it is possible to read two rows from the table and summarise them in a chart. In this case one y-axis per row will be created.

Measurement channel name: The channel names (values) that are later to be displayed at the y-axis are entered manually in this column. Changes of names may also affect entries of the Abscissa table. The name does not have to be distinct in this table. Multiple entries can have the same name. This may be necessary in case several prescalings are needed in the Abscissa table.

Using formula: This column determines whether the channel is an importer channel (deselected) or whether the data is a result of a calculation (selected). This is the only possibility for depicting the results of calculations in a chart.

The setting of this column is automatically applied to respective row of the Abscissa table.

Display name in the graph: Using the display name offers the possibility to create a more readable name for the depiction in charts in constrast to the often rather cryptic measurement channel names. Changes in the Ordinate table don’t influence the setting of the display names in the Abscissa table.

Prescaling: These four columns determine the scaling of the y-axis. These settings are independent from the settings of the Abscissa table. These values are only considered for the creation of the charts if no automatic scaling is enabled.

Minimum and maximum equal the lower and upper value of the axis. The major ticks define after how many units the axis receives a deviation with labeling. The minor ticks have to be a whole-number factor of the major ticks.
**Active as x-axis:** If enabled (checkmark is set), a corresponding row is generated in the Abscissa table. If the checkmark is removed, the corresponding row is deleted.

**Auto scale:** If the automatic scaling is enabled, the prescaling is invalidated. The axis’ scaling is determined according to the minimum and maximum value of the curve to be depicted.

The following three columns influence the determination of these values. The generated values are not depicted in the table; they are used directly for the generation of the chart later on.

**Same scaling:** A grouping name is given in this column that can be used in one or more other rows as well. The previous column **Auto scale** will change the meaning of the interpretation of this column.

If the column **Auto scale** is not enabled, the minimum and maximum value of the channel defined in this row (see **Measurement channel name**) are disregarded at the calculation. Yet, the result of the calculation is nevertheless adopted for this channel. That means that there is only writing access.

If, on the other hand, the column **Auto scale** is enabled, the individual values of minimum and maximum of all assigned channels/values are incorporated in the calculation. The results are then also adopted for this channel.

The calculation determines the smallest respective largest value of all minima and maxima taken into account and returns them as result. Like this, different curves can be synchronised according to their axis scaling.

**Min-Y delta:** This value is only used with the automatic axis scaling. The value determined here is always positive. The stated value defines the minimum difference between the minimum and maximum of the axis. This ensures that the zoom will not be too detailed with automatical scaling. In case this value is considered in the calculation because the difference between minimum and maximum is too small, only the maximum is accordingly corrected.

**Min-Y at 0:** The range determined for the axis with the automatical scaling is adjusted here once more. If a “P” was entered, only a negative minimum is set to 0. Thus, negative values or partial curves are excluded from the depiction. If a “0” was entered, the minimum is always set to 0. Hence, the display range always starts at 0.

**Page / Position:** These two rows define the page on which the evaluation appears. Furthermore, the chart in which the data is to be displayed is determined. The panel format is used so that four charts can be positioned on the left as well as right side. The count starts at 1 at the top left position and proceeds to the right side. The count continues below on the left side with 3 etc.

Additionally to the position labelling via numbers (1..8) a letter a (for left y-axis) and b (for right y-axis) can supplement the statement.

Up to 8 graphs can be located per page. 1, 2, 4, 6 and 8 is possible. Using 1, the graph covers the whole space. Using 2, one graph is placed on the upper half, the other on the lower half. From 3 onwards (position 4 is missing) two graphs are placed next to each other. If 2 successive graphs are missing, the following positions are respectively moved forward by two positions.

*Example:* The positions 1, 4, 5 and 8 are defined. Then 4 graphs are placed at the positions 1, 2, 3 and 4.
**Insert row**: This button inserts a row directly after the selected row into the **Ordinate** table.

**Append row**: This button appends a row at the end of the table **Ordinate**.

In both cases data from the currently selected row is adopted and partly changed. The position is incremented and the entry **active as x-axis** is disabled.

**Delete without ask**: If enabled, no security dialog will be displayed when deleting a row. If disabled, the adjacent dialog box has to be confirmed.

**Delete row**: This button is only available if a row is selected. Depending on the option set in **Delete without ask** the row is deleted immediately or after confirmation of the security dialog box.

---

**Automatic Filling of the Ordinate Table**

**Initialize from Excel**: After pressing this button the dialog box for selecting an Excel table opens. Here, an Excel table is selected which contains Speed Chart configurations. A plausibility check of the file’s data structure is not done. Therefore, necessary requirements of the file are:

- A worksheet with the name „Einstellungen“ has to exist.
- This sheet is searched for entries from the lines 10 to 400.
- The columns 1 to 12 are evaluated.
- Name: If column 1 does not contain a name, the line is ignored.
- Prescaling: The columns 2 to 5 have to contain numeric values.
- Axis reference & AutoScale: Column 6 and 7 are TRUE if they contain something and FALSE if they are empty.
- Group names: Column 8 contains texts
- Min. y-Scale: Column 9 contains numeric values. If no value is stated, it results in NaN (Not a Number). This may lead to errors in the further processing.
- Min. y-value: Colume 10 contains „P“ or „0“ (the number zero) or is empty.
- Page: Column 11 contains whole-number numbers. If an entry is missing, it will become page 0.
- Position: Column 12 contains a whole-number number. The letter “a” or “b” can be directly attached to it (without space character). Capitalisation does not matter in this case.

Other information is not read from the file. Please note concerning the reading speed that *.xlsm needs 4 times the expenditure of time in contrast to *.xls. Therefore, it is recommended to save *.xlsm files as *.xls files with the data format “Excel97-2003...” in Excel via <Menu/File/Save as> first and then to read them in. This may be blocked by Excel if there are still existing charts. In this case, the worksheet “Evaluation” has to be deleted first.
For all read entries in the Ordinate table having a marked “x-axis reference”, Abscissa table entries will be created automatically.

**Initialize from tests:** This button offers another possibility to initialise the Ordinate table. All active tests are iterated and the channels present in all tests are determined. Only those channels are then inserted into the table after emptying the table content. If no tests are defined, the depicted message is displayed.

It may occur that no common channels are available. In this case the table is only emptied. This will be pointed out to the user who can then decide whether he wants this or not.

Therefore, it may be reasonable to activate only one test before pressing the button and to activate all tests that are to be considered in the evaluation afterwards again.

When filling the Ordinate table, all channels are scanned and the optimised minima and maxima are entered into the prescaling. For this, it is necessary that all channel of the importer are set to <complete>. With other settings like <standby> or <start> the extreme values of the channel cannot be determined exactly. On basis of the entered minima and maxima the major and minor ticks are calculated. The individual generic jobs are set to automatic scaling. The minimum scaling range of the y-axis is calculated once on basis of the entered major tick. It creates half of the major tick. The minimum y-value is set fixedly to “P”. The pages are filled with up to 8 charts. Only charts with one axis are used thereby.

In addition to the Ordinate table the Abscissa table is also emptied. The Abscissa table is only filled with channels that are recognised as time channels.

All settings of the table **Ordinate** are considered in the configuration by the buttons **Load** and **Save**.

### 2.6.3.5 Valve Gear Analysis

Go to:

**Auto-Sequences**

- Protocol Generators

**Valve Gear Analysis**

![Image of Auto-Sequences and Protocol Generators]

![Image of Valve Gear Analysis]
2.6.3.6 Batch Report

Go to:

Auto-Sequences
  → Protocol Generators
    → Batch Report

The Batch Report offers a simple possibility to generate complex graphic and ASCII reports by using different templates, data sources and selection files. The basis for generating the reports are the templates that are worked off one after the other and filled with the data of the data sources (one or several at a time) and the filters of the selection files (one or several at a time) that are used on them.

2.6.3.7 Bosch Sequence Wizard

Go to:

Auto-Sequences
  → Protocol Generators
    → Bosch Sequence Wizard
2.6.3.8  jBEAM Project Analyzer

Go to:

Auto-Sequences
Protocol Generators
jBEAM Project Analyzer

The function jBEAM Project Analyzer allows examining a project regarding its load and save time, the up-to-dateness of the templates, errors in the project (e.g. components with errors, circular dependencies) and many more.

The jBEAM Project Analyzer is started either directly from jBEAM or via the command line as a standalone tool. The project to be tested and the desired analyses are selected via the dialog or via command line parameters. Afterwards the results can be displayed in a new window and serve as starting point for adjustments of corresponding components and data objects.

Starting the jBEAM Project Analyzer from jBEAM

Select analysis tasks to be performed: The desired analyses can be selected individually or all at once by activating or deactivating the respective checkboxes. The analysis of the Load time is not possible when the analysis is started from jBEAM because all components (including
the analysis itself) have to be deleted and the project started again in order to determine the load time. For this, the **jBEAM Project Analyzer** can be started as autonomous application or in batch mode.

**Start:** The analysis starts with the current settings. Depending on the project's complexity this may take some seconds.

**Stop:** The analysis is terminated without result.

**Show evaluation:** The results of the analysis are displayed in a separate window. The results can be viewed in detail by opening the nodes in the Explorer list.

**OK:** The settings are saved and the dialog is closed without an analysis.

**Cancel:** The dialog is closed and the settings are dismissed.

**Start of the jBEAM Project Analyzer as autonomous application**

The jBEAM Project Analyzer as autonomous application **with graphical user interface** is started via command line as follows:

```
> java -cp <jbeam.jar> com.AMS.jBEAM.ProjectAnalyzerTool
```

`${<jbeam.jar>}` designates the path to a jBEAM jar file.

The dialog of the **jBEAM Project Analyzer** opens.
Selected Project: In the input field, name and path of the project file to be analysed is entered. The file can also be selected via the Select button.

Select analysis tasks to be performed: The desired analyses can be selected individually or all at once by activating or deactivating the respective checkboxes.

Start: The analysis starts with the current settings. Depending on the project’s complexity this may take some seconds.

Stop: The analysis is terminated without result.

Show evaluation: After the completed analysis, the results are displayed in a separate window. The results can be viewed in detail by opening the nodes in the Explorer list.

Load: A previously generated project analysis file (*.xml) can be loaded.

Save: The current analysis results can be saved in a project analysis file (*.xml).
In case of faulty project files (FileParseException), the Project Analyzer shows an error text of the affected component in the Load Time. This way, the component can be corrected if necessary when the project is opened afterwards.

**Start of the jBEAM Project Analyzer in Batch Mode**

For the analysis of jBEAM projects in **Batch Mode (without graphical user interface)**, project file, analyses to be executed and output file have to be added as parameters.

```bash
> java -cp <jbeam.jar> com.AMS.jBEAM.ProjectAnalyzerTool
   -projectFile=<jBEAM Projektdatei>
   -taskTypes=<TaskTyp,TaskTyp,...>
   -out=<Ausgabedatei>
```

**Beschreibung der Parameter des Batch-Modus**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Beschreibung</th>
<th>Beispiel</th>
</tr>
</thead>
<tbody>
<tr>
<td>projectFile</td>
<td>Path to jBEAM project file to be analysed</td>
<td>-projectFile=&quot;Test 1.jbs&quot;</td>
</tr>
<tr>
<td>taskTypes</td>
<td>Comma-separated list of analyses to be executed</td>
<td>-taskTypes=UnresolvedInputItems,UnusedComponents</td>
</tr>
<tr>
<td></td>
<td>(without spaces). The parameter names of the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>analyses are listed in the right column of the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>List of analyses.</td>
<td></td>
</tr>
<tr>
<td>out</td>
<td>Output file of the jBEAM Project Analyzer</td>
<td>-out=Result1.xml</td>
</tr>
</tbody>
</table>

**Example:**

```bash
> java -cp jbeam-standard.jar com.AMS.jBEAM.ProjectAnalyzerTool
   -projectFile="Test 1.jbs"
   -taskTypes=UnresolvedInputItems,UnusedComponents,CircularDependencies
   -out=Result.xml
```
The jBEAM project “Test 1.jbs” is analysed. It is tested regarding Unresolved Input Items, Unused Component) and Circular Dependencies. The results are written to the file „Result.xml“.

In order to visualise the results, start the Project Analyzer with graphical user interface (see above) and load the file „Result.xml“.

### Analyses of the jBEAM Project Analyzer

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Description</th>
<th>Parameter name of the analysis for Batch mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unresolved Input Data Items</td>
<td>Determines all components with input data objects which cannot be resolved in the jBEAM project.</td>
<td>UnresolvedInputItems</td>
</tr>
<tr>
<td>Unresolved input components</td>
<td>Determines all components with input components which cannot be resolved.</td>
<td>UnresolvedInputComponents</td>
</tr>
<tr>
<td>Unused Result Data Items</td>
<td>Determines all data objects which are not used as input data object by any components or forulas.</td>
<td>UnusedDataItems</td>
</tr>
<tr>
<td>Unused Components</td>
<td>Determines all calculations and graphic components the result objects of which are not used or which do not have subcomponents used by other components.</td>
<td>UnusedComponents</td>
</tr>
<tr>
<td>Result data items with errors</td>
<td>Determines all result data objects with errors.</td>
<td>DataItemsWithErrors</td>
</tr>
<tr>
<td>Components with errors</td>
<td>Determines all components with errors.</td>
<td>ComponentsWithErrors</td>
</tr>
<tr>
<td>Template Test</td>
<td>Determines whether the project template or the used components or graphic templates are up-to-date with the referenced template files. If the stored path to the template file does not exist any more a warning is given.</td>
<td>LayoutTest</td>
</tr>
<tr>
<td>Circular Dependencies of Components</td>
<td>Determines all components which are part of a circular dependency in the jBEAM project. A dependency is given in case of a Consumer-Producer relation or when a component is input component of another component.</td>
<td>CircularDependencies</td>
</tr>
<tr>
<td>Validation time</td>
<td>Determines the time a component needs for validation. For this, all components are invalidated first, and</td>
<td>ValidationTime</td>
</tr>
</tbody>
</table>
2.6.3.9 Fleet Analysis

Go to:

Auto-Sequences
  → Protocol Generators
  → Fleet Analysis

2.6.4 Actions

Go to:

Auto-Sequences
  → Actions

The submenu Actions contains automated process sequences, which analyse and display complete crash analysis data (numerical and video data).

The submenu contains:

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Description</th>
<th>Parameter name of the analysis for Batch mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load time</td>
<td>Determines the time needed to load a component.</td>
<td>LoadTime</td>
</tr>
<tr>
<td>Save time</td>
<td>Determines the time needed to save a component.</td>
<td>SaveTime</td>
</tr>
</tbody>
</table>

then a framework validation is triggered. If the component is validated several times during the framework validation, the times are added.
• **Change Creation Time**
• **Video Crash Analysis**
• **Numerical Crash Analysis**

Modify lists all generated actions. They can be reopened for changes.

### 2.6.4.1 Change Creation Time

Go to:

**Auto-Sequences**

**Actions**

**Change Creation Time**

Changes date and time of a data object.

![Modify Creation Time dialog](image)

**Dataobject**: Combo box with a list of available data objects that can be selected and whose creation time is to be changed.

**Old Date/Time**: Shows the currently saved creation time of the data object.

**New Date/Time**: To manually change the creation time of the data object.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.6.4.2 Video Crash Analysis

Go to:

**Auto-Sequences** → **Actions** → **Video Crash Analysis**

Facilitates the synchronous depiction of numerical data and video data of a crash test.

2.6.4.3 Numerical Crash Analysis

Go to:

**Auto-Sequences** → **Actions** → **Numerical Crash Analysis**

The **Numerical Crash Analysis** generates a complete numeric crash analysis starting from the import (mme files) and the analysis (calculation) of crash test data to their visualisation.
2.7 Menu: Math

The **Math** menu collects available calculation and analysis functionalities. The menu content varies depending on the jBEAM version and loaded external components.

The menu consists of the following sub menus:

- Arithmetic
- Curve Calculations
- Curve Analysis
- Vibration Analysis (FFT)
- Signal Filters
- Data Filters
- Statistic
- Counting Procedures
- Conversions
- Geodesy
- Stress Analysis
- Characteristic Maps
- Data mining
- Safety – Motor Vehicles
- Safety – Railway Vehicles

**Modify** lists all generated calculations. They can be reopened for changes.

Alternatively the **Math** menu can be access by pressing `<ALT+B>`. 
2.7.1 Arithmetic

Go to:

**Math**

- Arithmetic

The menu item consists of the following sub menu items:

- [Formula Editor for numeric Objects](#)
- [Formula Editor for numeric Channels (Line by Line)](#)
- [Formula Editor with Text Resolver](#)
- Integration/Differentiation
- Bit Arithmetic
- Coordinate Transformation
- Pythagoras
- PID-Controller
- X-Values
- Matlab Wrapper
- Inline Java-Function
- Inline Java-Class

### 2.7.1.1 Formula Editor for Numeric Objects

Go to:

**Math**

- Arithmetic

The **Formula Editor for Numeric Objects** (formerly: Object Formula Editor) allows the creation of a mathematical formula that calculates a new data object out of up to 10 numeric data objects. Like the [Formula Editor for Numeric Channels (Line by Line)](#) also the **Formula Editor for Numeric Objects** processes a variety of input data object types, e.g. values, channels, matrices or channel groups. However, the type of the result data object is determined flexibly according
to the types of the input data objects as well as the kind of calculation. For example, a calculation with single values creates a single value as result, the calculation of the minimum of a channel creates a single value, or the calculation of the average of a matrix creates a channel.

Combined formulas, such as Min(A+1) or Min(abs(A)), are applicable in the Formula Editor for Numeric Objects as the calculation is not strictly carried out by columns and indices but uses temporary channel-like structures.

The formula may contain the following elements (see description under Tab Functions):

- **Variables**: Index
- **Constants**: Pi, e, k, c, a, NaN, ∞
- **Brackets**: (), [], {}  
- **Arithmetic operators**: +, -, *, /, ^, x², x³
- **Boolean operators**: <, >, ≤, ≥, ≠, &, |
- **Arithmetic functions**: ln(), log(), exp(), root(), mod(), remainder(), abs(), int(), round(), hypot()
- **Trigonometric functions**: sin(), cos(), tan(), asin(), acos(), atan(), atan2(), sinh(), cosh(), tanh(), asinh(), acosh(), atanh(), rad(), deg()
- **Statistical functions**: min(), max(), Nmin(), Nmax(), Span(), Sum(), Median(), average (), stddev(), both related to rows and to data objects
- **Data object functions**: value(), offsetX(), ΔX(), N(), LastVal(), NnotNaN(), NatOver(), NatLower(), if()
- **Conversions**: M:Transpose(), Concat(), toBaseUnit(), toUnit()
Result Data: Name of data object as it will appear in the Explorer.

Unit: Optionally, a unit can be assigned to the new data object.

- **no**: The values are calculated regardless of the units of the input values. The result data object has no unit.

- **auto**: The unit of the result data object is automatically determined out of the input data if possible. For this, the generic unit service is used to run the calculation unit-conform. Compatible units are then converted to the unit of the first operand.

With several operations, such as plus, minus or tan2(), compatible units are needed. If this is not the case, the result object contains NaN-values and the error "Units are not compatible ...". If one operand has no unit, the unit of the other operand is adopted.

When units are calculated it is distinguished between an operand without unit ("NULL") or with an empty unit (" "). If an operand has no unit, the result is calculated unit-independently and receives the unit of the other operand. If an operand has an empty unit, this is regarded as compatible unit with most calculations.

The units "%" and "‰" are special cases: Fraction references like "A*3%" are regarded as a unit.

**Examples:**

\[ 1 \ " \ + \ 1 \ % = 1.01 \]

\[ 400 \ N \ * \ 1 \ \% = 4 \ N \]
The values are calculated regardless of the units of the input values. The result data object receives the manually entered unit.

**convert**: This option works analog to auto but finally converts the result to the defined unit if possible. This means, the values are calculated in consideration of the units of the input data. The result is converted to the target unit provided that the units of the input data objects are compatible among themselves and with the manual unit. Otherwise the result returns an error.

**Input Data A...J**: Select input data from a combo box containing all available data objects.

The radio buttons in front of the input data can be used to define the activated channel as independent channel for the result data object (otherwise the x-parameters Xoff, Xdelta and Xunit of the first input channel are used for the result).

**Formula**: Input field for entering and displaying the formula. The formula can be entered manually or by using the buttons below. In order to facilitate the input of nested formulas, corresponding sets of brackets are highlighted.

**Check**: Tests consistency of the entered formula. This test is run automatically if OK or Apply is pressed. If Check is pressed, the entered formula is checked. If the formula is syntactically incorrect, an error message is displayed and the mistake is marked in the formula.

**Calculation mode**: In calculations with several channels as input objects it is tested immediately whether all input channels have the same x-base. If this is the case, the selection item **Index-based** is displayed blue. However, if there are differences in the x-bases of the input channels, the selection item **Index-based** is displayed red together with additional information.

In case of equal x-bases, the index-based mode is the first choice as it is faster and resampling is unnecessary. In case of unequal x-bases, it can be decided whether resampling is carried out, depending on the use case. In some cases, it might be not necessary to resample despite of different x-bases. With the formula "A + B – Max(C)", C can have a different x-base to A and B without having any effect on the result. In this case only the maximum of C is included in the calculation, the x-values itselfes are uninteresting.

**Index-based**: The calculation is carried out index by index. No resampling is carried out.

**X-based**: For the calculation, a resampling is carried out. The first operand always constitutes the x-base and the second operand is resampled to the x-base of the first operand. The result data object therefore receives the x-base of the first operand. This is the same with complex arithmetic. There, the resampling is carried out step by step for each operation.
Example: With the formula "A + B + C" the first step is to calculate "B + C" (R1) and the second step is "A + R1". In both cases "B + C" and "A + R1" the result has the x-base of the first operand, i.e. R1 has the x-base of B and the total result has the x-base of A.

The choice of the order of the operands therefore determines whether it is upsampled or downsampled. With the special case "A – A + B", the value sequence of B based on the x-base of A is the result.

The resampling is carried out according to different methods depending on the data type:

**Bit channels**: The method **Sample-Hold** is applied for the resampling, i.e. there is no interpolation carried out, but the respective value is held until the original value changes.

**Other channels** (Double, Float, Integer, Long): The method **AutoAverageLinear** is applied for the resampling. Depending on how many old values lie within the respective new x-interval, either the average is calculated (N > 2) or a linear interpolation is carried out.

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**Tab Section:**
- **Functions**
- **Description**
- **Names in grouped result object**

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ⚠ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

???: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

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**Tab Functions**

The tab offers a list of mathematical functions and constants. Clicking on a button will transfer the corresponding function into the formula.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>The value’s index; first value = 1, second value = 2, ...</td>
</tr>
<tr>
<td>π (Pi)</td>
<td>Pi constant π=3.14159...</td>
</tr>
<tr>
<td>e</td>
<td>Euler constant e=2.71828.... (base of the natural logarithm and exponential function)</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>k</td>
<td>Boltzmann’s constant $k = 1.380 \times 10^{-23} \text{ J/K}$</td>
</tr>
<tr>
<td>K</td>
<td>Freezing temperature of water in Kelvin $K = 273.15$ (iso unit)</td>
</tr>
<tr>
<td>c</td>
<td>Velocity of light $c = 2.9979 \times 10^8 \text{ m/s}$</td>
</tr>
<tr>
<td>a</td>
<td>Avogadro constant $a = 6.0221 \times 10^{23} \text{ Mol}$</td>
</tr>
<tr>
<td>NaN</td>
<td>Constant “Not a number”</td>
</tr>
<tr>
<td>∞</td>
<td>Constant for infinite</td>
</tr>
<tr>
<td>{...}</td>
<td>Defines a new (internal) channel with double values. Example: <code>{1.4; 3.64; 8.1}</code></td>
</tr>
</tbody>
</table>
| cplxVal(A;B) | Defines a new complex value or channel, with A as real part and B as imaginary part. With unequal channels as input, the result channel has the length of the shorter channel. Surplus values of the other channel are ignored.  
Example:  
cplxVal(1.4; 3.64) generates a complex value  
cplxVal({1.4; 3.6; 5.7};{1.2; 2.4; 3.1}) generates a complex channel  
cplxVal(A; B) with A and B channels generates a complex channel  
cplxVal(A; B) with A channel and B value generates a complex channel  
cplxVal(A; B) with A and B values generates a complex value |
| ()    | Brackets to group expressions |
| +     | Addition of two terms, e.g. $(A + 2)$ or $(A + B)$ |
| -     | Subtraction of two terms |
| *     | Multiplication of two terms |
| /     | Division of two terms |
| ^     | Exponentiation: $x^y$ raises the term $x$ to the power of term $y$.  
Examples:  
$A^2$ (the values of data object $A$ are raised to the power of 2)  
$2^3 = 8$  
$2.34^{(2,23)} = 2,84535$  
$2.34^{(1,23)} = 0,35145$ |
<p>| &lt;     | Relational operator: less than |
| &gt;     | Relational operator: greater than |
| ≤     | Relational operator: less than or equal |
| ≥     | Relational operator: greater than or equal |
| ≠     | Comparison of two terms: not equal |
| $x^2$ | Squares $x$ |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x^3$</td>
<td>$x$ is raised to the power of $3$</td>
</tr>
<tr>
<td>$\ln(x)$</td>
<td>The Natural Logarithm (base $e$) of $x$</td>
</tr>
<tr>
<td>$\log(x)$</td>
<td>Logarithm to the base $10$ of $x$</td>
</tr>
<tr>
<td>$\exp(x)$</td>
<td>Exponential function, matches $e^x$</td>
</tr>
<tr>
<td>sqrt($x$; $y$)</td>
<td>Square root of $x$. The optional parameter $y$ states whether the result is a complex data object. The following options are applicable:</td>
</tr>
<tr>
<td></td>
<td>For single values and channels:</td>
</tr>
<tr>
<td></td>
<td>sqrt($x$) and sqrt($x$;0) generates a double data object</td>
</tr>
<tr>
<td></td>
<td>sqrt($x$;1) generates a complex data object</td>
</tr>
<tr>
<td></td>
<td>For single values only:</td>
</tr>
<tr>
<td></td>
<td>sqrt($x$;2) generates a double value for $x \geq 0.0$</td>
</tr>
<tr>
<td></td>
<td>generates a complex value for $x &lt; 0.0$</td>
</tr>
<tr>
<td>mod($x$; $y$)</td>
<td>Modulo operation: The value of term $x$ modulo $y$. Examples: mod(2.4; 3) = 2.4  mod(3.4; 3) = 0.4</td>
</tr>
<tr>
<td>remainder($x$; $y$)</td>
<td>The remainder of term $x$ in reference to $y$. The remainder equals mathematically $x - y \times n$, with $n$ being the closest integer to the exact quotient of $x/y$. Examples: remainder(-4.4; 3) = -1.4  remainder(-2.4; 3) = 0.6  remainder(2.4; 3) = -0.6  remainder(4.4; 3) = 1.4</td>
</tr>
<tr>
<td>abs($x$)</td>
<td>The absolute (i.e. unsigned) value of term $x$.</td>
</tr>
<tr>
<td>int($x$)</td>
<td>Converts a double value into an integer value by cutting decimals of term $x$.</td>
</tr>
<tr>
<td>round($x$; $y$)</td>
<td>Rounds the value of $x$. An optional second parameter $y$ defines the number of decimal points to be rounded to. In case of negative $y$, the digits before the point are rounded (ten, hundred, ...) Examples: round(1.3) = 1  round(1.438; 2) = 1.44  round(1.8) = 2  round(1.8; 0) = 2  round(-1.3) = -1  round(1354; -2) = 1400  round(-1.8) = -2</td>
</tr>
<tr>
<td>hypot($x$; $y$)</td>
<td>Calculates the Pythagoras (hypotenuse) of the terms $x$ and $y$: $\sqrt{(x^2 + y^2)}$.</td>
</tr>
<tr>
<td>replNaN0($A$)</td>
<td>If the term $A$ has the value NaN, it is replaced by 0.</td>
</tr>
<tr>
<td>replNaN1($A$)</td>
<td>If the term $A$ has the value NaN, it is replaced by 1.</td>
</tr>
<tr>
<td>$\sin(x)$</td>
<td>The Sine function, $x$ is to be entered in degrees or as $(x \times 180 / \Pi)$</td>
</tr>
<tr>
<td>$\cos(x)$</td>
<td>The Cosine function</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tan(x)</td>
<td>The Tangent function</td>
</tr>
<tr>
<td>asin(x), acos(x), atan(x)</td>
<td>The inverse Sine, Cosine und Tangent functions</td>
</tr>
<tr>
<td>atan2(x; y)</td>
<td>Since the inverse tangent function does not have an unequivocal relation to a quadrant, this function might be used. x is the x-coordinate, y the y-coordinate. It calculates the inverse tangent (y/x) and corrects the quadrant relations.</td>
</tr>
<tr>
<td>to Radians</td>
<td>rad(x): Conversion of degrees ° to radians, e.g. rad(180) = 3,14..</td>
</tr>
<tr>
<td>to Degrees</td>
<td>deg(x): Conversion of radians to degrees °</td>
</tr>
<tr>
<td>sinh(x), cosh(x), tanh(x)</td>
<td>The hyperbolic functions of Sine, Cosine und Tangent</td>
</tr>
<tr>
<td>asinh(), acosh(), atanh()</td>
<td>The inverse hyperbolic functions of Sine, Cosine und Tangent</td>
</tr>
<tr>
<td>M: Transpose</td>
<td>MT(A): Transposing of rectangular matrices, but also channels or groups of values. If A is a channel, a single-row matrix is created. If A is a group of values, a channel is created.</td>
</tr>
<tr>
<td>Concat(x[;y;…])</td>
<td>Concatenation of constants and function results (single values and channels) to one channel</td>
</tr>
<tr>
<td>toBaseUnit(x)</td>
<td>Conversion of values to the base unit, e.g. toBaseUnit(36 km/h) = 10 m/s</td>
</tr>
<tr>
<td>toUnit(A;B[;C])</td>
<td>Conversion of values to a new (compatible) unit. Examples: toUnit(A;B) The values of A are converted to the unit of B toUnit(A;0g) The values of A are converted to the unit &quot;g&quot; toUnit(A;&quot;g&quot;) The values of A are converted to the unit &quot;g&quot;</td>
</tr>
<tr>
<td></td>
<td>The optional parameter C is a Boolean value: true: Forces a conversion. If units are not compatible the result will have an error. false: If the units are not compatible, input values and units are not changed.</td>
</tr>
<tr>
<td>if(x;y;z)</td>
<td>If the first term x is true, the second term y is the result. Else, the third term z is the result, e.g. if(A&lt;B;B;A). If the first term is a bit channel, the function is executed for each value of the channel.</td>
</tr>
<tr>
<td>Row: Min</td>
<td>MinOfRow(A;B;C;…): Minimum of the selected data objects per row</td>
</tr>
<tr>
<td>Row: Max</td>
<td>MaxOfRow(A;B;C;…): Maximum of the selected data objects per row</td>
</tr>
<tr>
<td>Row: Span</td>
<td>SpanOfRow(A;B;C;…): Span of the selected data objects per row</td>
</tr>
<tr>
<td>Row: Sum</td>
<td>SumOfRow(A;B;C;…): Sum of the selected data objects per row</td>
</tr>
<tr>
<td>Row: Median</td>
<td>MedOfRow(A;B;C;…): Median of the selected data objects per row (Median = value that is in the middle when all values are sorted according to size)</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Row: Average</strong></td>
<td>AveOfRow(A;B;C;...): Average of the selected data objects per row</td>
</tr>
<tr>
<td><strong>Row: Std.Dev</strong></td>
<td>StDevOfRow(A;B;C;...): Standard deviation of the selected data objects per row</td>
</tr>
<tr>
<td>min(A)</td>
<td>Minimum of data object A *1</td>
</tr>
<tr>
<td>max(A)</td>
<td>Maximum of data object A *1</td>
</tr>
<tr>
<td>NatMin</td>
<td>Nmin(A): The index of the minimum of data object A *1</td>
</tr>
<tr>
<td>NatMax</td>
<td>Nmax(A): The index of the maximum of data object A *1</td>
</tr>
<tr>
<td>Median</td>
<td>Med(A): Median of the selected data object (Median = value that is in the middle when all values are sorted according to size)</td>
</tr>
<tr>
<td>average(A)</td>
<td>Average of the data object A *1</td>
</tr>
<tr>
<td>stddev(A)</td>
<td>Standard deviation of the data object A</td>
</tr>
<tr>
<td>sum(A)</td>
<td>Sums up all values of data object A *1</td>
</tr>
<tr>
<td><strong>value(A; x [,y])</strong></td>
<td>The value of the data object A at the index determined by the term x. If the data object is a matrix or a group of channels, a third argument y can be defined to execute cuts in horizontal (y = 0) or vertical (y = 1) direction. The index starts at 1. Examples: value(A; 1): the first value of data object A. A - value(A; 1): subtracts the first value of all values of the data object A. value(A; Nmax(B)): determines the value of data object A at the position of data object B’s maximum. With groups of channels: value(A; 7) or value(A; 7; 0): the 7th values of all channels of the channel group A. value(A; 7; 1): the 7th channel of the channel group A. value(A; B): If B is an integer channel, it is regarded as a channel of indices to be applied on channel group A. If B is a double channel, it is regarded as a channel of X-values. With matrices: value(A; 7; 0): the values of the 7th row of the matrix A. value(A; 7) or value(A; 7; 1): the values of the 7th column of the matrix A.</td>
</tr>
<tr>
<td>offsetX(A[, dim])</td>
<td>X-Offset of data object A. If A is a group of channels or a matrix, a group of values or a channel of the individual offsets is created instead of a single value. If the input data object is a matrix, the optional parameter dim may define the dimension for which the offset values shall be calculated. By default, dim=0, i.e. offsetX(A;0) = offsetX(A).</td>
</tr>
<tr>
<td>ΔX(A)</td>
<td>Delta X of data object A</td>
</tr>
<tr>
<td>N(A)</td>
<td>The number of values of data object A *1. If A is a Group of Channels, a Group of Values is generated.</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>LastVal(A)</td>
<td>The last value of data object A</td>
</tr>
<tr>
<td>NnotNaN</td>
<td>The number of values of data object A that are not NaN</td>
</tr>
</tbody>
</table>
| NatOver(A;x;[k])              | Returns the index of the first value of data object A that is greater than or equal to x.  
If A is a Group of Channels and term x a channel, each value of this channel is regarded as trigger value for the corresponding channel of the group. 
The optional parameter k defines a start index or start x-value for the search. If k is an integer value, it is used as start index. Otherwise, it is used as x-value. Start index = 1. |
| NatLower(A;x;[k])             | Returns the index of the first value of data object A that is less than or equal to x. Further conditions as for NatOver(). |
| Match(C, v, mode)             | Returns the index of the first matching value of channel C in case a match was found; NaN otherwise. The matching itself depends on the selected mode. If no mode is selected, it will default to 1. 
Mode: 
1: Returns the index of the greatest value in channel C which is less than or equal to v. If C is not monotonously rising, the search is limited to its initial, monotonously rising part. 
0: Returns the index of the first exact match in the channel C. Values in the channel may be in any order. 
-1: Returns the index of the smallest value in channel C which is greater than or equal to v. If C is not monotonously falling, the search is limited to its initial, monotonously falling part. 
Startindex = 1. |

*1 If the inputs of statistical functions (Min(), Max(), Sum(), N(), ...) are Groups of Values, they calculate a single value over the whole group instead of applying the function to each of the grouped values and generating a Group of Values as result.

**Tab Description**

A detailed description (e.g. purpose, usage) of the generated formula can be entered into the text box of the Description tab for other users.
Tab Names in grouped result object

In calculations with channel groups or matrices, explicit names can be defined for the channels of the result channel group.

**Grouped result object suffix:** The defined suffix is applied in all patterns that contain the suffix.

**Set pattern for Channel Names in Result Group:** The result channel names can be generated via preset options or manual definition.

**Preset Options:**
- **Calculation Name**
- **Calculation Name + Used Channels**
- **Calculation Name + Suffix**
- **Calculation Name + Used Channels + Suffix**

**Channel name from input:** A channel of the set input data can be selected the name of which shall be used for the result objects.

**User Defined:** A formula for the generation of channel names can be entered in the input field. The buttons below can be used to insert useful elements.

**Check Formula:** The syntax of the entered formula is checked.

**CalcName:** Inserts the name of the calculation into the pattern. All channels contain the name of the calculation.

**Suffix:** Inserts the suffix into the pattern. Each channel name is appended with this suffix.

**Used Channels (ListOfArgs):** Inserts the arguments of the calculation into the pattern. Each channel name contains the names of the input channels used in the calculation \((X,Y,Z,\ldots)\).

**ChannelName() (ChannelName(inputPort)):** Inserts the channel names into the pattern. The name of the input channel is adopted for the name of the result channel. (Indexing starts with 0)
Substring() (Substring("str"; start; end)): Inserts a part of the string "str" into the pattern. The part string is generated starting at "start" up to "end"-1. Each channel receives this part string.

Length () (Length("str")): Returns the length of the string "str".

Preview: The result of the entered formula is displayed.

Example

In the xy-Graph (below) the result of the formula \((A + B) / 2\) as well as the input data are displayed. The input data objects were generated via Extra \(\rightarrow\) Generators \(\rightarrow\) Numeric Channel – DatGen as Sine function, DatGen2 as random generator.

![xy-Graph](image)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>All numeric data object types (single value, channel, matrix); no character/string data objects</td>
<td></td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
</tbody>
</table>

2.7.1.2 Formula Editor for Numeric Channels (Line by Line)

Go to:

Math
- Arithmetic
- Formula Editor for Numeric Channels (Line by Line)
The **Formula Editor for Numeric Channels (Line by Line)** (formerly: Formula Editor) allows the creation of a mathematical formula that calculates a new data object out of up to 10 numeric data objects. The calculation is carried out channel by channel and index-based. Even matrices can be used as input data objects. In this case the calculation order is column by column. The result of the calculation is a double channel in case of channels or values as input objects, respectively a matrix or channel group with matrices or channel groups as input objects.

⚠️ In case of statistical calculations only input data objects (A .. J) are allowed as arguments, e.g. Min(A). Combined formulas, such as Min(A+1) or Min(abs(A)), do not produce useful results as with the given index-wise calculation the result of the enclosed formula is not yet known at the time of calculation. For such calculations, the **Formula Editor for Numeric Objects** can be used which has a different calculation principle.

An important feature of the **Formula Editor for Numeric Channels (Line by Line)** is that it can be used for real-time calculation. During a running measurement, for example, the new measured values are appended to a channel. In the subsequent calculation only the new values are calculated.

The formula may contain the following elements (see description under **Tab Functions**):

- Variables: Index
- Constants: Pi, e, k, K, c, a, NaN, ∞
- Brackets: (), [], {}
- Arithmetic operators: +, -, *, /, ^, x², x³
- Boolean operators: <, >, ≤, ≥, ≠, &, |
- Arithmetic functions: ln(), log(), exp(), root(), mod(), remainder(), abs(), hypot()
- Trigonometric functions: sin(), cos(), tan(), asin(), acos(), atan(), atan2(), sinh(), cosh(), tanh(), asinh(), acosh(), atanh()
- Statistical functions: min(), max(), Nmin(), Nmax(), span(), sum(), average(), stddev(), both related to rows and to data objects
- Data object functions: value(), offsetX(), ΔX(), N(), LastVal(), NnotNaN(), if()
**Result Data:** Name of component and data object as it will appear in the Explorer.

**Unit:** Optionally, a unit can be assigned to the new data object.

- **no:** The values are calculated without consideration of the units of the input objects. The result data object has no unit.
- **auto:** The unit of the result data object is automatically adopted from the first input data object (A).
- **manu:** The values are calculated without consideration of the units of the input objects. The result data object receives the manually entered unit.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.
**View:** Different views for filtering display values can be generated via View-Selection-Manager. View 0 is always available and usually does not contain any filters. The display of the view selection can be enabled or disabled via Preferences→Dialogs.

[button]: This button opens the View-Selection-Manager in which definitions of views can be directly entered.

**Apply to:** If the option importer channels is selected, the selected view is applied to data objects that originate from an importer component (e.g., Import Values). This way the multiple application of a view to a data object is prevented. If all channels are selected, the selected view is applied to all data objects.

**Input Data A...J:** Select input data from combo box. If multidimensional data objects are selected, a sub matrix can be defined in the numeric fields.

<table>
<thead>
<tr>
<th>Input Data:</th>
<th>A: [DbMat[]]</th>
<th>B: [DbMat[]]</th>
</tr>
</thead>
<tbody>
<tr>
<td>C: [DbMat[]]</td>
<td>D: [--]</td>
<td></td>
</tr>
</tbody>
</table>

**Formula:** Input field for entering and displaying the formula. The formula can be entered manually or by using the buttons with preset functions below. In order to facilitate the input of nested formulas, corresponding sets of brackets are highlighted.

**Check:** Tests the consistency of the entered formula. This test is run automatically if OK or Apply is pressed. If Check is pressed, the entered formula is checked. If the formula is syntactically incorrect, an error message is displayed and the mistake is marked in the formula.

**Tab Section:**
- Functions
- Description

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

[button]: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
Tab Functions
The tab offers a list of mathematical functions and constants. Clicking on a button will transfer the corresponding function into the formula.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>The value’s index; first value = 1, second value = 2, ...</td>
</tr>
<tr>
<td>π (Pi)</td>
<td>Pi constant π=3.14159...</td>
</tr>
<tr>
<td>e</td>
<td>Euler constant e=2.71828.... (base of the natural logarithm and exponential function)</td>
</tr>
<tr>
<td>k</td>
<td>Boltzmann’s constant k=1.380 * 10^-23 J/K</td>
</tr>
<tr>
<td>K</td>
<td>Freezing temperature of water in Kelvin K=273.15 (iso unit)</td>
</tr>
<tr>
<td>c</td>
<td>Velocity of light c=2.9979 * 10^8 m/s</td>
</tr>
<tr>
<td>a</td>
<td>Avogadro constant a=6.0221 * 10^23 Mol</td>
</tr>
<tr>
<td>NaN</td>
<td>Constant „Not a number“</td>
</tr>
<tr>
<td>∞</td>
<td>Constant for infinite</td>
</tr>
<tr>
<td>(</td>
<td>Brackets to group expressions</td>
</tr>
<tr>
<td>+</td>
<td>Addition of two terms, e.g. (A + 2) or (A + B)</td>
</tr>
<tr>
<td>-</td>
<td>Subtraction of two terms</td>
</tr>
<tr>
<td>*</td>
<td>Multiplication of two terms</td>
</tr>
<tr>
<td>/</td>
<td>Division of two terms</td>
</tr>
<tr>
<td>^</td>
<td>Exponentiation, e.g. A^2 (the values of the data object A is raised to the power of 2)</td>
</tr>
<tr>
<td>&lt;</td>
<td>Relational operator: less than</td>
</tr>
<tr>
<td>&gt;</td>
<td>Relational operator: greater than</td>
</tr>
<tr>
<td>≤</td>
<td>Relational operator: less than or equal</td>
</tr>
<tr>
<td>≥</td>
<td>Relational operator: greater than or equal</td>
</tr>
<tr>
<td>≠</td>
<td>Comparison of two terms: ‘is not equal to’</td>
</tr>
<tr>
<td>x²</td>
<td>Squares x</td>
</tr>
<tr>
<td>x³</td>
<td>X is raised to the power of 3</td>
</tr>
<tr>
<td>ln(x)</td>
<td>The Natural Logarithm (base e) of x</td>
</tr>
<tr>
<td>log(x)</td>
<td>Logarithm to the base 10 of x</td>
</tr>
<tr>
<td>exp(x)</td>
<td>Exponential function, matches e^x</td>
</tr>
<tr>
<td>root(x)</td>
<td>Square root of x</td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>mod(x; y)</td>
<td>Modulo operation: The value of term x modulo y.</td>
</tr>
<tr>
<td>Examples</td>
<td>mod(2.4; 3) = 2.4</td>
</tr>
<tr>
<td></td>
<td>mod(3.4; 3) = 0.4</td>
</tr>
<tr>
<td>remainder(x; y)</td>
<td>The remainder of x in reference to y. The remainder equals mathematically x - y * n, with n being the closest integer to the exact quotient of x/y.</td>
</tr>
<tr>
<td>Examples</td>
<td>remainder(-4.4; 3) = -1.4</td>
</tr>
<tr>
<td></td>
<td>remainder (-2.4; 3) = 0.6</td>
</tr>
<tr>
<td></td>
<td>remainder (2.4; 3) = -0.6</td>
</tr>
<tr>
<td></td>
<td>remainder (4.4; 3) = 1.4</td>
</tr>
<tr>
<td>abs(X)</td>
<td>The absolute value of x</td>
</tr>
<tr>
<td>hypot(x; y)</td>
<td>Calculates the value of root(x^2 + y^2) (hypotenuse)</td>
</tr>
<tr>
<td>sin(x)</td>
<td>The Sine function. (*¹) x is to be entered in radians. If x is in degrees, the conversion formula x * Pi / 180 shall be used.</td>
</tr>
<tr>
<td>cos(x)</td>
<td>The Cosine function. *¹</td>
</tr>
<tr>
<td>tan(x)</td>
<td>The Tangent function. *¹</td>
</tr>
<tr>
<td>asin(x), acos(x),</td>
<td>The inverse Sine, Cosine und Tangent functions. *¹</td>
</tr>
<tr>
<td>atan(x)</td>
<td></td>
</tr>
<tr>
<td>atan2(x; y)</td>
<td>Since the inverse tangent function does not have an unequivocal relation to a quadrant, this function might be used. x is the x-coordinate, y the y-coordinate. It calculates the inverse tangent (y/x) and corrects the quadrant relations. *¹</td>
</tr>
<tr>
<td>sinh(x), cosh(x),</td>
<td>The hyperbolic functions Sine, Cosine und Tangent. *¹</td>
</tr>
<tr>
<td>tanh(x)</td>
<td></td>
</tr>
<tr>
<td>asinh(), acosh(),</td>
<td>The inverse hyperbolic functions Sine, Cosine und Tangent. *¹</td>
</tr>
<tr>
<td>atanh()</td>
<td></td>
</tr>
<tr>
<td>Row: Min</td>
<td>MinOfRow(A;B;C;): Minimum of the selected data objects per line</td>
</tr>
<tr>
<td>Row: Max</td>
<td>MaxOfRow(A;B;C;): Maximum of the selected data objects per line</td>
</tr>
<tr>
<td>Row: Span</td>
<td>SpanOfRow(A;B;C;): Span of the selected data objects per line</td>
</tr>
<tr>
<td>Row: Sum</td>
<td>SumOfRow(A;B;C;): Sum of the selected data objects per line</td>
</tr>
<tr>
<td>Row: Average</td>
<td>AveOfRow(A;B;C;): Average of the selected data objects per line</td>
</tr>
<tr>
<td>Row: Std.Dev</td>
<td>StdDevOfRow(A;B;C;): Standard deviation of the selected data objects per line</td>
</tr>
<tr>
<td>replNaN0(A)</td>
<td>If a term A has the value of NaN, it will be replaced by 0.</td>
</tr>
<tr>
<td>replNaN1(A)</td>
<td>If a term A has the value of NaN, it will be replaced by 1.</td>
</tr>
<tr>
<td>min(A)</td>
<td>Minimum of the data object A</td>
</tr>
<tr>
<td>max(A)</td>
<td>Maximum of the data object A</td>
</tr>
</tbody>
</table>
### Term Description

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NatMin</td>
<td>Nmin(A): The index of the minimum of data object A</td>
</tr>
<tr>
<td>NatMax</td>
<td>Nmax(A): The index of the maximum of data object A</td>
</tr>
<tr>
<td>average(A)</td>
<td>Average of the data object A</td>
</tr>
<tr>
<td>stddev(A)</td>
<td>Standard deviation of the data object A</td>
</tr>
<tr>
<td>sum(A)</td>
<td>Sums up all values of data object A</td>
</tr>
<tr>
<td>value(A; x)</td>
<td>The value of the data object A at the index determined by the term x.</td>
</tr>
<tr>
<td></td>
<td>Examples:</td>
</tr>
<tr>
<td></td>
<td>value(A; 1): the first value of data object A</td>
</tr>
<tr>
<td></td>
<td>A - value(A; 1): subtracts the first value of all values of data object A.</td>
</tr>
<tr>
<td></td>
<td>value(A; Nmax(B)): determines the value of data object A at the position of</td>
</tr>
<tr>
<td></td>
<td>data object B’s maximum</td>
</tr>
<tr>
<td></td>
<td>With matrices or groups of channels:</td>
</tr>
<tr>
<td></td>
<td>value(A; 7): the 7th values of each column of matrix A or each channel of</td>
</tr>
<tr>
<td></td>
<td>channel group A</td>
</tr>
<tr>
<td></td>
<td>value(A; B): If B is a channel, its values are regarded as indices to be</td>
</tr>
<tr>
<td></td>
<td>applied on matrix A or channel group A.</td>
</tr>
<tr>
<td>offsetX(A)</td>
<td>X-Offset of data object A</td>
</tr>
<tr>
<td>ΔX(A)</td>
<td>Delta X of data object A</td>
</tr>
<tr>
<td>N(A)</td>
<td>The number of values of data object A</td>
</tr>
<tr>
<td>LastVal(A)</td>
<td>The last value of data object A</td>
</tr>
<tr>
<td>NnotNaN</td>
<td>The number of values of data object A that are not NaN</td>
</tr>
<tr>
<td>if(x;y;z)</td>
<td>If the first term x is true, the second term y is the result. Else, the</td>
</tr>
<tr>
<td></td>
<td>third term z is the result, e.g. if(A&lt;B;B;A). If the first term is a bit</td>
</tr>
<tr>
<td></td>
<td>channel, the function is executed for each value of the channel.</td>
</tr>
</tbody>
</table>

### Tab Description

A detailed description (e.g. purpose, usage) of the generated formula can be entered into the text box of the Description tab for other users.

```
Formula:
A + B

Check  Formula ok!

Calculates the sum of A and B.
```
Example

In the xy-Graph (below) the result of the formula \((A + B) / 2\) as well as the input data are displayed. The input data objects were generated via Extra→Generators→Numeric Channel – DatGen as Sine function, DatGen2 as random generator.

![xy-Graph](image)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data</td>
<td>All numeric data object types (single value, channel, matrix); no character/string data objects</td>
<td></td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>

2.7.1.3 Formula Editor with Text Resolver

Go to:

Math

Arithmetic

Formula Editor with Text Resolver

The Formula Editor with Text Resolver allows the creation of a mathematical formula analog to the Text Resolver / Embedded Formula Editor. A single value data object is created the type of which depends on the formula. In contrast to the Text Resolver, the data objects and components used in the formula are monitored and automatically updated in case of changes. For instance, if the name of a data object changes, it is adapted in the formula immediately.
**Result Data:** Name of component and data object as it will appear in the Explorer.

**Formula:** Input field for entering and displaying the formula. The formula can be entered manually or by using the buttons with preset functions below. In order to facilitate the input of nested formulas, corresponding sets of brackets are highlighted.

**Clear:** Deletes the formula in the input field.

**Check:** Tests the consistency of the entered formula and shows the current Result. This test is run automatically if **OK** or **Apply** is pressed. If **Check** is pressed, the entered formula is checked. If the formula is syntactically incorrect, an error message is displayed and the mistake is marked in the formula.

For a full description of the Text Resolver see also [Text Resolver Service](#).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ⏯. The respective help topic is displayed when an area within the dialog is clicked on.

2.7.1.4 Integration/Differentiation

Go to:

Math

Arithmetic

Integration/Differentiation

The data of the input data object will be integrated or differentiated. The optional direct current suppression might offer better results while integrating.

The result unit will be adapted automatically. Examples:

<table>
<thead>
<tr>
<th></th>
<th>Input Unit</th>
<th>Result Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differentiation</td>
<td>mm</td>
<td>mm/s</td>
</tr>
<tr>
<td></td>
<td>mm*s</td>
<td>mm</td>
</tr>
<tr>
<td>Integration</td>
<td>mm</td>
<td>mm*s</td>
</tr>
<tr>
<td></td>
<td>mm/s</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>mm/s²</td>
<td>mm/s</td>
</tr>
<tr>
<td>Double Integration</td>
<td>mm</td>
<td>mm*s²</td>
</tr>
<tr>
<td></td>
<td>mm/s/s</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>mm/s³</td>
<td>mm</td>
</tr>
</tbody>
</table>
**Result Data:** Name of data object as it will appear in the Explorer.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data:** Select input data object from a list of available data objects. If the input data object is a matrix, a vector might be defined with two indices.

**Result Unit:** The unit of the result data object can be set automatically from the input data or manually.

**dx-Values**

**Constant value of 1:** A constant delta of 1 is used for the calculation.

**From dx of input channel:** Delta-X is adopted by the input data object for the calculation. In case of time series this is equivalent to integrating / differentiating over time.

**From:** Selection of a data object from a list. Differentiation/Integration will be executed via an independent variable i.e. force/distance integration.
Type of calculation

**Differentiation-standard \((V[i+1] - V[i-1]) / 2\):** The data of the input data object are differentiated via the respective neighbours to the right and to the left.

Examples:

\[ \frac{df(t)}{dt} \]: Calculates the speed from the distance signal.

\[ \frac{df(s(t))}{ds(t)} \]: Calculates the change in force depending on the distance.

**Differentiation-left \((V[i] - V[i-1])\):** The data of the input data object are differentiated via the respective neighbour to the left.

**Differentiation-right \((V[i+1] - V[i])\):** The data of the input data object are differentiated via the respective neighbour to the right.

**Differentiation (ECE R94):** The data of the input data object is differentiated according to the ECE R94 standard.

**Summation:** The data of the input data object is aggregated continuously.

**Integration:** The data of the input data object is integrated.

Example: \[ \text{Int}(F(t) \, dt) \]: Calculates the speed from the acceleration.

\[ \text{Int}(F(s(t)) \times ds(t)) \]: Calculates the force/distance surface integral.

**Double integration:** The data of the input data object is double integrated.

Example: Calculating the distance from the acceleration.

**Options**

**With highpass filter:** Only for integration. Even the smallest direct current proportion in the incoming signal leads to undesired effects when integrating. Therefore they can be filtered.

**Cut DC-part:** This option suppresses direct current proportions.

**Cutting frequency... \(* \Delta F\):** The cutting frequency regarding delta F depends on the number of values and the sampling rate (see FFT theory).

**Cutting frequency... Hz:** The cutting frequency in terms of an absolute frequency.

**With retract factor:** Sometimes it is insufficient to filter only the direct current proportion to get an acceptable signal for the visualisation. A retracting factor can also be defined to retrieve the drifting signal.

**NaN ranges:** Missing values (NaNs) of the input objects can be **interpolated** or **filled with 0**.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example

In the xy-Graph (below) the result of the integration as well as the input data are displayed. The input data object was generated as a sine function via Extra → Generators → Numeric Channel.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/LongChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>Matrix</td>
<td>2D- and 3D-matrices (float/double/integer/long/bit/reference)</td>
</tr>
<tr>
<td>dx-values</td>
<td>Channel</td>
<td>Numeric channels (float/double/integer/long/reference)</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleRectMatrix3D</td>
<td>3D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>

### 2.7.1.5 Bit Arithmetic

Go to: Math

Math

- Arithmetic
- Bit Arithmetic

The calculation **Bit Arithmetic** produces up to 32 bit channels with individual operations. Calculations of every single bit can be defined as e.g. relation, Boolean arithmetic or flipflop. The results can be used, for example, as input data for the calculation of part curves of a time signal.

**Result Data:** Name of the component and its result data objects (presetting) as they will appear in the lists. A channel with the stated name and bit number is generated for each defined bit the result of which is published. Alternatively, individual names can be entered for the bits.

**Note:** In older jBEAM versions a bit matrix was generated. When opening the modification dialog box of such a calculation, jBEAM offers a conversion of this matrix into channels.
Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Result types: Additionally to the generation of individual Bit-Channels, an Integer-Channel with up to 32 bits can be generated:

Bit-Channels: Each calculated bit-information is stored as one Bit-Channel.

Integer-Channel: Each calculated bit-information is stored as one bit of a common Integer-Channel. This channel is composed of the individual defined bits. Bit 1 is the lowest-order bit, Bit 32 the highest-order bit.

In Integer-Kanal mode as well as in Boolean calculation in both modes (Bool (Ext), Bool (Int)), all used channels must have the same X-grid (Xoffset, DeltaX, channel length). Otherwise the calculation receives an error message.

Bit: Selection of the bit to be defined. The bit is automatically preselected which is selected for modification in the Spreadsheet or Explorer. Bits with already defined functions are emphasised by blue, bold font. An individual name for this bit channel can be entered in the text field behind the bit number.

Publish results: Publishes the result as a new data object that can be used in other functions. Otherwise no data object is created. But the result can still be used internally for calculations of further bits.

Tabs for Operation Types

Each tab is furnished with a radio button which is automatically activated when the respective tab is clicked on. This shows that by changing the tab the parameters are actually changed.

- **Off** – No calculation of this bit.
- **Relation (Numeric)** – Relation between values.
- **Relation (Date)** – Relation between date specifications.
- **Relation(String)** – Relation between strings.
- **Bool (Ext)** – Boolean arithmetic with external data objects.
- **Bool (Int)** – Boolean arithmetic with internal bit processing.
- **Flipflop** – Alternate setting and resetting of bits according to defined conditions.
- **Level Duration** – Filtering out of short events.
Comment: The bit calculation can be explained in this description field.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?q?: The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

Tab Off

The calculation of the selected bit is switched off. No data object will be generated.

Tab Relation (Numeric)

Relation between values

Input data ("Sinus"): Selection of the input data object from the list of available data objects. Data objects of the type DoubleChannel, FloatChannel, IntegerChannel and DoubleValue are supported.

Relational operator: Selection of the relational operator from the list of available operators.

<, <=, =, >=, >: Relational operators: lesser than, lesser than or equal to, equals, greater than or equal to, greater than

[ ]: within a range

][: outside of a range

+/-%: range from +/- in per cent of the second value. Enter per cent value in the input field below.

+/-: range in +/- absolute from the second value. The absolute value is to be entered in input field below.

+/-1σ (Sigma): A range defined by the standard deviation.

+/-3 σ (Sigma): A range defined by the threefold standard deviation.

Comparison value: Definition of a second value via radio buttons:
**Fix value:** Manual input of a fix comparison value.

**Single value data object:** Constant value over a data object of the type DoubleValue or FloatValue.

**Channel:** Index-based comparison with values of a second data series of the type DoubleChannel, FloatChannel or IntegerChannel.

**Statistical value:** The minimum, maximum or average of the input data object.

---

**Tab Relation (Date)**

Relation between date specifications

Input data ("TimGen"): Selection of the input data object from the list of available data objects. Data objects of the type DoubleChannel, FloatChannel, IntegerChannel and DoubleValue are supported.

**Relational operator:** Selection of the relational operator from the list of available operators.

- `<`, `<=`, `>=`, `>`, `±`:
  - Relational operators: lesser than, lesser than or equal to, greater than or equal to, greater than
  - `±`:
    - A range in +/- absolute from the second value. The absolute value is to be entered into the input field below.
  - `±`:
    - A range outside of the +/- absolute of the second value. The absolute value is to be entered into the input field below.

**Comparison value:** Definition of a second value via radio buttons:

- **Fix value:** Manual input of a fix comparison value.
- **Single value data object:** Constant value over a data object of the type DoubleValue or FloatValue.
- **Channel:** Index-based comparison with values of a second data series of the type DoubleChannel, FloatChannel or IntegerChannel.

---

**Tab Relation (String)**

Relation between strings
**Input**: Selection of the input data object from a list of available data objects. Supported data objects are of the type StringChannel.

**Contains value**: If the channel value contains the **comparison value**, the bit is set to **true**.

**Matches value (RegEx)**: If the channel value matches the defined regular expression, the bit is set to true.

**Comparison value**: The definition of a second value via radio buttons:
- **Constant value**: Input of a string via the input field.
- **Variable value**: Definition of the value via single value data object of the type StringValue. Such a data object can, for example, be generated via the graphic object **Text Input**.
  
  Also a string channel can be selected. In this case, the complete channels are compared index-wise. The respective bit is set when both strings are identical.

**Tab Bool (Ext)**

Boolean arithmetic with external data objects

"NOT"**: Negates first value if selected.

**Input data ("this")**: Selection of the input data objects from a list of available data objects. Data objects of the type Bit RectMatrix respective BitChannel are supported. Because the resulting data object of the calculation **Bit Arithmetic** is a bit channel, lower bits may also be used for this calculation. In this case "this" has to be selected.

**Bit**: If "this" is selected in the **Input data** field, the corresponding bit is entered here.

**Boolean operator**: The following Boolean operators can be selected from a list.
- **empty**: The second value is not used.
- **AND**: Both values are linked with AND.
- **OR**: Both values are linked with OR.
- **XOR**: Both values are linked with XOR.

**Tab Bool (Int)**

Boolean arithmetic with internal bit processing.
Formula: A formula can be entered according to the pattern shown in Samples. Only internally defined bits are supported (B1 = Bit 1 etc.). Any number of lower bits can be used in the formula. Interlaced formulas are also possible. Different predefined Functions (NOT(), AND(), OR(), XOR()) facilitate the input. These functions can operate several arguments. Additionally available operators are &, | and ^ (XOR) as well as ! and ~ for negation.

The correctness of the entered formula can be checked via the Check button.

Tab Flipflop

Alternate setting and resetting of bits according to defined conditions.

Direction: The direction for setting and clearing the bits can either be Forward or Backward.

set, if: The bit is set if the input data meet the defined condition.

clear, if: The bit is reset if the input data meet the defined condition.

Input data ("this"): Selection of the input data objects from a list of available data objects. Data objects of the type BitRectMatrix3D, BitChannel, IntegerChannel and GroupOfChannels are supported. Lower bits of this calculation may be used as well. In this case, "this" has to be selected (not available for Bit 1).

Bit: If "this" is selected in the Input data field, the corresponding bit is entered here.

Condition: The following conditions can be selected from the list, one condition each for setting and clearing the bit:

- up: The initial bit changes from false to true.
- up+dx: A defined lag time dx, after changing the initial bit from false to true.
- down: The initial bit changes from true to false.
**down+dx**: A defined lag time dx, after changing the initial bit from true to false.

**dx**: The value dx can be defined as follows:

- **fix value**: The value is entered manually in the input field. This value is used for all channels (with channel groups) and all events.

- **constant input value(s)**: A single value or a group of values can be chosen. The single value is used for the whole time. A group of values is only supported, if the input object is a group of channels. In this case for the n'th grouped channel the n'th grouped value is used.

- **variable input values**: A channel or a group of channels can be chosen. For the k'th event the k'th value of the channel is used. A group of channels is only supported, if the input object is a group of channels. In this case for the n'th grouped input channel the n'th grouped channel is used.

**Tab Level Duration**

This calculation can be used to filter out short events.

**Input data ("this")**: Selection of the input data object from a list of available data objects. Data objects of the type BitRectMatrix3D and BitChannel are supported. As the resulting data object of this calculation is a bit channel, lower bits may be used for this calculation. In this case "this" has to be selected.

**Bit**: If "this" is selected in the Input data field, the corresponding bit is entered here.

**minimum duration**: Defines how long the signal has to be "on" in order to be counted.

- **manual**: The minimum duration is entered manually.

- **data object**: The minimum duration is defined by a single value data object.

**Example 1**: In the xy-Graph (below) the result of the **Bit Arithmetic** as well as the input data object (Extra→Generators→Numeric Channel - sine function) and the calculated partial curve are displayed. The range of the partial curve can be set via graphic cursor C1.
The following conditions have been defined:

Bit 1: Relation (Numeric): "DatGen" > Graphic-Cursor C1
Bit 2: Relation (Numeric): "DatGen" [+/-] 0.4 Graphic-Cursor C1
Bit 3: Bool: "this" Bit 1 "AND" "this" Bit 2

The partial curve has been defined over the first closed area at which Bit 3 is set.

When the result channels of the Bit Arithmetic are displayed in a line/points diagram, they are by default stacked on top of each other on a common axis. However, the Bit-Channel display can be adjusted to individual needs in the Datatypes tab of the diagram settings dialog. The single curves can either be assigned with an individual fix value range or all curves receive a uniform value range so that they are drawn on the same level.

Example 2 (Level Duration): From a signal "Signal_A+B" only the areas shall be filtered where the level of more than 0.2 is maintained longer than 1 second.

Bit 1: Relation (Numeric): " Signal_A+B " > 0.2
Bit 2: Level Duration: "this" Bit 1; minimum duration: 1s
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td>general: numeric values/channels and referenced data objects, e.g. from groups of calculations/graphics</td>
<td></td>
</tr>
<tr>
<td>Relation (Numeric)</td>
<td>Integer/Float/DoubleValue/Channel</td>
<td>Integer/floating point number, e.g. cursor value, or channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeValue/Channel</td>
<td>Value/Channel with geographic coordinates</td>
</tr>
<tr>
<td></td>
<td>DateTimeValue/Channel</td>
<td>Value/Channel as date/time</td>
</tr>
<tr>
<td></td>
<td>String/CharacterValue/Channel</td>
<td>Value/Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>ObjectValue/Channel</td>
<td>Value/Channel with objects</td>
</tr>
<tr>
<td></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues/Channels</td>
<td>Group of values/channels</td>
</tr>
<tr>
<td></td>
<td>Single value data items/BasicMap</td>
<td>Reference value: single value data object</td>
</tr>
<tr>
<td></td>
<td>all channel types</td>
<td>Reference value: channel</td>
</tr>
<tr>
<td>Relation (Date)</td>
<td>DateTimeValue</td>
<td>Single value as time specification</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Relation (String)</td>
<td>StringChannel</td>
<td>Channel with strings</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>StringValue</td>
<td>Reference value: single value as text</td>
</tr>
<tr>
<td>Bool (Ext), Flipflop, Level Duration</td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>BitRectMatrix3D</td>
<td>3D-matrix with Boolean values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
</tbody>
</table>

---

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Reference and Tutorial jBEAM

Version: jBEAMHelp7.2.2
2.7.1.6 Coordinate Transformation

Go to:

Math
  ▶ Arithmetic
  ▶ Coordinate Transformation

The **Coordinate Transformation** offers transformations between Cartesian and spherical coordinate system in 2 as well as 3 dimensions.

**Result Data**: Name of data object as it will appear in the Explorer.

**Input Data x/y/z**: Selection of the input data object from the list of available objects. The numeric fields show the units of the input data.

**Two/Three Dimensions**: Selection of the dimension to transform into. The z input data is only enabled if **Three Dimensions** is selected.

**Cartesian to Sphere**: Transformation from the Cartesian into the spherical coordinate system.

**Sphere to Cartesian**: Transformation from the spherical into the Cartesian coordinate system.
Set Pattern for Channel Names in Result Group: If channel groups are used as input data objects, the names of the channels in the result group can be defined. For this, a predefined pattern is selected in the Pattern combo box.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The Cartesian line chart shows the original data generated via Extra→Generators→Numeric Channel. The data is displayed in a Polar Diagram after using a Coordinate Transformation.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.1.7 Pythagoras

Go to:

Math
  ➔ Arithmetic
  ➔ Pythagoras

Pythagoras determines the space diagonal of 3 data objects. The sentence of Pythagoras is used for this.

The calculation has to be executed 2 times to calculate the space diagonal. After the conversion the following formula is created.

The calculation of the space diagonal in a 3-dimensional coordinate system is executed with the following formula:

\[ r = \sqrt{x^2 + y^2 + z^2} \]

Result Data: Name of data object as it will appear in the Explorer.

Unit: Optionally, a unit can be assigned to the new data object.

  no: Values are calculated without taking units from input data objects into account. The result data object will have no unit.

  auto: Values are calculated taking units of input data objects into account. The unit of the result data object is automatically adopted from the first input data object (x) if the units from the input data objects are compatible, otherwise the result has an error.

  manu: The unit of the result data object is entered manually. Values are calculated without taking units from input data objects into account. The result data object will have the manual unit.
**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data x/y/z:** Selection of the input data object from the list of available objects. The numeric input fields show the units of the input data.

**Time range:** Either the complete time range (full time) or a part of it (from ... to...) can be used for the calculation.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

*Calculation of a resulting acceleration of a crash test. The function Pythagoras calculates the resulting acceleration from 3 accelerations (forward/backward, lateral and up/down) with the help of the space diagonal.*

![Line chart](chart.png)

*The Line chart (left) visualises the different accelerations. The resulting acceleration of the crash test (black) is calculated from 3 input accelerations (red, green, blue) by means of the calculation of the space diagonal.*

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>IntegerChannel</td>
<td>Channel with integers</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Result data</th>
<th>DoubleChannel</th>
<th>Channel with floating point numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>

### 2.7.1.8 PID-Controller

Go to:

### Math

- **Arithmetic**
- **PID-Controller**
**Result Data:** Name of data object as it will appear in the Explorer.

**Unit:** The unit of the created data object can be entered optionally.

**Setpoints:** The set points can be defined manually or dynamically by a data object.

**State Regulator:**
- **disabled:**
- **by formula:**
- **by channel:**

**PID Controller:**

**Actual values:**

**Output range:** Can be limited if desired.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.
Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.1.9 x-Values

Go to:

Math

Arithmetic

x-Values

A new data object is created from the X-Offset and the Delta-X of an input data object.

The data object is calculated by using the following formula:

\[ W[i] = X_{offset} + i \times \Delta X \]

The result's Y unit equals the input data object's X unit.

Result Data: Name of data object as it will appear in the Explorer.
**Input Data:** Selection of the input data object from the list of available data objects.

**Dimension (0..2):** If a matrix is selected as the input data object, a dimension for calculating the x-values might be entered here.

**Starting point**

- **X-Offset:** The data is calculated with: \( W[i] = X_{\text{offset}} + i \times \Delta X \ [i = 0...N-1] \)
- **X-Offset + 1/2 \( \Delta X \):** The data is calculated with: \( W[i] = X_{\text{offset}} + i \times \Delta X + 0.5 \times \Delta X \)
- **X-Offset + \( \Delta X \):** The data is calculated with: \( W[i] = X_{\text{offset}} + i \times \Delta X + \Delta X \)

**Create time channel:** Alternatively the result channel can be created as DateTimeChannel. Otherwise a DoubleChannel is created.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The xy-Graph (below) displays the results of the 3 possible calculations. The input data object was created via Extra → Generators → Numeric Channel (Sine function).
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/ floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numerical channel</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/ floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleRectMatrix3D</td>
<td>3D-matrix with integers/ floating point numbers</td>
</tr>
<tr>
<td></td>
<td>NumericMatrixByReference</td>
<td>Referenced numeric matrix</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>time channel</td>
<td>Channel with date/time values</td>
</tr>
</tbody>
</table>

2.7.1.10 Matlab Wrapper

Go to:

**Math**

- Arithmetic
  - Matlab Wrapper

2.7.1.11 Inline Java-Function

Go to:

**Math**

- Arithmetic
  - Inline Java-Function
The **Inline Java-Function** generates a Java class from the entered Java code with up to 4 input objects and executes the defined calculation. The result will be stored as a data object and can be used for further calculations or graphic display. In contrast to the **Inline Java-Class** the developer can change only the content of calculation method, not the whole class content.

The compiled byte code will be stored in the jBEAM project file.

Note: To compile the Java source code it is necessary to run jBEAM with a JDK (Java Development Kit: Download from the Oracle web page) because only the JDK offers the inline compiler.

E.g. C:\Program Files\Java\jdk1.6.0\jre\bin\java.exe –jar jBEAM.jar

For further information about the **Inline Java-Function** see also [jBEAM – AMS Knowledge Base](#).

**Result Data:** Name of data object as it will appear in the Explorer.

**Input Data:** Selection of up to 4 input data objects from the list of available data objects.

**Compile:** The entered Java source code is compiled. The compiler messages are displayed below in the console.

**CodeReset:** The edited source code is reset to the initial settings.

**Clear Console:** The compiler messages in the console are cleared.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

??: The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.7.1.12 Inline Java-Class

Go to:

**Math**

**Arithmetic**

**Inline Java-Class**

The **Inline Java-Class** generates a Java class from the entered Java code with up to 4 input objects and executes the defined calculation.

The result will be stored as a data object and can be used for further calculations or graphic display. The developer can specify the complete content of the Java class or load it from a class file.

The compiled byte code will be stored in the jBEAM project file.

Note: To compile the Java source code it is necessary to run jBEAM with a JDK (Java Development Kit: Download from the Oracle web page), because only the JDK offers the inline compiler.

E.g. C:\Program Files\Java\jdk1.6.0\jre\bin\java.exe –jar jBEAM.jar

For further information about the **Inline Java-Function** see also [jBEAM – AMS Knowledge Base](https://www.ams.com).
### Result Data:
Name of data object as it will appear in the Explorer.

### Input Data:
Selection of up to 4 input data objects from the list of available data objects.

**Expand:** This Button expands the selection list for the input data objects. The arrow keys can be used to transfer up to 4 input data objects from the left to the right list. The input field above the left list can be used as filter for the available input data objects. Via the **Reduce** button, the initial dialog is rebuilt and the selected input data objects are assigned to the individual fields A .. D.
This section contains two lists, on the left side the available data objects and on the right side the selected data objects to be used as input objects.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

**from class file**: If this option is activated a class file (*.class) can be selected via the Select button. Further modification of the code is thus disabled.

**Compile**: The entered Java source code is compiled. The compiler messages are displayed below in the console.

**CodeReset**: The edited source code is reset to the initial settings.

**Clear Console**: The compiler messages in the console are cleared.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.
2.7.2 Curve Calculations

Go to:

Math
  Curve Calculations

The menu consists of the following sub menus:

- LMS Fitting
- Resolve Newton Formula
- Signal Calibration
- Partial Curve
- Curve Split into Matrix
- Date-Split Channel into Matrix
- Value Ranges around a Boolean Trigger
- Envelope Curve
- Memory
- Resampling
- Synchronize via Timechannel (date/time)
- Movetests
- Resampling Angle-Based
- Synchronize Hysteresis
- Integration of Hysteresis
- Sort channels
- X-Data change
- Complex channel extractor
2.7.2.1 LMS Fitting

Go to:

Math

\[\text{Curve Calculations} \xrightarrow{\text{LMS Fitting}}\]

**LMS Fitting** computes the approximation based on the minimum square deviation with a given function structure. The number of coefficients determines the degree of approximation. The methods Polynomial and Fourier can handle up to 20 coefficients. Furthermore the methods Power, Logarithmic and Exponential are supported.

The exponential approach, for example, enables the definition of the attenuation coefficient of an abating oscillation (2. coefficient).

As results of the LMS Fitting, channels are created containing the calculated X- and Y-values as well as the calculated coefficients. This channel also contains additional channel properties with statistical results of the calculation. One of them is e.g. the coefficient of determination which is an indicator of the goodness of fit (see also Types of data objects).
**Result Data**: Name of component and result data objects as they will appear in the Explorer. The data object with the coefficients receives the name suffix “-Coef”. If the calculated y channel is not synchronous to the input x channel, the calculated x-values are saved in the data object with the name suffix “-X”.

**Suffix**: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**x-values**: Data object with x-values.

  - **Auto**: Automatic computing of the x-values out of the data object of the y-values.

**y-values**: Data object with y-values.

**Tab Method**
Methodical approximation approaches.

**Polynomial (Standard)**: Describes a polynomial calculated with: \( a_0 + a_1 \cdot x + a_2 \cdot x^2 + \ldots + a_{(N-1)} \cdot x^{N-1} \).

  - **N**: Number of coefficients.
**Polynomial (Matrix):** Describes a polynomial calculated with: \( a_0 + a_1*x + n_2*x^2 + \ldots + a_{(N-1)}*a^{N-1} \).

The calculation is carried out via matrices.

**N:** Number of coefficients.

**Polynomial w/o a:** Describes a polynomial without \( a_0 \) calculated with: \( 0 + a_1*x + n_2*x^2 + \ldots + a_{(N-1)}*a^{N-1} \). The calculation is carried out via matrices.

**N:** Number of coefficients.

**Exponential:** Exponential approximation: \( a_0 * e^{a_1*x} \).

All y input values have to have the same algebraic sign.

**Fourier:** Fourier series approximation: \( a_0 + a_1*sin(x) + n_2*sin^2(x) + \ldots + a_{(N-1)}*sin^{N-1}(x) \).

**N:** Number of coefficients.

**Logarithmic:** Logarithmic approximation: \( a_0 + a_1*log(x) \).

All x input values have to have the same algebraic sign and must not be 0.

**Power:** Power function: \( a_0 * x^{a_1} \).

All y input values have to have the same algebraic sign.

**Rational:** Rational function: \( 1/(a + bx + cx^2 + \ldots) \).

**Coefficients:** The number of used coefficients. For Polynomial and Fourier the following is applied: \( 0 < N < 21 \), for others: \( N = 2 \).

**Tab Options**

**Handling of NaNs in x-channel:** If NaN values are present in the input x channel, these values can be **interpolated** or **deleted**. As the calculated y channel is not synchronous to the input x channel anymore when values are deleted, the reduced x-values are saved in the data object with the name suffix “-X”.

**Handling of NaNs in y-channel:** Option to calculate from coefficients or leave the NaNs.

**Calculate fitted values (Coefficients are calculated always):**

- Im-or explicit x-values from input channel
- Downsampling by the factor of:
- Extrapolate values of input by N =
- Resample with x-values from channel:
- Sort result-channels based on x-values *
Handling of NaNs in y-channel: If NaN values are present in the y channel, these values can be calculated from coefficients or left as NaNs.

Calculate fitted values: The following options define the points at which fitted values shall be calculated.

im- or explicit x-values from input channel: By default, implicit or if available explicit x-values of the input channel are used.

downsampling by the factor of: The number of x-values (grid points) is reduced by the defined integer value, i.e. with a factor=2 the number of grid points is halved.

extrapolate values of input by N=: The defined number of values is added to the result channel. The additional values are extrapolated according to the calculated fitting function.

resample with x-values from channel: The x-values (grid points) from the defined channel are used.

Sort result channels based on x-values: The result channels can be sorted upwards or downwards after x-values. When sorting downwards the calculated y channels are not synchronous to the input x channel anymore, and the sorted x-values are saved in the data object with the name suffix “-X”.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign 🔄 in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

???: The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

Example

The line chart (below) displays the result of a polynomial approximation with 6 coefficients and the input signal
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td></td>
<td>All types of channels (e.g. double, float, integer, bit, string,...) and channel groups.</td>
</tr>
<tr>
<td>Result data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;[name]-X&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated x-values; this channel contains values as soon as the calculated y-channel is not synchronous to the input x-channel anymore.</td>
</tr>
<tr>
<td>&quot;[name]&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated y-values.</td>
</tr>
<tr>
<td>&quot;[name]-Coef&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated coefficients. This channel also contains additional channel properties, e.g.:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Variance = Variance of values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- StdDeviation = Standard deviation of residues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- VariYvalues = Variation of Y-values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- VariResiduals = Variation of residues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- VariRegression = Variation of regression values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- CoeffDeterm = coefficient of determination $R^2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- CorrCoeffDeterm = corrected coefficient of determination $\overline{R}^2$</td>
</tr>
</tbody>
</table>

2.7.2.2 Resolve Newton Formula

Go to:

Math
曲线计算
Resolve Newton Formula

LMS fitting
Resolve Newton Formula
The calculation **Resolve Newton Formula** can be used to determine the heating or cooling curve of a test series.

**Result Data:** Name of data object as it will appear in the Explorer.

**X-Values:** The X-values can either be determined out of X₀ and ΔX or the respective index of the Y-values (auto) or defined by a data object.

**Y-Values:** Data object that holds the Y-values.

**Limit input data:** The input data can be limited to a certain range, either **between indexed boundaries** or **between X-values boundaries**.

**Calculation method:** Different methods for the calculation can be chosen: **Bisection** or **Quadratic function**. The combination of both methods is also applicable.

**Create result channel for approximation:** Optionally, a separate channel for the results of the approximation can be created.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🔄 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to 🎨. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.7.2.3 Interpolations

Go to:

Math

- Curve Calculations
  - Interpolations

The calculation **Interpolations** converts a data row to new grid points. Thus signals with different sampling rates can be synchronized to the same sampling rate to enable further computation.

This and other calculations have been bundled in the new calculation **Resampling**. In existing projects the old calculations are still applicable, but their context menu offers the chance to convert them to the new **Resampling** calculation. The conversion is recommended as **Resampling** offers the whole range of functions and will be updated further on.

#### Interpolations

**Result Data:** Name of data object as it will appear in the Explorer.

**X-Values:** The X-values can either be determined out of \(X_0\) and \(\Delta X\) or the respective index of the Y-values (**automatic**) or defined by a data object.

**Y-Values:** Data object that holds the Y-values.
**New X-Grid:** The new grid values (X-grid) can either be defined by a data object or **manually** via the input fields below. Please note that the X-values are required to be an increasing sequence of values.

**Fixed Number:** An absolute number of values for the new data object is defined.

**Scaled Number:** A coefficient for the number of values for the new data object is defined in relation to the number of values of the original data object. With values smaller than 1 the number of values is reduced (available range starting at 0.01).

**Type of interpolation:** Different methods for the interpolation can be chosen: **Linear, Cubic Spline** or **Lagrange**.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** The *xy-graph* (below) displays the results of a **Linear Interpolation** (Scaled number = 2) and an interpolation by **Cubic Spline** (Scaled number = 10) as well as the input data **Channel**.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/LongChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleRectMatrix3D</td>
<td>3D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>

#### 2.7.2.4 Signal Calibration

Go to:

**Math**
- Curve Calculations
- Signal Calibration

**LMS Fitting**
- Resolve Newton Formula
- Signal Calibration
The calculation is used to calibrate signals according to defined calibration curves.

Name: Name of data object as it will appear in the Explorer.

Signal: Data object holding the input values.

Calibration X: Data object holding the calibration values for the x-values.

Calibration Y: Data object holding the calibration values for the y-values.

Behaviour outside minimum and maximum of calibration curve

- **always NaN**: All values outside the calibration curve are set to NaN, i.e. not defined.
- **boundary value**: All values outside the calibration curve are set to the limiting value at the minimum/maximum.
- **extrapolation**: All values outside the calibration curve are extrapolated.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>All types of channels (e.g. double, float, integer, bit, string,...) and channel groups</td>
<td></td>
</tr>
<tr>
<td>Signal</td>
<td>Integer/Float/DoubleValue</td>
<td>Integer/floating point number</td>
</tr>
<tr>
<td></td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td>Calibration</td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td>curves</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.2.5 Partial Curve

Go to:  

- **Math**
  - Curve Calibration
  - Partial Curve

**Partial Curve** copies an area of a data object into a new data object. This new data object can be used for further analyses.

Example: A frequency spectrum can be calculated from a part of a curve.

An additional channel is created if the result data cannot be displayed equidistant, e.g. if the input channel has an independent channel or if areas of the input channel have been omitted in the result channel according to a bit channel. Thus, the values of the partial curve maintain their X-reference (mainly time reference).

In case of existing projects, this may lead to differences in calculated and displayed data:

- The gaps that arise when ranges are omitted will be visible by connecting lines when the parial curve is display with independent channel in the XY-curve. Previously, the value following an omitted range has been displayed directly next to the last value.
• As soon as a bit channel is selected for separation of the curve ranges it is checked whether the X-grids are identical. Blue text below indicates identical, red text different X-grids. In case of differences, the grids are automatically resampled.

• The partial curve refuses to separate values according to a bit channel if it has a different X-unit.

• There might be different results if a calculation which does not support independent channels uses a result channel of the partial curve.

• Even if the subsequent calculation supports independent channels, the results may nevertheless be different. For example, an integration (area below the curve) will generate different results.

⚠️ In case of jBEAM versions older than 7.1.1.1 and existing projects, the X-mode for display of a partial curve in an XY-curve has to be manually changed from **auto (Xo, Xdel)** to **auto (Indep. channel)**. Now, the new combined mode **auto (X)** automatically uses the independent channel if it exists.

Result Data: Name of component and data object as it will appear in the Explorer.
Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input Data: The data object from which data shall be copied is selected from the list of available data objects. The X-grid of the selected data object is displayed below the list. Input data objects with independent channels are supported as well.

Copy values
between indexed boundaries

from index: Index of the first value that is copied. Via the selection list, a suitable data object (Integer) is selected. Using the list item manual the index can also be entered manually into the input field.

upto index: Index of the last value that is copied. Via the selection list, a suitable data object (Integer) is selected. Using the list item manual the index can also be entered manually into the input field.

between x-values boundaries

from x-value: Index of the first value from which onwards values are copied. Via the selection list, a suitable data object (Integer/floating-point) is selected. Using the list item manual the index can also be entered manually into the input field.

to x-value: Index of the last value up to which values are copied. Via the selection list, a suitable data object (Integer/floating-point) is selected. Using the list item manual the index can also be entered manually into the input field.

For the definition of first and last values, also Groups of Values can be selected. Thus, if the calculation is applied to a Group of Channels, individual boundaries can be defined for each channel.

first consecutive range: Only the values of the first closed range of the input data object, where the bit specified below is set, are transferred to the result data object. X0 and DeltaX respectively the independent channel are adopted from the input data object.

each value: All values of the ranges of the input data object, where the bit specified below is set, are transferred to the result data object. The values are written as consecutive sequence to the result channel.

consecutive ranges as matrix columns: All ranges of the input data object, where the bit specified below is set, are transferred to the result data object. The values of each consecutive range are written separately to a matrix column.

where ... is set: A bit channel, e.g. the result of a bit calculation, or a bit matrix (with binary values) with the respective bit (input field) can be selected from a list. The X-grid of the selected data object is compared to the one of the input data and a resampling is carried out if necessary. Blue text below indicates identical, red text different X-grids (resampling).

Limit max columns to: This option sets the maximal number of the result matrix columns to the specified number if selected. The following option states how to proceed
in case of insufficient columns. If the option is deactivated, the number of columns is not limited which might cause memory overflow, though.

**Write remaining values in last column**: If the defined maximum number of columns is not sufficient to hold all ranges, the surplus values are added to the last column if this option is selected. Otherwise, an error is set.

The settings of the last two options are used as initial settings for future calculations.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The *xy-Graph* (below) displays the input data (red) as well as the partial curve (blue). The limits of the partial curve are set by cursors (as shown in the dialog above). When the cursors are shifted, the partial curve is automatically recalculated and the display updated.

The *xy-Graph* (below) shows a partial curve, the input data as well as single bits of the **Bit Arithmetic** (see Bit Arithmetic sample).
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between indices</td>
<td>Integer/LongValue</td>
<td>Integer</td>
</tr>
<tr>
<td>Between x-values</td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td>Condition</td>
<td>BitArray/BitChannel</td>
<td>Channel with Boolean data</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integer</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>IntegerVarColMatrix2D</td>
<td>2D-matrix with integer</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>GroupOfMatrixes</td>
<td>Group of matrixes</td>
</tr>
</tbody>
</table>
2.7.2.6 Curve Split into Matrix

Data channels can be split into several sections (various individual curves) and stored as a matrix. This section oriented splitting allows the usage of the data in other calculations.

The splitting of channels can be carried out through several possibilities:

- A uniform distribution with constant delta
- A uniform distribution with overlapping areas
- Using an independent external channel

The unit of the input channel is maintained in the result data object.
Result Data: Name of the calculation as it will appear in the Explorer.

Common Xoff for all columns: Defines a uniform x offset for all columns of the generated matrix.

Matrix suffix: The generated data objects (matrix) receive the name of the input channel with the appended defined suffix.

Input: List of all data objects available for the calculation. If the input data object is a channel, a matrix is generated. If the input data is a group of channels, a matrix is created for each channel.
Option:

Uniform distribution with constant delta: Splits the channel in equal intervals, either with the defined number of values or the defined range of x-values (e.g. time range).

Delta – value: Defines the number of values after which the data channel shall be split. This corresponds to the distance of 2 neighbouring values of the same row in the result matrix.

Delta – x-range: The channel is split at the set x-value and its multiples. This corresponds to the distance of 2 neighbouring values of the same row in the result matrix.

Columns are continuous: If this option is selected the x-values of the input channel are adopted continuously for the columns of the matrix (value and unit of ΔX of columns).

Uniform distribution with overlapping: The series can be split into a defined number of ranges. Start/end values of the series can overlap.

Number of Region: Defines the number of ranges (number of columns of the matrix) which are to exist after splitting the series.

Overlapping: Defines how many per cent of a range (column) shall overlap with the neighbouring ranges (preceding and following).

Triggered by channel: The splitting of the data channel can be triggered by an independent channel. The desired data object for the triggering can be selected from a list of available data objects. This option is suitable when the dependency of the input data object from a different quantity than the time is more important, e.g. force/travel or oscillation/revolutions. The unit of the independent trigger channel is displayed beside the correspondent fields.

Groups of channels can also be used as trigger data object. In this case, each channel of the input channel group is split according to the respective channel of the trigger channel group. If the numbers of channels in both channel groups are not identical, the result data objects receive error notes in spare channels (number of input channels > number of trigger channels). In case of spare trigger channels, they are simply ignored (number of input channels < number of trigger channels).

Constant trigger value: A new column starts when the values of the trigger channel pass the defined trigger level, either in the ascending slope or in the descending slope depending on the chosen direction.

Triggerlevel: Defines the value at which a new column starts. The value can be entered manually or defined by a data object (single value or group of values).

Direction: Direction of the change of the trigger value (upwards = ascending slope, downwards = descending slope).

Correction: A correction value can be entered in case the cut should be slightly shifted to the actual transgression of the trigger level. This can be done for example to capture the zero crossing at the column start.

Limit max columns to: This option sets the maximal number of the result matrix columns to the specified number if selected. The following option states how to
proceed in case of insufficient columns. If the option is deactivated, the number of columns is not limited which might cause memory overflow, though.

**Write remaining values in last column:** ![Checkmark] If the defined maximum number of columns is not sufficient to hold all ranges, the surplus values are added to the last column if this option is selected. Otherwise, an error is set.

![Error] The settings of the last two options are used as initial settings for future calculations.

**Increasing trigger values:** A new column starts when the trigger channel reaches the first value. The following columns are set by a constant delta.

**Number of Values:** If this option is activated, the value defines the number of values that are written into one matrix column.

All generated columns have the full **Number of Values**. In case of missing values, the columns are filled with zeros at the beginning or end. If the defined **Number of Values** is bigger than the distance between columns (*every*), the values will overlap. With a smaller number, however, some values are omitted.

If this option is deactivated, the matrix columns are as long as to hold all values between two trigger points (defined by *every*).

**First Value at:** Defines the first value at which the channel shall be splitted.

If **Number of Values** is deactivated, this value will be the first value of the first column of the generated matrix.

If a value is defined for **Number of Values** (activated), this value will be placed in the middle of the first column. The other values are calculated using +/- half of the **Number of Values**.

If no **First Value** is defined (option deactivated), the matrix starts with the first value of the input data.

**every:** Defines the further values at which the channel shall be splitted after the First Value. The value represents the distance between 2 neighbouring values of the same matrix row.

**Difference of 2 consecutive values of the trigger channel:** A new columns starts when 2 consecutive values of the trigger channel change more than the stated value.

**of more than +/-:** Defines a tolerance.

**Trigger channel contains split indices:** Each value of the trigger channel is used as split index.

**Trigger channel contains split X-Values:** Each value of the trigger channel is used as x-value at which a split is carried out. The calculation considers also an independent channel of the value channel if existent.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Example 1: Measurement of a chain’s oscillation while increasing the rotational speed up to 5000 rpm.

The measuring data Schwingung and DZAntrieb were measured by a Spider8 in BEAM. The channel Schwingung is to be split depending on the revolutions (in rpm) and displayed as a matrix.
jBEAM splits the channel Schwingung into several speed ranges (columns) using the settings in the dialog on top. In this example the number of values was set to 256, because an FFT analysis fits best with a number of the power of 2. If the number of the values in the matrix exceeds the current number of measured values, the missing values are generated by interpolation and inserted into the matrix.

The number of columns of the matrix is the result of:
\[
\frac{\text{Max}(A) - A(0)}{\Delta X(A)}
\]

- \( \text{Max}(A) \) – Number of values of the independent channel
- \( A(0) \) – First used value of the independent channel
- \( \Delta X(A) \) – Difference between 2 neighbouring values of the same row in the matrix
By using the calculation \textit{FFT Spectrum} an amplitude spectrum of each part of the matrix \textit{Split} can be created. The picture shows the generated frequency-characteristic field.

Example 2: The splitting of a periodical signal (here Sine) into the individual periods (cut at zero crossing, ascending slope). The settings can be seen in the dialog extract on the right side. With the option \textit{Common Xoff} for all columns activated, the ranges are drawn stacked on each other. The correction value of -1 ensures that the channel is always splitted before a zero crossing.

<table>
<thead>
<tr>
<th>Types of data objects</th>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
</tbody>
</table>
Data type | Comment
---|---
Character/StringChannel | Channel with characters/strings
NumericChannelByReference | Referenced numerical channel
ObjectChannel | Channel with unspecified data
GroupOfValues | Group of single values
GroupOfChannels | Group of channels
GroupOfChannelsByReference | Referenced group of channels

**Result data**
| DoubleVarColMatrix2D | 2D-matrix with floating point numbers |

### 2.7.2.7 Date-Split Channel into Matrix

Go to:

**Math**

↓ Curve Calculation

↓ Date-Split

Channel into Matrix

The function **Date-Split Channel into Matrix** can be used to split channels depending on time. The trigger channel can be a time channel or also any other channel.
**Name of Calculation**: Name of data object as it will appear in the Explorer.

**Suffix**: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Trigger Channel**: The trigger channel defines where the input channels shall be split. The selection list shows all suitable data objects. This might be a time channel but also other data object types are available. In this case the values are interpreted as respective time values.

**Input-1 .. 5**: Selection of the channels to be split from a list of available data objects.

  **rel**: If this option is selected the values of each column are calculated relatively to the first value, i.e. the first value of each column is always Zero.

**Trigger option**: The input channels can be cut at definable time periods referring to the trigger channel. The options enable cuts at a definable number of seconds/minutes/hours or cuts per day/week/month/quarter of year/year.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.
**Cancel:** The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numerical channel</td>
<td></td>
</tr>
<tr>
<td><strong>Group of Channels</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group of ChannelsByReference</strong></td>
<td>Referenced group of channels</td>
<td></td>
</tr>
<tr>
<td>Trigger channel</td>
<td>BitChannel</td>
<td>Kanal mit Booleschen Werten</td>
</tr>
<tr>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>StringChannel</td>
<td>Channel with strings</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numerical channel</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[name of input channel]+[suffix]</td>
<td>DoubleVarColMatrix2D</td>
<td>Matrices with splitted values</td>
</tr>
<tr>
<td>&quot;Time&quot;</td>
<td>DoubleVarColMatrix2D</td>
<td>Matrix with time values with option seconds/minutes/hours</td>
</tr>
<tr>
<td>&quot;Date&quot;</td>
<td>DateTimeVarColMatrix2D</td>
<td>Matrix with date values with option day/week/month/quarter of year/year</td>
</tr>
</tbody>
</table>

* Only one channel of the channel group can be selected by index.
2.7.2.8 Value Ranges around a Boolean Trigger

Go to:
Math
Curve Calculation
→ Value Ranges around a Boolean Trigger

This function calculates parts of signals around a Boolean trigger event.

The signal parts are stored in columns of a result matrix. A second result matrix contains the x-values (times) correlated to the signal matrix. The multiple parts of input signals are triggered by a Boolean input item. Pre-trigger time and post-trigger time can be set manually. A synchronization is included if Boolean input channel and signal input channel have different x-grids.

Parallel processing
On the one hand, this component enables the parallel processing of grouped data items as generated e.g. by the Data Source Manager. For instance, if several measurements are carried out over a period of time, many files are created. These files can be selected in the data source manager which generates channel groups, each including one signal of multiple measurements.

Sequential processing
On the other hand, this component supports a sequential processing of data provided e.g. by a Multi-File Import or an online measurement. The processing of data is controlled by action events provided by components such as the Multi-File Import or the Measurement Service.
**Result Data:** Name of the Producer as it will appear in the component list.

**Operation:** The selection of an operation mode is commonly used to execute a calculation on channels imported from multiple files. The three operation modes differ in two elementary characteristics:

- How are the files imported
- Internal or without/external aggregation

The aggregation is merging the intermediate results of the individual files into one final result.

**single/cluster:** The common case is to use this operation mode, when there is only one file to be calculated by the according component and there is no need for any aggregation.
If the calculation should be executed on a cluster, also this operation mode has to be selected. Due to technical limitations there is no internal aggregation available on the cluster, so the aggregation is handled externally by the Cluster-Aggregator. Thus the File-Importer and the aggregation are handled by the Cluster Multi File Controller.

**sequential:** This option is selected if the imported data are provided by e.g. the Multi File Import or by measurements. The Multi File Import loads the import files contained in a definable list one after another. After each load, the import data are processed by defined actions triggered by action events, e.g. append new values, and calculations are validated. The advantage is that the memory load is low even with many large files. However, for every new calculation all the files need to be imported and processed again.

**parallel:** This option is selected if the imported data are provided by e.g. the Data Source Manager. This component generates grouped data items, i.e. all date items of the same name throughout all import files are grouped together. With parallel processing, all files are loaded at the same time. The advantage is that on changes, e.g. a new calculation, no data need to be reloaded. However, in case of many large files this may lead to high memory load. Therefore this option is best suitable for few small files.

**Trigger Input:** The data object with the trigger events is selected from the list of available data objects. With parallel processing, a group of channels containing Boolean channels is expected. With sequential processing it is a Boolean channel. For each trigger event in the Boolean input channel one column is generated in the result matrix.

**Input Data:** This section contains two lists, on the left side all available data objects (groups of channels with parallel processing, all channel types with sequential processing) and on the right side the selected data objects to be included in the calculation.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

- These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.
- With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.
- These buttons sort the selected data objects alphabetically in ascending or descending order.

**Pretrigger:** A time period before the trigger start can be defined from which the values from the input signal are stored in the column of the result matrix. I.e. the signal values start at trigger start minus the defined time.

**Posttrigger:** A time period after the trigger event can be defined up to which the values from the input signal are stored in the column of the result matrix. I.e. the signal values of the respective column end at trigger start plus the defined time if the option posttrigger starts at begin of trigger time is selected, or at trigger end plus the defined time if the option posttrigger starts at end of trigger time is selected.
Max. events: The maximum number of trigger events to be included in the calculation can be defined.

Time mode: For the calculation of the time values, the following options are available:

relative to trigger: Relative time values are stored, i.e. the trigger time starts always at x = 0.

absolute: Absolute time values are stored, i.e. the corresponding time values from the input data.

no gaps between curves: The time values are continually calculated such that there are no gaps between consecutive sections.

base on zero: The continuous result time values start at zero.

Ignore errors in input items: Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

Action Events for Control: With sequential processing mode, the processing of data is controlled by action events. The Multi-File Import provides the action events “TRIGGER” and
"CLEAR" via "StatCtrl". Various control events are, for example, provided by the Measurement Service (Start, Pause, Clear, Stop, StopAll) or by other components, such as Button or Time Trigger.

**Append new Value:** The newly calculated value is written into the channel as soon as the event is triggered. The producer is selected in the first field and a contained control event (Action Event) is selected in the second field.

**Delete all Values:** If the defined event is triggered or Now pressed, all values are deleted.

![Action Events for Control](image)

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▼ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

🔍: The context sensitive help is activated and the cursor changes to 🔍. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>GroupOfChannels</td>
<td>with parallel processing</td>
</tr>
<tr>
<td></td>
<td>all numeric channels</td>
<td>with sequential processing</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.2.9 Envelope Curve

Go to:

**Math**

Curve Calculation

Envelope Curve

This function describes a new data object that envelopes a family of curves. Envelope curves are particularly suitable
to describe moving objects.

Example: Opening and closing of doors; determining the minimum width of a bend so as to ensure the safe passage of cars.

**Result Data:** Name of the Producer as it will appear in the component list. The contained result data objects receive a suffix for the selected calculations.

**Input Data:** Selects the input data from a list of available data objects.

**Preprocessing:** The input data can be preprocessed using the moving average.

- **Subtract moving average with window size:** The moving average calculated over the defined window size is subtracted from the signal value.

**Method:** The following specific methods for the calculation of the envelope curve can be selected:

- Calculates minima and maxima of moving range
- Calculates minima and maxima of moving range, and correct side by side values
- Interpolation between local extrema

**Parameter:**

- **Range for extrema:** For the first two methods, the size of the moving range can be defined.
- **Order:** For the method of **Interpolation between local extrema**, a number can be defined describing how many recursion steps will be applied. The 2nd-order envelope is the envelope of the envelope.

**Calculate envelope curves for:**

- **top:** The upper envelope curve is calculated. Suffix: "-Top".
**bottom**: The lower envelope curve is calculated. Suffix: "-Bottom".

**delta (top - bottom)**: The difference between upper and lower envelope curve is calculated. Suffix: "-Dif".

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

nThe context sensitive help is activated and the cursor changes to 🤔. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The *xy-Graph* (below) displays the envelope curve as well as the input data generated via *Extra→Generators→Numeric Channel*.

![Envelope curve]

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>All numeric data types (e.g. double, float, integer, bit, string, ...)</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>&quot;[name]-Top&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated upper envelope curve</td>
</tr>
<tr>
<td>&quot;[name]-Bottom&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated lower envelope curve</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>&quot;[name]-Dif&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated difference between upper and lower envelope curve</td>
</tr>
</tbody>
</table>

### 2.7.2.10 Memory

Go to:

**Math**

- Curve Calculation
- Memory

The Memory function can be used to create copies of the current state of selected data objects in new data objects.

**Name:** Name of data object as it will appear in the Explorer.

**Producer:** This option can be chosen to copy all data objects of the selected producer. The producer is selected from the list of available producers.
Data objects: This option can be chosen to select and copy individual data objects. The section contains two lists, on the left side the available data objects and on the right side the selected data objects that are to be copied by the memory function.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ▶ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>All data objects (single value, channels, matrices,...)</td>
<td></td>
</tr>
<tr>
<td>Result data</td>
<td>Same as input data</td>
<td></td>
</tr>
</tbody>
</table>

**2.7.2.11 Resampling**

Go to:

Math  
Curve Calculations  
Resampling

The calculation Resampling assembles a variety of functions for interpolation and
synchronisation of signals with different X-grid.

It replaces the former calculations Interpolations, Synchronize Curves and \( y(x) \) Synchronization. In existing projects the old calculations are still applicable, but their context menu offers the chance to convert them to the new Resampling calculation (recommended).

Result Data: Name of component and data object as it will appear in the Explorer.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input data: Data object whose data are to be resampled (interpolated, synchronised).

X-Values: The x-values can either be determined automatically out of \( X_0 \) and \( \Delta X \) or the respective index of the y-values (auto) or defined by a data object.

Since jBEAM version 7.1.4 the X-values do not have to be strictly monotonic increasing anymore. A simple monotonicity is sufficient, i.e. equal X-values are allowed. Also X-values with falling monotonicity are applicable.

Direction: In case of matrices as input, the dimension to be resampled can be selected: 1 (X), 2 (Y) or 3 (Z).

Interpolation: Algorithm that converts the values to a new grid:

Only x-shift (no x-grid change)

- **X-Offset Shift**: Change of the x-offset property; useful only for visualisation.
- **Index shift**: Change of the index relation, no change on grid.

x-shift and resampling to new grid: The resampling of the values to the new grid can be done via various interpolation algorithms:

- **auto average/linear**: The method to be applied is automatically determined in case of Double or Float channels and optionally in case of Integer channels. The applied method depends on how many old values lie within the new grid. If the new grid
needs more values than the old grid, new values are linear interpolated. However, if
the new grid has fewer values than the old grid, the average applies. In case of String
or Boolean channels and optionally Integer channels, the method **hold last value** is
applied.

**Integer: hold last value:** In case of Integer channels either the method **auto
average/linear** (deactivated) or **hold last value** (activated) can be applied.

**linear:** In case of Double or Float and optionally Integer channels it is linear interpolated.
In case of String or Boolean and optionally Integer channels, the method **hold last
value** is applied.

**cubic spline:** In case of Double or Float channels the method **cubic spline** is applied. In
case of String, Boolean and Integer channels, the method **hold last value** is applied.

**B-spline:** In case of Double or Float channels the method **B-spline** is applied. In case of
String, Boolean and Integer channels, the method **hold last value** is applied.

**Lagrange:** In case of Double or Float channels the method **Lagrange** is applied. In case of
String, Boolean and Integer channels, the method **hold last value** is applied.

**hold last value:** The last value is adopted until a new value appears in the input channel.

---

Examples for interpolation algorithms

**New grid:** The new grid values (X-grid) can either be defined by a data object or manually via
the input fields below. Please note that the x-values are required to be an increasing
sequence of values. Optionally, it is possible to create a result object with new x-values.

**Fixed Number:** An absolute number of values for the new data object is defined. The value
range is divided equally.

**Scaled Number:** A coefficient for the number of values for the new data object is defined in
relation to the number of values of the original data object. With values smaller than 1
the number of values is reduced (available range starting at 0.01).

**manual defined grid:** The data is projected to a new x-grid. Missing values are interpolated.

**Range from ... to:** Defines the range of the new grid.

**Delta:** Defines the distance between the x-values.

**values of the existing channel:** The values (Y) of the selected channel are used as new x-grid.

**x-values of the existing channel:** The x-values of the selected channel are used as new x-
grid.
**X-Shift:** Optionally, the new calculated grid can be shifted by the defined value. The value can either be entered manually, calculated via formula or defined by a single value data object.

**Formula Editor:** Opens the Embedded Formula Editor.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

*Example: Signal1 (blue) is resampled (green) using the X-grid of Signal2 (red).*

### 2.7.2.12 Synchronize Curves

Go to:

**Math**

   `→` Curve Calculations

    `→` Synchronize Curves

**Synchronize Curves** synchronises the sampling rates and the time offset with another measurement.

This function is used to compare measurements that are recorded e.g. with different measurement systems, not triggered or with different sampling rates. This calculation is only applicable for equidistant signals, but not for angle-synchronous signals.
This and other calculations have been bundled in the new calculation **Resampling**. In existing projects the old calculations are still applicable, but their context menu offers the chance to convert them to the new **Resampling** calculation. The conversion is recommended as **Resampling** offers the whole range of functions and will be updated further on.

**Result Data:** Name of data object as it will appear in the Explorer.

**Data to Synchronize:** Data object whose data is to be synchronised with the reference data.

**Interpolation:** Algorithm that converts the values to a new grid:
- **X-Offset Shift:** Change of the x-offset property; useful only for visualisation.
- **no interpolation:** Change of the index relation, no change on grid.
- **linear:** The values are calculated for the new grid via linear interpolation.
- **Cubic spline:** The values are calculated for the new grid via cubic spline interpolation.
- **Average:** The values are calculated for the new grid via interpolation by averaging.
- **Last Value:** The values for the new grid are determined each by the last detected value of the old grid.

**Reference-Data:** Data object that provides the reference sampling rate.

**Additional Offset:** Reference and measurement data are shifted relatively to each other by the defined value. The offset can be determined automatically by a data object of the type DoubleValue or entered manually.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign \( \Delta \) in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to \( ? \). The respective help topic is displayed when an area within the dialog is clicked on.

Example

In the xy-Graph (below) the reference data (B Lhori) that define the new grid are displayed in blue color. The measured values (Wischn-Weg - red) have been recorded by a second measuring system independently from the reference data. The red dots show the sampling grid. These data are resampled to the sampling rate of the reference data. The result is sync-Weg (black). In this example the offset is zero.

The following example includes a time offset which was computed automatically with the specification that the blue curve (force) maximum equals the red curve minimum (displacement). The new black curve has been restricted to the reference time range (0 - 2 seconds).
## Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Measured data / Reference</td>
<td>All types of channels (e.g. double, float, integer, bit, string, ...)</td>
</tr>
<tr>
<td></td>
<td>data</td>
<td>Time offset</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Integer/Float/DoubleValue</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

### 2.7.2.13 Synchronize via Timechannel (date/time)

**Go to:**

- **Math**
  - **Curve Calculations**
    - **Synchronize via Timechannel (date/time)**

**Synchronize via Timechannel (date/time)** converts measured values to a new time period and creates a new data object.

**Example:** Conversion of measurement data from a time interval into a new time period (start 29.10.2012 12:00:00). The values have a distance of 10 seconds.
Result Data: Name of component and data object as it will appear in the Explorer.

Input Data: Data objects the data of which shall be converted to the reference data. In the display field behind the selection list, the corresponding number of values of the selected channel is displayed.

Values: Selection of the Y-values to be converted to a new time base from the list of available data objects.

Date/Time: Selection of the corresponding time channel from the list of available data objects.

Reference: Reference data object providing the new time grid.

Date/Time: Selection of the reference time channel from the list of available data objects. If the option manual is selected, the following parameters can be set:

Number of values: In the input field behind the selection list, the number of values of the new time period can be defined. If the number of input and output values is different, the new values are interpolated.

Start: Starting time of the new time period.

Delta: Time interval between the values in the new time period.

Time-Offset: Shifts reference and measurement data by the defined offset.

Method: Algorithm that converts the values to a new grid:

auto average/linear: The method to be applied is automatically determined in case of Double or Float channels and optionally in case of Integer channels. The applied method depends on how many old values lie within the new grid. If the new grid needs more values than the old grid, new values are linear interpolated. However, if the new grid has
fewer values than the old grid, the average applies. In case of String or Boolean channels and optionally Integer channels, the method **hold last value** is applied.

**Integer:** **hold last value:** In case of Integer channels either the method **auto average/linear** (deactivated) or **hold last value** (activated) can be applied.

**linear:** In case of Double or Float and optionally Integer channels it is linear interpolated. In case of String or Boolean and optionally Integer channels, the method **hold last value** is applied.

**cubic spline:** In case of Double or Float channels the method **cubic spline** is applied. In case of String, Boolean and Integer channels, the method **hold last value** is applied.

**hold last value:** The last value is adopted until a new value appears in the input channel.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign⚠️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

**?** : The context sensitive help is activated and the cursor changes to❓. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Values</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Date/time</td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;[name]&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated new values</td>
</tr>
<tr>
<td>&quot;[name]-Time&quot;</td>
<td>DateTimeChannel</td>
<td>Channel with the calculated new time grid</td>
</tr>
</tbody>
</table>
2.7.2.14 Move tests

Go to:

Math
  ➔ Curve Calculations
    ➔ Move tests

2.7.2.15 y(x) Synchronization

Go to:

Math
  ➔ Curve Calculations
    ➔ y(x) Synchronization

**Y(x) Synchronisation** converts measured values to a new grid.

This and other calculations have been bundled in the new calculation **Resampling**. In existing projects the old calculations are still applicable, but their context menu offers the chance to convert them to the new **Resampling** calculation. The conversion is recommended as **Resampling** offers the whole range of functions and will be updated further on.

Example: Two data sets (force over displacement) having different x-grids are to be compared. For this purpose both data sets are joined to a uniform x-grid with this function.

![Synchronize a xy-Curve](image)

**Result Data:** Name of data object as it will appear in the Explorer.
Reference-Data: Algorithm that converts the values to a new grid.

Data to Synchronize: List of available data objects for the calculation.

Existing grid: The data is projected to an already existing x-grid. This x-grid has to be a result of a synchronisation calculation.

Channel: List of all available reference data objects.

New x-grid: The data is projected to a new x-grid. Missing values are interpolated.

Range from ... to: Defines the range of the new grid.

Delta: Defines the distance between the x-values.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

Example

The xy-Graph (below) displays the original data (red and blue curve) as well as the calculated data. The new x-grid of the red curve is marked with black; the blue curve is marked with green. Both curves have the same x-grid and can be subtracted via Formula Editor. The result curve is displayed in magenta.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference data</td>
<td>All types of channels (e.g. double, float, integer, bit, string, ...) and channel groups</td>
<td></td>
</tr>
<tr>
<td>/ data to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>synchronize /</td>
<td></td>
<td></td>
</tr>
<tr>
<td>grid</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.2.16 Resampling Angle-Based

Go to:

**Math**

- Curve Calculations
- Resampling Angle-Based

This function converts a time signal (vibration) into a signal with equidistant angles. The user can specify the delta of the scanning angle as well as the constraint concerning the range to be converted.
Result Data: Name of data object as it will appear in the Explorer.

Time series: Selection of the input data for the time series (time channel).

Value series: Selection of the input data (vibration).

Revolutions: Selection of the revolution on whose basis the order analysis is executed.

  Delta: Defines the delta of the angle for the sampling/conversion.

Limited range: Defines the range which is used for the conversion (referring to the time signal).

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example

The xy-Graphs (below) display the time signal (Vibration) and the resulting angle based values (WinkelSig).
## Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.2.17 Synchronize Hysteresis

Go to:

**Math**

- **Curve Calculations**
- **Synchronize Hysteresis**

The function *Synchronize Hysteresis* transforms the data of a hysteresis into a new grid.

The transformation can be applied to one oscillation or to several oscillations. Start and end points of the analysis can be defined. Margin areas that are not representative can be filtered.

**Example:** Recorded measurement data of a hysteresis is calculated with a new DeltaX (distance between the single measured values). If the new Delta-X is less than the original Delta-X, missing values are created by interpolation (the adding of new values which fit best in the new grid). If the new Delta-X is larger than the original Delta-X the number of values is reduced.

![Hysteresis Synchronisation](image)

**Result Data:** Name of data object as it will appear in the Explorer.

**x-values:** Data object with the x-values (e.g. way).

**y-values:** Data object with the y-values (e.g. force).

**New x-grid:**
Zero:

**Delta X**: Difference between 2 neighbouring values after the synchronisation.

**Amplitude**: Section for synchronising the values (starting from null; e.g. with an amplitude of 100 the span is from -100 to 100).

**symmetric**:

**Method 1**: The synchronized hysteresis is calculates for one oscillation.

**Method 2**: The synchronized hysteresis is calculates for several oscillations. Additionally, this option enables the filtering of certain areas.

**x-range / y-range**: The analysis starts as soon as the first value of the x-data object / y-data object is outside the defined range. The analysis stops when all subsequent values are within the defined area. If both options are activated, the first event counts.

**Filter values**: If the margin areas show values that are not representative, they can be filtered. When the option is activated, only the values are used that are within the defined ranges for the x-values and/or the y-values.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
Example

A spring measurement shall be analyzed and the spring rate determined. For this, the measured values for force (stress) and way (spring travel) as shown in image 1 are displayed in a force-way diagram. The resulting curve is a hysteresis. The Least Mean Square Fit calculation (polynomial with 2 coefficients) can be used to determine the spring rate (gradient). However, as the measured values are not evenly distributed over the entire hysteresis but concentrated on certain areas, the result is displaced, i.e., the straight line is not in the center of the hysteresis. To correct the fault, the function Synchronize Hysteresis is used to create a new grid for the hysteresis in which the values are distributed evenly. The setting of Delta-X has an important influence on the accuracy of the subsequent Least Mean Square Fit calculation. The best possible setting of Delta-X is dependent on the input data and has to be tested. A low value for Delta-X may reproduce the hysteresis more accurately. But if certain areas contain few measured values, it may be impossible to determine values for some grid points. On the other side, a higher value for Delta-X may not reproduce the hysteresis very accurately, but there can be determined values for each grid point.

Image 1: Input data for Way and Force

Image 2: Least Mean Square Fit without synchronization

Image 3: Least Mean Square Fit with synchronization
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

2.7.2.18 Integration of Hysteresis

Go to:

Math

Curve Calculations

Integration of Hysteresis

This function calculates the area of a hysteresis and the area below the hysteresis curve. To calculate the area, the integral calculus is used, allowing for the computation of areas below a graph or areas.

Result Data: Name of data object as it will appear in the Explorer.
Suffix: If the input data is a *group of channels*, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input X-Data:** List of available data objects for the calculation (x-axis).

**Input Y-Data:** List of available data objects for the calculation (y-axis).

**Hysteresis area (H)**
- **Single value:** The hysteresis‘area is stored as a single value in the Spreadsheet.
- **Curve:** The integration of the hysteresis is stored as a typical integration curve.

**Trim begin and end:** Approximation of initial and end value of the hysteresis in order to calculate the hysteresis integration more exactly. The values do not overlap.
- **Publish trim indices:** The starting as well as end index of the hysteresis are displayed as single values in the Spreadsheet.

**Close the path:** Connects the last and first value of the hysteresis.

**Calculate overall integral (I):** Calculates the area below the upper part of the hysteresis’ curve.

**Calculate relation (H/I):** Calculates the relation between the hysteresis’ area and the area below the upper part of the hysteresis’ curve.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

💡: The context sensitive help is activated and the cursor changes to 💡. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The **xy-Graph** (below) displays a hysteresis curve. Input values are force against displacement. The blue marked area shows the area of the hysteresis. The initial and end values were trimmed (approximated) and linked to have a more exactly regulation of the integration. Additionally, there’s the calculation of the integral (area of the hysteresis) as well as the relation between integral and area of the hysteresis. The calculated values are displayed in a **Free Table** in the Graphic window.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td></td>
<td>All types of channels (e.g. double, float, integer, bit, string,...) and channel groups</td>
</tr>
<tr>
<td>Result data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single value</td>
<td>DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td>Curve</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

2.7.2.19 Sort channels

Go to: Math

- Curve Calculations
  - Sort channels

The function sorts the values of a reference channel in ascending or descending order. The new indices of each value will be used as reference.
value for all selected channels.

Example: The values of the reference channel will be sorted ascending. The values of the selected channels will be sorted depending on the new indices of the reference channel, e.g. if the lowest value is situated at position/index 10, it will be moved to the first in the sorted channel. On basis of the new indices all values of the selected channels will be sorted (the 10th value is moved to the first position, etc.).

**Name:** Name of data object as it will appear in the Explorer.

**Result Suffix:** Suffix for each sorted result channel (result data object).

**Sort mode:** In the table, up to 10 levels can be generated after which shall be sorted in the given order.

- **Order by:** For each activated level, the channel to be sorted is selected from a list of available channels.
- **Ascending:** If this option is selected, the elements of this level are sorted in ascending order, otherwise in descending order.
**Actions:** Via the buttons of this column, levels can be added, shifted or deleted.

- **Level up:** The respective level is moved up in the list by one position.
- **Level down:** The respective level is moved down in the list by one position.
- **Add level:** A new level is added after the respective level.
- **Delete level:** The respective level is deleted.

**NaN-Handling:** If the data objects selected above contain NaN values, the following options can be used to define where NaNs shall be placed among the sorting criteria.

- **Hold position:** If one of the selected data objects contains a NaN at one position, this position is maintained, i.e. the respective line will not be moved.
  - Please note that with this option the sorting order of upper levels will not be observed if a NaN occurs in a lower level.
- **At the beginning:** If one of the selected data objects contains a NaN at one position, the respective line is placed at the beginning of the sorting criteria of this level.
- **At the end:** If one of the selected data objects contains a NaN at one position, the respective line is placed at the end of the sorting criteria of this level.

**Channels to sort with main:** This section contains two lists, on the left side the available data objects (channels or individual channels from channel groups) and on the right side the selected data objects that are to be sorted as well.

Channels from channel groups can also be selected (e.g. `ChannelGroup[]`). By default, on selection of a channel group the index is set to 1 at first. On further selections the index is incremented or set to the lowest available index until all existing indexes are selected. The indexes can be edited manually via the **Edit** button.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

- **>> > < << :** These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.
- **: With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.
- **: These buttons sort the selected data objects alphabetically in ascending or descending order.
- **: The dialog **Configure Input Objects** opens where the index of the desired channel of the group can be entered.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.
Delete: The calculation is deleted and the dialog closed. A warning sign ▶ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

FAQ: The context sensitive help is activated and the cursor changes to ❯❯. The respective help topic is displayed when an area within the dialog is clicked on.

Example

The upper xy-Graph displays the original values as a curve. The lower chart depicts the sorted result channels. The Spreadsheet displayed on the right side shows an extract of the original data and the sorted result channels.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data</td>
<td>All types of channels (e.g. double, float, integer, bit, string, ...)</td>
<td>Channels from channel groups</td>
</tr>
<tr>
<td>Result Data</td>
<td>As input data</td>
<td></td>
</tr>
</tbody>
</table>
2.7.2.20 X-Data change

Go to:

Math
   • Curve Calculations
   • X-Data change

This component generates data objects with modified X-information, i.e. the defined channel is explicitly assigned as independent channel.

Several channels with measured data and an X-channel can be selected. For each selected channel, the component generates one channel with the same data but the selected X-channel as independent channel.

![X-Data change dialog box]

**Name:** Name of data object as it will appear in the Explorer.

**Result suffix:** Suffix for each result channel (result data object).

**new X-Data Object:** Selection of the channel to be assigned as independent channel to the channels selected below.

**Items to change x-data:** This section contains two lists, on the left side the available data objects (channels) and on the right side the selected data objects the X-information of which shall be changed.
The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.7.2.21 Complex channel extractor

Go to:

Math

Curve Calculations

Complex channel extractor

This component enables to extract specific parts of a complex channel.
Result Data: Name of data object as it will appear in the Explorer.

Input Data: This section contains two lists, on the left side the available data objects and on the right side the selected data objects that are to be decomposed.

The expected data objects are complex channels. But also double and float channels can be selected. They then act as complex channels with an imaginary part of zero.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

These buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

Parts to extract: Selection of the desired part to be extracted (real part, imaginary part, amplitude or phase).

Decibel conversion: If the option Extract amplitude is selected, a decibel conversion can be carried out: dB-value = coefficient * log10(value/reference). Coefficient and reference can be entered manually or set via predefined values out of the selection list.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign⚠️ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to❓. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.7.2.22 Manual Channel Adjustment

Go to:

**Math**

- Curve Calculations
- Manual Channel Adjustment

This component enables to edit individual values of an existing channel. The changes are saved in a copy, thus the original channel remains unchanged.
Result Data: Name of data object as it will appear in the Explorer.

Input Data: Selection of the channel to be modified out of the list of available data objects.

Old Values / New Values: The table lists the original values of the input data object in the left column. The right column shows the result data object with the already changed values highlighted by color. The values in the right column can be edited by double-clicking and entering a new value.

Reset: All changed values are reset to the original values.

Preview: The curve shows the result data including all current changes. Analog to the Universal 2D-Graph in Non-Edit mode the curve can be zoomed and moved.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.7.3 Curve Analysis

Go to:

Math
  ▸ Curve Analysis

The menu consists of the following submenus:

- Plausibility of Channels
- Peak Detection
- Peak Area Detection
- Step-Response
- Correlation of 2 Curves
- Plateau Analysis
- Multiple Events Analysis
- E-Modulus
- Compression Work
- Gearwheel Analysis
- Haptic-Analysis
- Edit a Curve

2.7.3.1 Plausibility of Channels

Go to:

Math
  ▸ Curve Analysis
     ▸ Plausibility of Channels

This function checks the plausibility of data according to definable criteria.
Name: Name of the result data object as it will be listed.

Input

Producer: All data objects of the selected producer are checked.

Data objects: The data objects to be checked can be selected from the list on the left via arrow keys. All data objects of the list on the right are checked.

Plausibilities

channel has values (size > 0): It is checked whether the data objects contain values, i.e. the channel size is higher than 0. The result is true if this applies to all data objects. If only one data object is empty the result is false.

if values available, they are not all NaN: It is checked whether at least part of the contained values is not NaN. The result is true if all data objects contain values other than NaN. If only one data object contains only NaN values the result is false.

Formula: It is checked whether the contained values fulfill the defined formula (condition). The selected data objects are included in the formula by using CurrDataItem as variable. The result is true if all values of all selected data objects meet the condition. Otherwise the result is false.

results also per input item: In addition to the total result, the individual results for each selected data object can be generated. The calculated Integer value is the sum of the single plausibility checks which set a bit in case of error. These are:
Bit "1": Check **channel has values (size > 0)** – Bit is set if the condition for this channel is not met, i.e. the channel is empty. Otherwise the bit is 0.

Bit "2": Check **if values available, they are not all NaN** – Bit is set if the condition for this channel is not met, i.e. the channel contains only NaN values. Otherwise the bit is 0.

Bit "4": Check **Formula** – Bit is set if the condition for this channel is not met, i.e. the formula result is false. Otherwise the bit is 0.

**Example:** Result = 0: All conditions for this channel are met.
Result = 5: The plausibility check results in two error cases (Bit "1" + Bit "4"). The channel is empty and the formula result is false.

**Formula Editor:** Opens the [Embedded Formula Editor](#).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign △ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Help Button](image)

: The context sensitive help is activated and the cursor changes to ![Help Button](image). The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numerical channel</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Total_Plausibility&quot;</td>
<td>BitValue</td>
<td>Boolean value – total result for all checked channels and plausibilities</td>
</tr>
</tbody>
</table>
### 2.7.3.2 Peak Detection

With the function **Peak Detection** peak values can be determined in a defined range.

**Name**: Name of data object as it will appear in the Explorer.

**Input X-Data**: List of available data objects for the calculation (x-axis).

**Input Y-Data**: List of available data objects for the calculation (y-axis).

**Note**: Only positive peak values can be calculated so it’s necessary to choose a reasonable co-domain (0+X).

**Max. Number of Peaks**: Defines the maximum number of peaks displayed.

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Names&quot;</td>
<td>StringChannel</td>
<td>Channel with the names of the checked channels</td>
</tr>
<tr>
<td>&quot;Plausibility&quot;</td>
<td>IntegerChannel</td>
<td>Channel with the individual results for each checked channel</td>
</tr>
</tbody>
</table>
Sorted Peak Values: Sorts the peak values by the values that are situated next to the maximum.

Decrease after Peak to: The value must decrease to the indicated percentage rate of the peak value to be recognized as a peak value candidate.

Minimum Value for Peaks

Absolute: Specifies the absolute value (starting from null) which must be reached to be recognized as a peak values.

Relative: Specifies the relative value, which must be reached (starting from the maximum) to be recognized as peak values.

Graphic Output: Settings for the visualisation:

Line Color: Defines the color of the line between null and the peak value.

Values: Values are depicted with the desired decimal digits.

Text Parameter: Sets the text parameters (font, size, color, bold or italic). The demo field displays the selected font settings.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to  ? . The respective help topic is displayed when an area within the dialog is clicked on.

Example

In the table a temperature channel (Temp) is displayed, which consists of several values (temperatures). The different peak values of the measurement are to be determined by the function Peak Detection. The determined peak values are written in the generated data objects (channels) with their respective x- and y coordinates (Peaks-X/Peaks-Y).

The xy-Graph (below) displays the temperature curve as well as the peak values with the desired parameter.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
<td></td>
</tr>
<tr>
<td>IntegerChannel</td>
<td>Channel with integers</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
<td></td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
"[name]-X"/"[name]-Y" | DoubleChannel / GroupOfChannels | Channel or group of channels with the X- or Y-values of the peaks |
| 
"[name]-Graph"  | GraphObjectVector / GroupOfGraphObjectVectors | Graph object or group of graph objects to display the peaks with values in the Universal2D-Graph |

2.7.3.3 Peak Area Detection

Go to:

**Math**

- Curve Analysis
- Peak Area Detection

With the Peak Area Detection a user can analyze jumps within the course of a signal. Besides the determination of the peak value, the calculation provides freely definable timeframes
around the events. Additionally, the calculation enables the interactive switching between different events, detected in the channel, for a detailed evaluation.

**Result Data:** Name of the result data object as it will be listed.

**Suffix:** If the input data is a *group of channels*, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input X-Data:** List of available data objects for the calculation (x-axis).

**Input Y-Data:** List of available data objects for the calculation (y-axis).

**Max. Number of Peaks:** Defines the maximum number of peaks displayed.

**Min. Increase for a Peak:**

- **absolute:** Defines the absolute value (starting at zero) by which the values at least must change within the time period stated under *in*, in order to be recognised as peak values.

- **relative:** Defines the relative value by which the values at least must change within the time period stated under *in*, in order to be recognised as peak values. The defined percentage is related to the range between minimum and maximum.
Decrease after Peak to: The value must decrease to the indicated percentage rate of the peak value to be recognized as a peak value candidate.

Ident prefix: A string channel is created containing for each peak area the stated prefix plus number of the peak area.

Time-0: Peak minus: A channel [Name]-T0 is created containing the starting points of the peak areas. The value stated defines the span before the peak.

Time-1: Peak plus: A channel [Name]-T1 is created containing the end points of the peak areas. The value stated defines the span after the peak.

Graphic Output: If this option is activated a graphic object is created to display the peak areas. The following settings can be made:

- **Line Color**: Defines the color of the line between null and the peak value.
- **Values**: The values are displayed with the stated decimal digits.
- **Text Parameter**: Sets the text parameters (font, size, color, bold or italic). The demo field displays the selected font settings.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

![Help Button](image)

: The context sensitive help is activated and the cursor changes to ▲. The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** The *xy-Graph* (below) displays the input signal "OELTEMP" (blue) and the graphical representation of the peaks with their corresponding peak areas according to the set parameters (see dialog above).
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
<td></td>
</tr>
<tr>
<td>IntegerChannel</td>
<td>Channel with integers</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
<td></td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;[name]-Ident&quot;</td>
<td>StringChannel / GroupOfChannels</td>
<td>Channel or Group of channels with strings to name the peak areas</td>
</tr>
<tr>
<td>&quot;[name]-T0&quot;</td>
<td>DoubleChannel / GroupOfChannels</td>
<td>Starting point of the calculated peak area</td>
</tr>
<tr>
<td>&quot;[name]-T1&quot;</td>
<td>DoubleChannel / GroupOfChannels</td>
<td>End point of the calculated peak area</td>
</tr>
<tr>
<td>&quot;[name]-V&quot;</td>
<td>GraphObjectVector / GroupOfGraphObjectVectors</td>
<td>Value of the calculated peak</td>
</tr>
<tr>
<td>&quot;[name]-Graph&quot;</td>
<td>GraphObjectVector / GroupOfGraphObjectVectors</td>
<td>Graph object or group of graph objects to display the peak areas with values in the Universal2D-Graph</td>
</tr>
</tbody>
</table>

#### 2.7.3.4  Step-Response

Go to:

**Math**

Curve Analysis

Step-Response

The calculation **Step Response** determines the duration which a following signal needs to reach a certain level of the leading signal after a step.
**Result Data:** Name of data object as it will appear in the Explorer.

**Step X / Y:** Selection of data objects (X- and Y-values) for the leading signal. If "auto" is selected, X0 and deltaX of the Y-value will be used as reference for the calculation.

**Response X / Y:** Selection of data objects (X- and Y-values) for the following signal. If "auto" is selected, X0 and deltaX of the Y-values will be used as reference for the calculation.

**Reference:** Reference value of the leading signal (in per cent) which the following signal has to reach in order to be viewed as a step (minimum 20%).

**Line Color:** Selects the line color that will be used for drawing the time interval in a line chart.

**Values:** For selecting the decimal place of the time interval as it will be displayed in the graphic depiction.

**Text Parameter:** For setting the text parameter (font, size, color, bold or italic). The demo field displays the selected font settings.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ⚠ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
Example

The **xy-Graph** (below) shows the leading signal (blue with markers), the following signal (red) as well as the display of the step duration plus time (black).

![Example Graph](image)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td>DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>GraphObjectVector</td>
<td></td>
</tr>
</tbody>
</table>

2.7.3.5 Correlation of 2 Curves

Go to:

Math
- Curve Analysis
  - Correlation of 2 Curves

The calculation **Correlation of 2 Curves** determines the correlation coefficient of 2 channels. Beside the current correlation coefficient, the calculation also determines the maximum possible correlation of the channels as well as the time offset between current and maximum possible correlation coefficient.
Result Data: Name of the result data object as it will be listed.

Input 1 / 2: Selection of the data objects for the two signals between which the correlation shall be determined.

X-Data: Selection of the data object for the x-values. If auto is selected, X0 and deltaX of the Y-value will be used as reference for the calculation.

Y-Data: Selection of the data object for the Y-values.

Timeshift begin / end: Besides the current correlation coefficient, i.e. Timeshift = 0 (result value: [Name]-Coeff_0) the calculation also determines the maximum possible correlation coefficient (result value: [Name]-Coeff_Max). For this, the second curve is shifted against the first curve using a timeshift. The range of the timeshift is defined by begin and end. Within this range the curve is shifted step by step with the defined Increment. In each step the correlation coefficient is determined. The result is a number N of calculation steps and thus values in the channel for the maximum possible correlation coefficients (result channel: [Name]). For the maximum of these values the corresponding offset (timeshift) is determined (result value: [Name]-DelX).

The choice of the Timeshift range is deciding whether the real maximum possible correlation coefficient is found. If the range is too small, the necessary timeshift might be outside of the range and is then not included in the calculation. If the range is too large, there might be several peaks within the range. The values for Coeff_Max and DelX are determined out of the first or the highest found maximum. It can be easily tested via graphical display of the coefficient channel whether there is a maximum closer to the Zero point. Then, the range can be narrowed down accordingly (see example).

Increment: The choice of the Increment is deciding how precise the maximum possible correlation coefficient is calculated. The smaller the Increment the more precise is the result. With a very large number of calculation steps (N), however, the calculation might be slower.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**: The left xy-Graph (below) displays the two signals *Soll* and *Ist* (green and blue curve) for which the correlation coefficient shall be determined. The red curve represents the *Ist* curve shifted by the determined offset for the maximum possible correlation coefficient. The right graph shows the result of the calculation: the channel *Korrelation* with the correlation coefficients calculated over the Timeshift range (blue curve), the current correlation coefficient *Korrelation-Coeff_0* (red marker), and the maximum possible correlation coefficient *Korrelation-Coeff_Max* with the corresponding offset *Korrelation-DelX* (green marker).

Example for a too small Timeshift range: The real maximum possible (as in the example above) is not found as it is located at a DeltaX of 0.125s. Here however, the Timeshift range was limited to -0.05 to 0.05s.
Example for a too large Timeshift range: The found maximum is not the one closest to current position. Therefore the corrected curve has been shifted too much.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Result Data</td>
<td>&quot;[name]&quot;</td>
<td>Channel with correlation coefficients</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>calculated step by step</td>
</tr>
<tr>
<td></td>
<td>&quot;[name]-Coeff_0&quot;</td>
<td>current correlation coefficient</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>maximum possible correlation coefficient</td>
</tr>
<tr>
<td></td>
<td>&quot;[name]-Coeff_Max&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>Offset (Delta-X) of the second signal</td>
</tr>
<tr>
<td></td>
<td>&quot;[name]-DelX&quot;</td>
<td>for the maximum possible correlation coefficient</td>
</tr>
</tbody>
</table>
2.7.3.6 Plateau Analysis

Go to:

Math
   → Curve Analysis
   → Plateau Analysis

Plateau Analysis determines plateaus of an input channel as well as corresponding values of a second channel or a group of channels (e.g. various rotational speed levels are accessed and a performance value is determined for each rotational speed).

In the course of the Plateau Analysis, plateaus can be searched automatically or plateau values can be provided. Averaging the values is carried out by using either the full length of the plateau or a predefined length. Settling phases can be omitted.
Result Data: Name of the result data object as it will be listed. Two data objects are generated, one with the addition "~_X" for the time mean of the averaged area and a second with the addition "~_Y" for the mean value of the respective area.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Independent Channel (Time): A time channel is selected from the list of available channels. If auto is selected, the x-values are calculated from the y data object.

Channel with Plateaus: The channel containing the plateaus to be determined is selected from the list of available channels.

Channel to average: The channel with the corresponding values to be averaged is selected from the list of available channels.

Plateau setpoint values: The channel with predefined plateaus is selected from the list of available channels. If the option no is selected, the plateaus are automatically determined.
out of the input channel. Depending on the quality of the input signal this procedure may take some time and perhaps return imprecise results. With the option manual input the input field below is enabled and plateau values can be entered manually.

**manual plateau input:** The input field is enabled when the option manual input is selected under Plateau setpoint values. Then the plateau values can be entered here directly. The single values are separated by semicolon. The input field is highlighted in red until valid values are entered.

**global settling phase:** The starting values of the input channel can be omitted when determining the values average.

**relative:** If the input channel does not start at zero, the global settling phase can be specified as a value relative to the beginning of the channel.

**upper plateau border:** Defines the allowed deviation of the upper plateau border. The maximum deviation value is summed up from a percentage and an absolute value.

**lower plateau border:** The allowed deviation of the lower plateau border can be defined like upper plateau border. Alternatively, deviating percentage and absolute value can be defined as well.

**minimal plateau length:** Defines the value of the minimal plateau length. Note that the value cannot be less than the sum of settling phase and averaging phase. If also plateaus with only one value shall be found, the plateau values must be preset and the minimal plateau length set to zero.

**settling phase:** The beginning of each plateau can be omitted for the averaging of the values.

**averaging phase:** Defines the plateau length that is to be averaged. It begins at the end of the settling phase. Alternatively, the full plateau length minus the settling phase can be averaged.

**direction:** The Plateau Analysis can be carried out forwards or backwards.

**Number of measuring cycle:**

- **one:** To determine the plateaus one measuring cycle is evaluated, i.e. as soon as each plateau has been found and an average value determined, the analysis is terminated. The results for the x- and y-values are channels.

- **multiple:** To determine the plateaus several measuring cycles are evaluated. As soon as a plateau is found again, a new measuring cycle starts and the calculated average is written into the next row of the matrix. The results for the x- and y-values are matrices.

- **multiple combined:** To determine the plateaus several measuring cycles are evaluated. When a plateau is found again, the new values are combined with the already calculated average of this plateau. The results for the x-values are stored in a matrix, the results for the y-values are combined to one channel.

**State channel:** If active, an additional channel "[name]_State" is generated which states whether the corresponding measured value has been on a plateau or not (true/false).

**Sort mode:** The order of the plateaus in the result data objects can be defined via the following options:

- **Appearing order:** The plateaus are sorted in the order as they appear in the input data.
**Preset order**: If the plateaus are preset by a channel or a manual list, this order is maintained.

**Ascending**: The plateaus are sorted in ascending order.

**Descending**: The plateaus are sorted in descending order.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to help. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**: At the engine test bench different rotational speed levels \( (n) \) are accessed and the performance data \( (P) \) are recorded. A channel with defined plateaus for the rotational speed \( (\text{Plateaus}) \) is created in jBEAM. The Plateau Analysis is executed via a measuring cycle with the settings displayed in the Spreadsheet. 2 channels are generated: one consists of the time’s average \( (PA_X) \), the other contains the performance’s average \( (PA_Y) \) from the correspondent evaluation area.

![Spreadsheet]

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0</td>
<td>0.0</td>
<td>-0.100</td>
<td>500.000</td>
<td>51.2</td>
<td>15.529</td>
</tr>
<tr>
<td>2</td>
<td>0.0</td>
<td>0.0</td>
<td>-0.100</td>
<td>1,000.0...</td>
<td>126.0</td>
<td>27.592</td>
</tr>
<tr>
<td>3</td>
<td>0.0</td>
<td>2.7</td>
<td>-0.100</td>
<td>1,500.0...</td>
<td>183.0</td>
<td>39.457</td>
</tr>
<tr>
<td>4</td>
<td>0.0</td>
<td>7.3</td>
<td>-0.100</td>
<td>2,000.0...</td>
<td>260.3</td>
<td>51.416</td>
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<tr>
<td>5</td>
<td>0.0</td>
<td>12.9</td>
<td>-0.100</td>
<td>2,500.0...</td>
<td>359.9</td>
<td>63.716</td>
</tr>
<tr>
<td>6</td>
<td>0.1</td>
<td>21.0</td>
<td>-0.100</td>
<td>3,000.0...</td>
<td>438.5</td>
<td>75.292</td>
</tr>
<tr>
<td>7</td>
<td>0.1</td>
<td>29.7</td>
<td>-0.100</td>
<td>3,500.0...</td>
<td>844.7</td>
<td>87.380</td>
</tr>
</tbody>
</table>

**Values**

**Statistic / Properties**
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numerical channel</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels (only Channel to Average)</td>
</tr>
</tbody>
</table>

Result Data

| "[name]_X"      | DoubleChannel/DoubleVarColMatrix2D            | Channel or matrix with the time means of the averaged areas |
| "[name]_Y"      | DoubleChannel/DoubleVarColMatrix2D            | Channel or matrix with the mean values of the respective areas |
| "[name]_State"  | BitChannel                                    | Optional channel with status whether value is on plateau (true/false) |
2.7.3.7  Multiple Events Analysis

Go to:  
Math  
- Curve Analysis  
  - Multiple Events Analysis

The calculation **Multiple Events Analysis** analyses series of measurements according to definable events.

**Parallel processing**

On the one hand, this component enables the parallel processing of grouped data items as generated e.g. by the **Data Source Manager**. For instance, if several measurements are carried out over a period of time, many files are created. These files can be selected in the data source manager which generates channel groups, each including one signal of multiple measurements.

**Sequential processing**

On the other hand, this component supports a sequential processing of data provided e.g. by a **Multi-File Import** or an online measurement. The processing of data is controlled by action events provided by components such as the Multi-File Import or the Measurement Service.

**Processing in a jBEAM Cluster**

As a new option, the processing of data within a **jBEAM Cluster** is supported. Several jBEAM instances combined in a cluster analyse simultaneously different measurement files. The part results are then aggregated to a total result. This method is especially useful for a high amount of files while consuming little storage space. In order to perform a cluster calculation a **Cluster-MultiFile Controller** for control and a **Cluster-Aggregator** component is necessary.
Name: Name of the Producer as it will appear in the component list. The result data objects receive names according to the selected functions.

Operation: The selection of an operation mode is commonly used to execute a calculation on channels imported from multiple files. The three operation modes differ in two elementary characteristics:

- How are the files imported
- Internal or without/external aggregation

The aggregation is merging the intermediate results of the individual files into one final result.

single/cluster: The common case is to use this operation mode, when there is only one file to be calculated by the according component and there is no need for any aggregation.
If the calculation should be executed on a cluster, also this operation mode has to be selected. Due to technical limitations there is no internal aggregation available on the cluster, so the aggregation is handled externally by the Cluster-Aggregator. Thus the File-Importer and the aggregation are handled by the Cluster Multi File Controller. The calculation on the cluster is limited in its Input-Data-Object types, so that a Group of Channels as input is only permitted as far as the calculation supports it and if it does not originate from a Datasource-Manager.

**sequential:** This option is selected if the imported data are provided by e.g. the Multi File Import or by measurements. The Multi File Import loads the import files contained in a definable list one after another. After each load, the import data are processed by defined actions triggered by action events, e.g. append new values, and calculations are validated. The advantage is that the memory load is low even with many large files. However, for every new calculation all the files need to be imported and processed again.

**parallel:** This option is selected if the imported data are provided by e.g. the Data Source Manager. This component generates grouped data items, i.e. all data items of the same name throughout all import files are grouped together. With parallel processing, all files are loaded at the same time. The advantage is that on changes, e.g. a new calculation, no data need to be reloaded. However, in case of many large files this may lead to high memory load. Therefore this option is best suitable for few small files.

**Events:** The data item containing the events to be analysed is selected from the list of available data items. With the modes single/cluster and sequential all numeric channels are available, with parallel mode groups of data items are listed.

**Odometer:** The data item containing the corresponding mileage is selected from the list of available data items. With the modes single/cluster and sequential all numeric channels are available, with parallel mode groups of data items are listed.

**Event Detection Methodology:** These options define the criteria by which the events are determined.

**absolute:** All values are checked for the criteria.

**relative (delta):** The difference to the previous value is checked for the criteria. This way, rising or falling edges are determined.

**Relational operator:** Selection of the relational operator from the list of available operators.

- `>:` All values greater than the upper level.
- `>=:` All values greater than or equal to the upper level.
- `<=:` All values lesser than or equal to the lower level.
- `<:` All values lesser than the lower level.
- `[ ]:` All values within the range between upper and lower level.
- `] [:` All values outside of the range between upper and lower level.
Create result channels for: Optionally, channels can be created for index ("Event-No.") and file name ("File-Name") for each detected event.

Odometer: Optionally, channels can be created containing the mileage for begin ("Odo Begin"), end ("Odo End") and delta ("Odo Delta") of each event, both File based and Event based ("Odo Event-Start", "Odo Event-End", "Odo Event-Delta").

Time: Optionally, channels can be created containing corresponding times (X-values) for begin ("Time Begin"), end ("Time End") and duration ("Measuring-Time") of each event, both File based and Event based ("Time Event-Start", "Time Event-End", "Time Event-Duration"). Additionally, the duration of an event in relation to the measuring time of the corresponding file can be calculated ("Rel-Event-Duration").

File based: The start and end values as well as their difference of the file containing the event are determined.

Event based: The start and end values as well as their difference of each event are determined.

no gaps between curves: If this option is selected, the individual channels of all files are concatenated without gap even if the measurements have been recorded with a time interval in between.

Calculate Statistical Values For Each of the Selected Channels: Statistical values can be calculated for the selected channels and stored in a an own data item.

- **begin**: The start values of the channel in each file are stored ("[name of data item]-Begin").
- **end**: The end values of the channel in each file are stored ("[name of data item]-End").
- **delta**: The differences of start and end values of the channel in each file are stored ("[name of data item]-Delta").
- **minimum**: The minimum values of the channel in each file are stored ("[name of data item]-Min").
- **maximum**: The maximum values of the channel in each file are stored ("[name of data item]-Max").
- **average**: The average values of the channel in each file are stored ("[name of data item]-Average").
- **standard deviation**: The standard deviation values of the channel in each file are stored ("[name of data item]-StdDev").

Available Channels / Selected Channels: This section contains two lists, on the left side all available channels (groups of channels with parallel processing) and on the right side the selected channels of which the statistical values shall be calculated.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.
With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

**Action Events for Control:** With sequential processing mode, the processing of data is controlled by action events. The [Multi-File Import](#) provides the action events "TRIGGER" and "CLEAR" via "StatCtrl". Various control events are, for example, provided by the Measurement Service (Start, Pause, Clear, Stop, StopAll) or by other components, such as [Button](#) or [Time Trigger](#).

**Append new Value:** The newly calculated value is written into the channel as soon as the event is triggered. The producer is selected in the first field and a contained control event (Action Event) is selected in the second field.

**Delete all Values:** If the defined event is triggered or Now pressed, all values are deleted.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🔄 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

️: The context sensitive help is activated and the cursor changes to 🎯. The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** The following example shows the recording of the vehicle speed. Via [Multiple Events Analysis](#), all sections are counted as events where the speed continuously was higher than or equal to 50 km/h. For each event, the start
and end time as well as the duration is determined. Additionally, a statistical value for the average speed of each event is calculated (see dialog above).

2.7.3.8 E-Modulus

Go to:

Math
  ➜ Curve Analysis
  ➜ E-Modulus

The calculation E-Modulus determines the elasticity modulus. This material property describes the connection between stress and deformation (mostly strain) when solid bodies are subject to mechanical stress.

The value of the elasticity modulus is the bigger the more resistance a material offers to its deformation. That means a material with a high E-Modulus is inflexible and a material with low E-Modulus is flexible. Within the elasticity range the elasticity modulus corresponds to the gradient of the graph in a stress-strain chart.
Result Data: Name of data object as it will appear in the Explorer.

Force: The combo box lists all data objects available for the force input data. The unit of the selected data object is displayed in the right field.

Strain: The combo box lists all data objects available for the strain input data. The unit of the selected data object is displayed in the right field.

Evaluation: The values Force from and to define the start and end points for the data range to be evaluated. They are stated as percentage of all values.

Crosssection: The value for the cross-section of the body can be defined manually in the input field or via data object that is selected from the combo box with available data objects.

Max. force: If the checkbox is activated, the maximum force is marked in the result. The color for the marker can be selected via the color selector.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.
? : The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>GraphObjectVector</td>
<td>Graph of the type &quot;Graphic Objects&quot;</td>
</tr>
</tbody>
</table>

### 2.7.3.9 Compression Work

Go to:

**Math**
- Curve Analysis
- Compression Work

**Compression Work** allows the calculation of work/energy in relation to force and displacement.

**Example: Pressing pills**

After pressing pills compression and expansion energies can be computed from the force-displacement development. The plasticity value (the quotient of plastic energy and total energy) is stored as a quality feature in table form.
**Name:** Name of data object as it will appear in the Explorer.

**Displacement:** A list of available data objects for the calculation.

**Force:** A list of available data objects for the calculation.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign \( \Delta \) in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

\( \text{?} \): The context sensitive help is activated and the cursor changes to \( \vec{?} \). The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

When pressing pills the maximum forces for top and bottom punch as well as ejection force are determined. The following values are computed:

- **So:** Top punch distance when dipping into the bottom die
- **Se:** Top punch distance not receiving any force
- **Smax:** Maximum top punch distance
- **Fsm:** Force of the maximum top punch distance
- **Fm:** Maximum press capacity
- **Ep:** Plastic energy
- **Ee:** Elastic energy
- **P:** Plasticity
The force-displacement curve is displayed in the Graphic window (below).

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>Basic Map</td>
<td>Map with properties</td>
</tr>
</tbody>
</table>

2.7.3.10 Gearwheel Analysis

Go to:

Math
  → Curve Analysis
    → Gearwheel Analysis

The calculation Gearwheel Analysis determines the wear (angle alteration) of a gearwheel. The calculation shows the angle alteration of the gearwheel over time respectively with increasing number of revolutions.
Name: Name of data object as it will appear in the Explorer.

Timesignal: List of available data objects for the calculation.

Number of teeth: The number of the gearwheel’s teeth.

Mode

Single tooth: Selection of the tooth to be checked.

All teeth as one channel: All values of the teeth are depicted in a channel.

All teeth as a matrix: All values of the teeth are depicted in a matrix.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
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<tbody>
<tr>
<td>Input data</td>
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<td>Channel with floating point numbers</td>
</tr>
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<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>BasicMap</td>
<td>Map with properties</td>
</tr>
</tbody>
</table>
2.7.3.11 Haptic-Analysis

Go to:

Math
  → Curve Analysis
    → Haptic-Analysis

The evaluation module Haptic-Analysis calculates characteristic values of different controls. It is possible to analyse (in parts interactive) push buttons (also with multiple steps), slider (friction) and adjusting knobs (raster or friction) and calculate their characteristic value. The result can be integrated in reports as graph or text.

Result Data: Name of data object as it will appear in the Explorer.
Tab Parameter

**x-Channel**: List of available data objects for the calculation.

**y-Channel**: List of available data objects for the calculation.

**Type**: Selection of 4 controls: *Slider (friction)*, *Pushbutton (steps)*, *Turning knob (friction)*, *Turning knob (raster)*

Depending on the selected control several parameters can be set, e.g. if *Pushbutton* is selected, the steps can be detected **automatically** or set **manually**. Furthermore the tab **Manual Correction** will be enabled in order to make manual corrections.

**Filtered**:  
- **Outer-Ø**: Selects the outside-diameter of the knob either via data object (single value), manual input or formula. This parameter is only enabled if Turning knob (friction) or Turning knob (raster) is selected.
- **Usage-Ø**: Selects the usage diameter of the knob either via data object (single value), manual input or formula. This parameter is only enabled if Turning knob (friction) or Turning knob (raster) is selected.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ⚠ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

-speaking icon: The context sensitive help is activated and the cursor changes to 🕵️. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The **xy-Graph** (below) shows exemplary the result of pressing the turning knob (raster).
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
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<tr>
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<td></td>
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<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>StringChannel</td>
<td>Channels with strings</td>
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<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleRectMatrix3D</td>
<td>3D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/Float/DoubleValue</td>
<td>Integer/floating point number (diameter of friction gear and turning knob)</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GraphObjectVector</td>
<td></td>
</tr>
</tbody>
</table>
2.7.3.12 Edit a Curve

Go to:

Math
  \(\downarrow\) Curve Analysis
    \(\downarrow\) Edit a Curve

2.7.4 Vibration Analysis (FFT)

Go to:

Math
  \(\downarrow\) Vibration Analysis (FFT)

The menu consists of the following sub menus:

- FFT Spectrum
- Real FFT
- Complex FFT
- Inverse FFT
- Auto Spectrum
- Cross Spectrum
- Auto Correlation
- Cross Correlation
- Convolution
- Coherence Quotient
- Terz Analysis
- Effective Value
- Order Analysis
2.7.4.1 FFT Spectrum

Go to:

Math
  ➜ Vibration Analysis (FFT)
    ➜ FFT Spectrum

FFT Spectrum computes the amplitude spectrum, the phase spectrum as well as parameters of a periodical time signal. Furthermore, the frequency distribution is calculated form the time signal.

The maximum adjustable frequency is retrieved from the DeltaX of the input data by using the formula

\[
F_{\text{max}} = \frac{1}{\Delta X} \cdot 2 = \frac{\text{MR}}{2} \quad \text{[Hz]}
\]

with

- MR – input sampling rate [Hz]
- \(\Delta X\) – time difference of two time signal values (= \(1 / \text{MR}\)) [s].

2ⁿ Independence

Contrary to the commonly available FFT algorithms the FFT algorithm as developed by AMS is not limited to \(2^n\) values but is able to use any even number of values as input data.
**Name of Calculation**: Name of data object as it will appear in the Explorer.

**Calculate**:

- **Amplitude Spectrum**: Calculates the amplitude spectrum of the input data.
- **Phase Spectrum**: Calculates the phase spectrum of the input data.

**Input Data**: Selects the input data from a list of available input data objects. If multidimensional objects are selected, a sub matrix might be defined through numerical input fields.

- **Manual correction**: The spectrum will be calculated by using the sampling rate of the input data. If the input data don’t have an equidistant delta, another frequency can be defined which will be used for the calculation.

**Window**: Window function to fold input data.

- **Rectangle**: The input data will not be modified (folding of a rectangle function with the amplitude 1).
- **von Hann**: The input data is folded with a Hann function.
  \[ F(x) = 0.5 \times (1 - \cos(2\pi n/N)) \times (n = -M/2,...,(M/2)-1) \]
- **Hamming**: The input data is folded with a Hamming function.
  \[ F(x) = 0.54 - 0.46 \times \cos(2\pi n/N) \times (n = -M/2,...,(M/2)-1); (N – window width) \]
- **Blackmann**: The input data is folded with a Blackmann function.
  \[ F(x) = 0.42 + 0.50 \times \cos(2\pi n/N) + 0.08 \times \cos(4\pi n/N) \times (n = -M/2,...,(M/2)-1); (N – window width) \]
**Bartlett**: The input data is folded with a Bartlett function.

\[ F(x) = \left| 2n \right|/N, \ n = -M/2, \ldots, (M/2) - 1, \ (N - \text{window width}) \]

**Blackmann-Harris**: Input data is folded with a Blackmann Harris function.

\[ F(x) = 0.35875 - 0.48829\cos(2\pi*n/N) + 0.14128\cos(2\pi*2n/N) - 0.01168\cos(2\pi*3n/N), \ n = -M/2, \ldots, (M/2) - 1, \ (N - \text{window width}) \]

**Options:**

- **logarithmic**: The frequency amplitudes are calculated logarithmically.
- **Power spectrum**: Calculates the square of the amplitude spectrum of the signal.
- **Power density spectrum**: Computes the power-density spectrum which equates: power spectrum divided by the sampling rate (frequency intervall).
- **Without DC-part**: The first spectrum value that states the direct current is set to the value of the next value. Mostly, this results in better outcomes in the automatic scaling of the graphs.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign⚠️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 📄. The respective help topic is displayed when an area within the dialog is clicked on.
Example

The Spreadsheet tab Channels displays the following results:

- Amplitude spectrum
- Spectrum Phase

The parameters (Main Frequency, Max Amplitude, Main Phase) are stored as channel properties.

The *xy-Graph* (below) displays the frequency spectrum of the function \(\sin(x^2)/x\) generated via Extra→Generators→Numeric Channel.
Amplitude spectrum and phase difference of two oscillations:

Main frequency position (0.325 Hz) and phase difference are displayed with axis-cursor.

The phase difference (89.7°) was calculated using the Object Formula Editor with the following formula:

$$\text{mod}(\text{value}(A;3) - \text{value}(B;3); 360)$$

with A: Param1-Values and B: Param2-Values

<table>
<thead>
<tr>
<th>Types of data objects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
</tr>
<tr>
<td>Float/DoubleChannel</td>
</tr>
<tr>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
### Data Types

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IntegerChannel</td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td>Integer/DoubleRectMatrix3D</td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Result data</td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Channel with floating points numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleRectMatrix3D</td>
<td>3D-matrix with floating point numbers</td>
</tr>
</tbody>
</table>

### 2.7.4.2 Real FFT

**Go to:**

**Math**

- Vibration Analysis (FFT)
- Real FFT

**Real FFT** calculates a real FFT (Fast Fourier Transformation) for real data.

**Name of Calculation:** Name of data object as it will appear in the Explorer.

**Input Data:** Selection of input data from a list of available data objects.

**Calculate results for:**

- Next lower $2^n$ values
- Exact input values
- Next higher $2^n$ values

**OK:** The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

[?] : The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
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<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
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<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.4.3 Complex FFT

Go to:

Math

- Vibration Analysis (FFT)
- Complex FFT

**Complex FFT** calculates a complex FFT for complex data. These test series are hardly used in measuring but usually applied in mathematics.
**Name of Calculation**: Name of data object as it will appear in the Explorer.

**Real part**: List of available input data objects (test series for the real part).

**Imaginary part**: List of available input data objects (test series for the imaginary part).

**Calculate results for**:
- Next lower $2^n$ values
- exact input values
- next higher $2^n$ values

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
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<tbody>
<tr>
<td>Input data</td>
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<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.4.4 Inverse FFT

Go to:

Math
  ➔ Vibration Analysis (FFT)
    ➔ Inverse FFT

The **Inverse FFT** calculates an inverse FFT (Fast Fourier Transformation) for complex data.

**Name of Calculation:** Name of data object as it will appear in the Explorer.

**Real part:** List of available input data objects (test series for the real part).

**Imaginary part:** List of available input data objects (test series for the imaginary part).

**Calculate results for:**
- Next lower \(2^n\) values
- exact input values
- next higher \(2^n\) values

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🔄 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.
: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
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<tr>
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</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.4.5 Auto Spectrum

Go to:

Math

→ Vibration Analysis (FFT)

→ Auto Spectrum

**Auto Spectrum** calculates an auto spectrum for real data.

**Name of Calculation**: Name of data object as it will appear in the Explorer.

**Suffix**: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data**: Selects the input data from a list of available data objects.

**Calculate results for**: 

- next lower 2^n values
- exact input values
- next higher 2^n values
• Next lower $2^n$ values
• exact input values
• next higher $2^n$ values

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Help Icon]: The context sensitive help is activated and the cursor changes to ?

The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
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<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>

#### 2.7.4.6 Cross Spectrum

Go to:

**Math**

→ Vibration Analysis (FFT)

→ Cross Spectrum

The calculation **Cross Spectrum** calculates a cross spectrum for a series of measurement data.
**Name of Calculation**: Name of data object as it will appear in the Explorer.

**Signal 1**: List of available input data objects (test series for the real part).

**Signal 2**: List of available input data objects (test series for the imaginary part).

**Calculate results for**:
- Next lower $2^n$ values
- exact input values
- next higher $2^n$ values

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

**Context-sensitive help**: The context-sensitive help is activated and the cursor changes to help icon. The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
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<tbody>
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<td>Input data</td>
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<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.4.7 Auto Correlation

Go to:

Math
  ➔ Vibration Analysis (FFT)
  ➔ Auto Correlation

The calculation Auto Correlation calculates an auto correlation for real data.

Name of Calculation: Name of data object as it will appear in the Explorer.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input Data: Selects the input data from a list of available data objects.

Calculate results for:

• Next lower $2^n$ values
• exact input values
• next higher $2^n$ values

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.
**Delete**: The calculation is deleted and the dialog closed. A warning sign \(\Delta\) in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

\(\text{?:}\) The context sensitive help is activated and the cursor changes to \(\text{?:}\). The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>

### 2.7.4.8 Cross Correlation

Go to:

**Math**

- `Vibration Analysis (FFT)`
- `Cross Correlation`

The calculation **Cross Correlation** calculates a cross correlation for complex series of measurement data.
Name of Calculation: Name of data object as it will appear in the Explorer.

Signal 1: List of available input data objects (test series for the real part).

Signal 2: List of available input data objects (test series for the imaginary part).

Calculate results for:
- Next lower $2^n$ values
- exact input values
- next higher $2^n$ values

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign⚠️ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.4.9 Convolution

Go to:

Math
  ➔ Vibration Analysis (FFT)
  ➔ Convolution

The calculation Convolution calculates a convolution for real data.

Name of Calculation: Name of data object as it will appear in the Explorer.

Signal 1: List of available input data objects (test series for the real part).

Signal 2: List of available input data objects (test series for the imaginary part).

Calculate results for:

- Next lower $2^n$ values
- exact input values
- next higher $2^n$ values

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the calculated data is used by other components.
Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to 🔮. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.4.10 Coherence Quotient

Go to:

**Math**

- Vibration Analysis (FFT)
- Coherence Quotient

The calculation Coherence Quotient computes the coherence quotient for real data.

![Coherence Coefficient](image)

**Name of Calculation**: Name of data object as it will appear in the Explorer.

**Signal 1**: List of available input data objects (test series for the real part).

**Signal 2**: List of available input data objects (test series for the imaginary part).
Calculate results for:
- Next lower $2^n$ values
- exact input values
- next higher $2^n$ values

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

2.7.4.11 Terz Analysis

Go to:

**Math**

→ Vibration Analysis (FFT)

→ Terz Analysis

The calculation **Terz Analysis** calculates the amplitude spectrum of a periodical time signal and summarizes the amplitudes to logarithmically similar frequency ranges.

**Description**

The frequency distribution is calculated from a time signal using an FFT-Analysis. This analysis includes $N/2$ amplitude values which are evenly distributed in the frequency range. Now the
amplitude values are summarized for the frequency ranges, the octave or third-octave bands, which are equally large in the logarithmic frequency scale.

The centre frequencies of two neighbouring octave or third-octave bands are always in fixed proportions to each other. Octave bands have a ratio of 2:1 and third-octave bands have a ratio of \(\sqrt[3]{2} : 1\). The band widths of the associated frequency ranges result from the centre frequency and a constant factor which, in terms of figures, is 0.707 in the case of octave bands and 0.232 in the case of third-octave bands.

The valid centre and limit frequencies are fixed for the octave filter in the DIN 45651 standard and for the third-octave filter in the DIN 45652 standard. It might happen that they slightly deviate from the computed values. The reference frequency for defining third-octave and octave centre frequencies is 1 kHz.

By summarizing 3 successive third-octave bands one octave band is created whose centre frequency corresponds to the centre frequency of the middle third-octave band. The naming of octave and third-octave bands is carried out by using their centre frequency.

2\textsuperscript{nd} Independence

Contrary to the commonly available FFT algorithms the FFT algorithm as developed by AMS is not limited to 2\textsuperscript{n} values but is able to use any even number of values as input data.

### Name of Calculation
Name of data object as it will appear in the Explorer.

### Calculate

- **Terz Analysis**: The bands have a width of 1/3 of the octave.

- **Amplitudes octave related**: The sum of the single amplitudes is corrected by the factor 3 so that the results are directly comparable to an octave analysis.

- **Octave Analysis**: The bands correspond to the octaves.
**Input Data:** Lists the available data objects. If multidimensional data objects are selected, the sub matrix is selected in the numerical input field.

**Window:** Window function to fold input data.

- **Rectangle:** The input data will not be modified (folding of a rectangle function with the amplitude 1).
- **von Hann:** The input data is folded with a Hann function.
  \[ F(x) = 0.5 \times (1 - \cos(2\pi n/N)), \quad n = -M/2, ..., (M/2)-1, \quad (N - \text{window width}) \]
- **Hamming:** The input data is folded with a Hamming function.
  \[ F(x) = 0.54 - 0.46 \times \cos(2\pi n/N), \quad n = -M/2, ..., (M/2)-1, \quad (N - \text{window width}) \]
- **Blackmann:** The input data is folded with a Blackmann function.
  \[ F(x) = 0.42 + 0.50 \times \cos(2\pi n/N) + 0.08 \times \cos(4\pi n/N), \quad n = -M/2, ..., (M/2)-1, \quad (N - \text{window width}) \]
- **Bartlett:** The input data is folded with a Bartlett function.
  \[ F(x) = |2n|/N, \quad n = -M/2, ..., (M/2)-1, \quad (N - \text{window width}) \]
- **Blackmann-Harris:** Input data is folded with a Blackmann Harris function.
  \[ F(x) = 0.35875 - 0.48829 \times \cos(2\pi n/N) + 0.14128 \times \cos(2\pi 2n/N) - 0.01168 \times \cos(2\pi 3n/N), \quad n = -M/2, ..., (M/2)-1, \quad (N - \text{window width}) \]

**Options:**

- **logarithmic:** The frequency amplitudes are calculated logarithmically.
- **No Filter:** No filter is applied.
- **Filter A / C:** The frequency components are optionally filtered. Characteristic curve A or C are available.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

Question mark icon: The context sensitive help is activated and the cursor changes to question mark. The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** The xy-Graph (below) displays the third-octave spectrum with linear frequency axis.
The same values with a logarithmic frequency axis:

The transfer function of filter A and C:
## Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers (data length N = Ninput / 2)</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers (data length N = Ninput / 2)</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

### 2.7.4.12 Effective Value

Go to:

Math

Vibration Analysis (FFT)

Effective Value

The calculation **Effective Value** computes the effective square averaged amplitude of a periodical time signal. The averaging time can be selected and defines the time of dissolving the signal of the effective value.

In the special case of sine oscillation the effective value is \( \frac{1}{\sqrt{2}} \) (= 0.707...) of the oscillation amplitude.

In the field of electrical engineering, the Effective Value (= RMS = root mean square) of a continuously varying quantity, such as a cyclically alternating electric current, represents the corresponding value of the direct current that would produce the same power dissipation in a resistive load. Therefore, input data would mostly be signals oscillating around zero. In this case the option is given to compensate a possible systemic offset by subtracting the average value of the signal (normalization).
**Name of Calculation:** Name of data object as it will appear in the Explorer.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data:** Selects the input data from a list of available input data objects. If multidimensional objects are selected, a sub matrix might be defined through numerical input fields.

**Averaging Time:** Determines the time (in seconds) by which the effective value is averaged.

**Options:**

- **normalized:** In case of input signals that normally oscillate around zero, the curve can be slightly shifted due to bias in measuring. This option can be used to compensate this offset, i.e. normalize the curve, by subtracting the total average of the signal.

- **Level [dB]:** The effective value is calculated logarithmically in dB.

- **no Filter:** By default, no filter is applied.

- **Filter A / C:** Optionally, the A or C filter can be activated (future option).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to -question mark-. The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** The xy-Graph (below) displays the course of an acoustic signal and the corresponding effective value.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleRectMatrix3D</td>
<td>3D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleRectMatrix3D</td>
<td>3D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.4.13 Order Analysis

Go to:

Math
   Vibration Analysis (FFT)
   Order Analysis

The Order Analysis converts a time signal (vibration) into a measurement signal with equidistant angles. Afterwards an order spectrum is determined which is made available in jBEAM as a matrix.

This is done in 4 steps. Intermediate results (angle-based time, signal, revolution and signal matrix) can be optionally saved and displayed.

1st step: Preparation of the input channels. A restricted time range can be defined and the signal might be smoothed or derived.

2nd step: Conversion of the time signal into a signal with equidistant angles. For this, an angle can be defined.

3rd step: Splits (triggers) the angle-based signal using the revolutions or the time as trigger. The first trigger event and the interval for the following trigger events have to be defined. The number of trigger events is limited to 1000. For each trigger event a defined number of angle-based values are extracted.

4th step: Converts the angle-based signals into an order spectrum using the FFT analysis. The signals form the columns of the result matrix.
**Name of Calculation**: Name of data object as it will appear in the Explorer.

**Time series**: Selection of the input data for the time.

**Timebased signal**: Selection of the input signal (Vibration).

**Revolutions**: Selection of the revolution on whose basis the Order Analysis is to be executed.

**Save the intermediate results**: If checked, the angle-based intermediate results of the time, signal, revolution and signal matrix are stored as a new data objects.

**Step 1**: Preparation of the input channels.
Limit the range: Determines a limited range which is to be converted (referring to the time signal).

Smooth the signal with a moving average of: The signal can be averaged by the defined number of values.

Derivative of signal: Derives the signal.

Step 2: Conversion of the time-based signal (Vibration) into a signal with equidistant angles.

Angle increment: Declaration of the delta angle which is used for sampling respective conversion.

Step 3: Splits the calculated angle-based signal.

Using time as trigger: The angle-based signal is split by using time.

Using revolutions as trigger: The angle-based signal is split by using the revolution.

Smooth revolution signal: The revolution signal is smoothed before being used as trigger.

First trigger at: Declaration of the first trigger event from which onwards the splitting is to start.

Then every: Declaration of the interval for the subsequent trigger events.

Requested order oversampling:

For each trigger event ... angle based values are extracted: Declaration of values per trigger event (corresponds to the number of values per column).

Step 4: Calculation of the order matrix by using FFT Analysis.

Extract the following orders: For selecting the orders from the matrix that are to be stored to a matrix as a column.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Example: The xy-Graph (below) displays the course of a time signal (Vibration) and the calculated angle-based values (WinkelSig).
Visualisation of a computed order spectrum (order matrix):

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
</tbody>
</table>

#### 2.7.5 Signal Filters

Go to:

**Math**

**Signal Filters**

The menu consists of the following sub menus:

- FFT Bandpass
- Editable Filter
- CFC Filter
- Moving Average
- FIR-Filter
- ISO2631-Filter
- Human-Vibration
2.7.5.1 FFT Bandpass

Go to:
Math
  → Signal Filters
    → FFT Bandpass

The calculation FFT Bandpass filters a time signal by only letting a specified frequency range pass through. For this the frequency distribution is calculated from the time signal by using the FFT analysis. The frequency is folded with the filter characteristics and subsequently transferred back to the time signal via FFT.

2\textsuperscript{n} Independence

Contrary to the commonly available FFT algorithms the FFT algorithm as developed by AMS is not limited to 2\textsuperscript{n} values but is able to use any even number of values as input data. This guarantees that the result data will have the same number of values as the input signal. For reasons of symmetry of the FFT analysis the result data can only have an even number of values. If input data has an uneven number of values, one value will be ignored.

Result Data: Name of data object as it will appear in the Explorer.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input Data: Lists the available data objects.

Frequency Gate

  Minimum: The lower frequency cut off.
  Maximum: The upper frequency cut off.

OK: The changes are applied and the dialog is closed.
**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ▶️ in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

️: The context sensitive help is activated and the cursor changes to ?️️. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The xy-Graph (below) displays the input signal with random numbers generated via Extra→Generators→Numeric Channel and the filtered signal. The result contains only parts of the frequency below 2 Hz.

![BandPass Graph](image)

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleRectMatrix3D</td>
<td>3D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Passband (minimum, maximum)</strong></td>
<td>Integer/Float/DoubleValue</td>
<td>Integer/ floating point number</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
</tbody>
</table>
### 2.7.5.2 Editable Filter

**Go to:**

**Math**

† Signal Filters
   † Editable Filter

The calculation **Editable Filter** filters a time signal with an editable filter curve.

**Description**

A time signal is filtered by comparing every frequency part of the time signal to the filter curve. For this the frequency distribution is calculated from the time signal by using an FFT analysis. Then, the frequency signal is folded with the filter characteristic and subsequently transferred to the time signal via inverse FFT.

The used filter algorithm supports extremely steep flanks. Thus almost every filter characteristic can be realized.

**2ⁿ Independence**

Contrary to the commonly available FFT algorithms the FFT algorithm as developed by AMS is not limited to 2ⁿ values but is able to use any even number of values as input data. This guarantees that the result data will have the same number of values as the input signal. For reasons of symmetry of the FFT analysis the result data can only have an even number of values. If input data has an uneven number of values, one value will be ignored.

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>DoubleRectMatrix3D</td>
<td>3D-matrix with floating point numbers</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td></td>
</tr>
</tbody>
</table>
**Result Data:** Name of data object as it will appear in the Explorer.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data:** Lists the available data objects.

**Frequency-List:** The frequency and damping are entered for each point. The values are displayed in the graph and the frequency axis is automatically adjusted.

**New Point:** A new point is appended to the list.

**Delete Point:** The last point of the list is deleted.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The xy-Graph (below) displays the input signal with random numbers generated via Extra→Generators→Numeric Channel and the filtered signal. The frequency parts contained in the result are damped correspondent to the prompted filter.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>

2.7.5.3 CFC Filter

Go to:
Math
   ➔ Signal Filters
       ➔ CFC Filter

The calculation CFC Filter filters a time signal by evaluating each frequency part of the time signal with the filter characteristic defined by CFC (particularly used for crash tests).

For this the frequency distribution is calculated from the time signal by using an FFT analysis. Then, the frequency signal is folded with the filter characteristic and subsequently transferred to the time signal via inverse FFT.

The used filter algorithm supports extreme steep flanks. Thus every filter characteristic can be realized. Since CFC characteristics do not prescribe an exact characteristic but a range in which
the characteristic has to be, three permitted characteristics that are situated in the range are
given to choose from.

2\textsuperscript{nd} Independence

Contrary to the commonly available FFT algorithms the FFT algorithm as developed by AMS is
not limited to $2^n$ values but is able to use any even number of values as input data. This
guarantees that the result data will have the same number of values as the input signal. For
reasons of symmetry of the FFT analysis the result data can only have an even number of
values. If input data has an uneven number of values, one value will be ignored.

**Result Data:** Name of data object as it will appear in the Explorer.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result
channel group contains channels with the channel names of the input channel group with
the appended defined suffix.

**Input Data:** Lists the available data objects.

**Filter Frequency:** The CFC guideline offers 3 fixed frequencies. Additionally any other frequency
can be entered manually

**Filter Curve:** The desired filter curve can be selected.

**Graph:** The permitted filter range (yellow) is displayed in a CFC 60 Hz Filter. The selectable filter
curves A, B and C that are positioned in the permitted area are painted.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation
remains unchanged.
Delete: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ¿. The respective help topic is displayed when an area within the dialog is clicked on.

Example

The xy-Graph (below) displays the input signal with random numbers generated via Extra→Generators→Numeric Channel and the filtered signal. The frequency parts contained in the result are damped correspondent to the selected filter.

![Graph Image]

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.5.4 Moving Average

Go to:

Math
   ➔ Signal Filters
       ➔ Moving Average

The calculation Moving Average can be used e.g. to filter the noise out of a measured signal. Various types of filters are available.

The moving average is continuously calculated over a definable range of values, e.g. the last n values, applying the selected calculation model (arithmetic, squared, geometric, cubic, or harmonic). This average is recalculated with every new value. Additionally, new options allow calculating the moving maxima, minima or standard deviation.

In the case of the Exponential Filter each value of the test series is only incorporated to a certain extent (determined by the exponential factor) into the new value of the filtered data object (result channel). The exponential factor influences the suppression level of changes in the measurement signal.
**Result Data:** Name of data object as it will appear in the Explorer.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data:** Lists the available data objects.

**Type of Filter**

**Moving Maxima:** Calculates continuously the maxima of the values within the specified window.

**Moving Minima:** Calculates continuously the minima of the values within the specified window.

**Moving Average:** Calculates continuously the average of the values within the specified window according to the selected type of averaging.
Type of Averaging:

**arithmetic:** The arithmetic average or mean is the sum of a number of values divided by the number of values.

**squared:** The squared or quadradic mean (also RMS = root mean square) is the square root of the arithmetic mean of the squares of the values. It is e.g. a value characteristic of a continuously varying quantity, such as a cyclically alternating electric current.

**cubic:** The cubic mean is the third root of the arithmetic mean of the third powers of the values. It is used e.g. for predicting the life expectancy of machine parts.

**geometric:** The geometric mean is defined as the \( n \)th root of the product of \( n \) numbers. It indicates the central tendency or typical value of a set of numbers by using the product of their values. It may be applied only to positive values.

**harmonic:** The harmonic mean is the reciprocal of the arithmetic mean of the reciprocals. Typically, it is appropriate for situations when the average of rates is desired.

In addition calculate the selected average type for the whole channel: Optionally, the average of the whole channel can be calculated and stored as a new data object (Value).

**Moving Standard Deviation:** Calculates continuously the standard deviation of the values within the specified window.

**Exponential Filter:** Every value of the measurement series is integrated into the new value of the filtered data object (result channel) to the extent defined by the **Exponential Factor.** The exponential factor influences the suppression level of changes in the measurement signal.

Moving Window size and config: The declaration of the number of values can be done either via

**Number of Values:** Specifies the number of values, e.g. time, that are used for averaging.

**X-Range:** Specifies the range of x-values, e.g. time, that is used for averaging.

**As data item:** The moving window is defined by a data item (Value).

**modulo:** This operation finds the remainder after division of the calculated value by the specified modulo value.

**online:** All averaged values are situated left of the currently calculated value. This leads to a time delay.

**offline:** The currently calculated value is situated in the middle of the averaged values. No time delay occurs.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🔴 in the Delete button indicates that the calculated data is used by other components.
Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example: The various result objects have been calculated by using the calculation Moving Average over a range of 10 values. The exponential filter (green) has been calculated with an exponential factor of 0.1.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Averaging range</td>
<td>Integer/Float/DoubleValue</td>
<td>Integer/floating point number</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Channel with floating point number</td>
</tr>
<tr>
<td>Result data</td>
<td>With only one result object the suffix is omitted.</td>
<td></td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>&quot;[name]-Avg&quot;</td>
<td>DoubleChannel/GroupOfCh.</td>
<td>Channel with moving averages</td>
</tr>
<tr>
<td>&quot;[name]-Exp&quot;</td>
<td>DoubleChannel/GroupOfCh.</td>
<td>Channel with calculated values of the exponential filter</td>
</tr>
<tr>
<td>&quot;[name]-Max&quot;</td>
<td>DoubleChannel/GroupOfCh.</td>
<td>Channel with moving maxima</td>
</tr>
<tr>
<td>&quot;[name]-Min&quot;</td>
<td>DoubleChannel/GroupOfCh.</td>
<td>Channel with moving minima</td>
</tr>
<tr>
<td>&quot;[name]-StdDev&quot;</td>
<td>DoubleChannel/GroupOfCh.</td>
<td>Channel with moving standard deviation</td>
</tr>
<tr>
<td>&quot;[name]-Tot&quot;</td>
<td>DoubleValue/GroupOfValues</td>
<td>Average of whole channel</td>
</tr>
</tbody>
</table>

### 2.7.5.5 FIR-Filter

Go to:

**Math**

➡️ Signal Filters

➡️ FIR-Filter

The calculation **FIR-Filter** (Finite Impulse Response) is a non-regenerative, phase linear digital filter with a finite impulse response.

The calculation of the y-values refers to the finite history of the input signal. The filter possesses an impulse response of a defined length and therefore cannot become instable or start an autonomous vibration.

Alternatively, the **IIR Filter** (Infinite Impulse Response) can be chosen. This filter possesses feedback (recursive filter) and offers a high steepness at a small filter length.

Additionally, a band pass with upper and lower frequency as well as the values of the filter coefficients might be defined in the modification dialog. The number of filter coefficients is determined by the number of orders + 1.
Result Data: Name of data object as it will appear in the Explorer.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input Data: Lists the available data objects.

Type of Filter: Selection of the type of filter (FIR or IIR).

Order: Determines the number of orders (even, i.e. uneven numbers are rounded up to even numbers).

Way of filtering: Selection of the way of filtering: low pass, band pass or high pass.

Lower frequency: Determines the lower frequency of the band pass or high pass.

Upper frequency: Determines the upper frequency for band pass or low pass.

Show/remove Coefficients: Shows the used coefficients in a table/removes the table with coefficients. The number of coefficients is the result of the number of orders + 1.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
Example

The example graph shows the filtering by using the dialog box displayed above.

The lower graph displays the original values (blue) and the filtered values (red marker). The values are filtered using a low pass filter with an upper frequency of 1.5 Hz. The upper graph contains a spectrum of the original values that shows the different frequency ranges.

Types of data objects

<table>
<thead>
<tr>
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<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.5.6 ISO2631-Filter

Go to:
Math
  → Signal Filters
  → ISO2631-Filter

The calculation ISO2631-Filter is a specific filter characteristic described by the ISO standard 2631. This filter is used for evaluating the effect of the whole-body vibration on humans. The following subtypes are supported: Wk, Wd, Wf, Wc, We, Wj.

Result Data: Name of data object as it will appear in the Explorer.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input Data: Lists the available data objects.

Subtype: The following sub types are supported:

Wk: Vertical whole-body vibration, z-axis, sitting, standing or lying people
Wd: Horizontal whole-body vibration, x- or y-axis, sitting, standing or lying people
Wf: Low-frequency vertical whole-body vibration, z-axis, motion sickness, kinetosis of sitting or standing people
Wc: Horizontal whole-body vibration, x-axis, sitting person
We: Rotating whole-body vibration, all directions sitting person
Wj: Vertical head vibration, lying person
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example

The xy-Graph (below) shows the input signal (blue) generated via Extra→Generators→Numeric Channel and the filtered signal (red). The filtered signal was computed with the settings of the dialog box displayed above.

![xy-Graph](image)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.5.7 Human-Vibration

Go to:

Math
  ➔ Signal Filters
      ➔ Human-Vibration

The calculation Human-Vibration filters signal values according to DIN 45871, VDI 2057 or ORE B153. This filter is used for evaluation of human exposure to whole-body vibration. In the modification dialog box the impact position as well as the impact direction can be defined.

Result Data: Name of data object as it will appear in the Explorer.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input Data: Lists the available data objects.

Filter type: Selection of the standard for filtering. The following standards are supported: DIN45871, VDI 2057, ORE B153.

Impact position: Selection of the impact position: Standing, Sitting, Lying, Forward body, Hand arm system.

Impact direction: Selection of the impact direction: lateral axes (x,y) or vertical axis (z).

OK: The changes are applied and the dialog is closed.
**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign⚠️ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

🔍: The context sensitive help is activated and the cursor changes to❓. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The [xy-Graph](below) shows the input signal (blue) generated via **Extra→Generators→Numeric Channel** and the filtered signal (red). The filtered signal was computed with the settings of the dialog box displayed above.

![xy-Graph](image)

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.6 Data Filters

Go to:

Math
➡ Data Filters

The menu consists of the following sub menus:

• Matrix-Columns Filter/Sorter
• Value Filter
• View on Dataobjects
• Manual Value Filter

2.7.6.1 Matrix-Columns Filter/Sorter

Go to:

Math
➡ Data Filters
➡ Matrix-Columns Filter/Sorter

The calculation Matrix-Columns Filter/Sorter sorts the columns of a matrix depending on several conditions like minimum, maximum and the average of the available columns. The columns can be also sorted using a control channel. The user can define the sorting direction (upwards or downwards).

Result Data: Name of data object as it will appear in the Explorer.
**Input Data:** Lists the available data objects (matrices).

**Sorting Mode:**
- **By minimum:** The columns are sorted on basis of their minimum values.
- **By maximum:** The columns are sorted on basis of their maximum values.
- **By average:** The columns are sorted on basis of their average.
- **By control channel:** The columns are sorted on basis of the control channel.

**Sorting Direction:** The columns can be sorted upwards or downwards.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▶ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

FAQ: The context sensitive help is activated and the cursor changes to §. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

**Minimum upwards:** First column contains the smallest minimum of all columns, the last column contains the largest minimum.

**Maximum upwards:** First column contains the smallest maximum of all columns, the last column contains the largest maximum.

**By control channel:** Columns will be sorted on basis of the control channel’s values.

The example shows the sorting of matrix columns (Split) on basis of the values of the control channel DatGen (see modification dialog box above). The values of the channel will be sorted upwards and used as reference for the index of the matrix columns, i.e. the first value (5.0000) is the largest value therefore the first column will be assigned to the 5th position after the sorting. The other columns will be moved forward by one position.

The result matrix SoFi displays the columns after sorting. The number of columns depends on the number of values of the control channel.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleRectMatrix3D</td>
<td>3D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td><strong>Control channel</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
</tbody>
</table>
2.7.6.2 Value Filter

Go to:
Math
  ➔ Data Filters
    ➔ Value Filter

The calculation **Value Filter** filters values of selected channels on the basis of specified criteria, i.e. only values at the relevant indices that fulfill the set filter criteria are adopted by the result channel.

The result channels containing the filtered values can be used by other components for further calculations or for visualising data.

Name: Name of data object as it will appear in the Explorer.
Available channels/channels to be filtered: This section contains two lists, on the left side the available channels and on the right side the channels to be filtered.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

Ignore errors in input items: Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

Filter panel

Calculation options:

Calculation mode: If the data object of the filter condition and the data objects to be filtered have a different x-base, the calculation can be either carried out index based without resampling or x based with resampling. In case of equal x-bases, the index-based mode is the first choice as it is faster and resampling is unnecessary.

x based (with resampling): First, the data objects are synchronised to a common time grid. For this, the data object in each filter is resampled to the x information of the input data object. The data objects shall have the same or compatible units. ing is carried out. The first operand always constitutes the x-base and the second operand is resampled to the x-base of the first operand. The result data object therefore receives the x-base of the first operand. This is the same with complex arithmetic. There, the resampling is carried out step by step for each operation.

The resampling is carried out according to different methods depending on the data type:

Bit channels: The method Sample-Hold is applied for the resampling, i.e. there is no interpolation carried out, but the respective value is held until the original value changes.

Other channels (Double, Float, Integer, Long): The method AutoAverageLinear is applied for the resampling. Depending on how many old values lie within the respective new x-interval, either the average is calculated (N > 2) or a linear interpolation is carried out.

Index-based: The calculation is carried out index by index. No resampling is carried out.

Set independent item to each result: Generally, an additional channel is generated for each result data object. This channel contains the x information of the filtered values, i.e. the
positions where the filter conditions is met. If this option is selected, this channel is set as independent channel in the properties of the result channel with the filtered values.

**Unit:** Optionally, the units of the data objects in the **Relation** filter condition can be considered (with appropriate conversion) or ignored.

**consider:** If the units are compatible, they are automatically converted when a **Relation** filter condition is applied. Otherwise, the result object receives an error message.

**ignore:** The units are not considered when a **Relation** filter condition is applied.

**Filter condition:** Any number of filter conditions can be defined which are AND combined. To define a filter condition, a reference data object is selected as well as the corresponding filter criteria. The filter criteria can either be a Relation to a fix value or a data object but also an option to filter out duplicate values. If the input data object is a group of channels and the condition is a channel, each member of the group is tested against the individual condition.

**Relation:** The reference value is put in relation to a defined comparison value.

**Relational operator:** Selection of the relational operator from the list of available operators: \(<, \leq, =, \neq, >, \geq\)** (relational operators: lesser than, lesser than or equal to, equal, unequal, greater than, greater than or equal to)

*Examples:*  
- `ValueA > 10`  
  All values pass where `ValueA` is greater than 10.
- `ValueA ≠ NaN`  
  All NaN values are omitted.

**Fix value:** Manual input of a fix comparison value.

**Data item:** The comparison value is defined via data object which might be a single value or one value of a channel addressed by an index.

**Remove duplicates:** The values at indexes where duplicate values in the reference data object are detected are omitted.

**Precision:** The precision with which the values are checked for duplicity can be defined as number of matching decimal places. With a precision of 2, e.g. the values 1.453 and 1.451 are regarded as equal values and thus, the second value is omitted. The additional decimal places are rounded up or down according to the rounding rules. Also negative values can be defined. Then, the values are compared rounded to the respective decimal power, i.e. '-1' to 10s, '-2' to 100s etc.

**Add filter:** Adds the currently defined filter to the list of **Active filter conditions** as long as it is not yet existing.

**Delete filter:** Deletes the selected filter conditions from the list of **Active filter conditions**.

**Update filter:** Updates the selected filter condition from the list of **Active filter conditions** to the current settings.

**Active filter conditions:** The display field shows the active filter conditions. All filter conditions are AND combined. As soon as a filter condition is selected, the section **Filter condition** displays the correspondent values. If the filter conditions shall be modified, the settings are changed accordingly and then, the button **Update filter** is clicked. Only then, the settings are saved. The modified settings can also be added via **Add filter** as a new filter condition. In this case, the initially selected filter condition remains unchanged.
Tab Names in grouped result object

In calculations with channel groups, explicit names can be defined for the channels of the result channel group. By default, the channels receive the name of the original channel with the appended suffix "_Filtered".

**Grouped result object suffix:** The defined suffix is applied in all patterns that contain the suffix.

**Set Pattern for Channel Names in Result Group:** The result channel names can be generated via preset options or manual definition.

**Preset Options:**
- Calculation Name
- Calculation Name + Suffix
- Calculation Name + Used Channels
- Calculation Name + Used Channels + Suffix
- Channel name

**User Defined:** A formula for the generation of channel names can be entered in the input field. The buttons below can be used to insert useful elements.

**Check Formula:** The syntax of the entered formula is checked.

**CalcName:** Inserts the name of the calculation into the pattern. All channels contain the name of the calculation.

**Suffix:** Inserts the suffix into the pattern. Each channel name is appended with this suffix.

**Used Channels (ListOfArgs):** Inserts the arguments of the calculation into the pattern. Each channel name contains the names of the input channels used in the calculation (X,Y,Z,...).

**ChannelName() (ChannelName(inputPort)):** Inserts the channel names into the pattern. The name of the input channel is adopted for the name of the result channel. (Indexing starts with 0)
Substring() (Substring("str"; start; end)): Inserts a part of the string "str" into the pattern. The part string is generated starting at "start" up to "end". Each channel receives this part string.

Length () (Length("str")): Returns the length of the string "str".

Preview: The result of the entered formula is displayed. Exemplarily, it shows the name of the first channel from the first result object.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Example: The example shows the filtering of the channel DatGen using two filter conditions. The result channel DatGen_Filtered only contains values at which DatGen is greater than 0.5 and lesser than 1.2.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude</td>
<td>values</td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
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<tr>
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<td>Group of channels</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannelsByReference</td>
<td>Referenzierte Gruppe von Kanälen</td>
<td></td>
</tr>
</tbody>
</table>

| Filter condition              | All single value and channel    | data types, groups of values and channels     |
| Result data                   | Identical with input data       |                                              |

### 2.7.6.3 View on Dataobjects

Go to:

**Math**

- Data Filters
- View on Dataobjects

The calculation View on Dataobjects uses a defined view as a filter on data objects. This function can be used for calculations that do not support view selection. The filtered data objects can either be referenced or copied.

All contained channels are initially in standby mode. A channel is only loaded when it is actually requested by a consumer. Thus, all channels of an importer can be offered without loading them. This saves time and RAM space.

If the DataViewService has a filter condition that removes values from the mid of the channel, input channels of the ViewOnDataObjects might have no independent item. In this, an additional X-channel is generated and assigned as independent channel to the result channel.

Example: Input [0, 1, 2, 3, 4, 3, 2, 1, 0] with \( \Delta x = 1 \) and \( x_0 = 0 \) Filter condition "Input < 3" Result [0, 1, 2, 2, 1, 0] with Independent channel [0, 1, 2, 6, 7, 8].
Result Data: Name of data object as it will appear in the lists.

Create reference to the filtered data: A referenced data object is created for each selected data object.

Create copies of the filtered data: A copy is generated for each selected data object. This can be necessary if further calculations have to be carried out with the filtered data as some calculations do not support referenced data objects.

View: Selection of the desired view that is to filter the data objects. Different views for filtering display values can be generated via View-Selection-Manager. View 0 is always available and usually doesn’t contain any filters. The display of the view selection can be enabled or disabled via Preferences→Dialogs.

: This button opens the View-Selection-Manager in which definitions of views can be directly entered.

Available data objects/Apply view to dataobjects: This section contains two lists, on the left side all available data objects, on the right side the selected data objects that are to be filtered with the chosen view.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

: These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.
With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td><strong>NumericChannelByReference</strong></td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
</tr>
<tr>
<td></td>
<td>or <strong>Identical with input data</strong></td>
<td>with the option copy data</td>
</tr>
</tbody>
</table>
2.7.6.4 Manual Value Filter

Go to:

Math
  → Data Filters
  → Manual Value Filter

The calculation Manual Value Filter can be used to deactivate individual data points of a channel. Thus, outliers or unrepresentative margin areas can be hidden. The result channel contains 1 for each activated and 0 for each deactivated data point. A second result channel provides the filtered values of the input channel (suffix "_Filtered").

The Manual Value Filter dialog can also be opened via context menu of a Universal 2D graph. To do this, select the curve in the graph and open the context menu via right click. With a click on the menu item Manual Value Filter the dialog opens with the preset x- and y-values taken from the diagram.
**Result Data:** Name of the result data object as it will be listed. There are two result data objects, one with the 0/1-values for the activated or deactivated data points, the other one with the filtered input values (suffix "_Filtered").

**x-values:** The x-values can either be determined automatically out of Xo and ∆X or the respective index of the y-values (auto) or defined by a data object.

**y-values:** The y-values can be selected from the list of available data objects.

**diagram:** The selected channel is initially displayed with all values as activated markers (blue). Single points can be deactivated by mouse click and activated again by another click. Deactivated points are shown as gray markers. A rectangle can be drawn via click & move to activate or deactivate all contained points simultaneously. If there are activated as well as deactivated points within the rectangle, a request appears whether all points shall be activated or deactivated. Furthermore, the usual functions for zooming (Ctrl & click & scroll or Ctrl & Shift & click & move) and moving (Ctrl & click & move) of the 2D-graph can be applied. The value of the point on the mouse position is displayed as tooltip.

**OK:** The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▶️ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 📜. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[name]</td>
<td>IntegerChannel</td>
<td>Channel with the 0/1-values for the activated or deactivated data points</td>
</tr>
<tr>
<td>[name]_Filtered</td>
<td>as input data</td>
<td>Channel with the filtered (activated) input values. All deactivated values are replaced by NaN.</td>
</tr>
</tbody>
</table>
2.7.7 Statistic

Go to:

Math

Statistic

The menu consists of the following sub menus:

- Cluster Aggregator
- Extract Statistical Values
- Append Values (Statistical or Formula)
- Extract Values by Index
- Append Values (Input Values)
- Statistic over Channels
- Statistic of a Group
- Statistic over Matrix columns
- Distributions
- Box-Whisker Statistics
- Statistical Process Controll (SPC)
- Part Average Analysis (PAA)
- PTV-Statistics
- SuanShu Statistic

2.7.7.1 Cluster Aggregator

Go to:

Math

Statistic

Cluster Aggregator

When a calculation is distributed among several clusters, the Cluster Aggregator can be used to
combine the individual results to the total result.

2.7.7.2 Extract Statistical Values

Go to:

Math
  ➔ Statistic
  ➔ Extract Statistical Values

The calculation Extract Statistical Values generates different statistical values like minimum/maximum, average or standard deviation.

The created statistical single values are written into the Spreadsheet tab Values and overwritten with every new calculation. A further use of these values in calculations or graphic elements is possible.

Name of Calculation: Name of the Producer as it will appear in the component list.

Input Data: Lists the available data objects.

Statistical Quantity: Lists statistical data to be generated. By default, the result data objects receive an appropriate suffix.

- Minimum (minimum value of the channel; suffix "-Min")
- Maximum (maximum value of the channel; suffix "-Max")
- Index of Minimum (suffix "-MinI")
- Index of Maximum (suffix "-MaxI")
• **X at Minimum** (x-value at the minimum; suffix "-MinX")
• **X at Maximum** (x-value at the maximum; suffix "-MaxX")
• **Span** (the difference between the minimum and maximum value; suffix "-Span")
• **Average** (suffix "-Aver")
• **Standard-Deviation** (suffix "-StdDev")
• **Average + Standard-Deviation** (suffix "-AV+SD")
• **Average - Standard-Deviation** (suffix "-AV-SD")
• **Date/Time** (suffix "-Time")
• **Sum** (suffix "-Sum")
• **X-Offset** (suffix "-OffX")
• **DeltaX** (suffix "-DeltaX")
• **Number of Values** (suffix "-N")
• **Number of not NaN Values** (suffix "-NnotNaN")
• **NoV of indep. channel** (number of values of the independent channel; suffix "-NindCha")
• **Name of indep. channel** (suffix "-NameIC")
• **Median** (value that is in the middle when all values are sorted according to size; suffix "-Med")

**Name for result values**: Name of the result data object of the created statistical values. The statistical values are listed in the Spreadsheet tab Values and the component list under this name. If option **A** is checked, the name will be set automatically out of the data object name and a suffix for the statistical quantity. It can also be entered manually.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
Example

![Spreadsheet image]

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
<td></td>
</tr>
<tr>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
<td></td>
</tr>
<tr>
<td>GroupOfValues</td>
<td>Group of single values</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>Integer/DoubleValue</td>
<td>Integer/floating point number</td>
</tr>
<tr>
<td>DateTimeValue</td>
<td>Single value as time specification</td>
<td></td>
</tr>
</tbody>
</table>

#### 2.7.7.3 Append Values (Statistical or Formula)

Go to:

Math

- Statistic
  - Append Values (Statistical or Formula)
The calculation **Append Values (Statistical or Formula)** writes statistical values or values calculated from a formula into a channel. The used statistical values are calculated from the selected input and added to the generated channel as soon as the control event is triggered. Events can be graphic elements (buttons) or trigger events.

**Name of Calculation**: Name of the Producer as it will appear in the component list. The contained result data objects for the selected statistical quantities receive the names as defined under **Name for result values**.

**Operation**: The selected operation determines whether the data are processed in parallel or sequential mode.

- **parallel (using grouped items)**: This option is selected if the imported data are provided by e.g. the Data Source Manager. This component generates grouped data items, i.e. all date items of the same name throughout all import files are grouped together. With parallel processing, all files are loaded at the same time. The advantage is that on changes, e.g. a new calculation, no data need to be reloaded. However, in case of many large files this may lead to high memory load. Therefore this option is best suitable for few small files.
**sequential (with MultiFileImport, measurements):** This option is selected if the imported data are provided by e.g. the Multi File Import. This component loads the import files contained in a definable list one after another. After each load, the import data are processed by defined actions triggered by action events, e.g. append new values, and calculations are validated. The advantage is that the memory load is low even with many large files.

**Ignore errors in input items:** Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

**Function Definition**

**Statistical Quantity:** Lists the statistical data to be generated, either a statistical single value (S) or a formula (F). The formula can be entered manually or with the aid of the Formula Editor. The unit can be set optionally. The following statistical quantities can be selected:

- **Minimum** (minimum value of the channel; suffix "-Min")
- **Maximum** (maximum value of the channel; suffix "-Max")
- **Index of Minimum** (suffix "-MinI")
- **Index of Maximum** (suffix "-MaxI")
- **X at Minimum** (x-value at the minimum; suffix "-MinX")
- **X at Maximum** (x-value at the maximum; suffix "-MaxX")
- **Span** (the difference between the minimum and maximum value; suffix "-Span")
- **Average** (suffix ":-Aver")
- **Standard-Deviation** (suffix ":-StdDev")
- **Average + Standard-Deviation** (suffix ":AV+SD")
- **Average - Standard-Deviation** (suffix ":AV-SD")
- **Date/Time** (suffix ":-Time")
- **Sum** (suffix ":-Sum")
- **X-Offset** (suffix ":-OffX")
- **DeltaX** (suffix ":-DeltaX")
- **Number of Values** (suffix ":-N")
- **Number of not NaN Values** (suffix ":-NnotNaN")
- **NoVs of indep. channel** (nume of values of the independent channel; suffix ":-NindCha")
- **Name of indep. channel** (suffix ":-NameIC")
- **Median** (value that is in the middle when all values are sorted according to size; suffix ":-Med")
- **Name** (Suffix ":-Name")
- **First Value** (Suffix "-FirstVal")
- **Last Value** (Suffix "-LastVal")
- **First X-Value** (Suffix "-FirstXVal")
- **Last X-Value** (Suffix "-LastXVal")

**Input Data**: A list with available data objects.

**Name for result values**: Name of the result data object of the created statistical values. The statistical values are listed in the Spreadsheet tab Values and the component list under this name. The preset name is "[Data object name]-[suffix for statistical quantity]" in case of statistical value (S) or "Form-[number]" in case of formula (F). The names can be further edited freely.

**Action Events for Control (only for sequential operation)**

**Append new Value**: The newly calculated value is written into the channel as soon as the event is triggered. The producer is selected in the first field and a contained control event (Action Event) is selected in the second field. Various control events are, for example, provided by the Measurement Service (Start, Pause, Clear, Stop, StopAll). The corresponding control events are triggered via F5/F6 respective via the menu items of the menu Measure. Control events can also be provided by other components, e.g. Button, Time Trigger or Multi File Import.

**Delete last value**: If the defined event is triggered or **Now** pressed, the last value is deleted.

**Delete all Values**: If the defined event is triggered or **Now** pressed, all values are deleted.

**Formula Editor**: Opens the Embedded Formula Editor.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ⚠️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

*This example demonstrates the possibility how the function **Append Values (Statistical or Formula)** can be used:*

**Monitoring**: A monitor repeatedly measures the temperature with a frequency of 1 Hz for 30 seconds and writes the received values (30) in a channel. For each measure statistical values are to be recorded.

A measure is started by clicking on a beforehand generated **Button** button (**New Value**) that is visible in the Graphic window. Afterwards the function **Append Values (Statistical or Formula)** is called. In the configuration dialog box...
The input data channels are selected and the desired statistical quantities that are to be written into a generated data channel are specified. Channel 4.1 (temperature channel) is used as input data. For this channel the statistical quantities (minimum, maximum, span) are selected which are generated as separate data channels in jBEAM. The name of the result data object is generated from the input channel and an abbreviation of the statistical quantity, but can also be entered manually. Additionally the button **New Value** is set as event for taking over the statistical values.

<table>
<thead>
<tr>
<th>Statistical Quantity</th>
<th>Input Data</th>
<th>Name of result channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>4.1</td>
<td>4.1-Min</td>
</tr>
<tr>
<td>Maximum</td>
<td>4.1</td>
<td>4.1-Max</td>
</tr>
<tr>
<td>Span</td>
<td>4.1</td>
<td>4.1-Span</td>
</tr>
</tbody>
</table>

The table below displays the measuring data and the calculated statistical values in channels. One measure consists of 30 measured values and the channel 4.1 contains the current data of the last measure.

If the button **New Value** is pressed, the measure starts and the statistical quantities (minimum, maximum, span) are calculated. The statistical values can only be calculated when at least one measure has been performed. The calculated statistical values will be written into the corresponding channels. If the button **New Value** is pressed, 30 new values are loaded. This data is used for a new calculation of the statistical quantities and the result is transferred to the statistic channels.

With this function interval measurements with more than one value are possible which then can be used for calculating the statistical values. Not all received measured values have to be analysed, the statistic values represent the most important data in a short form and facilitate the graphic evaluation.
The Graphic window displays 3 statistical channels in a xy-Graph. The x-axis represents the measure intervals and the y-axis the temperature.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integer/LongValue</td>
<td>Integer</td>
<td></td>
</tr>
<tr>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeValue</td>
<td>Value with longitude/latitude specification</td>
<td></td>
</tr>
<tr>
<td>DateTimeValue</td>
<td>Value with date/time values</td>
<td></td>
</tr>
<tr>
<td>Character/StringValue</td>
<td>Value with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericValueByReference</td>
<td>Referenced numeric value</td>
<td></td>
</tr>
<tr>
<td>ObjectValue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
<td></td>
</tr>
<tr>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers floating point numbers</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>ObjectChannel</td>
<td></td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td>GroupOfValues</td>
<td></td>
<td>Group of single values</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
</tbody>
</table>
### 2.7.7.4 Extract Values by Index

Go to:

Math

- Statistic
- Extract Values by Index

The calculation **Extract Values by Index** generates several single values by extracting individual values of a channel.

From the input channel the respective y-value is extracted defined by the control object. If this control object is an integer value it is used as index. If it is a double value it is used as x-value. If need be, a value positioned between two points is determined by Interpolation.

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/ floating point numbers</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
</tbody>
</table>

**Result Data:** Name of the Producer as it will appear in the component list.

**Channels:** Lists the available channels in a combo box.

**Control Objects:** Control objects provide the reference to the index or x-value of which the corresponding y-value is to be extracted from the input channel. Suitable control objects are generated e.g. by **Slider, Value Input**, or **Time Controller**
**Name for result values:** Name of the result data object of the created statistical values. The statistical values are listed in the Spreadsheet tab Values and the component list under this name.

**Checkbox:** Selection of the respective entry/entries, e.g. for deletion.

- ![New entry](image1): A new entry is appended to the list.
- ![Delete selected](image2): The entries selected via checkbox are deleted.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign \( \Delta \) in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

- ![Help](image3): The context sensitive help is activated and the cursor changes to \( \text{?} \). The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The **xy-Graph** (below) shows a sine function generated by means of the generator. For the single value 0.71426 (Control Object) the y-value is determined by using the calculation **Extract Values by Index**. Because the x-value of the Control Object is situated between point A (0.65; 0.8) and B (0.75; 0.91) of the function, the correspondent y-value is generated via **Interpolation**.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>StringChannel</td>
<td>Channel with strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td><strong>Control objects</strong></td>
<td>Integer/LongValue</td>
<td>Integer</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>NumericValueByReference</td>
<td>Referenced numeric value</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>BitValue</td>
<td>Boolean value</td>
</tr>
<tr>
<td></td>
<td>Integer/LongValue</td>
<td>Integer</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeValue</td>
<td>Single value with longitude/latitude</td>
</tr>
<tr>
<td></td>
<td>DateTimeValue</td>
<td>Single value as time specification</td>
</tr>
<tr>
<td></td>
<td>StringValue</td>
<td>Single value as string</td>
</tr>
</tbody>
</table>
### 2.7.7.5 Append Values (Input Values)

Go to:

**Math**

- **Statistic**
- **Append Values (Input Values)**

The calculation *Append Values (Input Values)* writes different single values into a channel. Furthermore, complete channels can be appended to a group of channels.

Single values integrated into a channel are particularly suitable for generating a history (e.g., single values like the minimum of different intervals or measuring periods can be written into a channel and graphically depicted).

#### Name of Calculation: Name of the Producer as it will appear in the component list.

#### Input Value Objects: Lists the available producers and the contained data objects (single values or channels).

#### Result Names: Name of the result data objects. If the input data is single values, the result is a channel to which a line is added with every new value. If the input data is channels, a group of channels is generated to which the complete channel is appended as new column upon the control event.
**Events**

**Append new Value:** The newly calculated value is written into the channel as soon as the event is triggered. The producer is selected in the first field and a contained control event (Action Event) is selected in the second field. Various control events are, for example, provided by the Measurement Service (Start, Pause, Clear, Stop, StopAll). The corresponding control events are triggered via F5/F6 respective via the menu items of the menu Measure. Control events can also be provided by other components, e.g. **Button**, **Time Trigger** or **Multi File Import**.

**Delete last Value:** If the defined event is triggered, the last value is deleted.

**Delete all Values:** If the defined event is triggered, the all values are deleted.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▼ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Help Symbol]: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Integer/LongValue</td>
<td>Integer</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeValue</td>
<td>Single value with longitude/latitude specification</td>
</tr>
<tr>
<td></td>
<td>DateTimeValue</td>
<td>Single value as time specification</td>
</tr>
<tr>
<td></td>
<td>Character/StringValue</td>
<td>Single value with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericValueByReference</td>
<td>Referenced numeric value</td>
</tr>
<tr>
<td></td>
<td>ObjectValue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td>Data Type</td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
<td></td>
</tr>
<tr>
<td>GroupOfValues</td>
<td>Group of single values</td>
<td></td>
</tr>
</tbody>
</table>

2.7.7.6 Statistic over Channels

Go to: Math

Statistic

Statistic over Channels

The calculation Statistic over Channels computes the statistical quantities of selected input data and stores them into new data objects.
Result Data: Name of the Producer as it will appear in the component list. The contained result data objects receive a suffix for the selected statistical function.

Input Data: Either complete groups of channels or individual channels (also from channel groups) can be selected.

View: Different views for filtering display values can be generated via View-Selection-Manager. View 0 is always available and usually doesn’t contain any filters. The display of the view selection can be enabled or disabled via Preferences→Dialogs. The selected view setting is applied to all maps.

Apply to: If the option importer channels is selected, the selected view is applied to data objects that originate from an importer component (e.g. Import Values). This way the multiple application of a view to a data object is prevented. If all channels are selected, the selected view is applied to all data objects.

Group of channels: Selection of a complete group of channels. All channels of the group are included in the statistics.

List of channels: This section contains two lists, on the left side all available data objects (channels and individual channels out of channel groups) and on the right side the selected data objects to be used to create statistical data.

Channels from channel groups can also be selected (e.g. ChannelGroup[].) By default, on selection of a channel group the index is set to 1 at first. On further selections the index is incremented or set to the lowest available index until all existing indexes are selected. The indexes can be edited manually via the Edit button.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

>>> >> > < <<: These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.
With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

The dialog **Configure Input Objects** opens where the index of the desired channel of the group can be entered.

**Ignore errors in input items:** Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

**Type of statistic:**
- **Horizontal statistic:** A horizontal statistic is generated from all channel values per index.
- **Vertical statistic:** A statistic is generated from each input channel. The result channel has one value per input channel.

**Function:** The following statistical quantities can be generated:

- **Minimum:** Minimum value of the channel. Suffix "-Min".
- **Maximum:** Maximum value of the channel. Suffix "-Max".
- **Median:** Value that is in the middle when all values are sorted according to size. Suffix "-Med".
- **Average:** Average value of the channel. Suffix "-Ave".
- **Standard Deviation:** Dispersion around the average, i.e. distance of the values from the average. Suffix "-SDev". The standard deviation can be multiplied by a desired coefficient **Sigma** which is entered in the input field.
- **Average + StdDev:** Average and standard deviation are added. Suffix "-ApSD". The standard deviation can be multiplied by a desired coefficient **Sigma** which is entered in the input field.
- **Average - StdDev:** Average and standard deviation are subtracted. Suffix "-AmSD". The standard deviation can be multiplied by a desired coefficient **Sigma** which is entered in the input field.
- **Last value:** Last value of the channel. Suffix "-LVal". Only available with vertical statistic.
- **Value at:** Value of the channel at a certain index. Suffix "-Val". The index can be entered manually or calculated via formula. The formula can be entered manually or with the aid of the **Formula Editor**. Only available with vertical statistic.
- **Quantile:** Quantile of the channel. Suffix "-Quant". The 100pth percentile p is defined in the range between 0 and 1. With a value of 0.2 the Quantile represents the value at which 20% of the measured values are smaller. Only available with vertical statistic.
**Additional channels (for vertical statistic):** If checked, a separate channel is created for each selected property. Selectable properties are e.g.: Display-Name, Name, Producer-Name or further properties which can be selected or edited in the second drop-down list. With "+" and "−" properties can be added or deleted from the list. The generated data object receives the suffix "-Property-[property name]".

**Result item type (for vertical statistic):** For vertical statistic the data type of the result item can be set explicitly. Depending on the input data one of the following types is recommended and highlighted if not selected. The corresponding information is displayed below. For horizontal statistic this option is not necessary as the result is generally a channel.

**Group of Values:** Recommended if the units of the selected data items differ because this type saves the unit for each member separately.

**Channel:** Recommended if all selected data items have the same unit.

**Formula Editor:** Opens the [Embedded Formula Editor].

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▶ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Example: Several data channels created by the Generator are displayed in the Spreadsheet. Data objects displaying the name of the data object, function, minimum, maximum and average are created by using the calculation Statistic over Channels.](image)
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Integer/LongValue</td>
<td>Integer</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeValue</td>
<td>Single value with longitude/latitude specification</td>
</tr>
<tr>
<td></td>
<td>DateTimeValue</td>
<td>Single value with time specification</td>
</tr>
<tr>
<td></td>
<td>Character/StringValue</td>
<td>Single value with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericValueByReference</td>
<td>Referenced numeric value</td>
</tr>
<tr>
<td><strong>ObjectValue</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td><strong>GroupOfValues</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ObjectChannel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GroupOfChannels</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GroupOfChannelsByReference</strong></td>
<td></td>
<td>Referenced group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>in case of horizontal statistic; channel length corresponds with length of longest channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>in case of horizontal statistic; number of values corresponds with number of channels</td>
</tr>
<tr>
<td></td>
<td>StringChannel/IntegerChannel</td>
<td>Channels with additional properties; data object type is defined by property</td>
</tr>
</tbody>
</table>

#### 2.7.7.7 Statistic of a Group

This calculation is now to be found under menu Math → Conversions → Concatenate Items of Tests. When older projects are opened these calculations are automatically converted.
2.7.7.8 Statistic over Matrixcolumns

Go to:

Math
  ➔ Statistic
    ➔ Statistic over Matrixcolumns

The calculation Statistic over Matrixcolumns creates a data object which stores statistical single values of matrix columns or rows into a channel.

Name of Calculation: Name of the Producer as it will appear in the component list.

Input Data: List of all available data objects for generating statistical data.

Statistictype: The following statistical quantities can be generated:

- Sum
- Average
- Median (value that is in the middle when all values are sorted according to size; suffix "-Med")
- Standard-Deviation
- Minimum (smallest value of the series)
- Maximum (largest value of the series)
- Span (difference between minimum and maximum value)
- X at Minimum (x-value at the minimum)
- **X at Maximum** (x-value at the maximum)
- **Index of Minimum**
- **Index of Maximum**
- **Number of Values**

**Direction**

- **vertical**: Statistical values are determined column by column.
- **horizontal**: Statistical values are determined line by line.
  
  **only lines full of values**: Optionally, only completely filled lines are included in the calculation.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign⚠️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**
The used matrix (Matrix[]) is displayed above. The calculation **Statistic over Matrix columns** creates one data object/channel each with the average, the sum and the standard deviation of all 10 columns of the matrix (result objects Mat-Stat-..., as in image on the right).

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleRectMatrix3D</td>
<td>3D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.7.9 Distributions

Go to:
Math
  → Statistic
  → Distributions

The calculation Distribution computes various statistical distributions.

Result Data: Name of the result data object as it will appear in the lists.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Type: The following statistical distributions can be calculated:

- Normal Distribution (Density or Integral)
• Error Function
• Poisson Distribution
• Chi-squared Distribution (with definition of the degree of freedom)
• StudentT Distribution (with definition of the degree of freedom)
• Weibull Distribution (with definition of the degree of freedom)

Input for Statistic: List of all available data objects whose average and standard deviation can be used for calculating the statistical distribution. If nothing is selected, the average as well as the standard deviation have to be entered manually.

auto Min/Max: If an input data object is selected from the combo box, Xmin and Xmax may be retrieved automatically from the average and the standard deviation (MW +/- 4 * Std.dev).

x-Minimum / x-Maximum: If auto Min/Max is disabled, the values of x-Minimum and x-Maximum can be entered manually. Else they will be determined automatically.

Values: States the number of computed values for the respective distribution.

ΔX: DeltaX is calculated out of the defined values.

Average: If no input data object is selected, the average needs to be entered manually. Else the average is adopted from the data object selected in the combo box.

Std. Deviation: If no data object is selected, the standard deviation needs to be entered manually. Else the standard deviation is adopted from the data object selected in the combo box.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign \(\Delta\) in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

Help: The context sensitive help is activated and the cursor changes to \(\text{\textcircled{?}}\). The respective help topic is displayed when an area within the dialog is clicked on.
Example

1. Random numbers are generated via *Generators* → *Numeric Channel*: “Random Numbers”.
2. The calculation *Stat. Frequency 1D* computes the value distribution: “Histogram”.
3. The statistical distribution is computed as a normal distribution with density.
4. The statistical distribution is computed as a normal distribution with integral.
5. The data series "Histogram" is integrated by using the calculation *Integration/Differentiation*: "Integrated Histogram".
6. The calculation *Extract statistical Values* saves the average and standard deviation of the data series "Random Numbers" as single values.
7. The *Formula Editor for Numeric Objects* computes the values +1-sigma and -1-sigma.

The *xy-Graph* displayed below shows:

1. The value distribution of "Histogram" noise signal.
2. The normal distribution (density) with the average and standard deviation automatically adopted from the noise signal.
3. The normal distribution (integral) with the average and standard deviation automatically adopted from the noise signal.
4. The integrated values of the histogram.

Additionally three cursors automatically display the average as well as both borders of the 1-sigma deviation.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.7.10 Box-Whisker Statistics

Go to:

Math
   → Statistic
   → Box-Whisker Statistics

The Box-Whisker Statistics calculates a distribution statistics out of test data which enables conclusions about central tendency, dispersion, skewness and range of the distribution as well as possible outliers.
**Name:** Name of the resulting component. Several result data objects are generated (see Types of data objects).

**Parameter:** Defines the size of boxes and whiskers.

- **interquartile (25% quantile):** Defines the dimension of the boxes such that 50% of the values are within the values range of the box, i.e. between the 25%-quartile and the 75%-quartile.
- **quantile:** Alternatively, the values range of the box can be entered manually.
- **whisker at 2.5% quantile:** The length of the lower whisker is calculated out of the 2.5%-quantile, the length of the upper whisker out of the 97.5%-quantile. Thus 95% of all values are within the limits of the whiskers.
- **whisker restricted to 1.5*IQR:** The length of the whiskers is limited to a maximum of 1.5 times of the interquartile range (IQR). The outliers are divided into light outliers (between 1.5*IQR and 3*IQR) and extreme outliers (> 3*IQR).

**One channel containing multiple measurements:** Select this option if all measured data are in one channel (Measurement data). A second channel (Measurement identifier) provides the identifiers to separate the individual measurements.

**Each measurement as column of a matrix or channel group:** Select this option if the measured data are stored as separate measurements in a matrix or group of channels. Each column of the matrix or each channel of the group represents one measurement.

**Each measurement as separate channel:** Select this option if the measured data are stored in channels divided into individual measurements. Each channel selected from the list represents one measurement.

This section contains two lists, on the left side the available data objects and on the right side the selected data objects to be used as input objects.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

- **🔎 ▶ ▸ ▼ ◀ ◄:** These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.
- **🔍 ▲ ▼:** With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.
- **🔍 ▲ ▼:** These buttons sort the selected data objects alphabetically in ascending or descending order.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🔴 in the Delete button indicates that the calculated data is used by other components.
Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example: In the following example, a series of values (= measurement) is generated via tangens function. The xy-Graph shows the individual measured values and the histogram. Below, different calculations of the Box-Whisker Statistic are displayed via the Box-Whisker diagram of the Universal-2D graph.

1st diagram: Calculation of the box via interquartile (25%-quantile), whisker at 2.5% quantile
2nd diagram: Calculation of the box via 10%-quantile, whisker at 2.5% quantile
3rd diagram: Calculation of the box via 10%-quantile, whisker restricted to 1.5*IQR. Beside the light outliers also extreme outliers (> 3*IQR) are displayed.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/LongChannel</td>
<td>Channel with integers</td>
</tr>
</tbody>
</table>
### Data

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integersfloating point numbers</td>
<td></td>
</tr>
<tr>
<td>NumericMatrixByReference</td>
<td>Referenced numeric matrix</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
<td></td>
</tr>
</tbody>
</table>

### Result Data

| "Name"                             | StringChannel                                        | Names of the measurements                    |
| "Count"                            | IntegerChannel                                       | Number of samples                             |
| "LowWhisker"                       | DoubleChannel                                        | Values of the lower whiskers                  |
| "LowQuartil"                       | DoubleChannel                                        | Values of the lower quartiles                 |
| "Median"                           | DoubleChannel                                        | Values of the medians                         |
| "UpQuartil"                        | DoubleChannel                                        | Values of the upper quartiles                 |
| "UpWhisker"                        | DoubleChannel                                        | Values of the upper whiskers                  |
| "LightOutliers"                    | DoubleVarColMatrix2D                                 | Light outliers                                |
| "ExtremeOutliers""                 | DoubleVarColMatrix2D                                 | Extreme outliers (only filled with option whisker restricted to 1.5*IQR) |

#### 2.7.7.11 Statistical Process Control (SPC)

Go to:
```
Math
  ↪ Statistic
    ↪ Statistical Process Control (SPC)
```
Result Data: Name of the result data object as it will appear in the lists.

Input Data: Lists all suitable data objects that can be used for generating statistical data.

Lower process limit: The lower process limit can be entered manually or is determined by an existing value.

Upper process limit: The upper process limit can be entered manually or is determined by an existing value.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Process limits</td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleValue</td>
<td>Integer/ floating point number</td>
</tr>
</tbody>
</table>
2.7.7.12 Part Average Analysis (PAA)

Go to:

Math
  ➔ Statistic
  ➔ Part Average Analysis (PAA)

Result Data: Name of the result data object as it will appear in the lists.

Input Data: Lists all suitable data objects that can be used for generating statistical data.

Lower process limit: The lower process limit can be entered manually or is determined by an existing value.

Upper process limit: The upper process limit can be entered manually or is determined by an existing value.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.
**Delete**: The calculation is deleted and the dialog closed. A warning sign ▶ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Process</td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td>limits</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleChannel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>Floating point number</td>
</tr>
</tbody>
</table>

### 2.7.7.13 PTV-Statistics

Go to:

**Math**

∪ **Statistic**

∪ **PTV-Statistics**

The calculation **PTV-Statistics** creates a two dimensional conversion of PTV data objects into an equidistant matrix.

A PTV- data object (PTV: Partial Trace Velocity) is converted into a two dimensional matrix with an x-axis containing the directions and a y-axis containing the distances.
Result Data: Name of the data object as it will appear in the lists.

Input Data: List of all available input data objects.

Minimum: Minimum of the class range for length and angle.

Maximum: Maximum of the class range for length and angle.

# of classes: Number of classes into which is counted.

Δ per class: The delta per class is determined out of the class limits and number of classes.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example

The xy-Graph (below) visualises imported PTV data.
Data of a PTV-Statistic visualised in a matrix graph.

<table>
<thead>
<tr>
<th>Types of data objects</th>
<th></th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTV_ObjectVector</td>
<td></td>
<td>Channel with PTV objects</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IntegerVarColMatrix2D</td>
<td></td>
<td>2D-matrix with integers</td>
</tr>
</tbody>
</table>
2.7.7.14 SuanShu Statistic

Go to:

Math
  ➔ Statistic
    ➔ SuanShu Statistic

2.7.8 Counting Procedures

Go to:

Math
  ➔ Counting Procedures

The menu is divided into:

- Stat. Frequency 1D
- Stat. Frequency 2D
- Rainflow
- 1D-Classification
- Dwell Time
- Min-Max Classification
- Reversal Points
2.7.8.1 Stat. Frequency 1D

Go to:

Math
  Counting Procedures
    Stat. Frequency 1D

The calculation Stat. Frequency 1D is a one-dimensional classification of data series into a grid with definable classes.

All values of the input data are analysed. If a value resides within a defined class boundary, the correspondent class is being calculated and the counter of the class is raised by one. See also statistical distribution.

Parallel processing

On the one hand, this component enables the parallel processing of grouped data items as generated e.g. by the Data Source Manager. For instance, if several measurements are carried out over a period of time, many files are created. These files can be selected in the data source manager which generates channel groups, each including one signal of multiple measurements.

Sequential processing

On the other hand, this component supports a sequential processing of data provided e.g. by a Multi-File Import or an online measurement. The processing of data is controlled by action events provided by components such as the Multi-File Import or the Measurement Service.

Processing in a jBEAM Cluster

As a new option, the processing of data within a jBEAM Cluster is supported. Several jBEAM instances combined in a cluster analyse simultaneously different measurement files. The part results are then aggregated to a total result. This method is especially useful for a high amount of files while consuming little storage space. In order to perform a cluster calculation a Cluster-MultiFile Controller for control and a Cluster-Aggregator component is necessary.
**Result Data:** Name of the component and result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**Operation:** The selection of an operation mode is commonly used to execute a calculation on channels imported from multiple files. The three operation modes differ in two elementary characteristics:

- How are the files imported
- Internal or without/external aggregation

The aggregation is merging the intermediate results of the individual files into one final result.

**single / cluster:** The common case is to use this operation mode, when there is only one file to be calculated by the according component and there is no need for any aggregation. If the calculation should be executed on a cluster, also this operation mode has to be selected. Due to technical limitations, there is no internal aggregation available on the cluster, so the aggregation is handled externally by the **Cluster-Aggregator**. Thus, the **File-Importer** and the aggregation are handled by the **Cluster Multi File Controller**. The
calculation on the cluster is limited in its Input-Data-Object types, so that a Group of Channels as input is only permitted as far as the calculation supports it and if it does not originate from a Datasource-Manager.

**use calculation in cluster:** This option is to be selected when the calculation actually shall be run in a cluster. In this case, some setting, e.g. automatic range boundaries, are not available.

**sequential:** This option is selected if the imported data are provided by e.g. the Multi File Import or by measurements. The Multi File Import loads the import files contained in a definable list one after another. After each load, the import data are processed by defined actions triggered by action events, e.g. append new values, and calculations are validated. The advantage is that the memory load is low even with many large files. However, for every new calculation all the files need to be imported and processed again.

**parallel:** This option is selected if the imported data are provided by e.g. the Data Source Manager. This component generates grouped data items, i.e. all date items of the same name throughout all import files are grouped together. With parallel processing, all files are loaded at the same time. The advantage is that on changes, e.g. a new calculation, no data need to be reloaded. However, in case of many large files this may lead to high memory load. Therefore this option is best suitable for few small files.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data:** Lists all suitable data objects that can be used for generating statistical data. Suitable data objects are all numeric channels, string channels as well as matrices and channel groups.

In case of string channels, the setting of the class width is disabled. The distribution of the classes is done automatically according to the present strings in the selected channel. Each individual string generates a class.

In case of matrices and channel groups, it is counted column per column.

**Multithreaded:** The calculation of the histogram is executed by several threads. This mode can be applied for a faster calculation in case of higher data volume.

**Classes**

**equally spaced:** The class boundaries are equally distributed over the whole range.

**auto range:** The range boundaries are determined automatically via the minimum and maximum of the input data object. The class boundaries are evenly spread over the whole range. The determined values for Minimum, Maximum and Class width are displayed in the fields below.

⚠️ In case of cumulated calculation over several files it is not possible to determine automatic range boundaries because the data is not completely available at the beginning of the calculation. The range boundaries should be manually determined such that they cover the whole range of all files to be analysed in order to include all values.
**manual range:** The range boundaries are entered manually via the input fields **Minimum** and **Maximum**. The class boundaries are evenly spread over the whole range.

**# of classes:** This option defines the number of classes into which shall be counted. The determined range is equally divided into this number of classes.

**class width:** Optionally, the class width can be defined. The number of classes is then automatically calculated from the class width and the range is correspondently divided.

These are **Controllable Properties:** The range boundaries for instance can also be controlled by another data item. For this, the conversion **Dataitem Property** can be used to modify this property. Also number of classes and class width can thus be controlled. The also controllable property "FixNumberOfClasses" states which of those values is definable.

**list of class boundaries:** Optionally, a list of class boundaries can be defined where the range shall be devided. Thus, even unequal class widths are possible. The individual class boundaries are devided by semicolons. The class boundaries should be stated in ascending order, starting from the lower most boundary to the upper most boundary. When the values are counted into the classes, the lower boundary is counted into the respective class as well as all values smaller than the upper boundary. Therefore, if the maximum value shall be counted into the last class, the upper boundary must be slightly higher.

**Counting of:**

**Events:** The events are counted, i.e. how many values are attributable to the respective class.

- **absolute:** Calculates the absolute number of events per class.
- **relative [%]:** Calculates the number of events per class divided by the total counts in percent.
- **density:** Calculates the number of events per class in relation to the class width. This mode provides better results in case of unequal class widths.
- **rel. density:** Calculates the relative number of events per class in relation to the class width.

- **cumulative:** Adds up the absolute number of events over the classes.

- **histogram display:** The data will be prepared for the display in a line chart, so as to display for example a bar at the beginning of an axis without moving it to the back. Only with cumulative counting.

- **include NaNs:** If this option is selected, the NaN values are counted for the determination of the total number. Otherwise, they are ignored, i.e. the number of events is not increased. Only with relative counting.

**Values of a reference channel per class:** Not the events themselves but the corresponding values of a reference channel are used for the calculation of the selected statistical values. The result data objects receive a suffix for the respective statistical value.
x-values: If existing, the corresponding values of an independent channel or otherwise the implicit X-values of the input channel defined by X offset (Xoff) and delta X (Xdel) are used for the calculation. The text field below shows the currently used source.

Channel: The corresponding values of the selected data item are used for the calculation.

sum of values: Calculates the sum of the values of the reference channel per class (Suffix "-Sum").

average of values: Calculates the average of the values of the reference channel per class (Suffix "-Avg").

sum of deltas of 2 consecutive values: Calculates the sum of the differences of 2 consecutive values of the reference channel per class (Suffix "-Delta").
not counted, if delta is >: Optionally, differences exceeding the defined value can be excluded from the count. This is a Controllable Property:

minimum of values: Determines the minimum value of the reference channel per class (Suffix "-Min").

maximum of values: Determines the maximum value of the reference channel per class (Suffix "-Max").

span of values: Determines the span of the reference channel per class (Suffix "-Span").

standard deviation of values: Determines the standard deviation of the reference channel per class (Suffix "-StdDev").

Ignore errors in input items: Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

Store the calculated values also as a matrix: Optionally, the calculated values can additionally be stored in a matrix. A new column is generated for each imported file. Only with sequential and parallel operation.

Action Events for Control: With sequential processing mode, the processing of data is controlled by action events. The Multi-File Import provides the action events "TRIGGER" and "CLEAR" via "StatCtrl". Various control events are, for example, provided by the Measurement Service (Start, Pause, Clear, Stop, StopAll) or by other components, such as Button or Time Trigger.

Append new Value: The newly calculated value is written into the channel as soon as the event is triggered. The producer is selected in the first field and a contained control event (Action Event) is selected in the second field.

Delete all Values: If the defined event is triggered or Now pressed, all values are deleted.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example

The xy-Graph (below) displays a histogram result as well as the input data generated via Extra→Generators→Numeric Channel (random numbers).

![Histogram](image)

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data / x-values /</td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>reference channel</td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-Matrix with integers/floating point numbers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Result data</th>
<th>according to input data</th>
</tr>
</thead>
<tbody>
<tr>
<td>channels as input:</td>
<td>DoubleChannel</td>
</tr>
<tr>
<td>channel groups as input:</td>
<td>GroupOfChannels</td>
</tr>
<tr>
<td>matrices as input:</td>
<td>DoubleVarColMatrix2D</td>
</tr>
<tr>
<td>&quot;[name]&quot; or &quot;[name]-Sum&quot;</td>
<td>according to input data</td>
</tr>
<tr>
<td>&quot;[name]-X&quot;</td>
<td>according to input data</td>
</tr>
<tr>
<td>&quot;[name]-Delta&quot;</td>
<td>according to input data</td>
</tr>
<tr>
<td>&quot;[name]-Min&quot;</td>
<td>according to input data</td>
</tr>
<tr>
<td>&quot;[name]-Max&quot;</td>
<td>according to input data</td>
</tr>
<tr>
<td>&quot;[name]-Avg&quot;</td>
<td>according to input data</td>
</tr>
<tr>
<td>&quot;[name]-Span&quot;</td>
<td>according to input data</td>
</tr>
<tr>
<td>&quot;[name]-StdDev&quot;</td>
<td>according to input data</td>
</tr>
</tbody>
</table>

**Controllable Properties**

Nearly all properties of the Stat. Frequency 1D, e.g. DelXLimit, NumberOfClasses, Lower/UpperLimit, can be retrieved or controlled by another data item. The property values can be retrieved by the conversion Property → Dataitem and controlled by the conversion Dataitem Property. In the latter case, the respective values in the modification dialog are overwritten by the data item.
The image shows how the property **# of classes (NumberOfClasses)** is controlled via the **Value Input** control element. A description of the conversion is to be found under **Math → Conversions → Dataitem Property**.

<table>
<thead>
<tr>
<th>Controllable Property</th>
<th>Property Name</th>
<th>Permissible Data Types</th>
</tr>
</thead>
<tbody>
<tr>
<td># of classes</td>
<td>NumberOfClasses</td>
<td>IntegerValue/Channel</td>
</tr>
<tr>
<td>class width</td>
<td>ClassWidth</td>
<td>IntegerValue/Channel</td>
</tr>
<tr>
<td>Selection: # of classes / class width</td>
<td>FixNumberOfClasses</td>
<td>BitValue/Channel</td>
</tr>
<tr>
<td>&quot;true&quot; = number of classes definable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;false&quot; = class width definable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum: lower range boundary</td>
<td>LowerLimit</td>
<td>DoubleValue /Channel</td>
</tr>
<tr>
<td>Maximum: upper range boundary</td>
<td>UpperLimit</td>
<td>DoubleValue /Channel</td>
</tr>
<tr>
<td>Option &quot;not counted, if delta is &gt;&quot;</td>
<td>DelXlimit</td>
<td>DoubleValue /Channel</td>
</tr>
</tbody>
</table>

### 2.7.8.2 Stat. Frequency 2D

Go to:

**Math**

- Counting Procedures
- Stat. Frequency 2D

The calculation **Stat. Frequency 2D** supports the synchronous classification of 2 input signals by means of a procedure.
**Result Data**: Name of the component and result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**X / Y**: Class definitions for X and Y values.

**Input Data**: Lists all suitable data objects for the X- and Y-dimension.

**Classes**: The number of classes into which is counted. The range is equally divided into this number of classes.

![Image of software interface with input fields for classes and data definitions.]

This is a **Controllable Property**: The number of classes can also be controlled by another data item. For this, the conversion **Dataitem Property** can be used to modify this property.

**Boundary of Classes**: Defines the distribution of the class boundaries within the total range.

- **manual**: The range boundaries are entered manually via the input fields **Minimum** and **Maximum**. The class boundaries are evenly spread over the whole range. These are **Controllable Properties**.

- **Class width**: The class width is automatically calculated from the boundary of classes (Maximum - Minimum) and the number of classes.

- **automatic**: The range boundaries are determined automatically via the minimum and maximum of the input data object. The class boundaries are evenly spread over the whole range. The determined values for **Minimum**, **Maximum** and **Class width** are displayed in the fields below.
In case of cumulated calculation over several files it is not possible to determine automatic range boundaries because the data is not completely available at the beginning of the calculation. The range boundaries should be manually determined such that they cover the whole range of all files to be analysed in order to include all values.

**list of class boundaries:** Optionally, a list of class boundaries can be defined where the range shall be devided. Thus, even unequal class widths are possible. The individual class boundaries are devided by semicolons. The class boundaries should be stated in ascending order, starting from the lower most boundary to the upper most boundary. When the values are counted into the classes, the lower boundary is counted into the respective class as well as all values smaller than the upper boundary. Therefore, if the maximum value shall be counted into the last class, the upper boundary must be slightly higher.

**Counting of:**

**Events:** The events are counted, i.e. how many values are attributable to the respective class.

- **absolute:** Calculates the absolute number of events per class.
- **relative [%]:** Calculates the number of events per class divided by the total counts in per cent.
- **density:** Calculates the number of events per class in relation to the class width. This mode provides better results in case of unequal class widths.
- **rel. density:** Calculates the relative number of events per class in relation to the class width.

**Values of a reference channel per class:** Not the events themselves but the corresponding values of a reference channel are used for the calculation of the selected statistical values. The result data objects receive a suffix for the respective statistical value.

- **x-values:** If existing, the corresponding values of an independent channel or otherwise the implicit X-values of the input channel defined by X offset (Xoff) and delta X (Xdel) are used for the calculation. The text field below shows the currently used source.
- **Channel:** The corresponding values of the selected data item are used for the calculation.

- **sum of values:** Calculates the sum of the values of the reference channel per class (Suffix "-Sum").
- **average of values:** Calculates the average of the values of the reference channel per class (Suffix "-Avg").
- **sum of deltas of 2 consecutive values:** Calculates the sum of the differences of 2 consecutive values of the reference channel per class (Suffix "-Delta").
- **not counted, if delta is >:** Optionally, differences exceeding the defined value can be excluded from the count. This is a Controllable Property.
- **minimum of values:** Determines the minimum value of the reference channel per class (Suffix "-Min").
**maximum of values:** Determines the maximum value of the reference channel per class (Suffix "-Max").

**span of values:** Determines the span of the reference channel per class (Suffix "-Span").

**standard deviation of values:** Determines the standard deviation of the reference channel per class (Suffix "-StdDev").

**Cumulated:**

**Useful e.g., to cumulate over several files, uses events, e.g. from Multi-File-Import:** This option enables to cumulate data sequentially over several files. This sequential processing of data is controlled by control events. The Multi-File Import provides the action events "TRIGGER" and "CLEAR" via "StatCtrl". Various control events are, for example, provided by the Measurement Service (Start, Pause, Clear, Stop, StopAll) or by other components, such as Button or Time Trigger.

**Control Events:**

- **Reset:** If the defined event is triggered, all values are deleted. The producer is selected in the first field and a contained control event (Action Event) is selected in the second field.

- **Calculate:** The newly calculated value is written into the channel as soon as the defined event is triggered.

- **Ignore errors in input items:** Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Data/reference channel</td>
<td>all channel data types</td>
<td>GroupOfValues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GroupOfChannels</td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers (in case of channel input data)</td>
</tr>
<tr>
<td></td>
<td>GroupOfMatrixes</td>
<td>Group of matrices (in case of channel groups input data)</td>
</tr>
</tbody>
</table>

Controllable Properties

Nearly all properties of the Stat. Frequency 2D, e.g. DelXlimit, XClassesCount, XLower/UpperLimit, can be retrieved or controlled by another data item. The property values can be retrieved by the conversion Property → Dataitem and modified by the conversion Dataitem Property. In the latter case, the respective values in the modification dialog are overwritten by the data item.

The image shows how the property Classes of the X-value is controlled via the Value Input control element. A description of the conversion is to be found under Math → Conversions → Dataitem → Property.

<table>
<thead>
<tr>
<th>Controllable Property</th>
<th>Property Name</th>
<th>Permissible Data Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classes for X- and Y-values</td>
<td>XClassesCount / YClassesCount</td>
<td>IntegerValue/Channel</td>
</tr>
<tr>
<td>Minimum: lower range boundary for X- and Y-values</td>
<td>XLowerLimit / YLowerLimit</td>
<td>DoubleValue/Channel</td>
</tr>
</tbody>
</table>
### 2.7.8.3 Rainflow

Go to:

**Math**

\[ \text{Counting Procedures} \rightarrow \text{Rainflow} \]

The calculation **Rainflow** is a two-dimensional classification of data series into an equidistant matrix.

The signal sequence of a data object is analysed. Complete vibrations are analysed and each of them undergoes a two-dimensional classification resulting in a two-dimensional integer matrix.

**Result Data:** Name of the result data object as it will appear in the lists.

**Input Data:** Lists all suitable data objects that can be used for generating the statistical data.

**Vector calculation after:** The vibration analysis can be executed by using two different procedures. Both deliver similar results which only differ in the definition of the conditions.

- **Praha:** the so-called Prague method
Stuttgart: the so-called Stuttgart method

Class definition: Determines the method for the classification of each full oscillation. 4 class definitions are supported:

- **Average - Amplitude**: 1. dim: average; 2. dim: amplitude
- **Average - Span**: 1. dim: average; 2. dim: span (= 2*amplitude)
- **Startclass - Targetclass**: 1. dim: Startclass; 2. dim: Targetclass
- **Minimum - Maximum**: 1. dim: minimum; 2. dim: maximum

with Residua: The residua (open oscillations at the end of a calculation run) are classified additionally.

- **Minimum**: The minimum of the range to be classified.
- **Maximum**: The maximum of the range to be classified.

**Number of classes**: The number of classes in x- and y-direction into which is counted. The range is equally divided into this number of classes.

**Delta per class**: The class width is automatically calculated from the class boundary (Maximum - Minimum) and the number of classes.

**Noise limit**: Oscillations that are smaller than the defined noise limit are not classified.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign 🔄 in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to 🔄. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The *xy-Graph* (below) displays the time signal (123.000 values) that is subsequently classified.
The rainflow matrix is calculated from the time signal and displayed as a matrix graph:

The rainflow matrix is computed from random numbers \([-1; +1]\) with three different class definitions:
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>IntegerVarColMatrix2D</td>
<td>2D matrix with integers</td>
</tr>
</tbody>
</table>

#### 2.7.8.4 1D-Classification

Go to:

**Math**

- Counting Procedures
- 1D-Classification

The calculation **1D-Classification** adds up 2D-matrix cells (i.e. Rainflow -Matrix) according to certain criteria. The result is a one-dimensional integer data series. **1D-Classification** does not carry out a classification.

**Result Data:** Name of the result data object as it will appear in the lists.

**Input Data:** Lists all suitable data objects that can be used for generating statistical data.

**Standard Methods for an Integer Matrix**

- **Vertical Sum:** Matrix elements are added vertically.
- **Horizontal Sum:** Matrix elements are added horizontally.

**Special Methods for a Rainflow Matrix:**

- **Maxima:**
- **Minima:**
- **Span:**
- **Average:**
- **Rangepair:**
- **Level crossing:**

![Image of the One Dim-Counting interface](image-url)
- Maxima
- Minima
- Span
- Average
- Rangepair
- Level crossing

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ▶️. The respective help topic is displayed when an area within the dialog is clicked on.

Example

A from-to rainflow matrix is calculated from a data series with 10,000 random numbers [-1; +1]:

![Rainflow Matrix Diagram]
Various computed 1D-Classifications:

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>IntegerVarColMatrix2D</td>
<td>2D-matrix with integer</td>
</tr>
<tr>
<td>Result data</td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
</tbody>
</table>

2.7.8.5 Dwell Time

Go to:

Math
  ➔ Counting Procedures
    ➔ Dwell Time

The calculation Dwell Time is a two-dimensional classification of data series into an equidistant matrix.

The class of the instantaneous value is held. Then the values from each class are counted and classified two-dimensional. The result is a two-dimensional integer matrix.
**Result Data**: Name of the result data object as it will appear in the lists.

**Input Data**: Lists all suitable data objects for the x- and y-dimension.

**Range**: The range can be determined automatically or by minimum and maximum.

**Minimum**: The minimum of the range to be classified.

**Maximum**: The maximum of the range to be classified.

**Number of classes**: The number of classes in x- and y-direction into which is counted. The range is equally divided into this number of classes.

**Delta per class**: The class width is automatically calculated from the class boundary (Maximum - Minimum) and the number of classes.

**Result as**: The result can be stated in counts, percentage or time.

- **Counts**: Number of values of each class as integer value.
- **Percentage**: Computes the relative number of values per class divided by the total number in per cent.
- **Time**: Sum of the DeltaX with correspondent unit.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
Example

The graph below displays the distribution of values in an xy-Graph.

The resulting Dwell Time matrix displayed in a matrix chart:

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
</tbody>
</table>
2.7.8.6 Min-Max Classification

Go to:

Math
→ Counting Procedures
→ Min-Max Classification

The calculation **Min-Max Classification** determines the frequency scale of the positions of a signal’s extreme values separated by minima and maxima. The results are two one-dimensional integer channels.

A hysteresis with fluctuating measured values in which an extreme value cannot be identified (separate for minima and maxima) may be stated.

**Result Data:** Name of the result data object as it will appear in the lists.

**Input Data:** Lists all suitable data objects.

**Range**

- **Minimum:** The minimum of the range to be classified.
- **Maximum:** The maximum of the range to be classified.

**Hysteresis**

- **Minimum:** The minimum of the hysteresis.
- **Maximum:** The maximum of the hysteresis.

**Number of classes:** The number of classes in x- and y-direction into which is counted. The range is equally divided into this number of classes.
**Delta per class:** The class width is automatically calculated from the class boundary (maximum - minimum) and the number of classes.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

A Min-Max Classification calculated from a data series.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
</tbody>
</table>

#### 2.7.8.7 Reversal Points

Go to:

**Math**

- **Counting Procedures**
- **Reversal Points**

The calculation **Reversal Points** determines the reversal points of a signal in consideration of a defined hysteresis.

**Result Data**: Name of the result data object as it will appear in the lists.

**Suffix**: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Input Data**: Lists all suitable data objects.

**Hysteresis**: Declaration of the range filter. Only those reversal points are counted whose amplitude complies with the range filter.
**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 💡. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The reversal points (Rev-Points) are calculated from a data series (DatGen) on the basis of the settings in the dialog box (above).

![Graph of DatGen and Rev-Points](image)

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
</tbody>
</table>
2.7.9 Conversions

Go to:

Math

Conversions

The menu item is divided into:

- **Concatenate Values**
- **Concatenate Channels**
- **Concatenate Items of Tests**
- **Concatenate Producers**
- **Dataobjects switch**
- **Grouping data objects**
- **Grouping of calculations/graphics**
- **Ungroup Group of Data Objects**
- **Extract Bits**
- **Cuts through Matrix**
- **Channel → GroupOfValues**
- **Channels → Matrix**
- **Pos.-Vector → Matrix**
- **Matrix → PosVector**
- **Index for relative Time**
- **Abs. Time → rel. Time**
- **YMDHMS → Date/Time**
- **Date/Time conversion**
- **Key → Label**
- **String → Numeric value**
- **Video → Timed Images**
- **Property → DataItem**
- **DataItem → Property**
- **List of Properties**
- **Alarm Generator**
- **Counter → physical Values**
2.7.9.1 Concatenate Values

Go to:

Math
  → Conversions
    → Concatenate Values

The calculation Concatenate Values concatenates several single values to one result channel. This is helpful for merging statistical values of channels (e.g. maxima) into one channel which then will be displayed.

The available channels can be filtered by their data types, i.e. only channels with the selected data type are displayed as input data. The result data type can be specified as well. Additionally, properties of the input data can be assigned to the result channel.

Result Data: Name of component and result data object that appears in the lists.

Available values / Selected values: This section contains two lists, on the left side the Available values (single values) and on the right side the Selected values that are to be concatenated.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.
These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

**Show:** Only data objects having the selected data format are displayed in the list of **Available values**.

**Invert order of values:** The order of the values in the result channel corresponds with the order of the selected single values in the list **Selected values**. If this function is activated, the order of the values in the result channel will be inverted.

**Ignore errors in input items:** Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

**Result type:** Defines the data format of the result channel. If the option **Automatic** is selected, the format of the result channel is determined by the largest data format of the input values. The created data format of the current selection is displayed in brackets.

**Create channel for selected properties:** Up to 6 property values of the used single values can be adopted into a separate result channel. Possible property values are: Name, EnterpriseName, MinValue, StandardDeviation, Type, ProducerName, MaxValue, Id, Average, OrigName, Unit.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🚨 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

**Help icon:** The context sensitive help is activated and the cursor changes to 🤔. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

*The graph below displays the concatenated single values as bars in a line chart.*
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integer/LongValue</td>
<td>Integer</td>
<td></td>
</tr>
<tr>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeValue</td>
<td>Single value with longitude/latitude specification</td>
<td></td>
</tr>
<tr>
<td>DateTimeValue</td>
<td>Single value as time specification</td>
<td></td>
</tr>
<tr>
<td>Character/StringValue</td>
<td>Single values with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericValueByReference</td>
<td>Referenced numeric value</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integer/Long/Float/-DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
<td></td>
</tr>
<tr>
<td>Channels with property values</td>
<td>Integer/Double/StringChannel</td>
<td>The data type is determined via the property value</td>
</tr>
</tbody>
</table>
2.7.9.2 Concatenate Channels

Go to:

Math
- Conversions
  - Concatenate Channels

The calculation **Concatenate Channels** concatenates several channels to one result channel. The available channels can be filtered by their data types, i.e. only the channels with the selected data type are displayed. The result data type can be specified as well.

---

**Result Data:** Name of component and result data object that appears in the lists.
Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Available items / Selected items: This section contains two lists, on the left side the available items (channels) and on the right side the selected items that are to be concatenated.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

>>> >> > < <<: These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

^ ^ ^ ^ ^: With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

↓↓↓↓↓: These buttons sort the selected data objects alphabetically in ascending or descending order.

Show: Only data objects having the selected data format are displayed in the list of available items.

no x-gaps between channel values: If selected, the subsequent channels are shifted in x-direction such that there are no gaps between the individual channels.

automatic offset: If selected, the first channel starts with 0 and the following channels start with the last value of the previous channel.

Ignore errors in input items: Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

Concatenate channel by channel for group of channels: If selected, the result of an input data object containing at least one group of channels is a group of channels. The number of channels in the resulting group corresponds with the number of channels of the largest group of channels.

If several groups of channels are selected, the individual channels are concatenated according to their index in the group, i.e. all first channels are concatenated etc.

If the selection also contains a channel in addition to a group of channels, this channel is added to each channel of the group.

If the option is not selected, the result is a channel with the individual channels of a group concatenated to each other.

Result type: Defines the data format of the result channel. If the option Automatic is selected, the selected data items determine the result data type. In case of mixed input data types, the most comprehensive data type (e.g. Double (64 bit)) is applied. The resulting data format of the current selection is shown in brackets.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ☑. The respective help topic is displayed when an area within the dialog is clicked on.

Example

The graph displays the input data as well as the concatenated channels in a 2D-Graph.

![Graph displaying input data and concatenated channels](image)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Integer/LongValue</td>
<td>Integer</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeValue</td>
<td>Single value with longitude/latitude specification</td>
</tr>
<tr>
<td></td>
<td>DateTimeValue</td>
<td>Single values with time specification</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Character/StringValue</td>
<td>Value with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericValueByReference</td>
<td>Referenced numeric value</td>
<td></td>
</tr>
<tr>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
<td></td>
</tr>
<tr>
<td>Integer/LongChannel</td>
<td>Channel with integers</td>
<td></td>
</tr>
<tr>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
<td></td>
</tr>
<tr>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
<td></td>
</tr>
<tr>
<td>GroupOfValues</td>
<td>Group of single values</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
<td></td>
</tr>
<tr>
<td>Result data</td>
<td>Integer/LongChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time</td>
</tr>
<tr>
<td></td>
<td>StringChannel</td>
<td>Channel with strings</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>with option: Concatenate channel by channel for group of channels</td>
</tr>
</tbody>
</table>
2.7.9.3 Concatenate Items of Tests

The calculation **Concatenate Items of Tests** (formerly: Statistic of a Group) concatenates values of single value data items and channels, as well as statistical values of single values, channels or matrixes. Moreover, properties of data items can be concatenated.

**Parallel processing**

On the one hand, this component enables the parallel processing of grouped data items as generated e.g. by the **Data Source Manager**. Thus, generating a statistic over all items of a data object group is facilitated. For instance, if several measurements are carried out over a period of time, many files are created. These files can be selected in the data source manager which generates channel groups, each including one signal of multiple measurements. With **Concatenate Items of Tests** these channel groups can be statistically evaluated. Thus it is possible to display the frequency of certain states of a measured variable over several files. For example, to determine how long a vehicle has been driven at a certain speed, two dimensional histograms can be added up to monthly histograms.

**Sequential processing**

On the other hand, this component supports a sequential processing of data provided e.g. by a **Multi-File Import** or an online measurement. The processing of data is controlled by action events provided by components such as the Multi-File Import or the Measurement Service.
**Result Data:** Name of the Producer as it will appear in the component list. The contained result data objects receive a suffix for the selected statistical function.

**Operation:** The selected operation determines whether the data are processed in parallel or sequential mode.

- **parallel (using grouped items):** This option is selected if the imported data are provided by e.g. the **Data Source Manager**. This component generates grouped data items, i.e. all date items of the same name throughout all import files are grouped together. With parallel processing, all files are loaded at the same time. The advantage is that on changes, e.g. a new calculation, no data need to be reloaded. However, in case of many large files this may lead to high memory load. Therefore this option is best suitable for few small files.

- **sequential (with MultiFileImport, measurements):** This option is selected if the imported data are provided by e.g. the **Multi File Import**. This component loads the import files contained in a definable list one after another. After each load, the import data are processed by defined actions triggered by action events, e.g. append new values, and
calculations are validated. The advantage is that the memory load is low even with many large files.

**Ignore errors in input items:** Optionally, in case of missing or faulty input objects, these errors can be ignored. The results of the respective input object are set to NaN and all other results are calculated correctly. If this option is deactivated, the whole calculation would have no result in case of such errors.

**Input Data:** This section contains two lists, on the left side all available data objects (groups of channels, matrices or values) and on the right side the selected data objects to be concatenated or to be used to create statistical data.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

- These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

- With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

- These buttons sort the selected data objects alphabetically in ascending or descending order.

**Function:**

**Functions for time series:**

**Values of value-items or channels are concatenated:** The values of all group members are concatenated. Per value group one channel is created with all values; per channel group one channel is created with a length of the sum of lengths of all members (suffix ":CC", if independent channel exists additional channel with suffix ":CC-Time"). This option is only applicable for value or channel groups, not for matrix groups.

**no time gaps between curves:** If selected, the individual time series of the measurements are concatenated without a time gap even if the measurements have been carried out with a time lag.

**Statistical functions (especially for 1D- or 2D histograms):** The listed statistical quantities can be generated. For each value of the first group member (channels: v1[i]; matrices: v1[i,j]), the selected statistical functions are calculated over the elements vn(i,j) of all group members. One channel is created per channel group, one matrix per matrix group and one value per value group. The size of the result item (e.g. channel length) is the size of the first group member. The unit of the result object is also determined by the first group member.

**Sum:** The values of all group members at the same index (=row) are added. The result data object receives the suffix ":Sum".

**Minimum:** Minimum value of the row. Suffix ":Min".

**Maximum:** Maximum value of the row. Suffix ":Max".

**Average:** Average value of the row. Suffix ":Ave".
**Median:** Value that is in the middle when all values of the row are sorted according to size. Suffix ":-Med".

**All values of grouped item with index:** All values of the defined group member, i.e. column. The index can be entered manually, calculated via formula or defined by a data object (single value). Suffix ":-Val".

⚠️ As these statistical calculations are processed index-based, sensible results can only be expected with the same x-base (i.e. ΔX) of all input channels.

**Create channels for property values of selected dataitems:** Optionally up to 6 property values of the selected data items can be stored in channels. The result data items receive the name of the property with the index of the group member (e.g. "Name[1]", if independent channel exists additional channel with suffix ":-Time").

**Action Events for Control:** With sequential processing mode, the processing of data is controlled by action events. The Multi-File Import provides the action events "TRIGGER" and "CLEAR" via "StatCtrl". Various control events are, for example, provided by the Measurement Service (Start, Pause, Clear, Stop, StopAll) or by other components, such as Button or Time Trigger.

**Append new Value:** The newly calculated value is written into the channel as soon as the event is triggered. The producer is selected in the first field and a contained control event (Action Event) is selected in the second field.

**Delete all Values:** If the defined event is triggered or Now pressed, all values are deleted.

**Formula Editor:** Opens the Embedded Formula Editor.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ⚠️ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

💡: The context sensitive help is activated and the cursor changes to 📜. The respective help topic is displayed when an area within the dialog is clicked on.
**Example 1:** The component **Concatenate Items of Tests** has been used to calculate the statistical functions Sum, Maximum and Average from a group of three channels (left).

<table>
<thead>
<tr>
<th>Channel Group</th>
<th>Signal1</th>
<th>Signal2</th>
<th>Signal3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statistic Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

**Example 2:** Via **Concatenate Items of Tests** the sum matrix of a group of two matrices (left) has been calculated.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
</tr>
<tr>
<td></td>
<td>GroupOfMatrixes</td>
<td>Group of matrices</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.9.4 Concatenate Producers

Go to:

**Math**

- Conversions
- Concatenate Producers

Several measurements can be combined by concatenating all channels of the same name of selected producers.

If for example a measurement is spread across multiple files because it was suspended and resumed at a later time, the function allows representing the measurement without interruption.
Name: Name of component and result data object that appears in the lists.

Available Measurements / Selected Measurements: This section contains two lists, on the left side the Available Measurements (producers) and on the right side the Selected Measurements which are to be concatenated.

The input fields above the lists can be used to filter the producers. The lists then show only producer names containing the entered string.

>>> >> > > < < << : These buttons move the selected/all producers from one list to the other. The producers can also be moved by double click.

                                                                  : With the buttons situated below, the order of the selected producers in the right list is changed: move the producer to the first position / one position up / one position down / to the last position.

                                                             : These buttons sort the selected producers alphabetically in ascending or descending order.

Skip missing Items: Specifies the behaviour in case of a missing data item in one input producer. If selected, the result channel for this data item is not created. Else, the result channel is created with an error.

Skip incompatible Items: Specifies the behaviour in case of incompatible data items (differing units, data types etc.). If selected, the result channel for this data item is not created. Else, the result channel is created with an error.

With independent Items: If selected, independent items of the input channels are included and assigned. This may fail, e.g. if the independent items have differing names because the input channels are in different data groups. Then the affected result channels are created with an error. Else, the independent items are not considered in a special way.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.7.9.5 Dataobjects switch

Go to:

Math
  ➔ Conversions
    ➔ Dataobjects switch

The calculation Dataobjects switch enables automated switching between various input data objects for calculations and graphics.

A channel with input data is selected from a set of channels with input data, controlled by a data object, and is provided by the data object switch as a result object.

Data objects for controlling the switch can be any value, which either is generated by control elements or results from a calculation.

Possible applications are for example the representation of curves in dependence on a calculation result or the switch of the displayed channel depending on the test step.
Result Data: Name of component and result data object that appears in the lists.

Controlling dataobject:

Dataobject: Selection of a data object the values of which shall control which data object is selected. This can be created via Slider or Value Input. The values of the control data object provide the index of the data object to be selected from the list of Selected items. The value 0 represents the first item of the list etc.

The selection of an Integer data object is reasonable but also other data object types are available. Double values are then rounded to Integer.

Preview: The Preview shows the current value of the controlling dataobject.

Available items / Selected items: This section contains two lists, on the left side the Available items and on the right side the Selected items from which one shall be selected.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.7.9.6 Grouping data objects

Go to:

Math
  Conversions
    Grouping data objects

The calculation Grouping data objects combines a number of data objects (single values, channels, matrices, maps) into a group. The data is not copied but managed via references to the original data objects.

The group of data objects can be used for example for calculations that require synchronized processing (signal editor), for operations that are to be applied to all data objects (e.g. the deletion of data field) in order to keep data synchronised.
Result Data: Name of component and result data object that appears in the lists.

Group type: Select the type of data which are to be grouped (Single values, Channels, Matrixes, Maps). Only data objects of the same type can be grouped.

All result items of producer: If this option is selected, a producer can be selected from the list of available producers. All contained data objects of this producer are grouped automatically.

If an importer is selected as producer the channels of which are set to Standby, those channels remain in Standby mode also in the group. Only when they are actually used, they are loaded.

Data object selection: This section contains two lists, on the left side the Available data objects (according to the selected group type) and on the right side the Grouped data objects that are to be grouped.

For group type Channels, also channels out of channel groups can be selected (e.g. ChannelGroup[i]). By default, on selection of a channel group the index is set to 1 at first. On further selections the index is incremented or set to the lowest available index until all existing indexes are selected. The indexes can be edited manually via the Edit button.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

```plaintext
>>> > << <<< : These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.
```
With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

The dialog Configure Input Objects opens where the index of the desired channel of the group can be entered.

Create group of independent items: A group of the independent items (channels, matrixes) is created as long as they exist. For input data objects without independent item an empty group member is created.

Accept invalid inputs: If this option is selected, as many input data objects as possible are grouped. In case of an invalid input data object, an empty group member is inserted in its place. If the option is deactivated, an empty group is created as soon as at least one input data object is invalid. The group receives a corresponding error description.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

Example: The values of the generated group of data objects are displayed in the Spreadsheet tab Matrices:
Types of data objects

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
</tr>
<tr>
<td>all single value data types</td>
<td></td>
</tr>
<tr>
<td>all channel data types</td>
<td></td>
</tr>
<tr>
<td>all 2D-matrix data types</td>
<td></td>
</tr>
<tr>
<td>all group data types</td>
<td></td>
</tr>
<tr>
<td>all map data types</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>Group of single values</td>
</tr>
<tr>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td>GroupOfMatrixes</td>
<td>Group of matrixes</td>
</tr>
<tr>
<td>GroupOfMaps</td>
<td>Group of maps</td>
</tr>
</tbody>
</table>

2.7.9.7 Grouping of Calculations/Graphics

Go to:

Math
  ➔ Conversions
    ➔ Grouping of Calculations/Graphics

The calculation Grouping of Calculations/Graphics can be used to group selected calculations and graphic components. Such groups can be used e.g. to clear a complex chain of calculations by omitting irrelevant interim results.

Beside calculations, graphic components can be grouped as well. A group of calculations/graphics can be converted into a component template to be reused by other projects via the Template Manager.

There are two ways to generate a group of calculations/graphics:

- Open the menu item Grouping of Calculations/Graphics in the Math ➔ Conversions menu and select the desired components in the dialog box.
- Select the desired components in Explorer and Graphic window and group them via the context menu.
Interactive graphic elements, such as buttons, slider or axis cursor, can now be operated also in grouped condition (grouping, component group or graphic template).

Grouping of Calculations/Graphics via menu item

Result Data: Name of component and result data object that appears in the lists.

Available groupable components/Selected components for grouping: This section contains two lists, on the left side the groupable components and on the right side the selected components that are to be grouped.

The input fields above the lists can be used to filter the components. The lists then show only component names containing the entered string.

> > < << : These buttons move the selected/all components from one list to the other. The components can also be moved by double click.

A Z z A : These buttons sort the selected components alphabetically in ascending or descending order.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
The second way to group components is via context menu in the Explorer or the graphic window. For this, the calculations to be grouped are selected in the producer list, and the graphic objects in the Desktop list of the Explorer.

Several components in the Explorer are selected by holding the CTRL button and left-clicking the respective components. In case of calculation chains it is sufficient to select the first and the last calculation in order to group the whole chain. All interim steps are included automatically.

The graphic objects can also be selected in the graphic window. Several graphic objects are selected by spanning a window or by holding the Shift button and left-clicking the objects. The components selected in the Explorer remain selected as well.

This function is only available in the context menu if at least two groupable components are selected. Groupable components are only generators, calculations and graphic objects, but no importers or measurement components. If all components to be grouped are selected, the context menu is opened via right mouse click and the menu item Group components clicked.

The dialog Modify component group (calculations / graphics) opens. This dialog also opens to modify an existing component group.
**Result Data:** Name of the result data object. This name is used for the component group in the lists: the calculation part with active output data objects in the producer list and the graphic part in the desktop list.

**Preview:** The graphic shows a block diagram of all grouped components.

**Modify component (set internal input dataobjects):** The dialog box of the component selected in the block diagram is opened where it can be modified directly. If no component is selected this button is inactive.

Note: The component’s dialog only offers input data objects which are internal data objects of the component group. Other data objects of the project which are outside of the component group (external) are not available in the selection list.

**External input dataobjects of all components / Input dataobjects of component "...":** If no component is selected, the input data objects of all grouped components are displayed. Otherwise only the input data objects of the selected component are displayed.

**Port name:** A port name is listed for each input data object of the selected component / all components.

**Input dataobject (only external dataobjects are chooseable):** The defined data object for each input port is displayed. It can be changed via selection list. This list contains all data objects available in the project.
Output data objects of all components / of component "...": If no component is selected, the output data objects of all grouped components are displayed. Otherwise only the output data objects of the selected component are displayed.

Producer name of component: Shows the producer names of all components / the selected component.

Output data object name of component: Shows the data objects contained in the specified producer of all components / the selected component.

Output data object name of this component group: Shows the names of the output data objects as they are displayed in the spreadsheet and the explorer. The specified names can be edited in the input field.

Active: If the checkbox is activated, the respective output data object is generated. By deactivating the checkbox, unnecessary result objects of the individual components, e.g. interim results of a calculation chain, can be omitted.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another component group is created with the current settings.

Delete: The component group is deleted and the dialog closed. A warning sign in the Delete button indicates that the contained data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Ungroup a component group

A component group can be ungrouped via the menu item Dissolve component group in the context menu of the component group in the Explorer. Another way is the context menu of a grouped graphic in the graphic window. The menu item there is Ungroup.
Example: The example shows a calculation chain that determines a time difference in seconds and then converts this value into minutes, hours, days etc. The first block diagram shows the ungrouped calculations.

In order to group all calculations of the chain, at least the first calculation, in this case Seconds, and the last calculation have to be selected. In the example, these are Weeks, Months and Years. As they are not dependent on each other, they have to be selected individually to be grouped. All other calculations are dependent and are included automatically.
Interim results that are not needed can be deactivated in the dialog Modify component group. These results will not appear in any lists.

The component group is displayed in the Producer list with its generated (active) output data objects. Grouped graphic objects are listed under Desktop. If there are no active output data objects but graphic objects, the component group does only appear in the Desktop list but not in the Producer list.
2.7.9.8 Ungroup Group of Data Objects

Go to:

Math
  ▶ Conversions
  ▶ Ungroup Group of Data Objects

This function can be used to dissolve a group of data objects to its single parts. If the group contains subgroups, they are preserved.

Result Data: Name of component and result data object that appears in the lists.

Group to ungroup: Selection of a data object group from a list of available data objects.

Create reference to the grouped data objects: The ungrouped elements are referenced to the original element, i.e. changes in the original element cause changes in the ungrouped element.

Create copies of the grouped data objects: The ungrouped elements are copied and treated as separate elements, i.e. changes in the original element do not affect the ungrouped element.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
Delete: The calculation is deleted and the dialog closed. A warning sign 🔄 in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🧐. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
</tr>
<tr>
<td>Result data</td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td>or</td>
<td>identical with input data</td>
<td>with option Create copies of the grouped data objects</td>
</tr>
</tbody>
</table>

#### 2.7.9.9 Extract Bits

Go to:

**Math**

[![Conversions](image.png)](image.png)

The calculation Extract Bits (formerly: Integer Channel → Bit Matrix) converts an integer value into a bi channel or an integer channel into a matrix with bit streams. The result matrix consists of 32 columns whose length depends on the length of the input channel. It allows the access to each bit of the channel.
Result Data: Name of component and result data object that appears in the lists.

Input Data: Lists all suitable data objects (integer channels).

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ⚠️ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🔄. The respective help topic is displayed when an area within the dialog is clicked on.

Example

The Spreadsheet displays an extract of the computed bit matrix.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Result data</td>
<td>BitRectMatrix3D</td>
<td>3D-matrix with Boolean data</td>
</tr>
</tbody>
</table>

2.7.9.10 Cuts through Matrix

Go to:

Math
  ↓ Conversions
  ↓ Cuts through Matrix

The calculation Cuts through Matrix transforms a cut (or several cuts) through a matrix in x- or y-direction into a new data object.

The respective cut positions can be defined manually or via a data object published on the CEA bus (e.g. a published cursor value). Additionally, a new grid can be defined for the new result data object.

Exceptions: The cutting points in y-direction can be stated via indices for a group of channels. For maps the cutting points can either be stated via indices in x- or y-directions or in both directions via values.
Result Data: Name of component and result data object that appears in the lists.

Suffix: If the input data is a group of channels, a group of channels is generated (in case of multiple cuts). The result channel group contains channels with the channel name of the input channel group with the appended defined suffix.

Data Object: Selection from a list with available data objects. If the selected data object is a 3D-matrix, the desired level can be set in the input field behind Level. The selected level is displayed in the field behind Level.

The dialog box Filtered Selector of Dataitems is opened.
**Calculation Mode:** Defines how the values lying out of the range of the input matrix shall be calculated. The values lying within the matrix are interpolated. For the values outside, the following option can be selected:

- **NaN:** All values outside the matrix are set to NaN.
- **Take boundary:** All values outside the matrix are set to the next available boundary value (seen from the outer boundary). This means, the boundary values are continued line-by-line or column-by-column up to the defined cut values.
- **Extrapolation:** All values outside the matrix are calculated from the boundary values via linear extrapolated.

**X-Values/Y-Values/Z-values:** Parameters of the X-, Y- and Z-values at which the matrix shall be cut. If the stated cut positions are not available in the input data object, they are calculated according to the specified Calculation Mode.

**Channel with explicit values:** If the value of a new grid is determined via interpolation, the values of the grid are stored in a separate channel. The explicit channels are generated with the suffix "\_X" for the interpolated x-values respective "\_Y" for the interpolated y-values.

**Indices (grid):** The cut positions are determined via the indices.

  - **single index:** The matrix is cut at an index of the respective directions.
  - **manual index:** Manual input of the index of the input data object where the cut through the matrix is to be carried out. The Last Index can optionally be selected.
  - **Control-Index:** Selection of the control object (integer single value) that defines the cut position through the matrix.

**multiple indices:** The matrix is cut at several indices of the respective direction.

  - **all:** The matrix is automatically cut at all indices. The determined number of cuts for the selected matrix is displayed in brackets.
  - **manual:** Manual input of indices from ... to ... where the cut through the matrix is to be carried out.
  - **Control-Channel:** Selection of a control object (integer channel) that defines the cut position through the matrix.

**Values (Interpolation mode):** The cut positions are determined via the values that are defined via offset and delta. Missing values are interpolated. By using the definition **multiple values** a new grid for the result data object can be defined. This grid can optionally be saved to an explicit channel.

  - **single value:** The matrix is cut at a value of the respective direction.
  - **manual value:** Manual input of the index of the control object where the cut through the matrix is to be carried out.
  - **Control-value:** Selection of the control object (single value) that defines the matrix via the cut position.

**multiple values:** The matrix is cut at several values of the respective direction.

  - **automatic:** The values at which the cut is to be carried out are determined automatically via the defined number. The values between minimum and maximum of the input
data object are extrapolated to the new number and the interim values are interpolated.

**manual:** Manual input of minimum and maximum values and the number of values. From this input the values at which the cut is to be carried out are determined.

**manual list:** A list of values with user-defined intervals can be entered (separated by semicolon) at which the cut is to be carried out.

**Control-Channel:** Selection of a control object (channel) that defines the cut position through the matrix.

**Statistic over all values of this dimension:** Alternatively, several statistical calculations can be carried out (Average, dB-Average, Minimum or Maximum).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

🔍: The context sensitive help is activated and the cursor changes to 🔎. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The **Contour Plot** (below) displays a level of the input matrix two-dimensionally. The cutting points are defined by using cursor values (x- and y-direction). The Cartesian line chart **Amplitudes vs. Revolutions** contains the cut in x-direction, the line chart **Amplitudes vs. Frequency** displays the cut in y-direction. The digital display shows the values of the control objects.
Further examples for the usage of the calculation Cuts through Matrix: The individual levels of a three-dimensional matrix are converted to a two-dimensional matrix by setting all x- and y-values (automatic index) of the selected level. Furthermore any new grid can be defined for a matrix or a regular grid can be defined for an irregular map matrix.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitRectMatrix3D</td>
<td>3D-matrix with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleRectMatrix3D</td>
<td>3D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>2D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td></td>
<td>EngineMapMatrix</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TurboChargerMapMatrix</td>
<td></td>
</tr>
<tr>
<td>Control index</td>
<td>IntegerValue</td>
<td>Integer</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Control channel (index)</td>
<td>IntegerChannel</td>
<td>Channel with integer</td>
</tr>
<tr>
<td>Control index</td>
<td>Integer/Float/DoubleValue</td>
<td>Integer/floating point number</td>
</tr>
<tr>
<td>Control channel (value)</td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point number</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleValue</td>
<td>Cut at one value in x- and y-direction</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>Cut at one value in x- or y-direction</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>Cut at several values in x- and y-direction</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Cuts at several values in x- and y-direction if the input data object is a group of channels</td>
</tr>
</tbody>
</table>

2.7.9.11 Channel → GroupofValues

Go to:

Math
  Conversions
  Channel → GroupofValues

The calculation Channel → GroupofValues converts a channel to a group of values.

This may be necessary because some calculations generate a group of values. In case of further calculations with channels, a matrix would be generated. In order to avoid this, the channel can be converted to a group of values first.
Result Data: Name of component and result data object that appears in the lists.

Values: Selection of the channel with values to be converted from a list of available data objects.

Names: Selection of a channel (string channel) containing names for the individual values. If automatic is selected, the name of the Values channel is used together with the index. The names are used e.g. when the group of values is ungrouped.

Units: Selection of a channel (string channel) containing the units for the individual values. If from values item is selected, the unit of the Values channel is used for all individual values.

⚠️ If a channel with units is selected, these units are applied to the result values regardless of the unit of the input Values channel. There is no conversion of units.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ⚠️ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🕵️. The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>all numeric channels and string channels</td>
<td></td>
</tr>
<tr>
<td>Result data</td>
<td>GroupOfValues</td>
<td>Group of single values with the data type of the input data object</td>
</tr>
</tbody>
</table>
2.7.9.12 Channels → Matrix

Go to:

Math
  → Conversions
      → Channels → Matrix

The calculation Channels → Matrix combines several channels to a 2D-matrix. Each channel generates a column of the matrix.
Result Data: Name of component and result data object that appears in the lists.

Channels for matrix columns: Selection of the channels to be converted from the list of available data objects. This section contains two lists, on the left side the available data objects (channels or channel groups) and on the right side the selected data objects out of which the matrix is generated.

Channels from channel groups can also be selected (e.g. ChannelGroup[[]]). By default, on selection of a channel group the index is set to 1 at first. On further selections the index is incremented or set to the lowest available index until all existing indexes are selected. The indexes can be edited manually via the Edit button.

Only compatible channels can be converted to a matrix. In case of different data types, these are converted to a common data type if possible. For instance, if IntegerChannel and DoubleChannel are combined, the Integer values are converted to Double and the matrix is of type DoubleVarColMatrix2D. In case of different but compatible units, these are converted to the unit of the first channel.

Not convertible are channels with different X-grids, non-compatible units and non-compatible data types. For instance, String channels or DateTime channels cannot be
combined with other data types. In these cases, an error message is added to the result matrix.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

The dialog Configure Input Objects opens where the index of the desired channel of the group can be entered.

Column values: The column headers can be assigned with names or values.

channel names: The name of the corresponding channel is displayed in the channel header.

channel values: The value at the corresponding index of the selected channel is displayed in the channel header. The channel may contain strings or values.

implicit x-values: The corresponding X-value which is calculated out of the defined values for Offset X and Delta X is displayed in the channel header.

explicit x-values: The X-values defined in the list are displayed in the given order in the channel headers.

explicit names: The names defined in the list are displayed in the given order in the channel headers. Each line defines another name.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example: The result matrix calculated out of 5 signals is displayed in a 3D-Surface Diagram.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>all numeric channels and string channels</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>2D-Matrix according to the input data types</td>
<td></td>
</tr>
</tbody>
</table>
2.7.9.13 Pos.-Vector → Matrix

Go to:

**Math**

- Conversions
  - Pos.-Vector → Matrix

The calculation Pos.Vector → Matrix calculates a matrix grid from the position values of the x- and y data series with n*m fields.

The composition of the x- and y-values require the following structure (example with 2 levels):

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>x_1</td>
<td>y_1</td>
<td>a_1</td>
<td>b_1</td>
<td></td>
</tr>
<tr>
<td>x_2</td>
<td>y_1</td>
<td>a_2</td>
<td>b_2</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x_n</td>
<td>y_1</td>
<td>a_n</td>
<td>b_n</td>
<td></td>
</tr>
<tr>
<td>x_1</td>
<td>y_2</td>
<td>a_{n+1}</td>
<td>b_{n+1}</td>
<td></td>
</tr>
<tr>
<td>x_2</td>
<td>y_2</td>
<td>a_{n+2}</td>
<td>b_{n+2}</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x_n</td>
<td>y_2</td>
<td>a_{2*n}</td>
<td>b_{2*n}</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x_1</td>
<td>y_m</td>
<td>a_{(m-1)*n+1}</td>
<td>b_{(m-1)*n+1}</td>
<td></td>
</tr>
<tr>
<td>x_2</td>
<td>y_m</td>
<td>a_{(m-1)*n+2}</td>
<td>b_{(m-1)*n+2}</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x_n</td>
<td>y_m</td>
<td>a_{m*n}</td>
<td>b_{m*n}</td>
<td></td>
</tr>
</tbody>
</table>

The resulting matrix looks as follows:

Level 1:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>x-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>y</td>
<td>a_1</td>
<td>a_2</td>
<td>a_3</td>
<td>a_n</td>
</tr>
<tr>
<td>1</td>
<td>a_{n+1}</td>
<td>a_{n+2}</td>
<td>a_{n+3}</td>
<td>a_{2*n}</td>
</tr>
<tr>
<td>2</td>
<td>......</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>m</td>
<td>a_{(m-1)*n+1}</td>
<td>a_{(m-1)*n+2}</td>
<td>a_{m*n}</td>
<td></td>
</tr>
</tbody>
</table>

Level 2:
The result matrix is three-dimensional. The third dimension is situated between 1...4, i.e. four levels can be transformed at most in one cut.

**Position data describes a complete matrix grid**

To define the grid, the individual $x_n$- and $y_m$- values have to be within the tolerance range t% of the respective range of values. Otherwise, an error message will be displayed.

**Position data describes an incomplete matrix grid**

In case the input data only covers parts of the total matrix grid, all missing positions are defined as Not a Number (NaN). NaN values are not displayed in a chart.

### Result Data:
Name of component and result data object that appears in the lists.

### Input Data:
Selection of the input data objects from a list of available data objects.

- **x-Position**: A data object with x-positions.
- **y-Position**: A data object with y-positions.

### Option:
1-level, variable y-grid (2D):

Multi-level, strict x- & y-grid (3D):

Level n: A data series holding values for level n of the three-dimensional result matrix. If only one level is chosen in the section Option, a data object can only be defined for level one.

Options:

Complete Matrix: The input data define a complete matrix with n*m values.

Tolerance: The individual position data must form an even grid within a tolerance of t%. An error message will be displayed if the values are out of the given range.

Fill missing with NaNs: Position data don’t have to describe a complete grid. Missing positions are filled with NaNs (Not a Number) and ignored in the graphic depiction.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example

The Contour Chart (below) displays the resulting conversion (matrix). The input data describes a complete matrix grid.
The Grid Chart (below) displays the converted matrix. Since the input values do not cover a complete matrix, the missing positions are filled with NaN values and are omitted in the chart.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
</tbody>
</table>
### Data Table

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleRectMatrix3D</td>
<td>3D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
</tbody>
</table>

### 2.7.9.14 Matrix → PosVector

**Go to:**

**Math**

- Conversions
- Matrix → PosVector

The calculation `Matrix → PosVector` calculates the position vectors from a matrix.

The positions that are to be saved in two position vectors are calculated from the dX and dY matrix values. An additional vector is calculated for each matrix level.

The input matrix looks as follows:

**Level 1:**

$$
\begin{array}{cccc}
  \text{x} & 1 & 2 & 3 & \ldots & n \\
  \text{y} & a_1 & a_2 & a_3 & \ldots & a_n \\
  1 & a_{n+1} & a_{n+2} & a_{n+3} & \ldots & a_{2n} \\
  2 & \ldots & \ldots & \ldots & \ldots & \ldots \\
  m & a_{(m-1)n+1} & a_{(m-1)n+2} & a_{(m-1)n+3} & \ldots & a_{mn} \\
\end{array}
$$

**Level 2:**

$$
\begin{array}{cccc}
  \text{x} & 1 & 2 & 3 & \ldots & n \\
  \text{y} & b_1 & b_2 & b_3 & \ldots & b_n \\
  1 & b_{n+1} & b_{n+2} & b_{n+3} & \ldots & b_{2n} \\
  2 & \ldots & \ldots & \ldots & \ldots & \ldots \\
\end{array}
$$
The values $x_n$ are calculated with $X_0 + n \cdot dX$. The $y_n$ values are calculated with $Y_0 + n \cdot dY$.

<table>
<thead>
<tr>
<th>$a_1$</th>
<th>$b_1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_1$</td>
<td>$y_1$</td>
</tr>
<tr>
<td>$a_2$</td>
<td>$b_2$</td>
</tr>
<tr>
<td>$X_2$</td>
<td>$y_2$</td>
</tr>
</tbody>
</table>

...  

<table>
<thead>
<tr>
<th>$a_{n-1}$</th>
<th>$b_{n-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_{n-1}$</td>
<td>$y_{n-1}$</td>
</tr>
<tr>
<td>$a_{n}$</td>
<td>$b_{n}$</td>
</tr>
<tr>
<td>$X_n$</td>
<td>$y_n$</td>
</tr>
</tbody>
</table>

...  

<table>
<thead>
<tr>
<th>$a_{2n}$</th>
<th>$b_{2n}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_{2n-1}$</td>
<td>$y_{2n-1}$</td>
</tr>
<tr>
<td>$a_{2n+1}$</td>
<td>$b_{2n+1}$</td>
</tr>
<tr>
<td>$X_{2n}$</td>
<td>$y_{2n}$</td>
</tr>
</tbody>
</table>

...  

<table>
<thead>
<tr>
<th>$a_{m*n}$</th>
<th>$b_{m*n}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_{m*n-1}$</td>
<td>$y_{m*n-1}$</td>
</tr>
<tr>
<td>$a_{m*n}$</td>
<td>$b_{m*n}$</td>
</tr>
<tr>
<td>$X_{m*n}$</td>
<td>$y_{m*n}$</td>
</tr>
</tbody>
</table>

**Skip positions**

In case the matrix only covers parts of the total matrix grid, all missing positions are defined as Not a Number (NaN). If the input matrix contains NaNs, three options are available:

1. **never**: all NaN data is transferred to input data, the positions are not skipped
2. **if one level is NaN**: if one position of at least one level is NaN, the position is not saved in the result
3. **if all levels are NaN**: if all levels of one position are NaN, the position is not saved in the result

**Result Data**: Name of component and result data object that appears in the lists.
x-Values (N) (opt.): Selection of the input data object for the x-values from a list of available 2D-matrix data objects. This selection is only active if a 2D-matrix is selected as main matrix. The x-values are determined automatically via auto.

y-Values (M) (opt.): Selection of the input data object for the y-values from a list of available 2D-matrix data objects. This selection is only active if a 2D-matrix is selected as main matrix. The y-values are determined automatically via auto.

Main-Matrix (z): Selection of the input data objects from a list of available matrix data objects.

Options:

Skip position: Treatment of NaN elements in the matrix

Never: All matrix dots are generated in the position vectors. If the matrix contains NaN values, the result data object also contains NaN values.

If one level is NaN: If one position of at least one level is a NaN value, the position is not saved in the result.

If all levels are NaN: If all levels of one position are NaN, the position is not saved in the result.

Normalized map value: This option delivers the map values on a newly computed grid.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign 🚨 in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

Example

The Vector field chart (below) displays result data as received from the type conversion. The input data does not describe a complete matrix. Missing positions are filled with NaNs and not included in the result vectors. Therefore they do not appear in the chart.

The context sensitive help is activated and the cursor changes to ? in the Delete button. The respective help topic is displayed when an area within the dialog is clicked on.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Integer/DoubleRectMatrix3D</td>
<td>3D-matrix with integer/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integer/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>EngineMapMatrix</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TurboChargerMapMatrix</td>
<td></td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.9.15 Index for relative Time

Go to:

Math
  ➔ Conversions
  ➔ Index for relative Time

The calculation Index for relative Time determines the index for the relative time respectively a relative value within a channel. The relative time/relative value is a single value and is displayed as reference value in the dialog.

Result Data: Name of component and result data object that appears in the lists.

Channel: List of available data objects.

Time: List of available data objects that can be used as reference values. This value’s index in the channel is calculated as result.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
Example

The first Spreadsheet extract below shows the input channel from which the index of the time value (18:30:38) is determined in the second extract. The index (499) is displayed as single value in the Spreadsheet tab Values.

![Example Spreadsheet](image1)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td>Time</td>
<td>Float/DoubleValue</td>
<td>Floating point number</td>
</tr>
<tr>
<td>Result data</td>
<td>IntegerValue</td>
<td>Integer</td>
</tr>
</tbody>
</table>
2.7.9.16 Abs. Time → rel. Time

Go to:

Math
  ‣ Conversions
    ‣ Abs. Time → rel. Time

The calculation **Abs. Time → rel. Time** converts a channel with absolute time (date) into a channel with relative values.

**Result Data:** Name of component and result data object that appears in the lists.

**Input Data:** Selection from a list of available data objects (time channel).

**Time-Offset:** Shifts reference data against measurement data, i.e. the first relative time value receives the stated value. Otherwise the data series starts at 0.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▲ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
Example

The Spreadsheet below shows the input data (TimGen) as absolute time and the calculated result data object (relTime) as relative time values.

![Spreadsheet]

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.9.17 YMDHMS → Date/Time

Go to:

Math
   ▞ Conversions
       ▞ YMDHMS → Date/Time

The calculation YMDHMS → Date/Time calculates the absolute time from time values (year, month, day, hour, minute, second, millisecond). The computed time values are stored in a channel.

Result Data: Name of component and result data object that appears in the lists.

Fields: Selection of an available data objects from combo boxes for each element of a date (year, month, day, hour, minute, second, millisecond). The time to be generated can be entered manually via the input boxes if the respective checkbox Manual is checked.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign △ in the Delete button indicates that the calculated data is used by other components.
Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Example

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Integer/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td>Result data</td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
</tbody>
</table>

2.7.9.18 Date/Time conversion

Go to:

Math

Conversions

Date/Time conversion

The calculation Date/Time conversion converts several time formats to text and vice versa.
**Result Data:** Name of component and result data object that appears in the lists.

**Suffix:** If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Conversion type:** The following types of conversion can be selected:

- **Date/Time -> String:** A Date/Time data object is converted to a String data object. According to the selected **Format**, the individual Date/Time values are converted to the corresponding string.

- **String -> Date/Time:** A String data object is converted to a Date/Time data object. The contained strings are converted to the corresponding Date/Time values as long as they comply with the selected **Format**.

- **Relative time -> Date/Time:** A channel with relative time values is converted to a Date/Time data object. According to the selected **Start time**, the contained relative time values are converted to the corresponding Date/Time values.

**Input Data:** Selection of the input data object from a list of available data objects. The list contains the data objects qualified for the selected type of conversion. The configuration of input data and formatting is individual for each conversion type.

**Preview:** The preview table shows an extract of the conversion result with the current configuration.
Conversion type Date/Time -> String

Date/time object: Selection of the data object of type Date/time to be converted.

Format Settings: Defines the desired Date/time format for the strings.

Format: From the list, the item manual or a predefined format can be selected. In case of manual, an individual format can be entered in the Pattern input field.

Pattern: An individual format can be entered in the input field. A detailed description of the patterns can be found in topic Syntax of Date Time Formats.

Configure Formatter: The dialog Configure Formatter opens in the Date/time setting where detailed format properties can be set.

Conversion type String -> Date/Time

Date: Selection of the String data object containing the Date/time values as strings.

Time: The corresponding time can be defined as follows:
**included in date object:** This option is selected if the data object selected under Date additionally contains the time.

**contained in:** This option is selected if the corresponding time is contained in another String data object.

**user specific:** The corresponding time can also be defined explicitly. It is applied to all values.

**Format Settings:** The formatting used in the String data object(s) should be selected as precisely as possible so that all information can be extracted correctly. Parts not defined under **Format** or **Pattern**, e.g. seconds, are set to 0 in the conversion. If the selected format is not recognized the result values are invalid.

**Format:** From the list, the item **manual** or a predefined format can be selected. In case of **manual**, an individual format can be entered in the **Pattern** input field.

**Pattern:** An individual format can be entered in the input field. A detailed description of the patterns can be found in topic [Syntax of Date Time Formats](#).

:image: The dialog Configure Formatter opens in the Date/time setting where detailed format properties can be set.

### Conversion type Relative time -> Date/Time

<table>
<thead>
<tr>
<th>Input Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative time:</strong> relZeit</td>
</tr>
<tr>
<td><strong>Start time:</strong></td>
</tr>
<tr>
<td>creation time: 15. November 2012 10:28:38</td>
</tr>
<tr>
<td>jBEAM, Unix, Java: 1. Januar 1970</td>
</tr>
<tr>
<td>Microsoft Excel: 31. Dezember 1999</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preview</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
</tr>
<tr>
<td>relZeit:</td>
</tr>
<tr>
<td>0,0000</td>
</tr>
<tr>
<td>60,0000</td>
</tr>
<tr>
<td>120,000</td>
</tr>
</tbody>
</table>

**Relative time:** Selection of the data object with the relative time values to be converted.

**Start time:** Defines the desired start time (relative time = 0). For the definition of the start time, the following options can be selected:

- **creation time:** The creation time of the input data object is used as start time.
- **jBEAM, Unix, Java:** The Unix time (commonly used reference time for simplified time definition) is used as start time.
- **Microsoft Excel:** The reference time of the Excel time definition is used as start time.
- **user specific:** The start time can also be defined explicitly. It is generated out of the entries for **Date**, **Time** and **Time zone**.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign 🚧 in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🔍. The respective help topic is displayed when an area within the dialog is clicked on.

2.7.9.19 Key → Label

Go to:

Math
→ Conversions
→ Key → Label

The calculation Key → Label converts an Integer channel to a string channel. It is possible to convert a single value, a channel or a part of a channel.

This function can be used e.g. to convert operating states represented by Integers to strings.
Result Data: Name of component and result data object that appears in the lists.

Suffix: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

Input Data

Keys: Selection of the input data object from a list of available data objects. The data object contains the values (keys) to be converted.

Translation information: Defines the rules who to convert the input data.

  contained in channels: The rules for conversion are defined by two channels. The Key channel contains the Keys as Integers, the Label channel contains the corresponding strings. Both channels shall have the same number of values. The Key channel should ideally contain all keys which may occur in the input data. If not, the option Use the following label for keys without translation can be used to assign a text to all keys not defined.

  user specific (translation table): The translation rules are defined manually in the Translation Table below.
**Translation Table**: The occurring keys are entered in the **Key** column, the corresponding texts in the **Label** column. The buttons in the right column can be used to generate new keys or to delete the selected key. Duplicate keys are not allowed and are highlighted in red color.

<table>
<thead>
<tr>
<th>Key</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engine On</td>
</tr>
<tr>
<td>2</td>
<td>Fault</td>
</tr>
<tr>
<td>2</td>
<td><strong>jBEAM</strong></td>
</tr>
<tr>
<td>0</td>
<td>Engine Off</td>
</tr>
</tbody>
</table>

If not all occurring keys are defined in the list, the option **Use the following label for keys without translation** can be used to assign a text to all keys not defined. Otherwise, the calculation generates an error.

The input fields below the table can be used to filter for special strings or characters. Via drop-down list the **Text filter type** can be selected (Plain text, Wildcard text (?, *) or Regular expression).

**Use the following label for keys without translation**: All keys which are not defined in the Translation Information are converted to the defined text.

**Preview**: The preview table shows an extract of the conversion result with the current configuration.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ⚠️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.
2.7.9.20 String → Numeric value

Go to:

**Math**  
- Conversions  
  - String → Numeric value

The calculation **String → Numeric value** converts an Integer or Double channel to a String channel and vice versa. This function can be used to e.g. convert string channels containing values in decimal, hexadecimal or octal representation into integer or double channels. Furthermore, fix texts can be defined for selected values (0 -> Off; 1 -> On).
**Result Data**: Name of component and result data object that appears in the lists.

**Suffix**: If the input data is a group of channels, a group of channels is generated. The result channel group contains channels with the channel names of the input channel group with the appended defined suffix.

**Conversion type**: The following types of conversion can be selected:

- **String -> Integer**: A string data object containing integers as strings is converted to an integer data object. The used formatting, e.g. decimal, hexadecimal or octal representation, is automatically recognised and converted accordingly. Recognisable formats are the predefined formats displayed in the **Formatter Tab Integer**.

- **String -> Double**: A string data object containing double values as strings is converted to a double data object. The used formatting, e.g. decimal character or thousands separator, is automatically recognised and converted accordingly. Recognisable formats are the predefined formats displayed in the **Formatter Tab Double**.

- **Numeric -> String**: A numeric channel is converted to a string data object. The contained numeric values are converted to the corresponding strings according to the selected format.

**Input Data**: Selection of the input data object from a list of available data objects. The list contains the data objects qualified for the selected type of conversion. The further configuration of input data and formatting is individual for each conversion type.
**Preview:** The preview table shows an extract of the conversion result with the current configuration.

**Conversion type String -> Integer**

Data object: Selection of the string data object to be converted.

Input format settings: Defines the Locale to be used. This is needed for correct recognition of decimal character or thousands separator.

- Automatically use interface Locale: The Locale selected in the **Preferences** is used.
- Select Locale: The Locale can be explicitly selected from the list. Thus, it is possible to correctly convert string channels generated under a different Locale.

**Conversion type String -> Double**

Data object: Selection of the string data object to be converted.

Input format settings: Defines the Locale to be used. This is needed for correct recognition of decimal character or thousands separator.

- Automatically use interface Locale: The Locale selected in the **Preferences** is used.
- Select Locale: The Locale can be explicitly selected from the list. Thus, it is possible to correctly convert string channels generated under a different Locale.
Conversion type Numeric -> String

Data object: Selection of the numeric data object to be converted.

Format: A predefined format can be selected from the list of available formats. The following list items are available:

- 7.1426  Decimal representation
- 7.14E0  Exponential representation
- 7.143 | 7.143E8  automatic selection of decimal or exponential representation
- 00:00:07.1  Time representation
- 7°08.6  Angular representation in degrees and minutes
- 7°08m33  Angular representation in degrees, minutes and seconds
- 007°08.56'  Geographic longitude representation in degrees and minutes
- 007°08'33"  Geographic longitude representation in degrees, minutes and seconds
- 07°08.56'  Geographic latitude representation in degrees and minutes
- 07°08'33"  Geographic latitude representation in degrees, minutes and seconds
- 0b110000 00111001  Binary representation
- 0o3 0071  Octal representation
- 0x3039  Hexadecimal representation

Digits: Defines the number of decimal places.

Grouping: If this option is selected, each three digits are grouped by the thousands separator.

: The dialog Configure Formatter opens in the Date/time setting where detailed format properties can be set.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ▼ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

2.7.9.21 Video → Timed Images

Go to:

Math
  Conversions
   Video → Timed Images

The calculation Video → Timed Images copies a number of time synchronous images from an imported video file into a new data object. The time as well as image information is stored so that the video will not be needed anymore later on.

The video can optionally be synchronized with measured data. Extracted images can be displayed together with the numerical measurement results in a Cartesian line chart.
**Time Scale:** A line chart displaying measured test data chosen in **Numeric Data.** The current image position is displayed as marker position. Additionally, the beginning and the end of the video feed are marked.

The blue time marker can be moved via mouse. When the synchronizing is done the video is moved to the correspondent position.

**Frames:** List of selected single images with time data. Any image in the list can be selected in the list via mouse click. The video and the marker in the time scale are moved to the correspondent position.

**New Frame:** The currently displayed image is transferred together with the time.

**Delete Frame:** The current image is deleted from the list.

**Delete All:** All images are deleted from the list.

**Result Data:** Name of component and result data object that appears in the lists.

**Input Data:**

**Videomovie:** Selection of the video from a list of importable videos.

**Numeric Data:**

- **X:** Selection of the numeric data objects containing the data for x. If **auto** is chosen the x-values are calculated from the y-values.
- **Y:** Selection of the numeric data object containing the data for y.
Framerate:

**Movie**: Shows the frame rate saved in the video.

**Original**: Shows the true frame rate. When importing a video via multimedia import the frame rate is set in the import dialog box. With MME projects the frame rate is set automatically from the meta data.

**Synchr. Time**: Displays the time difference between the beginning of the video and the start of the measured data.

**Synchronize**: Synchronises the current position of the video with the marker position set in the graph of the numeric data.

**Synchronized**: Shows whether the video and numeric data are synchronised or not.

**Video display**: The display shows the content of the video. The tool bar below controls the video: play/pause, next/previous image, position of the image in the video, sound and image information.

If the video is synchronised, the position marker of the graph is automatically updated in case the video position is changed. As soon as play is clicked the marker in the graph automatically moves along.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The result data object containing the times of the extracted images is displayed in the Spreadsheet (tab Maps):

![Spreadsheet](image-url)
A Cartesian line chart with numerical measured data and single video images:

Hint 1:
Select the menu item Math -> Modify -> VideoFrames and a dialog appears with synchronous running of video and measured values.

Hint 2:
Mouse double-click one of the displayed video frames; it is displayed full size in an own frame.

Double clicking the thumbnails will open a new window displaying the image in original size.

The image size can be changed via the xy curve dialog.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>General_Video</td>
<td>Imported video data object</td>
</tr>
<tr>
<td>Numeric data</td>
<td>Integer/DoubleChannel</td>
<td>Channel with integers/float</td>
</tr>
<tr>
<td>Result data</td>
<td>ImageObjectVector</td>
<td></td>
</tr>
</tbody>
</table>
2.7.9.22 Property → DataItem

Go to:

Math
  → Conversions
  → Property → DataItem

The calculation Property → DataItem converts a property of a component or data object into a single value which then can be used as an input data object by other components.

Result Data: Name of component and result data object that appears in the lists.

  Use property name: Optionally, the name of the used property can be used as data object name.

Convert property of:

  Component: Selection of an available component from the combo box whose property is to be converted.
**Dataobject:** Selection of the data object whose property is to be converted.

**Property:** Selection of the property (component/data object property) from a combo box.

**Result type:** Definition of the result type. If **Automatic** is selected, the result data type will be determined by the input data type. Alternatively, the data type can be explicitly defined, e.g. as **Double**, **Integer** or **String**.

**International value format:** If Double or Integer is selected, the English data format syntax will be used for the result value. If this function is disabled, the syntax of the selected GUI language is used.

**Unit:** The unit of the created result data object can either be adopted from the used property (**From property**) or converted to an appropriate compatible unit (**Convert to**). The combo box shows all available compatible units. If the selected property does not have a unit, the options **Keep without unit** and **Assign unit** are available. For the latter option, the unit can be entered manually or selected from the list of known units.

**Update mode:** If the option **Standard** is selected, the calculation is updated each time it receives a message that input data have been changed. This message is provided by all jBEAM-internal calculations as soon as they change. The mode **Realtime** is suitable for those properties which are modified outside of jBEAM.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🔄 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

**Example**
The generated values are displayed in the Spreadsheet tab Values. Name, value, unit, type and data source of the generated value are shown. The value can also be used by other calculations and components.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type / Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td>Components and all data object types</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td>According to the selected property or result type (floating point number, integer, string)</td>
</tr>
</tbody>
</table>

2.7.9.23 DataItem $\rightarrow$ Property

Go to:
Math
 $\leftarrow$ Conversions
 $\leftarrow$ DataItem $\rightarrow$ Property

This component adopts the value of a data object to a specific property of another component.
Result Data: Name of component and result data object that appears in the lists.

Use data's name: Optionally, the name of the result data object is composed out of the names of the used input data objects.

Controlling dataobject:

Dataobject: Selection of the data object the value of which shall be adopted for the selected property of the controlled component.

Preview: The Preview shows the current value of the controlling dataobject.

Controlled component:

Component: Selection of an available component from the combo box the property of which shall be modified.

Property: Selection of an available property (component or data object property) from the list. Only properties are displayed which can be modified with the current settings. Thus, it is useful to know the expected data object type of the desired property.

Preview: The Preview shows the current value of the property before modification.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign⚠️ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🎨. The respective help topic is displayed when an area within the dialog is clicked on.
2.7.9.24 List of Properties

Go to:

Math
  ➔ Conversions
  ➔ List of Properties

The calculation List of Properties writes the names of the selected channel’s available properties into a new data object (string channel).

Result Data: Name of component and result data object that appears in the lists.
Producer: Selection from a list with available data objects.

All result objects: All result objects from the selected producer are shown even if they don’t possess any properties.
**Only result objects with properties:** Only data objects of the selected producer are shown that possess properties.

**Only result objects with selected properties:** Only data objects of the selected producer are shown that possess the selected properties.

**Available Keys:** This section contains two lists, on the left side all available keys and on the right side the selected keys that are to be displayed.

The property **Name** is automatically set at the first position and need not be selected.

The input fields above the lists can be used to filter the properties. The lists then show only property names containing the entered string.

- These buttons move the selected/all properties from one list to the other. The properties can also be moved by double click.
- With the buttons situated below, the order of the selected properties in the right list is changed: move the property to the first position / one position up / one position down / to the last position.
- These buttons sort the selected properties alphabetically in ascending or descending order.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🔄 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

- The context sensitive help is activated and the cursor changes to 🎯. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The properties and their values are stored in string channels and displayed in the Spreadsheet.
Furthermore the result values can be visualised, e.g. by using the Free Table.

<table>
<thead>
<tr>
<th>Name</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>XPos</td>
<td>380.0</td>
<td>220.0</td>
<td>Pixel</td>
</tr>
<tr>
<td>YPos</td>
<td>220.0</td>
<td>30.0</td>
<td>Pixel</td>
</tr>
<tr>
<td>XShift</td>
<td>1.39</td>
<td>-0.98</td>
<td>Pixel</td>
</tr>
<tr>
<td>YShift</td>
<td>3.43</td>
<td>-3.99</td>
<td>Pixel</td>
</tr>
</tbody>
</table>

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>All producers</td>
<td></td>
</tr>
<tr>
<td>Result data</td>
<td>StringChannel</td>
<td>Channel with strings</td>
</tr>
</tbody>
</table>
2.7.9.25 Alarm Generator

Go to:

Math
  → Conversions
  → Alarm Generator
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▼ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>GroupOfChannels</td>
<td>Group of channels</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>BitArrayChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Data Type</td>
<td>Comment</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>StringChannel</td>
<td>Channel with strings</td>
<td></td>
</tr>
</tbody>
</table>

### 2.7.9.26 Counter → physical Values

Go to:

Math

- Conversions
  - Counter → physical Values

![Math Menu](image)
2.7.10 Geodesy

Go to:

Math
    Geodesy

The menu item is divided into:
- **GPS → UTM**
- **UTM → GPS**
- **LongLatAltī → XYZ**
- **XYZ → LongLatAltī**
- **GPS → Dist./Head./Speed**
- **GPS → Dist./Head. (2 Point)**
- **GPS → Gauss Krüger**
- **Split Polygons**
- **Geofencing**

2.7.10.1 GPS → UTM

Go to:

Math
    Geodesy
        GPS → UTM

The calculation **GPS → UTM** converts GPS coordinates (longitude/latitude) into UTM coordinates.

The **Global Positioning System (GPS)** is a satellite navigation system used for the worldwide determination of positions.

The **UTM coordinate system** (Universal Transverse Mercator, universal transversal Mercator-projection) is a coordinate system enabling the precise identification of every location on earth
via a UTM coordinate (zone number, easting and northing).

![GPS—UTM(UTS) Conversion dialog](image.png)

**Name of Calculation**: Name of the producer that appears in the lists.

**Longitude**: Selection of the data object used for the longitude from a list of available data objects. If the option **manual** is selected, individual values for **Longitude** and **Latitude** can be entered in the input field behind the list boxes.

**Latitude**: Selection of the data object used for the latitude from a list of available data objects.

**Relative to first value**: The coordinates are optionally calculated relative to the first value. Otherwise the absolute coordinates are calculated.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ![warning](image.png) in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

[?]: The context sensitive help is activated and the cursor changes to ![help](image.png). The respective help topic is displayed when an area within the dialog is clicked on.
2.7.10.2 UTM → GPS

Go to:

Math
  ➔ Geodesy
    ➔ UTM → GPS

2.7.10.3 LongiLatiAlti → XYZ

Go to:

Math
  ➔ Geodesy
    ➔ LongiLatiAlti → XYZ

The calculation LongiLatiAlti → XYZ calculates the XYZ positions in a Cartesian coordinate system from GPS based longitude, latitude and altitude coordinates by using the WGS84 Ellipsoid.
Name of Calculation: Name of the producer that appears in the lists.

Longitude: Selection of the data object used for the longitude from a list of available data objects.

Latitude: Selection of the data object used for the latitude from a list of available data objects.

Altitude: Selection of the data object used for the altitude from a list of available data objects.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🔄. The respective help topic is displayed when an area within the dialog is clicked on.
2.7.10.4 XYZ → LongiLatiAlti

Go to:
Math
  ➔ Geodesy
    ➔ XYZ → LongiLatiAlti

2.7.10.5 GPS → Dist./Head./Speed

Go to:
Math
  ➔ Geodesy
    ➔ GPS → Dist./Head./Speed

The calculation GPS → Dist./Head./Speed calculates the distance, heading and speed from the longitude, latitude and altitude.
**Name of Calculation:** Name of the producer that appears in the lists.

**Speed:** Name of the result channel for the speed that appears in the lists.

**Heading:** Name of the result channel for the heading that appears in the lists.

*No heading if speed < .. km/h:* The heading is not calculated if the speed is less than the entered value (at starting and landing). That means the value is set to NaN.

**Distance:** Name of the result channel for the distance that appears in the lists.

*Distance as sum:* The values of the distance are continuously added up, i.e. each value shows the distance that was covered until then.

**Time:** Selection of the data object used for the time from a list of available data objects.

**Longitude:** Selection of the data object used for the longitude from a list of available data objects.

**Latitude:** Selection of the data object used for the latitude from a list of available data objects.

**Altitude:** Selection of the data object used for the altitude from a list of available data objects.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.7.10.6 GPS → Dist./Head. (2 Point)

Go to:

Math
  → Geodesy
    → GPS → Dist./Head. (2 Point)

2.7.10.7 GPS → Gauss Krüger

Go to:

Math
  → Geodesy
    → GPS → Gauss Krüger

The calculation GPS → Gauss Krüger converts GPS coordinates (longitude/latitude) into Gauß-Krüger coordinates and vice versa.

The Global Positioning System (GPS) is a satellite navigation system used for the worldwide determination of positions.
The **Gauß-Krüger coordinate system** is a coordinate system used for precisely identifying every point on the surface of the Earth with a Gauß-Krüger coordinate (northing and easting).

![Modify GPS - UTM dialog box](image)

**Name of Calculation**: Name of the producer that appears in the lists.

**Result Suffix**: The result channels receive the name of the calculation plus the defined suffix for the easting and northing value.

**Input Data**: Selection of the data object for longitude and latitude from a list of available data objects.

**Reference Altitude**: Relative to first value:

**Type of Calculation**: GPS coordinates can be converted into Gauss-Krüger coordinates and vice versa. Furthermore GPS coordinates can be converted into UTM coordinates (English or German) and vice versa (see also **GPS→UTM**). Correspondent to the selected type of calculation the settings for **result suffix** and **input data** change in the dialog box.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ▶ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

💡: The context sensitive help is activated and the cursor changes to ❓. The respective help topic is displayed when an area within the dialog is clicked on.
Example

2.7.10.8 Split Polygons

Go to:
Math
  ← Geodesy
  ← Split Polygons

![Spreadsheet interface with data entry fields for time, longitude, latitude, and elevation, showing data for 6 rows with time and coordinates.]
2.7.10.9 Geofencing

Go to:
Math
→ Geodesy
→ Geofencing

2.7.11 Stress Analysis

Go to:
Math
→ Stress Analysis

The menu item is divided into:

- Rosette
- Holedrill 2D
- Holedrill 3D
- Ringkernel
2.7.11.1 Rosette

The calculation Rosette calculates the two main stresses as well as the direction of main stress 1 from three expansion ducts. Measurement data from a 45° or 60° rosette strain gauge are needed.

The generated data from a 60° rosette are calculated with the following algorithm that is further described in the respective literature (a 45° rosette takes the angles 0°, 45° and 90°):

\[ \begin{align*}
    d_0 &= \text{stress at 0°} \\
    d_{60} &= \text{stress at 60°} \\
    d_{120} &= \text{stress 120°} \\
    E &= \text{elasticity modulus} \\
    v &= \text{Poisson’s ratio} \\
    f_1 &= E / (1 - v) \\
    f_2 &= E / (1 + v) \\
    f_3 &= f_1 * (d_0 + d_{60} + d_{120}) / 3 \\
    f_4 &= f_2 * \sqrt{((d_0 - d_{60})^2 + (d_{60} - d_{120})^2 + (d_{120} - d_0)^2) / 3} * \sqrt{2} \\
    Z &= \sqrt{3} * (d_{60} - d_{120}) \\
    N &= (2 * d_0 - d_{60}) - d_{120} \\
    \text{Main stress 1: } h_{s1} &= (f_3 + f_4) * 1e^{-6} \\
    \text{Main stress 2: } h_{s2} &= (f_3 - f_4) * 1e^{-6} \\
    \text{Direction HS1: } \phi &= \text{atan}(Z / N)
\end{align*} \]
**Name of Calculation**: Name of the producer that appears in the lists.

**Result Data**: Name of the result data object that appears in the lists.

**Type of rosette**: Defines the algorithm for calculation according to the used rosette.

**Modulus of Elast.**: Input of the elasticity modulus of the examined material with value and unit.

**Poisson ratio**: Poisson ratio of the used rosette.

**Input Strain**: Selection of the data object with the measured strain values.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ⚠ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

![Help Icon] : The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The example shows a tabular **Listing** (extract) of the calculated data. The **Polar chart** (below) displays the result visually.
Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>
2.7.11.2 Holedrill_2D

Go to:

Math
   ➔ Stress Analysis
      ➔ Holedrill_2D

The calculation Holedrill_2D computes the two-dimensional main stress of a drill hole measure. The measurement data of a specific drill hole rosette strain gauge is needed.

Name of Calculation: Name of the producer that appears in the lists.

Result Data: Name of the result data object that appears in the lists.

Input Strain: Selection of the data object with the measured strain values.

Modulus of Elast.: Input of the elasticity modulus of the examined material with value and unit.

Poisson ratio: Poisson ratio of the used rosette.

Rosette Innerdiameter: Declaration of the inner diameter of the used rosette.

Rosette Outerdiameter: Declaration of the outer diameter of the used rosette.

Hole diameter: Declaration of the drill hole diameter.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign ▲ in the Delete button indicates that the calculated data is used by other components.
Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

![Spreadsheet](image)

### 2.7.11.3 **Holedrill_3D**

Go to:

**Math**

- Stress Analysis
- Holedrill_3D

The calculation **Holedrill_3D** computes the three-dimensional main stress of a drill hole measure. The measurement data of a specific drill hole rosette strain gauge is needed.

Stress analysis with a drill hole rosette: After installing and null measurement of the rosette’s 3 measurement grids a hole (e.g. 1.5 mm Ø) is drilled into the measuring object at the centre of the rosette. The inherent stress condition is calculated from changes in the strain. By using this almost non-destructive method the internal stress can also be determined in its vertical distribution.
**Name of Calculation**: Name of the producer that appears in the lists.

**Result Data**: Name of the result data object that appears in the lists. The result data are calculated: Depth, Sigma 1, Sigma 2, Alpha, Sigma X, Sigma Y, Tau XY and Sigma V.

**Drilling depth**: Selection of the data object with the measured drilling depth values.

**Epsilon A,B,C**: Selection of the data objects with the measured strain values.

**E-Module**: Declaration of the elasticity modulus of the examined material.

**Poisson ratio**: Declaration of the Poisson ration of the used rosette.

**Yield stress**:

**Hole diameter**: Declaration of the drill hole diameter.

**Diameter rosette**: Declaration of the diameter of the used rosette.

**Correction angle**:

**Type of rosette**: Selection of the used type of rosette, RE/RK Rosette or UM Rosette.

**Filter**: Selection of the desired filter.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
Example

Measurement Data

Result Drill Hole Method
2.7.11.4 Ringkernel

Go to:

Math
  ➔ Stress Analysis
  ➔ Ringkernel

The calculation Ringkernel calculates the three-dimensional main stress of a drill hole measure. The measurement data of a specific drill hole rosette strain gauge is needed.

The stress analysis with a ring kernel rosette: In contrast to the Holedrill_3D a circular groove is milled around the fitted rosette into the surface of the measuring object.

Name of Calculation: Name of the producer that appears in the lists.

Result Data: Name of the result data object that appears in the lists. The following result data are calculated: Sigma 1, Sigma 2 and Direction.

Drilling depth: Selection of the data object with the measured drilling depth values.

Strain: Selection of the data object with the measured strain values.

E-Module: Declaration of the elasticity modulus of the examined material.

Poisson ratio: Declaration of the Poisson ration of the used rosette.

Hole diameter: Declaration of the drill hole diameter.
**Rosette Innerdiameter:** Declaration of the inner diameter of the used rosette.

**Rosette Outerdiameter:** Declaration of the outer diameter of the used rosette.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▶️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

![Help Button]: The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

![Spreadsheet Example](image-url)

<table>
<thead>
<tr>
<th>Depth</th>
<th>eps-1 (Clip)</th>
<th>eps-2 (Clip)</th>
<th>eps-3 (Clip)</th>
<th>Main stress 1 (RtKernel)</th>
<th>Main stress 2 (RtKernel)</th>
<th>Direction (RtKernel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0000</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>0.0500</td>
<td>6.00</td>
<td>6.00</td>
<td>6.00</td>
<td>84,053</td>
<td>84,053</td>
</tr>
<tr>
<td>3</td>
<td>0.1000</td>
<td>25.00</td>
<td>34.00</td>
<td>41.00</td>
<td>38,566</td>
<td>-3,255</td>
</tr>
<tr>
<td>4</td>
<td>0.1500</td>
<td>52.00</td>
<td>74.00</td>
<td>92.00</td>
<td>14,610</td>
<td>5,693</td>
</tr>
<tr>
<td>5</td>
<td>0.2000</td>
<td>81.00</td>
<td>116.00</td>
<td>147.00</td>
<td>8,905</td>
<td>4,282</td>
</tr>
<tr>
<td>6</td>
<td>0.2500</td>
<td>108.00</td>
<td>157.00</td>
<td>200.00</td>
<td>6,021</td>
<td>3,082</td>
</tr>
</tbody>
</table>

...
2.7.12 Characteristic Maps

Go to:

Math

Characteristic Maps

The menu item is divided into:

- Engine Map Matrix
- Turbocharger Map Matrix
- Iso-Torque-Curves
- Statistic Engine Map Matrix
- Statistic Turbocharger Map Matrix

2.7.12.1 Engine Map Matrix

Go to:

Math

Characteristic Maps

Engine Map Matrix

The calculation Engine Map Matrix calculates a matrix for an engine map from several input channels (e.g. revolution, torque, consumption). The resulting characteristic map matrix can be used as input for an engine map graph.

Moreover, this function supports the usage of data from the engine test stand as well as road trials in calculations with subsequent visualisation in a graphic object (universal 2D chart). See also example.

The calculation Engine Map Matrix also enables to calculate only parts of the engine map. Via mouse a rectangle can be drawn in the preview window. Thus, specific parts of the map can be extracted for detailed analysis.
Result Data: Name of component and result data object that appears in the lists. Depending on the selected mode, the result data object is of type EngineMapMatrix (auto mode) or TriangleMesh (scattered data). In case of the EngineMapMatrix, level 1 contains the calculated y-values and level 2 the z-values for the respective x-steps. If applicable, the y- and z-values for the new grid are stored in levels 3 and 4.

Parameter

View: Different views for filtering display values can be generated via View-Selection-Manager. View 0 is always available and usually doesn’t contain any filters. The display of the view selection can be enabled or disabled via Preferences→Dialogs.

: This button opens the View-Selection-Manager in which definitions of views can be directly entered.

Apply to: If the option importer channels is selected, the selected view is applied to data objects that originate from an importer component (e.g. Import Values). This way the multiple application of a view to a data object is prevented. If all channels are selected, the selected view is applied to all data objects.

X (Revolution): A data series containing the x-values (data for revolution) is selected from a list.

Y (Manifold pressure): A data series containing the y-values (data for manifold pressure) is selected from a list.

Z (Dep. Values): A data series containing the z-values (data for dependent values) is selected from a list.

Unit:
automatic: The unit of the result engine map is automatically determined out of the input Z data object.

manual: Optionally, the result engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

Mode

auto mode: First, limits of the x-values are detected by a histogram function and out of it discrete x-levels are calculated. The y- and z-values are adopted from the data for each x-step. This mode is more suitable for approximately regular x-grids.

Calculate a new grid: Optionally, in auto mode the engine map can be calculated in a new grid. The new y-values are stored in level 3 of the result matrix and the z-values in level 4.

Convex hull: The engine map is calculated such that the outer hull is always convex.

Interpolation: The new matrix dots are calculated via linear or cubic spline interpolation.

Values of N: If the number of speed ranges is low, it may be necessary to double or quadruple (4-times) the number in order to achieve a more accurate result in subsequent calculations (e.g. differential map). By default, the number of speed ranges remains unchanged (same count).

Values per N: This parameter determines the number of values (y, z) per speed range (x). Typically, a number higher than the original number of y-values is selected. Likewise, this might help to achieve a more accurate result in subsequent calculations.

scattered data: First, the convex envelope of the scattered data (on the xy-plane) is determined. From the data points of the point cloud a triangle mesh is generated via triangulation algorithm (Delaunay Triangulation). This mode allows to calculate the engine map out of irregularly distributed data (point clouds), i.e. no regular grid is necessary.

clip Engine Map Matrix: Optionally, the engine map can be clipped to specified x- and y-values. This may be necessary, e.g. if a rectangular map has been generated due to interpolation. Please note that with a calculated map via convex hull, the map can be clipped also only to a convex line. If the clipping line is concave the map will not be clipped completely.

The map can be clipped very simple by drawing with the mouse a rectangle in the preview window by simultaneously pressing the ALT key. Thus the limiting X- and Y-values can be defined. They can also be manually entered. Moreover, an existing curve can be used.

x / y: The limiting X- and Y-values can be entered in the min and max input fields. These values define the rectangle which is displayed in the preview window. The limit lines in the preview window can also be shifted via mouse. The values in the input fields are adopted accordingly.
**use curve:** The data objects are selected from the list of available data objects containing the pairs of values for \( x \) and \( y \) which define the clipping line for the map. The \( x \) values should cover the entire range of the map. The calculation of the \( y \)-values is limited to the corresponding \( y \)-values of the clipping line. If the \( x \)-values are not identical with the \( x \)-steps of the map, the respective \( y \)-values are interpolated. Non-monotone \( x \)-values are sorted.

![Diagram showing clipping line and original map.](image)

**Preview**

The preview window shows the currently calculated map and the clipping lines. The clipping lines can be defined by drawing with the mouse a rectangle in the preview window by simultaneously pressing the **ALT** key. The individual lines can also be manually shifted with the mouse.
Output

**create an Engine Map Matrix:** By default, an engine map matrix is calculated. In **auto mode**, an EngineMapMatrix is created. In **scattered data** mode, a TriangleMesh is created.

**create 2D-Rectangle-Matrix:** Alternatively to the standard engine map matrix a 2D-Rectangle-Matrix can be created. For this, not existent grid points are filled with NaNs. The grid points in X- and Y-direction can be defined as follows:

- **automatic:** The values are calculated according to the defined number. The number of values between minimum and maximum of the input map are recalculated to the new number and intermediate values interpolated.

- **manual:** Minimum and maximum values as well as number of values are entered manually. Out of this, the grid of the 2D-matrix is determined. The calculated distance ($\Delta$) of the grid points is shown.

- **manual list:** New grid points in varying distances can be entered in the list, separated by semicolons.

- **Control-Channel:** From the list, a control channel can be selected the values of which define the grid points.
**calculate a depending time series from the map data:** Along a defined characteristic line (x and y) within the engine map the corresponding z-values can be calculated. From the recorded data of a road trial (revolution speed and torque) the specific consumption can be calculated, for example.

**Name:** Name of the result data object as it will appear in the Explorer. This channel contains the calculated z-values corresponding to the defined characteristic line. By default, it receives the name of the input z-values with the suffix "-TS". However, any name can be edited. The text box behind displays the unit of the result data object.

**x / y:** The data objects are selected from the list of available data objects containing the pairs of values for x and y for which the corresponding z-values shall be calculated.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.
**Delete:** The calculation is deleted and the dialog closed. A warning sign △ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Example 1:** The following graphic object (Universal 2D Chart) shows an engine characteristic map and road trial data. With the help of the road trial data (blue) the specific consumption of the engine map can be read (cursor value) which corresponds with the z-value in the two-dimensional depiction.
Example 2: The following Engine Map Diagram shows a calculated engine map matrix. The specific consumption which corresponds with the z-value in the two-dimensional depiction can be read from the cursor value. The specific consumption is also displayed by isolines and the color gradient in the engine map.

![Engine Map Diagram](image)

Types of data objects

| Data           | Data type                | Comment                                           |
|----------------|--------------------------|                                                  |
| **Input data** |                          |                                                   |
| IntegerChannel | Channel with integers    |                                                   |
| Float/DoubleChannel | Channel with floating point numbers |               |
| **Result data** | EngineMapMatrix         | Engine map matrix (in auto mode)                  |
|                | Level 1: calculated y-values |                                                   |
|                | Level 2: calculated z-values |                                                   |
|                | [Level 3: calculated y-values for new grid] |                        |
|                | [Level 4: calculated z-values for new grid] |                        |
| TriangleMesh   | Engine map as triangle mesh (in scattered data mode) |            |
| DoubleVarColMatrix2D | 2D-matrix with floating point numbers |                            |
| Time series    | DoubleChannel            | Channel with calculated z-values                 |
2.7.12.2 Turbocharger Map Matrix

Go to:

Math
  → Characteristic Maps
  → Turbocharger Map Matrix

The calculation Turbocharger Map Matrix calculates a matrix for a turbocharger map from several input channels (e.g. revolution (N), massflow (X), Πtotal (Y), dependent values (Z)). The resulting characteristic map matrix can be used as input for the turbocharger map chart.

Moreover, this function supports the usage of test stand data and road trial data (e.g. specific consumption) in a calculation which will subsequently be depicted together in a graphic object (Universal 2D chart).
Result Data: Name of component and result data object that appears in the lists. The result data object is of type TurboChargerMapMatrix. Level 1 contains the calculated x-values, level 2 the y-values and level 3 the z-values for the respective N-steps. If applicable, the x-, y- and z-values for the new grid are stored in levels 4, 5 and 6.

Parameter

View: Different views for filtering display values can be generated via View-Selection-Manager. View 0 is always available and usually doesn’t contain any filters. The display of the view selection can be enabled or disabled via Preferences → Dialogs.

Apply to: If the option importer channels is selected, the selected view is applied to data objects that originate from an importer component (e.g. Import Values). This way the multiple application of a view to a data object is prevented. If all channels are selected, the selected view is applied to all data objects.

N (Revolutions): A data series containing the N-values (data for revolution) is selected from a list.

X (Massflow): A data series containing the x-values (data for massflow) is selected from a list.

Y (Πtotal): A data series containing the y-values (data for Πtotal) is selected from a list.
**Z (Dep. Values):** A data series containing the z-values (data for dependent values) is selected from a list.

**Configure Ranges:** This button opens the dialog Configure Ranges where the speed ranges can be manually adjusted.

![Configure Ranges](image)

*When the speed ranges are determined automatically, the fineness of gradation is mainly defined by the total speed range and the distances between the steps. This yields good results as long as the speed ranges have a relatively similar distance. However, if the distances are very different, i.e. if there are very large ranges as well as very small ranges, small ranges might not be differentiated reliably. Thus, a zigzag line appears in the map. In the other extreme, very large ranges might be separated. In such cases, it is recommended to manually adjust the speed ranges.*

**Calculate a new grid:** Optionally, the turbocharger map can be calculated in a new grid. The new x-values are stored in level 4 of the result matrix, the y-values in level 5 and the z-values in level 6.

**Interpolation:** The new matrix dots are calculated via linear or cubic spline interpolation.

**Values of N:** If the number of speed ranges is low, it may be necessary to double or quadruple (4-times) the number in order to achieve a more accurate result in subsequent calculations (e.g. Statistic Turbocharger Map Matrix). By default, the number of speed ranges remains unchanged (same count).

**Values per N:** This parameter determines the number of values (x, y, z) per speed range (N). Typically, a number higher than the original number of values is selected. Likewise, this might help to achieve a more accurate result in subsequent calculations.

**Unit:**

- **automatic:** The unit of the result engine map is automatically determined out of the input Z data object.
manual: Optionally, the result engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

Calculate a depending time series from the map data: Along a defined characteristic line (x and y) within the engine map the corresponding z-values can be calculated. From the recorded data of a road trial (revolution speed and torque) the specific consumption can be calculated, for example.

Name: Name of the result data object as it will appear in the Explorer. The text box displays the unit of the result data object.

x: A data series with the x-values is selected from a list.

y: A data series with the y-values is selected from a list.

Example of a calculated time series (red)

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

? : The context sensitive help is activated and the cursor changes to help topic is displayed when an area within the dialog is clicked on.

Example: A calculated turbocharger map matrix is displayed in the Turbocharger Map Diagram.
### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channels with floating point numbers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>TurboChargerMapMatrix</td>
<td>Turbocharger map matrix</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 1: calculated x-values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 2: calculated y-values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Level 3: calculated z-values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Level 4, 5 and 6: calculated x-, y- and z-values for new grid]</td>
</tr>
<tr>
<td>Zeitreihe</td>
<td>DoubleChannel</td>
<td>Channel with calculated z-values</td>
</tr>
</tbody>
</table>
2.7.12.3 Iso-Torque-Curves

Go to:

**Math**
- **Characteristic Maps**
  - **Iso-Torque-Curves**

---

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.
Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign ☢ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?$. The respective help topic is displayed when an area within the dialog is clicked on.

2.7.12.4 Statistic Engine Map Matrix

Go to:

Math
  → Characteristic Maps
    → Statistic Engine Map Matrix

The calculation Statistic Engine Map Matrix generates an engine map matrix from a plenty of X,Y,Z channels. The z-values correspond to statistical values, e.g. mean value or standard deviation.

If either the function minimum, maximum, mean value, sum or standard deviation is set, up to 10 engine maps can be used for the calculation.

Furthermore, a characteristic map matrix can be calculated from two engine maps (X,Y,Z channels) representing their differential engine map.

For calculating the grid of the engine map matrix the first X,Y,Z channels are used. The result matrix can be directly used in an Engine Map Chart.
Result Data: Name of component and result data object that appears in the lists. Depending on the selected Mode of the reference map, the result data object is of type EngineMapMatrix (auto mode) or TriangleMesh (scattered data). In case of the EngineMapMatrix, level 1 contains the calculated y-values and level 2 the z-values for the respective x-steps. If applicable, the y- and z-values for the new grid are stored in levels 3 and 4.

Another map is added or an existing map is deleted. In case of the Statistical Values Minimum, Maximum, Mean Value, Standard Deviation or Sum up to 10 maps can be defined.

Reference Map, Map 2, ...: The calculation of the new map is carried out in accordance with the reference map and up to 9 other maps. The set values of the reference map grid are used to calculate the result map grid.

Engine Map Matrix: An already existing or calculated engine map can be used as input map for the statistical calculation. If –Channels as Input— is selected, the following input fields for X (Revolution), Y (Manifold pressure) and Z (Dep. Values) are enabled.
View: Different views for filtering display values can be generated via View-Selection-Manager. View 0 is always available and usually doesn’t contain any filters. The display of the view selection can be enabled or disabled via Preferences→Dialogs. The selected view setting is applied to all maps.

This button opens the View-Selection-Manager in which definitions of views can be directly entered.

Apply to: If the option importer channels is selected, the selected view is applied to data objects that originate from an importer component (e.g. Import Values). This way the multiple application of a view to a data object is prevented. If all channels are selected, the selected view is applied to all data objects.

X (Revolution): A data series containing the x-values (data for revolution) is selected from a list.

Y (Manifold pressure): A data series containing the y-values (data for manifold pressure) is selected from a list.

Z (Dep. Values): A data series containing the z-values (data for dependent values) is selected from a list.

Mode: If channels are used as input, the mode defines how the result map is calculated.

Auto mode: First, limits of the x-values are detected by a histogram function and out of it discrete x-levels are calculated. The y- and z-values are adopted from the data for each x-step. This mode is more suitable for approximately regular x-grids.

Scattered data: First, the convex envelope of the scattered data (on the xy-plane) is determined. From the data points of the point cloud a triangle mesh is generated via triangulation algorithm (Delaunay Triangulation). This mode allows to calculate the engine map out of irregularly distributed data (point clouds), i.e. no regular grid is necessary.

Statistical Value: Maps with the following statistical values can be calculated:

- Minimum
- Maximum
- Mean Value
- Standard Deviation
- Sum
- Absolute Difference
- Relative Difference

Unit:

automatic: The unit of the result engine map is automatically determined out of the input Z data object or the input engine map.

manual: Optionally, the result engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed
in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

**Uniform Grid**

**Values of N:** If the number of speed ranges is low, it may be necessary to **double** or quadruple (**4-Times**) the number in order to calculate the new engine map more accurate. By default, the number of speed ranges remains unchanged (**same count**).

**Values per N:** This parameter determines the number of values (Y) per speed range (X). Typically, a number higher than the original number of values is chosen. Likewise, this might contribute to a more accurate result.

**Interpolation:** The new matrix dots are calculated via **linear** or **cubic spline** interpolation.

**Treatment of points of the reference map, which are not covered by map 2...:** The result engine map is calculated on the basis of the grid points of the reference map. If the grid points are not completely covered by the second (or further) map, i.e. if the other maps are 'smaller' than the reference map, this option states how the margin points which are not available in all maps shall be calculated.

**Result NaN:** If the grid point is not covered by one or more maps, the result is set to NaN.

**Ignore:** If the grid point is not covered by one or more maps, the result is calculated out of the remaining available values of the other maps.

**Take boundary:** If the grid point is not covered by one or more maps, the value of the first available neighbour value (seen from the outer boundary) of the respective map is used for the calculation. This means, the boundary values of the smaller map are continued line-by-line or column-by-column up to the boundary of the reference map.

**Extrapolation:** If the grid point is not covered by one or more maps, the missing values are extrapolated from their neighbour values and then calculated together with the values of the other maps.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▶️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

💡: The context sensitive help is activated and the cursor changes to 📜. The respective help topic is displayed when an area within the dialog is clicked on.
Example: The following graph shows a Universal 2D chart displaying a calculated engine map (minimum of 2 characteristic maps).

2.7.12.5 Statistic Turbocharger Map Matrix

Go to:

Math

Characteristic Maps
Statistic Turbocharger Map Matrix

The calculation Statistic Turbocharger Map Matrix generates a matrix for a turbocharger map from a plenty of N,X,Y,Z channels. The z-values correspond to the statistical values, e.g. mean value or standard deviation. If the functions minimum, maximum, mean value, sum or standard deviation are set, up to 10 turbocharger maps can be used for the calculation.

For two turbocharger maps a matrix can be calculated representing the difference between both characteristic maps. For calculating the grid of the engine map matrix the first N, X, Y, Z channels are used.
Result Data: Name of component and result data object that appears in the lists. The result data object is of type TurboChargerMapMatrix. Level 1 contains the calculated x-values, level 2 the y-values and level 3 the z-values for the respective N-steps. The grid points are adopted from the reference map. If applicable, the x-, y- and z-values for the new grid are stored in levels 4, 5 and 6.

Another map is added or deleted. For the statistical values Minimum, Maximum, Mean Value, Sum or Standard Deviation up to 10 maps can be defined.

Reference Map, Map 2, ...: The calculation of the new map is carried out in accordance with the reference map and up to 9 other maps. The set values of the reference map are used for the grid of the result matrix.

N (Revolutions): A data series containing the N-values (data for revolution) is selected from a list.

X (Massflow): A data series containing the x-values (data for massflow) is selected from a list.

Y (Πtotal): A data series containing the y-values (data for Πtotal) is selected from a list.

Z (Dep. Values): A data series containing the z-values (data for dependent values) is selected from a list.

Statistical Value: Maps with the following statistical values can be calculated:
• Minimum
• Maximum
• Mean Value
• Standard Deviation
• Sum
• Absolute Difference
• Relative Difference

Unit:

**automatic**: The unit of the result engine map is automatically determined out of the input Z data object or the input engine map.

**manual**: Optionally, the result engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

**Uniform Grid**

**Values of N**: If the number of speed ranges is low, it may be necessary to **double** or quadruple (4-times) the number in order to calculate the new engine map more accurate. By default, the number of speed ranges remains unchanged (same count).

**Values per N**: This parameter determines the number of values per speed range (N). Typically, a number higher than the original number of values is chosen. Likewise, this might contribute to a more accurate result.

**Interpolation**: The new matrix dots are calculated via linear or cubic spline interpolation.

**Treatment of points of the reference map, which are not covered by map 2...**: The result engine map is calculated on the basis of the grid points of the reference map. If the grid points are not completely covered by the second (or further) map, i.e. if the other maps are 'smaller' than the reference map, this option states how the margin points which are not available in all maps shall be calculated.

**Result NaN**: If the grid point is not covered by one or more maps, the result is set to NaN.

**Ignore**: If the grid point is not covered by one or more maps, the result is calculated out of the remaining available values of the other maps.

**Take boundary**: If the grid point is not covered by one or more maps, the value of the first available neighbour value (seen from the outer boundary) of the respective map is used for the calculation. This means, the boundary values of the smaller map are continued line-by-line or column-by-column up to the boundary of the reference map.

**Extrapolation**: If the grid point is not covered by one or more maps, the missing values are extrapolated from their neighbour values and then calculated together with the values of the other maps.
**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** The following graphic object (Universal 2D Chart) shows a turbocharger characteristic map with the calculated minimum of two turbocharger maps The option for boundary points is set to NaN which can be seen in the areas without contour areas.
2.7.12.6 Characteristic Map Trace

Go to:

Math
- Characteristic Maps
- Characteristic Map Trace

The calculation Characteristic Map Trace determines the Z-values out of an engine map or a 2D-matrix according to a characteristic line defined by X- and Y-values. If necessary, the Z-values are interpolated.

Result's Name: Name of the component and the result data object as it will appear in the lists.

Input object: Lists all available data objects for the calculation (engine map or 2D-matrix).

Trace values: Along a defined characteristic line (x and y) within the engine map or the matrix, the corresponding z-values are calculated. If necessary, the z-values are interpolated.

x / y: The data objects are selected from the list of available data objects containing the pairs of values for x and y for which the corresponding z-values shall be calculated.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.
Delete: The calculation is deleted and the dialog closed. A warning sign $\Delta$ in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

$: The context sensitive help is activated and the cursor changes to $\Rightarrow$. The respective help topic is displayed when an area within the dialog is clicked on.

Example: The red characteristic line is the trace through the engine map defined by x- and y-values. The corresponding z-values are displayed at the markers.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>IntegerVarColMatrix2D</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with floating point numbers</td>
</tr>
<tr>
<td></td>
<td>EngineMapMatrix</td>
<td>Engine map matrix</td>
</tr>
<tr>
<td></td>
<td>TriangleMesh</td>
<td>Engine map as triangle mesh</td>
</tr>
<tr>
<td></td>
<td>TurboChargerMapMatrix</td>
<td>Turbocharger map matrix</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with calculated z-values</td>
</tr>
</tbody>
</table>
2.7.13 Data Mining

Go to:

Math
   ▸ Data mining

The menu item is divided into:

• K-Means
• OPTICS
• DBScan
• Apriori
• FP-Growth
• Principal Component Analysis (PCA)
• Support Vector Machine (SVM)
• Linear & Periodic Prediction

This functional area provides various procedures for clustering, association analysis and prediction of chronological changes (linear and periodic).
2.7.13.1 K-Means

Go to:

Math

Data mining

Time

K-Means is a procedure for clustering of data. In this procedure, the number of desired clusters is defined. The algorithm sorts the data points into the corresponding clusters.

The algorithm starts with an initial cluster arrangement, selecting as many cluster centers as the defined number of clusters. For this, the K-Means++ algorithm is used. In the first iteration each data points is assigned to its nearest cluster center. Then, the cluster centers are recalculated. In each iteration, the sum of distances to the nearest cluster center for every point is minimized and the cluster centers are recalculated. The algorithm runs for the specified maximum number of iterations or until no more changes occur.

Example:
Result Data: Name of the component (Producer). Several result data objects are generated (see Types of data objects).

X-Input / Y-Input: From the list of available data objects for the calculation the X- and Y-input data object is selected (e.g. the result of a Principal Component Analysis).

XY-Unit Factor: This factor can be used to weigh the second input channel (Y) more (factor > 1) or less (factor < 1) than the first input channel (X).

Number of Clusters: Defines the number of clusters in which the data shall be divided.

Number of Runs: Since the K-Means algorithm does not always converge to the optimal clustering, it is possible to specify a number of runs from which the best clustering is chosen.

Iteration Limit: Defines the maximum number of iterations to determine the cluster points.

Distance Function: Selection of the function for calculating the distance of a point to the cluster center. Available functions are:
- euclidean: The euclidean distance is the "ordinary" straight-line distance between two points in Euclidean space.
- correlation: The distance is calculated via correlation.
- cosine: The distance is calculated via cosine.
- jaccard: The distance is calculated via Jaccard coefficient.
- manhattan: The Manhattan distance measures distance following only axis-aligned directions (also rectilinear distance). The name alludes to the grid layout of most streets in Manhattan

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ▶ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

![?: The context sensitive help is activated and the cursor changes to ![?:]. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>&quot;Cluster-#&quot; IntegerChannel</td>
<td>Channel with the assigned cluster numbers</td>
</tr>
<tr>
<td></td>
<td>&quot;Cluster-X&quot; DoubleChannel</td>
<td>Channel with the calculated X-values of the determined clusters</td>
</tr>
<tr>
<td></td>
<td>&quot;Cluster-Y&quot; DoubleChannel</td>
<td>Channel with the calculated Y-values of the determined clusters</td>
</tr>
<tr>
<td></td>
<td>&quot;Cluster-X-StdDev&quot; DoubleChannel</td>
<td>Channel with the calculated standard deviations of the X-values</td>
</tr>
<tr>
<td></td>
<td>&quot;Cluster-Y-StdDev&quot; DoubleChannel</td>
<td>Channel with the calculated standard deviations of the Y-values</td>
</tr>
<tr>
<td></td>
<td>&quot;Cluster-StdDev-Graphs&quot; GraphObjectVector</td>
<td>Graph object of type &quot;Graphic Objects&quot;to display the clusters in the Universal2D-Graph as Graph Objects Diagram</td>
</tr>
</tbody>
</table>
2.7.13.2 OPTICS

Go to:

Math
  Data mining
  OPTICS

OPTICS (ordering points to identify the clustering structure) is a procedure for clustering of data. This procedure provides predications about the reachability of data points among each other. It is a suitable preparation for further manual evaluations.

Result Data: Name of the component (Producer). Several result data objects are generated (see Types of data objects).

X-Input / Y-Input: From the list of available data objects for the calculation the X- and Y-input data object is selected (e.g. the result of a Principal Component Analysis).

XY-Unit Factor: This factor can be used to weigh the second input channel (Y) more (factor > 1) or less (factor < 1) than the first input channel (X).

Minimum number points: Defines the number of points required to form a cluster. A point is regarded a core point if at least the defined number of points is found within its Epsilon neighborhood.
**Epsilon**: Defines the maximum distance (radius) to consider. Two points within this distance are considered to be neighbors.

**Distance Function**: Selection of the function for calculating the reachability distance of a point. Available functions are:

- **euclidean**: The euclidean distance is the "ordinary" straight-line distance between two points in Euclidean space.
- **correlation**: The distance is calculated via correlation.
- **cosine**: The distance is calculated via cosine.
- **jaccard**: The distance is calculated via Jaccard coefficient.
- **manhattan**: The Manhattan distance measures distance following only axis-aligned directions (also rectilinear distance). The name alludes to the grid layout of most streets in Manhattan

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
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<tr>
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</tr>
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<tbody>
<tr>
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<td>Channel with Boolean values</td>
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<tr>
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<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
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<td>Channel with date/time values</td>
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<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
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<td><strong>Result data</strong></td>
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<td>Group of single values</td>
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<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>&quot;Cluster-Ordering&quot;</td>
<td>IntegerChannel</td>
<td>Channel with the order numbers of the original position</td>
</tr>
<tr>
<td>&quot;Cluster-X&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the reordered X-values</td>
</tr>
<tr>
<td>&quot;Cluster-Y&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the reordered Y-values</td>
</tr>
<tr>
<td>&quot;Reachability-Distance&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated reachability distances of the points</td>
</tr>
</tbody>
</table>

### 2.7.13.3 DBScan

Go to:

Math

Data mining

DBScan

DBScan is a procedure for clustering of data. In this procedure, the minimum number of points in a cluster and the maximum distance between the points of the cluster are defined. Based on the examined data, the algorithm decides how many clusters are generated.
Result Data: Name of the component (Producer). Several result data objects are generated (see Types of data objects).

X-Input / Y-Input: From the list of available data objects for the calculation the X- and Y-input data object is selected (e.g. the result of a Principal Component Analysis).

XY-Unit Factor: This factor can be used to weigh the second input channel (Y) more (factor > 1) or less (factor < 1) than the first input channel (X).

Minimum number points: Defines the number of points required to form a cluster. A point is regarded a core point if at least the defined number of points is found within its Epsilon neighborhood.

Epsilon: Defines the maximum distance (radius) of a point to a potential core point. All points within this distance to the investigated point form its Epsilon neighborhood.

Distance Function: Selection of the function for calculating the distance between the points. Available functions are:

- euclidean: The euclidean distance is the "ordinary" straight-line distance between two points in Euclidean space.
- correlation: The distance is calculated via correlation.
- cosine: The distance is calculated via cosine.
- jaccard: The distance is calculated via Jaccard coefficient.
- manhattan: The Manhattan distance measures distance following only axis-aligned directions (also rectilinear distance). The name alludes to the grid layout of most streets in Manhattan.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign 🚧 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

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<td>Channel with unspecified data</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Cluster-#&quot;</td>
<td>IntegerChannel</td>
<td>Channel with the assigned cluster numbers (first cluster starting with 0; -1 indicates that no cluster is assigned)</td>
</tr>
<tr>
<td>&quot;Cluster-X&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated X-values of the determined clusters</td>
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<td>&quot;Cluster-Y&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated Y-values of the determined clusters</td>
</tr>
<tr>
<td>&quot;Cluster-X-StdDev&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated standard deviations of the X-values</td>
</tr>
<tr>
<td>&quot;Cluster-Y-StdDev&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated standard deviations of the Y-values</td>
</tr>
<tr>
<td>&quot;Cluster-StdDev-Graphs&quot;</td>
<td>GraphObjectVector</td>
<td>Graph object of type &quot;Graphic Objects&quot; to display the clusters in the Universal2D-Graph as Graph Objects Diagram</td>
</tr>
</tbody>
</table>
2.7.13.4 Apriori

Go to:

Math
  Data mining
  Apriori

Apriori is a procedure for association analysis which is used to find interesting relations between variables in datasets. It proceeds by identifying the frequent individual items in the database and extending them to larger and larger item sets as long as those item sets appear sufficiently often in the database. The results can be used to determine association rules showing general trends in a database. A known application is the market basket analysis.
**Result Data:** Name of the component (Producer). Several result data objects are generated (see **Types of data objects**).

**Input data set:** This section contains two lists, on the left side the available data objects (channels) and on the right side the selected data objects that are to be analysed.

The calculation expects either bit channels as input data objects containing the true or false information whether an element is a member of the respective data set or not. But also integer channels can be selected. In this case, the individual bits are regarded as independent elements.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

**Min. support level:** Defines the relative frequency of the occurrence of an item or item set which has to be reached at least in order to be regarded.

**Lowest result dimension:** Defines the minimum number of items to constitute an item set.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

**Help:** The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/LongChannel</td>
<td>Channel with integers</td>
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<td>Result data</td>
<td>&quot;Pattern&quot;</td>
<td>StringChannel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Channel with the found patterns (item sets) complying with the rules</td>
</tr>
<tr>
<td>Data</td>
<td>Data type</td>
<td>Comment</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>&quot;Count&quot;</td>
<td>IntegerChannel</td>
<td>Channel with the numbers of occurrences of the item set</td>
</tr>
</tbody>
</table>

### 2.7.13.5 FP-Growth

Go to:

**Math**

- Data mining
- FP-Growth

**FP-Growth** (Frequent Pattern Growth) is a procedure for association analysis. It can be seen as an improvement over Apriori since it produces the results with less computational overhead. It offers also the option to adapt dynamically the parameters like minimal support level and minimum data sets in order to find a fitting result.
**Result Data:** Name of the component (Producer). Several result data objects are generated (see [Types of data objects](#)).

**Input data set:** This section contains two lists, on the left side the available data objects (channels) and on the right side the selected data objects that are to be analysed.

The calculation expects either bit channels as input data objects containing the true or false information whether an element is a member of the respective data set or not. But also integer channels can be selected. In this case, the individual bits are regarded as independent elements.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

- These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

- With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

- These buttons sort the selected data objects alphabetically in ascending or descending order.
**Min. support level:** Defines the relative frequency of the occurrence of an item or item set which has to be reached at least in order to be regarded.

**Reduce support level until a minimum number of item sets are found:** This option can be used to let the algorithm find a good solution on its own. In doing so, the minimum support level is reduced gradually until the minimum number of item sets fulfilling the rule is reached.

**Minimum item sets:** Defines the minimum number of item sets which must comply with the rule.

**Reduce support level by ... % per iteration:** After each iteration, it is checked whether the required number of item sets has been found. If not, the percentage value of the minimum support level is reduced by the defined value and a further iteration step is started. The reducing percentage always refers to the current value of the minimum support level.

**Maximum iterations:** The number of iterations is limited to the defined value in order to avoid endless running.

**Lowest result dimension:** Defines the minimum number of items to constitute an item set.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ▶ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

???: The context sensitive help is activated and the cursor changes to ???. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/LongChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Pattern&quot;</td>
<td>StringChannel</td>
<td>Channel with the found patterns (item sets) complying with the rules</td>
</tr>
<tr>
<td>&quot;Count&quot;</td>
<td>IntegerChannel</td>
<td>Channel with the numbers of occurrences of the item set</td>
</tr>
</tbody>
</table>
2.7.13.6 Principal Component Analysis (PCA)

Go to:

Math
   ➔ Data mining
   ➔ Principal Component Analysis (PCA)

This component is used in the preprocessing of data for a dimensionality reduction. Using a main axes transformation, the data can be reduced e.g. from four to two principal components.

In doing so, the coordinate system is rotated and the coordinates are reordered such that the first principal component contains the main part of the total variance ("VarianceCumulative") of the data set, the second principal component contains the second largest part etc.
Result Data: Name of the component (Producer). Several result data objects are generated (see Types of data objects).

Input data set: This section contains two lists, on the left side the available data objects (channels or 2D-matrices) and on the right side the selected data objects that are to be analysed.

The calculation expects either channels of the same length with the dimensions, or 2D-matrices. In the latter case, the individual columns are regarded as channels.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

>> > < << : These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

: With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

Principal components: Defines the number of components to be determined. However, there will not be more principal components than input channels. If 0 is entered, all principal components are generated.

For a best possible choice of the number of principal components, a first run can be used to calculate all principal components. The information content of the determined principal components can be assessed via the result data objects "VarianceProportion" and
"VarianceCumulative". If the variance of a dimension ("VarianceProportion") is very small, the information content of this principal component is also small. And vice versa, if the cumulated variance ("VarianceCumulative") of the first principal components is sufficiently high, they contain already most of the information. Therefore, the further principal components can be ommitted and thus dimensions reduced without significant loss of information.

**Normalize data set:** Normalisation or also called z-transformation subtracts the mean of each attribute from every value and then divides it by the standard deviation of the attribute. Thus, an average of zero and a standard deviation of one is reached. This might be necessary e.g. for comparing variables with varying distributions.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ⚠️ in the Delete button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?q️: The context sensitive help is activated and the cursor changes to ❌. The respective help topic is displayed when an area within the dialog is clicked on.

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>CharacterChannel</td>
<td>Channel with characters</td>
</tr>
<tr>
<td></td>
<td>Integer/DoubleVarColMatrix2D</td>
<td>2D-matrix with integers/floating point numbers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>&quot;StandardDeviation&quot; DoubleChannel</td>
<td>Channel with the calculated standard deviations of the principal components</td>
</tr>
</tbody>
</table>
### Data Types and Comments

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;VarianceProportion&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated variances of the principal components</td>
</tr>
<tr>
<td>&quot;VarianceCumulative&quot;</td>
<td>DoubleChannel</td>
<td>Channel with the calculated cumulated variances of the principal components</td>
</tr>
<tr>
<td>&quot;EigenVectors&quot;</td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with the weightings of the input channels</td>
</tr>
<tr>
<td>&quot;PrincipalComponent-([1...])&quot;</td>
<td>DoubleChannel</td>
<td>Channels (number of set principal components) with the calculated values of the respective dimension</td>
</tr>
</tbody>
</table>

---

### 2.7.13.7 Support Vector Machine (SVM)

Support Vector Machine (SVM) is a supervised machine learning algorithm for classification and regression tasks.

The goal is to find the line (or hyperplane in more than two dimensions) which separates the two classes of input data with the highest margin. The name stems from the fact, that only the data points (vectors) which are closest to the line are needed to support the resulting classifier.
If there are more than two classes in the input data, a separate Support Vector Classifier (SVC) will be created for each combination of two classes. And the class of a new data point will be determined by the most votes from all of these one-vs-one classifiers.
Result Data: Name of the component (Producer). A result data object is generated (see Types of data objects).

Input data set: This section contains two lists, on the left side the available data objects and on the right side the selected data objects that are to be analysed.

The input fields above the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other. The data objects can also be moved by double click.

These buttons move the data object to the first position / one position up / one position down / to the last position.

These buttons sort the selected data objects alphabetically in ascending or descending order.

Transform data: Available options: None or Normalize

Performance: Available options: None or Split Validation

SVM type: Available options: C-SVC, Nu-SVC, Epsilon-SVR or Nu-SVR

Kernel: Available options: Linear, Poly, RBF or Sigmoid

Degree:

Gamma:

C:

Eps:

Nu:

P:

Coefficient 0:

Shrinking:

Cache size:

Learn:

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to 
. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>CharacterChannel</td>
<td>Channel with characters</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>&quot;Prediction&quot; DoubleChannel</td>
<td>Channel with the learned predictions</td>
</tr>
</tbody>
</table>

#### 2.7.13.8 Linear & Periodic Prediction

Go to:

**Math**

- **Data mining**
  - **Linear & Periodic Prediction**

This component analyses time-dependent data according to their linearity and periodicity. On this basis, the algorithm can give a prediction about the future data trend.
Result Data: Name of the component (Producer). Several result data objects are generated (see Types of data objects).

X-Input / Y-Input: From the list of available data objects for the calculation the X- and Y-input data object is selected.

Step 1: find and subtract the linear trend: ....
- publish channel with linear trend:
- publish signal w/o linear trend:

Step 2: calculate the spectrum to detect periodics
- publish the FFT-signal:

Step 3: find periodics
- Count:
- Final StdDev:
- publish periodic average:
- publish periodic matrix:
- publish signal w/o periodics:

Step 4: prediction
- extend by [%]:
- predicted signal:
**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign 🚧 in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

💡: The context sensitive help is activated and the cursor changes to 🎯. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
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</tr>
<tr>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
<td></td>
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<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
<td></td>
</tr>
<tr>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
<td></td>
</tr>
<tr>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
<td></td>
</tr>
<tr>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
<td></td>
</tr>
<tr>
<td>GroupOfValues</td>
<td>Group of single values</td>
<td></td>
</tr>
<tr>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;LinearTrend&quot;</td>
<td>DoubleChannel</td>
<td>Channel with linear trend</td>
</tr>
<tr>
<td>&quot;Signal wo linear trend&quot;</td>
<td>DoubleChannel</td>
<td>Channel without linear trend</td>
</tr>
<tr>
<td>&quot;FFT-Analysis&quot;</td>
<td>DoubleChannel</td>
<td>Channel with FFT signal</td>
</tr>
<tr>
<td>&quot;Periodics Matrix&quot;</td>
<td>DoubleVarColMatrix2D</td>
<td>2D-matrix with periodic matrix</td>
</tr>
<tr>
<td>&quot;Periodics Average&quot;</td>
<td>DoubleChannel</td>
<td>Channel with periodic average</td>
</tr>
<tr>
<td>&quot;Signal w/o lin &amp; period&quot;</td>
<td>DoubleChannel</td>
<td>Channel without periodics</td>
</tr>
<tr>
<td>&quot;Prediction&quot;</td>
<td>DoubleChannel</td>
<td>Channel with predicted signal</td>
</tr>
</tbody>
</table>
2.7.14 Safety - Motor Vehicles

Go to:

Math
  ▶ Safety – Motor Vehicles
The menu item is divided into:
  • Time at Level
  • Xms Value
  • HIC – Head Injury Criterion
  • HIC(d) – Performance Criterion
  • HPC – Head Performance Criterion
  • HCD – Head Contact Duration
  • NIC – Neck Injury Criterion
  • VC – Viscous Criterion
  • FFC – Femur Force Criterion
  • TI – Tibia Index
  • TTI – Thorax Trauma Index
  • NCAP Result
  • MME – Based CrashAnalysis
  • Crashwall: Channels to Matrix

2.7.14.1 Time at Level

Go to:

Math
  ▶ Safety – Motor Vehicles
  ▶ Time at Level
The calculation Time at Level is used to calculate the maximum connected time interval for the underrunning of a certain lower limit of a measured value’s signal. The
searched value is determined either from the connected time interval (continuous calculation) or from the sum of all time intervals (cumulative calculation).

The calculation **Time at Level** is defined with the norms for crash tests.

**Result Data:** Name of the result data object as it will appear in the lists.

**Input Data:** The data object for the calculation is selected from the list of available data objects.

**Option:** The dwell time is calculated either from the connected time interval (**continuous**) or from the sum of all time intervals (**cumulative**).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
The line chart displays the result of a continuous (blue) and a cumulative (green) dwell time counting for the input signal (red).

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
</tbody>
</table>

2.7.14.2 Xms Value

Go to:

Math

Safety – Motor Vehicles

Xms Value

The calculation Xms Value determines the point in time and the value of the highest amplitude of the measurement signal or the acceleration at crash tests.

This calculation is mostly used at crash tests for determining the impact velocity. This is the so-called 3 millisecond value.
- **AVG**: Average of the amplitude of the acceleration, necessary for the calculation of the maximum of the highest amplitude of the acceleration
- **Max**: Maximum of the acceleration
- **T1**: Initial value of the range around the highest amplitude
- **T2**: End value of the range around the highest amplitude

The calculated values (maximum, initial and end value of the highest amplitude) are depicted in the Spreadsheet Values. The length of the range around the highest amplitude can be set manually.

---

**Result Data**: Name of the result data object as it will appear in the lists.

**Input Data**: The data object for the calculation is selected from the list of available data objects.

**Time Window**: Settings of the minimum value of the time frame: 1 ms, 3 ms, 5 ms or manual settings.

**Mode**: The XMS value is either **continuous**, i.e. at a stretch (single peak) or **cumulative**, i.e. calculated from several peaks (multiple peaks) that are put together.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign 🔴 in the Delete button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Example: The calculated single values of the highest amplitude of the acceleration are depicted in the Spreadsheet. The maximum as well as initial and end time of the amplitude are shown.

![Spreadsheet](image)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>BitArrayChannel/BitChannel</td>
<td>Channel with Boolean values</td>
</tr>
<tr>
<td></td>
<td>Integer/Long/Float/DoubleChannel</td>
<td>Channel with integers/floating point numbers</td>
</tr>
<tr>
<td></td>
<td>Longitude/LatitudeChannel</td>
<td>Channel with longitude/latitude values</td>
</tr>
<tr>
<td></td>
<td>DateTimeChannel</td>
<td>Channel with date/time values</td>
</tr>
<tr>
<td></td>
<td>Character/StringChannel</td>
<td>Channel with characters/strings</td>
</tr>
<tr>
<td></td>
<td>NumericChannelByReference</td>
<td>Referenced numeric channel</td>
</tr>
<tr>
<td></td>
<td>GroupOfValues</td>
<td>Group of single values</td>
</tr>
<tr>
<td></td>
<td>ObjectChannel</td>
<td>Channel with unspecified data</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleValue</td>
<td>Floating point number</td>
</tr>
</tbody>
</table>

2.7.14.3 HIC – Head Injury Criterion

Go to:

Math

Safety – Motor Vehicles

HIC – Head Injury Criterion

The calculation HIC – Head Injury Criterion computes the characteristic HIC value (HIC = Head Injury Criterion) as well as the corresponding time.
frame from an acceleration signal.

The HIC analysis determines the HIC value as well as the time range which follows the integral:

\[ HIC = \left[ \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a(t) dt \right] (t_2 - t_1) \]

The acceleration signal is used as input signal. The signal can optionally be evaluated via a CFC filter beforehand. The HIC calculation is defined in the norms of crash tests.

**Result Data:** Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**Input Data:** The data object for the calculation is selected from the list of available data objects.

**Zeit Fenster:** Die HIC-Analyse kann entweder über den gesamten Zeitbereich (ohne) oder über ein Zeitfenster berechnet werden. Es stehen zwei feste Zeitfenster (15 ms oder 36 ms) und ein beliebig definierbares Zeitfenster zur Auswahl.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
**Duplicate**: Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete**: The calculation is deleted and the dialog closed. A warning sign in the *Delete* button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

![Help icon]: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**: Two acceleration signals are depicted in the *line chart*. The measured signal (blue) and the signal filtered with 180 Hz by a *CFC filter*. The time frame calculated by the HIC analysis is displayed with two *axis cursor*. The calculated HIC value is depicted as *Digital Display*.

![Graph Image]

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleValue</td>
<td>&quot;[name]-HIC&quot;: the calculated HIC value</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T1&quot;: starting time of the calculated time window</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T2&quot;: ending time of the calculated time window</td>
</tr>
</tbody>
</table>
2.7.14.4 HIC(d) – Performance Criterion

Go to:

Math
  → Safety – Motor Vehicles
    → HIC(d) – Performance Criterion

The calculation **HIC(d) – Performance Criterion** computes the characteristic HIC(d) value as well as the corresponding time frame from an acceleration signal.

The HIC(d) analysis determines the weighed normed maximum integral value of the head acceleration and is determined by means of the **HIC36 values** (HIC value over a time frame of 36s) as follows:

\[ HIC(d) = 0.75446 \times HIC_{36} + 166.4 \]

An acceleration signal is used as input signal which can optionally be rated via a CFC filter beforehand. The HIC(d) calculation is defined in the norms of the crash tests.

**Result Data:** Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**Input Data:** The data object for the calculation is selected from the list of available data objects.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Example: The calculated HIC(d) values as well as the starting and end time of the amplitude are depicted in the Spreadsheet.

![Spreadsheet](image)

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result data</td>
<td>DoubleValue</td>
<td>&quot;[name]-HIC(d)&quot;: the calculated HIC(d) value</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T1&quot;: starting time of the calculated time window</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T2&quot;: ending time of the calculated time window</td>
</tr>
</tbody>
</table>

2.7.14.5 HPC – Head Performance Criterion

Go to:

Math

Safety – Motor Vehicles

HPC – Head Performance Criterion

The calculation HPC – Head Performance Criterion computes the characteristic HPC value (HPC = Head Performance Criterion) and the corresponding time frame from an acceleration signal.
The HPC analysis determines the weighed normed maximum integral value of the head acceleration whereas the corresponding time interval is at maximum 36 ms. The HPC value is identical with the HIC value.

\[
HPC = \sup_{t_1, t_2} \left\{ \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a \, dt \right\}^{2.5} (t_2 - t_1)
\]

An acceleration signal is used as input signal which can optionally be rated via a CFC filter beforehand. The HPC calculation is defined in the norms of the crash tests.

Result Data: Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

Input Data: The data object for the calculation is selected from the list of available data objects.

Time Window: Only the fixed time frame of 36 ms is available.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
### Types of data objects

<table>
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<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td>DoubleValue</td>
<td>&quot;[name]-HPC&quot;: the calculated HPC value</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T1&quot;: starting time of the calculated time window</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T2&quot;: ending time of the calculated time window</td>
</tr>
</tbody>
</table>

#### 2.7.14.6 HCD – Head Contact Duration

The calculation **HCD – Head Contact Duration** computes the characteristic HCD value \((HCD = \text{Head Contact Duration})\) from an acceleration signal.

The HCD analysis determines the normed maximum integral value of the head acceleration during head contact duration (maximum HIC value from all contact intervals). The contact intervals are determined by means of the resulting contact force.

For determining the contact intervals the resulting contact force \(F\) is calculated as follows:

\[
F = \sqrt{(m \cdot a_x - F_1)^2 + (m \cdot a_y - F_1)^2 + (m \cdot a_z - F_1)^2}
\]

with:
- \(m\) Mass of the head
- \(a\) head acceleration in \(i\)-direction
- \(F_1\) upper neck force in \(i\)-direction

Afterwards the HCD value is determined with the following formula:

\[
HCD = \max_j \{HIC_j\}
\]

An acceleration signal is used as input signal which can optionally be rated via a CFC filter beforehand. The HPC calculation is defined in the norms of the crash tests.
**Result Data:** Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**Resulting contact force:** Selection of the resulting contact force from a list of available data objects.

**Individual channels:** Selection of the Neck force and the Head acceleration in x-, y- and z-direction from a list of available data objects.

**Time Window:** The HCD analysis can be calculated either over the whole time range (no) or a time frame. There are two time frames (15 ms or 36 ms) and a freely definable time frame for selection.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Delete:** The calculation is deleted and the dialog closed. A warning sign ⚠️ in the Delete button indicates that the calculated data is used by other components.
Cancel: The dialog is closed and changes are dismissed.

? : The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Data</strong></td>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td><strong>Result Data</strong></td>
<td>DoubleValue</td>
<td>&quot;[name]-HCD&quot;: the calculated HCD value</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T1&quot;: starting time of the calculated time window</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-T2&quot;: ending time of the calculated time window</td>
</tr>
</tbody>
</table>

#### 2.7.14.7 NIC – Neck Injury Criterion

Go to:

**Math**

*Safety – Motor Vehicles → NIC – Neck Injury Criterion*

The calculation **NIC – Neck Injury Criterion** (NIC = Neck Injury Criterion) computes the dwell time for the force signals in the neck area and compares them with the corresponding limit values.

A compressive/tension force and a shear force signal are used. Within the calculation the compressive/tension force channel is split into its positive [traction force $Fz(+)$] and negative part [compressive force $Fz(-)$].

The input signals can optionally be rated via a CFC filter beforehand. The NIC calculation is defined in the norms of the crash tests.
**Result Data**: Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**Compressive/tension force**: Selection of the compressive/tension force channel from a list of available data objects.

**Shear Force**: Selection of the shear force channel from the list of available data objects.

**Option**: The dwell time for the input signals are generally **continuously** determined.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.
**Duplicate:** Another calculation is created with the current settings. The original calculation remains unchanged.

**Delete:** The calculation is deleted and the dialog closed. A warning sign △ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** Both line charts display the most important result data objects of the NIC calculation. The computed dwell time curves (e.g. NIC Load Criterion(X)) are compared with the correspondent limit value curves (e.g. NICShearLimit). The limit value curves of the individual forces are automatically generated (according to front impact ECE). The injury is stated in percent and displayed within the graphic element as Digital Display.

The results are depicted in terms of shear force in the first line chart.

The results are depicted in terms of compressive force (NIC-Load Criterion(Z-)) and tension force (NIC-Load Criterion(Z+)) in the second line chart.
### Types of data objects

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
</tr>
<tr>
<td>IntegerChannel</td>
<td>Channel with integers</td>
</tr>
<tr>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;NICShearLimit_X&quot;: x-values of limit channel for shear force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;NICShearLimit_Y&quot;: y-values of limit channel for shear force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;NICTensLimit_X&quot;: x-values of limit channel for tension force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;NICTensLimit_Y&quot;: y-values of limit channel for tension force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;NICComprLimit_X&quot;: x-values of limit channel for compressive force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;NICComprLimit_Y&quot;: y-values of limit channel for compressive force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;[name]-Load Criterion(X)&quot;&quot;: calculated dwell time of shear force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;[name]-Load Criterion(Z+)&quot;&quot;: calculated dwell time of tension force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;[name]-Load Criterion(Z-)&quot;&quot;: calculated dwell time of compressive force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;[name]-Force(X)&quot;&quot;: reference force in x-direction for shear force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;[name]-Force(Z+)&quot;&quot;: reference force in x-direction for tension force</td>
</tr>
<tr>
<td>DoubleChannel</td>
<td>&quot;[name]-Force(Z-)&quot;&quot;: reference force in x-direction for compressive force</td>
</tr>
<tr>
<td>DoubleValue</td>
<td>&quot;[name]-INJ_Ref_Shearing&quot;: shear force injury in %</td>
</tr>
<tr>
<td>DoubleValue</td>
<td>&quot;[name]-INJ_Ref_Tension&quot;: tension force injury in %</td>
</tr>
<tr>
<td>DoubleValue</td>
<td>&quot;[name]-INJ_Ref_Compression&quot;: compressive force injury in %</td>
</tr>
</tbody>
</table>
2.7.14.8 VC – Viscous Criterion

The calculation VC – Viscous Criterion (VC = Viscous Criterion) computes the injury criterion for the chest area. The VC analysis calculates the maximum of the indentation from the thorax deformation speed and the thorax deformation.

The VC value is calculated by using the following formula:

\[ VC = Scaling\text{factor} \cdot \frac{Y_{\text{CFC180}}}{Def_{\text{const}}} \cdot \frac{dY}{dt} \]

A speed signal is used as input signal that can optionally be rated via a CFC filter beforehand. The VC value can be computed by different calculation rules. For this, the input channel has to be filtered differently:

- in accordance with ECE-R94, ECE-R95 and EuroNCAP \( \rightarrow \) CFC 180Hz
- in accordance with SAEJ1727 \( \rightarrow \) CFC 600Hz.

The VC calculation is defined in the norms for the crash tests.
**Result Data**: Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**Input Data**: The data object for the calculation is selected from the list of available data objects.

**Dummytype**: Selection of the dummy type from the offered models. Depending on the selected dummy type the corresponding **Scaling factor** and the **deformation constant** are selected and displayed. The following dummy types are implemented:

- **Hybrid III, male 95%**: A widely spread crash test dummy from the Hybrid III family for frontal collision tests. It is larger than 95% of the adult male car drivers (*Large Adult Male*) assumed by the manufacturer, i.e. 188 cm body height and 101 kg weight.

- **Hybrid III, male 50%**: The most frequently used crash test dummy. Its measurements correspond to the average adult male car driver (*Middle Adult Male*) assumed by the manufacturer, i.e. 175 cm body height and 78 kg weight.

- **Hybrid III, female 5%**: The female crash test dummy from the Hybrid III family. It is larger than the lower 5% of the assumed female car drivers (*Small Adult Female*) assumed by the manufacturer, i.e. 152 cm body height and 54 kg weight.

- **BioSID**: Crash test dummy for the lateral collision tests (*Biofidelic Side Impact Dummy*). Height and weight are based on the Hybrid III, male 50%.

- **EuroSID-1**: Crash test dummy for the lateral collision tests following the European standard (*SID = Side Impact Dummy*).

- **ES-2**: Advancements of the EuroSID-1.
**SID-IIs**: Crash test dummy especially for lateral collision protection systems, i.e. side airbag (Small Side Impact Dummy).

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign ⚠️ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Example**: Both **Digital Displays** below display the result data object of the VC calculation. The value of the maximum indention speed (VC_Value) and the point in time of the maximum indention (VC_Time).

<table>
<thead>
<tr>
<th>VC_Value</th>
<th>VC_Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.11 m/s</td>
<td>0.08 s</td>
</tr>
</tbody>
</table>

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IntegerChannel</td>
<td>Channel with integers</td>
<td></td>
</tr>
<tr>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
<td></td>
</tr>
<tr>
<td><strong>Result data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DoubleValue</td>
<td>&quot;[name]_Value&quot;: value of maximum indentation</td>
<td></td>
</tr>
<tr>
<td>DoubleValue</td>
<td>&quot;[name]_Time&quot;: time of maximum indentation</td>
<td></td>
</tr>
</tbody>
</table>
2.7.14.9 FFC – Femur Force Criterion

Go to:

Math
  → Safety – Motor Vehicles
  → FFC – Femur Force Criterion

The calculation FFC – Femur Force Criterion calculates the force that impacts on the thigh and its dwell time.

The calculated dwell time is computed cumulative. The input signals can optionally be rated by a CFC filter.

The FFC calculation is defined in the norms of the crash tests.

Result Data: Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

Input Data: The data object for the calculation is selected from the list of available data objects.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: Another calculation is created with the current settings. The original calculation remains unchanged.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.
Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example: The line chart shows the calculated dwell time (red) and the corresponding limit curve (blue) that is automatically generated. The calculated dwell time curve is compared to the corresponding limit curve. From this, the injury (in %) can be deduced which is displayed as Digital Display in the graphic element.

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
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</tr>
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<tr>
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</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleChannel</td>
<td>&quot;FFCLimit_X&quot;: x-values of limit channel</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>&quot;FFCLimit_Y&quot;: y-values of limit channel</td>
</tr>
<tr>
<td></td>
<td>DoubleChannel</td>
<td>&quot;[name]-Injury&quot;: calculated dwell time</td>
</tr>
<tr>
<td></td>
<td>DoubleValue</td>
<td>&quot;[name]-Value&quot;: injury in %</td>
</tr>
</tbody>
</table>
2.7.14.10  TI – Tibia Index

Go to:

Math
  - Safety – Motor Vehicles
  - TI – Tibia Index

The calculation **TI – Tibia Index** calculates the injury criterion for the lower leg area of the crash analyses. The bending moment around the x- and y axis as well as the axial compressive force in z-direction are considered. The input signals can optionally be rated via a CFC filter beforehand.

The TI calculation is defined in the norms of the crash tests.

**Result Data:** Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.
**Moment Mx**: Selection of the bending moment around the x-axis from a list of available data objects.

**Moment My**: Selection of the bending moment around the y-axis from a list of available data objects.

**Compression Force**: Selection of the axial compression in z-direction from a list of available data objects.

**Dummytype**: Selection of the dummy type from the offered models. Depending on the selected dummy type the corresponding **Critical Bending Moment** and the **Critical Compression Force** are selected and displayed. The following dummy types are implemented:

- **Hybrid III, male 95%**: A widely spread crash test dummy from the Hybrid III family for frontal collision tests. It is larger than 95% of the adult male car drivers (*Large Adult Male*) assumed by the manufacturer, i.e. 188 cm body height and 101 kg weight.

- **Hybrid III, male 50%**: The most frequently used crash test dummy. Its measurements correspond to the average adult male car driver (*Middle Adult Male*) assumed by the manufacturer, i.e. 175 cm body height and 78 kg weight.

- **Hybrid III, female 5%**: The female crash test dummy from the Hybrid III family. It is larger than the lower 5% of the assumed female car drivers (*Small Adult Female*) assumed by the manufacturer, i.e. 152 cm body height and 54 kg weight.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Delete**: The calculation is deleted and the dialog closed. A warning sign △ in the **Delete** button indicates that the calculated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

![Context Sensitive Help](image)

: The context sensitive help is activated and the cursor changes to ≥. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**: The **Digital Display** on the right side show the calculated Tibia index (TI-Injury). ![TI-Injury](image)

**0.90**

**Types of data objects**

<table>
<thead>
<tr>
<th>Data</th>
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<tbody>
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<td></td>
</tr>
<tr>
<td>Result Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DoubleValue</td>
<td>&quot;[name]-Injury&quot;: value as floating point number</td>
<td></td>
</tr>
</tbody>
</table>
2.7.14.11 TTI – Thorax Trauma Index

Go to:

**Math**
- Safety – Motor Vehicles
- TTI – Thorax Trauma Index

The calculation **TTI – Thorax Trauma Index** computes the injury criterion for the thorax area in case of a lateral collision.

The TTI value is the average of the maximum acceleration of the lower spine (12th segment of the spine) and the larger value of the maximum acceleration of the upper (8th) and lower (4th) rib.

The input signals can optionally be rated via a CFC filter and a FIR filter beforehand.

The TTI calculation is defined in the norms of the crash tests.

---

**Result Data:** Name of the result data object as it will appear in the lists. The name is used as prefix for the different result data objects.

**Lower Rib:** Selection of the channel for the lower rib from a list of available data objects.

**Upper Rib:** Selection of the channel for the upper rib from a list of available data objects.

**Spine:** Selection of a channel for the spine from a list of available data objects.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The calculation is deleted and the dialog closed. A warning sign in the Delete button indicates that the calculated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to 🔍. The respective help topic is displayed when an area within the dialog is clicked on.

Example: The Digital Display on the right side displays the calculated Thorax Trauma Index (TTI-Value).

Types of data objects

<table>
<thead>
<tr>
<th>Data</th>
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</tr>
<tr>
<td></td>
<td>Float/DoubleChannel</td>
<td>Channel with floating point numbers</td>
</tr>
<tr>
<td>Result Data</td>
<td>DoubleValue</td>
<td>&quot;[name]-Value&quot;: value as floating point number</td>
</tr>
</tbody>
</table>

2.7.14.12 NCAP Result

Go to:

Math

Safety – Motor Vehicles

NCAP Result
2.7.14.13 MME – Based Crash Analysis

Go to:

Math

\[\text{Safety – Motor Vehicles}\]

\[\text{MME-Based Crash Analysis}\]
2.7.14.14 Crashwall: Channels to Matrix

Go to:
Math
  Safety – Motor Vehicles
  Crashwall: Channels to Matrix

2.7.15 Safety - Railway Vehicles

Go to:
Math
  Safety – Railway Vehicles

The menu item is divided into:
- Test Section Generator
- Analysis Parameter Generator
- UIC-518 Safety and Behaviour
2.7.15.1 Test Section Generator

Go to:

Math
  → Safety – Railway Vehicles
    → Test Section Generator

2.7.15.2 Analysis Parameter Generator

Go to:

Math
  → Safety – Railway Vehicles
    → Analysis Parameter Generator

2.7.15.3 UIC-518 Safety and Behaviour

Go to:

Math
  → Safety – Railway Vehicles
    → UIC-518 Safety and Behaviour
2.8 Menu: Windows

The menu item Windows is divided into:

- **Graphic 1**
- **Graphic 2**
- **Graphic 3**
- **Header**
- **Footer**
- **Spreadsheet**
- **Explorer**
- **Blockdiagram**
- **Toolbox**
- **Auxiliary**
- **Toolbars**
- **Formatter**
- **Page View**
- **Page Management**
- **Select Page**
- **Select graph by data object**
- **Editable**
- **Window- and page settings**
- **Full Screen Mode**

2.8.1 Graphic

Go to:

Window
- ➔ Graphic 1

or press <CTRL+1>

Window
- ➔ Graphic 2

or press <CTRL+2>
Window

→ Graphic 3

or press <CTRL+3>

The selected window of the three independent Graphic windows is opened.

2.8.2 Header / Footer

Go to:

Windows

→ Header

Windows

→ Footer

A separate Graphic window opens which can be filled with graphic elements.

For each of the 3 Graphic windows an individual header and footer which are modified in a separate window can be created. It is possible to define different headers and footers for even and odd pages or to design the first page differently from the following pages.

Graphic objects created within the header and footer are immediately displayed in their correspondent graphic window. Graphic objects may be moved to other graphic windows via Drag&Drop.

NEW Control elements, such as buttons and links, can now be used also in header and footer.

Header and footer can be exported as template. When doing a report export headers and footers can, for example, directly be used as headers and footers in Word.

Example

The example shows that a header and footer were created in Graphic window 1. The generated objects are automatically put on every page of the Graphic window.
Different first page: If the checkbox is set, the tab First is enabled and can be edited. Modifications in this tab are only applied to the first page.

Different odd and even: If the checkbox is set, the tab Odd pages is enabled and can be edited. Modifications in this tab are only applied to odd pages.

Tab General / Even pages: This tab is always enabled. If no other option is selected, modifications in this tab are applied to all pages.
2.8.3 Spreadsheet

Go to:

Windows

Spreadsheet

The Spreadsheet window is opened and displays all data objects.

2.8.4 Explorer

Go to:

Windows

Explorer

or press <CTRL+E>.

The Explorer window is opened and displays all defined components in a tree structure.

2.8.5 Blockdiagram

Go to:

Windows

Blockdiagram

or press <CTRL+B>.

The Blockdiagram window displays the defined import, analysis and visualisation components in a block structure. The blocks represent producers and consumers, the lines between the blocks represent the data items. A data item possesses only one producer but can take several consumers.
Blocks – Producers and Consumers

The color of the block specifies the block type, e.g. importer, connection, worker, graphic object.

If the mouse is moved over an element, a tooltip shows the name and class of this element.

Connection Lines – Data Items

Each connection line corresponds to a data item. The line width represents the size of the data:

- 1 Pixel: Single values
- 3 Pixel: one-dimensional objects (channels)
- 5 Pixel: two- or three-dimensional objects (matrices)

The line color displays the type of the data object:

- blue - double
- green - integer
- black - time
- red - event
If a component is selected and the operation is performable, the buttons **Modify** and **Delete** are enabled. If a component is editable, the dialog box is opened via double clicking the block. A component can be deleted if none of its data objects has a consumer.

### 2.8.6 Toolbox

Go to:

- **Window**
- **→ Toolbox**

Frequently used functions can be assembled in a window by a user via **Toolbox**. The toolbox may remain open during work with jBEAM so that the user can quickly access the desired functions. By default, the toolbox contains most of the available functions that are divided into folding menus.

The default setting can be modified individually via **Edit → Preferences (tab Menu settings)**.

Graphic objects can directly be dragged from the toolbox into the graphic window by Drag&Drop. All other functions like calculations, services or importers are called by a mouse click. The modification dialog box is opened and the data object is created.

The input field above the list can be used to filter the functions. Then, only functions are displayed which contain the edited string in their names.
2.8.7 Auxiliary

Go to:

**Windows**
- **Auxiliary**

The menu item is divided into:
- **VW Item Supervision**
- **Quickview with Dual-Cursor**

2.8.7.1 VW Item Supervision

Go to:

**Windows**
- **Auxiliary**
  - **VW Item Supervision**
2.8.7.2 Quickview with Dual-Cursor

Go to:

Windows
  ➡ Auxiliary
    ➡ Quickview with Dual-Cursor

The Quickview with Dual-Cursor is used to get a quick overview of several curves in the Universal 2D graph.

Both integrated cursors return the Y values of all curves and depicts them next to other curve parameters in the table. The cursors can be modified by shifting with the mouse as well as by clicking. By hovering with the mouse over y values they can be displayed temporarily or permanently when double clicked.

When opening the quickview via the menu the currently marked Universal 2D graph is displayed. If no Universal 2D graph is selected, the Quickview is empty.

The Quickview can also be found in the context menu of the Universal 2D graph.

The Quickview can also be opened out of the explorer for the selected channels via context menu. Channels with compatible units and similar value range are grouped in one Y-axis.

The window of the Quickview is divided into three areas: the table area (top left), the parameter area (bottom left) and the display area (right).
**Table area**

The first row (or column in case of switched rows/columns) contains the values of the x-axis, the other rows show the y values of the contained diagrams in the Universal 2D Graph. A right-click into the column or row headers open the context menu where the values to be displayed can be selected.

**Visible**: By default, all diagrams of the Universal 2D Graph are displayed. If the checkmark **Visible** is disabled, individual diagrams are blanked out. For the currently selected curve, the visibility can also be switched via <Ctrl>+B.

**Symbol**: The legend symbol is displayed that represents type and color of the displayed curve.

**Name**: Displays the name of the data object.

**Unit**: If available, the corresponding unit is displayed.

**Value 1 / Value 2**: The y values of the first and second cursors are displayed.

**Delta**: The differences of both cursor values are displayed.

**Slope**: From the difference values of x and y the corresponding slope is calculated.

**Minimum / Maximum / Average**: The respective statistical values are displayed.

**Test name**: The name of the source or the producer is displayed.

**Axis**: The number of the axis can be selected.

**Histogram**: This option can be used to switch between linear interpolation and step mode (histogram). If histogram mode is selected, the step from old to new Y value is displayed in the middle of the interval in case of implicit X values. In case of explicit X values, the step is displayed at the X value. When the cursor is shifted, the value remains at one level up to the next step according to the displayed curve.
Parameter area

**Table:**

**Switch rows/columns:** Switches the display of rows and columns in horizontal and vertical direction.

**Columns/Order / Rows/Order:** A dialog opens where columns or rows can be activated for display. The order of columns or rows can also be changed via arrow buttons.

**Apply changes:** Using this button, the current display is applied to the original graph. If the Quickview has been opened out of an existing graph, this one is updated. That means, the zoom area and stack mode of the Quickview is also set in the original graph, and added or removed data objects are updated. The cursor settings of the original graph remain unchanged, however. If there is not yet an original graph, i.e. if the Quickview has been opened via menu or data object selection, a new graph is created with the respective settings on the current page.

**Graph:**

**<Ctrl>Click:** Current mouse position becomes new position for cursor 1.

**<Ctrl><Alt>Click:** Current mouse position becomes new position for cursor 2.

- **show curves with marker:** All curves are displayed with markers. All points of the curves are displayed as markers by default. If individual points of a curve are furnished with value label and marker via double click, only these markers are displayed. Like all other settings of the quickview this option has no influence on the display in the Universal 2D Graph as long as the button **Apply changes** has not been pressed.

- **automatically scale y-axes:** The y-axis is automatically scaled according to minimum and maximum values.

- **scale y-axes for x-range:** The y-axis is automatically scaled according to minimum and maximum values within the visible x-range.

- **show complete curve:** The complete curve is displayed (normal view A).

- **show curve between cursors:** The display is zoomed to the range between cursors.

- **zoom to last stored x-axis range:** The display is zoomed back to the previously set cursor position.

**Cursor 1 / 2:** Alternatively to the positioning with the mouse, the cursors can be set manually by entering values in the input fields. They always show the current cursor position. As soon as a value is changed, the cursor position in the display window changes automatically. Via the button **show curve between cursors** the axis limits can then be adopted automatically.

**Stack axis:** Optionally, the axes can be stacked. An individual Y axis is created for each data object.

**Unstack axis:** All data objects are displayed on a common Y axis.

**Stack axis by unit:** n individual Y axis is created for each existing unit. All data objects with the same unit are displayed on the same Y axis.
Display area

In the display area the selected data objects as well as both cursors are displayed with the current settings.

As soon as a curve is marked via mouseclick in the table, this curve is also marked in the display area and vice versa.

Similar to the Universal 2D Graph numerous modifications can be carried out in the display area via keyboard and mouse (see Interactive Mouse Activities).

Additionally, data objects can be added to the list by Drag&Drop out of the Explorer into the diagram. These are placed in the diagram according to their position and properties, analog to the Universal 2D Graph:

- Dragging a data object into the diagram area: If a data object with the same unit already exists, the new data object is assigned to the same Y axis. Otherwise, it is displayed on a new Y axis.
- Dragging a data object onto a Y axis: The new data object is assigned to the respective Y axis.
- The new data object is automatically displayed in a new color.
- The new data object is automatically added in the table.
- A marked data object (in table or diagram) can be removed from the Quickview via Del key.
- Data objects can also be added several times. They are treated as individual channels with own color.

Interactive Mouse Activities

Various additional keyboard combinations can be used in the Quickview:

\(<CTRL>+B:\) The visibility of the selected curve(s) is switched. The curves can be selected by clicking them in the table or diagram.

\(<CTRL>+K:\) Both cursors are shifted to the current (X-)range. Cursors outside the currently visible range are indicated by a dashed line at the edge. Via \(<CTRL>+K\) those cursors can be shifted to the visible range, their new position then being at ¼ respectively ¾ of the current X-range.

\(<CTRL>+F12:\) The whole X-axis is shown (in case of zoomed mode).

\(<CTRL>+K:\) The automatic scaling mode of the Y-axis is switched (alternating between \(\square\) and \(\square\)).

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Square with A or B in the upper right corner</td>
<td>Shifts between normal view and zoomed view</td>
</tr>
<tr>
<td></td>
<td>Frame (cursor changes to an arrow – only in zoomed view)</td>
<td>Shifts the section to the direction of the arrow</td>
</tr>
<tr>
<td>CTRL &amp; click</td>
<td>Diagram area</td>
<td>Positions the first cursor</td>
</tr>
<tr>
<td>CTRL &amp; ALT &amp; click</td>
<td>Diagram area</td>
<td>Positions the second cursor</td>
</tr>
<tr>
<td>Click &amp; Move</td>
<td>Frame or window separator</td>
<td>Increases/decreases size of the display window</td>
</tr>
<tr>
<td>Action</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Axis</td>
<td>Changes the axis scaling, switching to system of coordinates B</td>
<td></td>
</tr>
<tr>
<td>Cursor line</td>
<td>Moves the cursor</td>
<td></td>
</tr>
<tr>
<td>Diagram area</td>
<td>Moves the diagrams in the system of coordinates, switches to system B</td>
<td></td>
</tr>
<tr>
<td>Scroll wheel</td>
<td>Diagram area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zooms the diagrams, switches to system of coordinates B</td>
<td></td>
</tr>
<tr>
<td>Axes</td>
<td>Zooms the axes, switches to system of coordinates B</td>
<td></td>
</tr>
<tr>
<td>ALT &amp; click &amp; move</td>
<td>Diagram area</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zooms in on an area and switches the system of coordinates to B</td>
<td></td>
</tr>
</tbody>
</table>

### 2.8.8 Toolbars

Go to:

**Windows**

*Toolbars*

Upon activating the menu items, the [Standard toolbar](#) (Standard) and/or the [Graphics toolbar](#) (Graphic) are displayed on the jBEAM user interface.
2.8.9   Formatter

Go to:

Windows
   •  Formatter

There is only one sub menu item, the Page Formatter.

The Page Formatter adjusts the page layout. Overlapping of existing headers/footers with the page content is corrected. If elements overlap, they are moved upwards or downwards accordingly. If necessary, graphic objects are splitted and pages inserted.

The Page Formatter is only applicable in canvas mode.

As the application of the Page Formatter actually changes the layout of the project, this should be carried out at the end. It is recommended to save the project beforehand to be able to start again with the original state in case of changes on the Page Formatter. So, for instance, tables are fitted into the defined ranges and splitted accordingly. If the border areas are changed and the Page Formatter carried out again, the once splitted sections of the tables would be fitted to the new ranges and splitted in even smaller sections.
shift and split graphs in border area: The graphs in the defined border areas are shifted out of these areas. Graphic objects (e.g. large tables or tables of contents) which do not fit into the remaining area anymore are splitted accordingly. If necessary, new pages are inserted until all table parts are accommodated.

Only moveable graphic objects (e.g. Interactive Table, Table of Contents, Legend) are split.

upper / lower border area: Defines the area from the upper or to the lower border to be left clear. All shiftable graphic objects are shifted out of these areas.

If certain graphic objects shall remain explicitly in the border areas of the corresponding page even if they are not part of the header or footer, the option moveable can be deactivated in the Properties of the graphic object.

preserve next pages while clearing upper/lower margin: Optionally, the positioning of graphic elements within the following pages can be preserved when a table is splitted. Then, whole pages are inserted to accommodate the new table parts.
In order to ensure the correct execution of this option, it is necessary to deactivate the option **shift other graphs** in the **General** tab of the dialog of the table to be splitted. Otherwise, the subsequent graphic elements would already be shifted inadvertently by the table before the **Page Formatter** even starts.

![Image](image.png)

**Dissolve multi-paged layout templates**: Multi-paged layout templates can be dissolved. No groupings exist anymore.

**Fill space of disabled templates**: The space allocated by the template containers is filled with low positioned graphic objects that are lifted to the exact size of the container height.

**Free space of enabled templates**: The page formatter moves all graphic elements with the top edge of the visible template downwards to the height of the currently visible template.

**OK**: The changes are applied and the dialog is closed. The page formatting is executed which changes the whole layout immediately.

**Apply**: The settings are applied and the dialog remains open. The page formatting is not executed. If the dialog is closed by **Cancel**, the project layout is not changed. However, the settings are saved with the project and can be used later on, e.g. for a PDF report.

**Cancel**: The dialog is closed and changes are dismissed. The page formatting is not executed.

![Help Symbol]: The context sensitive help is activated and the cursor changes to  . The respective help topic is displayed when an area within the dialog is clicked on.
2.8.10 Page View

Go to:

Windows

Page View

or press <CTRL+ALT+P>.

The jBEAM graphic window supports 2 modes for displaying available pages:

- Page View
- Canvas (all pages are positioned on one drawing area)

If Page View is checked in the menu, the page view is active. Only one page is displayed then. To navigate between all pages the tabs the bottom of the page are used.

Graphic objects that are positioned on two pages are only displayed on the page, namely the page which contains the larger visible part of the graphic element.

If the Page View is active, the following actions can be performed by right-clicking on the page tab:

- Insert New Page
- Append New Page
- Delete Page
- Copy page to clipboard
- Insert page from clipboard
- Save as subproject
- Duplicate Page
- Change Pagenames
- Select Page
- Page in page sets
- Page sets de-/activate
- Replace data...
2.8.11 Page Management

Go to:

Windows
    ➞ Page Management

The Page Management shows all pages of the active graphic window as an overview with preview windows. The pages can be sorted manually via Drag&Drop. Individual settings, like page name and tooltip, can be edited. The pages can also be grouped in page sets.
Tab Page configuration

All pages of the active graphic window are shown in an overview with preview windows and main settings. These settings can be edited directly in the overview.

**Name:** The name of the page can be edited. It may contain formulas, e.g. "@PageNumber()@" inserts the number of the respective page.

**Tooltip:** A text can be edited which is displayed as soon as the mouse moves over the page tab.

**Printable:** Optionally, the respective page can be excluded from printing (deactivated). By default, this option is activated, i.e. the page is printed.

**Background color:** If activated, a color for the background can be selected in the color selection dialog. The background color is applied in the following order:
1. from preferences
2. from graphic window
3. from page.

The pages can be sorted manually by shifting a page via Drag&Drop to the desired position.

Name and tooltip of each page can be edited as multi-language text. This setting can also be modified via the context menu of the page tab in the graphic window. A right-click in the page tab and selection of the menu item Change Pagenames or a double-click in the page tab opens
the edit field. There, the button beside the edit field der opens the dialog for Language Dependent Strings.

A right-click in the page preview opens the context menu with the menu item Page in page sets. In a submenu all existing page sets are listed and the current page can be assigned to the desired page sets.

**Tab Page sets**
This tab shows all existing page sets. Page sets can be added, deleted, loaded, saved and modified.

**Show all pages:** All page sets existing in the active graphic window are displayed, independent of active page sets.

**Show pages of active page sets:** All pages of the active page sets are displayed. If no page set is active, all pages are shown.

**Show pages of selected page set:** All pages of the selected page set are displayed. If no page set is selected, the first page set is selected automatically. Conversely, this option is also selected automatically as soon as a page set is selected in the list.

The middle section contains the list of existing page sets on the left side.

**Active:** The desired page sets can be activated or deactivated. If the dialog is closed with OK, only the pages included in at least one of the active page sets are displayed in the graphic window.

**Page set:** The names of the page sets can be individually edited by double-clicking the input field.

The input fields below the list can be used to filter for certain page sets (e.g. letters in the name). Via a drop-down list the **Text-Filter-Typ** *(Plain text, Wildcard text (?, *) or Regular expression)* can be selected.

- ![Load](image): A previously saved page set (*.jbps) can be loaded.
- ![Save](image): The selected page set can be saved in a file (*.jbps).
- ![Add](image): A new page set is added.
- ![Delete](image): Die ausgewählte Seitensammlung wird gelöscht.

The dialog section on the right contains two lists for the available and the selected pages.

**Available pages / Pages in Page set "...":** In the left list all pages are displayed which are not yet included in the selected page set. The right list contains the already included pages. The input fields above the lists can be used to filter the pages. The lists then only show the pages, the names of which contain the entered string.

- ![>>](image) ![>](image) ![<](image) ![<<](image): The buttons between the lists allow the shifting of the selected/all data objects from one list to the other.

**Show preview images:** Optionally, the preview images can be displayed. Otherwise only page names are listed.

**Formula Editor:** The **Embedded Formula Editor** is opened via this button.

**N / C / D:** These buttons *(New / Change / Delete)* can be used to define **Language Dependent Strings** for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language *(std. / de / en / ...)* directly in the dialog.
**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Cancel**: The dialog is closed and changes are dismissed.

![](https://via.placeholder.com/15) **?** : The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.8.12 Select Page

Go to:

**Windows**

> Select Page

or press <CTRL+G>.

The dialog box for selecting the page number is opened:

![Select Page](https://via.placeholder.com/150)

The entered page is displayed by clicking **OK**.
2.8.13 Select Graph by Data Object

Go to:

Windows

Select Graph by Data Object

or press <CTRL+Shift+G>.

This function can be used to search for graphic elements which use a certain data object as input object. A list shows all found graphic elements. Even graphic elements are found which use the data object for control (e.g. controlled color in Line/Points diagram or controlled cursor) or in formulas (e.g. axes). As soon as one of them is clicked it is shown and highlighted in the respective graphic window on the respective page.

If a data object is selected in the Explorer and then called this function (also possible by context menu) the data object is preset in the dialog. Otherwise it can be selected from a list of available data objects.

Dialog for selection of data object

The data object is selected from the list of available data objects.

OK: The dialog is closed. A new dialog opens showing the found graphic elements containing the selected data object.

Cancel: The dialog is closed and settings are dismissed.
Calling function via context menu

![Dialog for selection of found graphic elements](image)

Dialog for selection of found graphic elements

The list shows all found graphic elements. The column **Graphic window** lists the number of the graphic window containing the graphic element, column **Page** the respective page in this graphic window. By clicking a listed graphic element, the respective window/page is displayed in the background and the graphic element highlighted. After closing the dialog, the selected graphic element remains marked in the graphic window.

**OK:** The dialog is closed. The respective window/page is displayed and the graphic element marked.

**Cancel:** The dialog is closed and settings are dismissed.
A ruler and grid can optionally be displayed in the Graphic windows in order to facilitate the positioning of the graphic objects. The ruler can be set to centimetre or inch.

The menu item Editable turns the display of ruler and grid on and off. If the Graphic window is not editable, existing graphic objects cannot be edited.

The ruler automatically adjusts itself to the set size of the Graphic window.

Graphic window with active ruler in centimetre:  

Graphic window with active ruler in inch:
Latching Graphic Objects on the Grid
If a graphic object is moved or made bigger/smaller with the mouse, the graphic element is latched on the grid in case <CTRL> is pressed at the same time.

Proportional Enlargement
If a graphic object is scaled up/down at one of its four edges, the graphic element’s width-to-height ratio is kept in case <SHIFT> is pressed at the same time.

2.8.15 Window- and page settings

Go to:
Windows
   ➔ Window- and page settings
The function Window- and page settings allows general settings for the active graphic windows.
Window properties

Window title: The title of the active window can be edited.

View: The mode of view can be set either to Single pages or to Canvas. See also Page View.

Maximize canvas: The graphic panel uses all available place in the graphic window, irrespective of page borders.

Content editable: If the option is activated the graphic elements of the active window can be edited. See also Editable.

Page grid: The page grid can be activated, i.e. made visible, or else deactivated, i.e. hidden.

Page border lines: The page border lines can either be displayed (activated) or hidden (deactivated).

Ruler: The ruler can either be displayed (activated) or hidden (deactivated). For ruler unit, cm or inch can be selected.

Zoom:

Automatic complete page: The zooming factor is automatically adjusted so that the complete page is visible within the set graphic window.

Automatic page width on window width: The zooming factor is automatically adjusted so that the page width completely fills the set graphic window.

User defined: A predefined value for the zooming factor can be selected from the list or any percentage value edited in the field.
The variable zoom can also be set either by using the input field / selection list of the Standard Toolbar or via keyboard and mouse. For this, press <CTRL> and simultaneously move the mouse wheel to increase or reduce the zooming factor.

The zooming factor of the graphic window has no effect on the printout. This is always carried out at 100%.

**Moving graphs:**

**show position lines to neighboring elements:** To facilitate positioning and alignment of graphic elements, reference lines are shown as soon as a moved or zoomed element crosses an outline or centre line of a neighboring element. When the mouse button is released the graphic element snaps to the shown line or lines.

**show connection lines to original position:** To facilitate positioning and alignment of graphic elements, reference lines are shown to the original position of the graphic element.

**Snap to grid:** Graphic elements snap to the grid while they are moved or zoomed.

⚠️ When editing the graphic page, the mode defined here can be temporarily inverted by pressing the <Ctrl> button. I.e. if the option here is deactivated, the graphic elements normally do not snap to the grid, yet they do with the <Ctrl> button pressed. Conversely, with activated option the graphic elements always snap, but can be freely positioned with the <Ctrl> button pressed.

**Page properties:** The settings can be applied to All pages, to the Current page or to selected pages (User defined). For the user defined input of several pages, semicolons are used to divide individual pages and ranges, and hyphens to define ranges.

**Page format:** The page format can either be Portrait or Landscape. With the option Standard orientation the defined settings are applied in the following order:

1. from preferences (see menu **File → Printer Setup**)
2. from graphic window
3. from page

**Background color:** A background color can be selected for the active window.

_D2HLink_428964).}
2.8.16 Full Screen Mode

Go to:

**Windows**

→ **Full Screen**

or press **F11**.

If this mode is selected, the content of the currently used Graphic window is displayed full screen (on a white background without grid and menu bar).

The mode is ended by double-clicking the mouse or pressing **F11** or **<ESC>**.

The modification of graphic elements is depending on the set properties of the respective graphic element, mainly limited to interactive elements such as buttons, input fields or cursors but also to display settings, shifting or zooming. The latter modification options can be enabled or disabled via the properties of the graphic element.
2.9 Menu: Graph Editor

The menu **Graph Editor** is divided into the following sub menu items:

- Mark Objects
- Simple Forms
- Text Elements
- Tables
- Realtime Graphics
- Cockpit Instruments
- 2D/3D-Axis Charts
- SPC Graphs
- Multi Media
- Controls
- Modify
- Properties
- Replace Data
- Delete active
- Delete all
- Order
- Alignment
- Group
- Ungroup

The menu **Graph Editor** can also be called by pressing <ALT+G>.

2.9.1 General Information

Some graphic elements like the Universal 2D Graph offer many possibilities to define settings via different dialog boxes.
Title: Most graphic elements possess a title that is formatted by using the following buttons.

**N** = **New**: This button opens the dialog box for Language Dependent Strings.

![Font](image)

: This button opens the dialog box for setting the Text Parameter.

![Alignment](image)

: These buttons determine the alignment of the title: left-aligned, centred, right-aligned.

![Axis](image)

: These buttons open the dialog box Modify Axis, initialised with the system of coordinates A or B.

![Legend](image)

: This button opens the dialog box Modify Legend.

![Limits](image)

: This button opens Limits Definition.

![Cursor](image)

: This button opens the dialog box Modify Cursor Set.

- **Not Stacked**: If there are several curves in a graphic object, all curves have a common Y-axis.
- **Stacked A**: If there are several curves in a graphic object, each curve has an own Y-axis. The Y-axes are stacked.
- **Stacked B**: If there are several curves in a graphic object, all curves with the same unit have a common Y-axis. Axes with different units are stacked.

- **Analysis Cursorset**: Every curve automatically gets a predefined cursor. All cursors are linked, i.e. shifting the first cursor shifts the other cursors. The X-, Y- and index values of the curves are displayed as a tooltip at the cursor. The window Curve Analysis using Cursor displays the X- and Y-values of the curves.
  
  Note: All cursors defined before are overwritten!

- **Delta Cursorset**: Every curve automatically gets 2 predefined cursors. This means that there are 2 linked cursor groups that can be shifted by using their first cursor. The X-, Y- and index values of the curves are displayed as a tooltip at the cursor. The Curve Analysis using Cursor...
displays the X- and Y-values of both cursors, the delta of the Y-values and the gradient.
Note: All cursors defined before are overwritten!

- **Clear Cursortset**: Deletes all cursors.
- **Analysis 2**: Generates 2 cursors (if there are none) and a **Legend as Table** with the cursor values.

The following standard commands of the buttons in the footer of the dialogs can also be executed via shortcut key:

- **OK**: Enter
- **Cancel**: Escape
- **Apply**: SHIFT+ENTER

### 2.9.1.1 Language Dependent Strings

Languages are selected and added from a list of available languages in the dialog box for Language Dependent Strings. The language dependent strings are entered into the text field and saved by clicking **OK**.

The newly added languages can be selected from a list in the dialog box of the graphic object (e.g. **Plain String**). By using this selection, language-dependent strings can be changed directly in the dialog box of the graphic object.

Via the button **C (Change)** the dialog box for Language Dependent Strings reopens. The button **D (Delete)** deletes the created list.
To display graphic elements in other languages the corresponding language has to be selected at **show strings in** in the **Preferences tab ML-Layouts**.

### Example:

<table>
<thead>
<tr>
<th>Option: show strings in GUI language</th>
<th>Option: show strings in English</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grafik</td>
<td>Grafik2</td>
</tr>
</tbody>
</table>

#### 2.9.1.2 Text Parameter

The font, size and color as well as the type (bold and/or italic) are determined in this dialog box. The preview window displays the currently chosen parameters.

#### 2.9.1.3 Axes

The scaling of the displayed measurement data is defined by the axes. jBEAM supports axes for Cartesian coordinate systems as well as polar coordinate systems.

**Example of a Cartesian coordinate system:**

During zooming (axis system A)  
After zooming (axis system B)
A system of coordinates consists of at least one X- and Y-axis (respective phi- and r-axis). Different graphs (e.g. the Universal 2D Graph) have two systems of coordinates (A and B). If a graph supports several systems of coordinates, the current system of coordinates is displayed in the top right corner of the graph. For this, the graph needs to be marked. The user switches between the systems of coordinates by clicking on the label of the system of coordinates. When zooming into a curve system B is additionally activated and by using arrows (8 directions) the axes can be modified (see above).

The modification dialog box is opened by double clicking on the graph axes’ area or the command **Modify... Axis** in the context menu via right mouse click. Some dialog boxes of graphic objects contain the button **Axis (A/B)** that also open the axes’ dialog box.

A shortcut for changing the axis unit is provided by a double-click on the respective unit. A small dialog opens where the unit can be changed analog to the axis dialog. All changes (**automatic/manual** or **visible**) are immediately applied in the diagram.
Note: In contrast to the view above, the modification dialogs of the individual axes can also be displayed in individual tabs (horizontal alignment). The display mode can be set in Menu: Edit→Preferences→Dialogs by enabling respective disabling the option Compact Layout.

It is also possible to enable several axes of each axis type which are assigned to different curves. Each axis has an individual tab (1, 2, ...) with corresponding settings (vertical alignment).
Tab System A / System B: If the corresponding chart contains several systems of coordinates, the settings of each system are displayed in individual tabs. Each tab possesses a radio
button which is automatically enabled as soon as the tab is selected. This shows that the parameters are actually modified by switching tabs.

**Keep axis range of invisible diagrams:** This option keeps the axis range of currently invisible diagrams free.

A two-dimensional system of coordinates contains two types of axes:

- Cartesian coordinate system: **x-Axis** and **y-Axis**
- Polar coordinate system: **phi-Axis** and **r-Axis**

**Compact Layout:** This option leads to a more compact layout in case of multiple (stacked) axes. The necessary space is reduced by applying the individually necessary space of each axis. By default (option deactivated), the necessary space of the broadest axis determines the space for all axes.

**Label:** The axis label is entered. If the input field is empty, no axis label is displayed and space needed for the axis is smaller. The axis label may contain a fix string or a formula. Additionally, some predefined labels like item name or item name + unit are offered in the combo box — **Select**—.

**auto wrap:** The label is automatically wrapped if it is too long for one line.

**Position:** The X-axis can be placed above (top) or below (bottom) the chart, the Y-axis left or right of it.

**Range:** Defines the axis range relatively to the curve range. If consecutive axes do not overlap, the axis ranges are merged. Example: Range of Y-axis 1 (0-45%), Y-axis 2 (55-100%): the axes are drawn on top of each other.

**fill background:** Defines the background color of the curve range.

**Modify:** A fill color and gradient (i.e. if a second background color is selected, a continuous color gradient is created) can be entered via the dialog box **fill mode.** Furthermore, the fill range of individual ranges can be defined.

**Dialog Fill Mode**
complete: The selectable background color is used for the whole chart area.

gradient: If a second background color is selected, a color gradient is drawn.

ranges: Multiple ranges (from...to) can be created for which individual fill colors and gradients can be defined.

- A new range is added.
- The marked range is deleted.

Example for a gradient filling area by area of the Y-axis.

Example for the background filling of the X-axis.

Units:

- automatic: The unit to be displayed is automatically determined out of the respective data object.

- manual: A unit compatible with the data object is selected from a list. The conversion of the values is done automatically (Unit Service).

- visible: The units of the data objects assigned to this axis are displayed.

Font: Defines the font (Name) and Size of the axis label and the style: bold and/or italic.
Table of axis formatting

The individual elements **Axis line, Major ticks, Minor ticks, Major grid, Minor grid, Tick labels** and **Label** can be individually formatted.

**visible:** The individual elements can be activated or deactivated for display.

**width:** Defines the line width in pixel.

**style:** Defines the line style, e.g. solid line or dashed line.

**use color from:** The color of the axis element can either be defined **manually** or adopted from another element. According to the element, **Diagram, Axis line, Major ticks, Minor ticks or Label** can be selected.

**manual color:** Via color selection button the color can be selected.

**Text orientation:** The axis label can be drawn in 3 directions: 0°, +90° and -90°. The Tick labels can be drawn additionally in a 45° angle. The direction is changed to the next option with each click on the button.

### Table of axis formatting

<table>
<thead>
<tr>
<th></th>
<th>visible</th>
<th>width</th>
<th>style</th>
<th>use color from</th>
<th>manual color</th>
<th>text orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis line</td>
<td></td>
<td>0.6 Px</td>
<td></td>
<td>manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major ticks</td>
<td></td>
<td>2 Px</td>
<td></td>
<td>manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor ticks</td>
<td></td>
<td>0.4 Px</td>
<td></td>
<td>manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major grid</td>
<td></td>
<td>1 Px</td>
<td></td>
<td>manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor grid</td>
<td></td>
<td>0.8 Px</td>
<td></td>
<td>manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tick labels</td>
<td></td>
<td></td>
<td></td>
<td>manual</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Label</td>
<td></td>
<td></td>
<td></td>
<td>Diagram</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scaling:** The different methods for axis scaling are set in individual tabs.

**Tabs for the Scaling Type**

- Min/Max
- Date/Time
- Map
- Probability

Each tab contains a radio button that is automatically activated when the tab is selected. This indicates that by switching tabs the parameters are actually modified.
Tab Min/Max

The axis range is divided into N identical ranges for numerical data object.

linear: Linear axis scaling.

log (base 10): Logarithmic axis scaling (logarithm to the base 10).

log (base 2): Logarithmische Skalierung der Achse (logarithm to the base 2).

octav: Starting from the initial axis value a logarithmic scaling to the base 2 is carried out (frequency doubling).

Tab Simple

automatic: Minimum and maximum of the axis are automatically determined from the corresponding data object.

manual: Minimum and maximum of the axis are manually set (Right value/Left value respective Top/Bottom value). Optimized has to be deselected for this action.

dataobjects: Minimum and maximum of the axis are determined via data objects (single values) for Right value/Left value. Optimized has to be deselected for this action.

Right value/Left value respective top/bottom value: Is only enabled if automatic is deselected.

The minimum and maximum of the axis are manually entered or a data object for each entry is selected that contains the desired value.

optimized: Minimum and maximum are adapted if necessary, so that smooth axis areas are generated for the defined number of intervals. At the same time the number of decimal places is optimized.
The tab offers advanced settings for right/left value respective top/bottom value. The values can be defined in identical tabs positioned below each other.

**automatic:** The value is automatically determined from the corresponding data object.

- **adapted to visible x-range:** This option is only available for Y-axes. If enabled, the values for top/bottom are only determined from the visible area.

**manual:** The value is manually entered.

**Formula:** The value is determined via a formula.

**Dataobject:** The value is set via data object (single value).

**List of values:** The value is determined via a value list. The individual values of the list are separated by semicolons. Values recognised correctly are displayed in the tooltip. A syntax error is marked by red background color. The respective value to be used from the entered list is determined as follows: For the minimum (left or bottom) either the smallest value from the list or the highest value which is smaller than the data minimum is used. For the maximum (right or top) either the highest value from the list or the smallest value which is higher than the data maximum is used.

*Example:* The value list for the maximum contains "10; 100; 1000; 10000". Depending on the selected data object the applicable value is determined. If e.g. the maximum of the data is 90, the next higher value from the list, i.e. 100, is used for the axis maximum. If the maximum of the data is 1500 or also 15000, the highest value from the list, i.e. 10000, is used in both cases.

**optimized:** The value is adapted if necessary, so that smooth axis areas are generated for the defined number of intervals.

**publish value:** The axis limit can be published to a new data object (single value) which can be used in other components.
**minimal display range:** Defines a minimum display range that should not be underrun. If the actually necessary display range is smaller than the minimum value, the display range is enlarged in both directions up to the defined minimum display range.

*Example: If the actually necessary display range is at \(-7.5 \ldots +12.5\) (range = 20) but the minimum range is 25, then the display range is enlarged to \(-10 \ldots +15\).*

**no values range:** These setting apply if the values range cannot be determined automatically, e.g. in case of empty channels.

**Numberformat:** Defines the number format of the chart’s axis scaling. With *octav* selected this option is not available, with *log (base 10)* or *log (base 2)* only if *optimized* is deactivated.

- **7.1426:** A standard number format – the number is displayed without rounding.
- **7.14E0:** Scientific notation for large numbers.
- **7.143 | 7.143E8:** Automatic selection of decimal or exponential format.
- **00:00:07.1:** A format for time specifications.
- **7°08.6:** A format for angular measurement (7° 08.6 s).
- **7°08m33:** A format for angular measurement (7° 08 min 33 s).
- **E 007°08.56**: A format for local coordinates. West and east are stated in degrees (°) and minutes (’).
- **E 007°08’33”:** A format for local coordinates. West and east are stated in degrees (°), minutes (’) and seconds (”).
- **N 07°08.56**: A format for local coordinates. North and south are stated in degrees (°) and minutes (’).
- **N 07°08’33”:** A format for local coordinates. North and south are stated in degrees (°), minutes (’) and seconds (”).
- **0b110 01110101:** A format for binary numbers.
- **0o76 2354:** A format for oktav numbers.
- **0xf1 a0bb:** A format for hexadecimal numbers.

**Digits:** Defines the decimal place of the numbers at the axes. This option is only enabled if *optimized* and *octav* are deselected.

**Grouping:** If this option is selected, each three digits are grouped by the thousands separator.

**Major ticks:** The number of major ticks of the scaling at which numbers and lines are displayed. A major tick is always shown at the minimum and maximum axis value.

- **Fix:** The scaling is set to N sections with the same distance.
- **Number:** The *Number* of major ticks can be defined.
- **optimized:** If this option is selected, and minimum and maximum are optimized, the number of intervals is adapted if necessary, so that smooth axis ranges are created.

**Reference/Delta:** The major ticks are displayed on the basis of a defined *Delta*, starting from the *Reference* value.
**Minor ticks**: The number of minor ticks of the scaling at which a line is displayed.

**with values**: The lines of the supporting intervals are additionally labelled. By using this option a reasonable visualisation of the intervals of a logarithmic display (to the base 10) is ensured.

![Example for a logarithmic display with the numbering of the supporting intervals](image)

**Tab Date/Time**

The axis range is divided into N identical ranges for date/time data object.

- **automatic**: Minimum and maximum of the axis are automatically determined from the corresponding date/time data object.
- **manual**: Minimum and maximum of the axis are manually set (**Right time**/**Left time** respective **Top/Bottom time**).
- **dataobjects**: Minimum and maximum of the axis are determined via data objects (single values) for **Right time** /**Left time**.

**Right time** /**Left time** respective **top/bottom time**: Is only enabled if **automatic** is deselected.

The minimum and maximum of the axis are manually entered as date/time value or a date/time data object is selected for each entry that contains the desired value.
**optimized**: Minimum and maximum are adapted if necessary, so that smooth axis areas are generated for the defined number of intervals.

**Major Ticks at**: The division of the major ticks is carried out manually via the following options.

- **fixed number of divisions**: The number of major ticks of the scaling at which numbers and lines are displayed.
- **at ... with a delta of ...**: Defines a fixed starting value and following major ticks.
- **month, plus every ... day**: Defines the intervals between the major ticks with a month plus a fixed number of days.
- **year, plus every ... month**: Defines the intervals between the major ticks with a year plus a fixed number of months.

**Format**: Defines the format for major ticks.

- **Second line**: A second line can optionally be generated for long time specifications.

**Minor ticks**: The number of minor ticks of the scaling at which a line is displayed.

**Time zone**: The time zone is set either to the system time zone (*my time zone*) or alternatively to a time zone selected from the list (*manual time zone*).

---

Example with a second line (see settings above)

**Tab Maps**

The axis range is divided into \( N \) identical section for values representing geographical coordinates.
**automatic**: The minimum and maximum of the axis are automatically determined from the corresponding data object with coordinates.

**manual**: The **Center** value manually defines the centre of the map on the axis. The minimum and maximum of the axis are automatically determined by the stated scaling.

**Center**: Defines the coordinate that is located in the centre of the axis.

**Scaling**: Defines the zoom of the map. The value defines how many kilometres correspond to one centimetre.

**Delta**: Defines the intervals between major ticks.

**Optimized**: Minimum and maximum are optimized, i.e. smooth axis ranges are created. At the same time intervals are automatically optimized.

**Minor ticks**: The number of minor ticks of the scaling at which a line is displayed.

**Note**: The grid is displayed behind the curves, i.e. they are not visible if there are overlying graphs with filled areas (e.g. maps).

**Tab Probability**

Probability axis with the inverse Gaussian distribution.

**Percent ranges**: Selection of the desired range.

**absolute**: The scaling values at the major ticks are displayed as absolute values.

**per cent**: The scaling values at the major ticks are displayed in per cent.
**Formula Editor:** The Embedded Formula Editor is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Axis Context Menu**

Axis settings can be copied and transferred to other axes. To do so the user has to right-click on the axis. A context menu opens and displays depending on the attributes of the selected axis for example the following content:

- **Modify:** Opens the modification dialog box of the axes.
- **Modify Subaxis:** Opens the dialog box Subaxis and Reference Points for defining additional reference points. A selected axis can be divided into sub axes that can be individually formatted regarding their scaling and line and marker properties.
- **Copy Settings of all Axes:** Copies the parameters of all axes to the clipboard so that they can be transferred to other axes.
- **Copy Settings of this Axis:** Copies the parameters of the selected axis to the clipboard so that they can be transferred to other axes.
- **Copy Axis Scaling:** Copies the scaling parameters of the selected axis to the clipboard so that they can be transferred to other axes.
- **Copy Axis Font:** Copies the font parameters of the selected axis to the clipboard so that they can be transferred to other axes.
- **Copy Axis Position:** Copies the position of the marked axis to the clipboard so that it can be transferred to other axes.
- **Paste:** Transfers the previously copied axis parameters of another axis to the selected axis. The text displayed in the context menu states the component copied to the clipboard, e.g. Paste Axis Scaling.
- **Edit axis group(s):** Axes of several graphs can be grouped and synchronized in axis groups.
- **As default:** The current settings of the selected axis are used as default settings for new axes of this type.
**Reset default:** Previously user-defined default settings for axes of the selected type are reset to the initial default settings.

**Dialog Subaxis and Reference Points**

![Subaxis and Reference Points dialog](image)

**Start** (0%) and **end point** (100%) of the axis are fixed. Inbetween additional reference points can be defined. The percentaged or absolute value can be defined manually or via data object. Between the reference points sub axes are created that can be formatted individually in the right side dialog concerning their scaling and line/marker properties. Note that with generated reference points the respective settings (scaling, color etc.) of the axis dialog have no effect.

**Properties:** When clicking on the button the parameters of the selected subaxis are displayed on the right side of the dialog box (property button is being disabled).

**New:** A new reference point is inserted at this position.

**Delete:** The selected reference point (this line) is deleted.

**equal distribution for all sub axes:** If this option is selected, the percentaged and absolute values (position and value) are determined in proportion to each other. When a position is entered the corresponding value is automatically calculated and vice versa. This option is useful in the case that the individual areas shall only have different formatting without changing the proportions. If this option is deactivated, position and value can be set independently and thus the proportions of the curve can be changed.

**Dialog Properties Sub-axis (right) - Axis**

The settings for the scaling and intervals of the sub axis are analogue to the settings of **Axis Min/Max** (only applicable settings).
Dialog Properties Sub-axis (right) - Line

These settings are only visible if the option show lines (Tab Line) is enabled in the curve properties.

**own line properties**: Enables the individual settings for line properties. Otherwise the parameters of the general curve properties are used.

**own line color**: Enables the individual settings for the line color. Otherwise the parameters of the general curve properties are used.

The settings are analogue to the settings of the curve properties - Tab Line (only applicable settings).
Dialog Properties Sub-axis (right) - Marker

**own marker properties**: Enables the individual settings for marker properties. Otherwise the parameters of the general curve properties are used. The settings are analogue to the settings of the curve properties - Tab Marker (only applicable settings).

**show marker**: Markers are shown regardless of whether they are enabled in the curve properties.

**own marker color**: Enables the individual settings for marker colors (border and filling). The settings are analogue to the settings of the curve properties - Tab Marker (only applicable settings).

**Manual shifting of reference points**: When an axis with reference points is clicked, the shifting rectangle is displayed with the defined reference points. Via the shifting spots, the reference points can be modified using the mouse. The modified percentage values of the position are adapted accordingly in the dialog. The individual reference points can only be shifted manually if the option *equal distribution for all sub axes* is deactivated.
Example for an axis with additional reference point.

**Axis Groups**

Axes of several graphs can be grouped and synchronizes in axis groups. The synchronisation effects that shifting or zooming one of the grouped axes has the same effect on the other axes of the group. Thus, e.g. an axis can be zoomed and the other grouped axes zoom as well automatically.

The context menu of the diagram axis contains the new item **Edit axis group(s)**. The following dialog opens:

```
<table>
<thead>
<tr>
<th>Axis Group Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis group: - - - -</td>
</tr>
<tr>
<td>OK</td>
</tr>
</tbody>
</table>
```

**Axis group**: An existing group can be selected from the list, or a new name for a group to be generated can be entered in the field. The axis from which the context menu has been opened, is added to the selected group with OK. If a new group name has been entered, the group is automatically generated with the current axis via OK. Axes can only be member of one group at a time. If the axis shall not be contained in any group, the "- - - -" item is to be selected.

**Edit all axis groups**: For complex modifications this button can be used to open the following dialog where all axis groups can be edited:
The left part shows all axes of the project which are not yet grouped. The line above the list can be used to filter the axes.

The right part shows the existing groups. Axes can be added to or removed from the groups by using the arrow keys in the middle part. When adding an axis, a group name or **New Group** has to be selected from the list below. In case of **New Group** a new name is requested.

Axes can also be added or removed by Drag&Drop. If empty groups arise, they are automatically deleted.

**OK**: Changes are applied and the dialog closed.

**Apply**: The changes are applied and the dialog remains open.

**Cancel**: The dialog is closed and changes are dismissed.

**?**: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
2.9.1.4 Legend

A legend is used in charts and tables to display additional information about displayed curves and their axes or about individual table columns. It is created via the context menu item Modify...Legend of suitable graphic objects. If the legend is visible, it can be placed at any position in or beside the graphic object.

In case of diagrams the legend shows the curve shape, e.g. line, the curve color including defined gradients and the origin of the displayed data. The representation of the curve shape (detailed, simple, only color) can be defined in the dialog of the respective curve. This example displays the X data object, e.g. auto (X), and the Y data object, e.g. EFX COU SUP HVG, with its producer, e.g. 98_7707. The legend also gives information about the assignment of the axes: the text color of the entry corresponds with the color of the assigned axis.

In case of tables, all columns of type Channel are displayed in the legend as long as they are enabled for the legend. If conditional text and fill colors are defined, the color gradients (scaled or discrete color definitions) are displayed as well. The legend may show the respective Y data object, e.g. channel name, and the producer.

The modification dialog box is opened by a double click on the chart’s legend or via the context menu (Modify...Legend) that opens by a right-click on the chart.

In some dialog boxes of graphic objects exists the button Legend that also opens the dialog box.
**visible:** Defines whether the legend is drawn or not.

**show X Data Object:** Shows the name of the data object with values for the horizontal direction.

**show Y Data Object:** Shows the name of the data object with values for the vertical direction.

**show Data Producer:** Shows additionally the producer’s name of the respective data object.

**items per line:** Defines the number of legend entries that are to be displayed per line. This option is only available with top or bottomn position of the legend.

**optimized:** If this option is selected, the maximum number of columns in the legend is automatically determined by the legend entries to be displayed. The column division is adjusted accordingly when the legend is changed in size. This option is only available with automatic layout.

**Font:** Defines the font, size and style (bold and/or italic) of the legend text.

Note: The color of the data object name is in accordance with the corresponding axis color.

**with frame:** The legend is framed. The frame color and line width (in pixels) can be determined by the user.

**background filled:** States the background color of the legend.
**transparent:** Defines the transparency of the legend’s background color in per cent.

**Displayed line width:** The line width can be defined either automatically (by adopting the curve property) or manually.

**automatic layout:** The legend is placed automatically in the graphic object (top, bottom, right, left).

  - **limit to curves:** The legend is limited to the curve range.

**manual layout:** Manual positioning of the legend:

  - **Location:** Defines the origin for positioning in X and Y direction. The values are defined in a range from 0 to 100%, taking the left upper corner of the chart as starting point.
  - **Size:** Defines the **width** and **height** of the legend taking the origin as starting point.
  - **Orientation:** Defines the legend’s orientation (**horizontal** or **vertical**).

**OK:** Changes are applied and the dialog closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

[?] : The context sensitive help is activated and the cursor changes to 🔍. The respective help topic is displayed when an area within the dialog is clicked on.

### Legend Context Menu

The legend settings can be transferred to other legends as well. The context menu is opened with a right-click on the legend. The following content is displayed:

- **Set Legend Invisible:** Sets the legend of a graphic object to visible or invisible.
- **Modify Legend:** Opens the legend’s modification dialog box.
- **Copy Legend Setting:** Copies the legend’s settings so that they can be transferred to other legends.
- **Paste Legend Setting:** Applies the previously copied settings of another legend to the active legend.
- **top (automatic) / left (automatic) / bottom (automatic) / right (automatic):** Positions the legend automatically on the basis of the selected settings.
- **manual layout:** The settings for the manual positioning of the legend are adopted.
- **As default:** The current settings of the selected legend are used as default settings for new legends.
- **Reset default:** Previously user-defined default settings for legends are reset to the initial default settings.
2.9.1.5 Limits

Limits can be defined in a line chart for displaying additional information about the displayed curve. Limits are fixed with regard to the settings.

The modification dialog box for limits is opened via the button **Limits** in the line chart dialog box or via context menu (Modify... Limits) that opens with a right-click on the chart. At first there are no limits defined. The first limit is enabled by selecting **Limits visible**. Further limits are created via **Add**. The content of the following dialog box shows the settings of the image displayed above.

**Limits visible**: Defines whether the limits are drawn or not.

**Font**: Defines the font, size and style (bold and/or italic) of the text displayed at the limit.

**hor.**: A horizontal line is drawn.

**ver.**: A vertical line is drawn.

**x-A**: For entering the axis index (X) which the limit refers to.
**y-A:** For entering the axis index (Y) which the limit refers to.

**Value:** Defines the value at which a line is drawn. The value refers to the selected axis (index) as selected before, i.e. for a horizontal limit the Y-value is set, for a vertical limit the X-value is set.

**Line width:** The line width is selected in the selection list.

**Line type:** The line type is selected in the selection list.

**Color:** Defines the color of the limit line and the text.

**Label:** Input of the text at the line of the limit.

**Position:** The text position in relation to the width of the curve range (in per cent).

**Delete:** The last limit in the list is deleted.

**Add:** Adds a new limit to the list.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to 

```
?: The context sensitive help is activated and the cursor changes to 
```

The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.1.6 Cursor

Up to 50 cursors can be defined in a line chart in order to display additional information about the displayed curve. Every cursor and its settings are clearly represented in individual tabs. Cursors can be moved via mouse or controlled by data objects.

The buttons **Analysis Cursor** and **Delta Cursor** offer the possibility to generate predefined, interrelated cursor sets whose parameters are set automatically. Additional manual parameterisation is not necessary.

All cursor settings can be transferred to another cursor by using the button **Duplicate.**
The modification dialog box for cursors is opened via the button **Cursor** in the line chart dialog box or via context menu (**Modify... Cursor**) that opens with a right-click on the chart. If a cursor modifiable by mouse is already defined, the dialog box is also opened with a double click on the cursor.

If no cursor is defined, a small dialog box opens at first. Predefined cursors can be generated or a new cursor is manually defined.

### Analysis Cursorset

Every curve has a predefined cursor. All cursors are linked and can be moved by moving the first cursor. The X-, Y- and index values of the curves are displayed at the cursor as tooltip. The window **Curve Analysis using Cursor** displays all X- and Y-values of the curve.

### Delta Cursorset

Every curve automatically gets 2 predefined cursors, i.e. there are 2 linked cursor sets that can be moved by moving the respective first cursor. The X-, Y- and index values of the curves are displayed at the cursor as tooltip. The window **Curve Analysis using Cursor** displays the X- and Y-values of both cursors, the delta of the Y-values and the gradient.
The **Curve Analysis using Cursor** window for the **Analysis Cursorset** respective **Delta Cursorset**

![Image of Curve Analysis using Cursor](image1)

![Image of Curve Analysis using Cursor](image2)

After generating a cursor or cursor set the whole modification dialog box is displayed. The content of the following dialog boxes shows the settings for the blue cursor in the first chart. The data object *Acceleration-MaxX* was generated with the calculation **Extract Statistical Values** and contains the X-value at the maximum of the data object *Acceleration*. This cursor is bound to the values of curve 1 in the line chart.

![Image of Modify Cursor Set](image3)
The second cursor (red) is controlled by a data object containing the mean value of the curve. The following dialog displays the settings:

![Modify Cursor Set dialog](image)

**Analysis Cursorset**: Generates an **Analysis Cursorset**.

Note: all cursors defined before are overwritten!

**Delta Cursorset**: Generates a **Delta Cursorset**.

Note: all cursors defined before are overwritten!

**Clear Cursorset**: Deletes all cursors.

**New**: Creates a new cursor.

**Duplicate**: Duplicates the selected cursor. All settings of the cursor are transferred to the new cursor.

**Delete**: Deletes the selected cursor.

**Delete All**: Deletes all cursors.

**Printable**: If selected, the cursors are printed. This option is enabled/disabled for the whole cursor set.
Tab 1, 2, ...
Parameterisation area for the individual cursors.

**visible**: Defines whether the cursor is drawn or not.

**Color**: Defines the color of cursor line and text.

- **take diagram color**: The color of the respective curve is used. Thus it is possible to generate at once several cursors with the respective curve color using the command **For each sub diagram** under **Diagram Relation**.

**Changeable by Mouse**: The cursor contains a small triangle at the corresponding axis which allows moving the mouse with the cursor.

**dynamic Update**: As soon as the cursor is moved (via mouse or controlled by data objects) the chart is automatically updated.

**Show out of range**: If the cursor is located outside of the visible diagram area, this is indicated by a dashed vertical line at the left/right margin. This line can be clicked again and moved from there. Additionally, the cursor can be centered via context menu of the diagram. If the cursor is located outside of the related diagram, i.e. there is no y-value, a dashed horizontal line labelled ‘out of range’ is displayed at the upper margin in case this option is selected. Otherwise no cursor is displayed.

**Related to**: If the cursor is not bound to a curve, an axis which the cursor relates to can be assigned to this cursor. Optionally, the cursor can be set to the center position of the respective axis (C).

**Preset Value**: If no control data object is defined in the combo box the cursor is set to this value.

**Controlled by**: An X- respective Y-value is selected from a list of available data objects (single values of the type DOUBLE_VALUE). The value is adopted by the cursor.

**Show line**: If enabled, a vertical respective horizontal line is drawn at the corresponding cursor value.

**Text Label**: A text to be displayed at the cursor can be entered in the input field. If the option **Value as Label** is activated, the value is displayed behind the text. Using the N / C or D buttons in the bottom line the text can be formatted as **multi-language text**.

**Value as Label**: Displays the cursor value, optionally with or without **Unit**.

**Format**: The cursor value can be individually formatted.

- **own format**: The button opens the dialog **Configure Formatter** where detailed format properties can be set.

- **format of axis + ... significant digits**: The stated decimal digits are displayed in addition to the number defined in the axis format.

**Publish Value**: If activated, the adjusted X-, Y- or Z-value of the cursor is published as a new data object and can be used in calculations or charts.
Diagram Relation

**Related to Diagram:** The cursor is bound to the values of the curve, i.e. the cursor is always located on the curve. The number at the beginning represents the curve index in the chart to whose value the cursor is bound.

**Subdiagram:** If this option is activated and a matrix or group of channels is selected above, the column or channel index can be selected here. If the option is deactivated, all Y-values are indicated in case of multidimensional data objects (for display as tooltip or publishing).

![Diagram Relation](image)

**For each sub diagram:** After a confirmation prompt a new cursor with the current settings is created for each subdiagram of the diagram. All other existing cursors that relate to this diagram are deleted.

**Show values as tooltip:** The X-, Y- and index values of the corresponding cursor are displayed as tooltip.

**Snap to input values:** If the cursor is moved, it latches at the curve’s input value that is located nearest.

**Preset Index:** If the cursor is not controlled, the index can be defined.

**Controlled by:** An index value is selected from a list of available data objects (single value of the type `INTEGER_VALUE`). The value is adopted by the cursor. If the X-value is already controlled by a data object, the data object selected here has no effect.

**Publish Index:** The defined cursor index is published as a new data object of the type `INTEGER_VALUE` and can be used in calculations or charts.

**Text Parameter**

Font settings of the cursor values displayed in the chart.

**Fontsize:** Defines the font size of the text displayed at the cursor.

**Auto coloring:** The text is displayed in the curve color. A different color can be defined optionally via `Fontcolor`.

**Background:** The area displaying the values in the chart can be drawn transparent. The opacity is variable.

**N / C / D:** These buttons (`New / Change / Delete`) can be used to define `Language Dependent Strings` for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (`std. / de / en / ...`) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.
**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

---

**Example of a Delta Cursor Set**

The cursors can be moved with the mouse. All values displayed in the chart and in the window **Curve Analysis using Cursor** are constantly updated.

If the cursor is located outside of the visible diagram area, this is indicated by a dashed vertical line at the left/right margin. This line can be clicked again and moved from there. The accompanying value display can also show values outside of the visible range. Via the command **Center the cursor** of the context menu the cursor can be centered.
2.9.1.7 Positioning and Alignment of Graphic Elements

For a better orientation in positioning and alignment of graphic elements, jBEAM offers rulers and grids. They can be activated and deactivated via Window- and page settings.

When graphic elements are moved or zoomed via mouse, they can be aligned along the grid by simultaneously pressing the <Ctrl> button. Simultaneously pressing the <Shift> button during zooming has the result that the proportions are maintained. During moving the <Shift> button effects the graphic element to snap into place in angles of 0°, 45° or 90°.

In case of zooming graphic elements containing text, these texts can be adapted in size by simultaneously pressing the <Alt> button. A detailed overlook of available mouse and buttons combinations shows the chapter Interactive Mouse Activities.

Additionally, to facilitate positioning and alignment of several graphic elements, reference lines are shown as soon as a moved element crosses an outline or centre line of a neighboring element. When the mouse button is released the graphic element snaps to the shown line or lines. Graphic elements can also snap to the grid while they are moved. These auxiliaries can be activated and deactivated both via Window- and page settings and the Preferencies→Graphic Defaults.

2.9.1.8 Interactive Mouse Activities

Interactive mouse activities at simple forms

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Everywhere</td>
<td>Selects the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Everywhere</td>
<td>Modification of the graphic element</td>
</tr>
</tbody>
</table>
### Interactive mouse activities at strings, tables, cockpit instruments, real-time graphics, ...

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Everywhere</td>
<td>Selects the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Everywhere</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Frame</td>
<td>Increase/decrease size</td>
</tr>
<tr>
<td></td>
<td>Vertical column boundaries (tables)</td>
<td>Increase/decrease size of the column width with alignment of the neighbouring column on the right</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Moves the whole graphic element</td>
</tr>
<tr>
<td>CTRL &amp; click &amp; move</td>
<td>Frame</td>
<td>Increases/decreases size on the given grid</td>
</tr>
<tr>
<td></td>
<td>Vertical column boundaries (tables)</td>
<td>Increase/decrease size of the column width with alignment of all following columns</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Moves the whole graphic element on the grid</td>
</tr>
<tr>
<td>SHIFT &amp; click &amp; move</td>
<td>Frame</td>
<td>Increases/decreases size while keeping the aspect ratio</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Moves the graphic element, the angle is always a multiple of 45°</td>
</tr>
<tr>
<td>ALT &amp; click &amp; move</td>
<td>Frame</td>
<td>Increases/decreases size with adapting the text size</td>
</tr>
<tr>
<td>Right mouse button</td>
<td>Everywhere</td>
<td>Graphic Element Context Menu</td>
</tr>
</tbody>
</table>

### Interactive mouse activities at 2D Graphs

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Everywhere</td>
<td>Selects the graphic element</td>
</tr>
<tr>
<td>Action</td>
<td>Selection</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Axes</td>
<td>Selects the axis</td>
<td></td>
</tr>
<tr>
<td>Legend</td>
<td>Selects the legend</td>
<td></td>
</tr>
<tr>
<td>Square with A or B in the right corner (graphic element is selected)</td>
<td>Shifts between standard view and zoomed view</td>
<td></td>
</tr>
</tbody>
</table>

### Double click

<table>
<thead>
<tr>
<th>Double click</th>
<th>Selection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axis</td>
<td>Modification of the axis</td>
<td></td>
</tr>
<tr>
<td>Legend</td>
<td>Modification of the legend</td>
<td></td>
</tr>
<tr>
<td>Cursor triangle</td>
<td>Modification of the cursor</td>
<td></td>
</tr>
<tr>
<td>Chart (Universal 2D-Graph)</td>
<td>Modification of the selected chart</td>
<td></td>
</tr>
</tbody>
</table>

### Click & move

<table>
<thead>
<tr>
<th>Click &amp; move</th>
<th>Selection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame</td>
<td>Increase/decrease size</td>
<td></td>
</tr>
<tr>
<td>Legend (black square)</td>
<td>Increase/decrease size of the legend</td>
<td></td>
</tr>
<tr>
<td>Axis (black square)</td>
<td>Increase/decrease size of the axis</td>
<td></td>
</tr>
<tr>
<td>Legend (if selected)</td>
<td>Moves the legend</td>
<td></td>
</tr>
<tr>
<td>Axis (if selected)</td>
<td>Moves the axis from top to bottom/left to right and vice versa; In case of several axes: Changes the order of the axes (with Y-axis: drop axis left of the center of an axis -&gt; axis is pasted directly before the other axis, otherwise directly after the axis; with X-axis respectively above/below of the center)</td>
<td></td>
</tr>
<tr>
<td>Cursor triangle</td>
<td>Moves the cursor (only if changeable by mouse)</td>
<td></td>
</tr>
</tbody>
</table>

### CTRL & mouse wheel

<table>
<thead>
<tr>
<th>CTRL &amp; mouse wheel</th>
<th>Selection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart area</td>
<td>Zooms the chart, switches the system of coordinates to system B</td>
<td></td>
</tr>
<tr>
<td>Axes</td>
<td>Zooms the axes, switches the system of coordinates to system B</td>
<td></td>
</tr>
</tbody>
</table>

### CTRL & SHIFT & mouse wheel

<table>
<thead>
<tr>
<th>CTRL &amp; SHIFT &amp; mouse wheel</th>
<th>Selection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axes</td>
<td>Shifts the value range of the axis, switches the system of coordinates to system B</td>
<td></td>
</tr>
</tbody>
</table>

### CTRL & click & move

<table>
<thead>
<tr>
<th>CTRL &amp; click &amp; move</th>
<th>Selection</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chart area</td>
<td>Moves the chart in the system of coordinates, switches the system of coordinates to system B</td>
<td></td>
</tr>
<tr>
<td>Axes</td>
<td>Changes the axis scaling, switches the system of coordinates to system B</td>
<td></td>
</tr>
<tr>
<td>Frame</td>
<td>Increases/decreases size on the given grid</td>
<td></td>
</tr>
</tbody>
</table>
### Title area
- Moves the whole graphic element on the grid

<table>
<thead>
<tr>
<th>Action</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SHIFT &amp; click &amp; move</strong></td>
<td>Frame</td>
<td>Increases/decreases size while keeping the aspect ratio</td>
</tr>
<tr>
<td><strong>ALT &amp; click &amp; move</strong></td>
<td>Frame</td>
<td>Increases/decreases size with adapting the text size</td>
</tr>
<tr>
<td><strong>CTRL &amp; ALT &amp; click &amp; move</strong></td>
<td>Chart area</td>
<td>Close up on a zoom area and switches to system B</td>
</tr>
<tr>
<td><strong>CTRL &amp; SHIFT &amp; click &amp; move</strong></td>
<td>Chart area</td>
<td>Moves the diagram within the axis system either in X- or in Y-direction, switches to system B</td>
</tr>
<tr>
<td><strong>Right mouse button</strong></td>
<td>Axes</td>
<td><strong>Axis Context Menu</strong></td>
</tr>
<tr>
<td></td>
<td>Legend</td>
<td><strong>Legend Context Menu</strong></td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td><strong>Graphic Element Context Menu</strong></td>
</tr>
</tbody>
</table>

If set to not modifiable, all actions regarding moving, changing size and modifying the graphic objects cannot be carried out. Only zooming is enabled (pressing STRG is omitted then).

#### Interactive mouse activities at Universal 3D Graphs

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single click</strong></td>
<td>Everywhere</td>
<td>Selects the graphic element</td>
</tr>
<tr>
<td><strong>Double click</strong></td>
<td>Legend</td>
<td>Modification of the legend</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td><strong>Click &amp; move</strong></td>
<td>Frame</td>
<td>Increase/decrease size</td>
</tr>
<tr>
<td></td>
<td>Triangle</td>
<td>Changes the view</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Moves the whole graphic element</td>
</tr>
<tr>
<td><strong>CTRL &amp; click &amp; move</strong></td>
<td>Frame</td>
<td>Increases/decreases size on the given grid</td>
</tr>
<tr>
<td></td>
<td>Title, legend</td>
<td>Moves the whole graphic element on the grid</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Turns the view</td>
</tr>
<tr>
<td><strong>SHIFT &amp; click &amp; move</strong></td>
<td>Corners</td>
<td>Increases/decreases size while keeping the aspect ratio</td>
</tr>
<tr>
<td></td>
<td>Else (except triangle)</td>
<td>Moves the graphic element, the angle is always a multiple of 45°</td>
</tr>
<tr>
<td><strong>ALT &amp; click &amp; move</strong></td>
<td>Frame</td>
<td>Increases/decreases size with adapting the text size</td>
</tr>
<tr>
<td><strong>Right mouse button</strong></td>
<td>Legend</td>
<td><strong>Legend Context Menu</strong></td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td><strong>Graphic Element Context Menu</strong></td>
</tr>
</tbody>
</table>
If set to not modifiable, all actions regarding moving, changing size and modifying the graphic objects cannot be carried out. Only zooming is enabled (via CTRL & mouse wheel) or changing the 3D perspective (via rectangle or CTRL & click & move).

2.9.1.9 Context Menus

Graphic Element Context Menu

The general context menu consists of the following menu items depending on the active graphic element:

Maximize and Modify: The active graphic element is displayed enlarged in a separate window. Diverse settings can be performed in this window and then saved by OK or Apply or dismissed by Cancel. For further settings the modification dialog of the graphic element can be opened by double-click. Furthermore the zoom factor for text display can be set.

Modify: Opens the modification dialog box of the selected graphic element. If several graphic elements are selected, the element which the mouse points to is opened.

Properties: Opens the Properties dialog box of the selected graphic elements.

Replace Data: Opens the dialog box Input replace of the selected graphic elements.

Copy: Copies the selected graphic elements from the Clipboard.

Copy as: By opening the submenu the format can be selected that shall be used to copy the selected graphic elements into the Clipboard. Available formats are: BGE (jBEAM graphic element), PNG (Portable Network Graphics), EMF (Windows Enhanced Metafile), SVG (Scalable Vector Graphics), SWF (Shockwave Flash) and PDF (Portable Document Format).

Cut: Copies the selected graphic elements from the Clipboard and deletes them.

Duplicate: Duplicates the selected graphic elements.

Save as graphic template: Opens the dialog box for saving the selected graphic elements as graphic template. Graphic templates are saved with the file extension *.blf and can be used in projects via the Template Manager.

Save as: Opens the dialog box for exporting the selected graphic elements. The desired file type is selected in the dialog box. Various image formats like JPEG, Bitmap or PDF as well as the jBEAM project file can be selected. If saved as a jBEAM project file, additionally all
components are saved that are needed for the selected graphic objects, i.e. importers, generators, calculations etc.

**Delete/delete active:** Deletes the selected graphic elements.

**Maximize:** The graphic element is enlarged so that it fills the available space completely. If it is within a page border it is enlarged up to the complete page. If the graphic element extends over the page border in canvas mode, it is enlarged to the full size of all pages partly covered.

**Order:** By opening the submenu the selected graphic elements can be moved to the front (**Bring to Front**), one level forward (**Bring Forward**), one level backward (**Send Backward**) or to the background (**Send to Back**).

**Insert data objects from clipboard:** In case of graphic elements which use data objects, these data objects can be inserted directly via context menu. For this, a data object has to be copied to the clipboard first. This might be the name of the data object (text) or the data object entry in the Explorer window.

**Display statistic:** A window opens showing the statistical values and properties.

**Display history:** A window opens showing the history.

**Display data table:** A window opens showing the data table.

**As default:** The current settings of the selected graphic element are used as default settings for new graphic elements of this type.

**Reset default:** Previously user-defined default settings for graphic elements of the selected type are reset to the initial default settings.

If several graphic elements are selected, additional options for grouping and aligning the elements are available:

**Group:** Groups the selected graphic elements.

**Group components:** The selected graphic elements and possibly selected calculations in the Explorer are combined to a component group.

The dialog **Modify component group** is opened. Calculations that are not selected but dependend on the components to be grouped are included in the group. If only the first and last calculations of a calculation chain are selected, all other calculations of the chain are also grouped.

**Ungroup:** Ungroups the selected group or component group.

**Alignment:** By opening the submenu the following options are available to align the selected graphic elements:

- **left / right / top / bottom:** Aligns the selected graphic elements at the appropriate line in vertical or horizontal direction.
- **side by side / below each other:** Aligns the selected graphic elements so that they are positioned next to each other or one below the other without space in between.
Universal 2D Graph Context Menu

The context menu of the Universal 2D Graph offers additional entries for fast access to individual elements:

**Open Quick View**: The window with the [Quickview with Dual-Cursor](#) opens.

**Modify... Axis**: The [Axis dialog](#) opens.

**Modify... Legend**: The [Legend dialog](#) opens.

**Modify... Limits**: The [Limits dialog](#) opens.

**Modify... Cursor / New... Cursor**: The [Cursor dialog](#) opens. If there is not yet exists a cursor, a new one is created.

**Center the cursor**: The selected cursor can be centered within the visible diagram area. A submenu lists all available cursors.

**Modify... Curve...**: The curve dialog depending on the respective curve type opens.

**Modify all curves**: The dialog for configuration of all contained curves opens. Only the parameters applying to all curves can be modified.

With a selected diagram (line/points diagram) in the Universal 2D graph, the context menu contains additional specific entries:

**As curve default configuration**: The current settings of the selected diagram are used as default for new diagrams.

**Copy parameters of diagram**: The current settings of the selected diagram are copied and can be transferred to another diagram.

**Paste parameters of diagram**: The settings copied before are transferred to the currently selected diagram.
When copying the diagram settings, the elements to be copied (line, marker, bar settings etc.) can be selected in a separate dialog. The listed elements correspond with the tabs in the dialog of the line/points diagram. The selection of elements effects the copying of the settings of the respective tab. The input data objects of the diagram are not copied.

Isolines Context Menu

In the Universal 2D Graph isolines and isoline labels can be manually modified for characteristic map diagrams*. If isolines shall be modified in a characteristic map graph, the graph has to be converted into a Universal 2D Graph first via context menu (right click on the graph).

A right click on the map diagram in the Universal 2D Graph opens the context menu with the settings for isolines:

Add Isolines: The mouse cursor changes \( \overset{\text{\textbullet}}{\text{\textbullet}} \). If clicking on any place of the map with the left mouse button, the dialog Isolnies Modify (without delete option) opens. Depending on the position of the click a value for a new isoline is suggested and the color is automatically calculated. The value for the isoline can be adjusted (rounded) and further settings can be carried out. This mode can be quitte via the Cancel button in the dialog box or by clicking outside of the diagram of the same graph.

Delete Isolines: The mouse pointer changes \( \overset{\text{\textbullet}}{\text{\textbullet}} \). By clicking on an existing isoline it is deleted. By drawing up a rectangle all isolines in this area are deleted. The mode is left by clicking or drawing up a rectangle on an area with no isolines.

Add Isolines Labels: The mouse pointer changes \( \overset{\text{\textbullet}}{\text{\textbullet}} \). By clicking on an isoline a label is inserted at this position. By drawing up a line labels are inserted at all intersections with isolines. By clicking on an area with no isolines the mode is quitte.
Delete Isolines Labels: The mouse pointer changes ( ). By clicking on a label it is deleted. By drawing up a rectangle all labels are deleted from the area. By clicking on an area that contains no label the mode is quitted.

Isolines Labels: Options to modify the isoline label.

Automatic Labels: The labels are automatically arranged and all manual label settings are reversed. When inserting a new isoline the automatic label settings are used.

Manual Labels: All label positions are saved. When inserting a new isoline it does not receive a label.

Three vertical Stripes: Three vertical stripes are drawn virtually at \( \frac{1}{4} \), \( \frac{1}{2} \) and \( \frac{3}{4} \) of the X-values. Isoline labels are displayed at the intersections.

Three horizontal Stripes: Three horizontal stripes are drawn virtually at \( \frac{1}{4} \), \( \frac{1}{2} \) and \( \frac{3}{4} \) of the Y-values. Isoline labels are displayed at the intersections.

Existing isolines can be modified by double clicking on an isoline. The dialog box Isoline opens. The isoline can also be selected via left mouse button and the context menu can be opened via right mouse button. Modify opens the dialog box, Delete deletes the isoline. The settings of the isoline can also be saved As default an later be used as template for new isolines.

If the Value of the isoline is changed the isoline will be shifted to a new position. Adapt color calculates the color for the new value (by means of the superior settings). The line width is defined via Line. The line can be drawn dashed and/or with Label. The number of decimal places can be defined via Digits. Furthermore, Area color, Font and label angle can be set.

Depending on the type of the graphic element additional functions are also offered. These functions are described when dealing with the respective graphic element.
Context Menu Page

The context menu of the drawing area contains mainly menu items for modifying and setting the view:

**Undo**: The last action is undone.

**Redo**: The last undone action can be redone.

**Copy**: The selected element is copied to the clipboard.

**Insert**: The element contained in the clipboard is inserted at the mouse position.

**Select all**: All elements of the active page are selected.

**Delete all**: All elements of the active page are deleted.

**Save as subproject**...: Opens a dialog box for saving the project. The active graphic page can be saved either as jBEAM project file or as jBEAM project template. All graphic elements of the active page as well as all components needed for the graphic objects (i.e. importer, generators, calculations etc.) are saved in the jBEAM project file.

**Save as layout**...: When the graphic page is in page mode, the content can be saved as layout file (*.blf). There, all graphic elements of the active page are saved without data.

**Replace data**...: Opens the dialog box for replacing data of the graphic elements of the active page.

**Header / Footer**: Opens the graphic area of the header respective footer.

**Page View**: Changes between the view of individual pages (page mode) and the view of the whole drawing area (canvas mode).

**Editable**: Changes between the editing mode and the non-editing mode.

**Window and page settings**...: The dialog Window and page settings enables the configuration of general settings for the active graphic window or page, like e.g. zoom or grid.

### 2.9.2 Mark Objects

Go to:

**Graph Editor**

**Mark Objects**

This function is used to select elements in the Graphic window.
2.9.3  Simple Forms

Go to:

Graph Editor

Simple Forms

The menu item is divided into:

- Line
- Rectangle
- Circle
- Curved Line
- Speechbox
- Tabbed Graphic Area

2.9.3.1  Line

Graph Editor

Simple Forms

Line

Upon calling this function a line is drawn in the currently selected Graphic window.

A line can be described in the modification dialog box or manually. A single mouse click selects the line and circles become visible at both ends. The line can be moved via mouse. Length and position of the line are changed by moving the circles. A double click opens the modification dialog box.

A right click opens the context menu. See also Interactive Mouse Activities.
Line: For defining the line properties.

Color: Defines the line color.

Width: Defines the line width in pixels.

Dashed: The line can optionally be drawn with dashes. Different types are listed in the combo box or the user defines a type manually. The style of the dashes is stated as the relation of dash length respective gap to the line width. The 4 values mean: dash – gap – dash – gap.

Decoration:

Type: The beginning and end of the line can be decorated with special shapes like circle or arrow.

Size: Defines the size of the shape selected in Type for the beginning and end of the line.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new line is created with the current settings. The original graphic object remains unchanged.

Delete: The line is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.3.2 Rectangle

Go to:

**Graph Editor**

- Simple Forms
  - Rectangle

This function draws a rectangle into the currently selected Graphic window.

Position and size of the rectangle can be changed via mouse. For changing the size the circles on the rectangle frame have to be used. A double click opens the modification dialog box. A right click opens the context menu. See also Interactive Mouse Activities.

**Line**: Defines the frame around the rectangle.

**Color**: Defines the color of the rectangle frame.

**Width**: Defines the line width of the frame in pixels.

**Dashed**: The line can optionally be drawn with dashes. Different types are listed in the combo box or the user defines a type manually. The style of the dashes is states as the relation of dash length respective gap to the line width. The 4 values mean: dash – gap – dash – gap.

**Filled**: If enabled, the rectangle is filled according to the parameters stated below.

**Color**: Defines the fill color of the rectangle.

**Opacity**: Defines the degree of transparency of the fill color. If 100% is chosen, the rectangle is filled with the selected color and without any transparency.
**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new rectangle is created with the current settings. The original graphic object remains unchanged.

**Delete**: The rectangle is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ??. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.3.3 Circle

Go to:

**Graph Editor**
- **Simple Forms**
  - **Circle**

This function draws a circle in the currently selected Graphic window.

Position and size of the circle can be changed via mouse. To change the size the small circles on and around the graphic object can be used. A double click opens the modification dialog box. A right click opens the **context menu**. See also **Interactive Mouse Activities**.

![Circle dialog](image)

**Line**: Defines the frame of the circle.
**Color:** Defines the color of the circle frame.

**Width:** Defines the line width of the frame in pixels.

**Dashed:** The line can optionally be drawn with dashes. Different types are listed in the combo box or the user defines a type manually. The style of the dashes is states as the relation of dash length respective gap to the line width. The 4 values mean: dash – gap – dash – gap.

**Filled:** If enabled, the circle is filled according to the parameters stated below.

**Color:** Defines the fill color of the circle.

**Opacity:** Defines the degree of transparency of the fill color. If 100% is chosen, the circle is filled with the selected color and without any transparency.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new circle is created with the current settings. The original graphic object remains unchanged.

**Delete:** The circle is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.3.4 Curved Line

Go to:

**Graph Editor**

- Simple Forms
- Curved Line

This function draws a curved line in the currently selected Graphic window.

Position, length and curve of the line can be changed via mouse. For changing the bow the circle above or below the line is used. A double click opens the modification dialog box. A right click opens the [context menu](#). See also [Interactive Mouse Activities](#).
**Line**: For defining the line properties.

**Color**: Defines the color of the line.

**Width**: Defines the line width of the frame in pixels.

**Dashed**: The line can optionally be drawn with dashes. Different types are listed in the combo box or the user defines a type manually. The style of the dashes is stated as the relation of dash length respective gap to the line width. The 4 values mean: dash – gap – dash – gap.

**Start/End line type**: The beginning and end of the line can be decorated with special shapes like circle or arrow.

**Start/End line size**: Defines the size of the shape selected in **Type** for the beginning and end of the line.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new line is created with the current settings. The original graphic object remains unchanged.

**Delete**: The line is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.3.5 Speechbox

Go to:

**Graph Editor**

- Simple Forms
  - Speechbox

This function draws a speech box with text into the currently selected Graphic window.

Position and size of the graphic element can be changed via mouse. To change the size the marker points can be used. A double click opens the modification dialog box. A right click opens the context menu. See also Interactive Mouse Activities.
Name: Name of the graphic element.

Frame: Defines the line width and color of the speech balloon frame.

Filled: The speech balloon can be filled with a color or set to transparent.

Text and Formatting: Font size, font name and color of the speech balloon text are defined.

- **bold / italic / underlined**: The selected text passage is displayed bold, italic and/or underlined.

- **superscript / subscript**: The selected text passage is displayed superscript or subscript.

- **Alignment**: The selected text paragraph is left-aligned, centred or right-aligned.

Fontsize: Defines the font size for the selected text passage.

Fontname: Defines the font for the selected text passage.

Color: Defines the text color for the selected text passage via color selection button.

List: The selected text is formatted as a list with simple bullets.

Numbering: The selected text is formatted as a numbered list with automatically incrementing numbers.
**Automatic line break:** The whole text is formatted with an automatic line break. If a word does not fit into a line it is automatically wrapped down to the next line. By default, this option is deactivated for existing projects in order to maintain the original behaviour.

**Input field:** Input field for text. Each character can be individually formatted regarding font, size, style and color. Alignment, list and numbering apply to paragraphs, the automatic line break to the whole text. Title and text may contain embedded formulas.

**Formula Editor:** The Embedded Formula Editor is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object Speech box is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

![Context sensitive help](image)

: The context sensitive help is activated and the cursor changes to 🤔. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.3.6 Tabbed Graphic Area

Go to:

**Graph Editor**

→ Simple Forms

→ Tabbed Graphic Area

With this function several graphic areas can be created lying on top of each other. In each graphic area different content can be placed.

The graphic element consists of the title and the graphic area divided into tabs. Clicking on the tabs changes from one graphic area to the next. The individual tabs can themselves contain Tabbed Graphic Areas.

Position and size of the graphic element can be changed via mouse. A double click on the Graphic Area (outside of contained elements) opens the modification dialog box. A double click on a contained graphic element opens the respective dialog. A right click opens the context menu. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Tab font: Defines the properties of the tab text: font name, size and color as well as font style (bold and/or italic).

Tab selection controlled by: Optionally, the tab can be selected by another data object. The data object needs to be an integer value (single value or last value of a channel), e.g. created by a slider or a cursor.

Hide inactive tabs: If this option is enabled, only the selected tab is visible. All other tabs are hidden. This option is only available when the tabs are selected by a data object.
adjust the tab content by resizing: If the option yes is selected, the graphic elements contained in the tabs are resized when the Tabbed Graphic Area is resized. This way, the proportions are maintained. If the option no is selected, the size of the graphic elements remains unchanged. Protruding graphic elements are then not completely visible. With the option with scroll bar, the size of the graphic elements remains unchanged. Scrollbars are displayed to scroll to the hidden content.

Number of areas: Any number of lapping areas can be created. For each area, a line is displayed (Tab 1, Tab 2, ...). For each tab, an individual title can be entered which may contain formulas and Language Dependent Strings. Additionally a background color for the graphic area can be defined.

Formula Editor: The Embedded Formula Editor is opened via this button.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Tabbed Graphic Area Context Menu

A right click on a contained graphic element opens the context menu of the respective graphic element. A right click on the header area (title and tabs) opens the context menu of the Tabbed Graphic Area which contains the following menu items in addition to the general context menu:

Duplicate Tab: The active tab is duplicated and the new tab placed next behind the active tab.

Delete Tab: The active tab is deleted.

Append new Tab: A new tab is appended at the end.

Insert new Tab: A new tab is inserted in front of the active tab.
2.9.4 Text Elements

Go to:

Graph Editor

Text Elements

The menu item is divided into:

- Plain String
- Plain Text
- Formatted Text
- MathML Graphic
- Variable as Text

2.9.4.1 Plain String

Go to:

Graph Editor

Text Elements

Plain String

The graphic object Plain String is used for displaying a short single-line text displayed in a rectangle.

The text alignment within the rectangle can be defined as well as other parameters like the rotation of the graphic object, the background color and frame.

Moreover, the text can be linked to another graphic element, a web page or a file. When the link to a graphic element within the project is clicked the jump destination can be highlighted (to be set in preferences, tab Graphic elements).

Position and size of the rectangle can be changed manually via mouse. A right click opens the context menu. See also Interactive Mouse Activities.
String: Input box for text. Formulas can be entered as well. For this, the Formula Editor can be used.

Font: Defines font, size, color and style: bold and/or italic.

Alignment: Defines the text alignment within the rectangle. The combo box contains: top left/centre/right, centre left/centre/right, bottom left/centre/right.

Alignment buttons: Predefined alignments for fast access:

- Standard horizontal alignment: from left to right.
- Horizontal alignment rotated by -90°: from bottom to top.
- Horizontal alignment rotated by 90°: from top to bottom.
- Horizontal alignment rotated by -45°: from bottom left to top right.
- Standard vertical alignment: from top to bottom.
- Vertical alignment rotated by -90°: from left to right.
- Vertical alignment rotated by 90°: from right to left.
rotated by: If selected, the text and rectangle are rotated according to the defined degree (-180° bis 180°).

vertical arrangement: The individual characters are arranged one below the other (from top to bottom).

filled: If selected, the rectangle is filled with the selected Color and Opacity. At an opacity of 0% the filling is completely transparent, i.e. graphic objects situated behind the filling are visible. At 100% the color is displayed unchanged and graphic objects situated underneath are not visible.

with frame: If enabled, the rectangle displaying the text is framed with a selected Color and Width.

dashed: The line can optionally be drawn with dashes. Different types are listed in the combo box or the user defines a type manually. The style of the dashes is stated as the relation of dash length respective gap to the line width. The 4 values mean: dash – gap – dash – gap.

Link to: Optionally, the text can be linked to the following elements:

a graphic component: Link to a graphic component within the project. The display changes to the page or graphic window containing this graphic component.

a web page: Link to a web page. The page is opened in the set standard browser. On entering the web address, it is checked for completeness. If necessary elements such as "http:" are missing, the input field is highlighted in red color.

Example: http://www.amsonline.de

a file or folder: Link to a file or folder on the computer or linked network. File and folder are selected via the Choose File button. As soon as the link is clicked the application assigned to the file extension is opened.

Formula Editor: The Embedded Formula Editor is opened via this button.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / …) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new plain string is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object Plain String is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to "?: The respective help topic is displayed when an area within the dialog is clicked on.
2.9.4.2 Plain Text

Go to:

**Graph Editor**

**Text Elements**

**Plain Text**

The graphic object **Plain Text** is used for displaying any text.

The text can be formatted via tabulators. The title and text may contain [embedded Formulas](#).

The **Plain Text** consists of a title and the text area. Size and position of the text field are changed via mouse. A right click opens the [context menu](#). See also [Interactive Mouse Activities](#).

**Title**

This is an example of a plain text. The text can be formatted via tabulators. Like this, a tabular format is created.

**Modify Text**

[Image of Modify Text dialog box]

**Name**: Name of the graphic object.

**Title**: A title can optionally be defined.
Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Font: Defines the properties of the text displayed in the input field below.

Name: Defines the font.

Size: Defines the font size (manually or calculated with formula).

Bold/Italic: Defines the style: bold and/or italic (set manually or calculated with formula).

Color: Defines the text color either manually, via the button for color selection or by choosing predefined colors. The values for the coloring are thereby calculated with formula. See also the example for formulas in the Item Property Table.

Flashing: Optionally, the text of the text field (without title) can be flashing. Via Interval the frequency of the flashing can be set. The flashing option can also be linked to a Condition.

Alignment: Defines whether the text is left-aligned, centred, right-aligned or justified.

Characters per Tab: Defines the tabulator space in characters.

Predefined Tab Position: If enabled, the tabs are at the same position in all lines. If disabled, the tab space is geared to the end of the preceding text.

New: Language Dependent Strings can be changed for the input field via this button.

Input field: Input field for text. Formulas can be entered as well. For this, the Formula Editor can be used.

Formula Editor: Opens the Embedded Formula Editor. The title as well as text may contain embedded formulas.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new plain text is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object Plain Text is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.4.3 Formatted Text

Go to:

Graph Editor
  ➔ Text Elements
    ➔ Formatted Text

The graphic object Formatted Text is used for displaying any formatted text.

In contrast to the Plain Text every single character can be formatted separately. Title and text may contain embedded formulas.

The Formatted Text consists of a title and a text area.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

<table>
<thead>
<tr>
<th>Formatted Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>A <strong>bold</strong> text. An <em>italic</em> text. An underlined text. A superscript and subscript text.</td>
</tr>
<tr>
<td>A project file (with formula): Beispiel Text-jB7.jbs</td>
</tr>
</tbody>
</table>

- A list without numbering
- A list with numbering
Name: Name of the graphic element.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

**bold / italic / underlined:** The selected text passage is displayed bold, italic and/or underlined.

**superscript / subscript:** The selected text passage is displayed superscript or subscript.

Alignment: The selected text paragraph is left-aligned, centred or right-aligned.

Fontsize: Defines the font size for the selected text passage.

Fontname: Defines the font for the selected text passage.

Color: Defines the text color for the selected text passage via color selection button.

List: The selected text is formatted as a list with simple bullets.

Numbering: The selected text is formatted as a numbered list with automatically incrementing numbers.

Automatic line break: The whole text is formatted with an automatic line break. If a word does not fit into a line it is automatically wrapped down to the next line. By default, this option is deactivated for existing projects in order to maintain the original behaviour.

Input field: Input field for text. Each character can be individually formatted regarding font, size, style and color. Alignment, list and numbering apply to paragraphs, the automatic line break to the whole text. Title and text may contain embedded formulas.
**Formula Editor:** The [Embedded Formula Editor](#) is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define [Language Dependent Strings](#) for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new formatted text is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object [Formatted Text](#) is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.4.4 MathML Graphic

Go to:

- **Graph Editor**
  - **Text Elements**
    - **MathML Graphic**

The graphic object **MathML Graphic** allows the creation and display of formulas via MathML and the embedding of formulas from other programmes compatible with MathML.

The formulas can be generated directly in the dialog box via [Mathematical Markup Language](#) or imported from other programmes compatible with MathML (e.g. MS Word). Created formulas can be integrated into protocols without any problems.

The text graphic object contains a title and a text area.

If the definition of the formula is done manually, the syntax will automatically be searched for errors. If the code is not MathML compliant, the text is colored red. Else the text is displayed green.

Information regarding MathML can be taken from: [http://www.w3.org/Math](http://www.w3.org/Math)
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

MathML Code: For displaying or entering a formula definition in MathML syntax. Embedded formulas may be used which can be created via the Formula Editor. For this, the desired variable is marked in the code and the Formula Editor clicked. The created formula is integrated in the code by Paste Formula. In case of later modifications of the formula it is necessary that a complete term is marked before the Formula Editor is clicked. This is to ensure that the formula is implemented correctly. See Example.

Samples: Examples of formulas whose MathML code is displayed in the text field when clicking on the button.

Formula Editor: The Embedded Formula Editor is opened via this button.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object MathML Graphic is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to ↵. The respective help topic is displayed when an area within the dialog is clicked on.

Example: In the example formula \( \left( \frac{h}{k/2} \right) \) the \( h \) is replaced by the value of the data object \( My \ h \).

For a correct modification of the formula via Formula Editor a complete term must be marked, e.g. with enclosing < and > as in the image above. Other correct marks are:

- \(<\text{mi}!\![CDATA[@Value(DataItem("My h", "My h"),1)]]>\</\text{mi}>\) (with enclosing @)
- \(<\text{mi}!\![CDATA[@Value(DataItem("My h", "My h"),1)]]>\</\text{mi}>\) (only the formula)
2.9.4.5 Variable as Text

Go to:

Graph Editor

Text Elements

Variable as Text

The graphic object **Variable as Text** is used for displaying statistical or descriptive data (meta data) of a data object and secondly to display values of key-value lists (maps) or properties of components.

The graphic object consists of a title and a data section.

<table>
<thead>
<tr>
<th>Item Statistic</th>
<th>Item Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name: DatGen2</td>
<td>Name: DatGen2</td>
</tr>
<tr>
<td>Producer: DatGen2</td>
<td>Type: 802</td>
</tr>
<tr>
<td>Date: Oct 27, 2014</td>
<td>ProducerName: DatGen2</td>
</tr>
<tr>
<td>Time: 1:28:56 PM</td>
<td>Function: ( \sin(x^2)/x )</td>
</tr>
<tr>
<td>X-Unit: s</td>
<td>Datatype: DOUBLE</td>
</tr>
<tr>
<td>Unit: - - -</td>
<td>Storage: RAM</td>
</tr>
<tr>
<td>Values: 500</td>
<td>Mappen Werte</td>
</tr>
<tr>
<td>XOffset: 0.00 ( \mu ) s</td>
<td>test: Apr 11, 2013 2:59:16 F</td>
</tr>
<tr>
<td>DeltaX: 0.10 s</td>
<td>test2: Enum</td>
</tr>
<tr>
<td>Minimum: -5.46</td>
<td>Component Properties</td>
</tr>
<tr>
<td>Minimum at: 2.10 s</td>
<td>id: NumericChannelGener</td>
</tr>
<tr>
<td>Maximum: 10.21</td>
<td>Name: DatGen2</td>
</tr>
<tr>
<td>Maximum at: 1.10 s</td>
<td>Count: 500</td>
</tr>
<tr>
<td>Span: 15.66</td>
<td>Function: SIN_X2_X</td>
</tr>
<tr>
<td>Average: 0.19</td>
<td>Datatype: DOUBLE_64</td>
</tr>
<tr>
<td>Std. Deviation: 1.58</td>
<td>Storage: RAM</td>
</tr>
<tr>
<td>First Value: 0.00</td>
<td></td>
</tr>
<tr>
<td>Last Value: 0.23</td>
<td></td>
</tr>
</tbody>
</table>

A double click on the graphic element opens the modification dialog box. A right click opens the **context menu**. Position and size are changed via mouse. See also **Interactive Mouse Activities**.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**Font:** A [dialog box](#) opens for defining font, size, color and formatting of the title.

**Alignment:** Defines whether the title is left-aligned, centred or right-aligned.

**Font:** Defines the font, size and color of the table text. The font can additionally be displayed italic and/or bold.

**Parameter**

**Chars for Tab:** The column width of the first column is calculated from the stated number of characters multiplied by the character width of the selected font.

**Linedistance:** One ±: Defines an additional line pitch to the single spacing.
Alignment of value list: If a group of channels or maps is selected as data object, the values of the individual channels or maps can be displayed **below each other** or **side by side**.

Arrange values horizontally: If the option **side by side** was selected in the section **alignment of value list**, the separation of the values can be determined here.

Values separated by: The values of the individual channels of the group are displayed one after the other, separated by the selected character.

Column by column, chars for Tab: The values of the individual channels of the group are displayed in columns. The column width is defined by the number of character multiplied by the character width.

Infotype Tabs

Each tab contains a radio button that is automatically activated when the tab is selected. This indicates that by switching tabs the parameters are actually modified.

Infotype Item Statistic

**Input object**: Selection of the data object whose metadata are to be displayed.

**: Opens the **Filtered Selector of Dataitems** dialog for a fast selection from a large number of data items.

**Decimal digits**: Defines the number of decimal places for floating-point numbers.

**Items to be displayed**: The desired items can be selected for display. The labels of the items to be displayed can be edited in the text fields.

**All**: All items are selected.

**No**: All items are deselected.
**Clear Strings**: Deletes all text field entries listed in **Items to be displayed**.

**Init Strings**: Initialises the text fields of **Items to be displayed** with predefined strings.

### Infotype Item Properties

<table>
<thead>
<tr>
<th>Input object:</th>
<th>Selection of the data object whose metadata are to be displayed.</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Filtered Selector of Dataitems" /></td>
<td>Opens the <strong>Filtered Selector of Dataitems</strong> dialog for a fast selection from a large number of data items.</td>
</tr>
</tbody>
</table>

**Init with all properties**: If selected, all available keys (maximum 15) are listed and initialised with their corresponding properties.

**Label**: The labels of the keys are entered in this column. They are displayed in the first column of the resulting list.

**Key**: The desired key is selected from a list of available keys.

**Value**: The value assigned to the selected key is displayed in the second column of the resulting list.

### Infotype Map Values

<table>
<thead>
<tr>
<th>Input Map:</th>
<th>Selection of the data object whose metadata are to be displayed.</th>
</tr>
</thead>
</table>

**Init with all properties**: If selected, all available keys (maximum 15) are listed and initialised with their corresponding properties.

**Label**: The labels of the keys are entered in this column. They are displayed in the first column of the resulting list.

**Key**: The desired key is selected from a list of available keys.

**Value**: The value assigned to the selected key is displayed in the second column of the resulting list.

**Unit**: The unit assigned to the selected key is displayed in the third column of the resulting list.
**Input Map**: Selection of a **Map** data object whose values are to be displayed.

: Opens the **Filtered Selector of Dataitems** dialog for a fast selection from a large number of data items.

**Init with all properties**: If selected, all available keys (maximum 15) are listed and initialised with their corresponding properties.

**Label**: The labels of the keys are entered in this column. They are displayed in the first column of the resulting list.

**Key**: The desired key is selected from a list of available keys.

**Value**: The value assigned to the selected key is displayed in the second column of the resulting list. If a group of maps has been selected as Input Map, the corresponding values are displayed in additional columns. In the preview they are separated by semicolons.

**Unit**: Optionally, a unit can be displayed behind the value.

**Infotype Component Properties**

**Components**: Selection of the component whose values are to be displayed.

**Init with all properties**: If selected, all available keys (maximum 15) are listed and initialised with their corresponding properties. Keys that are not needed can simply be deleted in the preview list. Empty lines are not displayed in the resulting list.

**With system components**: If selected, the system components are displayed next to the project components in the combo box **Components**.

**Label**: The labels of the keys are entered in this column. They are displayed in the first column of the resulting list.

**Key**: The desired key is selected from a list of available keys.

**Value**: The value assigned to the selected key is displayed in the second column of the resulting list.
**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object *Variable as Text* is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

[?]: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.5 Tables

Go to:

**Graph Editor**

**Tables**

The menu item is divided into:

- Table of Contents
- Free Table
- Interactive Table
- Item Property Table
- Legend as Table
- Variable as Text
- Spreadsheet
- Matrix Table
- Realtime Table

### 2.9.5.1 Table of Contents

Go to:

**Graph Editor**

**Tables**

**Table of Contents**

The graphic object *Table of Contents* creates a table of contents with names,
chapter number and page number of the graphic objects used in jBEAM.

Each entry is linked to the corresponding graphic object. When the link is used the display changes to the page or area containing the graphic object. Optionally, the destination object can be highlighted (setting can be changed in the preferences, tab Graphic elements).

In order to include a graphic object in the table of contents the option Table of Contents has to be selected in the dialog box Properties.

The display of each level in the table of contents can be individually configured. A title can also consist of formulas that are calculated at run time.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

The entries of the Table of Contents are linked to their corresponding graphic objects and enable to jump to the respective position in the project or report. The jumped-to graphic object can be highlighted. This option can be set in Menu: Edit→Preferences→Graphic Elements.

Table of Contents

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plain Text</td>
</tr>
<tr>
<td>1.1</td>
<td>Formatted Text</td>
</tr>
<tr>
<td>1.2</td>
<td>Formatted Text</td>
</tr>
<tr>
<td>2</td>
<td>Digital Display</td>
</tr>
<tr>
<td>2.1</td>
<td>Bar Graph</td>
</tr>
<tr>
<td>2.2</td>
<td>Needle Indicator</td>
</tr>
</tbody>
</table>
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Visible up to level: The table of contents only shows elements up to the specified level. The choice is all or the levels 1 to 6.

Numbering up to level: The automatic numbering is only applied up to the specified level. Lower levels will not be numbered in the table of contents and the titles. The choice is all, none or the levels 1 to 6.

Keep chapters together: In case of splitted tables of contents, this option defines whether a chapter (level 1) is splitted or kept together, i.e. shifted to the next split part as a whole if it does not fit in the first part.

If this option is activated each part contains as much complete chapters as it is able to accommodate. If a chapter cannot be displayed completely in one part it is shifted to the next part.

If this option is deactivated each part displays as much entries as it is able to accommodate.

Level 1-6: For defining the parameters of the titles for each level.

Font: Defines font, size and color of the title and the style: bold and/or italic.

Indent of digit: The alignment of the chapter number is carried out with a right-aligned tab at the defined position.

Indent of label: The alignment of the title is carried out with a left-aligned tab at the defined position.

Line spacing before: The defined distance is kept above the entry line.

Line spacing after: The defined distance is kept below the entry line.
**Before page index:** Defines the filling between title and page number. One of the following options can be selected: no filling, filled with dots or filled with line.

**Formula Editor:** The Embedded Formula Editor is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new table of contents is created with the current settings. The original graphic object remains unchanged.

**Delete:** The table of contents is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** See tutorial Configuration of a Table of Contents.

### 2.9.5.2 Free Table

Go to:

**Graph Editor**

♂ Tables  ♂ Free Table

The Free Table is used for displaying diverse data in table form. Every column can contain values from data channels, manual texts or formulas. All texts that can be entered may consist of formulas calculated at run time.
The graphic object **Free Table** consists of a title and a column-wise text area that displays the defined data. The columns can be arranged vertical or horizontal. Every column has a header with up to 5 lines that can be defined generally or individually for each line.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size can be changed via mouse. See also [Interactive Mouse Activities](#).

<table>
<thead>
<tr>
<th>Goods group</th>
<th>Daily requirement</th>
<th>Weekly requirement</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>60</td>
<td>350.0</td>
<td>Golden Delicious</td>
</tr>
<tr>
<td>Pears</td>
<td>12</td>
<td>84.0</td>
<td></td>
</tr>
<tr>
<td>Strawberries</td>
<td>36</td>
<td>252.0</td>
<td>Strawberries, fresh</td>
</tr>
<tr>
<td>Bananas</td>
<td><strong>65</strong></td>
<td>455.0</td>
<td></td>
</tr>
<tr>
<td>Cherries</td>
<td>23</td>
<td>161.0</td>
<td></td>
</tr>
<tr>
<td>Raspberries</td>
<td>7</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>Kiwis</td>
<td>5</td>
<td>35.0</td>
<td>Kiwi (New Zealand)</td>
</tr>
</tbody>
</table>

**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.
Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Parameter sections / Tabs: General, Column Headers and Column

Note: In contrast to the view above, the parameter sections General, Column Headers and Column can also be displayed in individual tabs (as demonstrated in the following images). The display mode can be set in Menu: Edit→Preferences→Dialogs by enabling respective disabling the option Compact Layout.

Formula Editor: The Embedded Formula Editor is opened via this button.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new free table is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object Free Table is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Tab General

Orientation: The values of a column are displayed in vertical or horizontal orientation.

Frame: Defines the color and line width of the frame surrounding the table.
Cell clipping: If the text is too large for a cell, it can optionally be clipped to the size of the cell.

Horizontal grid / Vertical grid: Defines color and line width of a horizontal / vertical grid.
  Optionally, the first line can be drawn in bold. The first Edit button opens the Horizontal grid / Vertical grid dialog. There it can be defined whether the grid shall be drawn in all rows /all columns or only in the rows / columns stated in the manual list.

Special color: Additionally, the lines of selected rows / columns can be drawn in a special color.
  The second Edit button opens the Horizontal grid: special color / Vertical grid: special color dialog. There it can be defined after how many rows / columns a line is drawn (each ...-th row / each ...-th column) in a selectable special color or if such lines are drawn only in the rows / columns stated in the manual list. The lines defined here are only drawn if the general grid is activated.

manual list: Lines are drawn at the defined indexes of the list. Ranges are indicated by hyphens; individual indexes and ranges are separated by semicolons. If the dialog is closed with OK the input is automatically checked, and indexes are sorted or grouped in ranges if necessary. Invalid input is ignored.
  In case of Horizontal grid index n refers to the line below the n-th row. Index 0 refers to the line above the first row of data. Index -1 refers to the line above the header cells (if they are enabled and Frame is disabled).
  In case of Vertical grid index n refers to the line on the right side of the n-th column. Index 0 refers to the line on the left side of the first column of data. Index -1 refers to the line on the left side of the header cells (if they are enabled and Frame is disabled).

Lines from ... to: Defines the section of the values displayed in the table, i.e. the number of lines. The line numbers can be used in formulas as the variable Index.

Step: By entering the step, values can be skipped. The entered value defines the interval after how many lines a line is displayed.

Distribute lines: The height of the line is adjusted so that all lines of the table are evenly distributed over the table.
Tab Column Headers

**Height**: The height of the column headers is defined in millimetre.

**Alignment**: Defines whether the column headers are left-aligned, centred or right-aligned.

**Font**: Defines the font, size and color of the column header text as well as the style: bold and/or italic.

**Background**: A background color for the general column headers can be set optionally.

**Text**: Defines the text of the general column headers. This text appears in the column header in case no Individual Header cells are defined (see tab **Column**). If the entry is rather long, a line break can be created (see **Long Table Column Headers**).
Tab Column

The defined columns are displayed on the left side with their name and [column type].

**Up/down:** The selected column is moved upwards or downwards.

**Add:** A new column is generated as a copy of the selected column and added to the list.

**Remove:** The selected column is deleted.

The properties of the selected column are set on the right side.

**Name:** Defines the name of the column.

**Display name:** Optionally, an individual name can be defined which is displayed in the legend. If **automatic** is selected, the data object name is displayed.

**Individual Headercells:** Each column can optionally contain up to 6 individual header cells. If the checkbox is set, the entered text is displayed in the corresponding header cell. Else the general header text is displayed (in case it is defined). If the entry is rather long, a line break can be created (see [Long Table Column Headers](#)).
**W. of width**: The weight defines a relative width. The width of each column is calculated from the weight of the column divided by the sum of all weights. Alternatively, the columns can be adjusted by clicking & moving via mouse within the table. The values of the weight are then automatically recalculated.

**Value alignment**: Defines the text alignment: left-aligned, centred, right-aligned or after the decimal point.

**Reference**: A reference point for value respective text alignment, e.g. the starting point of the text when being left-aligned or the centre of the text when centred. The reference value is displayed in per cent and refers to the cell width of the respective column (0% = completely left, 100% = completely right).

**Font**: Defines the font, size and color of the column text as well as the style: bold and/or italic.

**Tabs for the Column Type**

Each tab contains a radio button that is automatically activated when the tab is selected. This indicates that by switching tabs the parameters are actually modified.

**Column Type Channel**

![Column Type Channel](image)

**Channel**: The dataobject to be displayed (channel or map) is selected from a list.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**For Channels**: Settings for a Channel data object.

**Show values**: The column contains values or properties of channels.
Show property names: The names of the available properties of the selected channel are displayed in the column.

Show property values: The values of the available properties of the selected channel are displayed in the column.

Formatting of values: Depending on the data type of the selected channel different formatting options are available:

- **Format**: A predefined format can be selected from the list of available formats. The list items depend on the data type of the selected channel.
- **Digits / Number of characters to be displayed / Pattern**: For double and float channels, the number of decimal digits can be stated. If the Grouping option is selected, each three digits are grouped by the thousands separator. For string channels, the Number of characters to be displayed in case of part strings can be stated. For time channels, the Pattern can be stated.

![The dialog Configure Formatter opens where detailed format properties can be set.](image)

For Maps: Is enabled if the column contains map values.

- **Show keys**: All available keys of the selected map are displayed in the column.
- **Show values**: All available values of the selected map are displayed in the column.

Unit: A unit can optionally be set for the selected channel.

- **Automatic**: The unit is taken from the channel properties.
- **Manual**: The unit is entered manually or selected from a list.
- **Show unit behind values**: The unit is displayed in each cell behind the value.
- **Show unit in header line ...**: The unit of the selected channel is displayed in the defined header line. If the selected column has already an individual header line having the same index, this function overwrites the header line.

Show this column in legend: If this option is selected and the table has a legend, this column is displayed in it.

Conditional Text and Fill Color: If this option is selected (only available for numeric channels), text and background can be displayed in different colors depending on the values.

- **scaled colors**: A color gradient each can be defined for the text (T:) and the background filling (F:).

![Conditional Text and Fill Color](image)

The currently defined color gradient is shown in the color gradient window with the values for Minimum and Maximum as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the Color Ranges Editor opens where color ranges can be modified or added. With the Rainbow
option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**discrete color definitions:** Up to 6 color sections can be defined for the value display of the selected channel. Each color section can be defined in a separate tab in the tab section on the right. The structure of the tabs is identical. One color each can be defined for the text (T:) and the background filling (F:). Furthermore the text style can be set to **bold**.

The condition that determines whether the color definition applies can be defined either by a formula (F:) or by manual setting (M). If more than one definition applies to the value, the higher-order definition prevails.

**F:** The condition is defined by a formula that has a Boolean result. For entering the formula the **Formula Editor** can be used.

*Example:* `contains(Value(DataItem("Clipboard", "Name"),Index),"i")` → The color definition is applied to all values that have an "i" in their respective Name.

**M:** With manual setting, various relational operators can be selected depending on the data type.

For numeric data (floating point numbers, integers, ...):

- `< / <= / >= / >`: All values that are lesser than / not greater than / not lesser than / greater than the reference value.
- `[]`: All values within a range around the reference value `[±%] / [±] / [±1σ] / [±3σ]`.
- `][`: All values outside of a range around the reference value `[(±%] / [±] / [±1σ] / [±3σ]`.
- `+/-%`: The range around the reference value is defined by a percentaged +/- value to be entered into the input field on the right.
- `+/-`: The range around the reference value is defined by an absolute +/- value to be entered into the input field on the right.
- `±1σ`: The range around the reference value is defined by the single standard deviation (Sigma).
- `±3σ`: The range around the reference value is defined by the threefold standard deviation (Sigma).

For the reference value the following options are available:

- **Fix value:** The value is entered into the input field above.
- **Formula:** The value is defined by a formula to be entered in the input field on the right. For entering the formula the **Formula Editor** can be used.

*Example:* `Value(DataItem("Clipboard", "Number"), 0)` → The reference value is the first value of the column "Number" (Index starts at 0).

- **Minimum:** The minimum of the column. A difference value can optionally be entered into the input field above on the right.
- **Maximum:** The maximum of the column. A difference value can optionally be entered into the input field above on the right.
**Average:** The average of the column. A difference value can optionally be entered into the input field above on the right.

Example: The settings result in: All values lesser than 10 are colored red, values between 10 and <50 are colored black (standard color) and values greater or equal 50 are displayed in bold blue digits.

For strings and characters:

**equals:** All strings or characters that are identical to the stated string or characters.

**contains:** All strings that contain the stated string or characters.

**starts with:** All strings that start with the stated string or character.

**ends with:** All strings that end with the stated string or character.

: The color definitions of this column are copied and can be used for the definition of a different column.

: The color definitions copied before are pasted in this column. They can also be copied from one table to the other.

**From column:** The settings for the conditional text and fill colors are adopted from the stated column. When the settings of the stated column are changed the settings of this column are changed as well.

**Column Type Text**

**Text input:** The content of the individual cells is entered as text. Each line in the input field corresponds to one cell in the table. Formulas can be entered as well. For this, the Formula Editor can be used.

**multiline:** The text can be distributed over several lines if it is longer than the column width. In order to see the additional lines, the line height has to be sufficient. This is accomplished by setting the line height to distribute lines in the tab General and accordingly enlarging the table.
**publish data item:** Optionally, a new data item (StringChannel) can be generated from the entered texts. It is named after the respective column.

**Conditional Text and Fill Color:** The settings for the conditional text and fill color can be adopted from the stated column (**From column**). If the settings are changed there, the changes automatically apply to this column.

### Column Type Expression

- **Value(DataItem("Number"),Index) \* 7**

<table>
<thead>
<tr>
<th><strong>Resolve</strong></th>
<th>350.0</th>
</tr>
</thead>
</table>

The expression is used for each row.

**Variable index contains the row index [0...]**

- **publish data item**
- **Conditional Text and Fill Color**

| **From column:** | 1 |

**Input field:** The entered expression is used for all cells of this column. Different values respective texts in the different cells are achieved by using the line variable **Index** in the formula. Index is starting with 0, i.e. the channel value with the Index = 0 is shown in line 1 of the table. For entering the formula the **Formula Editor** can be used.

**Resolve:** The embedded formula is resolved and the result displayed in the text field.

**publish data item:** Optionally, a new data item can be generated from the calculated values. It is named after the respective column. The data object type is determined by the formula.

**Conditional Text and Fill Color:** The settings for the conditional text and fill color can be adopted from the stated column (**From column**). If the settings are changed there, the changes automatically apply to this column.
Column Boolean Display

A column with a Boolean Display is generated. In each cell the defined symbol for the values True or False is displayed depending on the result of the defined expression.

Expression: The entered expression is used for all cells of this column. Different values respective texts in the different cells are achieved by using the line variable Index in the formula. Index is starting with 0, i.e. the channel value with the Index = 0 is shown in line 1 of the table. For entering the formula the Formula Editor can be used.

Simple Circle: The Boolean Display is displayed as circle. A color can be defined for each of the values True and False and whether they shall be transparent (i.e. invisible).

LED: The Boolean Display is displayed as LED. From the combo box, an LED type (color, luminescent) can be selected for each of the values True and False.

Imported Images: Alternatively, imported images may be used as symbols for the values. The combo box lists all available images. If transparent is selected, the display is invisible.

Load new image: New images are imported to the combo box via the dialog box of the image import.

Long Texts in the Table Header Cells of Vertical Tables (Standard)

The texts of headers can be very long, e.g. when using long channel names. In order to be able to completely read them a line break can be inserted.

For this, further headlines have to be defined that are always visible and that can be used in case of line breaks. If the next line (at Column Headers for the general column header respective Column for individual header cells) consists of one of the following strings, the text of the current line is continued there: " " (space character), "...", "ff" or "ff.".

When working with individual header cells it is enough to enable the checkbox for further headlines (the input field remains empty).
### 2.9.5.3 Item Property Table

Go to:

Graph Editor

- Tables
  - Item Property Table

This table is used for displaying fix and variable properties of data objects.

#### Item Property Table

<table>
<thead>
<tr>
<th>Name</th>
<th>Producer</th>
<th>Number</th>
<th>Minimum</th>
<th>Datatype</th>
<th>Value at 1</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Clipboard2</td>
<td>7</td>
<td>0.0000</td>
<td></td>
<td>Apples</td>
<td>1</td>
</tr>
<tr>
<td>Number</td>
<td>Clipboard2</td>
<td>7</td>
<td>5.0000</td>
<td></td>
<td>50.0</td>
<td>1</td>
</tr>
<tr>
<td>DatGen</td>
<td>DatGen</td>
<td>500</td>
<td>-1.4142</td>
<td>DOUBLE</td>
<td>0.0</td>
<td>2</td>
</tr>
<tr>
<td>TimGen</td>
<td>TimGen</td>
<td>500</td>
<td>0.0000s</td>
<td></td>
<td>08.04.13 15:18:27</td>
<td>3</td>
</tr>
</tbody>
</table>

The graphic object consists of a title and the column-oriented text area. The columns are arranged horizontally. The data objects are selected from a list of available data objects whose fix and variable properties are to be displayed. Every column has a header with up to two lines that can be defined generally or individually for each column. All texts used as input may also contain formulas that are calculated at run time.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size can be changed via mouse. See also Interactive Mouse Activities.
Context Menu

The context menu opens via right-clicking the mouse. There are special functions next to the general menu items that are available depending on the set parameters:

Split Vertical: The table is split vertically at the current mouse position. The resulting tables can be moved independently from one another. They can even be split again. Upon deleting the second/following table the parts are joined together again. **Note:** Deleting the first part of the split table deletes the whole table. This function is only available if in the General tab Line height is set to fix and the option auto resize table height is enabled.
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Parameter sections / Tabs: General, Column Headers, Data Items und Column

Note: In contrast to the view above, the parameter sections General, Column Headers, Data Items and Column can also be displayed in individual tabs (as demonstrated in the following
images). The display mode can be set in **Menu: Edit → Preferences → Dialogs** by enabling respective disabling the option **Compact Layout**.

**Formula Editor:** The **Embedded Formula Editor** is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define **Language Dependent Strings** for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new table is created with the current settings. The original graphic object remains unchanged.

**Delete:** The table is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to `?`. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab General**

**Frame:** Defines the color and line width of the frame surrounding the table.

**Horizontal grid / Vertical Grid:** Defines color and line width of a horizontal/vertical grid. The first line can optionally be displayed **bold**.

**Line height:**

- **fix:** The line height is set for all lines according to the font size.
- **distribute lines:** The line height is adjusted so that all lines of the table are evenly distributed over the whole table.

**auto resize table height:** The size of the table is automatically adjusted to the content.
Tab Column Headers

Name / Size / Color / bold / italic: Defines font, size and color of the header text as well as the style: bold and/or italic.

Height: The height of the header is defined in millimetre.

Alignment: Defines whether the headers are left-aligned, centred or right-aligned.

Text: Defines the general column header text. This text appears in the column header in case no Individual Headercells are defined (see tab Column). If the entry is rather long, a line break can be created (see Long Table Column Headers).

Tab Data Items

Available Items / Used Items: This section contains two lists – the available data objects on the left side – the selected data objects that are to be displayed on the right side. The input fields above the lists can be used to filter the data objects. The list then shows only data object names containing the entered string.

\[> > < <\]: The buttons between the lists allow the shifting of the selected/all data objects from one list to the other.

\[< > \]: The buttons below the right list can be used to change the order of the selected data objects: Data objects to the top / one position up / one position down / to the bottom.
Tab Column

The defined columns are displayed on the right side with their column type and name.

**up / down:** The selected column is moved upwards or downwards.

**Add:** A new column is generated as a copy of the selected column and added to the list.

**Remove:** The selected column is deleted.

The properties of the selected column can be configured on the left side.

**Display name:** Optionally, an individual name can be defined which is displayed in the legend. If **automatic** is selected, the data object name is displayed.

**Individual Headercells:** Each column can optionally contain up to 2 individual header cells. If the checkbox is set, the entered text is displayed in the corresponding header cell. Else the general header text is displayed (in case it is defined). If the entry is rather long, a line break can be created (see Long Table Column Headers).

**W. of width:** The weight defines a relative width. The width of each column is calculated from the weight of the column divided by the sum of all weights. Alternatively, the columns can be adjusted by clicking & moving via mouse within the table. The values of the weight are then automatically recalculated.
Value alignment: Defines the text alignment: left-aligned, centred, right-aligned or after the decimal point.

Reference: A reference point for value respective text alignment, e.g. the starting point of the text when being left-aligned or the centre of the text when centred. The reference value is displayed in per cent and refers to the cell width of the respective column (0% = completely left, 100% = completely right).

Name / Size / Bold / Italic / Color / Fillcolor: Defines font and size of the column text, the style: bold and/or italic, the font color and color for filling (a defined color or transparent).

**manual:** The font parameters are manually defined.

**Calculated with formula:** The font parameters can alternatively be calculated via a formula. There are 8 different colors that can be defined.

### Column Type Tabs

Each tab contains a radio button that is automatically activated when the tab is selected. This indicates that by switching tabs the parameters are actually modified.

#### Column Type Fix Props

Property: Selection of the property to be displayed from a combo box.

Format: Defines the number of decimal digits. The exponential (scientific) depiction can be chosen optionally.

#### Column Type Var-Props

Property: Selection of the property to be displayed from a combo box.
Column Type Values

- **Values at index**: Selection of the index the value of which is to be displayed.
- **Format**: Defines the number of decimal digits. The exponential (scientific) depiction can be chosen optionally.

Column Type Expression

- **Input field**: The entered expression is used for all cells of the column. Different values respective texts in the different cells are achieved by using the line variable `Index` in the formula. Index is starting with 0, i.e. the channel value with the Index = 0 is shown in line 1 of the table. For entering the formula the Formula Editor can be used.
- **Resolve**: The embedded formula is resolved and the result is displayed in the text field.
- **publish data item**: Optionally, a new data item can be generated from the calculated values. It is named after the respective column. The data object type is determined by the formula.
2.9.5.4 Legend as Table

Go to:

Graph Editor
-Tables
→ Legend as Table

The graphic object **Legend as Table** is used for displaying a legend in table form referring to another graphic object (diagram or table). Besides displaying information about the data objects, it also shows their properties and further parameters.

From a list of available graphic objects, one is selected as a reference. All contained data objects (curves or columns) and their properties can be used in the **Legend as Table**. All editable text fields may also contain formulas that are calculated at run time.

A **Legend as Table** can also be created via the respective icon of the graphic toolbar and drawn directly into the graphic window. The legend table does not even have to be located directly next to the graphic object. It automatically relates to the next closest graphic object. However, it is possible to select a different graph as reference object using the dialog or the context menu.

The graphic object consists of a title and the column-oriented text area. The columns are ordered horizontally or vertically.

![Legend as Table](image)

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also **Interactive Mouse Activities**.
Context Menu

The context menu opens via right-clicking the mouse. There are special functions next to the general menu items that are available depending on the set parameters:

Split Vertical: The table is split vertically at the current mouse position. The resulting tables can be moved independently from one another. They can even be split again. Upon deleting the second/following table the parts are joined together again. **Note:** Deleting the first part of the split table deletes the whole table. This function is only available if in the **General** tab **Line height** is set to **fix** and the option **auto resize table height** is enabled.

reassign legend to: A dialog opens where the reference graphic object (2D curve graph or table) can be selected. The information in the legend then automatically refers to the new graph. The selected graph is highlighted in the graphic window as long as it is within the visible window.
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Parameter sections / Tabs: General, Column Headers und Column

Note: In contrast to the view above, the parameter sections General, Column Headers and Column can also be displayed in individual tabs (as demonstrated in the following images). The display mode can be set in Menu: Edit→Preferences→Dialogs by enabling respective disabling the option Compact Layout.

Formula Editor: The Embedded Formula Editor is opened via this button.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this
dialog, all text fields can be edited in the selected language (std. / de / en / …) directly in the dialog.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new **Legend as Table** is created with the current settings. The original graphic object remains unchanged.

**Delete**: The table is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab General**

![Legend table dialog](image)

**Graph**: Selection of a graph from a list of available graphic objects (2D curve graph or table). All contained data objects (curves or columns) and their properties can be displayed in the legend. As soon as a graph is selected from the list it is highlighted in the graphic window as long as it is within the visible window.

In addition to curves and charts, legends can now also be created for the free, the interactive and the matrix tables. The individual columns of the table are listed in the legend. If in table columns measured data is colorized based on a continuous or discrete color definition, this color definition can now be displayed in the associated legend.
**hide not displayable diagrams:** If selected, a diagram is displayed in the table only if it is regularly painted in the graph. So e.g. curves with missing input data are ignored. A diagram marked as invisible is hidden only if the table contains no Visibility column.

**hide empty diagrams:** If selected, a diagram is displayed in the table only if its data object actually contains values. So if the data object contains no values, e.g. due to the application of a view, it is ignored.

**Organisation**

**Orientation:** The table can be oriented in *vertical* or *horizontal* direction.

**Line height:**
- *fix:* The line height is set for all lines according to the font size.
- *auto resize table height:* The size of the table is automatically adjusted to the content.
- *distribute lines:* The line height is adjusted so that all lines of the table are evenly distributed over the whole table.
- *with scroll bar:* For large tables, a scroll bar can be displayed.
  - *automatically display the last row:* In large tables with scroll bar it is automatically scrolled down to the last row.

**fix row count per view:** The legend table is automatically divided vertically into several parts of the defined row number. The number of parts is determined by the total number of rows to be displayed. When diagrams are added or deleted the needed row number is adjusted. Accordingly, new parts are added or existing parts deleted as necessary.

**Diagram grouping:** Diagrams can be displayed ungrouped or grouped by test or quantity.

*Example for ungrouped display:* In 4 tests (Quelle 1 to 4) 2 measured quantities each have been recorded (APNR and DRZ). The measured data has been imported via Datasource Manager. In this view, all available test properties as well as data object properties can be displayed as they are unique.

| Quelle1_APNR,DRZ,ASC | APNR |
| Quelle2_APNR,DRZ,ASC | APNR |
| Quelle3_APNR,DRZ,ASC | APNR |
| Quelle4_APNR,DRZ,ASC | APNR |
| Quelle1_APNR,DRZ,ASC | DRZ |
| Quelle2_APNR,DRZ,ASC | DRZ |
| Quelle3_APNR,DRZ,ASC | DRZ |
| Quelle4_APNR,DRZ,ASC | DRZ |

*Example for grouping by test:* The 2 measured quantities of the tests have been grouped. Thus, the data object properties cannot be displayed any more as they are not uniquely assigned.

*Example for grouping by quantity:* The 4 tests have been grouped. Thus, the test properties cannot be displayed any more as they are not uniquely assigned.

| Quelle1_APNR,DRZ,ASC |
| Quelle2_APNR,DRZ,ASC |
| Quelle3_APNR,DRZ,ASC |
| Quelle4_APNR,DRZ,ASC |
| APNR |
| DRZ |
**Mark cells of selected curves:** By a curve selection in the 2D curve graph, the backgrounds of the respective lines are highlighted with the selected color in the table. Conversely, the respective curve is selected in the graph if a row is marked in the legend. If a scroll bar is activated and the option **automatically display the last row** is disabled, it is automatically scrolled down to the first selected row.

**Format**

**Frame:** Defines the color and line width of the frame surrounding the table.

**Cell clipping:** If the text is too big for a cell it can optionally be cut to the size of the cell.

**Horizontal grid / Vertical grid:** Defines color and line width of a horizontal / vertical grid. Optionally, the first line can be drawn in **bold**. The first Edit button opens the **Horizontal grid / Vertical grid** dialog. There it can be defined whether the grid shall be drawn in **all rows** / **all columns** or only in the rows / columns stated in the **manual list**.

**Special color:** Additionally, the lines of selected rows / columns can be drawn in a special color. The second Edit button opens the **Horizontal grid: special color** / **Vertical grid: special color** dialog. There it can be defined after how many rows / columns a line is drawn (each ...-th row / each ...-th column) in a selectable special color or if such lines are drawn only in the rows / columns stated in the **manual list**. The lines defined here are only drawn if the general grid is activated.

**manual list:** Lines are drawn at the defined indexes of the list. Ranges are indicated by hyphens; individual indexes and ranges are separated by semicolons. If the dialog is closed with **OK** the input is automatically checked, and indexes are sorted or grouped in ranges if necessary. Invalid input is ignored.

In case of **Horizontal grid** index n refers to the line below the n-th row. Index 0 refers to the line above the first row of data. Index -1 refers to the line above the header cells (if they are enabled and **Frame** is disabled).

In case of **Vertical grid** index n refers to the line on the right side of the n-th column. Index 0 refers to the line on the left side of the first column of data. Index -1 refers to the line on the left side of the header cells (if they are enabled and **Frame** is disabled).
Tab Column Headers

**Height:** The height of the column headers is defined in millimetre.

**Alignment:** Defines whether the column headers are left-aligned, centred or right-aligned.

**Text:** A general column header text can be set for up to 3 lines. This text appears in the column header in case no Individual Headercells are defined (see tab Column). If the entry is rather long, a line break can be created (see Long Table Column Headers).

**Font:** Defines the font, size and color of the column header text as well as the style: bold and/or italic.
Tab Column

The defined columns are displayed on the left side with their name and [column type].

**up/down:** The selected column is moved upwards or downwards.

**Add:** A new column is generated as a copy of the selected column and added to the list.

**Remove:** The selected column is deleted.

The properties of the selected column are set on the right side.

**Name:** Defines the name of the column.

**Display name:** Optionally, an individual name can be defined which is displayed in the legend. If automatic is selected, the data object name is displayed.

**Individual Headercells:** Each column can optionally contain up to 3 individual header cells. If the checkbox is set, the entered text is displayed in the corresponding header cell. Else the general header text is displayed (in case it is defined). If the entry is rather long, a line break can be created (see Long Table Column Headers).

**W. of width:** The weight defines a relative width. The width of each column is calculated from the weight of the column divided by the sum of all weights. Alternatively, the columns can be adjusted by clicking & moving via mouse within the table. The values of the weight are then automatically recalculated.
No line at right: The line on the right side of the column is not drawn.

Value alignment: Defines the text alignment: left-aligned, centred, right-aligned or after the decimal point.

Reference: A reference point for value respective text alignment, e.g. the starting point of the text when being left-aligned or the centre of the text when centred. The reference value is displayed in per cent and refers to the cell width of the respective column (0% = completely left, 100% = completely right).

Background: Defines the background color of the column.

Font: Defines the font, size and color of the column text as well as the style: bold and/or italic.

Column Type Tabs

Each tab contains a radio button that is automatically activated when the tab is selected. This indicates that by switching tabs the parameters are actually modified.

Column Type Symbol

Displayed line width: The curve symbol is displayed in the defined width.

  automatic: The line is drawn with the same width as in the diagram.

  manual: A line width can be selected from the combo box.

Padding: Optionally, a distance between symbol and cell border can be defined so that the symbol does not fill the cell completely. The preset value for new tables is 0.7 mm.

Legend symbol mode: The legend symbol mode can be set for the whole column out of the following options:

  from Diagram: The legend symbol mode is adopted from the settings of the individual diagrams. Thus, an individual display of the symbols is possible.

  detailed: A representative miniature of the curve type is shown.
simple: A rough sketch of the curve type is shown.

only color: A rectangle in the defined curve colors is shown.

In case of curves with a color gradient controlled by another data object this gradient is displayed if the column is sufficiently wide. In narrow columns only a line in the defined width is drawn.

Column Type Data Item Names

- show X-dataitems
- show Y-dataitems
- show Z1-dataitems
- show Z2-dataitems
- show Z3-dataitems
- show views

Show dataitems / producer name: Displays the name of the selected data objects respective producers.

Show views: Displays the selected view of the respective curve.

Column Type Properties

Diagram: Diagram-specific properties can be selected via Var-Property.

X- / Y- / Z-data item: Fix (Fix-Property) or variable properties (Var-Property) of the selected X, Y or Z data object can be displayed. The desired Z data object is selected by using the following input box.

like first column of type Data Item Names: The same data items as selected in the first Data Item Names column are displayed.
**Fix-Property:** A property is selected from the list of available fix properties (e.g. producer name, unit, minimum or maximum). When characters are entered in the field, the selection list is filtered accordingly.

**Var-Property:** A property is selected from the list of available variable properties (e.g. ID or data type). When characters are entered in the field, the selection list is filtered accordingly.

**Format:** The displayed property value can be individually formatted.

- **own format:** The button opens the dialog *Configure Formatter* where detailed format properties can be set.
- **format of axis + ... significant digits:** The stated decimal digits are displayed in addition to the number defined in the axis format.
- **with unit:** The unit of the input object is displayed.
- **prefer axis unit:** If an axis is available and the unit of the input object is compatible to the axis unit, the axis unit is used and decimal values are converted.

### Column Type Value at Cursor

<table>
<thead>
<tr>
<th>Visibility</th>
<th>Test</th>
<th>Local Stat.</th>
<th>Expression</th>
<th>Text</th>
<th>Boolean Display</th>
<th>Value at Cursor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **cursor position:** The cursor position is displayed, i.e. in a line/points diagramm normally the X-value or in an engine map the X- and Y-value.
- **cursor value:** The curve value at the respective cursor position is displayed, i.e. in a line/points diagramm normally the Y-value or in an engine map the Z-value.
- **cursor position and value:** The cursor position and the curve value are displayed.
- **show absolute values:** The absolute values of the selected cursor are displayed.
- **show difference values:** If the graphic object contains at least 2 cursors, the difference between 2 cursors can be displayed.

**Cursor #1 / #2:** The above values are displayed for the cursor entered in the field. For difference values, the difference is calculated out of the values of the two entered cursors. The Y-values of the cursors should be published so that the values are automatically updated in the table when the cursors are shifted. Otherwise an update will only be carried out upon
calling the modification dialog box. The setting of the cursors is done by right-clicking on the chart and subsequently selecting the context menu entry Modify...Cursor.

**format:** The displayed value can be individually formatted.

**own format:** The button opens the dialog Configure Formatter where detailed format properties can be set.

**format of axis + ... significant digits:** The stated decimal digits are displayed in addition to the number defined in the axis format.

### Column Type Visibility

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Visibility</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SIN_X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SIN_X2_X</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SAWTOOTH_A</td>
</tr>
</tbody>
</table>

For each row the diagram may be shown/hidden by click on a checkbox.

*Please note:* The visibility isn’t changeable here if the diagrams are grouped by test!

A column with a checkbox in each line is created. By activating or deactivating of the checkbox the respected diagram is shown or hidden in the associated graph.

The checkboxes of this column will be disabled when the diagrams are grouped by test (Tab General).

### Column Type Test

**Test property:** A property is selected from a list of available properties.
Column Type Locale Stat.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Data Item Names</th>
<th>Visibility</th>
<th>Test</th>
<th>Local Stat.</th>
<th>Expression</th>
<th>Properties</th>
<th>Value at Cursor</th>
<th>Boolean Display</th>
</tr>
</thead>
</table>

Shows statistical values calculated only from the visible part

minimum / maximum / span / average / x-Minimum / x-Maximum / Unit / x-Unit: Local statistical values referring to the visible section of the X-axis respectively the visible table section are displayed.

Unit / x-Unit: If units are available for the selected data items they are displayed.

**format**: The displayed value can be individually formatted.

- **own format**: The button opens the dialog *Configure Formatter* where detailed format properties can be set.
- **format of axis + ... significant digits**: The stated decimal digits are displayed in addition to the number defined in the axis format.
- **with unit**: Optionally, the selected value can be displayed with its unit.

**Column Type Expression**

Input field: The entered expression is used for all cells of the column. Different values or texts in the individual cells can be created by the line variable *Index* in the formula. Index is starting with 0, i.e. the channel value with the Index = 0 is shown in line 1 of the table. For entering formulas, the *Embedded Formula Editor* can be used.

Resolve: The embedded formula is resolved and the result is displayed in the text field.
**publish data item:** Optionally, a new data item can be generated from the calculated values. It is named after the respective column. The data object type is determined by the formula.

### Column Type

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Data Item Names</th>
<th>Properties</th>
<th>Value at Cursor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visibility</td>
<td>Test</td>
<td>Local Stat.</td>
<td>Expression</td>
</tr>
</tbody>
</table>

**Text input:** The content of the individual cells is entered as text. Each line in the input field corresponds to one cell in the table. Formulas can be entered as well. For this, the [Formula Editor](#) can be used.

**multiline:** The text can be distributed over several lines if it is longer than the column width. In order to see the additional lines, the line height has to be sufficient. This is accomplished by setting the line height to distribute lines in the tab General and accordingly enlarging the table.

**publish data item:** Optionally, a new data item (StringChannel) can be generated from the entered texts. It is named after the respective column.

### Column Type Boolean Display

Expression: 
```
val(ColumnValue(2, Index)) > 1.5
```

(The expression must return a boolean value.)

**True**

- Simple Circle
  - Transparent

**False**

- LED
  - Transparent
  - Load new image

- Imported Images
  - Transparent
  - Load new image

Reference and Tutorial jBEAM

Version: jBEAMHelp7.2.2
A column with a **Boolean Display** is generated. In each cell the defined symbol for the values **True** or **False** is displayed depending on the result of the defined **expression**.

**Expression**: The entered expression is used for all cells of this column. Different values respective texts in the different cells are achieved by using the line variable **Index** in the formula. Index is starting with 0, i.e. the channel value with the Index = 0 is shown in line 1 of the table. For entering the formula the **Formula Editor** can be used.

**Simple Circle**: The Boolean Display is displayed as circle. A color can be defined for each of the values **True** and **False** and whether they shall be **transparent** (i.e. invisible).

**LED**: The Boolean Display is displayed as LED. From the combo box, an LED type (color, luminescent) can be selected for each of the values **True** and **False**.

**Imported Images**: Alternatively, imported images may be used as symbols for the values. The combo box lists all available images. If **transparent** is selected, the display is invisible.

**Load new image**: New images are imported to the combo box via the dialog box of the **image import**.

### 2.9.5.5 Spreadsheet

Go to:

**Graph Editor**

→ **Tables**

→ **Spreadsheet**

The graphic element **Spreadsheet** is used for displaying the data of a data object.

The graphic object consists of a title and a data area that displays the data of the selected data object.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also **Interactive Mouse Activities**.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Lines**
- **with Header:** If selected, the headers (name of data object, date, time) are displayed.
- **with Indices:** If selected, the indices of the channel values are displayed.
- **from... to...:** Defines the indices for the starting and end value. All values of the data object/data objects within the defined range are displayed.

**Font:** Defines the font, size and color of the table text. The font can additionally be displayed **bold** and/or **italic**.

**Channels:** The channels to be displayed are selected from a list with available channels. A column is created for each selected channel.
- **...** opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.
- **width:** Defines the column width in characters.
- **Digits:** Defines the number of decimal places.
- **Color:** Opens the color selection for the column’s font color.

**Remove:** Deletes the last column.

**Add:** Adds a new column.
N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new Spreadsheet object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.5.6 Matrix Table

Go to:

Graph Editor

Tables

Matrix Table

The graphic element Matrix Table is used for displaying a matrix in table form.

The graphic object consists of a title and a data area.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

Matrix Table

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0.841</td>
<td>0.841</td>
<td>0.841</td>
<td>0.841</td>
<td>0.841</td>
<td>0.841</td>
<td>0.841</td>
<td>0.841</td>
</tr>
<tr>
<td>2</td>
<td>0.909</td>
<td>0.909</td>
<td>0.909</td>
<td>0.909</td>
<td>0.909</td>
<td>0.909</td>
<td>0.909</td>
<td>0.909</td>
</tr>
<tr>
<td>3</td>
<td>0.141</td>
<td>0.141</td>
<td>0.141</td>
<td>0.141</td>
<td>0.141</td>
<td>0.141</td>
<td>0.141</td>
<td>0.141</td>
</tr>
<tr>
<td>4</td>
<td>-0.757</td>
<td>-0.757</td>
<td>-0.757</td>
<td>-0.757</td>
<td>-0.757</td>
<td>-0.757</td>
<td>-0.757</td>
<td>-0.757</td>
</tr>
<tr>
<td>5</td>
<td>-0.959</td>
<td>-0.959</td>
<td>-0.959</td>
<td>-0.959</td>
<td>-0.959</td>
<td>-0.959</td>
<td>-0.959</td>
<td>-0.959</td>
</tr>
<tr>
<td>6</td>
<td>-0.279</td>
<td>-0.279</td>
<td>-0.279</td>
<td>-0.279</td>
<td>-0.279</td>
<td>-0.279</td>
<td>-0.279</td>
<td>-0.279</td>
</tr>
<tr>
<td>7</td>
<td>0.657</td>
<td>0.657</td>
<td>0.657</td>
<td>0.657</td>
<td>0.657</td>
<td>0.657</td>
<td>0.657</td>
<td>0.657</td>
</tr>
<tr>
<td>8</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
<td>0.999</td>
</tr>
<tr>
<td>9</td>
<td>0.412</td>
<td>0.412</td>
<td>0.412</td>
<td>0.412</td>
<td>0.412</td>
<td>0.412</td>
<td>0.412</td>
<td>0.412</td>
</tr>
</tbody>
</table>
Context Menu

The context menu opens via right-clicking the mouse. There are special functions next to the general menu items that are available depending on the set parameters:

**Split Vertical**: The table is split vertically at the current mouse position. The resulting tables can be moved independently from one another. They can even be split again. Upon deleting the second/following table the parts are joined together again. **Note**: Deleting the first part of the split table deletes the whole table. This function is only available if in the **General** tab Line height is set to **fix** and the option **auto resize table height** is enabled.

**Modify... Legend**: The Legend dialog box is opened where the legend can be set to display e.g. data object and/or producer.
Name: Name of the graphic object.
Title: A title can optionally be defined.
Font: A dialog box opens for defining font, size, color and formatting of the title.
Data-Object: Selection of a matrix from a list of available matrices.
- Opens the **Filtered Selector of Dataitems** dialog for a fast selection from a large number of data items.

Parameter sections / Tabs: General, Column Headers, X-Column and Y-Columns

**Note:** In contrast to the view above, the parameter sections General, Column Headers, X-Column and Y-Columns can also be displayed in individual tabs (as demonstrated in the following images). The display mode can be set in **Menu: Edit→Preferences→Dialogs** by enabling respective disabling the option **Compact Layout**.

**Formula Editor:** The **Embedded Formula Editor** is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define **Language Dependent Strings** for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new **Matrix Table** is created with the current settings. The original graphic object remains unchanged.

**Delete:** The **Matrix Table** is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab General**

**Orientation:** Defines whether the values of a matrix column are displayed **vertical** or **horizontal**.
**Frame**: Defines the color and line width of the frame surrounding the table.

**Cell clipping**: If the text is too big for a cell it can optionally be cut to the size of the cell.

**Horizontal grid / Vertical grid**: Defines color and line width of a horizontal / vertical grid. Optionally, the first line can be drawn in **bold**. The first Edit button opens the **Horizontal grid / Vertical grid** dialog. There it can be defined whether the grid shall be drawn in *all rows / all columns* or only in the rows / columns stated in the manual list.

**Special color**: Additionally, the lines of selected rows / columns can be drawn in a special color. The second Edit button opens the **Horizontal grid: special color / Vertical grid: special color** dialog. There it can be defined after how many rows / columns a line is drawn (*each ...-th row / each ...-th column*) in a selectable special color or if such lines are drawn only in the rows / columns stated in the manual list. The lines defined here are only drawn if the general grid is activated.

**manual list**: Lines are drawn at the defined indexes of the list. Ranges are indicated by hyphens; individual indexes and ranges are separated by semicolons. If the dialog is closed with **OK** the input is automatically checked, and indexes are sorted or grouped in ranges if necessary. Invalid input is ignored.

In case of **Horizontal grid** index n refers to the line below the n-th row. Index 0 refers to the line above the first row of data. Index -1 refers to the line above the header cells (if they are enabled and **Frame** is disabled).

In case of **Vertical grid** index n refers to the line on the right side of the n-th column. Index 0 refers to the line on the left side of the first column of data. Index -1 refers to the line on the left side of the header cells (if they are enabled and **Frame** is disabled).

**Line height: fix**: The line height is set for all lines according to the font size.

**Auto resize table height**: The size of the table is automatically adjusted to the content.

**Distribute lines**: The line height is adjusted so that all lines of the table are evenly distributed over the whole table.

### Column Headers

**Height**: The height of the header line is defined in millimetre.

**Alignment**: Defines whether the headers are left-aligned, centred or right-aligned.

**Decimal digits**: Defines the number of decimal places.

- **maximal**: The defined number of decimal places is only displayed when needed.
- **exact**: The defined number of decimal places is always displayed and if necessary filled with zeros.
**scientific**: The exponential depiction can be chosen optionally.

**Font**: Defines font, size and color of the header text as well as the style: bold and/or italic.

### X-Column

![X-Column settings](image)

**W. of width**: The weight defines a relative width. The width of each column is calculated from the weight of the column divided by the sum of all weights. Alternatively, the columns can be adjusted by clicking & moving via mouse within the table. The values of the weight are then automatically recalculated.

**Value alignment**: Defines the text alignment: left-aligned, centred, right-aligned or after the decimal point.

**Reference**: A reference point for value respective text alignment, e.g. the starting point of the text when being left-aligned or the centre of the text when centred. The reference value is displayed in per cent and refers to the cell width of the respective column (0% = completely left, 100% = completely right).

**Decimal digits**: Defines the number of decimal places.

- **scientific**: The exponential depiction can be chosen optionally.

**Headercells**: Up to 3 individual header cells can be defined for the X-column. For entering an embedded formula the Formula Editor can be used. If the checkbox is set, the entered text is displayed in the corresponding header cell. If the entry is rather long, a line break can be created (see Long Table Column Headers).

**Font**: Defines font, size and color of the header text as well as the style: bold and/or italic.
Y-Columns

**W. of width:** The weight defines a relative width. The width of each column is calculated from the weight of the column divided by the sum of all weights. Alternatively, the columns can be adjusted by clicking & moving via mouse within the table. The values of the weight are then automatically recalculated.

**no line at right:** No line is drawn on the right side of the column.

**Value alignment:** Defines the text alignment: left-aligned, centred, right-aligned or after the decimal point.

**Reference:** A reference point for value respective text alignment, e.g. the starting point of the text when being left-aligned or the centre of the text when centred. The reference value is displayed in per cent and refers to the cell width of the respective column (0% = completely left, 100% = completely right).

**Decimal digits:** Defines the number of decimal places.

- **scientific:** The exponential depiction can be chosen optionally.

**Font:** Defines font, size and color of the header text as well as the style: bold and/or italic.

**Headercells:** Up to 3 individual header cells can be defined for the Y-columns. For entering an embedded formula the Formula Editor can be used. If the checkbox is set, the entered text is displayed in the corresponding header cell. If the entry is rather long, a line break can be created (see Long Table Column Headers).

- **automatic:** If this option is selected, the column name (for matrices) or the channel name (for groups of channels) is automatically displayed.

**Conditional Text and Fill Color:** If this option is selected, text and background can be displayed in different colors depending on the values.

- **scaled colors:** A color gradient each can be defined for the text (T:) and the background filling (F:).
The currently defined color gradient is shown in the color gradient window with the values for **Minimum** and **Maximum** as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the **Color Ranges Editor** opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**discrete color definitions:** Up to 6 color sections can be defined for the value display of the selected matrix. Each color section can be defined in a separate tab in the tab section on the right. The structure of the tabs is identical. One color each can be defined for the text (T:) and the background filling (F:). Furthermore the text style can be set to **bold**.

The condition that determines whether the color definition applies can be defined either by a formula (F) or by manual setting (M). If more than one definition applies to the value, the higher-order definition prevails.

**F:** The condition is defined by a formula that has a Boolean result. For entering the formula the **Formula Editor** can be used.

Example: `contains(Value(DataItem("Clipboard", "Name"),Index),'i')` → The color definition is applied to all values that have an "i" in their respective Name.

**M:** With manual setting, the following relational operators can be selected from a list:

- `< / <= / >= / >`: All values that are lesser than / not greater than / not lesser than / greater than the reference value.
- `[]`: All values within a range around the reference value ([$\pm%$] / [$\pm$] / [$\pm1\sigma$] / [$\pm3\sigma$]).
- `[]`: All values outside of a range around the reference value ([$\pm%$] / [$\pm$] / [$\pm1\sigma$] / [$\pm3\sigma$]).
- `+/-%`: The range around the reference value is defined by a percentaged +/- value to be entered into the input field on the right.
- `+/-`: The range around the reference value is defined by an absolute +/- value to be entered into the input field on the right.
- `+/-1\sigma`: The range around the reference value is defined by the single standard deviation (Sigma).
- `+/-3 \sigma`: The range around the reference value is defined by the threefold standard deviation (Sigma).

For the reference value the following options are available:

- **Fix value:** The value is entered into the input field above.
- **Formula:** The value is defined by a formula to be entered in the input field on the right. For entering the formula the **Formula Editor** can be used.
Example: \texttt{Value(DataItem("Clipboard", "Number"), 0)} \rightarrow The reference value is the first value of the column "Number" (Index starts at 0).

**Minimum**: The minimum of the matrix. A difference value can optionally be entered into the input field above on the right.

**Maximum**: The maximum of the matrix. A difference value can optionally be entered into the input field above on the right.

**Average**: The average of the matrix. A difference value can optionally be entered into the input field above on the right.

Example: The settings result in: All values lesser than 10 are colored red, values between 10 and 50 are colored black (standard color) and values greater or equal 50 are displayed in bold blue digits.

### 2.9.6 Realtime Graphics

Go to:

**Graph Editor**

→ **Realtime Graphics**

The menu item is divided into:

- Digital Display
- Bar Graph
- Needle Indicator
- XY-Stripchart
- TY-Stripchart
- Boolean Display
- Controlled Image
- Vectors
- Moving Images
- Curved Line (controlled)
- Controlled Arrow
- Multi Digital Display
- Dynamic Images
- Compass Rose
- Realtime Table
- Crash test dummy
2.9.6.1 Digital Display

Go to:

Graph Editor
- Realtime Graphics
- Digital Display

The graphic object Digital Display is used to create a digital display that shows values in real-time.

The graphic object consists of the title as well as the digital display.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

- **Font:** A dialog box opens for defining font, size, color and formatting of the title.
- **Alignment:** Defines whether the title is left-aligned, centred or right-aligned.

**For input error:**

- **Replace title with input name:** In case of errors in the input data, e.g. if an input data object has been deleted, the name of the data object is displayed as title of the digital display.
- **Color:** Defines the color of the title in case of error.
- **With producer name:** The input data objects are displayed with producer name in case of error.

**Input Data:** Selection of a data object to be displayed from a list of available data objects.

**Control for channels:** Defines which value of the selected data object is displayed. If the option **Last Value** is selected, the last value of the input channels is displayed. Furthermore, an available single value data object like a published cursor value or a slider value can be selected that defines the X-value of the displayed value of the input channel.
Opens the **Filtered Selector of Dataitems** dialog for a fast selection from a large number of data items.

**Auto font sizes**: Can be selected optionally. If enabled, the font sizes of title, value and status are determined automatically. The adjoining selection list can be used to define the proportion of the text size to the available space (smallest ... medium ... biggest).

**Values**

**Font**: Defines font **name**, **size** and style: **bold** and/or **italic**.

**Segmented font**: Optionally, the text can be displayed as a 7-segment display.

**Formatting of Values**

**automatic value format by property**: If the data object has the property **ValueFormat**, the display can be automatically formatted according to the pattern defined in this property. As soon as the option is activated, the text field below shows whether the property **ValueFormat** is "available" or "not available". In the latter case the settings remain unchanged.

**Format**: A predefined format can be selected from the list of **available formats**. The list items depend on the data type of the selected channel.

**Digits / Number of characters to be displayed / Pattern**: For double and float values / channels, the number of decimal digits can be stated. If the **Grouping** option is selected, each three digits are grouped by the thousands separator. For string values / channels, the **Number of characters to be displayed** in case of part strings can be stated. For time values / channels, the **Pattern** can be stated.

When values close to zero are displayed only with zeros because the other decimal places are omitted, then even positive values are displayed with a sign "+" in order to differentiate them from exact zero. This option is enabled by default, but can be set in the dialog **Configure Formatter**.

**Ranges**

**Value ranges**: Up to 3 value ranges can be defined that may be configured individually. Depending on the selected type, text and background colors, alerts, LEDs and limits for the standard, warning and alarm range can be defined. The limits can either be entered manually in the input field or defined by a formula or by value or property of data objects.
Selection / Input field: The 1st selection list contains 4 preset items (***) and the available data objects:

**manual**: A value can be entered in the input field.

**Formula**: A formula can be entered in the 2nd selection field.

**actual data object**: Value or property of current, i.e. displayed, data object.

**actual producer**: Property of current producer.

If the current data object or any other data object from the list is selected, either its value or a selectable property can define the limit. The second selection box can be used to select an available property. If the box is empty, the value of the data object is used. The input field next to the selection box remains valid and editable until a valid selection has been made.

Color: Text and background color for each range can be set in the color selection dialog that opens via left click in the respective range field. Different colors can be set for upper and lower warning and alarm ranges.

Sound: Each range can be equipped with a sound. Clicking on the loudspeaker icon switches the sound on and off. In order to change the settings of the sound output, a right-click on the loudspeaker icon and clicking Configure sound in the context menu opens the dialog Configure Sound to configure the warning sounds.

LED: Optionally, an LED can be assigned to each range by activating the checkbox. By clicking on the LED symbol, color and state (1st column: LED on; 2nd column: LED off; 3rd column: LED flashing) can be selected from the list. If the checkbox is not activated, no LED appears.

Background: The background filling can be activated and either be filled with a single color or dynamically with definable colors for each value range.

Invalid value (NaN): Optionally, invalid values can be configured with an individual color and sound setting.

Status

Visible: Optionally, the current status of the measurement can be displayed (e.g. idle, new data received, ...). The display can be changed in font, size and color; its style can be set to bold and/or italic.
Unit

**automatic / manual:** The unit can either be determined automatically from the input channel or selected manually from a list of available units.

**Visible:** Optionally, the unit of the selected values can be displayed. The position at which the unit is displayed can be selected out of **append to title, in own row or append to value.** In case of the first two options, the color of the title is used for the unit, in the latter case the current color of the values is used.

Skin

**Background Type:** Selection of a background design for the digital display from a list of available designs.

**Preview:** Generates an image of the digital display as it will appear in the currently selected style.

**Formula Editor:** The **Embedded Formula Editor** is opened via this button.

**N / C / D:** These buttons (**New** / **Change** / **Delete**) can be used to define **Language Dependent Strings** for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (**std. / de / en / ...**) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object **Digital Display** is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to "?". The respective help topic is displayed when an area within the dialog is clicked on.

**Dialog Configure Sound "Warning"**

In this dialog settings for the audible signal can be defined for the respective value ranges **OK, Warning, Alarm** and **NaN.**
Priority of the sound: The setting of the priority of the sounds to be played (from 1 to 10).

Stop other sounds with equal priority: Can be selected optionally. Sounds with the same priority are stopped so that this sound is played prior to the others.

Repeat mode: Defines when the sound is repeated.

- Play always: The sound is played repeatedly as long as the displayed value is within the respective value range even if it does not change.
- On value change: The sound is played every time when the displayed value changes and is within the respective value range.
- Once on range hit: The sound is played once as soon as the displayed value enters the respective value range.

Play midisound: Plays a predefined midisound that is played at the respective value range.

Text-to-Speech: Plays a predefined speech. The following place holders are available: @value@ for the current value, @unit@ for the current unit, @itemname@ for the current data object name.

Play Audiofile: If enabled, an audio file can be selected that is played in the corresponding value range.

Opens the dialog box for the selection of the audio file.

Play recorded sound: Plays a sound that can be recorded from different sources (microphone, line-in). The recording can directly be started in the dialog box.

Test Sound: Plays the selected sound for testing.

OK: The changes are applied and the dialog is closed.
The context sensitive help is activated and the cursor changes to 💭. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.6.2 Bar Graph

Go to:

- **Graph Editor**
  - ➔ Realtime Graphics
  - ➔ Bar Graph

The graphic object Bar Graph is used for displaying a bar graph that displays values in real-time.

The graphic object consists of a title and a bar graph. Different ways to display bar graphs are displayed adjacently.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Input Data: Selection of a data object to be displayed from a list of available data objects.

Control for channels: Defines which value of the selected data object is displayed. If the option Last Value is selected, the last value of the input channels is displayed. Furthermore, an available single value data object like a published cursor value or a slider value can be selected that defines the X-value of the displayed value of the input channel.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.
**Status**

**Visible**: Can optionally be selected. The function displays the current status of the measure in the real-time graph (e.g. idle, new data received,...). The display can be changed in font, size and color, its style can be set to bold and/or italic.

**Axis**

**Label**: The axis label.

**Scaling**: Defines the range of the bar graph. Selection between **manual** input or input via **data objects**.

**Top value/Bottom value**: Top respective bottom value of the scaling.

**Reference**: States the reference value at which the bar graph starts.

**Ticks**: Sets the display range and its subsections. The **major ticks (mj)** divide the axis into a defined number of sections. The **minor ticks (mn)** define the number of sections within one major tick. Major ticks are represented by larger marks and label, minor ticks by small marks.

**Digits**: Defines the displayed decimal places.

**Font**: Defines font, size and color of the axis labels. Optionally, the axis labels can be displayed bold and/or italic.

**Ranges**

**Value ranges**: Up to 3 value ranges can be defined that may be configured individually. Depending on the selected type, colors of the range indication, LEDs and limits for the standard, warning and alarm range can be defined. The limits can either be entered manually in the input field or defined by a formula or by value or property of data objects.

**Selection / Input field**: The 1st selection list contains 4 preset items (**) and the available data objects:

- **manual**: A value can be entered in the input field.
- **Formula**: A formula can be entered in the 2nd selection field.
- **actual data object**: Value or property of current, i.e. displayed, data object.
- **actual producer**: Property of current producer.

If the current data object or any other data object from the list is selected, either its value or a selectable property can define the limit. The second selection box can be used to select an available property. If the box is empty, the value of the data object is used.
The input field next to the selection box remains valid and editable until a valid selection has been made.

**Color:** The colors of the range indication can be set in the color selection dialog that opens via left click in the respective range field. Different colors can be set for upper and lower warning and alarm ranges.

**LED:** Optionally, an LED can be assigned to each range by activating the checkbox. By clicking on the LED symbol, color and state (1st column: LED on; 2nd column: LED off; 3rd column: LED flashing) can be selected from the list. If the checkbox is not activated, no LED appears.

**Invalid value (NaN):** Optionally, invalid values can be configured with an individual color and LED setting.

**Unit**

- **automatic / manual:** The unit can either be determined automatically from the input channel or selected manually from a list of available units.
- **visible:** Optionally, the unit of the values can be displayed at the axis between the last and second last major tick.

**Skin**

**Style:** Defines the display of the bar graph.

- **compact:** Only the initial value and the end value of the scale are displayed.
- **with axis:** The display comprises an axis with the defined intervals.

**Orientation:** The bar graph can be displayed vertically or horizontally.

**Background Type:** Defines the background from a list of available designs and colors.

**Preview:** Generates an image of the bar graph as it looks with the current settings.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object Bar Graph is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.
Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.6.3 Needle Indicator

Go to:

Graph Editor

Realtime Graphics

Needle Indicator

The graphic element Needle Indicator is used for displaying an indicator that displays values in real-time.

The graphic object consists of a title and a display showing the time. The images above are examples of different representations.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

Optionally, the Needle Indicator can be controlled via mouse. For this, the needle is clicked, moved and released at the desired position. Additionally, a second needle can be created, e.g. for reference value indication. This needle can be controlled in the same way.
Note: In contrast to the view above, the parameter sections can also be displayed in individual tabs (as demonstrated in the following images). The display mode can be set in Menu: Edit→Preferences→Dialogs by enabling respective disabling the option Compact Layout.
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Input Data: Selection of a data object to be displayed from a list of available data objects.

Control for channels: Defines which value of the selected data object (if it is a channel) is displayed. If the option Last Value is selected, the last value of the input channel is displayed. Furthermore, an available single value data object like a published cursor value or a slider value can be selected that defines the X-value of the displayed value of the input channel.

□: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Publish result data: The result data, i.e. the current needle value, can optionally be published as a new data object which can be used by other functions. Available data object types are Double, Float, Integer and String.

Decimal digits: For double and float values the number of decimal digits of the published value can be defined.

Update and validate when adjusting: If this option is selected, the data object and all depending components in the project are updated immediately as long as the needle is adjusted. Otherwise, the data are only recalculated after the needle has been released. It is recommended to disable this option if time-consuming calculations affect the usability.
**Needle manually controlled with reset to input value after:** The needle can be controlled via mouse. The needle then stays on this position for the time stated. After that, it returns to the value of the input data object.

**Manual control with second needle (Actual-/Target display):** A second needle can be displayed which is controllable via mouse. The first needle is still controlled only by the input data object.

**Tab Skin**

- **Arc index:** Defines the display of the scale from a list of available designs (without displaying any color range (Without), display of the color range below the axis (Under axis), display of the color range on the axis (On axis), the scale is situated in the middle of the color range (Centred)).
- **Needle index:** Defines the appearance of the indicator from a list of designs. The needle color can be selected from the color list.
- **Background Type:** Defines the background of the needle indicator from a list of available designs and colors. Knobs can optionally be set on both sides that indicate the limit of the needle deflection.
- **angle:** The position of the LEDs defined in the Ranges tab can be defined via the angle (0° = on top, etc.).
Tab Ranges

Value ranges: Up to 3 value ranges can be defined that may be configured individually. Depending on the selected type, colors of the range indication, LEDs and limits for the standard, warning and alarm range can be defined. The limits can either be entered manually in the input field or defined by a formula or by value or property of data objects.

Selection / Input field: The 1st selection list contains 4 preset items (**) and the available data objects:

**manual**: A value can be entered in the input field.

**Formula**: A formula can be entered in the 2nd selection field.

**actual data object**: Value or property of current, i.e. displayed, data object.

**actual producer**: Property of current producer.

If the current data object or any other data object from the list is selected, either its value or a selectable property can define the limit. The second selection box can be used to select an available property. If the box is empty, the value of the data object is used. The input field next to the selection box remains valid and editable until a valid selection has been made.

Color: The colors of the range indication can be set in the color selection dialog that opens via left click in the respective range field. Different colors can be set for upper and lower warning and alarm ranges.
**LED:** Optionally, an LED can be assigned to each range by activating the checkbox. By clicking on the LED symbol, color and state (1st column: LED on; 2nd column: LED off; 3rd column: LED flashing) can be selected from the list. If the checkbox is not activated, no LED appears.

**Invalid value (NaN):** Optionally, invalid values can be configured with an individual color and LED setting.

**Tab Axis**

<table>
<thead>
<tr>
<th>Skin</th>
<th>Ranges</th>
<th>Axis</th>
<th>Unit</th>
<th>Status</th>
<th>Skin second needle</th>
</tr>
</thead>
</table>

**Scaling:** Defines the range of the needle indicator. Selection between manual input or input via data objects.

**Right value / Left value:** Top respective bottom value of the scaling. It is also possible to define the right value lower than the left value. Then, the scaling will be inverse.

**at ... - ...:** Defines the size of the scale. The values are stated in degree and define an angle for the start respective to the end of the scale.

**Ticks:** Sets the display range and its subsections. The major ticks (mj) divide the axis into a defined number of sections. The minor ticks (mn) define the number of sections within one major tick.

**Digits:** Defines the displayed decimal places of the tick labels.

**Font:** Defines font Name, Size and color. Optionally, the axis labels can be displayed bold and/or italic. The look is shown by an example.
Tab Unit

<table>
<thead>
<tr>
<th>Skin</th>
<th>Ranges</th>
<th>Axis</th>
<th>Unit</th>
<th>Status</th>
<th>Skin second needle</th>
</tr>
</thead>
</table>

- **automatic / manual**: The unit can either be determined automatically from the input channel or selected manually from a list of available units.

- **visible**: Optionally, the unit of the values can be displayed at the selected position.
  - **append to title**: The unit is displayed in square brackets behind the title.
  - **in axis area**: The unit is displayed at the axis between the last and second last major tick.
  - **above the needle**: The unit is displayed above the needle centre point.
  - **below the needle**: The unit is displayed below the needle centre point.

Tab Status

<table>
<thead>
<tr>
<th>Skin</th>
<th>Ranges</th>
<th>Axis</th>
<th>Unit</th>
<th>Status</th>
<th>Skin second needle</th>
</tr>
</thead>
</table>

- **visible**: Can optionally be selected. The function displays the current status of the measurement in the real-time graph (e.g. idle, new data received...). The display can be changed in font, size and color, its style can be set to bold and/or italic. The look is shown by an example.

Tab Skin second needle

<table>
<thead>
<tr>
<th>Skin</th>
<th>Ranges</th>
<th>Axis</th>
<th>Unit</th>
<th>Status</th>
<th>Skin second needle</th>
</tr>
</thead>
</table>

- **Needle index**: Defines the appearance of the second needle from a list of designs. The needle color can be selected from the color list.
visible: Can optionally be selected. The function displays the current status of the measurement in the real-time graph (e.g. idle, new data received...). The display can be changed in font, size and color, its style can be set to bold and/or italic. The look is shown by an example.

Preview: Generates an image of the needle indicator with the current settings.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object Needle Indicator is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the published data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.6.4 XY-Stripchart

Go to:

Graph Editor
  ➔ Realtime Graphics
  ➔ XY-Stripchart

The graphic objects XY-Stripchart is used for displaying a line chart element that is able to display values in real-time.
The graphic object consists of a title and a line chart. This graphic element is a simplified version of the Cartesian line chart and specifically optimised for monitoring tasks. Values can be recorded online. If the measure continues and exceeds the displayed axis value, the initial value of the X-axis always remains constant, only the final value is adjusted.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Alignment:** Defines whether the title is left-aligned, centred or right-aligned.

**Axis A:** Opens the Axis dialog box with system of coordinates A initialised.

**Legend:** Opens the Legend dialog box.

**Limits:** Opens the Limits dialog box.

**Stacked A:** Each curve has its own Y-axis. The axes are stacked.

**Stacked B:** All curves with the same unit belong to one Y-axis.

**Not Stacked:** All curves have a common Y-axis.
Visible: If selected, the curve is set to visible and will be displayed in the coordinate system.

X/ Y: Defines the data objects for X respective Y. The combo box lists all available data objects.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Axis: Selects the curve’s axis index.

Color: Opens the dialog box for selecting the curve color.

: Opens the dialog box Curve of Graph "XY-Stripchart".

Append New: Creates a new curve.

Delete Last: Deletes the last curve from the list.

Delete Invisible: Deletes all curves that are not set to visible.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.6.5 TY-Stripchart

Go to:

Graph Editor

Realtime Graphics

TY-Stripchart

The graphic object TY-Stripchart is used for displaying a line chart that allows the display of values in real-time.

This graphic element is a simplified version of the Cartesian line chart and specifically optimised for monitoring tasks. Values can be recorded online. In contrast to the XY-Stripchart, the initial
The value of the X-axis is not static but changes at run-time, similar to a ticker line. The axis’ feeding speed can be modified.

The graphic object consists of the title and the line chart.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

The graphic element contains buttons for interaction.

**Start / Stop:** Starts/stops the recorder.

**Filter:** The displayed measured values can be filtered (w/o: no filtering; low: low smoothing of the values; high: high smoothing of the values).

**entire buffer:** Switches between the display of the configured axes and the entire content of the buffer. The requirement is that a user-defined buffer size is set in the axis dialog of the X-axis.

Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Axes: Opens the Axis dialog box. The TY-Stripchart has special setting possibilities for a **Realtime (X-Axis)**.
Legend: Opens the Legend dialog box.

Limits: Opens the Limits dialog box.

Stacked A: Each curve has its own Y-axis. The axes are stacked.

Stacked B: All curves with the same unit belong to one Y-axis.

Not Stacked: All curves have a common Y-axis.

Display controls: The controls can optionally be blanked out.

Start event / Stop event: Optionally, a start or stop event can be stated in order to start or stop the realtime display.

Sel: If the checkbox is set, the curve is selected.

Visible: If selected, the curve is set to visible and will be displayed in the coordinate system.

X / Y: Defines the data object for Y. All available data objects are listed in the combo box. X is predefined as time axis.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Axis: Selects the curve’s axis index.

Type: Defines the display of the curve.

Color 1: Opens the dialog box for selecting the curve color.

Marker: Defines the marker from a list of available marker styles.

Color 2: Opens the dialog box for selecting the marker color.

: Opens the dialog box Diagram of Graph TY-Stripchart.

Append New: Creates a new curve.

Move Up: Moves the selected curve in the list of curves up.

Move Down: Moves the selected curve in the list of curves down.

Delete Last: Deletes the last curve from the list.

Delete Invisible: Deletes all curves that are not set to visible.

Delete Selection: All selected curves are deleted.

Modify Selected: The selected curve can be changed. The dialog box Diagram of Graph TY-Stripchart opens.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object **TY-Stripchart** is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

**Realtime (X-Axis)**

![Realtime (X-Axis) screenshot]

**Minor ticks:** The number of minor ticks in the scaling at which a line appears. The requirement is that the display of the minor grid is activated in the upper part of the axis dialog.

**Feeding Speed:** Defines the feeding speed for the X-axis.

**Delta:** The Delta X is determined out of the defined feeding speed.

**Buffer size:** Defines the buffer size for the recording of the signals. If this option is not selected, the buffer size is set to the minimum, i.e. the time range displayed in the diagram.

**2.9.6.6 Boolean Display**

Go to:

**Graph Editor**

- Realtime Graphics
  - Boolean Display

The graphic object **Boolean Display** is used for displaying a switch that changes between two different states.
The **Boolean Display** consists of a title, an optional status indication and an image representing the current state.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also [Interactive Mouse Activities](#).

---

**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

- **Font:** A [dialog box](#) opens for defining font, size, color and formatting of the title.
- **Alignment:** Defines whether the title is left-aligned, centred or right-aligned.

**Input Data:** Selection of a data object to be displayed from a list of available data objects.

- [ ] : Opens the [Filtered Selector of Dataitems](#) dialog for a fast selection from a large number of data items.

**Range for "On":** Defines the range of values for the status **On**. All values outside this range generate the status **Off**. Single values as well as ranges can be entered. Several ranges are separated by a semicolon. Positive and negative decimal numbers as well as negated entries starting with the character ‘!’ are allowed. Negative and positive infinity are denoted by ‘min’/‘<’ and ‘max’/‘>’. The entry is checked for validity. In case of faulty entry, the kind of fault is displayed in red writing behind the input field.
Examples: [-10 - 5; 0-3; 10] or [0-3.5;5.2-9.5] or [min-10; 20-max] or [<10; 20>] or ![20-30;50-60] (the whole entry is negated).

**with status:** Optionally, the current status of the measurement can be displayed in the real-time graph (e.g. idle, new data received...). The display can be changed in font (Name), Size and color; its style can be set to **bold** and/or **italic**.

**Image size (%):** The size of the images can be defined in relation to the available space.

**Configuration of the states On and Off**

**Simple Circle:** The Boolean Display is displayed as circle. A color and optional transparency (100%) of the circles can be defined for the states **On** and **Off**.

**LED:** The Boolean Display is displayed as LED. For each of the states **On** and **Off** an LED representation (color, luminous) can be selected from the list. If the option Flashing is selected, the list shows the pairs with luminous and non-luminous LED.

**Imported Images:** Alternatively, imported images may be used as symbols for the states. The combo box lists all available images. If **transparent** is selected from the list, the display remains empty.

- **Load new image:** New images are imported to the combo box via the dialog box of the [Images import](#).
- **Tooltip:** Optionally, a text can be edited which is displayed as tooltip when the mouse moves over the display. The text can be **multi-lingual** and may contain formulas. For entering the formula the [Formula Editor](#) can be used.

**Flash:** Optionally, the image (without title) can be flashing. Via **Interval**, the flashing frequency can be defined. The flashing function can also be linked to a **Condition**.

*Example:* The flashing of the image is conditional on a checkbox. If the checkbox is activated, it has the result "true", else "false". As soon as the condition is "true", the image flashes.

```
Flash: [ ] Interval: 500 ms Condition: Value(DataItem("CBG:1031", "CBG:1031-V"),)
```

**Formula Editor:** The [Embedded Formula Editor](#) is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define **Language Dependent Strings** for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object **Boolean Display** is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
### Data object types

<table>
<thead>
<tr>
<th>Data</th>
<th>Data type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>Single values and channels of all data types</td>
<td></td>
</tr>
<tr>
<td>Imported images</td>
<td>ScaledBufferedImage</td>
<td>importable image formats (jpg, gif, …)</td>
</tr>
</tbody>
</table>

### 2.9.6.7 Controlled Image

Go to:

**Graph Editor**
- **Realtime Graphics**
  - **Controlled Image**

The graphic object **Controlled Image** is used for displaying circles or images that change their appearance in case the input values are located within the defined range.

The Controlled Image graphic object consists of a title and the displayed image (a colored circle or an image). A range and a graph to be displayed in the graphic object can be defined for each image.

**Note:** In order to define a range, a new picture has to be determined first (button **New**). Otherwise the standard image respective standard circle is displayed even if the values of the input data change.

A double click on the graphic element opens the modification dialog box. A right click opens the **context menu**. Position and size are changed via mouse. See also **Interactive Mouse Activities**.
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: The title can be left-aligned, right-aligned or centred.

Input Data: Selection of a data object from a list of available data objects. This can be done, for example, by using a value generated by the time generator or by using a published cursor value. If the input data object is a measuring channel, the currently last value will be used. As long as no input data object has been selected or the input data object has been deleted, the Standard image is displayed.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Image: Several images can be defined and configured via the parameter settings below. The combo box shows all images already defined. The settings for the currently selected image are displayed in the section Configuration and can be modified if necessary.

The image Standard is predefined and cannot be deleted. It automatically applies to all ranges not covered by other images. Except the range, all other settings can be edited.

New: Creates a new image the name of which has to be entered in the input box. As long as no valid name is entered the input box is colored red. Then, the range and image can be set for this image.

Delete: Deletes the currently selected image and its settings.
**Configuration:** The following settings apply to the currently selected Image.

**Range:** Defines the range in which the image appears. Single values as well as ranges can be defined. Several ranges are separated by semicolon. Positive and negative decimal numbers and negated entries beginning with ‘!’ are allowed. Negative and positive infinity can be displayed as follows: ‘min’/’<’ and ‘max’/’>’. The input box is colored red as long as no valid range is entered. A note on the error is displayed when positioning the mouse cursor on the red marked field. A range must be defined for all images except Standard. The defined ranges must not overlap.

*Examples:* [-10 - -5; 0-3.5; 5; 5.2-9.5] or [min-10; 20-max] or [<10; 20>] or [|20-30; 50-60] (the whole entry is negated).

**Description:** Optionally, a text can be edited which is displayed as tooltip when the mouse moves over the display. The text can be multi-lingual and may contain formulas. For entering the formula the Formula Editor can be used.

**Simple Circle:** If selected, a circle with a defined color is displayed as soon as the corresponding range is reached.

**Imported Images:** The combo box lists all imported images. The image to be displayed for the current range can be selected from the list. If transparent is selected from the list, the display remains empty.

Load new image: New images are imported to the combo box via the dialog box of the Images import.

**Image size (%):** The size of the image can be defined in relation to the available place.

**Flashing:** Optionally, the image (without title) can be flashing. Via Interval, the flashing frequency can be defined. The flashing function can also be linked to a Condition.

*Example:* The flashing of the image is conditional on a checkbox. If the checkbox is activated, it has the result “true”, else “false”. As soon as the condition is “true”, the image flashes.

| Flasing: | Interval: | 500ms | Condition: | ValueDataItem("CBG:1031", "CBG:1031-V"),) |

**Formula Editor:** The Embedded Formula Editor is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object Controlled Image is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

**: The context sensitive help is activated and the cursor changes to 🤔. The respective help topic is displayed when an area within the dialog is clicked on.
**Example:** See [Dynamic Pictures](#).

### Data object types

<table>
<thead>
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<tr>
<td>Imported images</td>
<td>ScaledBufferedImage</td>
<td>importable image formats (jpg, gif, ...)</td>
</tr>
</tbody>
</table>

### 2.9.6.8 Vectors

Go to:

- **Graph Editor**
  - Realtime Graphics
  - Vectors

The graphic object Vectors is used for displaying a vector graph that shows values in real-time.

The vector graphic object consists of a title and 1 to 3 vector displays. The dimensions displayed in this example are XY, XZ and YZ.

A double click on the graphic element opens the modification dialog box. A right click opens the [context menu](#). Position and size are changed via mouse. See also [Interactive Mouse Activities](#).
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / …) directly in the dialog.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Orientation:** Defines the alignment of the vector graphs. The three vector graphs (XY, XZ, YZ plane) can be displayed horizontally or vertically or only one vector graph (XY plane) is shown.

**X-Input/ Y-Input/ Z-Input**

**Input Map:** For selecting the input data from a list of available data objects.

Button: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Axis Maximum:** Defines the axis length.

**Color:** Opens the dialog box for selecting the axis color.

**Value index of channels controlled by:** Defines the control of the vector display via the index of the selected data object.

1. **Vectorgraphic** / 2. **Vectorgraphic** / 3. **Vectorgraphic**

**Vector Width:** Defines the line width of the vector (in pixels).

**Enddecoration Size:** Defines the size and color of the vector’s tip.

**Background:** Defines the background color of the respective vector graph.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object Vectors is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.6.9 Moving Images

Go to:

Graph Editor
  ➔ Realtime Graphics
  ➔ Moving Images

The graphic object Moving Images is used for displaying a graphic element. There are two input channels that control the X and Y position of the smaller image on a bigger image that functions as background.

The graphic object consists of a title and two pictures. Depending on the input channels, the smaller image moves across the background.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

### Images

**Background:** Selection of the background image from a list with all imported images. For the display of the background image one of the following representations is chosen.

- **Mosaic:** The background image is shown as a mosaic, i.e. it is so often placed next to each other or below one another until the whole background is filled.
- **Scaled:** The background image is scaled to the size of the graphic object.
- **Original Size:** The background image is displayed in its original size.

**Small Moving:** Selection of the moving image from a list containing all imported images. 

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

### Data for Movement

**Datarow:** Defines the input values for the X- and Y-axis. Both input channels determine the position of the moving image in X and Y direction.

**Minimum/ Maximum:** Defines the coordinate system (minimum and maximum for the X- and Y-axis).

**OK:** The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object **Moving Images** is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

![Context sensitive help icon](image)

The context sensitive help is activated and the cursor changes to ![help icon](image). The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.6.10 Curved Line (controlled)

Go to:

**Graph Editor**
- ➔ **Realtime Graphics**
  - ➔ **Curved Line (controlled)**

The graphic object **Curved Line (controlled)** is used for displaying a controlled curved line the size and color of which can be changed by definable value ranges. The type of the line ends can be set.

The graphic object consists of the title and the curved line. The line is controlled by a data object and changes its color and size on the basis of defined ranges. It is suitable for displaying changing states in the process visualization.

Position, length and curve shape are set via mouse (by using the displayed circles). A double click on the graphic element opens the modification dialog box. A right click opens the context menu. See also **Interactive Mouse Activities**.
**Channel**: Selection of the input data from a list of available channels.

[ ]: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Linestyle**: A combo box with all generated lines. The settings of the currently selected line are shown in the section **Configuration** and can be changed if necessary.

**New**: Creates a new line that needs to be defined in the section **Configuration**.

**Löschen**: Deletes the currently selected line and its settings.

**Configuration**

**Range**: Defines the range at which the selected line appears.

**Color**: Defines the line color via the color button.

**Transparent**: Optionally selectable. Defines whether the line is visible (if not enabled) or invisible (if enabled).

**Dashed**: The type of line dash to be used can be selected from a combo box or defined by the user. The style of the dashes is stated as the relation of dash length respective gap to the line width. The 4 values mean: dash – gap – dash – gap.

**Width**: Defines the line width in pixels.

**Start/End line type**: Defines the appearance of the beginning and end of the line.

**Start/End line size**: If a symbol was chosen as line type, the size of the symbol is determined here.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.
Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.6.11 Controlled Arrow

Go to:

Graph Editor
   ➔ Realtime Graphics
   ➔ Controlled Arrow

The graphic object Controlled Arrow displays an arrow the size of which is controlled by another data object.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
**Name:** Name of the graphic object.

**Input Data:** Selection of a data object to be displayed from a list of available data objects. This may be a single value or a channel.

**Control for channels:** Defines which value of the selected data object (if it is a channel) is displayed. If the option **Last Value** is selected, the last value of the input channel is displayed. Furthermore, an available single value data object like a published cursor value or a slider value can be selected that defines the X-value of the displayed value of the input channel.

![Controlled Arrow](image)

**Arrow size and direction:**

- **Relative start position in %:** A value can be defined for the X- and Y-position where the starting point (Zero). The middle of the object is represented by 0%.

- **Controlled length:** The **Arrow length** defines the length that has the arrow with the corresponding **Input value** (0 or 100). The displayed unit is adopted from the input data.

- **Width:** The value defines the width of the arrow.

- **Angle:** The arrow can be directed to any direction. The value defines the angle by which the arrow is rotated. An angle of 0° states that the arrow is directed to the right for positive values.

- **Skin:** Design and color of the arrow can be selected via the two selection lists behind **Needle index**. The preview below shows the arrow with the current value and settings.

**OK:** The changes are applied and the dialog is closed.
**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new graphic object **Controlled Arrow** is created with the current settings. The original graphic object remains unchanged.

**Delete**: The graphic object is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.6.12 Multi Digital Display

#### Go to:

**Graph Editor**

- ➔ **Realtime Graphics**
  ➔ **Multi Digital Display**

The **Multi Digital Display** is used for simultaneous digital display of several channels. Like this, numerical values, date/time, Boolean values or strings can be displayed depending on the data type of the input data object.

The graphic object consists of a title and a digital display table.

<table>
<thead>
<tr>
<th>Distance</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.66 km</td>
<td>30.34 m/s</td>
</tr>
<tr>
<td>TimeGen</td>
<td>Signal</td>
</tr>
<tr>
<td>15:48:02.75</td>
<td>-0.31</td>
</tr>
<tr>
<td>Height</td>
<td></td>
</tr>
<tr>
<td>363.42 m</td>
<td></td>
</tr>
</tbody>
</table>

The cells of the Multi Digital Display can be filled with data objects either via the dialog, or via Drag&Drop from the Explorer as well as per Ctrl+V or the context menu item **Insert data objects from clipboard**. The object copied before can be the name of a data object (text) or the data object entry in the Explorer window.
The orientation and order of the digital displays can be changed directly in the table via mouse by click&move. The individual boxes can be deleted via the delete button. Furthermore whole lines or rows can be marked and new lines or rows can be inserted before or after them or the marked lines/rows are deleted via the buttons.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

Marking a row: upper or lower border of row
Marking a line: right or left border of the line
Marking / deleting a box
Marking and shifting whole graphic element: inner border area of each box as well as inner title area
Marking and shifting a box: inner area of each box
Changing line height or row width: inner borders between lines or rows (shifting outer borders changes size of whole graphic element)

Name: Name of the graphic object.
**Title:** A title can optionally be defined.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Alignment:** The title can be left-aligned, right-aligned or centred.

**Size:** Manual or automatic definition of the number of rows and columns. The option auto can be selected for either the number of rows or lines. Like this, the number in this direction is determined automatically according to the number of selected channels. Accept size saves the changes.

**Automatic Layout:** This option can be used if the input data contain special formatting properties. The tabs Channels and Parameter are adapted accordingly.

**Font size [%]:** If enabled, the respective display element is displayed. The percentage value determines the size relations of title, state, unit and values. The space available for each text is automatically determined in relation to the display field.

**Font size factor:** Depending on the font (tab Parameter) the texts fill up the available space differently. The adjoining selection list can be used to adapt the proportion of the text size to the available space (smallest … medium … biggest).

**Title:** The titles of the boxes can be left-aligned, right-aligned or centred.

**Unit:** Defines at which position the unit is displayed. The user can choose between append to title, in own row and append to value.

**Inset:** Defines the horizontal and vertical distance of the text to the border of the box.

**Cells size:** Optionally, Width and / or Height of the cells can be set to fixed, uniform size.

**Tab Channels**

The section Channels contains two lists – the available data objects on the left side – the selected data objects that are to be displayed on the right side. The input field above the left list can be used to filter the data objects. The list then shows only data object names containing the entered string.

>&>&>&>>&>: The buttons between the lists allow the shifting of the selected/all data objects from one list to the other.

>_<><><>: The buttons below the right list can be used to change the order of the selected data objects: Data objects to the top / one position up / one position down / to the bottom. These buttons are only active when the Multi Digital Display is initialized. In case of later modification, the order of the displayed data objects can be changed in the Parameter tab. After closing the modification dialog, this order can also be changed directly in the graphic object by moving them with the mouse.
Tab Parameter

This tab shows the parameter settings for the data objects selected in the list on the right.

**Item to Display**: Selection of an input data object to be displayed from a list of available data objects.

**Control for channels**: Defines which value is displayed if the selected input data object is a channel. If the option **Last Value** is selected, the last value of the input channel is displayed. Furthermore, an available single value data object like a published cursor value or a slider value can be selected that defines the X-value of the displayed value of the input channel.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Title**: Defines font name, color and style (bold and/or italic) of the title. The text size is automatically determined according to the percentages defined above under font size.

**For input error**:

- **Replace title with input name**: In case of errors in the input data, e.g. if an input data object has been deleted, the name of the data object is displayed as title of the cell.

- **Color**: Defines the color of the title in case of error.

- **With producer name**: The input data objects are displayed with producer name in case of error.

**Status**: Defines font name, color and style (bold and/or italic) of the status. The text size is automatically determined according to the percentages defined above under font size.

**Values**

**Font**: Defines font name and style (bold and/or italic) of the values. The text size is automatically determined according to the percentages defined above under font size.

**Formatting of values**
**automatic value format:** If the data object has the property **ValueFormat**, the display can be automatically formatted according to the pattern defined in this property.

**Format:** A predefined format can be selected from the list of available formats. The list items depend on the data type of the selected channel.

**Digits / Number of characters to be displayed / Pattern:** For double and float values / channels, the number of decimal digits can be stated. If the **Grouping** option is selected, each three digits are grouped by the thousands separator. For string values / channels, the **Number of characters to be displayed** in case of part strings can be stated. For time values / channels, the **Pattern** can be stated.

When values close to zero are displayed only with zeros because the other decimal places are omitted, then even positive values are displayed with a sign "+" in order to differentiate them from exact zero. This option is enabled by default, but can be set in the dialog **Configure Formatter**.

The dialog **Configure Formatter** opens where detailed format properties can be set.

**Unit:** The unit of the displayed values can either be determined automatically from the input data object or selected manually from a list of available (compatible) units. In the latter case the value is converted automatically to the selected unit.

**Title, Status** and **Unit** can only be configured if the display is activated under **Font size [%]**.

**Skin**

**Background Type:** Selection of a background design for the cell from a list of available designs.

**Ranges**

**Value ranges:** Up to 3 value ranges can be defined that may be configured individually.

Depending on the selected type, text and background colors, alerts, LEDs and limits for the standard, warning and alarm range can be defined. The limits can either be entered manually in the input field or defined by a formula or by value or property of data objects.

**Selection / Input field:** The 1st selection list contains 4 preset items (**) and the available data objects:

- **manual**: A value can be entered in the input field.
- **Formula**: A formula can be entered in the 2nd selection field.
- **actual data object**: Value or property of current, i.e. displayed, data object.
**actual producer**: Property of current producer.

If the current data object or any other data object from the list is selected, either its value or a selectable property can define the limit. The second selection box can be used to select an available property. If the box is empty, the value of the data object is used. The input field next to the selection box remains valid and editable until a valid selection has been made.

**Color**: Text and background color for each range can be set in the color selection dialog that opens via double click in the respective range field. Different colors can be set for upper and lower warning and alarm ranges.

**Sound**: Each range can be equipped with a sound. Clicking on the loudspeaker icon switches the sound on and off. In order to change the settings of the sound output, a right-click on the loudspeaker icon and clicking *Configure sound* in the context menu opens the dialog *Configure Sound* to configure the warning sounds.

**LED**: Optionally, an LED can be assigned to each range by activating the checkbox. By clicking on the LED symbol, color and state (1st column: LED on; 2nd column: LED off; 3rd column: LED flashing) can be selected from the list. If the checkbox is not activated, no LED appears.

**Background**: The background filling can be activated, either with a single color or dynamically with definable colors for each value range.

**Invalid value (NaN)**: Optionally, invalid values can be configured with individual colors.

**List of channels**: The list shows the set number of display fields with their assigned data objects or empty fields. All displayed parameters in the tab correspond to the currently selected display field. It is also possible to select multiple data objects. Different settings are indicated by a modified parameter display. The data objects can be shifted in their order by the arrow buttons below the list. They can also be sorted alphabetically.

**Formula Editor**: The *Embedded Formula Editor* is opened via this button.

**N / C / D**: These buttons (New / Change / Delete) can be used to define *Language Dependent Strings* for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.
Duplicate: A new graphic object Multi Digital Display is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ". The respective help topic is displayed when an area within the dialog is clicked on.

Dialogs with automatic layout

The automatic layout is suitable for special input files containing appropriate formatting properties.

Tab Channels - automatic layout

Input Component: An input component can be selected from the list. This should be a producer with several data objects which are displayed automatically.

Property for position: Special formatting properties contained in the input component can be directly used for positioning.
Tab Parameter - automatic layout

The configuration of text properties of values, title, status and unit as well as the skin and value ranges is analog to the manual formatting. Additionally, the value formatting by the Property for text format of the selected component and the configuration of the value ranges by Property is possible.

2.9.6.13 Dynamic Images

Go to:

Graph Editor

Realtime Graphics

Dynamic Images

The graphic object Dynamic Images is used to dynamically visualise animated images, e.g. animated GIF files. This format stores several layers in one image which result in an animation if replayed consecutively. Alternatively, all pictures of a folder can be imported via the extended MultiMedia import and played as a video via the dynamic video graph. The playback characteristics can be set or controlled by a data object.
The graphic object consists of a title and an animated image.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

Name: Name of the graphic object.
Title: A title can optionally be defined.
N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.
Font: A dialog box opens for defining font, size, color and formatting of the title.

Parameter
Image: Combo box with imported images.
: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.
Control: Selection of a data object from a list of available data objects. This can, for example, be a value generated via a time generator or a crank angle calculated from it (see example).
Offset: Defines the value of the first image.
Delta: Defines the interval between two images.
Modulo: The animation is repeated from the stated value onwards.

Scaling

Size Graph to fit Image: The size of the graphic object is automatically adjusted to the size of the image.

Size Image to fit Graph: The image is scaled so as to fit the current size of the graphic object.

Original Size: The image is drawn in original size. The positioning within the graphic object is carried out following the orientation defined with the Navigation (top, bottom, left, right).

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

Example: The animation "DynEngine" shows an engine cycle at a crank angle of 720°, i.e. two whole revolutions. The image sequence consists of 48 images. This results in a delta of 15° from picture to picture. At first, a Time Generator is created to control the display. This time value is then converted into the crank angle for all channels via a coefficient by using the Formula Editor (e.g. mod(A * 60; 720). The crank angle is used as control value for the dynamic image graph (for the settings see the dialog box above). The animation may now be started or stopped by using the keys of the time generator. The execution speed can be changed with the slider. Additionally, the time of
ignition can be highlighted via the Controlled Image by defining a different-colored circle for the corresponding range (e.g. 320-340).
2.9.6.14 Compass Rose

Go to:
Graph Editor
  ➔ Realtime Graphics
    ➔ Compass Rose

The graphic object Compass Rose is used for displaying real-time values in form of a compass rose.

The graphic element consists of a title and a compass rose.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Alignment:** The title can be left-aligned, right-aligned or centred.

**Input Data:** Selection of a data object to be displayed from a list of available data objects. If Last Value is selected, the last value of the input channel is displayed. Furthermore, an available single value data object, e.g. a published cursor value or slider value, can be selected for defining the X-value of the displayed value of the input channel.

**Control for channels:** Defines which value of the selected data object is displayed.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Status**

**Visible:** Can optionally be selected. The function displays the current status of the measure in the real-time graph (e.g. idle, new data received,...). The display can be changed in font, size and color, its style can be set to bold and/or italic.
Options

**North always top:** If selected, the position **North** of the compass rose always points to the top and only the indicator changes its position whenever the value changes.

**Direction always top:** If selected, the indicator always points to the top and the direction of the compass rose changes its position whenever the value changes.

Skin

**Needle index:** Selection of the indicator type from a list of designs. Moreover, the index color can be selected from a list of colors.

**Background type:** Selection of the compass rose’s background design from a list of available designs as well as the selection of the background color via the color button (color selection dialog box).

**Compass rose:** Selection of the compass rose’s display from a list of available designs as well as the selection of the font and line color via the color button (color selection dialog box).

**Preview:** The preview of the compass rose with the current settings is displayed in the preview window.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object **Compass Rose** is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

❓: The context sensitive help is activated and the cursor changes to 📖. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.6.15 Realtime Table

Go to:

Graph Editor → Realtime Graphics → Realtime Table

The **Realtime Table** is a fast table for visualising large amounts of data. If input data change only the displayed area is redrawn instead of the whole table.

The **Realtime Table** consists of a title and a table.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.
General

Frame: Defines the color and line width of the frame surrounding the table.
Horizontal grid: Defines color and line width of a horizontal grid.
Vertical Grid: Defines color and line width of a vertical grid.

Column Headers

Text field: Defines the general column header text. This text appears in the column header in case no Individual Headercells are defined.
Font: Defines font, size and color of the header text as well as the style: bold and/or italic.

Column

The defined columns are displayed on the left side with their name and [column type]. If the option Compact Layout (Menu: Edit→Preferences→Dialogs) is disabled, the list with columns is displayed on the right side.

Up/down: The selected column is moved upwards or downwards in the list.
Add: A new column is generated as a copy of the selected column and added to the list.
Remove: The selected column is deleted.

On the right side (respective left side when deactivating the option Compact Layout) the properties of the selected column can be set.
Name: Defines the column name.

Individual Headercells: If enabled, the entered text is displayed in the corresponding header cell. Else the general header text is displayed.
Font of column: Defines font, size and color of the header text as well as the style: bold and/or italic.

Column Type Tabs

Channel: Each tab contains a radio button that is automatically activated when the tab is selected. This indicates that by switching tabs the parameters are actually modified.

Tab Channel

Channel: The data object to be displayed is selected from a list.
: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.
With view: Different views with filtered display values can be set in the View-Selection-Manager. View 0 is always available and usually does not contain any filters. Whether the view selection is enabled or disabled can be set via Preferences→Dialogs.

Only importers: If enabled, only importer data objects are filtered, e.g. importer, generators, databases or measurement components. This is done to prevent double filtering of data objects. If a data object is already filtered in a component, e.g. a calculation, the data object from this component is not filtered again. Otherwise, all data objects are filtered.

For double & float channels: Defines the number of decimal places for all floating-point channels.

Scientific: The exponential depiction can optionally be selected.

Depending Text Colors: Depending on the values, the text and background can be displayed in different colors.

Use definition of column: The settings for the depending text color are taken over from the stated column.

Own definition: Three color sections can be defined for the value display of the selected channel at certain events. A color can be defined for text (T:) and background (F:).

Off: A standard formatting is used for all values.

Tab Expression

Expression: The entered expression is used for all cells. Different values respective texts in the different cells are achieved by using the line variable index in the formula. For inputting formulas the Embedded Formula Editor can be used.

Resolve: The embedded formula is resolved and the result displayed in the text field.

Formula Editor: The Embedded Formula Editor is opened via this button.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new Realtime Table is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.6.16 Crash test dummy

Go to:

Graph Editor

Realtime Graphics

Crash test dummy

The function Crash test dummy is used to visualize the results of crash tests according to the EuroNCAP standards. There are two types (head-on and side collision) for displaying crash test dummies. The crash test dummy is colored in accordance with the evaluation of the individual sections.

The evaluation follows the EuroNCAP point system from 0 to 4 points. The calculation forming the basis of determining the points is not a constituent of jBEAM.

Single values are expected for the evaluation points. They can, for example, be generated via Graph Generator→Controls→Value Input.
The assignment of the colors to the points according to EuroNCAP standard 2012:

- **4.00 Points**
- **2.67 – 3.99 Points**
- **1.33 – 2.66 Points**
- **0.01 – 1.32 Points**
- **0.00 Points**

A double click on the graphic object opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element are changed via mouse. See also Interactive Mouse Activities.

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>4.00</td>
</tr>
<tr>
<td>Neck</td>
<td>3.55</td>
</tr>
<tr>
<td>Chest</td>
<td>2.68</td>
</tr>
<tr>
<td>Thigh</td>
<td>2.66</td>
</tr>
<tr>
<td>Low Leg</td>
<td>1.10</td>
</tr>
<tr>
<td>Foot</td>
<td>0.00</td>
</tr>
<tr>
<td>Head</td>
<td>0.10</td>
</tr>
<tr>
<td>Breast</td>
<td>0.00</td>
</tr>
<tr>
<td>Stomach</td>
<td>4.00</td>
</tr>
<tr>
<td>Hip</td>
<td>3.99</td>
</tr>
</tbody>
</table>
Result Data: Name of the graphic object.

Crash test dummy: Selection of the dummy type: Front Dummy for the head-on collision or Side Dummy for the side collision.

Crash standard: Selection of the standard for crash test evaluation. Currently only the EuroNCAP (European New Car Assessment Programme) standard is implemented.

Body part/score: Individual values can be assigned to the listed body parts. These values have to be available as single values and may, for example, be generated via Graph Editor → Controls → Value Input. The points determined in the crash test (0..4) are entered into the single value data objects. The coloring is carried out according to the EuroNCAP standard in concordance with the table.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
Duplicate: A new graphic object **Crash test dummy** is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 📔. The respective help topic is displayed when an area within the dialog is clicked on.

Extract of the dialog box for the side dummy type:

<table>
<thead>
<tr>
<th>body part</th>
<th>score</th>
</tr>
</thead>
<tbody>
<tr>
<td>head</td>
<td>Kopf-V</td>
</tr>
<tr>
<td>chest</td>
<td>Brust-V</td>
</tr>
<tr>
<td>stomach</td>
<td>Bauch-V</td>
</tr>
<tr>
<td>hip</td>
<td>Hüfte-V</td>
</tr>
</tbody>
</table>

### 2.9.7 Cockpit Instruments

Go to:

Graph Editor ➤ Cockpit Instruments

The menu item is divided into:

- **Altimeter**
- **Variometer**
- **Speedometer**
- **Accelerometer**
- **Chronograph**
2.9.7.1 Altimeter

Go to:

Graph Editor
  └→ Cockpit Instruments
      └→ Altimeter

The graphic element Altimeter is used for displaying an altimeter graph similar to the one present in an airplane cockpit.

The altimeter displays the height above average sea level. Additionally, the QNH value is set for stating the atmospheric pressure of the respective heights. The QNH value is set by default to 1030 hPa (medium atmospheric pressure). The value can be changed via mouse click in the box situated in the lower left corner via QNH+ or QNH- in order to adjust the QNH value to respective height. The set value is displayed on the right side of the graphic element.

The graph shows an altimeter integrated in jBEAM containing two needles. If the long needle moves from a scale line to another on the indicator scale, it corresponds to an altitude change of 20 feet. If the short needle moves from a scale line to another, it corresponds to an altitude change of 200 feet.

QNH: The abbreviation QNH (Q=Atmospheric Pressure, NH=Nautical Height) is used in aviation and corresponds to the atmospheric pressure reduced to average sea level at a measuring station with an assumed temperature of 15°C.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities. There is the QNH button for changing the QNH value additionally to the general mouse actions (see above).

Name: Name of the graphic object.
**Input Item:** Selection of the data object from a list of available data objects. The text field following will show the unit if available.

**Control Item:** Defines which value of the selected data object is displayed.

- : Opens the [Filtered Selector of Dataitems](#) dialog for a fast selection from a large number of data items.

**QNH value:** The QNH value can be determined manually. By default, the value is set to 1013 hPa which corresponds to the average atmospheric pressure. The QNH value can also be changed directly in the graphic element (see above).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object *Altimeter* is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ‣. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.7.2 Variometer

Go to:

**Graph Editor**
- →Cockpit Instruments
- →Variometer

The graphic object *Variometer* is used for displaying a graph for the rate of ascent and descent similar to the one present in an airplane cockpit.

The variometer shows the rate of ascend or descend (in m/s) of an airplane.

The section above zero indicates the rate of ascend, the section below zero indicates the rate of descend.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also [Interactive Mouse Activities](#).
2.9.7.3 Speedometer

Go to:

Graph Editor
  ➤ Cockpit Instruments
  ➤ Speedometer

The graphic object Speedometer is used for displaying an air-speed indicator graph, similar to the one present in an airplane cockpit.
The speedometer displays the aircraft speed in relation to the ambient atmosphere in km/h. The speedometer is divided into several sections.

**Below green:** The minimal aircraft speed is underrun.

**Green:** Safe speed, the airplane is also unrestricted manoeuvrable with gustiness.

**Yellow:** Attention! Flying is only allowed in calm air. Extreme piloting motions should be avoided.

**Red:** Maximum admissible top speed. This limit must not be exceeded!

**White mark:** Recommended speed for the approach for a landing.

**Blue line:** Minimum speed of an airplane with several air-screws in case one of the air-screws is not working.

**Yellow triangle:** Minimum speed for an airplane’s approach for a landing.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

**Name:** Name of the graphic object.

**Input Item:** Selection of the data object from a list of available data objects. The text field following will show the unit if available.

**Control Item:** Defines which value of the selected data object is displayed.

![](opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.)
Vso: Defines the minimum speed of the landing configuration.

Vfe: Defines the maximum speed for extended flaps.

Vs: Defines the minimum speed an airplane needs to be operating as expected.

Vno: Defines the maximum aircraft speed when travelling up to which the aircraft is unrestricted manoeuvrable. It is displayed as the upper end of the green section on the air-speed indicator.

Vne: Defines the admissible top speed. It is displayed as the end of the yellow section that is marked with a red line.

Special indications

V??: Defines the minimum speed for the approach for landing of the airplane (yellow triangle).

Vse: States the minimum speed for one-engined operating (blue line).

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object Speedometer is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.7.4 Accelerometer

Go to:

Graph Editor
  ➔ Cockpit Instruments
    ➔ Accelerometer

The graphic object Accelerometer is used for displaying an acceleration graph, similar to one present in an airplane cockpit.
The accelerometer (g-meter) shows the maximum values of the acceleration forces that are acting on a pilot. This can be a positive acceleration (e.g. pressing the pilot into the seat) or a negative acceleration (e.g. lifting the pilot off the seat).

The graph shows an accelerometer integrated into jBEAM having three needles. The medium needle (here at 0.1) states the current acceleration. Additionally there are two "drag indicators" that state the positive and negative acceleration during the measure.

The drag indicators are reset to the position of the medium needle by using the R button (lower left corner).

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

Name: Name of the graphic object.

Input Item: Selection of the data object from a list of available data objects. The text field following will show the unit if available.

Control Item: Defines which value of the selected data object is displayed.

Amin: States the minimum acceleration limit in g.

Amax: States the maximum acceleration limit in g.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object Accelerometer is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.
Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.7.5 Chronograph

Go to:

Graph Editor
  → Cockpit Instruments
    → Chronograph

The graphic object Chronograph is used for displaying a clock containing an additional stop watch, similar to the watch in an airplane cockpit.

The clock shows the time of the input data object depending on the respective time zone.

The graph shows a clock with chronograph function integrated in jBEAM. The short needle indicates the hours, the long thick needle indicates the minutes of the local time. The long thin needle represents the seconds of the stop watch that is situated on the left side of the clock. The buttons in the left lower corner have the following functions:

ON/OFF: To add/remove the short-time meter (stop watch with 30 minutes).

START/STOP: Starts/stops the stop watch and the second hand.

RESET: Sets the stop watch to zero (original state).

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Input Item: Selection of the data object from a list of available data objects. The text field following will show the unit if available.

Control Item: Defines which value of the selected data object is displayed.

Control Item: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Time zone: Defines the time zone and dependent local time. The Greenwich mean time (UTC) at the zero meridian is used as reference.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object Chronograph is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

Help: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.8 2D/3D-Axis Charts

Go to:

Graph Editor

2D/3D-Axis Charts

The menu is divided into:

- Universal cart. 2D-Chart
- Line/Points Chart (Polar)
- Pie Graph
- Line/Points Chart (Cartesian)
- Box-Whisker Chart
- Vectorfield
- Grid Chart
- Wafer Chart
- Contour Plot (Matrix)
- Contour Plot (dynamic)
- Engine Characteristic Map
- Differential Engine Map
- Turbocharger Map
- Differential Turbocharger Characteristic Map
- Universal 3D-Graphic (OpenGL)
2.9.8.1 Universal cart. 2D-Chart

Go to:

**Graph Editor**

- 2D/3D-Axis Charts
- Universal cart. 2D-Chart

The Universal 2D Graph is a universally applicable graphic object supporting the simultaneous presentation of different curve types in one graph.

For each curve type specific functionalities and properties can be specified that are assigned to the corresponding graphic objects.

The Universal 2D-Chart consists of a title, one or more X- and Y-axes, a legend and the curve area.

The example graph shows a Universal 2D-Chart with 3 diagrams: 1. diagram: dynamic map, 2. diagram: GPS data (Line/Points-Diagram), 3. diagram: aircraft (Moving Sprite).

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like the axes, legend or chart opens the respective modification dialog boxes. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Axis A: Opens the Axis dialog box with system of coordinates A initialised.

Axis B: Opens the Axis dialog box with system of coordinates B initialised.

Legend: Opens the Legend dialog box.

Limits: Opens the Limits dialog box.

Cursor: Opens the Cursor dialog box.

Not Stacked: All curves have a common Y-axis.

Stacked A: Each curve has its own Y-axis. The axes are stacked.

Stacked B: All curves with the same unit belong to one Y-axis.

Analysis Cursorset: Every curve has a predefined cursor. All cursors are linked and can be moved by moving the first cursor. The X-, Y- and index values of the curves are displayed at the cursor as tooltip. The window Curve Analysis using Cursor displays all X- and Y-values of the curve.

Note: all cursors defined earlier are overwritten!

Delta Cursorset: Every curve automatically gets 2 predefined cursors, i.e. there are 2 linked cursor sets that can be moved by moving the respective first cursor. The X-, Y- and index values of the curves are displayed at the cursor as tooltip. The window Curve Analysis using Cursor displays the X- and Y-values of both cursors, the delta of the Y-values and the gradient.

Note: all cursors defined earlier are overwritten!

Clear Cursorset: Deletes all cursors.

Analyse 2: Generates 2 cursors (if none exist) and a legend table with the cursor values.
Synchronize X-Input object automatically: After changing the producer of the Y-dataobject, the new producer will also be used for the X-dataobject, but only if both had the same producer and a result object with this name exists for the new producer. If the same sub indices had been selected for the X-dataobject and the Y-dataobject, the new sub indices of Y-dataobject will automatically be applied to the X-dataobject.

Sel (checkbox): Individual curves can be selected in order to be selected upon pressing the button Delete Selected.

Visible (checkbox): Curves can be set visible or invisible. The curve type is displayed as an abbreviation in square brackets.

X: A data object or an auto mode for the X-values of the curve is selected from the list. If a matrix is selected, a submatrix can be defined with the two index fields.

auto (X): The X-values are automatically calculated from XO and ∆X of the Y data object. If an independent channel exists it is automatically used for the X-values. This auto mode unites the former modes auto (Xo,Xdel) and auto (Indep. Channel).

auto(Index): The X-values are automatically calculated from the respective index of the Y data object.

[X-axis]: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

(Y-)Axis: This curve’s index of the Y-axis is selected from a list.

Y: A data object or an auto mode for the Y-values of the curve is selected from the list. If a matrix is selected, a submatrix can be defined with the two index fields.

auto (X): The Y-values are automatically calculated from XO and ∆X of the X data object. If an independent channel exists it is automatically used for the X-values.

auto(Index): The Y-values are automatically calculated from the respective index of the X data object.

[Y-axis]: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

View: Different views with filtered display values can be set in the View-Selection-Manager. View 0 is always available and usually does not contain any filters. Whether the view selection is enabled or disabled can be set via Preferences→Dialogs.

Type: Defines the display of the curve from a list of basis types.

Color 1: Defines the line color of the curve.

Marker: The marker type (circle, rectangle,...) is selected form a list.

Color 2: Defines the color of the marker or the filling.

[more]: An additional dialog box for setting the curve shape is opened (dependent on the curve type).
Append New: A new curve of the selected type is added to the list of curves. The following curve types can be chosen:

- **Line/Points-Diagram** [LP]
- **Graph Objects Diagram** [GO]
- **Scaled Images** [SI]
- **Timed Images** [TI]
- **Moving Sprite** [MS]
- **Box-Whisker Diagram** [BW]
- **Bubbles Diagram** [BU]
- **Errorbars Diagram** [EB]
- **Vectorfield-Diagram** [VF]
- **Matrix-Diagram** [FM]
- **Isoline/Contour-Diagram** [IS]
- **Engine Map** [EF]
- **Δ-Engine Map** [ΔE]
- **Turbocharger Map** [TF]
- **Δ-Turbocharger Map** [ΔT]
- **Moving Map** [MM]

**Move Up:** The selected curve is moved one position upwards in the list.

**Move Down:** The selected curve is moved one position downwards in the list.

**Delete Last:** Deletes the last curve from the list.

**Delete Invisible:** Deletes all invisible curves from the list.

**Delete Selected:** Deletes the selected curve from the list.

**Duplicate Selected:** Adds a new curve with the same settings.

**Modify Selected:** Opens the modification dialog box of the selected curve.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to 🎨. The respective help topic is displayed when an area within the dialog is clicked on.
**X and Y Data Objects**

Depending on the selected diagram type, data objects for the Y-values and, for various diagram types, also for the X-values can be chosen in the selection lists.

If in case of two selectable data objects one of the values is set to **auto**, the respective values are calculated from the X-values of the second data object. This is either carried out by using X0 and ΔX or the independent channel [auto(X)] or the indices [auto(Index)] of the second data object.

This leads to the following options:

<table>
<thead>
<tr>
<th>X-Values</th>
<th>Y-Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>auto</td>
<td>Data Object Example</td>
<td>The default settings for a time object, the X-values are calculated from the values X0 and ΔX or the independent channel (if it exists) of the data object Example. X represents the sampling time of a test object, frequency of spectra, ...</td>
</tr>
<tr>
<td>Data Object Example</td>
<td>auto</td>
<td>Like the first case, however, the curve runs vertically and not horizontally.</td>
</tr>
<tr>
<td>Data Object Example1</td>
<td>Data Object Example2</td>
<td>This setting defines an xy chart. The values of data object Example2 are displayed by using the values of Example1, e.g. force-deflexion graph.</td>
</tr>
<tr>
<td>auto</td>
<td>auto</td>
<td>No curve can be drawn.</td>
</tr>
</tbody>
</table>

The [list of data types](#) names all data objects that can be displayed with the line chart.

**Curve Types**

The data can be drawn with six different predefined types or with individual settings (**special**).

1. The data points are connected with lines.
2. The data points are connected with lines. Additionally, markers are drawn at certain intervals.
3. The data points are connected with lines. Additionally, all data points are labelled with a marker.
4. All data points are drawn with a marker.
5. A histogram display. The respective data point is situated in the middle of the horizontal line.
6. Like 5 but filled with Color 2.
Zooming Curves

Details in the curve area can be enlarged by zooming the curves. This is done by pressing the keys `<CTRL+SHIFT>` and describing a rectangle in the curve area with pressed mouse button at the same time. After letting go the mouse button the selected area is enlarged. The axes receive new min/max values. If the axes are set to optimised scaling (standard), "smooth" axis areas are calculated from the new min/max values.

While Zooming

Generally, zooming changes only the axes of the system of coordinates B which is automatically switched to. This can be seen in the right upper edge. The letter indicating the activated system of coordinates changes from A to B. After zooming, the active system of coordinates can be switched by clicking on this field. The user can return to the previous settings by switching to the system of coordinates A.

Upon a moving the mouse over the borders in the in the system of coordinates B, arrows for moving the curve appear. Additionally, in the upper right corner an overview area is displayed that shows the whole curve as well as the zoomed area (framed red). The display of this area can be configured via the tab Tracking Window.

If the graph is already displayed in system B, system B remains activated.

Moving Curves

The whole curve area can be moved to all directions by pressing both `<CTRL>` and the mouse button while moving the mouse within the axis system. The axes receive new min/max values and the ticks are adopted corresponding to the system of coordinates A. Additionally, an overview window appears in the upper right corner that displays the whole curve and the moved area (marked red).
Changing Axis Ranges

Next to moving curve areas also axis ranges can be enlarged or reduced by using the mouse button. For this, press both <CTRL> and the mouse button and move the mouse left/right (X-axis) or up/down (Y-axis).

The axes receive new min/max values. If the axes are set to optimised scaling (standard), "smooth" axis areas are calculated from the new min/max values.

Additionally, an overview window appears in the upper right corner that displays the whole curve and the moved area (marked red).
**Display of Multidimensional Data Objects**

If multidimensional data objects are selected in the modification dialog, 2 numerical input boxes situated after the select list are enabled. The first field shows the matrix level (1 with a two-dimensional matrix) and the second input field the column of the matrix.

**Representable Data Objects**

Depending on the selected diagram type, data objects e.g. of the following types can be visualised in a Universal cart. 2D-Chart:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOUBLE_VALUE</td>
<td>0D</td>
<td>Floating point numbers</td>
<td>double</td>
</tr>
<tr>
<td>DOUBLE_CHANNEL</td>
<td>1D</td>
<td>Floating point numbers</td>
<td>double[]</td>
</tr>
<tr>
<td>INTEGER_CHANNEL</td>
<td>1D</td>
<td>Integer</td>
<td>int[]</td>
</tr>
<tr>
<td>TIME_CHANNEL</td>
<td>1D</td>
<td>Date/Time</td>
<td>long[]</td>
</tr>
<tr>
<td>BOOLEAN_CHANNEL</td>
<td>1D</td>
<td>Boolean (yes/no)</td>
<td>boolean[]</td>
</tr>
<tr>
<td>TEXT_CHANNEL</td>
<td>1D</td>
<td>Text</td>
<td>String[]</td>
</tr>
<tr>
<td>CEA_VALUE_CHANNEL</td>
<td>1D</td>
<td>ASAM-CEA Definition</td>
<td>diverse</td>
</tr>
<tr>
<td>DOUBLE_MATRIX</td>
<td>3D</td>
<td>Floating point numbers</td>
<td>double[][][]</td>
</tr>
<tr>
<td>INTEGER_MATRIX</td>
<td>3D</td>
<td>Integer</td>
<td>int[][][]</td>
</tr>
<tr>
<td>REF_NUMCHANNEL_MATRIX</td>
<td>2D</td>
<td>Reference to NumericChannels</td>
<td>NumericChannel[]</td>
</tr>
<tr>
<td>PTV_OBJECT_CHANNEL</td>
<td>1D</td>
<td>Objects with PTV data</td>
<td>PTVObject[]</td>
</tr>
<tr>
<td>GRAPH_OBJECT_CHANNEL</td>
<td>2D</td>
<td>Objects with simple graphs</td>
<td>Vector()</td>
</tr>
<tr>
<td>TIMED_IMAGE_CHANNEL</td>
<td>1D</td>
<td>Video images</td>
<td></td>
</tr>
</tbody>
</table>

**2.9.8.1.1 Line/Points-Diagram**

The Line/Points-Diagram is used for displaying X-Y and T-Y curves via lines, markers, bars or numerical values. Each curve can be displayed by a line that connects individual values. Those curves are defined in regards to color, width and display style (dotted, dashed, etc.). Moreover, a curve can be colored in dependency on another channel.

Markers are defined in terms of symbols, size and color so that all or only specific values are marked. A range of tolerance can be defined and displayed around the lines. Numerical values can be displayed at preferred positions by means of labels.

If matrices are used as input data objects, an automatic display of all lines in the diagram is possible. As soon as the number of matrix columns changes the number of displayed lines in the diagram is automatically updated.

Next to numerical channels various other data types can be visualized:
• The display of comments at defined X-values
• The display of limits as lines at predefined values
• A flexible display of legends

The dialog for modifying the xy curve is called by pressing the button More in the Universal 2D-Chart dialog box or by double clicking on the respective curve in the diagram. Alternatively, the context menu entry Modify... Curves can be selected via right-click on the diagram.

Visible: The curve is drawn.

Data Channels

X: A data object or an auto mode for the X-values of the curve is selected from the list. If a matrix is selected, a submatrix can be defined with the two index fields.
**auto (X):** The X-values are automatically calculated from $X_0$ and $\Delta X$ of the Y data object. If an independent channel exists it is automatically used for the X-values. This auto mode unites the former modes auto (Xo,Xdel) and auto (Indep. Channel).

**auto(Index):** The X-values are automatically calculated from the respective index of the Y data object.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Y:** A data object or an auto mode for the Y-values of the curve is selected from the list. If a matrix is selected, a submatrix can be defined with the two index fields.

**auto (X):** The Y-values are automatically calculated from $X_0$ and $\Delta X$ of the X data object. If an independent channel exists it is automatically used for the X-values.

**auto(Index):** The Y-values are automatically calculated from the respective index of the X data object.

**Axis Index:** Defines the axis assigned to the curve.

**inverted:** Shows the curve with inverted values.

**Offset:** Offsets for X and Y can be entered to shift the curves manually in the respective direction. Thus, curves of various measurements can easily be moved one upon the other for a better comparison. The offset only effects the display, channel properties are not changed.

**View:** Different views with filtered display values can be set in the View-Selection-Manager. View 0 is always available and usually does not contain any filters. Whether the view selection is enabled or disabled can be set via Preferences→Dialogs.

**stacked:** Several curves in the diagram can be stacked in groups. The respective curves are selected (set a checkmark) and assigned to the group that they should be associated with. All curves of the same group are stacked in the diagram. Groups with just one curve are treated like individual curves. Different groups and individual curves are displayed next to each other.

**relative[%]:** The stacking of the curves within the groups can be converted to 100%. The sum of the values of all curves in a group adds up to 100% and the individual curves are displayed in accordance with their part of the whole. Please note that for this a checkmark has to be set for all curves in the group.

**auto sync x and y input channel:** As soon as the input objects for X and Y are selected it is checked automatically if they are index synchronous. If they are synchronous or one of the input objects is in auto mode, there is no need for synchronisation and the text is written in blue. If they are not index synchronous, the text appears red. In this case, activating this option induces an internal synchronisation of X and Y.
Tab Section

The parameter settings for the diagram can be modified in individual tabs:

- Line
- Marker
- Bar
- Band
- Curve Label
- Value Labels
- Legend
- Axis label
- Tracking Window
- Datatypes

Formula Editor: Opens the Embedded Formula Editor.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to help. The respective help topic is displayed when an area within the dialog is clicked on.

Tab Line

Parameters for the lines connecting the values.
show lines: The dots are connected with a line if the checkmark is set.

**Exporting as Bitmap:** Activating this option effects that the diagram is exported as bitmap instead of a vector graphic. This may reduce the size of the created report document and thus the loading time in the viewer software if there is a huge amount of graphic elements. The resolution can be configured via the option *pixel graphic resolution* in the Printing/Report tab in Preferences dialog. Please note that with this option texts and lines will show artefacts if displayed with a high zoom factor.

**get from datasources:** If the checkbox is set, the settings for the line width and type of the respective curve are taken from the Datasource-Manager. If chosen, no further settings can be done in this area.

**Width:** Defines the line width in pixels.

**dashed:** Defines the form of the dashes. The style of the dashes is states as the relation of dash length respective gap to the line width. The 4 values mean: dash – gap – dash – gap. This option is only available if the line color is not set to variable.

**Samples:** A predefined line type can be chosen from the list. The values for the dashes are displayed in the input boxes above and may be changed manually.
**Histogram:** The values are connected in steps so that every value receives a "platform".

**xy-Histogram: y changes at x:** If this option is selected, the step to the next value is exactly on the X-value. Else the steps are positioned centred around the X-value. This option is only effective if the X-values originate from a data object and are not created via auto...

**filled**

**with color:** The area between curve and reference line is filled with the stated color.

**transparent:** The filling is drawn transparently, i.e. curves, objects and grids situated underneath are visible.

**with hatching:** The area between curve and reference line is drawn hatched. The hatching pattern and the width of the hatching lines can be defined. The relation of the line width to the space between the hatching lines is defined by the **Hatching distribution** (linewidth to hatching factor). The larger the factor, the wider the space between the lines.

**line color:** The hatching lines are drawn with the curve color.

**own color:** Defines a color for the hatching lines differing from the curve color.

**transparent:** The hatching lines are drawn transparently, i.e. curves situated underneath are visible.

**to value:** The reference line is set to the stated value, i.e. the area between this value and the curve is filled with a color or a hatching.

**to axis minimum:** The reference line is set to the value of the axis minimum.

**to axis maximum:** The reference line is set to the value of the axis maximum.

**to global curve minimum:** The reference line is set to the minimum value of the curve.
to **global curve maximum**: The reference line is set to the maximum value of the curve.

**inner area**: The reference line is created by connecting the last dot of the curve with the first dot.

**with previous curve**: The curve situated underneath is used as reference line.

**get from datasources**: If the checkbox is set, the settings for the line color of the respective curve is taken from the [Datasource-Manager](#). If chosen, no further settings can be done in this area.

**manual color**: The lines between the dots are all drawn with the defined color.

**transparent**: The line is drawn semi-transparently, i.e. curves, objects and grids situated underneath are visible.

**axis color**: The curve is drawn with the defined axis color.

**controlled by channel/column index**: If the input object is a matrix or a group of channels the individual curves (columns) can be drawn with a color gradient. The values for **Minimum** and **Maximum**, i.e. first and last column of the matrix or group of channels, are set automatically to the indices of the first and last columns.

**Controlled by input channel**: The lines between the dots are drawn with a color that is dependent on the values of the controlling channel. The controlling data object is selected from the list. If control values are NaN no line is drawn in this area. This option automatically sets the line type to solid line.

The currently defined color gradient is shown in the color gradient window with the values for **Minimum** and **Maximum** as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the [Color Ranges Editor](#) opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**gap, if**: If subsequent values of a reference channel change by more than the stated value, a gap is drawn in the graph, i.e. a dot is drawn but no line. This option is used to blank out outliers.
changes by: A gap is drawn if the difference of subsequent values is larger than the stated value (>+) respective less than the negative value (<-). <-/+ works in both directions.

draw average of level: Optionally, the average of all values between two gaps can be displayed. This can be used to show plateau averages.

span NaN values: A solid line can be drawn in case of NaN values using neighboring values.

Tab Marker

Example:

get from datasources: If the checkbox is set, the settings for the markers of the respective curve are adopted from the Datasource-Manager. If chosen, all further settings of this area are disabled.

exporting as Bitmap: Activating this option effects that the diagram is exported as bitmap instead of a vector graphic. This may reduce the size of the created report document and thus the loading time in the viewer software if there is a huge amount of graphic elements. The resolution can be configured via the option pixel graphic resolution in the reference.
Printing/Report tab in Preferences dialog. Please note that with this option texts and lines will show artefacts if displayed with a high zoom factor.

**show marker:** If the checkbox is set, the markers are drawn.

**Type:** manual: The marker type is chosen from a list.

**Size:** Defines the percentaged size of the marker (dependent on the marker type) to the basic parameter.

**rotate to course:** Optionally, the markers can be rotated so that they follow the orientation of the curve (only for certain marker types).

**Controlled by:** Optionally, the marker settings can be controlled by another data object (IntegerChannel). This should contain indices for the markers according to the marker list. With value=1, the first marker of the list is drawn at this index, with value=2 the second marker etc. A value of -1 effects that no marker is drawn at this index.

**extend axis scale to be always visible:** The axis scaling is automatically adjusted if the marker would else exceed the diagram borders.

**Range**

- **all values:** All values of the curve range are drawn with markers.

- **only last value:** Only the last value of the curve range is drawn with a marker.

- **last ... values:** A defined number of last values is drawn with markers.

- **transparent:** The markers of the defined number of last values are drawn transparently so that curves situated underneath are visible.

**Declaration of indices:** The indices of the values that are to be drawn with a marker can be entered into the list. Individual indices or ranges are separated by semicolons.

**Minimum/Maximum:** Optionally, only the Minimum and/or Maximum of the curve can be drawn with a marker. If the option local is selected, the minimum/maximum is determined only from the visible range of the diagram.

**Grid**

- **mark every value:** Every value of the range defined above is drawn with a marker.

- **only some values:** Values of the range defined above are drawn with markers only when they have a certain distance (especially for curves with a large amount of values). The distance of the drawn markers depends on the number of values in the available range.

- **every ...-th value:** All values having the defined distance are drawn with a marker (referring to the visible area).
Color

**get from datasources:** If the checkbox is set, the color settings for the markers of the respective curve are adopted from the [Datasource-Manager](#). If chosen, all further settings of this area are disabled.

**stroke:** The outline of the markers can be set to one of the options below.

**with filling:** Optionally, the markers can be filled with color which is defined by one of the options below.

**manual:** All markers are drawn with the defined color.

**as axis:** All markers are drawn with the defined axis color.

**as line:** The color settings of the markers are adopted from the line settings.

**subdiagram index:** If the input object is a matrix or a group of channels the markers of the individual curves (columns) can be drawn with a color gradient. The values for Minimum and Maximum, i.e. first and last column of the matrix or group of channels, are set automatically to the indices of the first and last columns.

**input channel:** The markers are drawn with a color that is dependent on the values of the controlling channel.

**Controlled by:** The controlling data object is selected from the list. If control values are NaN no marker is drawn.

The currently defined color gradient is shown in the color gradient window with the values for Minimum and Maximum as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the Color Ranges Editor opens where color ranges can be modified or added. With the Rainbow option, the colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.
Tab Bar

- **show bars**: If the checkbox is set, the bars are drawn.

- **Alignment**: The bars can be arranged vertically or horizontally.

- **auto scaling**: The bar width around the measured value is automatically set (e.g. 10-90%).

- **manual scaling**: The bar width around the measured value can be set manually. When setting from 0% to 100% the bars are drawn without any space, at 10-90% with a small gap, etc.

**Barwidth (only for x&y)**: The following options are enabled if data objects are set for X-as well as Y-values.

- **auto**: The bar width is automatically determined.

- **fix value**: Defines a fix, absolute value for the bar width referring to the set X-axis.

- **percent of x-axis**: Defines a percentaged value for the bar width referring to the set X-axis.

- **Controlled by**: Optionally, the bar width can be controlled by another data object. The controlling data object is selected from the list. It should contain absolute values for the bar width referring to the set X-axis. If control values are NaN no bar is drawn at this index.

**Style of the stacked bars**: Settings for stacked curves.

Examples:
- x & y data objects with variable color and high overlap of bars
- Display of cumulated values
cumulated: The bars of the stacked curves are set on top of each other (added).

show cumulated value: The added values of the stacked curves are displayed. The Distance to the top of the bars is defined in pixels.

not cumulated: The bars of the stacked curve are not added. The top curve is drawn on top of the lower curve and may hide it partly or even completely.

negative values separated: Negative values are not displayed.

Line Width: The line width and color of the bars’ frame can be defined.

filled, with color: The bars are filled with the defined color.

manual color: All bars are filled with the defined color.

get from datasources: If the checkbox is set, the settings for the bar’s fill color of the respective curve is taken from the Datasource-Manager.

controlled by channel/column index: If the input object is a matrix or a group of channels the individual bars can be drawn according to their indeces with graduated colors. The values for Minimum and Maximum, i.e. first and last column of the matrix or group of channels, are set automatically to the indices of the first and last columns.

When several measurements are compared, the values of the same measurement can thus be drawn in the same color.

Controlled by input channel: The individual bars are drawn with a color that is dependent on the values of the controlling channel. The controlling data object is selected from the list. If control values are NaN no bar is drawn in this area.

The currently defined color gradient is shown in the color gradient window with the values for Minimum and Maximum as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the Color Ranges Editor opens where color ranges can be modified or added. With the Rainbow option, the colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.

gradient: A second fill color can be chosen for the bar’s centre. There will be a continuous color gradient from outwards (fill color) to the inner area (gradient color) of the bar by interpolation. Thus, the bars receive a columnar, three-dimensional appearance.

transparent: The filling of the bars is drawn transparently, i.e. lines located behind the bars are visible.

Consider axis label color: The line color is preferentially used for the axis label. If no lines are active, the selected color to be considered (fill color or frame color) is used.
Tab Band

- **show band around the curve:** Draws a tolerance band around the curve if the checkbox is set.
- **Upper boundary:** Calculates the upper boundary of the tolerance band. The boundary value is calculated from an **absolute part** and a **percentage** of the respective value. The **absolute part** and the **percentage** can either be entered manually in the input fields or defined by **data objects** or calculated by a **formula**. The line **color** of the upper boundary can be selected via color selection button.
- **Lower as upper:** The settings of the upper boundary regarding the discrepancies and line color are adopted by the lower boundary.
- **Lower boundary:** Definition of the distance and line color of the lower boundary of the tolerance band analog to the upper boundary.
- **Line width:** Defines the line width in pixels.
- **filled with:** The area of the band is filled with the stated color.
- **transparent:** The filling of the band is drawn transparently so that the lines situated behind the filling are visible.

**Example:**

![Example Image]
Tab Curve Label

**show label at line:** Draws a label at the curve if the checkbox is set.

**Text:** Input of the text that is to be displayed at the curve. This may also be a formula that is resolved at runtime. For entering the formula the [Formula Editor](#) can be used via the button in the footer. The selection list behind the input field can be used to select a predefined expression.

**extend axis scale to be always visible:** The axis scaling is automatically adjusted if the label would else be located outside. For this, the respective axis must be in **auto Min/Max** mode.

**Position:** Defines the position of the label at the curve.

**x:** Positioning of the label in x-direction:

- **at maximum of data:** The label is displayed at the maximum value of the curve.
- **variable at:** The label is displayed at the stated percentage referring to the displayed curve area.
- **at minimum of data:** The label is displayed at the minimum value of the curve.

**y:** Positioning of the label in y-direction:

- **top/right axis:** The label is displayed at the upper margin of the axis or, in case of swapped axes, on the right. To see the label, an **Alignment** option with a positioning below respectively left of the reference point should be selected.
- **variable at:** The label is displayed at the stated percentage referring to the maximum value of the curve.
- **bottom/left axis:** The label is displayed at the bottom margin of the axis or, in case of swapped axes, on the left. To see the label, an **Alignment** option with a positioning above respectively right of the reference point should be selected.

**Font:** Defines font, size, color and style: bold and/or italic. Optionally, the color of the lines or markers can be applied (line color prevails).
Alignment: Alignment of the font (the red dot is the reference point for the alignment).

with frame, width: A frame is drawn around the label. The line width and color can be defined.

filled, with color: The frame is filled with the defined color.

transparent: The filling of the frame is drawn transparently so that lines located behind the filling are visible.

Tab Value Labels

show value labels: If the checkbox is set, the values of the data object are displayed in the diagram.

extend axis scale to be always visible: The axis scaling is automatically adjusted if the label would else be located outside.

auto x/y-values: X-and/or Y-values are automatically displayed in case they originate from a data object, i.e. not from auto....

always x/y-values: X-and Y-values are always displayed.

only x-values: Only X-values are displayed.

only y-values: Only Y-values are displayed.

with values of: The values displayed as labels can be taken from a data object.

each value: A label is displayed at every value.

only at marker: A label is only displayed at values that are defined as a marker.
**Minimum/Maximum**: Optionally, only the labels for the **Minimum** and/or **Maximum** of the curve can be displayed. If the option **local** is selected, the minimum/maximum is determined only from the visible range of the diagram.

**Format**: The number format of **X**- and/or **Y-value** can be defined via the **Formatter** button.

**with unit**: Optionally, the value labels can be displayed with unit.

**Position**: Defines the position of the labels along the curve.

- **Top/right axis**: The labels are positioned at the upper margin of the axis or, in case of swapped axes, on the right. The **Alignment** of the labels has to be considered, i.e. they should be located below respectively left of the reference point.

- **Variable at**: The numerical values are displayed at the stated percentage of the respective measured values.

- **Alignment**: With this option, the individual value labels can then be moved manually by Drag&Drop in the diagram.

- **Bottom/left axis**: The numerical values are located at the lower axis border and left-aligned of the respective measured value. The **Alignment** of the labels has to be considered, i.e. they should be located above respectively right of the reference point.

**Alignment**: Alignment of the text (the red dot is the reference point for the alignment).

- **switch for values <**: The alignment of the label for values smaller than the stated value can be mirrored.

- **Alignment**: Alignment of the text (the red dot is the reference point for the alignment). A special alignment feature is the labelling perpendicular to the curve.

- **switch for values <**: The alignment of the label for values smaller than the stated value can be mirrored.

**Rotation and distance**: The label is displayed rotated by the stated angle. The angle ranges between -180° ... 180°. Additionally, a distance between label and marker can be defined.

**Font**: Defines font **Name**, **Size**, **Color** and style: **bold** and/or **italic**.

**take line/marker color**: Optionally, the line or marker color can be used. If the option only at marker is selected, the defined marker color is used, in all other cases the line color.

**with frame, width**: A frame with the set width is drawn around the number.

**filled, with color**: The frame is filled with the defined color.
**transparent**: The filling of the frame is drawn transparently so that lines located behind the filling are visible.

---

**Tab Legend**

<table>
<thead>
<tr>
<th>Line</th>
<th>Marker</th>
<th>Bar</th>
<th>Band</th>
<th>Curve label</th>
<th>Value labels</th>
<th>Legend</th>
<th>Axis label</th>
<th>Tracking</th>
<th>Window</th>
<th>Datatypes</th>
</tr>
</thead>
</table>

- **Show this diagram in the legend:** If enabled, this diagram is displayed in the legend of the graph. The listing consists of a symbol in the selected **Legend symbol mode** (see below) representing the curve type and the defined information for the set dataobjects. A precondition is that in the **Legend dialog** of the graph the display of the legend is enabled and the respective elements for display are selected.

**X-dataobjects**

- **Dataitem text**: Show dataitem name
- **my name x**

**Producer text**: Show producername
- **my producer x**

**Y-dataobjects**

- **Dataitem text**: Show dataitem name
- **my name y**

**Producer text**: Show producername
- **my producer y**

*All textfields accept embedded formulas.*

- **Legend symbol mode**: One of the following symbol modes can be selected:
  - **detailed**: A representative miniature of the curve type is shown.
  - **simple**: A rough sketch of the curve type is shown.
  - **only color**: A rectangle in the defined curve colors is shown.

---

**Example:**

- **X-dataobjects/Y-dataobjects**: Settings for the X- and Y-data objects.

- **Dataitem text / Producer text**: Choice whether the name of the data item / producer or a manually entered label is displayed. The manual label may contain embedded formulas.

- **Legend symbol mode**: One of the following symbol modes can be selected:
Source: This option defines which properties shall be used for the representation of the legend symbol. The legend symbol can either be created automatically or according to the properties of the selected elements line, line filling (considers filling and hatching of the curve, especially useful in simple mode), marker, bar filling or bar frame.

Tab Axis label


**Axis label:** Standard setting is

- **Use label definition from axis:** This is the standard setting, i.e. the settings from the Axis dialog are applied.
- **No axis label for this diagram:** No axis label is displayed regardless of what is set in the Axis dialog.

Text field: An individual axis label can be displayed. The input field may contain formulas.

Tab Tracking Window

A zoom window is positioned in the right upper edge of the chart. The whole graphic object is displayed minimised, the zoom area is framed with a defined color. If there are several curves in the chart, all curves should be set to the same settings at the following options so that they are effective. In case there are different settings options defined in Preferences may be used if necessary.

**No tracking window:** No zoom window is displayed in the chart. Example:
**Only in zoomed mode:** The zoom window is only displayed if an area within the chart is maximised.

**Always:** The zoom window is always displayed.

**Window size:** Defines the window size. The maximum size is 50%.

**Line, track frame, background:** Different line colors for the curves, the frame and the background can be defined for the zoom window.

---

### Tab Datatypes

<table>
<thead>
<tr>
<th>Line</th>
<th>Marker</th>
<th>Bar</th>
<th>Band</th>
<th>Curve label</th>
<th>Value labels</th>
<th>Legend</th>
<th>Axis label</th>
<th>Tracking Window</th>
<th>Datatypes</th>
</tr>
</thead>
</table>

- **String-Channel display:** The following options only have effect when the input data object is a string channel.

  - **Index of string in string-list:** The strings contained in the channel are analysed and summarized in a string list. Each different string is added to the string list as soon as it appears in the channel for the first time and is assigned to a continuous index. Each index generates a rubric in the Y-axis. Thus, all identical strings in the channel are displayed on the same level.

  - **Regular (n-th string has value n):** Each value of the string channel is displayed in the given order in its own rubric in the Y-axis.

  - **Labelled lines when string changes:** Draws a line with label only at those indices of the string channel where the string changes. With this option the value labels are disabled.

Examples:

- **Index of string in string list**

- **Regular (n-th string has value n)**

- **Labelled lines when string changes**
In order to define the display settings for all curves simultaneously, click in an empty area of the diagram and open the context menu by right click. There, select the entry Modify all curves. The dialog that opens offers all setting possibilities available for this selection, including the display of string channels.

**Bit-Channel display:** The following options only have effect when the input data object/s is/are a bit matrix or bit channels.

**(automatically) by channel index:** The individual channels or columns of the matrix are stacked on a common axis. The order complies with the channel or column index.

**set value range:** Each curve can be set within a defined fix value range.

In case of result channels of a **Bit Arithmetic** calculation which are stacked by default, the setting of a uniform value range can be forced so that all curves are drawn on the same level.

In case of individual, independent bit channels however, this option can effect that each curve is drawn on a distinct level.

**dependent on diagram index:** Individual channels are stacked. The order complies with the diagram index in the Universal 2D-graph. In case of matrices, all curves are drawn on the same level, as they all have the same index.

Examples:
- **Standard display of a bit matrix** (automatically stacked by column index)
- **Standard display of result bit channels of a Bit Arithmetic calculation (automatically stacked by channel index)**
- **Display of result bit channels of a Bit Arithmetic calculation with defined value range of 0.0 to 1.0 for all curves**

**2.9.8.1.2 Graph Objects Diagram**

The Graph Objects Diagram is used to embed graphic objects like image files into the Universal 2D-Graph. These may be used as scaled background image in a chart. There are no further parameters for the type Graph Objects that can be set. The graphic object is just selected in the modification dialog box of the Universal 2D-Graph.
2.9.8.1.3 Scaled Image

The Scaled Image is a curve type used in the Universal 2D-Graph that allows the display of scaled images in the graphic object.

Image: Selection of the image to be displayed. The original image size is displayed below in pixels. The scaling has to be taken into consideration for the visibility of the image. If no image is visible, the image scaling might not be in agreement with the axis scaling.

New scaling: Manual scaling of the image in the Universal 2D-Graph. 4 coordinates (top, bottom, left, right) are defined according to the scale value.

Importer scaling: Applies the scaling of the image import for the display of the image in the Universal 2D-Graph.

Draw images as tiles: The selected image is placed next to and below itself as many times as necessary in order to fill the whole area of the diagram. The right upper edge of the first tile (reference tile) can be defined via Reference X and Reference Y).

Color Component for z-Values:

- RGB (as a 4 byte int):
  - red/green/blue:
  - hue/saturation/brightness:

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.
: The context sensitive help is activated and the cursor changes to ?? The respective help topic is displayed when an area within the dialog is clicked on.

Result of the settings of the dialog box above:

2.9.8.1.4 Timed Images

The Timed Images diagram integrates images with attached time and, if available, GPS information into the Universal 2D-Graph. Suitable images are created e.g. by a MultiMedia Import of multiple images of a digital camera. They can also be created out of videos by the calculation Video→Timed Images.

When displayed in a time chart, the images are placed in the time axis according to their time information.

When displayed in a map chart and if the images have also GPS information, the images are placed in the map according to the GPS information. The exact position is indicated by a point in the bottom left corner of the image. This point can also be used to hide or show this individual image by Ctrl & Click.

Display with time axis  Display in map mode
**Visible:** The diagram is drawn.

**Data channels**

**X:** The X-values are automatically calculated from the delta X of the Y data.

**Y:** A data object containing the timed images is selected from a list.

**Axis Index:** The axis assigned to this chart.

**Inverted:** Shows the chart with inverted values.
Tab Line

Show lines: Vertical lines are drawn at the left side of the displayed images.

Width: Defines the line width in pixels.

Single color: All lines are drawn with the defined color.

Transparent: The line is drawn transparently, i.e. curves, objects and grids situated underneath are visible.

Axis color: The curve is drawn with the axis color.

Variable color: The lines are drawn with a color that depends on the values of the controlling channel.

Controlled by: A data object is chosen from a list the values of which shall control the line color. At control values NaN no line is drawn.

Minimum: Value and color of the minimum are defined.

Maximum: Value and color for the maximum are defined. The colors between Minimum and Maximum are automatically interpolated.

Rainbow: The colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.

The settings of the lines have only effect in a time chart.

Tab Legend

See also the description of the tab Legend of the Line/Points-Diagram.
**Tab Images**

<table>
<thead>
<tr>
<th>Line</th>
<th>Legend</th>
<th>Images</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Scaling:** The value defines the size of the images in per cent in relation to the width of the graph.

**transparent:** Optionally, the images can be drawn in transparent mode. The value of the transparency can be set between 1% and 100%. The higher the value the more transparent is the image.

**Show all images when closing the dialog:** After closing the dialog all images are displayed. Individual images can be hidden by Ctrl & Click on the respective point in the dialog. This option is only effective when displayed in map mode.

**Hide all images when closing the dialog:** After closing the dialog no image is displayed. Individual images can be shown by Ctrl & Click on the respective point in the dialog. This option is only effective when displayed in map mode.

**GPS-Data from GPS-logger:** If GPS data has been recorded simultaneously by a GPS logger which GPS information is more accurate than that recorded by the camera, this information can be used alternatively. For this, the respected input channels are selected.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.8.1.5 Moving Sprite

The Moving Sprite is used to visualise position-oriented test data. The sprite moves on defined channels. Next to the usage of predefined sprites own graphic objects can be included as well.
Visible: The curve is drawn and visible in the graphic object.

Longitude: Defines the longitude for the horizontal direction. A data channel is selected from the combo box. If auto is chosen, the values are derived from the Y data object.

Latitude: Defines the latitude for the vertical direction. A data channel is selected from the combo box. If auto is chosen, the values are derived from the X data object.

Axis Index: The axis assigned to the curve.

Tab Parameter

Heading: Defines the direction respective rotation of the image. If auto is chosen, the direction of the currently used route section determines the rotation of the image, i.e. the when moving along the route the image is also moving in travel direction. Alternatively, the direction can be determined by an independent channel or a single value (without rotary motion).
Control: Defines the control object that controls the picture respective the moving image, e.g. a cursor.

Image: Selection of the moving image from the following possibilities:

   Inputitem: Selection of an imported image from the list. Suitable image objects can be imported via File→Import MultiMedia→Images. If manual is chosen, the selection of a predefined image or the inserting of a clip image is expected.

Clip Image: A clip image can be inserted from the clipboard or deleted.

Predefined images: Displays predefined images that can be selected and partly edited. The Fill and Frame of the upper 4 image objects can be colored in any color. The hotspot, i.e. the reference point for the image’s alignment in relation to the respective coordinate can be moved in X and Y direction or be centred (C).

Scaling: The size of the image in per cent to the original size.

Transparency: Sets the transparency from 0% = not transparent, i.e. the full opacity, to 100% = fully transparent.

Preview: The defined image object is displayed with hotspot.

Tab Legend

See also the description in the tab Legend of the Line/Points-Diagram.

OK: The changes are applied and the dialog is closed.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.1.6 Box-Whisker Diagram

The Box-Whisker Diagram is used for displaying statistical values with minimum, average, maximum as well as optional outliers and the number of random samplings. The appropriate input data can be generated out of test data e.g. via the calculation Box-Whisker Statistic.
Tab Parameter

**x-Axis:** A data object for the X-values or an auto mode is selected from the list. Also falling X-values are accepted.

- **auto (X):** The X-values are automatically calculated from X0 and ΔX of the Y data object. If an independent channel exists it is automatically used for the X-values. This auto mode unites the former modes **auto (Xo,Xdel)** and **auto (Indep. Channel)**.

- **auto(Index):** The X-values are automatically calculated from the respective index of the Y data object.

  : Opens the [Filtered Selector of Dataitems](#) dialog for a fast selection from a large number of data items.

**y-Axis:** The data objects for the various criteria of the Y-values are selected from the respective lists.

- **Whisker max:** Optional channel for values lying outside of the boxes (outliers above).
  - **Box upper:** The values for the maximum.
  - **Box mid:** The values for the average.
  - **Box lower:** The values for the minimum.
**Whisker min:** Optional channel for values lying outside of the boxes (outliers below).

**Light outliers:** Optional channel for light outliers.

**Extr. outliers:** Optional channel for extreme outliers.

 Campo: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Frame:** Defines width and color of the lines framing the boxes. The frame can also be deactivated (no Frame).

**Box upper:** The colors defined below refer to the upper parts of the boxes.

**Box lower:** The lower part of the boxes can optionally receive different colors. If the checkmark is set, the color selection buttons can be used to define the filling and hatching. Else the settings of **Box upper** are used for the lower boxes.

**Filling:** Fill color of the boxes.

**transparent:** Sets the transparency of the boxes.

**Hatching:** The boxes can be drawn with a hatching. Color, line width and pattern of the hatching can be set.

**Box from ... to ...:** Defines the width of the boxes within the respective categories (measurements). With a range of 0% to 100% the boxes border on each other. A distance between the boxes is reached by a range of 20% to 80%, for example.

**Samples:** Optionally, a data object can be selected that contains the number of samples. The numbers are then displayed below the corresponding boxes. If empty is selected, the number of samples is not displayed.

**Text:** Defines the color for the display of the number of samples.

with **Whisker:** Outliers (whisker) can optionally be displayed.

**Line Width:** Defines the line width and color of the whisker.

**out of channels:** Channels can be stated as reference for the outliers that contain the values for the upper and lower outliers. If this option is selected, channels can be selected at **Whisker max** and **Whisker min** on the left side.

**in relation to Box mid (Ybm):** A difference is calculated from the middle of the box for the upper and lower outliers. The calculation is carried out via a definable Percentage or Delta. If both options are selected, the formulas situated below can be utilised to define whether the larger \((Ybm + Max (p * Ybm; \Delta))\) or the lesser value \((Ybm + Min (p * Ybm; \Delta))\) is used.
Tab Legend

Show this diagram in the legend: If enabled, this diagram is displayed in the legend of the graph. The listing consists of a symbol in the selected Legend symbol mode (see below) representing the curve type and the defined information for the set dataobjects. A precondition is that in the Legend dialog of the graph the display of the legend is enabled and the respective elements for display are selected.

dataobjects: Settings for the various data objects defined in the Parameter tab. If all data objects have the same producer, only the producer name is shown in the legend.

X-dataobjects: Data object selected for x-Axis.
YWt-dataobjects: Data object selected for Whisker max.
YBt-dataobjects: Data object selected for Box upper.
BW/ YBm-dataobjects: Data object selected for Box mid.
YBb-dataobjects: Data object selected for Box lower.
YWb-dataobjects: Data object selected for Whisker min.
YIR-dataobjects: Data object selected for Light outliers.
YeR-dataobjects: Data object selected for Extr. outliers.
S-dataobjects: Data object selected for Samples.
**Dataitem text / Producer text:** Choice whether the name of the data item / producer or a manually entered label is displayed. The manual label may contain embedded formulas.

**Legend symbol mode:** One of the following symbol modes can be selected:
- **detailed:** A representative miniature of the curve type is shown.
- **simple:** A rough sketch of the curve type is shown.
- **only color:** A rectangle in the defined curve colors is shown.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

**?** : The context sensitive help is activated and the cursor changes to ??. The respective help topic is displayed when an area within the dialog is clicked on.

**Example:**

*Representation of a test series of 12 measurements with display of the number of samples:*

![Box-Whisker Graph](image)

*See also example of Box-Whisker Statistics.*
2.9.8.1.7 Bubbles Diagram

The Bubbles Diagram is a curve type of the Universal 2D-Graph that displays coordinates of 3 dependent quantities two-dimensionally. The coordinates (x/y direction) are replaced by bubbles whose size is determined by the Z-values.

Example:

![Bubbles Diagram Example](image)

Visible: The curve is drawn.
X: A data object for the X-values or an auto mode is selected from the list.

auto (X): The X-values are automatically calculated from X₀ and ΔX of the Y data object. If an independent channel exists it is automatically used for the X-values. This auto mode unites the former modes auto (X₀,Xdel) and auto (Indep. Channel).

auto(Index): The X-values are automatically calculated from the respective index of the Y data object.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Y: A data object for the Y-values or an auto mode is selected from the list.

auto (X): The Y-values are automatically calculated from X₀ and ΔX of the X data object. If an independent channel exists it is automatically used for the X-values.

auto(Index): The Y-values are automatically calculated from the respective index of the X data object.

Axis Index: Defines the axis assigned to the curve.

Inverted: The values of the respective curve are inverted. The inverted values are displayed with adjusted scaling if the automatic scaling is enabled.

Type: Selection of the bubbles display type: circle, rectangle, triangle or rhombus.

Size: The size of the bubbles can be displayed uniform (fixed size) or can be controlled, thus having variable size (Z-values). If a variable size is used, the minimum size (Min) and maximum size (Max) can additionally be defined.

Frame: Defines the settings of the bubbles’ frame (e.g. line width, color, line type).

Fill: Defines the fill color of the bubble. It can be set to transparent so that objects situated underneath are visible. The color may be uniform for all bubbles (single color) or variable by means of the values of a controlling data object. In this case a minimum and maximum value for the colors may be defined.

Label: Each bubble can have a label. A possible label may be the value for bubble size, the value for color or the value of input channel. The number format, alignment and font can be modified as well.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to  🎨. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.8.1.8 Errorbars Diagram

The Errorbars Diagram is a curve type of the Universal 2D-Graph that allows the visualization of measurement uncertainties in jBEAM. It contains information about the position of a sampling’s average and the probable position of the average in the entirety. The graph allows the display of the confidence interval (area around the estimated value), the deviation above and below, the upper and lower validation boundary as well as tolerance range and upper range value.

Measured Values (X): A data object for the X-values or an auto mode is selected from the list.

auto (X): The X-values are automatically calculated from \( X_0 \) and \( \Delta X \) of the Y data object. If an independent channel exists it is automatically used for the X-values. This auto mode unites the former modes auto (\( X_0, \Delta X \)) and auto (Indep. Channel).

auto(Index): The X-values are automatically calculated from the respective index of the Y data object.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Show validation limits: Shows the validation limits in which the error bars are displayed. The color for the display of the validation limit can be defined.

Upper/lower: Defines the validation limit manually, via formula or via data object.

Measured range end: Input of the reference value for the calculation of the error limit from an accuracy class. This can be done manually, via formula or via data object.

Deviation (Y): Selection of the data object from a list of available data objects for the data in Y direction (deviation).
Uncertainty (above/below): Standard deviation (distribution of the values) of the sample upwards and downwards.

Line color: Selection of the color for the display of the line connection the average values of the samples.

Bar color: Selection of the color for displaying the error bars of a sample.

Marker color: Selection of the color for the display of the marker that determines the average of the sample.

Show specification limits: Specification limits can optionally be displayed and their color defined.

Legend:

With all input items: All data objects used in the graph are shown in the legend. Each curve appears as an entry in the legend.

"Type VW": A specific display of the legend entries. There are several legend entries for one curve corresponding to the data objects used for the display. A legend may, for example, contain individual entries with display icons for the error bars, deviations and validation limit.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Example:
2.9.8.1.9 Vectorfield-Diagram

This component maps vector fields. Up to two vector fields and their difference can be illustrated in different colors. The display of the vectors can be parameterised.

Example:
**Coordinates**

**x**: A data object for the X coordinates of the vector is selected from a list.

**y**: A data object for the Y coordinates of the vector is selected from a list.

The X and Y coordinates need not be sorted.

**Options** (2 vector fields can be activated at maximum)

**dx / dx2**: A data object with the X-values of the vectors is selected from a list.

**dy / dy2**: A data object with the Y-values of the vectors is selected from a list.

**Differential vectorfield**: A difference vector field can optionally be stated.

**Scaling**: The scaling value of the displayed vector’s length, unit [1/cm].

**Coloring**: The color gradient of the vectors is chosen by defining the color of a minimum and maximum value. The color is interpolated between the values. If the checkmark is not set at **Maximum**, the values are displayed with the color defined at **Minimum**.

- **Rainbow**: The colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**Arrows**: Defines whether arrows are drawn at the end of the vectors and which form they take.

**Linesize**: Defines the line size of the vector arrows.

**OK**: The changes are applied and the dialog is closed.
**Apply**: The changes are applied and the dialog remains open.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

See also the description Vectorfield Graph.

### 2.9.8.1.10 Matrix-Diagram

By coloring the cells of a matrix a matrix data object is displayed. The coloring is dependent on the current values. Additionally, there is the option to display the value in the cell. The matrix graph is especially suitable for the visualisation of rainflow data.

![Rainflow-Matrix](example.png)

*Example with color-filled areas and value display*
Matrix: A matrix data object containing values is selected from a list. With three-dimensional matrices the desired level can be chosen in the text input field.

Switch x/y axis: Switches the X and Y-values/axes.

x&y-values shifted by delta/2: Shifts all X and Y-values by delta/2 (delta = the distance between two X-values).

relative Z-values between 0% and 100%: The Z-values are displayed as relative values in % referring to the minimum and maximum. The maximum Z-value corresponds to 100 %, the minimum corresponds to 0%.

Filled: The single fields receive a background color. Individual colors can be defined for Minimum, Medium and Maximum. The color gradient between these values is interpolated. If neither Medium nor Maximum is checked, all values are displayed with the color defined at Minimum.

Rainbow: The colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.

With values: Enables the display of numerical matrix values.

Font: Defines font, size, color and style: bold and/or italic.

Number format: The number format can either be determined automatically (according to data object type) or defined manually. The number of decimal Digits can be selected. With the option maximal only necessary decimal digits up to the defined number are
displayed. With the option **exact** the defined number of decimal digits is always displayed and if necessary filled with zeros. Optionally, the number can be displayed in **scientific** notation.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.8.11 Isoline/Contour-Diagram

The Isoline/Contour-Diagram is based on a rectangular data matrix. There is a full NaN support for areas without data. Areas between level lines can be colored depending on the values.

**Example:**

![Universal 2D-Graph](image-url)
**Tab Parameter**

**Data matrix**: The data object for the display of the data is chosen from a list. If the data object is a three-dimensional matrix, the sub-matrix (level) can be chosen in the input field. **List of data types**.

**Switch X and Y values**: Switches the X and Y-values.

**1D Interpolation (bars)**: The isolines are shown as bars.

**Colorrange**: The currently defined color gradient is shown in the color gradient window with the values for **Minimum** and **Maximum**. The colors between those values are interpolated. With a click in the window, the **Color Ranges Editor** opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.
**Bar labels:** A separate channel for the labels of the bars can be selected.

**2D Interpolation (field):** Isolines are displayed as a field (see example chart above).

- **relative Z-values between 0% and 100%:** The Z-values are displayed as relative values in % referring to the minimum and maximum. The maximum Z-value corresponds to 100%, the minimum Z-value to 0%.

**Tab Isolines**

- **visible:** Enables the display of isolines.
- **auto:** By means of a defined number of **levels** the gradation of the Z-axis is calculated and displayed.

**Color Gradient:** The color gradient is defined by defining a color for the initial value and the end value. The colors are interpolated between the values.

**Rainbow:** The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

- **Name / Size / bold / italic:** Defines font and size of the isoline labels as well as the style: bold and/or italic.

- **label angle:** The isoline labels can all be aligned in a fixed angle. If the option **automatic** is enabled, the labels are aligned in the current angle of the isoline.

- **fixed levels:** The values of the level are defined manually. Lists can be created, modified and deleted via the buttons. If a single isoline is selected and modified in a diagram, a new list with the current settings is automatically generated (see **Context Menu Isolines**).

- **used set:** If several lists of level curves are defined, the list used for the characteristic map can be chosen via a data object (IntegerValue) or manual value input in the field behind.
**discrete area colors:** The area between two isolines is drawn with a single color instead of a color gradient. With this setting the tab **Contour Areas** is deactivated. Analog to the contour area, discrete areas can be drawn **transparent**.

- **Create a new list:** A new list with presets is generated.
- **Modify list:** The dialog box **configure level** is opened for defining the marked list.
- **Delete list:** The marked list is deleted.

### Tab Contour Areas

<table>
<thead>
<tr>
<th>Isolines</th>
<th>Contour Areas</th>
<th>Marker</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>visible</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Colorrange:</strong></td>
<td>0.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**visible:** Enables the display of contour areas.

**Colorrange:** The currently defined color gradient is shown in the color gradient window with the values for **Minimum** and **Maximum** as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the **Color Ranges Editor** opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**transparent:** The contour areas are drawn semi-transparently.

### Tab Marker

<table>
<thead>
<tr>
<th>Isolines</th>
<th>Contour Areas</th>
<th>Marker</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>visible</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>points:</strong></td>
<td><strong>all points</strong></td>
<td><strong>minimum</strong></td>
</tr>
<tr>
<td><strong>only border points</strong></td>
<td><strong>maximum</strong></td>
<td></td>
</tr>
<tr>
<td><strong>ignore NaN points</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**visible:** Enables the display of markers.

**points:** Enables the display of the points as marker. The appearance of these markers can be set in the tab **points**.

- **all points:** All points of the map are displayed.
only border points: Only the border points around the map are displayed.

ignore NaN points: If the z value is NaN no marker is drawn.

minimum: The minimum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab Minimum.

maximum: The maximum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab Maximum.

Tab Points/Minimum/Maximum
Each marker group can be set individually. The set-up of the tabs is identical.

Size: Defines the size of the markers in pixel.

fill color: Defines the fill color of the markers.

Type: A predefined marker type can be selected from the selection list.

frame width: Defines the frame width around the markers in pixel.

frame color: Defines the frame color of the markers.

show values: The values of the markers are displayed with a defined number of decimal places (DcD) and the set font size.

white background: The value display can be drawn with a white background. Otherwise, the background is transparent.

Alignment: Defines the position of the value display in relation to the marker.

apply settings to all markers: The settings of the currently displayed marker tab are taken over for all marker groups.

Mesh: The calculated grid of the data is displayed in the selected color.

with Values: The grid values are displayed in the chart. The number of displayed decimal places (Digits) can be defined.

Boundary: The chart is drawn with a frame. Color, line width and line type can be defined.
Tab Legend

- show this diagram in the legend:

**M-dataobjects**: Settings for the matrix data object.

**Dataitem text**: Choice whether the data object name or a manually entered label is displayed. The manual label may contain embedded formulas.

**Producer text**: Choice whether the producer name or a manually entered label is displayed. The manual label may contain embedded formulas.

See also the tab Legend of the Line/Points-Diagram.

**N / C / D**: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Cancel**: The dialog is closed and changes are dismissed.

![?]: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.8.1.12 Engine Map

The **Engine Map** diagram is used for displaying engine data from tests. The map is displayed via isolines and/or contour areas.

The isolines and contour areas can receive a value dependent color gradient. The isolines connect points with the same Z-values and can be labelled. Interactive cursors may be defined to publish current X-, Y- and Z-values.

An already existing engine map as well as an engine map created via the calculation **Engine Map Matrix** can be used as input data for the graphic display. Alternatively, channels can directly be used as input data. Then, the map is determined internally. For this, the same algorithm is used as in the separate calculation but there, the new grid can be chosen more flexibly. A further advantage of the separate calculation is that the calculated map can be used in other graphic objects, e.g. 3D-graph.

The input data revolution, manifold pressure and the dependent channel, e.g. specific consumption, do not need an equidistant grid.
Tab Parameter

**Engine Map Matrix**: An already existing or calculated map matrix can be used as input data. If **Channels as Input** is chosen, the following selection fields of channels for revolution, manifold pressure and dependent values are enabled.

**View**: The different views with different filtered display values can be set via View-Selection Manager. View 0 is always available and usually does not contain any filtering. The display of the view-selection is enabled or disabled via Preferences → Dialogs.

**X (Revolution)**: The data object containing the X-values (data for revolution) are chosen from a list.

**Y (Manifold Pressure)**: The data object containing the Y-values (manifold pressure) is chosen from a list.

**Z (Dep. Values)**: The data object containing the Z-values (data for dependent values) is chosen from a list.

**Conflicts**: If the engine map has been determined out of channels, this button opens the Conflict Handling Editor where detected conflicts are listed. Conflicts result from overlaying points, i.e. if different Z-values exist for identical or very close X- and Y-values. The individual
conflicts are shown with the corresponding X- and Y-value ranges in the tooltip. In the dialog, a general strategy for handling the conflicts can be selected (Average, Median, Maximum, Minimum) which is applied to all points. Alternatively, a strategy can be selected for every individual conflict via the option Manual. Moreover, the strategy can be requested for individual conflicts in a separate dialog via the option Request.

relative Z-values between 0% and 100%: The Z-values are displayed as relative values in % referring to the minimum and maximum. The maximum Z-value corresponds to 100 %, the minimum corresponds to 0%.

Mode: If channels are used as input, the mode specifies how the map is determined.

auto mode: By means of a histogram function the boundaries of the X-values are determined from the data. These are used to calculate discrete X-steps. For each X-step the Y and Z-values are adopted from the data. This mode needs an almost uniform X-grid.

covex hull: In contrast to the auto mode the map is always convex.

scattered data: A triangular grid is created from the individual data points of the scattered data via a triangulation algorithm.
**New grid:** Settings of the grid for the display. These options are not enabled with scattered data mode.

**vertical:** Defines the number of Y-values of each X-value in the interpolated map. The fineness of the grid is set in the grading **rough, medium, fine**. This option is not enabled with scattered data.

**Map smoothen:** The curves take a more regular course by smoothing them. The points for the smoothing are determined by cubic spline interpolation.

⚠️ This smoothing algorithm may lead to unwanted effects of overshooting if two points are close to each other but the corresponding Z-values differ considerably. In such cases the smoothing should be disabled.

**show grid:** Enables the display of the value grid including the color selection.

**Unit:**

- **automatic:** The unit of the displayed engine map is automatically determined out of the input Z data object.

- **manual:** Optionally, the displayed engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is
displayed in black and the conversion is shown as tooltip.Convertible units are e.g. "g/kWh" and "kg/Wh".

**Boundary:** A boundary is drawn around the map. **Color, line width** and **line type** of the frame can be defined.

**Tab Isolines**

**visible:** Enables the display of the isolines.

**auto:** The gradation of the Z-axis is calculated and displayed by means of the defined number of levels.

**Color gradient:** The color gradient of the isolines is chosen by defining a color for the initial value and the end value. The colors are interpolated between the values.

**Rainbow:** The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

**Name / Size / bold / italic:** Defines font and size of the isoline labels as well as the style: bold and/or italic.

**label angle:** The isoline labels can all be aligned in a fixed angle. If the option **automatic** is enabled, the labels are aligned in the current angle of the isoline.

**fixed levels:** The values of the levels are defined manually. Lists can be created, modified and deleted via the buttons. If a single isoline is selected and modified in a diagram, a new list with the current settings is automatically generated (see Context Menu Isolines).

**used set:** If several lists of level curves are defined, the list used for the map can be chosen via a data object (IntegerValue) or manual value input in the field behind.

**discrete area colors:** The area between two isolines is drawn with a single color instead of a color gradient. With this setting the tab Contour Areas is deactivated. Analogue to the contour area discrete areas can be drawn **transparent**.

- [Create a new list](#): A new list with presets is generated.
- [Modify list](#): The dialog box configure level is opened for defining the marked list.
- [Delete list](#): The marked list is deleted.

**prefer data object color properties:** If available, the color properties of the data objects (as set in the Datasource-Manager) are used for the display of the isolines.
**Tab Contour Areas**

**visible**: Enables the display of contour areas.

**Colorrange**: The currently defined color gradient is shown in the color gradient window with the values for **Minimum** and **Maximum** as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the **Color Ranges Editor** opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**transparent**: The contour areas are drawn semi-transparently.
### Tab Marker

<table>
<thead>
<tr>
<th>Visible</th>
<th>Points</th>
<th>All Points</th>
<th>Each ...th Value</th>
<th>Keep Boundary Points</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Minimum of Data</th>
<th>Maximum of Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **visible**: Enables the display of markers.
- **points**: Enables the display of points as marker. The appearance of the marker can be set in the **tab points**.
  - **all points**: All points of the map are displayed.
  - **each ...th value**: Only points of the defined distance are displayed. With the option **keep boundary points** it is still possible to display all boundary points.
  - **values per N**: Defines the number of values that are displayed per X-step.
  - **only border points**: Only the border points around the map are displayed.
  - **ignore NaN points**: If the z value is NaN no marker is drawn.
- **minimum**: The minimum point of the calculated map is displayed. The appearance of this marker can be set individually in the **tab Minimum**.
- **maximum**: The maximum point of the calculated map is displayed. The appearance of this marker can be set individually in the **tab Maximum**.
- **minimum of data**: A minimum point of the input data is displayed. The appearance of this marker can be individually set in the **tab Minimum of data**.
- **maximum of data**: A maximum point of the input data is displayed. The appearance of this marker can be individually set in the **tab Maximum of data**.
- **Marker labels with values of**: If the engine map has been determined out of channels, a channel can be selected that supplies the labels for the markers.

#### Tab Points/Minimum/Maximum/Minimum of data/Maximum of data

Each marker group can be set individually. The set-up of the tabs is identical.

- **Size**: Defines the size of the marker in pixel.
**fill color:** Defines the fill color of the marker.

**Type:** A predefined marker type can be selected from the selection list.

**frame width:** Defines the frame width around the marker in pixel.

**frame color:** Defines the frame color of the marker.

**show values:** The values of the marker are displayed with a defined number of decimal places (DcD) and the set font size. A negative input for DcD effects a rounding to the corresponding decimal power, i.e. '-1' rounds to ten, '-2' rounds to hundred etc.

**white background:** The value display can be drawn with a white background. Otherwise, the background is transparent.

**Alignment:** Defines the position of the value display in relation to the marker.

**apply settings to all markers:** The settings of the currently displayed marker tab are taken over for all marker groups.

### Tab Clip Map

<table>
<thead>
<tr>
<th>Isolines</th>
<th>Contour Areas</th>
<th>Marker</th>
<th>Clip Map</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="clip Engine Map Matrix" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**clip Engine Map Matrix:** If the map has been determined by channels, the displayed map can optionally be clipped to definable values. This may be necessary for instance if a rectangular map has been created due to interpolation. Please note that in case of determination of the map via convex hull the clipping line may also be convex. If the clipping line is concave the map is not clipped completely.

**x / y:** The data items containing pairs of values for X and Y which define the clipping line for the displayed map are selected from the selection list. The values for X should cover the whole range of the map. The display of the Y-values of the map is limited to the corresponding Y-value of the clipping line. If the X-values are not identical with the X-steps of the map, the respective Y-values are interpolated. Not-monotone X-values are sorted.
Tab Legend

Show this diagram in the legend: If enabled, this diagram is displayed in the legend of the graph. The listing consists of a symbol in the selected Legend symbol mode (see below) representing the curve type and the defined information for the set dataobjects. A
precondition is that in the Legend dialog of the graph the display of the legend is enabled and the respective elements for display are selected.

**X-dataobjects/Y-dataobjects/Z-dataobjects**: Settings for the X, Y and Z data objects.

**Dataitem text / Producer text**: Choice whether the name of the data item / producer or a manually entered label is displayed. The manual label may contain embedded formulas.

**Legend symbol mode**: One of the following symbol modes can be selected:

- **detailed**: A representative miniature of the curve type is shown.
- **simple**: A rough sketch of the curve type is shown.
- **only color**: A rectangle in the defined curve colors is shown.

**Source**: This option states which properties are used for the representation of the legend symbol. The symbol representation is either created automatically or on the basis of only one of the elements contour, revolutions, isolines or boundary.

**Exporting as Bitmap**: Activating this option effects that the map graphic is exported as bitmap instead of a vector graphic. This may reduce the size of the created report document and thus the loading time in the viewer software if there is a huge amount of graphic elements. The resolution can be configured via the option pixel graphic resolution in the Printing/Report tab in Preferences dialog. Please note that with this option texts and lines will show artefacts if displayed with a high zoom factor.

**Formula Editor**: Opens the Embedded Formula Editor.

**N / C / D**: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Cancel**: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
Set of Levels

Tab Complete Set

**Name:** Label of the list.

**Number of new Levels:** Defines the number of levels that are to be generated.

**First Value:** Defines the value for the first isoline.

**Delta:** Defines the distance between the isolines.

**Create:** A set of isolines and areas are generated with the stated parameters.

**Line Width:** Defines the line width in pixels. The line width is applied to all isolines via **Apply to all**. The buttons **All only Line** and **All with dashed Line** allow the drawing of isolines as continuous or dashed lines.

**Color range:** Defines the color range of the isolines by selecting individual colors for **Minimum** and **Maximum**. The color gradient between these values is interpolated. If **Maximum** is not selected, all lines are drawn with the color defined under **Minimum**.

**Rainbow:** The colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**Set colors:** The isolines of the generated lists receive the defined colors.
Area color range: Defines the color range for the discrete area colors by selecting individual colors for Minimum and Maximum. The color gradient between these values is interpolated. If Maximum is not selected, all lines are drawn with the color defined under Minimum.

Rainbow: The colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.

Set area colors: The areas of the generated list receive the defined colors.

All with Label: A label is drawn at each isoline.

All without Label: No label is drawn at each isoline.

Font Size: Defines the font size of the isoline label.

Digits: Defines the number of decimal places. The button Apply to all assigns these settings to all isoline labels.

Tab Each Level

Each isoline and contour area as well as the corresponding value can be set individually. Several isolines can be selected and edited simultaneously (individual selection by Ctrl & Click; range selection by Shift & Click).

Level #: Shows the number of the selected level in the listing displayed on the right side.

Value: Defines the value at which the selected isoline is to be drawn.

Line: Defines the line width in pixel. Another color can be set via the color selection button and the line can be displayed dashed and/or with label.

Digits: Defines the number of decimal places of the selected isoline.

Area color: Another color can be set via the color selection button.

Delete: The selected isoline is deleted.

Delete All: All isolines are deleted.

Add new: A new isoline is added at the end of the list.
Save levels: The defined list can be saved for later usage. The storage location and file name can be set in the dialog box for saving the file. The level file receives the extension *.jbSOL.

Load levels: A saved level file with the extension *.jbSOL can be selected and loaded in the Open dialog box. A level file can also be loaded via Drag&Drop from the Explorer to the list display.

2.9.8.1.13 Engine Maps (Statistic)

The Engine Maps (Statistic) diagram is used for a two-dimensional display of an engine map respective centre map.

The isolines and contour areas can receive a value independent color gradient. The isolines connect points with the same Z-values and can be labeled. The size of the respective map can be visibly displayed via a boundary. Measured values can be displayed via markers. Furthermore, the display of grid, boundary and/or markers can be determined.

The grid describes the set-up of the map. It represents the interpolated Z-values and can be colored via the contour area. This is done by interpolating the Z-values of the individual grid cells.
Tab Parameter

**Reference Map, Map 2:** Selection of the input values. Usually one matrix per map or 3 input channels (X: Revolution, Y: Manifold Pressure, Z: Dependent Values).

**Engine Map Matrix:** An already existing or calculated map matrix can be used as input data. If **Channels as Input** is chosen, the following selection fields of channels for revolution, manifold pressure and dependent values are enabled.

**View:** The different views with different filtered display values can be set via View-Selection Manager. View 0 is always available and usually does not contain any filtering. The display of the view-selection is enabled or disabled via Preferences $\rightarrow$ Dialogs.

**X (Revolution):** The data object containing the X-values (data for revolution) are chosen from a list.

**Y (Manifold Pressure):** The data object containing the Y-values (manifold pressure) is chosen from a list.

**Z (Dep. Values):** The data object containing the Z-values (data for dependent values) is chosen from a list.

**Conflicts:** If the engine map has been determined out of channels, this button opens the Conflict Handling Editor where detected conflicts are listed.
**Tab Parameter**

**Calculation:** Selects the type of calculation: **Absolute Difference, Relative Difference, Average, Minimum, Maximum** or **Sum**.

**New grid:** Settings of the grid for the display. These options are not enabled with **scattered data** mode for the **Initial Maps**.

- **vertical:** Defines the number of Y-values for each X-value of the calculated difference map. The fineness of the grid is set with the gradings **rough, medium, fine**.

- **Values of N:** If there is a small number of speed ranges, it may be reasonable to **double** or **quadruple** their number in order to calculate a meaningful delta engine map. By default, the number of speed ranges remains unchanged (**same count**).

- **Map smoothen:** The curves take a more regular course by smoothing them. The points for the smoothing are determined by cubic spline interpolation.

**Unit:**

- **automatic:** The unit of the displayed engine map is automatically determined out of the input Z data object.

- **manual:** Optionally, the displayed engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

**Handling of points out of the reference map:** The result engine map is calculated on the basis of the grid points of the reference map. If the grid points are not completely covered by the second (or further) map, i.e. if the other maps are 'smaller' than the reference map, this option states how the margin points which are not available in all maps shall be calculated.

- **Result NaN:** If the grid point is not covered by one or more maps, the result is set to NaN.

- **Extrapolation:** If the grid point is not covered by one or more maps, the missing values are extrapolated from their neighbour values and then calculated together with the values of the other maps.

- **Take boundary:** If the grid point is not covered by one or more maps, the value of the first available neighbour value (seen from the outer boundary) of the respective map is used for the calculation. This means, the boundary values of the smaller map are continued line-by-line or column-by-column up to the boundary of the reference map.

**Tab Isolines**

- **visible:** Enables the display of the isolines.

  - **auto:** The gradation of the Z-axis is calculated and displayed by means of the defined number of levels.

  - **Color gradient:** The color gradient of the isolines is chosen by defining a color for the initial value and the end value. The colors are interpolated between the values.
**Rainbow:** The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

**fixed levels:** The values of the levels are defined manually. Lists can be created, modified and deleted via the buttons. If a single isoline is selected and modified in a diagram, a new list with the current settings is automatically generated (see also Context Menu Isolines).

**used set:** If several lists of level curves are defined, the list to be used for the map can be chosen via a data object (IntegerValue) or manual value input in the field behind.

**discrete area colors:** The area between two isolines is drawn with a single color instead of a color gradient. With this setting the tab Contour Areas is deactivated. Analogue to the contour area discrete areas can be drawn *transparent*.

- [ ] **Create a new list:** A new list with presets is generated.
- [ ] **Modify list:** The dialog box set of levels is opened for defining the marked list.
- [ ] **Delete list:** The marked list is deleted.

**Tab Contour Areas**

![Contour Areas Tab](image)

**visible:** Enables the display of contour areas.

**Colorrange:** The currently defined color gradient is shown in the color gradient window with the values for Minimum and Maximum as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the Color Ranges Editor opens where color ranges can be modified or added. With the Rainbow option, the colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.

**transparent:** The contour areas are drawn semi-transparently.
Tab Marker

**visible**: Enables the display of markers.

**points**: Enables the display of the points as marker. The appearance of these markers can be set in the tab **points**.

- **all points**: All points of the map are displayed.
- **each ...th value**: Only points of the defined distance are displayed. If selecting **keep boundary points**, all boundary points can still be displayed.
- **values per N**: A defined number of points per X-step is displayed.
- **only border points**: Only the border points around the map are displayed.

**minimum**: The minimum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab **minimum**.

**maximum**: The maximum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab **maximum**.

**Tabs points / minimum / maximum**

Each marker group can be set individually. The set-up of the tabs is identical.

**Size**: Defines the size of the marker in pixel.

**fill color**: Defines the fill color of the marker.

**Type**: A predefined marker type can be selected from the selection list.

**frame width**: Defines the frame width around the marker in pixel.

**frame color**: Defines the frame color of the marker.

**show values**: The values of the marker are displayed with a defined number of decimal places (DcD) and the set **font size**. A negative input for DcD effects a rounding to the corresponding decimal power, i.e. '-1' rounds to ten, '-2' rounds to hundred etc.

**white background**: The value display can be drawn with a white background. Otherwise, the background is transparent.

**Alignment**: Defines the position of the value display in relation to the marker.
**apply settings to all markers:** The settings of the currently displayed marker tab are taken over for all marker groups.

**Tab Initial Maps**

**Reference Map/Map 2:** Settings for the first and second initial map.

**Mode**

- **auto mode:** By means of a histogram function the boundaries of the X-values are calculated from the data. Hence, discrete X-steps can be determined. The Y-and Z-value are adopted from the data for each X-step.

- **convex hull:** In contrast to the auto mode the map is always convex.

- **scattered data:** A triangular grid is created from the individual data points of the scattered data via a triangulation algorithm.

**Mesh:** Enables the display of the value grid of the respective map including color selection.

**Boundary:** A boundary is drawn around the displayed map. Line color, line width and line type can be defined.

**show marker:** The markers are drawn if the checkbox is set.

- **fill color:** Defines the fill color of the marker.

- **frame color:** Defines the frame color of the marker.

- **Size:** Defines the pixel size of the marker.

- **frame width:** Defines the frame width of the marker in pixels.

- **Type:** A predefined marker type can be selected from the combo box.

**Show values:** The values of the marker are displayed with a defined number of decimal places (**Decimal digits**) and the set **Fontsize**.
**white background**: The value display can be displayed with a white background. Otherwise the background is transparent.

**Alignment**: Defines the position of the value display at the marker.

### Tab Legend

![Diagram of Tab Legend](image)

**Show this diagram in the legend**: If enabled, this diagram is displayed in the legend of the graph. The listing consists of a symbol in the selected **Legend symbol mode** (see below) representing the curve type and the defined information for the set dataobjects. A precondition is that in the **Legend dialog** of the graph the display of the legend is enabled and the respective elements for display are selected.

**dataobjects**: Settings for the N1, Y1, Z1, N2, Y2 and Z2 data objects.

**Dataitem text / Producer text**: Choice whether the name of the data item / producer or a manually entered label is displayed. The manual label may contain embedded formulas.

**Legend symbol mode**: One of the following symbol modes can be selected:

- **detailed**: A representative miniature of the curve type is shown.
- **simple**: A rough sketch of the curve type is shown.
- **only color**: A rectangle in the defined curve colors is shown.

**Source**: This option states which properties are used for the representation of the legend symbol. The symbol representation is either created automatically or on the basis of only one of the elements **contour**, **isolines** or **boundary**.
Exporting as Bitmap: Activating this option effects that the map graphic is exported as bitmap instead of a vector graphic. This may reduce the size of the created report document and thus the loading time in the viewer software if there is a huge amount of graphic elements. The resolution can be configured via the option pixel graphic resolution in the Printing/Report tab in Preferences dialog. Please note that with this option texts and lines will show artefacts if displayed with a high zoom factor.

Formula Editor: Opens the Embedded Formula Editor.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?️. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.1.14 Turbocharger Map

The Turbocharger Map diagram is suitable for displaying turbocharger data from tests. The map is displayed by using isolines and/or contour areas.

The isolines and contour areas may get a value dependent color gradient. The isolines connect points with the same Z-values and can be labelled. Interactive cursor can be defined in order to publish the current X-, Y- and Z-values.

The input data revolution, mass flow, π total and a dependent channel, e.g. efficiency, need no uniform grid.
Tab Parameter

**Turbocharger Matrix:** An already existing or calculated turbocharger matrix can be used as input data. If **Channels as Input** is chosen, the following selection fields of the channels for revolution, massflow, Πtotal and the dependent values are enabled.

**View:** The different views with different filtered display values can be set via View-Selection Manager. View 0 is always available and usually does not contain any filtering. The display of the view-selection is enabled or disabled via Preferences→Dialogs.

**N (Revolution):** The data object containing the values of the revolution is selected from a list.

**X (Massflow):** The data object containing the values of the massflow is selected from a list.

**Y (Πtotal):** The data object containing the values of Πtotal is selected from a list.
**Z (Dep. Values):** The data object containing the values of the dependent values is selected from a list.

**Configure Ranges:** This button opens the dialog Configure Ranges where the speed ranges can be manually adjusted.

When the speed ranges are determined automatically, the fineness of gradation is mainly defined by the total speed range and the distances between the steps. This yields good results as long as the speed ranges have a relatively similar distance. However, if the distances are very different, i.e. if there are very large ranges as well as very small ranges, small ranges might not be differentiated reliably. Thus, a zigzag line appears in the map. In the other extreme, very large ranges might be separated. In such cases, it is recommended to manually adjust the speed ranges.

**relative Z-values between 0% and 100%:** The Z-values are displayed as relative values in % referring to the minimum and maximum. The maximum Z-value corresponds to 100 %, the minimum corresponds to 0%.

**New grid:** Settings for displaying the grid.

**vertical:** Defines the number of Y-values for each X-value in the interpolated map. The fineness of the grid is set with the grading rough, medium, fine.

**Map smoothen:** The curves take a more regular course by smoothing them. The points for the smoothing are determined by cubic spline interpolation.

**show grid:** Enables the display of the value grid including the color selection.

**Unit:**

- **automatic:** The unit of the displayed engine map is automatically determined out of the input Z data object.
- **manual:** Optionally, the displayed engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units
which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

**Boundary:** A boundary is drawn around the map. **Color, line width** and **line type** of the frame can be defined.

**Tab Revolutions**

**visible:** If the checkbox is set, the revolution ranges are displayed in the chart.

**color:** Defines the color of the revolution display.

- **manual color:** All revolution ranges are drawn in the same color.
- **prefer data object color properties:** If available, the color properties of the data objects (as set in the [Datasource-Manager](#)) are used for the display of the curve.
- **variable color:** The currently defined color gradient of the revolution ranges is shown in the color gradient window with the values for **Minimum** and **Maximum** as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the [Color Ranges Editor](#) opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**Line Width:** Defines the line width in pixel for the display of the revolution ranges.

**Labels:**

- **Unit:** The unit of the displayed revolution ranges is either **automatically** determined out of the input data object or optionally **manually** defined. The new unit has to be a compatible unit. It is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

- **Label font size:** Defines the position and font size of the revolution ranges.

- **DcD:** Defines the number of decimal places for the display of the revolution ranges. A negative input effects a rounding to the corresponding decimal power, i.e. '-1' rounds to ten, '-2' rounds to hundred etc.

- **with dataitem name / with unit:** The data object name as well as the unit can be displayed.

- **Position:** The revolution ranges can be displayed **left** or **right** of the data points.
**Tab Isolines**

- **visible**: Enables the display of the isolines.
- **auto**: The gradation of the Z-axis is calculated and displayed by means of the defined number of levels.
  - **Color gradient**: The color gradient of the isolines is chosen by defining a color for the initial value and the end value. The colors are interpolated between the values.
  - **Rainbow**: The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.
- **Name / Size / bold / italic**: Defines font and size of the isoline labels as well as the style: bold and/or italic.
- **label angle**: The isoline labels can all be aligned in a fixed angle. If the option automatic is enabled, the labels are aligned in the current angle of the isoline.
- **fixed levels**: The values of the levels are defined manually. Lists can be created, modified and deleted via the buttons. If a single isoline is selected and modified in a diagram, a new list with the current settings is automatically generated (see **Context Menu Isolines**).
- **used set**: If several lists of level curves are defined, the list used for the map can be chosen via a data object (IntegerValue) or manual value input in the field behind.
- **discrete area colors**: The area between two isolines is drawn with a single color instead of a color gradient. With this setting the tab **Contour area** is deactivated.Analogue to the contour area discrete areas can be drawn transparent.
  - **Create a new list**: A new list with presets is generated.
  - **Modify list**: The dialog box set of levels is opened for defining the marked list.
  - **Delete list**: The marked list is deleted.
- **prefer data object color properties**: If available, the color properties of the data objects (as set in the **Datasource-Manager**) are used for the display of the isolines.
Tab Contour Areas

Visible: Enables the display of contour areas.

Colorrange: The currently defined color gradient is shown in the color gradient window with the values for Minimum and Maximum as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the Color Ranges Editor opens where color ranges can be modified or added. With the Rainbow option, the colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.

transparent: The contour areas are drawn semi-transparently.

Tab Marker

visible: Markers are drawn if the checkbox is set.

points: Enables the display of points as marker. The appearance of the marker can be set in the tab points.

all points: All points of the map are displayed.

each...th value: Only points of the defined distance are displayed. If selecting keep boundary points, all boundary points can still be displayed.

...values per N: A defined number of points per X-step is displayed.

only border points: Only the border points around the map are displayed.

ignore NaN points: If the z value is NaN no marker is drawn.
**minimum:** The minimum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab **minimum**.

**maximum:** The maximum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab **maximum**.

**minimum of data:** A minimum point of the input data is displayed. The appearance of this marker can be individually set in the tab **minimum of data**.

**maximum of data:** A maximum point of the input data is displayed. The appearance of this marker can be individually set in the tab **maximum of data**.

**Marker labels with values of:** If the turbocharger map has been determined out of channels, a channel can be selected that supplies the labels for the markers.

**Tab Points/Minimum/Maximum/Minimum of data/Maximum of data**

Each marker group can be set individually. The set-up of the tabs is identical.

**Size:** Defines the size of the marker in pixel.

**fill color:** Defines the fill color of the marker.

**Type:** A predefined marker type can be selected from the selection list.

**frame width:** Defines the frame width around the marker in pixel.

**frame color:** Defines the frame color of the marker.

**show values:** The values of the marker are displayed with a defined number of decimal places (\(DcD\)) and the set **Font size**. A negative input for \(DcD\) effects a rounding to the corresponding decimal power, i.e. '-1' rounds to ten, '-2' rounds to hundred etc.

**white background:** The value display can be shown with a white background. Otherwise, the background is transparent.

**with unit:** Optionally, the values of the displayed markers are drawn with unit.

**Alignment:** Defines the position of the value display in relation to the marker.

**apply settings to all markers:** The settings of the currently displayed marker tab are taken over for all marker groups.
Tab Legend

Show this diagram in the legend: If enabled, this diagram is displayed in the legend of the graph. The listing consists of a symbol in the selected Legend symbol mode (see below) representing the curve type and the defined information for the set dataobjects. A precondition is that in the Legend dialog of the graph the display of the legend is enabled and the respective elements for display are selected.


Dataitem text / Producer text: Choice whether the name of the data item / producer or a manually entered label is displayed. The manual label may contain embedded formulas.

Legend symbol mode: One of the following symbol modes can be selected:

- **detailed:** A representative miniature of the curve type is shown.
- **simple:** A rough sketch of the curve type is shown.
- **only color:** A rectangle in the defined curve colors is shown.

Source: This option states which properties are used for the representation of the legend symbol. The symbol representation is either created automatically or on the basis of only one of the elements contour, revolutions, isolines or boundary.
Exporting as Bitmap: Activating this option effects that the map graphic is exported as bitmap instead of a vector graphic. This may reduce the size of the created report document and thus the loading time in the viewer software if there is a huge amount of graphic elements. The resolution can be configured via the option pixel graphic resolution in the Printing/Report tab in Preferences dialog. Please note that with this option texts and lines will show artefacts if displayed with a high zoom factor.

Formula Editor: Opens the Embedded Formula Editor.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.1.15 Turbocharger Maps (Statistic)

The Turbocharger Maps (Statistic) diagram is used for the two-dimensional display of a turbo charger map respective centre map.

The isolines describe the value based progress in the map and its property value. The size of the respective map can be visibly displayed via a boundary. Measured values can be displayed via markers. Furthermore, the display of grid, boundary and/or markers can be determined.

The first map is used as reference map for the grid onto which the values of the second map are projected. Non-existing values can be extrapolated or are viewed as NaN.
Tab Parameter

**Reference Map, Map 2:** Selection of the input values. Usually one matrix per map or 4 input channels: Revolution (N), Massflow (X), Πtotal (Y) and the dependent values (Z).
**Engine Map Matrix:** An already existing or calculated map matrix can be used as input data. If -- **Channels as Input** -- is chosen, the following selection fields of the channels for revolution, massflow, Πtotal and the dependent values are enabled.

**View:** The different views with different filtered display values can be set via **View-Selection Manager**. View 0 is always available and usually does not contain any filtering. The display of the view-selection is enabled or disabled via **Preferences → Dialogs**.

**N (Revolution):** The data object containing the values of the revolution is selected from a list.

**X (Massflow):** The data object containing the values of the massflow is selected from a list.

**Y (Πtotal):** The data object containing the values of Πtotal is selected from a list.

**Z (Dep. Values):** The data object containing the values of the dependent values is selected from a list.

**Tab Parameter**

**Calculation:** Selects the type of calculation: **Absolute Difference, Relative Difference, Average, Minimum, Maximum or Sum**.

**New Grid:** Settings of the grid for the display.

- **Vertical:** Defines the number of Y-values for each X-value of the calculated difference map. The fineness of the grid is set with the gradings **rough, medium, fine**.

- **Values of N:** If there is a small number of speed ranges, it may be reasonable to **double or quadruple** their number in order to calculate a meaningful delta engine map. By default, the number of speed ranges remains unchanged (**same count**).

- **Map smoothen:** The curves take a more regular course by smoothing them. The points for the smoothing are determined by cubic spline interpolation.

**Unit:**

- **automatic:** The unit of the displayed engine map is automatically determined out of the input Z data object of the reference map.

- **manual:** Optionally, the displayed engine map can receive a compatible unit. This unit is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip. Convertible units are e.g. "g/kWh" and "kg/Wh".

**Handling of points out of the reference map:** The result engine map is calculated on the basis of the grid points of the reference map. If the grid points are not completely covered by the second (or further) map, i.e. if the other maps are 'smaller' than the reference map, this option states how the margin points which are not available in all maps shall be calculated.

- **Result NaN:** If the grid point is not covered by one or more maps, the result is set to NaN.

- **Extrapolation:** If the grid point is not covered by one or more maps, the missing values are extrapolated from their neighbour values and then calculated together with the values of the other maps.
**Take boundary:** If the grid point is not covered by one or more maps, the value of the first available neighbour value (seen from the outer boundary) of the respective map is used for the calculation. This means, the boundary values of the smaller map are continued line-by-line or column-by-column up to the boundary of the reference map.

**Tab Isolines**

**visible:** Enables the display of the isolines.

**auto:** The gradation of the Z-axis is calculated and displayed by means of the defined number of levels.

**Color gradient:** The color gradient of the isolines is chosen by defining a color for the initial value and the end value. The colors are interpolated between the values.

**Rainbow:** The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

**fixed levels:** The values of the levels are defined manually. Lists can be created, modified and deleted via the buttons. If a single isoline is selected and modified in a diagram, a new list with the current settings is automatically generated (see **Context Menu Isolines**).

**used set:** If several lists of level curves are defined, the list used for the map can be chosen via a data object (IntegerValue) or manual value input in the field behind.

**discrete area colors:** The area between two isolines is drawn with a single color instead of a color gradient. With this setting the tab **Contour area** is deactivated. Analogue to the contour area discrete areas can be drawn **transparent**.

- **Create a new list:** A new list with presettings is generated.
- **Modify list:** The dialog box **set of levels** is opened for defining the marked list.
- **Delete list:** The marked list is deleted.

**Tab Contour Areas**

**visible:** Enables the display of contour areas.

**Colorrange:** The currently defined color gradient is shown in the color gradient window with the values for **Minimum** and **Maximum** as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the **Color Ranges Editor** opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**transparent:** The contour areas are drawn semi-transparently.
Tab Marker

visible: Markers are drawn if the checkbox is set.

points: Enables the display of points as marker. The appearance of the marker can be set in the tab points.

  all points: All points of the map are displayed.
  each ...th value: Only points of the defined distance are displayed. If selecting keep boundary points, all boundary points can still be displayed.
  ...values per N: A defined number of points per X-step is displayed.
  only border points: Only the border points around the map are displayed.

minimum: The minimum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab minimum.

maximum: The maximum point of the calculated map is displayed. The appearance of this marker can be set individually in the tab maximum.

Tab Points/Minimum/Maximum

Each marker group can be set individually. The set-up of the tabs is identical.

Size: Defines the size of the marker in pixel.

fill color: Defines the fill color of the marker.

Type: A predefined marker type can be selected from the selection list.

frame width: Defines the frame width around the marker in pixel.

frame color: Defines the frame color of the marker.

show values: The values of the marker are displayed with a defined number of decimal places (DcD) and the set font size. A negative input for DcD effects a rounding to the corresponding decimal power, i.e. '-1' rounds to ten, '-2' rounds to hundred etc.

white background: The value display can be shown with a white background. Otherwise, the background is transparent.

Alignment: Defines the position of the value display in relation to the marker.
apply settings to all markers: The settings of the currently displayed marker tab are taken over for all marker groups.

**Tab Revolutions**

![Tab Revolutions](image)

_visible_: If the checkbox is set, the speed range is displayed in the chart.

**Line Width**: Defines the line width in pixel for the display of the speed ranges.

**Labels**:

- **Unit**: The unit of the displayed revolution ranges is either automatically determined out of the input data object or optionally manually defined. The new unit has to be a compatible unit. It is either selected out of the selection list with suggestions or entered manually. Units which are not compatible are displayed in red color. If the unit has been recognised, it is displayed in black and the conversion is shown as tooltip.Convertible units are e.g. "g/kWh" and "kg/Wh".

- **Label font size**: Defines the position and font size of the revolution ranges.

- **DcD**: Defines the number of decimal places for the display of the revolution ranges. A negative input effects a rounding to the corresponding decimal power, i.e. '-1' rounds to ten, '-2' rounds to hundred etc.

- **with dataitem name / with unit**: The data object name as well as the unit can be displayed.
Tab Initial Maps

Reference Map/Map 2: Settings for the first and second initial map.

Revolutions: Defines color and position of the speed ranges.

Mesh: Enables the display of the value grid of the respective map including color selection.

Boundary: A boundary is drawn around the displayed map. Line color, line width and line type can be set.

show marker: The markers are drawn if the checkbox is set.

  fill color: Defines the fill color of the marker.
  frame color: Defines the frame color of the marker.
  Size: Defines the pixel size of the marker.
  frame width: Defines the frame width of the marker in pixels.
  Type: A predefined marker type can be selected from the combo box.

Show values: The values of the marker are displayed with a defined number of decimal places (Decimal digits) and the set Fontsize.

white background: The value display can be displayed with a white background. Otherwise the background is transparent.

Alignment: Defines the position of the value display at the marker.
Tab Legend

Show this diagram in the legend: If enabled, this diagram is displayed in the legend of the
graph. The listing consists of a symbol in the selected Legend symbol mode (see below)
representing the curve type and the defined information for the set dataobjects. A
precondition is that in the Legend dialog of the graph the display of the legend is enabled
and the respective elements for display are selected.

dataobjects: Settings for the N1, X1, Y1, Z1, N2, X2, Y2 and Z2 data objects.

Dataitem text / Producer text: Choice whether the name of the data item / producer or a
manually entered label is displayed. The manual label may contain embedded formulas.

Legend symbol mode: One of the following symbol modes can be selected:

detailed: A representative miniature of the curve type is shown.
simple: A rough sketch of the curve type is shown.
only color: A rectangle in the defined curve colors is shown.

Source: This option states which properties are used for the representation of the legend
symbol. The symbol representation is either created automatically or on the basis of only
one of the elements contour, revolutions, isolines or boundary.

Exporting as Bitmap: Activating this option effects that the map graphic is exported as bitmap
instead of a vector graphic. This may reduce the size of the created report document and
thus the loading time in the viewer software if there is a huge amount of graphic elements. The resolution can be configured via the option **pixel graphic resolution** in the **Printing/Report** tab in Preferences dialog. Please note that with this option texts and lines will show artefacts if displayed with a high zoom factor.

**Formula Editor:** Opens the [Embedded Formula Editor](#).

**N / C / D:** These buttons (New / Change / Delete) can be used to define [Language Dependent Strings](#) for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ? ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.8.1.16 Moving Map

The diagram type Moving Maps is mainly used as a background map in the Universal 2D-Graph and for the visualisation of position related measurement data in combination with the line graph. Depending on the position and zoom the component reloads the needed data dynamically and renders the map live. There are several map services in jBEAM. They can be loaded via the menu item **Extra→Map Services**.
Map server: Selection of the map services (data object) from a list of available data objects. Map services are provided via the menu item Extra→Map Services.

Tab Moving Map

Map scale: Defines the display of the chart’s scale.
- no scale: No map scale is displayed in the graphic object.
- arrows: The scale in X and Y direction is displayed with arrows.
- box: The scale in X and Y direction is displayed as box.
- color: The color for the scale can be selected via color selection button.
- horizontal: Only the horizontal scale is displayed.
- vertical: Only the vertical scale is displayed.
- Unit: A unit for the scale can be selected via selection list.

Map resolution: Defines the resolution of the map (low, medium, high).
- show tile frames: Every tile of the loaded map is drawn with a frame.
- show tile ident: The corresponding code for every tile of the loaded map is displayed.

Tab Legend

The legend entries for the Map data objects can be configured as described in the tab Legend of the Line/Points-Diagram.

Tab Axis label
The axis labels for the X- and Y-axes can be configured as described in the tab Axis label of the Line/Points-Diagram.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to 🎨. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.2 Line/Points Chart (Polar)

Go to:

Graph Editor

2D/3D-Axis Charts

Line/Points Chart (Polar)

The Line/Points Chart (Polar) is a standard graph for displaying curve progressions with polar coordinates. The line chart is using a polar coordinate system.

A typical line chart with polar coordinates looks as follows:
The line chart consists of a title, one phi- and r-axis, a legend and a curve area. A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

![Polar Diagram](image)

**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Axis:** The axis dialog box opens.

**Legend:** The legend dialog box opens.

**Curve:** Curves can be set to visible or invisible.

**Phi:** A data object containing the curve’s Phi values is selected from a list.

- **Auto:** The Phi values are calculated automatically from X0 and ΔX or the respective index of the R data object.
- ![ ]: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**R:** A data object containing the curve’s R values is selected from a list.

- **Auto:** The R values are calculated automatically from X0 and ΔX or the respective index of the Phi data object.
- ![ ]: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Type:** The type of curve display is chosen from a list.
**Line:** Defines the line color of the curve.

**Marker:** Selects the marker type (circle, rectangle,...) from a list.

**Color:** Depending on the curve type the color of the marker/area is selected.

**RI:** If selected, a radial interpolation is carried out.

**Append New:** A new curve is appended to the list.

**Delete Last:** Deletes the last curve from the list.

**Delete Invisible:** Deletes all invisible curves.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

- The context sensitive help is activated and the cursor changes to ![help](image). The respective help topic is displayed when an area within the dialog is clicked on.

**Phi and R Data Object**

The desired data object for Phi and R values can be chosen in both lists.

If one of the values is set to **auto**, the respective values are calculated from the X-values of the second data object. This may be carried out by using \(X_0\) and \(\Delta X\) [\(\text{auto}(X_0, \Delta X)\)] or the indices [\(\text{auto}(\text{Index})\)] of the second data object. This leads to the following options:

<table>
<thead>
<tr>
<th>Phi Values</th>
<th>R Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>auto</td>
<td>Data Object Example</td>
<td>The default settings for the time object, the Phi values are calculated from the values (X_0) and (\Delta X) of the data object Example.</td>
</tr>
<tr>
<td>Data Object Example</td>
<td>auto</td>
<td>Like the first case, just that the curve runs vertically and not horizontally.</td>
</tr>
<tr>
<td>Data Object Example1</td>
<td>Data Object Example2</td>
<td>This setting defines a Phi-R chart. The values of data object Example2 are displayed by using the values of Example1.</td>
</tr>
<tr>
<td>auto</td>
<td>auto</td>
<td>No curve can be drawn.</td>
</tr>
</tbody>
</table>
Curve Types
The data can be drawn in 4 different display types.

1. Special
2. The data points are connected with lines.
3. The data points are connected with lines. Additionally, the data points are labelled with a marker.
4. The data points are drawn with a marker.

Representable Data Objects
Data objects of the following types can be visualised in a polar line chart:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOUBLE_CHANNEL</td>
<td>1D - Array</td>
<td>Floating point numbers</td>
<td>double[]</td>
</tr>
<tr>
<td>FLOAT_CHANNEL</td>
<td>1D - Array</td>
<td>Floating point numbers</td>
<td>float[]</td>
</tr>
<tr>
<td>INTEGER_CHANNEL</td>
<td>1D - Array</td>
<td>Integer</td>
<td>int[]</td>
</tr>
</tbody>
</table>

2.9.8.3 Pie Graph
Go to:

Graph Editor

- 2D/3D-Axis Charts
- Pie Graph

A pie chart is used for displaying the share of the data object’s values in the whole by means of segments of a circle.
Example

Pie chart unsorted and without a rest class

Pie chart in 3D view, sorted and with rest class "Other fruits" as well as singled out slice

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

Alternatively to the dialog settings, some adjustments are possible directly in the diagram. The diagram can be rotated via Drag&Drop with pressed <Ctrl> button (equivalent to changing the Start angle). Individual pie slices can be singled out also via Drag&Drop. The Tilt angle of a 3D view can be adjusted via Drag&Drop with pressed <Shift> button. When the mouse moves over the individual pie slices, the corresponding values are displayed as tooltips.
Name: Name of the graphic object.

Title: A title can optionally be defined.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Tab Basics

Values: The data object for the curve is selected from a list.

Display: Defines the representation of the pie diagram.

Set up: Defines the arrangement of the pie slices.
Start angle (clockwise): Defines the angle at which the first slice shall be started. The angle is stated in clockwise direction. Alternatively, the start angle can be changed in the diagram via Drag&Drop with the <Ctrl> button pressed.

clockwise: If selected, the pie slices are arranged clockwise, starting with the stated start angle. If the option is deactivated, the slices are arranged counter-clockwise.

sorted: If selected, the segments of the circle are sorted by values in descending order, i.e. the largest value is first.

View: Defines the view of the pie diagram.

2D: The pie diagram is displayed in 2D view.

3D: The pie diagram is displayed in 3D view. The Tilt angle defines the grade of the 3D effect. The angle can be set between 40° and 90°, with 40° being the flattest view. The 90° angle is equivalent to the 2D view (top view). Alternatively, the tilt angle can be changed in the diagram via Drag&Drop with the <Shift> button pressed.

Line color: Defines the line color for the frame of the segments.

Labels: Defines position and layout of the segment labels.

none: No label is displayed.

inside: The label is displayed within the segments of the circle.

outside: The label is displayed outside of the segments of the circle.

with color circle: The label is displayed additionally with a circle of the corresponding color.

with box: The label is displayed in a colored rectangle the background filling and frame color of which can be defined.

Font: Defines the font, size and color of the column header text as well as the style: bold and/or italic.

Labeltype: Defines which information the labels shall display.

index: The corresponding index of the value is displayed.

string channel: Selection of a channel which contains the labels. Optionally, Values and/or Percentages of the pie slices can be displayed in brackets. For this, Format and number of decimal Digits can be defined. The values can be displayed either with unit or without.

Important: The channel selection is also active when the option formula is selected. If the expression 'Label(CurrDataItem, Index)' is used within the formula, the texts from the channel selected here are displayed.

value: The absolute values are displayed, optionally with unit.

percentage: The percentage values are displayed.

Format: The number format and the number of decimal Digits can be defined for the display of the absolute and percentage values.

formula: The label can be generated by a formula. The predefined formulas below the input field can be used for a fast definition. They are inserted by a click on the respective button. The Formula Editor can also be used to enter the formula.
2nd line / 3rd line: If labels are placed outside of the segments an additional second and third line can be enabled.

: Clicking the respective button inserts the predefined formula behind into the input field.

Examples:

'Label(CurrDataItem, Index) + ": " + Value(CurrDataItem, Index)+Unit(CurrDataItem)' -> 'Apples: 50.0kg'.

'Label(CurrDataItem, Index) + ": " + Value(CurrDataItem, Index)/Sum(CurrDataItem)*100 + "%"' -> 'Apples: 25.25%'.

Tab Pie Slices

Number of predefined slices: Colors can be defined for the defined number of slices via the buttons for color selection. A maximum number of 50 slices can be predefined. If the number of values in the data channel exceeds the number of predefined slices, a rest class containing the supernumerous values is created automatically.

Colors: Each pie slice can be assigned with an individual color via color selection buttons.

Single out: Each pie slice can be singled out individually. According to the defined percentage value, the slice is pulled out of the pie. Alternatively, each slice can be singled out directly in the diagram via Drag&Drop.

Reset Fill Colors: Changed colors are reset to their original state.

Reset single out: All values for single out are reset to zero.
### Tab Rest Class

<table>
<thead>
<tr>
<th>Basics</th>
<th>Pie Slices</th>
<th>Rest Class</th>
</tr>
</thead>
</table>

- **with rest class**: If not all values are to be displayed as individual segments, this option can be chosen in order to summarise smaller values to a rest class.

- **all values except the ... highest values**: Only the defined number of highest values are displayed as slices, all smaller values are added and displayed as a common segment.

- **all values below**: All values less than the defined absolute value are added and displayed as a common segment. The unit is automatically determined by the data object.

- **All values below (%)**: The values less than the defined percentage value are added and displayed as a common segment.

- **Name of rest class**: A name for the summarized group of values can be defined that is displayed in the chart.

- **Parameter**: The common segment can be assigned with a color via color selection button. The slice can also be singled out by the defined percentage value.

- A rest class is automatically created if the size of the selected channel exceeds the number of defined pie slices. The default name for the rest class is "Rest".

### Formula Editor

- The **Embedded Formula Editor** is opened via this button.

- **N / C / D**: These buttons (New / Change / Delete) can be used to define **Language Dependent Strings** for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

- **OK**: The changes are applied and the dialog is closed.

- **Apply**: The changes are applied and the dialog remains open.

- **Duplicate**: A new graphic object is created with the current settings. The original graphic object remains unchanged.

- **Delete**: The graphic object is deleted and the dialog closed.

- **Cancel**: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to 🔮. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.4 Graphic Objects

Go to:

Graph Editor
- 2D/3D-Axis Charts
- Graphic Objects

Graphic Objects is used for displaying simple graphic elements like line, circle, text, etc. A data object with simple graphic elements is generated with the calculation Graphic Objects.

The graphic object consists of a title and a graphic area that contains the individual graphs of the data object.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size are changed via mouse. See also Interactive Mouse Activities.

Name: Name of the graphic object.

Title: A title can optionally be defined.
N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Graphical data: Selection of a data object from the combo box.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Unit of data: The position data stored in the data object can be interpreted in different ways: as a statement in millimetre (mm), centimetre (cm), inch (inch), per cent in relation to the graph (% of graph) or per cent in relation to the current page (% of page).

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.5 Line/Points Chart (Cartesian)

The Line/Points Chart (Cartesian) will not be developed further. The Universal cart. 2D-Chart offers the same functionality but additionally the opportunity for combinations with other curve types. Via context menu item Convert into Uni2D-Graph the Line/Points Chart (Cartesian) can be converted to a Line/Points-Diagram as part of the Universal cart. 2D-Chart.

The line graph consists of the title, one or more X and Y axes, the legend as well as the curve area.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu.

Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Alignment: Defines whether the title is left-aligned, centred or right-aligned.

Axis A: Opens the Axis dialog box with system of coordinates A initialised.

Axis B: Opens the Axis dialog box with system of coordinates B initialised.

Legend: Opens the Legend dialog box.

Limits: Opens the Limits dialog box.

Cursor: Opens the Cursor dialog box.

Not Stacked: All curves have a common Y-axis.

Stacked A: Each curve has its own Y-axis. The axes are stacked.

Stacked B: All curves with the same unit belong to one Y-axis.

Analysis Cursorset: Every curve has a predefined cursor. All cursors are linked and can be moved by moving the first cursor. The X-, Y- and index values of the curve are displayed at the cursor as tooltip. The window Curve Analysis using Cursor displays all X- and Y-values of the curve.

Note: all cursors defined earlier are overwritten!

Delta Cursorset: Every curve automatically gets 2 predefined cursors, i.e. there are 2 linked cursor sets that can be moved by moving the respective first cursor. The X-, Y- and index values of the curve are displayed at the cursor as tooltip. The window Curve Analysis using Cursor displays the X- and Y-values of both cursors, the delta of the Y-values and the gradient.

Note: all cursors defined earlier are overwritten!

Clear Cursorset: Deletes all cursors.
**Background Image:** A scaled background image is selected from a list.

**Sel** (checkbox): Individual curves can be selected in order to be selected upon pressing the button **Delete Selected**.

**Visible** (checkbox): Curves can be set visible or invisible.

**X:** A data object for the X-values of the curve is selected from a list. If a matrix is selected, a submatrix can be defined with the two index fields.

- **auto:** The X-values are automatically calculated from X0 and ΔX or the respective index of the Y data object.
- : Opens the **Filtered Selector of Dataitems** dialog for a fast selection from a large number of data items.

**(X-)Axis:** The index of the X-axis for this curve is chosen from a list.

**Y:** A data object for the Y-values is selected from a list.

- **auto:** The Y-values are automatically calculated from X0 and ΔX or the respective index of the X data object.
- : Opens the **Filtered Selector of Dataitems** dialog for a fast selection from a large number of data items.

**(Y-)Axis:** The index of the Y-axis for this curve is chosen from a list.

**View:** The different views with different filtered display values can be set via View-Selection Manager. View 0 is always available and usually does not contain any filtering. The display of the view-selection is enabled or disabled via Preferences→Dialogs.

**Type:** Defines the display of the curve from a list of basis types.

**Color 1:** Defines the line color of the curve.

**Marker:** The marker type (circle, rectangle,...) is selected form a list.

**Color 2:** Defines the color of the marker.

: The dialog for setting the xy curve is opened.

**Append New:** A new curve is appended to the list.

**Move Up:** The selected curve is moved upwards in the list by one position.

**Move Down:** The selected curve is moved downwards in the list by one position.

**Delete Last:** Deletes the last curve from the list.

**Delete Invisible:** Deletes all invisible curves.

**Delete Selected:** Deletes the selected curves from the list.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.
X and Y Data Object

The desired data object for the X and Y-values can be chosen in both lists. If one of the values is set to auto, the respective values are calculated from the X-values of the second data object. This may be carried out by using \( X_0 \) and \( \Delta X \) \([\text{auto}(X_0,Xdel)]\) or the indices \([\text{auto}(\text{Index})]\) of the second data object.

This leads to the following options:

<table>
<thead>
<tr>
<th>X-Values</th>
<th>Y-Values</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>auto</td>
<td>Data Object Example</td>
<td>The default settings for a time object, the X-values are calculated from the values ( X_0 ) and ( \Delta X ) of the data object Example. ( X ) represents the sampling time of a test object, the frequency of spectra, …</td>
</tr>
<tr>
<td>Data Object Example</td>
<td>auto</td>
<td>Like the first case, just that the curve runs vertically and not horizontally.</td>
</tr>
<tr>
<td>Data Object Example</td>
<td>Data Object Example</td>
<td>This setting defines an xy chart. The values of data object Example2 are displayed by using the values of Example1, e.g. force-deflexion graph.</td>
</tr>
<tr>
<td>auto</td>
<td>auto</td>
<td>No curve can be drawn.</td>
</tr>
</tbody>
</table>

The list of data types names all data objects that can be displayed with the line chart.

Curve Types

The data can be drawn with six different predefined types or with individual settings (special).

7. The data points are connected with lines.
8. The data points are connected with lines. Additionally, markers are drawn at certain intervals.
9. The data points are connected with lines. Additionally, all data points are labelled with a marker.
10. All data points are drawn with a marker.
11. A histogram display. The respective data point is situated in the middle of the horizontal line.
12. Like 5 but filled with Color 2.
Zooming Curves

Details in the curve area can be enlarged by zooming the curves. This is done by pressing the keys <CTRL+SHIFT> and describing a rectangle in the curve area with pressed mouse button at the same time. After letting go the mouse button the selected area is enlarged. The axes receive new min/max values. If the axes are set to optimised scaling (standard), "smooth" axis areas are calculated from the new min/max values.

While Zooming

Generally, zooming changes only the axes of the system of coordinates B which is switched to. This can be seen in the right upper edge. The letter indicating the activated system of coordinates changes from A to B. After zooming, the active system of coordinates can be switched by clicking on this field. The user can return to the previous settings by switching to the system of coordinates A.

Upon a moving the mouse over the borders in the in the system of coordinates B, arrows for moving the curve appear. Additionally, in system an overview area is displayed that shows the whole curve as well as the zoomed areas (framed red).

If the graph already displays system B, system B remains activated.

Moving Curves

The whole curve area can be moved to all direction within the system of coordinates by pressing both <CTRL> and the mouse button. The axes receive new min/max values and the ticks are adopted corresponding to the system of coordinates A. Additionally, an overview window appears in the upper right corner that displays the whole curve and the moved area (marked red).
Changing Axis Ranges

Next to moving curve areas also axis ranges can be enlarged or reduced by using the mouse button. For this, press both <CTRL> and the mouse button and move left/right (X-axis) or up/down (Y-axis).

The axes receive new min/max values. If the axes are set to optimised scaling (standard), "smooth" axis areas are calculated from the new min/max values.

Additionally, an overview window appears in the upper right corner that displays the whole curve and the moved area (marked red).
Display of Multidimensional Data Objects

If multidimensional data objects are selected in the modification dialog box, 2 numerical input boxes situated after the select list are enabled. The first field shows the matrix level (1 with a two-dimensional matrix) and the second input field the column of the matrix.

Representable Data Objects

Data objects of the following types can be visualised in a Cartesian line chart:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOUBLE_VALUE</td>
<td>0D</td>
<td>Floating point numbers</td>
<td>double</td>
</tr>
<tr>
<td>DOUBLE_CHANNEL</td>
<td>1D</td>
<td>Floating point numbers</td>
<td>double[]</td>
</tr>
<tr>
<td>INTEGER_CHANNEL</td>
<td>1D</td>
<td>Integer</td>
<td>int[]</td>
</tr>
<tr>
<td>TIME_CHANNEL</td>
<td>1D</td>
<td>Date/Time</td>
<td>long[]</td>
</tr>
<tr>
<td>BOOLEAN_CHANNEL</td>
<td>1D</td>
<td>Boolean (yes/no)</td>
<td>boolean[]</td>
</tr>
<tr>
<td>TEXT_CHANNEL</td>
<td>1D</td>
<td>Text</td>
<td>String[]</td>
</tr>
<tr>
<td>CEA_VALUE_CHANNEL</td>
<td>1D</td>
<td>ASAM-CEA Definition</td>
<td>diverse</td>
</tr>
<tr>
<td>DOUBLE_MATRIX</td>
<td>3D</td>
<td>Floating point numbers</td>
<td>double[][][]</td>
</tr>
<tr>
<td>INTEGER_MATRIX</td>
<td>3D</td>
<td>Integer</td>
<td>int[][][]</td>
</tr>
<tr>
<td>REF_NUMCHANNEL_MATRIX</td>
<td>2D</td>
<td>Reference to NumericChannels</td>
<td>NumericChannel[]</td>
</tr>
<tr>
<td>PTV_OBJECT_CHANNEL</td>
<td>1D</td>
<td>Objects with PTV data</td>
<td>PTVObject[]</td>
</tr>
<tr>
<td>GRAPH_OBJECT_CHANNEL</td>
<td>2D</td>
<td>Objects with simple graphs</td>
<td>Vector()</td>
</tr>
<tr>
<td>TIMED_IMAGE_CHANNEL</td>
<td>1D</td>
<td>Video images</td>
<td></td>
</tr>
</tbody>
</table>

2.9.8.6 Box Whisker Chart

The **Box-Whisker Chart** will not be developed further. The [Universal cart, 2D-Chart](#) offers the same functionality with the curve type **Box-Whisker Diagram** but additionally the opportunity for combinations with other curve types.

The Box-Whisker Chart is used for displaying statistical values over time. The minimum, average and maximum of a statistic is displayed. Outliers and the number of samples can optionally be displayed.

The Box-Whisker Chart consists of title, one X-axis and Y-axis as well as the curve area.

A typical Box-Whisker Graph looks as follows:
For data and settings of this display, see the example.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Modification Dialog Box of the Box-Whisker Graph:

Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Axis A: Opens the Axis dialog box with system of coordinates A initialised.

Axis B: Opens the Axis dialog box with system of coordinates B initialised.

Limits: Opens the Limits dialog box.

Section with the settings for the Box-Whisker-Chart.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.
Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.
Delete: The graphic object is deleted and the dialog closed.
Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.

Representable Data Objects

Data objects of the following types can be visualised in a Box-Whisker Chart:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOUBLE_CHANNEL</td>
<td>1D - Array</td>
<td>Floating point number</td>
<td>double[]</td>
</tr>
<tr>
<td>INTEGER_CHANNEL</td>
<td>1D - Array</td>
<td>Integer</td>
<td>int[]</td>
</tr>
<tr>
<td>TIME_CHANNEL</td>
<td>1D - Array</td>
<td>Date/Time</td>
<td>long[]</td>
</tr>
<tr>
<td>STRING_CHANNEL</td>
<td>1D - Array</td>
<td>Text</td>
<td>String[]</td>
</tr>
</tbody>
</table>

Example

1. Data for the chart.
2. Axis settings

![Axis settings dialog box]

3. Limit settings

![Limit settings dialog box]
2.9.8.7 Vectorfield

Go to:

Graph Editor
   ➔ 2D/3D-Axis Charts
   ➔ Vectorfield

The Vectorfield is used for displaying two-dimensional fields that describe a vector field over dx and dy.

A Vectorfield allows the display of one or two vector fields at a time. The difference of the individual vectors can optionally be displayed. A considerable color selection facilitates the identification of the vectors.

A Vectorfield with two vector fields and their difference looks as follows:
The complete vector field is displayed in the following chart.

The Vectorfield chart consists of a title, one X- and Y-axis, the legend as well as the data area with vectors.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Axis A: Opens the Axis dialog box with system of coordinates A initialised.

Axis B: Opens the Axis dialog box with system of coordinates B initialised.

Legend: Opens the Legend dialog box.

Limits: Opens the Limits dialog box.

Cursor: Opens the Cursor dialog box.

Coordinates

x: The data object containing the X coordinates of the vectors is selected from a list.
The data object containing the Y coordinates of the vectors is selected from a list. The X and Y coordinates need not be sorted!

**Vectors** (Maximum 2 vector fields can be enabled)

- **dx**: The data object containing the X-values of the vectors is selected from a list.
- **dy**: The data object containing the Y-values of the vectors is selected from a list.

**Coloring**: The color gradient of the vectors is chosen by defining the color of a **Minimum** and **Maximum** value. The color is interpolated between the values.

- **Rainbow**: The colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.

**Fixed color**: All vectors can optionally be drawn with the same color.

**Delta**: Shows the difference between the two displayed fields.

**Options**

- **Scaling**: For determining the scaling value for the length of the displayed vector, unit [1/cm].
- **Arrows**: Enables the display with an arrow at the end of the vector. Otherwise only lines are drawn.
- **Linesize**: Defines the line size of the vector arrows.

**Background Image**: A scaled background image (e.g. image of a test object) can be drawn as background.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete**: The graphic object is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

?? : The context sensitive help is activated and the cursor changes to ". The respective help topic is displayed when an area within the dialog is clicked on.

See also the description of the **Vectorfield Chart**.

**Representable Data Objects**

Data objects of the following types can be visualised in a Vectorfield Chart:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
</table>

Reference and Tutorial jBEAM

Version: jBEAMHelp 7.2.2
<table>
<thead>
<tr>
<th>Channel Type</th>
<th>Data Type</th>
<th>Array Type</th>
<th>Value Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOUBLE_CHANNEL</td>
<td>1D - Array</td>
<td>Floating point numbers</td>
<td>double[]</td>
</tr>
<tr>
<td>FLOAT_CHANNEL</td>
<td>1D - Array</td>
<td>Floating point numbers</td>
<td>float[]</td>
</tr>
<tr>
<td>INTEGER_CHANNEL</td>
<td>1D - Array</td>
<td>Integer</td>
<td>int[]</td>
</tr>
</tbody>
</table>

**Axis Settings**

![Axis Settings Image]

### 2.9.8.8 Grid Chart

Go to:

**Graph Editor**

- 2D/3D-Axis Charts
- Grid Chart

The Grid Chart is used for displaying two-dimensional fields.
A grid chart with background (original grid: red, shift: yellow) looks as shown on the right.

The grid chart consists of a title, one X- and Y-axis, the legend as well as a data area.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

Name: Name of the graphic object.
Title: A title can optionally be defined.
N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.
Font: A dialog box opens for defining font, size, color and formatting of the title.
Axis A: Opens the Axis dialog box with system of coordinates A initialised.
Axis B: Opens the Axis dialog box with system of coordinates B initialised.
Legend: Opens the Legend dialog box.
**Limits**: Opens the [Limits dialog box](#).

**Cursor**: Opens the [Cursor dialog box](#).

**Parameter**

**Datamatrix dX-Level**: A data matrix for the display of data is selected from a list. The level for the dX-values is selected in the numerical input field. [List of data types](#).

**dY-Level**: The level of the dY-values is selected in the numerical input field.

**Switch X and Y values**: Switches X and Y-values/axes.

**Original Grid / Color**: Activates the original grid with the positions. The color of the grid is selected via the color dialog box.

**Displacement / Color**: Activates the shifting grid. The color of the grid is selected via the color dialog box. The points of the shifting grid are calculated from the original grid and the values of the dX and dY level of the matrix.

**Scaling**: The shifting calculated from the values of the dX and dY level of the matrix is scaled with a definable coefficient.

**Background Image**: A scaled background image (e.g. image of a test object) can be drawn as background.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete**: The graphic object is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

??: The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

**Representable Data Objects**

Data objects of the following types can be visualised in a Grid Chart:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>DoubleMatrix</td>
<td>3D - Array</td>
<td>Floating point numbers</td>
<td>double[][][]</td>
</tr>
<tr>
<td>ScaledImage</td>
<td></td>
<td>Background image</td>
<td></td>
</tr>
</tbody>
</table>
2.9.8.9 Wafer Chart (Matrix Graph)

The **Matrix Graph** will not be developed further. The **Universal cart, 2D-Chart** offers the same functionality with the curve type **Matrix Diagram** but additionally the opportunity for combinations with other curve types.

The **Matrix Graph** is used for displaying two-dimensional matrices.

Elements are displayed in terms of color and/or numerical values in a **Matrix Graph**. For a better identification the fields may receive a value dependent color gradient.

A **Matrix Graph** filled with color areas looks as follows.

The **Matrix Graph** consists of a title, an X- and Y-axis as well as a data area with color areas and/or values.

An example with filled color areas and value display looks as follows.

The parameter settings for this display are displayed in the **modification dialog box**.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the **context menu**. Position and size of the graphic element can be changed via mouse. See also **Interactive Mouse Activities**.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Axis A:** Opens the Axis dialog box with system of coordinates A initialised.

**Axis B:** Opens the Axis dialog box with system of coordinates B initialised.

**Legend:** Opens the Legend dialog box.

**Limits:** Opens the Limits dialog box.

**Cursor:** Opens the Cursor dialog box.

**Parameter**

For a description of the parameter see Matrix-Diagram.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ??. The respective help topic is displayed when an area within the dialog is clicked on.

**Representable Data Objects**

Data objects of the following types can be visualised in a Wafer Chart:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>DoubleMatrix3D</td>
<td>2D - Array</td>
<td>Floating point numbers</td>
<td>double[][]</td>
</tr>
<tr>
<td>IntegerMatrix3D</td>
<td>2D - Array</td>
<td>Integer</td>
<td>int[][]</td>
</tr>
<tr>
<td>DOUBLE_3D_RECT_MATRIX</td>
<td>2D - Array</td>
<td>Floating point numbers</td>
<td>double[][]</td>
</tr>
<tr>
<td>INTEGER_3D_RECT_MATRIX</td>
<td>2D - Array</td>
<td>Integer</td>
<td>int[][]</td>
</tr>
</tbody>
</table>

2.9.8.10 Contour Plot (Matrix)

The Contour Plot (Matrix) will not be developed further. The Universal cart, 2D-Chart offers the same functionality with the curve type Isoline/Contour-Diagram but additionally the opportunity for combinations with other curve types.

The Contour Plot (Matrix) is used for displaying two-dimensional fields.
A Contour Plot with active contour areas and isolines looks as follows:

![Isolines of Speed](image)

A Contour Plot with bars:

![Flow field](image)
A Contour Plot with isolines:

The Contour Plot consists of a title, one X- and Y-axis, the legend as well as the data area. A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Axis A: Opens the Axis dialog box with system of coordinates A initialised.

Axis B: Opens the Axis dialog box with system of coordinates B initialised.

Legend: Opens the Legend dialog box.

Cursor: Opens the Cursor dialog box.

Background Image: A scaled background image (e.g. image of a test object) can be displayed as background.

Note: Contour Areas have to be disabled!
Parameter
For the description of the parameter see Isoline/Contour-Diagram.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

Representable Data Objects
Data objects of the following types can be visualised in a Contour Plot:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>DblValMatrix</td>
<td>3D - Array</td>
<td>Floating point numbers</td>
<td>double[][][][]</td>
</tr>
<tr>
<td>RefMatrix</td>
<td>2D - Array</td>
<td>Floating point numbers</td>
<td>double[][]</td>
</tr>
<tr>
<td>IntValMatrix</td>
<td>3D - Array</td>
<td>Integer</td>
<td>int[][][][]</td>
</tr>
<tr>
<td>RefMatrix</td>
<td>2D - Array</td>
<td>Integer</td>
<td>int[][][]</td>
</tr>
</tbody>
</table>

2.9.8.11 Contour Plot (dynamic)

Go to:

Graph Editor
  2D/3D-Axis Charts
  Contour Plot (dynamic)

The Contour Plot (dynamic) is used for displaying three-dimensional fields. The matrix levels can be replayed consecutively as a video.

A Contour Plot with active contour areas and isolines looks as follows:
In contrast to the statistical contour plot display this function allows the display of each level of the matrix as an isoline chart. Upon pressing Start the different levels are consecutively replayed as image (similar to a video). The individual levels can be selected by using the forward and backward button.

The Contour Plot consists of a title, one X- and Y-axis, the legend and the data area.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Axis: Opens the Axis dialog box with system of coordinates A initialised.

Legend: Opens the Legend dialog box.

Parameter

Datamatrix: The data object for displaying data is selected from a list. The data object should be a three-dimensional matrix, so that dynamics can develop. List of data types.
Switch X and Y values: Switches X and Y-values.

Levels: All: All levels of the three-dimensional data matrix can be displayed or a certain range From ... to... is shown. The number of the currently shown level is displayed on top right position in the graphic display.

Isolines: Enables the display of isolines.

Auto: By means of a defined number of levels the gradation of the Z-axis is calculated and displayed.

Color Gradient: The color gradient of the isolines is defined by defining a color for the initial value and the end value. The colors are interpolated between the values.

Rainbow: The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

Fixed levels: The values of the level are defined manually. Lists can be created, modified and deleted via the buttons.

Used set: If several lists of level curves are defined, the list used for the map can be chosen via a data object (IntegerValue) or manual value input in the field behind.

Create new list: A new list is created with the presettings.

Modify list: The dialog configure levels for the definition of the marked list opens.

Delete list: The marked list is deleted.

Contour Areas: Enables the display of contour areas.

Colorrange: The color gradient for the contour areas is chosen by defining individual colors for Minimum, Medium and Maximum value. The colors between those values are interpolated. If the checkmark is not set at Maximum, all values are displayed in the color defined at Minimum.

Rainbow: The colors for Minimum and Maximum are automatically defined so that the interpolation runs through the whole color spectrum.

Transparent: The contour areas are drawn semi-transparently.

Mesh: The calculated grid of the data is displayed with a selected color.

Framerate: Defines the number of images per second at replay.

Background Image: A scaled background image (e.g. photo of the test object) can be drawn in the background. Note that an activated contour area is drawn above the background image.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to ²°. The respective help topic is displayed when an area within the dialog is clicked on.

Representable Data Objects

Data objects of the following types can be visualised in a dynamic Contour Plot:

<table>
<thead>
<tr>
<th>Data</th>
<th>Data Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>IntegerRectMatrix3D</td>
<td>3D-Matrix with integers</td>
</tr>
<tr>
<td>DoubleRectMatrix3D</td>
<td>3D-Matrix with floating point numbers</td>
<td></td>
</tr>
<tr>
<td>NumericMatrixByReference</td>
<td>Referenced numerical matrix</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannelsByReference</td>
<td>Referenced group of channels</td>
<td></td>
</tr>
<tr>
<td>IntegerVarColMatrix2D</td>
<td>2D-Matrix with integers</td>
<td></td>
</tr>
<tr>
<td>DoubleVarColMatrix2D</td>
<td>2D-Matrix with floating points numbers</td>
<td></td>
</tr>
<tr>
<td>GroupOfChannels</td>
<td>Group of channels</td>
<td></td>
</tr>
</tbody>
</table>

2.9.8.12 Engine Characteristic Map

The Engine Characteristic Map Graph will not be developed further. The Universal cart, 2D-Chart offers the same functionality with the curve type Engine Map but additionally the opportunity for combinations with other curve types.

The Engine Characteristic Map is used for displaying two-dimensional fields. The displayed field needs no uniform grid.

The engine map in an Engine Characteristic Map is displayed via level curves. The isolines connect points with the same Z-values. For a better identification the isolines can receive a value dependent color gradient.

An isoline engine characteristic map chart looks as follows:
The parameter settings for this display are displayed in the modification dialog box and the corresponding axis setting dialog box. The Spreadsheet shows the used data.

The isoline field is limited in Y direction by the minimum and maximum Y-values (here EFFMOM).

The boundary is illustrated as a dashed line.

The Engine Characteristic Map consists of a title, one X- and Y-axis, the legend and the data area with isolines.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

<table>
<thead>
<tr>
<th>DRZ</th>
<th>EFFMOM</th>
<th>SPZVERB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,249</td>
<td>20.3</td>
<td>360.5</td>
</tr>
<tr>
<td>1,254</td>
<td>40.4</td>
<td>275.0</td>
</tr>
<tr>
<td>1,254</td>
<td>56.6</td>
<td>254.7</td>
</tr>
<tr>
<td>1,249</td>
<td>81.5</td>
<td>229.9</td>
</tr>
<tr>
<td>1,249</td>
<td>100.0</td>
<td>219.1</td>
</tr>
<tr>
<td>1,249</td>
<td>120.1</td>
<td>216.1</td>
</tr>
<tr>
<td>1,249</td>
<td>139.6</td>
<td>213.9</td>
</tr>
<tr>
<td>1,249</td>
<td>154.9</td>
<td>215.8</td>
</tr>
<tr>
<td>1,499</td>
<td>24.0</td>
<td>339.2</td>
</tr>
<tr>
<td>1,504</td>
<td>39.1</td>
<td>279.8</td>
</tr>
<tr>
<td>1,503</td>
<td>58.2</td>
<td>249.2</td>
</tr>
<tr>
<td>1,499</td>
<td>81.4</td>
<td>232.3</td>
</tr>
<tr>
<td>1,499</td>
<td>99.0</td>
<td>225.5</td>
</tr>
<tr>
<td>1,499</td>
<td>119.5</td>
<td>218.0</td>
</tr>
<tr>
<td>1,498</td>
<td>139.5</td>
<td>209.5</td>
</tr>
<tr>
<td>1,499</td>
<td>160.0</td>
<td>205.1</td>
</tr>
<tr>
<td>1,499</td>
<td>178.1</td>
<td>207.1</td>
</tr>
<tr>
<td>1,498</td>
<td>175.9</td>
<td>207.2</td>
</tr>
<tr>
<td>1,748</td>
<td>20.6</td>
<td>381.8</td>
</tr>
<tr>
<td>1,753</td>
<td>37.6</td>
<td>290.4</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Axis A: Opens the Axis dialog box with system of coordinates A initialised.

Axis B: Opens the Axis dialog box with system of coordinates B initialised.

Legend: Opens the Legend dialog box.

Cursor: Opens the Cursor dialog box.

Background Image: A scaled background image (e.g. image of a test object) can be displayed as background.
**Note:** Contour Areas have to be disabled!

**Parameter**

For the description of the parameter see [Engine Map](#).

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.8.13 Differential Engine Map

The **Differential Engine Map Graph** will not be developed further. The [Universal cart, 2D-Chart](#) offers the same functionality with the curve type [A-Engine Map](#) but additionally the opportunity for combinations with other curve types.

The Differential Engine Map is used for displaying a two-dimensional differential engine map or average map.

This component consists of a 2D map graph that displays a two-dimensionally differential or average map. The user can define different settings for the graph. The differential map only displays the contour areas and isolines for the calculated map but not for the original map. The display of the grids, boundaries and/or markers can be determined.

The isolines describe the value-based progress in the map and its property value. The size of the respective map can be visualised by a boundary.

The measured values are shown via the marks which can be displayed with or without numerical values.

The grid describes the format of the map. The interpolated Z-values are displayed and colored via the contour area. This is done by interpolating the Z-values of the individual grid cells.
A differential engine map chart looks as follows:

The Differential Engine Map consists of a title, one X- and Y-axis, the legend as well as a data area with isolines.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Axis A:** Opens the Axis dialog box with system of coordinates A initialised.

**Axis B:** Opens the Axis dialog box with system of coordinates B initialised.

**Legend:** Opens the Legend dialog box.

**Cursor:** Opens the Cursor dialog box.

**Parameter**

For the description of the parameters see A-Engine Map.
OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.
Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.
Delete: The graphic object is deleted and the dialog closed.
Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to ??. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.8.14 Turbocharger Map Graph

The Turbocharger Map Graph will not be developed further. The [Universal cart. 2D-Chart](#) offers the same functionality with the curve type Turbocharger Map but additionally the opportunity for combinations with other curve types.

The Turbocharger Map is used for displaying two-dimensional fields. The described field does not need a uniform grid.

A turbo charger map is displayed via level curves in the Turbocharger Map chart. The isolines connect points with the same Z-values. For a better identification the isolines can receive a value dependent color gradient.

An isoline turbo charger chart looks as follows:

The data used as a basis for the visualisation:

<table>
<thead>
<tr>
<th>nred</th>
<th>mredSS</th>
<th>pi</th>
<th>eta</th>
</tr>
</thead>
<tbody>
<tr>
<td>17,989.08</td>
<td>2.86</td>
<td>2.30</td>
<td>0.63</td>
</tr>
<tr>
<td>18,014.71</td>
<td>4.01</td>
<td>2.32</td>
<td>0.71</td>
</tr>
<tr>
<td>17,987.55</td>
<td>5.03</td>
<td>2.36</td>
<td>0.76</td>
</tr>
<tr>
<td>17,999.86</td>
<td>6.80</td>
<td>2.38</td>
<td>0.82</td>
</tr>
<tr>
<td>17,993.07</td>
<td>6.77</td>
<td>2.39</td>
<td>0.82</td>
</tr>
<tr>
<td>17,969.48</td>
<td>7.32</td>
<td>2.35</td>
<td>0.82</td>
</tr>
<tr>
<td>18,005.60</td>
<td>8.22</td>
<td>2.23</td>
<td>0.79</td>
</tr>
<tr>
<td>17,987.67</td>
<td>8.71</td>
<td>2.10</td>
<td>0.75</td>
</tr>
<tr>
<td>17,966.10</td>
<td>9.07</td>
<td>1.97</td>
<td>0.71</td>
</tr>
<tr>
<td>18,007.63</td>
<td>9.37</td>
<td>1.67</td>
<td>0.56</td>
</tr>
<tr>
<td>16,521.52</td>
<td>2.58</td>
<td>2.06</td>
<td>0.63</td>
</tr>
<tr>
<td>16,496.30</td>
<td>3.52</td>
<td>2.07</td>
<td>0.71</td>
</tr>
<tr>
<td>16,506.77</td>
<td>4.77</td>
<td>2.10</td>
<td>0.77</td>
</tr>
<tr>
<td>16,491.63</td>
<td>4.72</td>
<td>2.11</td>
<td>0.77</td>
</tr>
<tr>
<td>16,481.98</td>
<td>5.52</td>
<td>2.11</td>
<td>0.81</td>
</tr>
<tr>
<td>16,454.74</td>
<td>5.96</td>
<td>2.11</td>
<td>0.82</td>
</tr>
<tr>
<td>16,509.59</td>
<td>6.53</td>
<td>2.07</td>
<td>0.82</td>
</tr>
</tbody>
</table>

The modification dialog box of this display and the corresponding axis dialog box.

The isoline field is limited in Y direction by the minimum and maximum Y-values (here mredSS). The boundary is illustrated as a dashed line.
The Turbocharger Map consists of a title, one X- and Y-axis, the legend and the data area with isolines.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**Axis A:** Opens the Axis dialog box with system of coordinates A initialised.

**Axis B:** Opens the Axis dialog box with system of coordinates B initialised.
Legend: Opens the Legend dialog box.

Cursor: Opens the Cursor dialog box.

Parameter
For the description of the parameter see Turbocharger Map.

Background Image: A scaled background image (e.g. image of a test object) can be displayed as background.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.15 Differential Turbocharger Characteristic Map

The Differential Turbocharger Characteristic Map Graph will not be developed further. The Universal cart, 2D-Chart offers the same functionality with the curve type A-Turbocharger Map but additionally the opportunity for combinations with other curve types.

The Differential Turbocharger Characteristic Map is used for the two-dimensional display of a differential turbocharger map.

This component consists of a 2D map graph that displays a two-dimensionally differential or average map. The user can define different settings for the graph. The differential map only displays the contour areas and isolines for the calculated map but not for the original map. The display of the grids, boundaries and/or markers can be determined.

The isolines describe the value-based progress in the map and its property value. The size of the respective map can be visualised by a boundary.
An example of a differential turbo charger map chart:

The Differential Turbocharger Map chart consists of a title, one X- and Y-axis, the legend as well as a data area with isolines.

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Axis A: Opens the Axis dialog box with system of coordinates A initialised.

Axis B: Opens the Axis dialog box with system of coordinates B initialised.

Legend: Opens the Legend dialog box.

Cursor: Opens the Cursor dialog box.

Parameter

For the description of the parameters see A-Turbocharger Map.
OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

FAQ: The context sensitive help is activated and the cursor changes to a question mark. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.8.16 Universal 3D-Graphic (OpenGL)

Go to:

Graph Editor

3D-Axis Charts

Universal 3D Graphic (OpenGL)

The graphic object Universal 3D Graphic (OpenGL) is a universally employable graphic object that is used for displaying different curve types three-dimensionally and even four-dimensionally in a chart.

Special functionalities and properties can be set for each curve type and assigned to the corresponding graphic object.

The following curve types are supported:

- 3D-Points Diagram
- 3D-Surface Diagram
- 3D-Waterfall Diagram
- 3D-Bar Diagram
- 4D-Surface Diagram

A double click on the graphic element opens the modification dialog box. Double clicking on individual sections like axes or legend opens the corresponding modification dialog boxes. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
The following graph is created with the displayed settings:

**Universal 3D-Graph**

The dialog box for the modification of the graph:

**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define [Language Dependent Strings](#) for the currently active text field.

**Font:** A [dialog box](#) opens for defining font, size, color and formatting of the title.

**Sel** (checkbox): Individual curves can be selected in order to be selected upon pressing the button Delete Selected.

**Visible** (checkbox): Curves can be set visible or invisible.

**more:** An additional dialog box for setting the curve shape is opened (dependent on the curve type).
**Append New**: A new curve of the selected type is added to the list of curves. The following curve types can be chosen:

- 3D-Points Diagram
- 3D-Surface Diagram
- 3D-Waterfall Diagram
- 3D-Bar Diagram
- 4D-Surface Diagram

**Move Up**: The selected curve is moved one position upwards in the list.

**Move Down**: The selected curve is moved one position downwards in the list.

**Delete Last**: Deletes the last curve from the list.

**Delete Invisible**: Deletes all invisible curves from the list.

**Delete Selected**: Deletes the selected curve from the list.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete**: The graphic object is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

❓: The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.

**Curve Types**

Different modification dialog boxes containing curve parameters can be set depending on the curve type.
3D-Points Diagram

With surfaces: Enables the surface display.

**Single color:** The surface is drawn with one color.

**Variable color:** The color gradient of the surface is selected by defining an initial and end value. The colors between the values are interpolated.

**Rainbow:** The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

**Point size:** Defines the point size in pixels.
3D-Surface Diagram

Surface: Enables the surface display.

Single color: The surface is drawn with one color.

Variable color: The color gradient of the surface is selected by defining an initial and end value. The colors between the values are interpolated.

Rainbow: The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

Transparent: The surface is drawn semi-transparently.

With grid: The calculated data grid is displayed with the selected color and line width.

Projection on: Projects the data (X and Y direction) to a plane in z direction, e.g. at the minimum/maximum of Z (z-axis minimum/maximum) or at a defined Z-value (Z=).

Same color as surface: Optionally, the surface colors can be used.

Single color: The projection is drawn with one color.
**Variable color:** The color gradient of the surface is selected by defining an initial and end value. The colors between the values are interpolated.

**Rainbow:** The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

**3D-Waterfall Diagram**

**With surfaces:** Enables the surface display.

**Single color:** The surface is drawn with one color.

**Variable color:** The color gradient of the surface is selected by defining an initial and end value. The colors between the values are interpolated.

**Rainbow:** The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

**With lines:** Enables the line display.

**Single color:** The line is drawn with one color.

**Variable color:** The color gradient of the line is selected by defining an initial and end value. The colors between the values are interpolated.
Rainbow: The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

Line width: Defines the line width.

3D-Bar Diagram

With surfaces: Enables the surface display.

Single color: The surface is drawn with one color.

Variable color: The color gradient of the surface is selected by defining an initial and end value. The colors between the values are interpolated.

Rainbow: The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

Bar width: Defines the bar width in pixels.
Offset X/Y: Optionally, an offset in pixels can be defined for the display of values in X respective Y direction by which the values are shifted.

4D-Surface Diagram

2.9.8.17 3D-Graph (without libraries)

The 3D-Graph (without libraries) will not be developed further. The Universal 3D-Graphic (OpenGL) offers the same functionality with the curve type 3D-Surface Diagram but additionally the opportunity for combinations with other curve types.
2.9.9 SPC Graphs

Go to:

Graph Editor

→ SPC Graph

There is only one sub menu entry: Xbar-R.
2.9.10 Multi Media

Go to:

Graph Editor

→ Multi Media

The menu item is divided into:

- Moving Images
- Dynamic Images
- Image
- Audio-Player
- Video-Player
2.9.10.1 Image

Go to:

Graph Editor
Multi Media
Image

The graphic object image is used for displaying imported images that have been imported via the graphic import (File→Import MultiMedia→Images) or in the image dialog described here.

An imported image is stored in an internal library and can be drawn at different positions of the Graphic page, e.g. a logo on each page.

The graphic object consists of a title as well as the image area.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

Name: Name of the graphic object.

Title: A title can optionally be defined.
N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Image: Selects an image from the list of all available data objects stored in the internal library. 
[ ]: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Load new Image: Additional images can be imported into the internal library. For some image formats the JAI library is needed in order to load the images.

Scaling

Size Graph to fit Image: The size of the graphic object is automatically fit to the size of the image.

Size Image to fit Graph: The image is scaled so that the current size fits the graphic object.

Original Size: The image is drawn in original size. The positioning within the graphic object is carried out according to the orientation that is set via the navigation (top, bottom, left, right) in the dialog box on the right side.

OK: The changes are applied and the dialog is closed.
Apply: The changes are applied and the dialog remains open.
Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.
Delete: The graphic object is deleted and the dialog closed.
Cancel: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.

Representable Data Objects

Data objects of the following types can be visualised in an image graphic object:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIFJPEG_Image</td>
<td>2D</td>
<td>Pixel image</td>
<td>Image</td>
</tr>
<tr>
<td>JAI_Image</td>
<td>2D</td>
<td>Pixel image</td>
<td>Image</td>
</tr>
<tr>
<td>PVIS_Vector</td>
<td>2D</td>
<td>Vector graph</td>
<td>pvisObject</td>
</tr>
</tbody>
</table>
2.9.10.2 Audio-Player

Go to:

**Graph Editor**
- **Multi Media**
- **Audio-Player**

The graphic object Audio-Player is used to replay imported audio data. Audio data are imported via the **Multimedia Import**.

The graphic object consists of a title and the playback section.

A double click on the graphic element opens the modification dialog box. A right click opens the **context menu**. Position and size of the graphic element can be changed via mouse. See also **Interactive Mouse Activities**.
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Audio object: Selection of the desired audio object from a list of available audio objects.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

Time controlled by: Defines the time control of the audio file. This can be done via an own time control or a published data object of the type DOUBLE_VALUE.

Min. time to play: States the minimum playback time.

Publish audio time: Can optionally be selected. The current time of the audio file is published as a data object of the type DOUBLE_VALUE.

Scale: Defines the font, font size and color of the scale. The font can optionally be displayed bold and/or italic.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to 🎧. The respective help topic is displayed when an area within the dialog is clicked on.

The following formats can be played with the audio player:

<table>
<thead>
<tr>
<th>Name</th>
<th>Data Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Interchange Format Wave</td>
<td>*.wav</td>
</tr>
<tr>
<td>Audio Interchange File Format</td>
<td>*.aif; *.aiff</td>
</tr>
<tr>
<td>Musical Instrument Digital Interface</td>
<td>*.mid</td>
</tr>
<tr>
<td>Audio files</td>
<td>*.au</td>
</tr>
<tr>
<td>Rich music format</td>
<td>*.rmf</td>
</tr>
</tbody>
</table>

2.9.10.3 Video-Player

Go to:

Graph Editor
  ➡ Multi Media
    ➡ Video-Player (Videograph)

The graphic object **Video-Player (Videograph)** is used for displaying a video via QuickTime technology.
A video is imported to the internal library via the function
File→Import MultiMedia→Video.

The video graph consists of a title, the image area and the area for the playback control.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.
Title: A title can optionally be defined.
N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.
Font: A dialog box opens for defining font, size, color and formatting of the title.

Parameter
Video: All videos of the internal library are listed.
Time controlled by: Defines the time control of the video. An own time control or a published data object of the type DOUBLE_VALUE can be selected.
Publish video time: The current video time is published as a data object of the type DOUBLE_VALUE in jBEAM.
Repeat: As soon as the video ended, the replay starts from the beginning.
Play sound: The video is played with sound.
**Video Replay Control:**

- ![Replay Option](Image)
  - One picture backwards.
- ![Play Option](Image)
  - Play, the video is started.
- ![Pause Option](Image)
  - Pause, the video is paused at the current position.
- ![Stop Option](Image)
  - Stops the replay of the movie and the slider returns to the beginning of the video.
- ![Advance Option](Image)
  - One picture forward.
- ![Slider Option](Image)
  - The slider can be moved to different positions in the video.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

- ![Help Icon](Image)
  - The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.
**Example**

Four videos and a xy chart with numerical data are displayed. A video is defined by a time control. The current time of this video is published as a data object of the type `DOUBLE_VALUE`. The three other videos are controlled via this data object. Additionally, a cursor of the xy graph is controlled.

If the time of the first video is changed, all other videos as well as the cursor are adjusted.

**Representable Data Objects**

Data objects of the following types can be visualised in a video graphic object:

<table>
<thead>
<tr>
<th>Name</th>
<th>Dimension</th>
<th>Content</th>
<th>Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>M5533_3.avi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5533_2.avi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5533_1.avi</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5533_5.avi</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.9.11 Controls

Go to:

Graph Editor

Controls

The menu is divided into:

- Interactive Table
- Switch
- Checkbox
- Combobox
- Data Item Selector
- Radiobuttons
- Value Input
- Text Input
- Slider
- Knob
- Button
- Multibutton
- Command Button
- Command Field
- Import Controller
- Iterable Graph Input Controller
- Time Controller
- Data Item Reference Holder
- Property Editor
- Tabbed Graphic Area
- Command Push-Button
2.9.11.1 Interactive Table

Go to:

*Graph Editor*  
*Controls*  
Interactive Table

The **Interactive Table** is an extended Free Table and is used for the tabular display of different data.

In contrast to the Free Table the **Interactive Table** additionally allows the insertion of interactive elements as combo boxes, checkboxes or text fields. All texts that can be inserted can also consist of **Formulas** that are calculated at run-time.

Every interactive column creates a data object on the CEA bus that can be used by other components as well. This may be components of databases that act as interfaces for a database.

The graphic object **Interactive Table** consists of a title and the column oriented text area that displays the defined data. The ordering of the columns may be vertical or horizontal. Each column possesses a header of up to six lines that is defined generally or individually for every column. It is also possible to generate titles for several columns with automatically adjusted vertical lines. The title text is located centrally at the combined column header.

**Example**

<table>
<thead>
<tr>
<th>Tyre</th>
<th>Profile</th>
<th>Tyre Position</th>
<th>Producer</th>
<th>Tread Depth in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Summer</td>
<td>Winter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tyre 1</td>
<td>✔ Summer</td>
<td>□ Winter</td>
<td>front/right</td>
<td>Producer A</td>
</tr>
<tr>
<td>Tyre 2</td>
<td>✔ Summer</td>
<td>□ Winter</td>
<td>front/left</td>
<td>Producer B</td>
</tr>
<tr>
<td>Tyre 3</td>
<td>□ Summer</td>
<td>✔ Winter</td>
<td>back/right</td>
<td>Producer B</td>
</tr>
<tr>
<td>Tyre 4</td>
<td>□ Summer</td>
<td>✔ Winter</td>
<td>back/left</td>
<td>Producer C</td>
</tr>
</tbody>
</table>

**Interactive Mouse Activities**

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Interactive cells with combo box</td>
<td>Displays and selects the combo box</td>
</tr>
<tr>
<td></td>
<td>Interactive cells with checkbox</td>
<td>Enables/disables the checkbox</td>
</tr>
<tr>
<td></td>
<td>Interactive cells with input field</td>
<td>For entering texts/values</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Selects the graphic element</td>
</tr>
<tr>
<td><strong>Double click</strong></td>
<td>Everywhere except interactive cells</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td><strong>Click &amp; move</strong></td>
<td>Frame</td>
<td>Increases/decreases the size of the graphic element (not possible in vertical direction if the line height is fixed)</td>
</tr>
<tr>
<td></td>
<td>Vertical column boundaries</td>
<td>Increases/decreases the size of the column width with alignment of the neighbouring right column</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Moves the whole graphic element</td>
</tr>
<tr>
<td><strong>CTRL &amp; click &amp; move</strong></td>
<td>Frame</td>
<td>Increases/decreases size on the given grid</td>
</tr>
<tr>
<td></td>
<td>Vertical column boundaries</td>
<td>Increase/decrease size of the column width with alignment of all following columns</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Moves the whole graphic element on the grid</td>
</tr>
<tr>
<td><strong>SHIFT &amp; click &amp; move</strong></td>
<td>Frame</td>
<td>Increases/decreases size while keeping the aspect ratio</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Moves the graphic element, the angle is always a multiple of 45°</td>
</tr>
<tr>
<td><strong>Right mouse button</strong></td>
<td>Everywhere except interactive cells</td>
<td>Context menu</td>
</tr>
</tbody>
</table>

**Context Menu**

Next to the **general menu** entries the following special functions are available depending on the set parameters:

**Split Vertical:** The table is split vertically at the current mouse position. The resulting tables can be moved independently from one another. They can even be split again. Upon deleting the second/following table the parts are joined together again. **Note:** Deleting the first part of the split table deletes the whole table. This function is only available if in the **General tab Line height** is set to **fix** and the option **auto resize table height** is enabled.
Modification Dialog box of the Interactive Table

**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**Font:** A [dialog box](#) opens for defining font, size, color and formatting of the title.

**Alignment:** Defines whether the text is left-aligned, centred or right-aligned.

**Parameter Section:**

- **General**
- **Column Headers**
- **Column**
**Note:** In contrast to the view above, the parameter sections **General, Column Headers** and **Column** can also be displayed in individual tabs (as demonstrated in the following images). The display mode can be set in **Menu: Edit→Preferences→Dialogs** by enabling respective disabbling the option **Compact Layout**.

**Formula Editor:** Opens the Embedded Formula Editor.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ☰. The respective help topic is displayed when an area within the dialog is clicked on.

**Tab General**
**Orientation:** The values of a column are displayed *vertically* or *horizontally*.

**Frame:** Defines the color and line width of the frame surrounding the table.

**Cell clipping:** If the text is too large for a cell, it can optionally be clipped to the size of the cell.

**Horizontal grid / Vertical grid:** Defines color and line width of a horizontal / vertical grid. Optionally, the first line can be drawn in **bold**. The first Edit button opens the **Horizontal grid / Vertical grid** dialog. There it can be defined whether the grid shall be drawn in all rows / all columns or only in the rows / columns stated in the **manual list**.

**Special color:** Additionally, the lines of selected rows / columns can be drawn in a special color. The second Edit button opens the **Horizontal grid: special color / Vertical grid: special color** dialog. There it can be defined after how many rows / columns a line is drawn (each ...-th row / each ...-th column) in a selectable special color or if such lines are drawn only in the rows / columns stated in the **manual list**. The lines defined here are only drawn if the general grid is activated.

**manual list:** Lines are drawn at the defined indexes of the list. Ranges are indicated by hyphens; individual indexes and ranges are separated by semicolons. If the dialog is closed with OK the input is automatically checked, and indexes are sorted or grouped in ranges if necessary. Invalid input is ignored.

In case of **Horizontal grid** index n refers to the line below the n-th row. Index 0 refers to the line above the first row of data. Index -1 refers to the line above the header cells (if they are enabled and **Frame** is disabled).

In case of **Vertical grid** index n refers to the line on the right side of the n-th column. Index 0 refers to the line on the left side of the first column of data. Index -1 refers to the line on the left side of the header cells (if they are enabled and **Frame** is disabled).

**Lines from ... to:** Defines the section of the values displayed in the table, i.e. the number of lines. The line numbers can be used in formulas as the variable **Index**.

**from:** For the definition of the starting line the following options are available:

- Definition of a fix value (line x). The line index starts at 1.
- **Formula:** Entering of a formula, e.g. via the **Formula Editor**.
  
  *Example:* Via the formula "PropValue(DataItem("Channel1", "Channel1"), "IndexOfMinimum") + 1" all lines starting at the absolute minimum of Channel1 are displayed. When using the Index functions in formulas, such as IndexOfMinimum or Nmin, please note that the Index starts at 0. Therefore, add 1 to receive the correct line index.

**to:** For the definition of the number of lines the following options are available:

- Definition of a fix value for the last line based on the channel index (line x). The line index starts at 1.
- **Formula:** Entering of a formula, e.g. via the **Formula Editor**.
  
  *Example:* Via the formula "PropValue(DataItem("Channel1", "Channel1"), "IndexOfMaximum") + 1" all lines up to the absolute maximum of Channel1 are displayed. When using the Index functions in formulas, such as IndexOfMaximum or Nmax, please note that the Index starts at 0. Therefore, add 1 to receive the correct line index.
- **channel size**: The table is limited by the channel size. The longest of the displayed channels determines the line number. There can also be set a **Limit** for the maximum number of lines.

- **start index +**: The value defines the number of lines to be displayed in addition to the starting line, i.e. "start index + 10" adds up to 11 lines.

  **step**: By entering a step other than 1, values can be skipped. The entered value defines the interval after how many values a line is displayed. The starting line is always displayed and then every x-th line.

**Line height**

- **fix**: The line height is set for all lines according to the font size.

  **auto resize table height**: The line height is automatically adjusted to the content.

  **shift other graphs**: If the table size changes, graphic elements situated underneath are automatically shifted up or down so that the distance is maintained.

  **distribute lines**: The height of the lines is adjusted so that all lines of the table are evenly distributed over the table.

  **with scroll bar**: Large tables can be displayed with a scroll bar.

    **automatically display the last row**: Large tables with a scroll bar are automatically scrolled down to the last line.

**Tab Column Headers**

<table>
<thead>
<tr>
<th>General</th>
<th>Column Headers</th>
<th>Column</th>
</tr>
</thead>
</table>

**Height**: The height of the column headers is defined in millimetres.

**Alignment**: Defines whether the column headers are left-aligned, centred or right-aligned.

**Background**: A background color for the general column headers can be set optionally.

**General headercells (formatable)**: Up to six lines can be entered in the general header cells.

This text appears in the column header in case no **Individual Headercells** are defined (see
If the entry is rather long, a line break can be created (see Long Table Column Headers).

Example: The formula "@CurrDataItem" has the result that the name of the respective data object is displayed in each column header.

Name/Size: Defines the font, size and color of the column header text as well as the style: bold, italic, underlined, superscript or subscript.

Tab Column

The defined columns are displayed on the left side with their name and [column type].

Up/down: The selected column is moved upwards or downwards.

Add: A new column is generated as a copy of the selected column and added to the list.

Remove: The selected column is deleted.

The properties of the selected column are set on the right side.

Name: Defines the name of the column. The interactive columns Comboboxes, checkboxes, Radiobuttons and Textfields generate a data object that is displayed under this name in the Spreadsheet tab Channels or Values and in the Explorer under Items on CEA-Bus.

Display name: Optionally, an individual name can be defined which is displayed in the legend. If automatic is selected, the data object name is displayed.
**Individual Headercells:** Each column can optionally contain up to 6 individual header cells. If the checkbox is set, the entered text is displayed in the corresponding header cell. Else the general header text is displayed (in case it is defined). If the entry is rather long, a line break can be created (see [Long Table Column Headers](#)).

**C:** If the checkbox is set, the header cell of the selected column is connected with the following column. Like this, header cells can be defined that cover several columns. The vertical lines are automatically adjusted.

**Name, Size, Color, Style:** Defines the font, size and color of the selected header cell text as well as the style: bold, italic, underlined, superscript or subscript.

**W. of width:** The weight defines a relative width. The width of each column is calculated from the weight of the column divided by the sum of all weights. Alternatively, the columns can be adjusted by clicking & moving via mouse within the table. The values of the weight are then automatically recalculated.

A weight of 0 can be used to hide the column.

**No line at right:** No line is drawn on the right side of the column.

**Value alignment:** Defines the text alignment: left-aligned, centred, right-aligned or after the decimal point.

**Reference:** A reference point for value respective text alignment, e.g. the starting point of the text when being left-aligned or the centre of the text when centred. The reference value is displayed in per cent and refers to the cell width of the respective column (0% = completely left, 100% = completely right).

**Background:** Defines the background of the column.

**Font of column:** Defines the font, size and color of the column text as well as the style: bold and/or italic.

**Column Type Tabs**

![Column Type Tabs](image)

**Channel**

**Channel-X-Data**

**Text**

**Expression**

**Boolean Display**

**Comboboxes**

**Checkboxes**

**Radiobuttons**

**Textfields**

Each tab contains a radio button that is automatically activated when the tab is selected. This indicates that by switching tabs the parameters are actually modified.
Column Type Channel

Channel: The dataobject to be displayed (channel or map) is selected from a list.

- : Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

For Channels: Settings for a Channel data object.

Show values: The column contains values or properties of channels.

- With view: Different views with filtered display values can be set in the View-Selection-Manager. View 0 is always available and usually does not contain any filters. Whether the view selection is enabled or disabled can be set via Preferences→Dialogs.

- Only importer: If enabled, only importer data objects are filtered, e.g. importer, generators, databases or measurement components. This is done to prevent double filtering of data objects. If a data objects is already filtered in a component, e.g. a calculation, the data object from this component is not filtered again. Otherwise, all data objects are filtered.

Show property names: The names of the available properties of the selected channel are displayed in the column.

Show property values: The values of the available properties of the selected channel are displayed in the column.

Formatting of values: Depending on the data type of the selected channel different formatting options are available:

- Format: A predefined format can be selected from the list of available formats. The list items depend on the data type of the selected channel.

- Digits / Number of characters to be displayed / Pattern: For double and float channels, the number of decimal digits can be stated. If the Grouping option is selected, each
three digits are grouped by the thousands separator. For string channels, the **Number of characters to be displayed** in case of part strings can be stated. For time channels, the **Pattern** can be stated.

![Icon](image)

The dialog **Configure Formatter** opens where detailed format properties can be set.

**For string channels:** Via the option **Strings with multiline support** longer text can be distributed over several lines. In order to see the additional lines, the line height has to be sufficiently high. This is accomplished by setting the line height to **distribute lines** in the tab **General** and accordingly enlarge the table.

**For Maps:** Is enabled if the column contains map values.

- **Show keys:** All available keys of the selected map are displayed in the column.
- **Show values:** All available values of the selected map are displayed in the column.

**Unit:** A unit can optionally be set for the selected channel.

- **Automatic:** The unit is taken from the channel properties.
- **Manual:** The unit is entered manually or selected from a list.

**Show unit behind values:** The unit is displayed in each cell behind the value.

**Show unit in header line:** The unit of the selected channel is displayed in the defined header line. If the selected column has already an individual header line with the same index, this function overwrites the header line.

**Show this column in legend:** If this option is selected and the table has a legend, this column is displayed in it.

**Use links in this column:** This option enables to use hyperlinks in a table. The input field expects an URL as text, optionally with embedded expressions, e.g. `file:///C:/files/setting@INDEX@.config` or `@Value(DataItem("Links"), INDEX)@`. By using the variable `INDEX`, the links can refer to different documents depending on the respective line.

**Conditional Text and Fill Color:** If this option is selected (only available for numeric channels), text and background can be displayed in different colors depending on the values.

- **scaled colors:** A color gradient each can be defined for the text (T:) and the background filling (F:).

The currently defined color gradient is shown in the color gradient window with the values for **Minimum** and **Maximum** as well as already defined intermediate values. The colors between those values are interpolated. With a click in the window, the **Color Ranges Editor** opens where color ranges can be modified or added. With the **Rainbow** option, the colors for **Minimum** and **Maximum** are automatically defined so that the interpolation runs through the whole color spectrum.
discrete color definitions: Up to 6 color sections can be defined for the value display of the selected channel. Each color section can be defined in a separate tab in the tab section on the right. The structure of the tabs is identical. One color each can be defined for the text (T:) and the background filling (F:). Furthermore the text style can be set to **bold**.

The condition that determines whether the color definition applies can be defined either by a formula (F) or by manual setting (M). If more than one definition applies to the value, the higher-order definition prevails.

**F:** The condition is defined by a formula that has a Boolean result. For entering the formula the [Formula Editor](#) can be used.

Example: `contains(Value(DataItem("Clipboard","Name"),Index),"i")` → The color definition is applied to all values that have an "i" in their respective Name.

**M:** With manual setting, the following relational operators can be selected from a list:

- `< / <= / >= / >:` All values that are lesser than / not greater than / not lesser than / greater than the reference value.
- `[]:` All values within a range around the reference value ([±%] / [±] / [±1σ] / [±3σ]).
- `][:` All values outside of a range around the reference value ([±%] / [±] / [±1σ] / [±3σ]).

±%: The range around the reference value is defined by a percentaged +/- value to be entered into the input field on the right.

±: The range around the reference value is defined by an absolute +/- value to be entered into the input field on the right.

±1σ: The range around the reference value is defined by the single standard deviation (Sigma).

±3σ: The range around the reference value is defined by the threefold standard deviation (Sigma).

For the reference value the following options are available:

**Fix value:** The value is entered into the input field above.

**Formula:** The value is defined by a formula to be entered in the input field on the right. For entering the formula the [Formula Editor](#) can be used.

Example: `Value(DataItem("Clipboard","Number"),0)` → The reference value is the first value of the column "Number" (Index starts at 0).

**Minimum:** The minimum of the column. A difference value can optionally be entered into the input field above on the right.

**Maximum:** The maximum of the column. A difference value can optionally be entered into the input field above on the right.
Average: The average of the column. A difference value can optionally be entered into the input field above on the right.

Example: The settings result in: All values lesser than 10 are colored red, values between 10 and <50 are colored black (standard color) and values greater or equal 50 are displayed in bold blue digits.

For strings and characters:

equals: All strings or characters that are identical to the stated string or characters.
contains: All strings that contain the stated string or characters.
starts with: All strings that start with the stated string or character.
ends with: All strings that end with the stated string or character.

: The color definitions of this column are copied and can be used for the definition of a different column.

: The color definitions copied before are pasted in this column. They can also be copied from one table to the other.

From column: The settings for the conditional text and fill colors are adopted from the stated column. When the settings of the stated column are changed the settings of this column are changed as well.

Column Type Channel-X-Data

The column type Channel-X-Data displays the X-values of another column.

Reference column index: The index of the column for which the X-values shall be displayed is stated here. The index starts at 1. If the option next channel data column is selected, the index of the next column is used automatically.

Formatting of values: The values can be formatted via the formatter button . The dialog Configure Formatter opens where detailed format properties can be set.

Conditional Text and Fill Color from reference column: The settings for the conditional text and fill color can be adopted from the stated reference column. If the settings are changed there, the changes automatically apply to this column.
Column Type Text

Text input: The content of the individual cells is entered as text. Each line in the input field corresponds to one cell in the table. Formulas can be entered as well. For this, the Formula Editor can be used.

multiline: The text can be distributed over several lines if it is longer than the column width. In order to see the additional lines, the line height has to be sufficient. This is accomplished by setting the line height to distribute lines in the tab General and accordingly enlarging the table.

publish data item: Optionally, a new data item (StringChannel) can be generated from the entered texts. It is named after the respective column.

Conditional Text and Fill Color: The settings for the conditional text and fill color can be adopted from the stated column (From column). If the settings are changed there, the changes automatically apply to this column.

Column Type Expression

Input field: The entered expression is used for all cells. Different values respective texts in the different cells are achieved by using the line variable Index in the formula. Index is starting with 0, i.e. the channel value with the Index = 0 is shown in line 1 of the table. For entering the formula the Formula Editor can be used.

Resolve: The embedded formula is resolved and the result displayed in the text field.

publish data item: Optionally, a new data item can be generated from the calculated values. It is named after the respective column. The data object type is determined by the formula.
Conditional Text and Fill Color: The settings for the conditional text and fill color can be adopted from the stated column (From column). If the settings are changed there, the changes automatically apply to this column.

Column Type Boolean Display

This column type enables the definition of several states (value ranges) which can be represented by different LEDs, circles or images. The respective state is determined either by an expression for all lines or by one expression for each line.

Single expression for all lines: The entered expression is used for all lines. Different values in the individual lines are achieved by using the line variable Index in the formula. Index is starting with 0, i.e. the channel value with the Index = 0 is shown in line 1 of the table. For entering the formula the Formula Editor can be used.

Individual expression for each line: For each line, an individual expression can be defined. In case of empty or missing lines in the definition, the corresponding line in the table is not evaluated, i.e. no LED, circle or image is displayed.

LED: The determined states are represented by different LEDs which can be choosen from the selection list.

Simple Circle: The determined states are represented by circles with different colors which can be choosen via color selection button. The display of specific states can be hidden by using the option transparent.
**Imported Images:** The determined states are represented by images which can either be chosen from the selection list showing all images already imported (MultiMedia Import) or be imported directly via the **Load new image** button. The display of specific states can be hidden by using the list item **transparent**.

<table>
<thead>
<tr>
<th>Expression</th>
<th>Display</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 0.2</td>
<td>LED</td>
<td></td>
</tr>
<tr>
<td>&lt; 0.2</td>
<td>Simple Circle</td>
<td></td>
</tr>
<tr>
<td>Else</td>
<td>Imported Images</td>
<td></td>
</tr>
</tbody>
</table>

**Expression:** The results of the expressions defined above are compared with the conditions listed in this column. The individual conditions are checked one after another from top to bottom until the first condition is met. In order to achieve a classification into several value ranges, the conditions have to be listed from the most particular to the most common. The most common condition **Else** is predefined at the end of the list and comprises all cases which are not covered by the preceding conditions.

For the definition of the conditions the following syntax is expected: **op value** with

- **op:** =, !=, <=, <, >=, >
- **value:** numerical value

**Display:** According to the selected type of display, the corresponding LED, circle color or image for each state is selected.

**Actions:** The arrow keys can be used to shift the selected condition up or down in the list. Conditions can be added or deleted via the plus and minus keys.
Column Type Comboboxes

The column type Comboboxes generates an interactive column that allows the selection of values from a combo box. The entries set in the table are stored in a data object displayed in the Spreadsheet tab Channels and in the Explorer under Items on CEA-Bus and are available for other components.

**Items:** Every cell of the column can be selected from the combo box.

- **automatic:** The combo box entries are filled with channel values.
- **manual:** The items of the list can be entered manually. Each line in the input field results in an entry of the combo box.

**Column Displayname mode:** The selected column is used as display name and the previous column is used for values. The selected column index should at least be set to 2.

**Data type:** The types String (field i.e. short text), Double and Integer are permitted for the combo box. In case of manual list, the type has to be specified here. With the automatic list, the data type is automatically set according to the channel type.

**Enabled, if:** Only if the defined condition is fulfilled, the respective cell of this column is enabled, i.e. editable. To enter the condition the Formula Editor can be used via menu Extra → General Services → Text Resolver Service or the button in the dialog footer.

**Initial value:** If the cell is enabled, i.e. the condition fulfilled, its value is set to the defined initial value. The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well when the state changes to enabled.

**Example 1:** The term "Value(DataItem("Winter", "Winter"),Index)" has the result that the combobox in this column is enabled in those lines where the checkbox of column "Winter" is checked (value = true). The initial value is set to "Winter 1" (must be an item from the list), i.e. this item is...
selected as long as no other item is selected from the list.

Example 2: The term
"Value(DataItem("Tread Depth", "Tread Depth"),Index) < 0.1" has the result that the checkbox in this column is enabled in those lines where the value in column "Tread Depth" is less than 0.1. The initial value is set to false, i.e. the checkbox is not checked.

Conditional Text and Fill Color: The settings for the conditional text and fill color can be adopted from the stated column (From column). If the settings are changed there, the changes automatically apply to this column.

Column Type Checkboxes

The column type Checkboxes creates an interactive column that contains a checkbox with label in every cell. The entries in the table (true/false) are stored in a data object displayed in the Spreadsheet tab Channels and in the Explorer under Items on CEA-Bus and are available for other components.

Label: Input box for the label of the checkbox. The checkbox is selected via mouse click.

Controls for "All" in headline: A checkbox appears in the stated column header that allows the selection/deselection of all checkboxes in the column at once. Thereby, a potentially entered header text is overwritten.

Enabled, if: Only if the defined condition is fulfilled, the respective cell of this column is enabled, i.e. editable. To enter the condition the Formula Editor can be used via menu Extra → General Services → Text Resolver Service or the button in the dialog footer.

Initial value: If the cell is enabled, i.e. the condition fulfilled, its value is set to the defined initial value. The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.

Examples for Initial value.
Conditional Text and Fill Color: The settings for the conditional text and fill color can be adopted from the stated column (From column). If the settings are changed there, the changes automatically apply to this column.

**Column Type Radiobuttons**

The column type Radiobuttons creates an interactive column that contains a radio button with label in every cell. Only one row can be selected at a time. The index (0-based) of the currently selected row is stored in a single value data object (Integer). The data object is displayed in the Spreadsheet tab Values and in the Explorer under Items on CEA-Bus and is available for other components.

**Label:** Input box for the label of the radio button. The radio button is selected via mouse click.

**Enabled, if:** Only if the defined condition is fulfilled, the respective cell of this column is enabled, i.e. editable. To enter the condition the Formula Editor can be used via menu Extra→General Services→Text Resolver Service or the button in the dialog footer.

**Initial value:** If the cell is enabled, i.e. the condition fulfilled, its value is set to the defined initial value. The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.

Examples for Initial value.

**Conditional Text and Fill Color:** The settings for the conditional text and fill color can be adopted from the stated column (From column). If the settings are changed there, the changes automatically apply to this column.
Column Type Textfields

The column type **Textfield** creates an interactive column that contains a text field in every cell which can be filled with values or text of the defined data type. The entries in the table are stored in a data object displayed in the Spreadsheet tab **Channels** and in the Explorer under **Items on CEA-Bus** and are available for other components.

**Data type:** The stated data type is adopted for all values in the column.

- **Double:** The column contains floating point values. Minimum and maximum as well as the number of decimal digits can be defined.
- **Integer:** The column contains integer values. Minimum and maximum can be defined.
- **Latitude:** The column contains geographical latitude values. The number of decimal digits can be defined.
- **Longitude:** The column contains geographical longitude values. The number of decimal digits can be defined.
- **Date/Time:** The column contains date/time values.
- **String (field):** The column contains single-line texts.
- **String (area):** The column contains multiline texts.

**Channel Parameter:** The column values are stored as separate data object (channel) that can be used by other data objects. The following parameters can be defined for this channel: **Y-Unit, Offset X, Delta X, X-unit.**

**Enabled, if:** Only if the defined condition is fulfilled, the respective cell of this column is enabled, i.e. editable. To enter the condition the **Formula Editor** can be used via menu **Extra → General Services → Text Resolver Service** or the button in the dialog footer.
Initial value: If the cell is enabled, i.e. the condition fulfilled, its value is set to the defined initial value. The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.

Examples for Initial value.

Conditional Text and Fill Color: The settings for the conditional text and fill color can be adopted from the stated column (From column). If the settings are changed there, the changes automatically apply to this column.

Error message: An error message is displayed in case the entered value does not correspond with the data type that is defined for this cell or in case the value is located outside of the defined range.

As tool tip: The error message is displayed as tool tip.

As dialog: A dialog window containing the error message is displayed.

Message: A user-defined error message can be stated that is displayed additionally to the default error message.

2.9.11.2 Switch

Go to:

Graph Editor
  ➔ Controls
  ➔ Switch

For the display of a switch that can be toggled via mouse.

The graphic element of the type Switch creates a data object of the type BOOLEAN_VALUE which holds the current position of the switch. This data object can also be used in other components.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / …) directly in the dialog.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

### Settings for Button

**Buttontype:**

- **Toggle:** The state of the switch changes with every mouse click: OFF – ON – OFF – ...
- **Push:** The state is set to ON as long as the mouse is pressed. If the mouse is released, the state OFF is automatically resumed.

**Feedback:** If a data object is defined as feedback channel, the switch does not immediately change its state to ON but to a transition state that will lead to the state ON as soon as the value of the feedback channel changes to "true". The transition state automatically changes between the images ON and transition (1 Hz).

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.
**Delay for feedback**: Defines an idle time (in seconds) after which a feedback is given. The precondition for a feedback is an entry at Feedback.

**Enabled, if**: Optionally, it can be stated that the switch is only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra→General Services→Text Resolver Service.

**Type of button**

**Text**: The first option defines a text button. The corresponding texts entered in the input fields are displayed for the currently active state.

**Predefined Switch**: The next three options display predefined switches for the visual display.

**Image**: The last option offers the possibility to select further images for the display of the switches. For the active state, an image available at the internal library can be selected from a list.

- **Load new image**: Additional images can be loaded into the internal library in order to display them in the different states.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete**: The graphic object is deleted and the dialog closed. A warning sign ⚠️ in the Delete button indicates that the generated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

🖥️: The context sensitive help is activated and the cursor changes to 🛡️. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.3 Checkbox

Go to:

Graph Editor
  → Controls
    → Checkbox

This graphic element allows the display of a checkbox that can be selected (enabled) or deselected (disabled) by the user via mouse.

Checkboxes are used to generate interactive select and question lists. There are two states: enabled and disabled.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

Name: Name of the graphic object.
Label: Defines the name of the checkbox.
Publish the state: The status of the checkbox can optionally be published as a new data object which can be used by other functions.
Color: Opens the color selection for defining the font color.
Enabled, if: Optionally, it can be stated that the checkbox is only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra → General Services → Text Resolver Service or the button in the dialog footer.
Initial value: If the checkbox is enabled, i.e. the condition fulfilled, its value is set to the defined initial value (example). The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.
Formula Editor: The Embedded Formula Editor is opened via this button.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / …) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.11.4 Combobox

Go to:

Graph Editor

Controls

Combobox

For the display of a combo box, from which the user can select the element via mouse click.

The graphic object consists of a list’s label and the selection element containing the objects for choosing.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.
Name: Name of the graphic object.

Label: Defines the name (label) of the combo box.

Label Width: Defines the width of the label (in per cent) in relation to the width of the whole graphic object.

Items

Automatic: If selected, the entries of the combo box are loaded from another data object (String Channel, e.g. a generated via the function String Channel).

No duplicates: If selected, the combo box will not contain entries with the same content. If the value "green" appeared several times in the selected data object, this value would only appear once in the combo box.

Manual: If selected, the entries of the combo box are manually entered.

Publish selected item: Publishes the current value of the combo box as a new data object (String Value) which can be used by other functions.

Publish Index: Publishes the current index of the object selected in the combo box as new data object (Integer Value) which then can be used by other functions.

Enabled, if: Optionally, it can be stated that the combobox is only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra → General Services → Text Resolver Service.
**Initial value**: If the combobox is enabled, i.e. the condition fulfilled, its value is set to the defined initial value *(example)*. The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.

**N / C / D**: These buttons *(New / Change / Delete)* can be used to define *Language Dependent Strings* for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language *(std. / de / en / ...)* directly in the dialog.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete**: The graphic object is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel**: The dialog is closed and changes are dismissed.

![Help Icon]: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.11.5 Data Item Selector

Go to:

**Graph Editor**

- **Controls**
  - Data Item Selector

The graphic object **Data Item Selector** is used for displaying a combo box from which the user can select a data object out of a list of available data objects. This data object can be used as new data object by other functions or graphs without the need of opening their modification dialog box.
A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

**Name:** Name of the graphic object.

**Label:** Defines the name (label) of the combo box.

**Label Width:** Defines the width of the label (in per cent) in relation to the width of the whole graphic object.

**Create item property "OrigName":** Optionally, the property "OrigName" can be created in the result item properties. It contains the name of the currently selected data object.

**Dataobjects:** The combo box can be filled with single values, channels, matrices or view items. Corresponding to the selected option the available data objects are displayed in the section Values/Channels/Matrices. The different data object types cannot be mixed.

**Item label:** Data object names are displayed in the combo box by default. Optionally, a formula can be entered or generated via the formula editor.

**Option <no choice>:** Defines the text that is displayed as long as no data object is selected. Apart from the predefined texts, an individual text can be entered.

**Available Value items/Channels/Matrices/View items + Value items/Channels/Matrices/View items in drop-down list:** The section contains two lists. The list with available data objects is
situated on the left; the selected data objects that later on will be displayed in the combo box are situated on the right.

The input field above the left list can be used to filter the data objects. The list then shows only data object names containing the entered string.

These buttons move the selected/all data objects from one list to the other.

With the buttons situated below, the order of the selected data objects in the right list is changed: move the data object to the first position / one position up / one position down / to the last position.

**Formula Editor:** The [Embedded Formula Editor](#) is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define [Language Dependent Strings](#) for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed. A warning sign ![warning](#) in the **Delete** button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to ![help](#). The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The combo box in the modification dialog box (see above) contains 3 data objects. The combo box (NOSG:8-R) is selected as input data object in a Cartesian line chart.

Then, the values of the different channels can be displayed graphically by selecting them in the combo box without opening and modifying the line chart.
2.9.11.6 Radiobuttons

Go to:

Graph Editor

Controls

Radiobuttons

The graphic object Radiobuttons is used for displaying radio buttons offering several options from which only one option can be selected.

If a radio button is selected, the other is automatically deselected.

The graphic object consists of a title and the area for the radio buttons.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the...
graphic element can be changed via mouse. See also Interactive Mouse Activities.

Name: Name of the graphic object.
Title: A title can optionally be defined.
Font: A dialog box opens for defining font, size, color and formatting of the title.
Columns: Defines the number of columns in which the radio buttons are arranged.
Items

Automatic: If selected, the entries for the list of radio buttons are taken from another data object (String Channel).

No duplicates: The radio buttons will not contain entries with the same content, e.g. if the value "0" appeared several times in the selected data object, this value would only appear once among the radio buttons.

Manual: If selected, the entries for the radio buttons are entered manually. Each line represents an entry of the list of radio buttons.

Publish the selected item: Publishes the value of the currently selected radio button to a new data object (String Value) which can be used by other components.

Enabled, if: Optionally, it can be stated that the radio buttons are only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra→General Services→Text Resolver Service.
**Initial value:** If the radio buttons are enabled, i.e. the condition fulfilled, their value is set to the defined initial value *(example)*. The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.

**N / C / D:** These buttons *(New / Change / Delete)* can be used to define *Language Dependent Strings* for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language *(std. / de / en / ...)* directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed. A warning sign ⚠ in the *Delete* button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

??: The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.11.7 Value Input

Go to:

**Graph Editor**

- **Controls**
  - **Value Input**

The graphic object *Value Input* is used for displaying a value input box into which values can be entered by the user. The entered value is stored in a single value data object which can be used by other components.

The *Value Input* graphic object consists of a label as well as the input box and the unit display.
A double click on the graphic element (outside of the input box) opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

**Interactive Mouse Activities**

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Input area</td>
<td>Value input</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Outside of input area</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Outside of input area</td>
<td>Shifting of the complete graphic element</td>
</tr>
</tbody>
</table>

**Name:** Name of the graphic object.

**Label:** The label of the input box.

**Label Width:** Defines the width of the label (in per cent) in relation to the width of the whole graphic object.
**Input Width**: Defines the width of the input box (in per cent) in relation to the complete width of the graphic object.

**Input field editable**: Can optionally be selected. If selected, the entry in the input box can be modified.

**Input field with frame**: Can optionally be selected. If selected, the input box is bordered with a frame.

**Unit**: Optionally, a unit of the result data object can be stated.

**Font Size/Color**: Defines the font size and color of the text elements.

**Data type**

- **Double [64bit] / [32bit]**: Entered values are used as 64-bit or 32-bit floating-point numbers (FLOAT/DOUBLE values).

- **Integer**: Entered values are used as integer (INTEGER values).

- **Latitude**: Entered values are used as geographical latitude values.

- **Longitude**: Entered values are used as geographical longitude values.

- **Date/Time**: Entered values are used as date/time values.

- **String (field)**: Entered values are used as text.

- **File**: Entered values are used as file names. Under **Format** the type of file path can be selected: Relative, Absolute or Canonical.

**Value Format**: Defines the formatting and values range of the entered value. The adjustable options depend on the selected data type.

- **Format**: A predefined format can be selected from the list of available formats. The list items depend on the selected data type.

- **Digits / Number of characters to be outputted / Pattern**: For double and float values, the number of decimal digits can be stated. If the **Grouping** option is selected, each three digits are grouped by the thousands separator. For string values, the Number of characters to be outputted in case of part strings can be stated. For time channels, the Pattern can be stated.

- **Minimum**: States the minimum of the value to be entered. If the entered value is less than the minimum, the minimum value is displayed.

- **Maximum**: States the maximum of the value to be entered. If the entered value is larger than the maximum, the maximum value is displayed.

  : The dialog Configure Formatter opens where detailed format properties can be set.

- **Increment/Decrement Value**: Optionally, arrow keys can be displayed in the input field which can be used to increase or decrease the entered value by the value defined under **Step size**.

**Enabled, if**: Optionally, it can be stated that the input box is only enabled if the defined condition is fulfilled. To enter the condition the **Formula Editor** can be used via menu Extra → General Services → Text Resolver Service or the button in the dialog footer.
**Hide text if disabled:** Optionally, the value can be hidden if the input field is disabled, i.e. if the condition is not fulfilled.

**Initial value:** If the input box is enabled, i.e. the condition fulfilled, its value is set to the defined initial value (example). The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.

**Feedback:** If a data object is defined as feedback object, the entered value is only temporarily displayed and adopts then the value of the feedback object.

: Opens the Filtered Selector of Dataitems dialog for a fast selection from a large number of data items.

**Error message:** Optionally, an error message can be displayed if the entered value does not correspond with the selected data type. Generally, the input field is highlighted in red if the input is faulty.

*as tool tip:* The error message is issued as a tool tip.

*as dialog:* The error message is displayed in a dialog box. In addition to the standard error message, a user defined error message can be entered in the message input field.

**Formula Editor:** The Embedded Formula Editor is opened via this button.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ?? . The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.8 Text Input

Go to:

Graph Editor
  ▼ Controls
    ▼ Text Input

The graphic object **Text Input** is used for displaying an input box into which text can be entered by the user. The entered text is stored in a single value data object which can be used by other components.

The **Text Input** graphic object consists of a title and an input box.

A double click on the graphic element (outside of the input box) opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

**Interactive Mouse Activities**

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Input area</td>
<td>String input</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Outside of input area</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Outside of input area</td>
<td>Shifting of the complete graphic element</td>
</tr>
</tbody>
</table>
**Name:** Name of the graphic object.

**Title:** A title can optionally be defined.

**Font:** A dialog box opens for defining font, size, color and formatting of the title.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

**Font Size:** Defines the font size of the input box.

**Color:** Defines the color of the input box.

**Editable:** Can optionally be selected. If selected, the entry in the input box can be modified.

**Enabled, if:** Optionally, it can be stated that the input box is only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra → General Services → Text Resolver Service or the button in the dialog footer.

**Initial value:** If the input box is enabled, i.e. the condition fulfilled, its value is set to the defined initial value (example). The initial value is set as soon as the graphic object is created, i.e. also when the project is opened, as well as when the state changes to enabled.

**Formula Editor:** The Embedded Formula Editor is opened via this button.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.9 Slider

Go to:

Graph Editor
  → Controls
    → Slider

The graphic object **Slider** is used for displaying a slider whose position can be changed via mouse by the user.

The **Slider** graphic element generates a data object whose data type can be defined. The value corresponds to the current slider position. This data object can be used by other components.

The **Slider** graphic object consists of the title as well as the slider area. It can be placed horizontally or vertically.

The adjustor can either be shifted via mouse click & move or via keyboard. In case of the horizontal slider, the value can be increased/decreased by 1 via arrow keys ↑/↓, or the adjuster jumps to the previous/next tick via arrow keys ←/→. In case of the vertical slider, the key functions are interchanged accordingly.

A double click on the graphic element (outside of the slider area) opens the modification dialog box. A right click opens the **context menu**. Position and size of the graphic element can be changed via mouse. See also **Interactive Mouse Activities**.

**Interactive Mouse Activities**

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Slider area</td>
<td>The slider is moved to the direction of the mouse click.</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Outside of slider area</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Adjuster (Slider)</td>
<td>Increases/decreases the slider value.</td>
</tr>
<tr>
<td></td>
<td>Outside of slider area</td>
<td>Shifts the complete graphic element</td>
</tr>
</tbody>
</table>
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Data type: Selection of the data type of the result data object:

- Double[64 bit]: Floating-point number (double)
- Float[32 bit]: Floating-point number (float)
- Integer: Integer
- String: Text

Decimal digits: Defines the number of decimal places for floating-point numbers.

Unit: Optionally, a unit of the result data object can be stated.

Scale: Defines the range of the slider.

Ticks: The number of major and minor ticks of the scale. Major ticks are displayed as lines with values, minor ticks as small lines.
Snap to grid: If selected, the slider snaps to the ticks. Else, all interim values can be set as well.

Orientation: The slider can be oriented horizontally or vertically.

Adjuster: A design for the adjuster can be selected from a list of available designs.

Track: The track in which the adjuster runs can be displayed not at all (none) or as a thin, medium or thick line.

Axis: Optionally, the ticks (Show ticks) and/or labels (Show labels) can be displayed.

Font: Defines the font, size and color of the value display as well as the style: bold and/or italic.

Enabled, if: Optionally, it can be stated that the input box is only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra→General Services→Text Resolver Service.

Update and validate when adjusting: If this option is selected, the result data object and all depending components of the project are updated immediately while the knob is turned. Otherwise the depending data is only updated after the knob has been released. It is recommended to deselect this option if complex calculations affect the usability.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed. A warning sign ⚠ in the Delete button indicates that the generated data is used by other components.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ?$. The respective help topic is displayed when an area within the dialog is clicked on.
The graphic object **Knob** is used for displaying a controller in the design of a rotary knob. The knob can be rotated both via mouse and via arrow keys.

A data object is generated holding the currently set value. This data object can be used by other components.

The **Knob** graphic object consists of a title and the knob area. The rotation indicator can either be shifted via mouse click & move or via keyboard. If the knob graphic object is selected, the value can be increased via arrow keys ↑ and →, or decreased via arrow keys ↓ and ←.

A double click on the graphic element opens the modification dialog box. A right click opens the context menu. Position and size of the graphic element can be changed via mouse. See also Interactive Mouse Activities.

### Special Interactive Mouse Activities

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Everywhere</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Everywhere</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Knob area</td>
<td>Increases/decreases the knob value.</td>
</tr>
<tr>
<td></td>
<td>Outside of knob area</td>
<td>Shifts the complete graphic element</td>
</tr>
</tbody>
</table>
Name: Name of the graphic object.

Title: A title can optionally be defined.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

Font: A dialog box opens for defining font, size, color and formatting of the title.

Data type: Selection of the data type of the result data object:
- Double[64 bit]: Floating-point number (double)
- Float[32 bit]: Floating-point number (float)
- Integer: Integer
- String: Text

Decimal digits: Defines the number of decimal places for floating-point numbers.

Unit: Optionally, a unit of the result data object can be stated.

Range: Defines the values ranges (Min / Max) of the knob. The upper line defines the values range of the result in the selected unit. The lower line defines the rotational range of the knob in degrees. Optionally, the Min / Max values can be set to infinity. In this case, the knob continues its rotation in the respective direction indefinitely. The values in the fields
for 0 [unit] at and 1 [unit] conforms are either determined out of the defined Min / Max values or they can be edited when the infinity options are selected.

**Background type:** A filling design for the knob can be selected from a list of available designs. The color of the filling can be selected via color selection button.

**Indicator color:** Defines the color of the rotation indicator of the knob.

**Grip border color:** Defines the color of the border (grip) of the knob.

**Enabled, if:** Optionally, it can be stated that the knob is only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra→General Services→Text Resolver Service.

**Update and validate when adjusting:** If this option is selected, the result data object and all depending components of the project are updated immediately while the knob is turned. Otherwise the depending data is only updated after the knob has been released. It is recommended to deselect this option if complex calculations affect the usability.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed. A warning sign in the Delete button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

???: The context sensitive help is activated and the cursor changes to ???. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.11  Button

Go to:
Graph Editor
  Controls
    Button

The graphic object Button is used for displaying a button that can be clicked by
the user in order to initiate a function associated with this control. This event can
trigger several processes, e.g. the triggering of several measurement components.

Interactive Mouse Activities

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Button</td>
<td>The button is pressed.</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Not button</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Frame area</td>
<td>Increases/decreases the size of the graphic element</td>
</tr>
<tr>
<td></td>
<td>Outside of button area</td>
<td>Shifting of the complete graphic element</td>
</tr>
</tbody>
</table>
**Name:** Name of the graphic object.

**Label:** The label of the button as it will be displayed in the Graphic window.

**Action:** Selects the name of an action from a list of predefined names. But any user-defined name can be entered as well. This name is displayed as control event in case the button is used to control another component.

**Tool Tip Text:** A text can optionally be entered that will be displayed when the mouse pointer is moved over the graphic object.

**Foreground:** Defines the color of the button font.

**Background:** Defines the background color of the button.

**Automatically resize font according to graph height:** If the button is increased or decreased the size of the label is automatically resized so as to fill the button.

**Show confirmation dialog with the following message:** After clicking the button a dialog window with a definable message is displayed.

**Enabled, if:** Optionally, it can be stated that the button is only enabled if the defined condition is fulfilled. To enter the condition the **Formula Editor** can be used via menu **Extra → General Services → Text Resolver Service** or the button in the dialog footer.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed.

**Cancel:** The dialog is closed and changes are dismissed.
The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

2.9.11.12 Multi-Button

Go to:

Graph Editor
  ➔ Controls
    ➔ Multi-Button

The graphic object Multi-Button is used for displaying a list of buttons that can be clicked by the user in order to initiate certain events. Different functions are assigned to the buttons in the list.

Interactive Mouse Activities

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Buttons</td>
<td>The button is pressed.</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Not buttons</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Frame area</td>
<td>Increases/decreases the size of the graphic element</td>
</tr>
<tr>
<td></td>
<td>Outside of button area</td>
<td>Shifting of the complete graphic element</td>
</tr>
</tbody>
</table>
Name: Name of the graphic object.

Button with: Every button can optionally be displayed with images and normal or bold label. The following function can be defined for each button:

Active: If enabled, the button is displayed.

Label: The label of the button as it will be displayed in the Graphic window.

Tooltip Text: A text can optionally be entered that will be displayed when the mouse pointer is moved over the graphic object.

Colors: Defines the font and background color of the button.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.13  Command Button

Go to:

Graph Editor  
> Controls  
> Command Button

The graphic object Command Button is used for displaying a button that can be clicked by the user in order to initiate a certain event. Functions can be assigned to the control element, e.g. exporting to PDF, loading a project, saving a project or starting a measure. This allows the calling of functions directly from a complex layout to which the user may not have a direct access. Furthermore, one or more command parameters can be transferred with one command, e.g. when exporting data the complete path including file name can be defined.

Interactive Mouse Activities

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Button</td>
<td>The button is pressed.</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Not button</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Frame area</td>
<td>Increases/decreases the size of the graphic element</td>
</tr>
<tr>
<td></td>
<td>Outside of button area</td>
<td>Shifting of the complete graphic element</td>
</tr>
</tbody>
</table>

- Save Project/Export PDF
- Save Project
- Show matrix table
**Name:** Name of the graphic object.

**Tab Commands**

**Commands:** The section **Commands** contains two lists. On the left side the available commands are listed, on the right side the selected commands are listed whose assigned events are triggered upon clicking the buttons.

The input fields above the lists can be used to filter the commands. The lists then show only commands containing the entered string.

- These buttons move the selected/all commands from one list to the other.
- With the buttons situated below, the order of the selected commands in the right list is changed: move the command to the first position / one position up / one position down / to the last position.

**Command Parameter:** Depending on the selected command, special command parameters can be defined (e.g. path).

**Enabled, if:** Optionally, it can be stated that the command button is only enabled if the defined condition is fulfilled. To enter the condition the **Formula Editor** can be used via menu **Extra → General Services → Text Resolver Service** or the button in the dialog footer.

**Blocking execution:** The programme (jBEAM) is blocked as long as the command is executed.
Determine texts automatically: The label and tool tip of the button are determined via the selected command. This option is available if the button is assigned with only one command that is called upon pressing the button.

Label: The label of the button as it will be displayed in the Graphic window (language dependent).

Tooltip: A text can optionally be entered that will be displayed when the mouse pointer is moved over the graphic object (language dependent).

Font: Defines font Name, Size and color. Optionally, the text can be displayed bold and/or italic. The look is shown by an example.

  Automatically resize font according to graph height: When the button is resized, the size of the text is automatically adjusted so that it fits into the button.

Background: Defines the background color of the button.

Show standard icon: The icon of the selected command is displayed. The option is only available if only one command is selected.

Formula Editor: Opens the Embedded Formula Editor.

N / C / D: These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field. If several languages have been defined in this dialog, all text fields can be edited in the selected language (std. / de / en / ...) directly in the dialog.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.
: The context sensitive help is activated and the cursor changes to question mark. The respective help topic is displayed when an area within the dialog is clicked on.

**Example 1**

In the example (see dialog box above) pressing the button will save the project and generate a PDF report at the same time. Both commands receive the complete path including file name as parameter. This parameter can also contain formulas which are resolved at run-time. The following example shows how the path parameter is generated out of different parts: path input via text field *Path* + name and date of the data object *Test* as file name.

Full example formula for PDF report:

```
@Value(DataItem("Path", "Path-V")) + "\" + Name(DataItem("Test", "Test")) + "\" + str(Date(DataItem("Test", "Test")),"yyyy-MM-dd HH-mm-ss") + ".pdf"
```

Resolved e.g.: C:\jBEAM\Exporte\Test 2018-02-28 13-01-10.pdf

**Example 2**

The **Command Button** is used to jump to another graphic object, e.g. a matrix table. For this, the command *JumpToComponent* coming from the **GraphicService** is applied. As its parameter **targetComponent**, the command expects a graphic object which can be selected from the list.

With a click on the button the display jumps to the defined matrix table and highlights it.
2.9.11.14 Command Field

Go to:

Graph Editor
  Controls
    Command Field

The graphic object Command Field is used to generate an interactive area that the user can click in order to trigger an event. Functions can be assigned to control elements, e.g. starting a PDF export, loading a project, saving a project or starting a measurement. This allows the user to call functions directly from a complex layout to which, for example, he has no direct access.

Moreover, one or more command parameters can be handed over to a command, i.e. when exporting data the whole path including file name can be defined.

The area can be displayed with a background color and frame, transparency can be set continuously. The area can also be set completely invisible. Like this, different functions can be assigned to individual areas of an image via several command fields.

⚠️ The Command Field executes the assigned commands only in display mode (window not editable).
Name: Name of the graphic object.

Tab Commands

Commands: The section Commands contains two lists. On the left side the available commands are listed, on the right side the selected commands are listed whose assigned events are triggered upon clicking the buttons.

The input fields above the lists can be used to filter the commands. The lists then show only commands containing the entered string.

These buttons move the selected/all commands from one list to the other.

These buttons change the order of the selected commands in the right list: move the command to the first position / one position up / one position down / to the last position.

Command Parameter: Depending on the selected command, special command parameters can optionally be defined (e.g. path).

Enabled, if: Optionally, it can be stated that the command field is only enabled if the defined condition is fulfilled. To enter the condition the Formula Editor can be used via menu Extra → General Services → Text Resolver Service or the button in the dialog footer.

Blocking execution: The programme (jBEAM) is blocked as long as the command is executed.
### Tab Layout

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line:</td>
<td><strong>Color, Width and dashes</strong> of the frame around the graphic element.</td>
</tr>
<tr>
<td></td>
<td><strong>draw in run-mode</strong>: If this option is active, the frame is also drawn in</td>
</tr>
<tr>
<td></td>
<td>run-mode or display mode, i.e. when graphic window is not editable.</td>
</tr>
<tr>
<td></td>
<td>Otherwise, the frame is only visible in edit mode.</td>
</tr>
<tr>
<td>Filled:</td>
<td><strong>Color and Opacity</strong> of the background filling of the graphic element.</td>
</tr>
<tr>
<td></td>
<td><strong>draw in run-mode</strong>: If this option is active, the filling is also drawn</td>
</tr>
<tr>
<td></td>
<td>in run-mode or display mode, i.e. when graphic window is not editable.</td>
</tr>
<tr>
<td></td>
<td>Otherwise, the filling is only visible in edit mode.</td>
</tr>
<tr>
<td>Use standard tooltip:</td>
<td>When the mouse pointer is moved over the graphic object, a tool tip is</td>
</tr>
<tr>
<td></td>
<td>displayed which is assigned to the selected command.</td>
</tr>
<tr>
<td>Tooltip:</td>
<td><strong>If</strong> the standard tooltip is disabled, an individual text can optionally</td>
</tr>
<tr>
<td></td>
<td>be entered which is displayed when the mouse pointer is moved over the</td>
</tr>
<tr>
<td></td>
<td>graphic object (<strong>language dependent</strong>).</td>
</tr>
<tr>
<td>Formula Editor:</td>
<td>Opens the <strong>Embedded Formula Editor</strong>.</td>
</tr>
<tr>
<td>N / C / D:</td>
<td>These buttons (<strong>New / Change / Delete</strong>) can be used to define **Language</td>
</tr>
<tr>
<td></td>
<td>Dependent Strings** for the currently active text field. If several</td>
</tr>
<tr>
<td></td>
<td>languages have been defined in this dialog, all text fields can be edited</td>
</tr>
<tr>
<td></td>
<td>in the selected language (<strong>std. / de / en / ...</strong>) directly in the dialog.</td>
</tr>
<tr>
<td>OK:</td>
<td>The changes are applied and the dialog is closed.</td>
</tr>
<tr>
<td>Apply:</td>
<td>The changes are applied and the dialog remains open.</td>
</tr>
<tr>
<td>Duplicate:</td>
<td>A new graphic object is created with the current settings. The original</td>
</tr>
<tr>
<td></td>
<td>graphic object remains unchanged.</td>
</tr>
<tr>
<td>Delete:</td>
<td>The graphic object is deleted and the dialog closed.</td>
</tr>
</tbody>
</table>

**Line**: Defines **Color, Width** and **dashes** of the frame around the graphic element.

**Filled**: Defines the **Color** and **Opacity** of the background filling of the graphic element.

**Tooltip**: If the standard tooltip is disabled, an individual text can optionally be entered which is displayed when the mouse pointer is moved over the graphic object (**language dependent**).
**Cancel**: The dialog is closed and changes are dismissed.

The context sensitive help is activated and the cursor changes to `?`. The respective help topic is displayed when an area within the dialog is clicked on.

### 2.9.11.15 Import Controller

**Go to:**

- **Graph Editor**
  - **Controls**
    - **Import Controller**

![Import Controller dialog]

*Comment:*
Name: Name of the graphic object.

Button with: Every button can optionally be displayed with images and normal or bold label. The following function can be defined for each button:

Active: If enabled, the button is displayed.

Label: The label of the button as it will be displayed in the Graphic window.

Tooltip Text: A text can optionally be entered that will be displayed when the mouse pointer is moved over the graphic object.

Colors: Defines the font and background color of the button.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.16  Iterable Graph Input Controller

Go to:

Graph Editor

Controls

Iterable Graph Input Controller

The graphic object **Iterable Graphic Input Controller** allows the control of components via the index.

**Example**

The input data for the iterator control is a matrix. Every column of the matrix is displayed as a curve in a Cartesian line chart. The iterator control controls which column is currently displayed.

The graphic element Iterable Graph Input Controller consists of a section with buttons and the display of the current index of all indices.

**Interactive Mouse Activities**

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Buttons</td>
<td>The button is pressed.</td>
</tr>
<tr>
<td></td>
<td>Input field (Index)</td>
<td>Index can be edited.</td>
</tr>
</tbody>
</table>
**Else**
Marks the graphic element

**Double click**
Not buttons/field
Modification of the graphic element

**Click & move**
Frame area
Increases/decreases the size of the graphic element

Outside of button area
Shifting of the complete graphic element

---

**Name:** Name of the graphic object.
**Buttons with:** Every button can optionally be displayed with images and normal or bold label. The following function can be defined for each button:

**Active:** If enabled, the button is displayed.

**Label:** The label of the button as it will be displayed in the Graphic window (multi-language).

**Tooltip Text:** A text can optionally be entered that will be displayed when the mouse pointer is moved over the graphic object (multi-language).

**Colors:** Defines the font and background color of the button.

**Commands:** The section Commands contains two lists. On the left side the available commands are listed, on the right side the selected commands are listed whose assigned events are triggered upon clicking the buttons.

The input field above the left list can be used to filter the commands. The list then shows only commands containing the entered string.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
| >> | > | < | << | These buttons move the selected/all commands from one list to the other.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|   |   |   |   | With the buttons situated below, the order of the selected commands in the right list is changed: move the command to the first position / one position up / one position down / to the last position.

**Publish Index:** The index can optionally be published as a new data object which can be used by other functions.

**Controlled by:** The Iterable Graph Input Controller itself can be controlled by another control element. The available components are displayed in the selection list.

**Big step:** Defines the intervals of the buttons Fast forward respective Fast rewind. They can be set to automatic (10%) or manual (in number of steps).

**Player-Section**

**Delay in ms:** Defines the time intervals that the different indices are subsequently called.

**Repeat:** As soon as the end is reached, the replay cycle starts again from the beginning.

**N / C / D:** These buttons (New / Change / Delete) can be used to define Language Dependent Strings for the currently active text field.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed. A warning sign ! in the Delete button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.17  Time Controller

Go to:

Graph Editor
  Controls
    Time Controller

The graphic object **Time Controller** generates variable times whose parameters can be defined. The created time value may be used by other components like the video player and audio player or as a control value of a cursor.

The following parameters affect the time controller:

- speed (can be changed via a slider)
- buttons
- time window (can be limited manually or via data objects, e.g. cursor)

The Time Controller graphic object consists of a playback bar, a display for time and speed and the slider for the modification of the speed.
Buttons

- The playback of the data can be carried out forwards as well as backwards.
- The data are replayed step by step forwards or backwards.
- Pause. The playback of the data is paused. The further playback of the data starts from the paused position.
- Stop. The playback of the data is stopped.
- For going back to the starting position (Reset).

Interactive Mouse Activities

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single click</td>
<td>Buttons in the playback area</td>
<td>The buttons of the playback bar are pressed.</td>
</tr>
<tr>
<td></td>
<td>Slider area</td>
<td>The slider is moved to the direction of the mouse click.</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td>Double click</td>
<td>Not slider area and buttons</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td>Click &amp; move</td>
<td>Slider</td>
<td>Increases/decreases the slider value</td>
</tr>
<tr>
<td></td>
<td>Outside of the slider area and the buttons</td>
<td>Shifting of the complete graphic element</td>
</tr>
</tbody>
</table>

Time Generator

- Name: Name of the graphic object.
- Start value: The initial value of the time controller.
- Stop value: The stop value of the time controller.
- Manual: If not determined by the X-value of a cursor or another data object, the initial value of the time controller can be determined manually.
**Automatic:** Automatically defines the start/stop value by predefined cursors or other data objects.

**Increment:** Sets a time interval (ΔT) determining the time progresses per second in relation to a speed (slider value) of 100%.

**OK:** The changes are applied and the dialog is closed.

**Apply:** The changes are applied and the dialog remains open.

**Duplicate:** A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete:** The graphic object is deleted and the dialog closed. A warning sign ⚠ in the **Delete** button indicates that the generated data is used by other components.

**Cancel:** The dialog is closed and changes are dismissed.

**?** : The context sensitive help is activated and the cursor changes to `?`. The respective help topic is displayed when an area within the dialog is clicked on.

*Example:* See *Dynamic Images*.

### 2.9.11.18 DataItem Reference Holder

**Go to:**

**Graph Editor**
- Controls
  - DataItem Reference Holder

**Example**

1: SaveProjectFile
2: Print
3: SelectPage

![Graph Editor](image)
Name: Name of the graphic object.

Items: Up to 10 items can be selected from a list of available services and data objects

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Duplicate: A new graphic object is created with the current settings. The original graphic object remains unchanged.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

? : The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
Go to:

**Graph Editor**
- **Controls**
  - **Property-Editor**

With the help of the Property-Editor the properties of components or data objects can be displayed and modified.

The graphic object consists of the property display and the editable input field which shows the current value of the property.

**Description:**

Head Acceleration X

### Interactive Mouse Activities

<table>
<thead>
<tr>
<th>Mouse Operation</th>
<th>Where</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single click</strong></td>
<td>Input area</td>
<td>Input of values</td>
</tr>
<tr>
<td></td>
<td>Else</td>
<td>Marks the graphic element</td>
</tr>
<tr>
<td><strong>Double click</strong></td>
<td>Not input area</td>
<td>Modification of the graphic element</td>
</tr>
<tr>
<td><strong>Click &amp; move</strong></td>
<td>Outside of input area</td>
<td>Shifting of the complete graphic element</td>
</tr>
</tbody>
</table>
**Name**: Name of the graphic object.

**Label**: The label of the input field. This can also be a formula expression.

**Label Width**: Defines the width of the label in %.

**Input Width**: Defines the width of the input field in %.

**Property to edit**: Selection of the data object and its properties.

- **Edit property of component**: Selection of an available component whose property is to be modified.
- **Edit property of dataobject**: Selection of the data object whose property is to be modified.

**Property to edit**: Selection of the property from the selection list.

**Format**: The input of the formatting of the property value.

**Preview**: Display of the formatted value.

**OK**: The changes are applied and the dialog is closed.

**Apply**: The changes are applied and the dialog remains open.

**Duplicate**: A new graphic object is created with the current settings. The original graphic object remains unchanged.

**Delete**: The graphic object is deleted and the dialog closed.

**Cancel**: The dialog is closed and changes are dismissed.

? : The context sensitive help is activated and the cursor changes to ?. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.11.20  Command Push-Button

Go to:

Graph Editor
  ➔ Controls
     ➔ Command Push-Button

2.9.12  Modify

Go to:

Graph Editor
  ➔ Modify

The modification dialog also box opens via double click on the respective graphic object.

This command opens the type specific properties of a graphic object. In order to execute the command a graphic element in the active Graphic window has to be marked. Several graphic elements cannot be modified at the same time.
### 2.9.13 Properties

Go to:

**Graph Editor**

The general properties of a graphic element can be called via the context menu opening upon right click on the graphic object.

This command opens the dialog box showing general properties of the marked graphic element. Several graphic elements can be marked at the same time when calling this function. Like this the modified properties of all graphic elements can be changed at the same time.

---

**Base properties for 1 Graphic elements**

**Name:** Name of the graphic element. This input enables to name also grouped graphic objects.

**Position and Size:** The position can be determined in pixels or millimetre. The pixel value is dependent on the current window position. If a view of 50% is determined, the position in pixels is only 50% of the 100% view position.

- **left:** Defines the left frame. The position is set in relation to the printable page.
- **top:** Defines the upper frame. The position is set in relation to the printable page.

---

**Name:** main layout

---

**Border**

- **Borderwidth:**
  - **outer:** 0
  - **inner:** 1

---

**Background**

- **transparent**

---

**Formula Editor**

---

**OK**  **Apply**  **Delete**  **Cancel**
**width**: Defines the width of the graphic element.

**height**: Defines the height of the graphic element.

**Properties**

**modifiable**: Can optionally be selected. If enabled, the graphic element can be modified. If the graphic element is marked, the modifiability of the element is marked by an ‘m’ in the left upper corner.

**resizable**: Can optionally be selected. If enabled, the graphic element can be modified. If the graphic element is marked, the resizable of the element is marked by a ‘g’ in the left upper corner.

**visible**: Can optionally be selected. If enabled, the graphic element is displayed. If disabled, the graphic element is not drawn. This property can e.g. be modified via the component `DatItem→Property` in order to control the visibility of a graphic element by data items.

**printable**: Can optionally be selected. If enabled, the graphic element can be printed. If the graphic element is marked, the printability of the element is marked by a ‘p’ in the left upper corner.

**moveable**: Can optionally be selected. If enabled, the graphic element can be moved.

**Table of Contents**: Can optionally be selected. If enabled, the graphic element is included in the table of contents.

**ToC Level**: The level on which the graphic object is displayed in the table of contents can be stated in the input field.

**Visibility**: Additionally, the display of the numbering in the title of the graphic element can be set independently of the settings in the Table of Contents Graph. With option **Show**, the numbering appears in the title, with option **Hide** not. The display of the numbering in the Table of Contents Graph, however, is not affected. With option **Default**, the settings from the Table of Contents Graph are adopted.

**Refresh rate**: A **Limited refresh rate** can be defined in order to avoid constant redrawing of complex graphic elements.

**Template**: By default, graphic elements are parts of the main layout. They can also be part of a template. The **Name** of the layout and the storage location **(Filepath)** are displayed.

**Border**: Optionally, the graphic element can be drawn with borders.

**Borderwidth**: Defines the outer and inner border width of the graphic element.

**outer**: The outer border is drawn in the defined width with the color selected via color selection button. If width = 0, no border is drawn. In edit mode the margins of the graphic element are then represented by a dotted line. In the right selection list a shape for the outer border can be selected.
inner: The inner border is transparent and defines the distance of the actual graphic element to the outer border.

Background: Optionally, the graphic element can be drawn with background.

transparent: If enabled, the background of the graphic object is displayed transparently. If disabled, a background design can be selected from the selection list. The background color can be set either via the color button or via formula. For this, the Formula Editor can be used.

print: Can only be enabled if the background is not transparent. If enabled, the set background color is printed, provided that in the Preferences (tab Printing/Report) the option Print Background is activated.

Formula Editor: The Embedded Formula Editor is opened via this button.

OK: The changes are applied and the dialog is closed.

Apply: The changes are applied and the dialog remains open.

Delete: The graphic object is deleted and the dialog closed.

Cancel: The dialog is closed and changes are dismissed.

?: The context sensitive help is activated and the cursor changes to help. The respective help topic is displayed when an area within the dialog is clicked on.

2.9.14 Replace Data

Go to:

Graph Editor
  ➔ Replace Data

This function can be used to replace simultaneously all data objects, components or data sources of a selected area by others. This way, data objects can be replaced in a large number of diagrams without opening all individual dialogs.

The used data objects, components respective data sources are listed in the dialog box and can be replaced by other available data objects, components respective data sources via combo boxes.
Tab Replace data sources

**old data source:** All data sources in the selected area (graphic element, graphic window, Explorer) which are used and replaceable are listed.

**new data source:** All data sources available for the respective data source are listed. When a different data source is selected, it will be highlighted in yellow. If a used data object of the old data source is not contained in the new data source, the text is displayed in red.

Tab Replace components

**old component:** All components in the selected area (graphic element, graphic window, Explorer) which are used and replaceable are listed.

**new component:** All components available for the respective component are listed. When a different component is selected, it will be highlighted in yellow.

The input fields below the lists can be used to filter the components. The lists then show only component names containing the entered string.
Tab Replace data objects

old data object: All data objects in the selected area (graphic element, graphic window, Explorer) which are used and replaceable are listed. Data objects which are not available are displayed in red.

new data object: All data objects available for the respective data object are listed. When a different data object is selected, it will be highlighted in yellow.

The input fields below the lists can be used to filter the data objects. The lists then show only data object names containing the entered string.

show only not available data objects: If this option is activated, only data objects are listed for which no corresponding source has been found in the current project. If a data object with the same name has been found in another producer, this is already offered under new data object. If no suitable data object has been found, it is displayed in red.

OK: The changes are applied and the dialog is closed.

Cancel: The dialog is closed and changes are dismissed.

: The context sensitive help is activated and the cursor changes to help. The respective help topic is displayed when an area within the dialog is clicked on.
2.9.15 Delete active

Go to:

Graph Editor
    ➔ Delete active

or press <DEL>

The command deletes all marked graphic elements of the active Graphic window.

2.9.16 Delete all

Go to:

Graph Editor
    ➔ Delete all

This command deletes all graphic elements of the active Graphic window.
2.9.17 Order

Go to:

Graph Editor

- Order

The menu item is divided into:

- Bring to Front
- Bring Forward
- Send Backward (O)
- Send to Back

The graphic objects are drawn in a certain order. This order determines which graphic object is drawn on top of the other if necessary. The graphic objects are drawn in reverse order, i.e. the graphic element with the index 1 is always drawn as the last one.

The index of a graphic object is visible when the object is marked. The index is displayed in the left upper corner.

In order to change the order, the graphic object has to be marked.

Bring to Front: The selected graphic object gets the index 1, i.e. it is positioned in front of all other graphic objects.

Bring Forward: The index of the selected graphic element is decreased by 1.

Send Backward (O): The index of the selected graphic element is increased by 1.

Send to Back: The selected graphic element receives the last available index, i.e. it is positioned after all other graphic objects.
2.9.18 Alignment

Go to:

*Graph Editor*

→ Alignment

The menu item is divided into:

- Left
- Right
- Top
- Bottom
- Side by side
- Among each other

The alignment function is only enabled if a Graphic window is selected and contains graphic elements.

All graphic elements that are to be aligned have to be marked before carrying out the command.

**left:** The marked graphic object is moved to the left. The graphic object situated farthest left is used as reference. The height of the graphic object is not changed.

**right:** The marked graphic object is moved to the right. The graphic object situated farthest right is used as reference. The height of the graphic object is not changed.

**top:** The marked graphic object is moved upwards. The graphic object situated farthest on top is used as reference. The alignment of the graphic object in X direction is not changed.

**bottom:** The marked graphic object is moved downwards. The graphic object situated farthest down is used as reference. The alignment of the graphic object in X direction is not changed.

**side by side:** The marked graphic objects are ordered next to each other. The height of the graphic object is not changed.

**below each other:** The marked graphic objects are ordered below each other. The alignment in X direction is not changed.
2.9.19 Group

Go to:

**Graph Editor**

- **Group**

All selected graphic elements in the active Graphic windows are arranged as a group via **Group**. A group is visualised by a frame surrounding all elements when selecting a grouped graphic objects. Position and distance of the graphic elements among each other remain the same and do not change when moving the grouped element in the Graphic window.

Already created groups can be grouped again and be assigned to a superordinate group. This is carried out by marking the elements and calling the command **Group**.

Interactive graphic elements, such as buttons, slider or axis cursor, can now be operated also in grouped condition (grouping, component group or graphic template).

Grouped graphic elements are displayed in the **Explorer** under **Desktop**.

This example shows four graphic elements that are grouped into two groups respectively. Both generated groups are subsequently grouped to a superordinate group.
2.9.20 Ungroup

Go to:

Graph Editor

> Ungroup

or press <CTRL+U>

The function Ungroup annuls the grouping of a marked group. The previously grouped elements become independent again and can be positioned individually in the Graphic window.
2.10 Menu: Help

The Help menu is divided into:

- **jBEAM Help** – starts the jBEAM online help
- **Help on Item** – activates the context sensitive help
- **System Info** – shows Java specific system parameters
- **Package Info** – shows all loaded Java packages
- **Components in use** – shows the currently used components
- **Memory Monitor** – show the current and past memory
- **jBEAM Projectfile – Dictionary** – shows contents of project file without opening
- **Resources/Library Usage** – shows used and available resources and libraries
- **About jBEAM** – shows information about jBEAM and AMS
- **Release Notes** – shows changes of jBEAM versions
- **Project Show** – shows all jBEAM projects of a folder
- **Simulation** – starts a simulation of using jBEAM
- **Stop Simulation** – stops the simulation

Help is also called by pressing <ALT+H>.

2.10.1 jBEAM Help

Go to:

Help

← jBEAM Help

or press <F1>
or press the **Help** symbol situated in the toolbar.

The jBEAM help is an integrated online help system describing the individual functions of jBEAM.

There are three possibilities for navigating the help system:

- **Table of Contents**
- **Index Register**
- **Full-text Search**

**Help with activated table of contents:**

The desired topic is selected via the directory tree of the table of contents and displayed. Entries with subdirectories are opened and closed via double click or the +/- symbol.
Help with activated index register:

The navigation in the index register is done via mouse by opening individual items of the content tree. When entering a search term the suitable element is searched in the index register and its content is displayed. If there are several suitable entries, pressing <ENTER> directs the user to the next entry.
Help with activated full-text search:

A search term is entered into the input box behind **Search** and all help documents are searched for this term. The result of the search is a list with help topics. The degree of filling within the circle represents the relevance:

- filled – the topic agrees well with the searched term
- ...
- empty – the topic hardly agrees with the searched term

The number next to the circle indicates the occurrences of the searched term in the document. The topic content is displayed by clicking on the desired topic in the list.

### 2.10.2 Help on Item

Go to:

**Help**  

→ **Help on Item**

or press `<SHIFT+F1>`

or press the **Help on Item** symbol in the toolbar.

First, the cursor changes to an arrow with an associated question mark. Then, the jBEAM object about which information is to be obtained is clicked on.
The jBEAM online help is opened and the help topic associated with the object is automatically displayed. Any further navigation can be carried out manually by the user.

2.10.3 System Info

Go to:

Help
  → System Info

A window with available Java system information is opened.

The left column displays available system parameters (properties) and the right column the corresponding values. Clicking on the column headers sorts the lines alphabetically. The information in this window helps Java system administrators to solve problems when loading jBEAM components.

2.10.4 Package Info

Go to:

Help
  → Package Info

Information about the loaded Java packages is displayed in a window. A mouse click on the column header sorts the lines alphabetically.
Package: Name of the Java package

Impl. Title: Title of the implementation

Impl. Version: Version of the implementation

Impl. Vendor: Vendor of the implementation

Spec. Title: Title of the specification that serves as basis for the implementation

Spec. Version: Version of the specification

Spec. Vendor: Vendor of the specification

Sealed: true – the package is sealed; false – the package is not sealed

The information in this window helps Java system administrators to solve problems when loading jBEAM components.

2.10.5 Components in Use

Go to:

Help
  \<-Components in Use

The used components of the currently generated project are displayed in a window. This function is useful, for example, for determining the needed components of the licensed version when working with a demo version.
2.10.6 Memory Monitor

Go to:
Help
→ Memory Monitor

The **Memory Monitor** displays the currently used memory as well as the trace of memory usage in a window. The window may remain open while working with jBEAM.

**Collect**: The Java Garbage Collector is called. All objects that are not needed anymore are deleted and the memory they occupied is cleared.

**Close**: Closes the window Memory Monitor.
2.10.7 jBEAM Projectfile - Dictionary

Go to:

Help
- jBEAM Projectfile - Dictionary

The content of a jBEAM project file is displayed in a window. Upon calling the function a window for selecting a file opens and an existent project file can be selected from a directory. Then the content of the selected file will be displayed. The currently opened project is not affected by this action.

This function is mainly used for problem solving when loading jBEAM components.

Copy: The marked cells (respective all cells if nothing is marked) are copied and can be inserted into the current jBEAM project or other applications (e.g. Excel).

New File: The window for selecting a file reopens and a new project file can be selected

Close: The window is closed.
2.10.8 Resources/Library Usage

Go to:

Help
   Resources/Library Usage

Used and available resources and libraries are displayed in a window.

The Libraries state shows whether all libraries are there (green dot) or not (red dot) and which libraries are available. Available libraries can be downloaded via the button Download.

Tab Information

General information like name, version, availability or license of the selected library is displayed.
Tab Usage in Components
This tab states the components in which the selected resource/library is used.

2.10.9 About jBEAM

Go to:
Help

About jBEAM

Information about AMS and jBEAM is displayed in a window.

The jBEAM version, built and information about available languages are stated. The listed languages are available for the user interface of the current jBEAM customer version.

jBEAM is automatically adjusted to the language of the operating system if that language is available in jBEAM.
2.10.10  Release Notes

Go to:

Help

Release Notes

In a window, changes within the individual jBEAM versions are listed. The release notes can be sorted or filtered according to content.

The dialog shows Version, Component, Category, Changes and Mantis ticket.

Version: The change is effective from the stated version on.
**Component:** The change applies to the stated component.

**Category:** The change is classified into one of the categories **new**, **modified** or **Bugfix**.

**Changes:** Description of the change.

**Mantis ticket:** The corresponding Mantis ticket is stated if one exists.

A click in the column title sorts the release notes by component name, category etc. Repeated clicks shift through the modes **ascending** – **descending** – **without sort**.

The filter line beneath the list can be used to search for specific content of the respective column. Via the filter field of column **Version** e.g. older or all release notes can be selected.

### 2.10.11 Project Show

Go to:

**Help**

- **Project Show**

The **Project Show** shows all jBEAM projects one after the other that are contained in the subfolder **ProjectShow** or the jBEAM folder (e.g. "C:\Program Files (x86)\jBEAM\ProjectShow").

The projects are opened and displayed for the estimated **Time per project file**.

The user can determine that the display of the projects is continuously **repeated**. Otherwise the show is automatically finished after running through all projects.

All current components are deleted for the Project Show so that an enquiry for saving the project is displayed.

The Project Show can be stopped via the menu entry **Stop Simulation**.
2.10.12 Simulation

Go to:

Help → Simulation

The Simulation shows typical operations when using jBEAM. Mouse movements, the calling of the menu and dialog inputs are slowly shown so that an unexperienced jBEAM user can learn the usage of jBEAM by means of this example.

After calling the menu item the starting dialog box is displayed with an overview of the sequence. Here the user determines if the simulation is displayed repeatedly (repeat show). All current components are deleted when starting the simulation that’s why an enquiry dialog box for saving the project opens. The simulation can be stopped at any time via <SHIFT>+<ESC>.

Note: During the simulation the mouse must not be moved.

The simulation consists of the following processes:

- A data row of random numbers is generated via the generator **Double Channel**.
- These random numbers are depicted in a line chart. A section of the chart is zoomed and the view is changed from zoomed to normal.
- The amplitude spectrum of these random numbers is calculated via FFT analysis.
- The spectrum is depicted in a line chart. The chart is moved and enlarged.
The Graphic window is set to page view.

At the end of the sequence a dialog box appears that the simulation is finished. Afterwards jBEAM can be used as usual.
The jBEAM project file should have the following content:
2.10.13  Stop Simulation

Go to:

Help

→ Stop Simulation

or press <SHIFT+ESC>.

A running Simulation or Project Show is stopped.
3 Components

3.1 Embedded Formula Editor

jBEAM can resolve text embedded formulas at runtime. The embedded formulas can be used in graphic element titles, axis names, etc. The part of the text which is an embedded formula must be enclosed by two @. An @ at the end of the complete text may be omitted. If the editor is started out of a component editor, formulas contained in the input field where the cursor is positioned are automatically taken over.

Example: The label “@displayname(currdataitem)@” of the y-axis is resolved to the name “current example” in the graphic depiction.
For a full description of the Text Resolver see also [Text Resolver Service](#).
3.2 Filtered Selector of Dataitems

The Filtered Selector of Dataitems offers the possibility to select certain data objects that are concordant with the created filters out of the variety of all available data objects.

**Filters**: Lists all created filters.

**Field**: The combo box contains keys that can be used for filtering.

**Condition**: Contains criteria that are used to set up filters. The conditions vary according to the selected Field. The input box for defining the condition is situated next to the Condition combo box.

**Delete filter**: Deletes all selected filters from the list Filters.

**Load last filter**: Possibility to reload the last filter. The last filter can only be reloaded if it was actually used and a data object selected.

**Add filter**: Adds the created filter to the list Filters.

**Filtered dataobjects**: Lists all data objects that correspond to the filter criteria.

**OK**: Inserts the data object that was selected by filtering (or the user’s choice) into the dialog field from which the Filtered Selector of Dataitems was called.

**Cancel**: Closes the dialog box without applying filters.
### Overview of Fields/Conditions

<table>
<thead>
<tr>
<th>Field</th>
<th>Condition:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name, Producer, Unit</td>
<td>Contains: Checks if the input box’s entry is contained in a data object.</td>
</tr>
<tr>
<td></td>
<td>Equals: Checks if the entered characters/words equal a data object’s.</td>
</tr>
<tr>
<td></td>
<td>Not contains: Selects the data objects that don’t contain the input box’s entry.</td>
</tr>
<tr>
<td></td>
<td>Not equals: Selects the data objects that are not equal to the entered characters/words.</td>
</tr>
<tr>
<td>Date</td>
<td>Equals: Checks if the entered date equals a data object’s date.</td>
</tr>
<tr>
<td></td>
<td>Not equals: Selects all data objects whose date doesn’t correspond with the entered date.</td>
</tr>
<tr>
<td></td>
<td>Before: Selects all data objects whose date is older than the entered date.</td>
</tr>
<tr>
<td></td>
<td>After: Selects all data objects whose date is more recent than the entered date.</td>
</tr>
<tr>
<td>Valuecount, Dimension,</td>
<td>Equals: Checks if the entered number equals the data object’s.</td>
</tr>
<tr>
<td>Minimum, Maximum</td>
<td>Not equals: Selects the data objects whose values are not equal to the input value.</td>
</tr>
<tr>
<td></td>
<td>Greater: Selects all data objects whose key value is greater than the input value.</td>
</tr>
<tr>
<td></td>
<td>Less: Selects all data objects whose key value is lesser than the input value.</td>
</tr>
</tbody>
</table>

Textual filter criteria also contain the option whether or not to consider lower case and upper case.

### 3.3 Dataobject Filter

The filter is available both in the **Channels** tab of the **Spreadsheet** and in the **Filtered List** of the **Explorer**. The display of the data objects available in the current project can be filtered according to different editable criteria. The filtered list only contains the data objects that comply with the defined conditions. The filter supports the check for letter combinations in the data item or producer name as well as formulas yielding a Boolean value. It is possible to combine several filter conditions, e.g. **Dataitem name contains** and **Formula**.
**Data-item name contains / Producer name contains:** Only the data items or producers are listed whose names contain the defined string. Several strings can be defined, separated by semicolons. If the option **Case sensitive** is activated, only the names with the string in exact upper and lower cases are listed.

**Formula:** The formula can be edited manually or by means of the **Formula Editor**. It should yield a Boolean result and not contain an '@' at the beginning and the end.

**Formula Editor:** Opens the **Embedded Formula Editor**.

**OK:** The list of data objects is filtered according to the defined options and the dialog is closed.

**Apply:** Like **OK** but the dialog remains open.

**Cancel:** The dialog is closed and all new entries and changes are dismissed.

**?:** The context-sensitive help is activated and the cursor changes to `?`. The respective help topic is displayed when an area within the dialog is clicked on.

**Example**

The example above shows the filtering by means of a combination of a string included in the data object name and a formula. The filter criteria are that the string "Cha" is included in the data object name and simultaneously the maximum of the data object is greater than 0. Afterwards, the desired data objects are listed in the **Channel** tab of the **Spreadsheet** or in the **Filtered List** of the **Explorer**. The filters are independent, i.e. different filter criteria can be defined for the **Channel Spreadsheet** and the **Filtered List**.
3.4 Configure Formatter

The Formatter Dialog enables detailed possibilities to format values of various types. The button to open the Formatter is available in many modification dialogs of graphic elements. The individual data object types can be formatted in separate tabs. The data type selected in the calling dialog is automatically preselected.

**Tab Section**

The formatter settings can be modified in individual tabs according to the data type. The following data types are available: Double, Complex, Boolean, Date/Time, Integer, Longitude, Latitude, String and File.

**OK**: The settings are applied and the dialog is closed.

**Cancel**: The dialog is closed and all new entries and changes are dismissed.

**?**: The context sensitive help is activated and the cursor changes to ? . The respective help topic is displayed when an area within the dialog is clicked on.
### Tab Double

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Integer</th>
<th>Longitude</th>
<th>Latitude</th>
<th>String</th>
<th>File</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Double</strong></td>
<td><strong>Complex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Formatter configuration for values, channels and matrices of type Float and Double, such as "FloatValue" and "DoubleChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.

**Format:** A predefined format can be selected from the list of available formats. The following list items are available for double data object types:

- **7.1426** Decimal representation
- **7.14E0** Exponential representation
- **7.143 | 7.143E8** automatic selection of decimal or exponential representation
- **00:00:07.1** Time representation
- **7°08.6** Angular representation in degrees and minutes
- **7°08m33.4** Angular representation in degrees, minutes and seconds
- **O 007°08.56'** Geografic longitude representation in degrees and minutes
- **O 007°08'33.36''** Geografic longitude representation in degrees, minutes and seconds
- **N 07°08.56'** Geografic latitude representation in degrees and minutes
- **N 07°08'33.36''** Geografic latitude representation in degrees, minutes and seconds

**Digits:** Defines the number of decimal places. If the option **exact** is selected the defined number of decimal places is always displayed and if necessary filled with zeros. With the option **maximal** the defined number of decimal places is only displayed when needed.

**Magnitude:** This value states the power of 10 to round the integer value, i.e. '1' for rounding to full 10, '2' for full 100 etc.

**Grouping:** If this option is selected, each three digits are grouped by the thousands separator.

**Engineering notation:** The engineering notation is a version of scientific notation where the exponent must be a multiple of three.
"+0" for formatted zero, but non zero value: When values close to zero are displayed only with zeros because the other decimal places are omitted, then even positive values are displayed with a sign "+" in order to differentiate them from exact zero.

Start position: Denotes the first position visualized in the time format.

End position: Denotes the last position (the decimal position) of the relative time format.

Tab Complex

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Integer</th>
<th>Longitude</th>
<th>Latitude</th>
<th>String</th>
<th>File</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double</td>
<td>Complex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Formatter configuration for values, channels and matrices of type Float and Double, such as "FloatValue" and "DoubleChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.

Format: A predefined format can be selected from the list of available formats. The following list items are available for complex data object types:

- 7.142G – 0.8200i Decimal representation
- 7.14E0 + i*8.20E-1 Exponential representation

Digits: Defines the number of decimal places. If the option exact is selected the defined number of decimal places is always displayed and if necessary filled with zeros. With the option maximal the defined number of decimal places is only displayed when needed.

Magnitude: This value states the power of 10 to round the integer value, i.e. '1' for rounding to full 10, '2' for full 100 etc.

Grouping: If this option is selected, each three digits are grouped by the thousands separator.

Engineering notation: The engineering notation is a version of scientific notation where the exponent must be a multiple of three.
**Tab Boolean**

<table>
<thead>
<tr>
<th>Double</th>
<th>Boolean</th>
<th>Date/Time</th>
<th>Integer</th>
<th>Longitude</th>
<th>Latitude</th>
<th>String</th>
</tr>
</thead>
</table>

Formatter configuration for values, channels and matrices of type Boolean, such as "BitValue" and "BitChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.

**Format:** A predefined format can be selected from the list of available formats. The list items shown above are available for Boolean data object types.

**String 'true' / 'false':** The Boolean strings 'true' and 'false' can be replaced by individual strings. The strings can be formatted as multi-language text.

**Tab Date/Time**

<table>
<thead>
<tr>
<th>Double</th>
<th>Boolean</th>
<th>Date/Time</th>
<th>Integer</th>
<th>Longitude</th>
<th>Latitude</th>
<th>String</th>
</tr>
</thead>
</table>

Formatter configuration for values, channels and matrices of type Date/Time, such as "DateTimeValue", " and "DateTimeChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.

**Format:** A predefined format can be selected from the list of available formats. The list items shown above are available for date/time data object types.
Pattern: If the Format option manual is selected an individual pattern can be defined. Pattern examples are shown in the dialog. A detailed description can be found in topic Syntax of Date Time Formats.

Tab Integer

<table>
<thead>
<tr>
<th>Double</th>
<th>Boolean</th>
<th>Date/Time</th>
<th>Integer*</th>
<th>Longitude</th>
<th>Latitude</th>
<th>String</th>
</tr>
</thead>
</table>

Formatter configuration for values, channels and matrices of type Integer and Long, such as "Integer/value" and "LongChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.

Format: A predefined format can be selected from the list of available formats. The following list items are available for integer data object types:

- 12,345 Normal representation
- 1.23E4 Exponential representation
- 0b110000 00111001 Binary representation
- 0o3 0071 Octal representation
- 0x3039 Hexadecimal representation

Digits: Defines the number of decimal places (only for exponential representation). If the option exact is selected the defined number of decimal places is always displayed and if necessary filled with zeros. With the option maximal the defined number of decimal places is only displayed when needed.

Magnitude: This value states the power of 10 to round the integer value, i.e. '1' for rounding to full 10, '2' for full 100 etc.

Grouping: If this option is selected, each three digits are grouped by the thousands separator in case of normal representation. In case of binary, octal and hexadecimal representation the digits are grouped by blanks. The blanks can either be inserted after 4 bit or after 8 bit.

Prefix: If selected, the prefixes '0b', '0o', or '0x' are inserted before the binary, octal, or hexadecimal representation of an integer.
**Digits to be displayed:** The value defines the number of digits to be displayed in case of binary, octal and hexadecimal representation. Missing digits are filled with 0. Too many digits are hidden.

**Tab Longitude**

![Formatter configuration for values and channels of type Longitude, such as "LongitudeValue" and "LongitudeChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.]

**Format:** A predefined format can be selected from the list of available formats. The list items shown above are available for longitude data object types.

**Digits:** Defines the number of decimal places (max. 20).

**Tab Latitude**

![Formatter configuration for values and channels of type Latitude, such as "LatitudeValue" and "LatitudeChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.]

**Format:** A predefined format can be selected from the list of available formats. The list items shown above are available for latitude data object types.

**Digits:** Defines the number of decimal places (max. 20).
Tab String

Formatter configuration for values, channels and matrices of type String, such as "StringValue" and "StringChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.

Format: A predefined format can be selected from the list of available formats. The following list items are available for string data object types:

- Entire string: All characters are displayed.
- Start of string: Only the defined number of characters from the start is displayed.
- Start and end of string: Only the defined number of characters (in total) from the start and from the end is displayed.
- End of string: Only the defined number of characters from the end is displayed.

Number of characters to be displayed: The value defines the maximum number of characters to be displayed. Hidden characters are symbolised by dots.

Tab File

Formatter configuration for values and channels of type File, such as "FileValue" and "FileChannel". The formatter configuration is currently active, since the displayed data object has one of the above mentioned data types.

Format: A predefined format can be selected from the list of available formats. The following list items are available for file data object types:

- Relative file path: The value is displayed as relative file path.
Absolute file path: The value is displayed as absolute file path.

Canonical file path: The value is displayed as canonical file path.

Output: The length of the displayed path name can be defined as follows:

Entire file path: The entire file path is displayed.

Start of file path: The start of the file path is displayed up to the defined number of characters.

Start and end of file path: The start and the end of the file path are displayed up to the defined number of characters. The medium part is omitted.

End of file path: The end of the file path is displayed up to the defined number of characters.

Number of characters to be displayed: The value defines the maximum number of characters to be displayed. Hidden characters are symbolised by dots.

Whole file and directory names: Optionally, in case of partly displayed file path names it can be stated that only whole name parts (file name, directory name) are displayed up to the maximum number of characters.

3.5 Color Ranges Editor

This editor enables the definition of any color gradient with minimum and maximum values as well as intermediate values.

Color mode: The color ranges can either be represented by Discrete colors or a Color gradient. In case of Color gradient, the colors can be interpolated either in the HSB or RGB Color space.
Rainbow: The colors for minimum and maximum are automatically defined so that the interpolation runs through the whole color spectrum.

For each value which can be edited in the input fields a corresponding color can be selected via color selection button. The buttons can be used to insert new reference points or to delete existing ones. Edited values are only accepted if they are between their neighbor values.

Copy color ranges to the clipboard: The configured color range is copied to the clipboard. It can be pasted into another diagram afterwards.

Paste color ranges from the clipboard: A color range previously copied to the clipboard is pasted into the current diagram.

OK: The settings are applied and the dialog is closed.

Cancel: The dialog is closed and all new entries and changes are dismissed.

: The context sensitive help is activated and the cursor changes to . The respective help topic is displayed when an area within the dialog is clicked on.

3.6 Configure Ranges Dialog

The display field shows the existing data points with a preview of the detected limits for the speed ranges. They are represented by cursor lines. These lines can be manually shifted with the mouse. Via right click on a cursor line, this speed range separator can be removed. A right click in an empty area between the ranges can add a speed range.
Individual points can be deactivated and activated again by holding the Ctrl button and drawing a rectangle with the mouse button pressed. All points within the marked area are deactivated or activated.

The display can be zoomed and shifted similar to the Universal 2D graph. Via Alt & Click & Move e.g., a rectangle can be drawn to zoom into this area. Thus, an accurate positioning of the limit lines is possible.

**Y-Axis shows:** Either the X- or the Y-Values can be displayed.

**Reset Settings:** All changes can be dismissed. The settings are reset to the last saved values.

**OK:** The settings are applied and the dialog is closed.

**Cancel:** The dialog is closed and all new entries and changes are dismissed.

❓: The context sensitive help is activated and the cursor changes to 📚. The respective help topic is displayed when an area within the dialog is clicked on.

**Example:** The dialog above shows an example where the upper 3 speed ranges are very close. The automatic detection has combined those ranges to one which leads to a zigzag line in the map.

Via Alt & Click & Move the concerned area is zoomed in so that the upper 3 speed ranges can be marked off precisely.
Via right click in the area between the speed ranges a new range is inserted at this position.

This way, two speed ranges have to be added. The mouse can be used to shift the lines to the correct position.
Thus, the speed ranges are clearly separated and the map shows straight lines.
3.7 Overview of Producer and Consumer Views

P and C inactive

Shows the result items of all components (calculations, services and graphics) in the first level (e.g. Producer list) and the consumers of the result items.
**P active**

Shows the result items of all components (calculations, services and graphics) and the consumers of the result items. The result items of the consumers are shown additionally.
C active

Shows the input items of all components (calculations, services and graphics) and the producers of the input items. The input items of the producers are shown additionally.
**P and C active**

Shows input and result items of all components (calculations, services and graphics) as well as the producers of the input items and the consumers of the result items. Additionally, input and result items of the producers and consumers are shown.

\[[0], \[1], \ldots\]  
**Input data item at Port 0, Port 1, ...**

\[P[0], P[1], \ldots\]  
**Port 0, Port 1, ... of the consumer that consumes the data item**
3.8 Float Format Syntax

jBEAM offers two ways to read floats from text files:

1. Standard formats
2. Sample-defined formats

Standard formats

Standard formats describe all common number formats that are used to write floats to text and ASCII files.

Depending on local usage, a dot or a comma might be used as decimal separator.

Samples for standard floating point numbers:

- ',' separated: 12,34 -34 -0,2345 1,34E2 1,34E003 -1,34E-03 -1,34E+03
- ',' separated: 12.34 -34 -0.2345 1.34E2 1.34E003 -1.34E-03 -1.34E+03

Sample defined formats are required for:

- Numbers with group separators (thousands): e.g. 1,234.45 ("#,#0.0")
- Numbers with units: e.g. EUR 12.3 ("EUR '0.0") 0.2 mm ("0.0' mm")

Sample-defined formats

The structure of floats that have been saved in special formats might be defined in a sample pattern. This pattern reserves all ASCII characters as defined below:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Presentation</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Digit</td>
<td>(Number)</td>
<td>0.0</td>
</tr>
<tr>
<td>#</td>
<td>Digit, if not 0</td>
<td>(Number)</td>
<td>#0.0</td>
</tr>
<tr>
<td>.</td>
<td>Decimal separator</td>
<td>(Number)</td>
<td>#0.0</td>
</tr>
<tr>
<td>-</td>
<td>Minus</td>
<td>(Number)</td>
<td>-#0.0</td>
</tr>
<tr>
<td>,</td>
<td>Group separator</td>
<td>(Number)</td>
<td>#,##0.0</td>
</tr>
<tr>
<td>E</td>
<td>Exponential display</td>
<td>(Number)</td>
<td>0.0E0</td>
</tr>
<tr>
<td>;</td>
<td>Sub pattern separator</td>
<td>(Number)</td>
<td>#0.0;(#0.0)</td>
</tr>
<tr>
<td>%</td>
<td>*100 and display as percent</td>
<td>(Prefix or Suffix)</td>
<td>'%'#0.0</td>
</tr>
<tr>
<td>‰</td>
<td>*1000 and display as promille (\u2030)</td>
<td>(Prefix or Suffix)</td>
<td>'‰'#0.0</td>
</tr>
<tr>
<td>¥</td>
<td>Currency symbol, substituted by the local currency symbol; if double, the international currency symbol. (\u00A4)</td>
<td>(Prefix or Suffix)</td>
<td>'¥'0.00</td>
</tr>
<tr>
<td>'</td>
<td>Indicates begin and end of special row of characters</td>
<td>(Prefix or Suffix)</td>
<td></td>
</tr>
</tbody>
</table>

A pattern containing an invalid character can not be used to create or recognise a number.
Samples for pattern-defined formats:

Decimal sign \',\':
- "0.0"  -12,34  -34  -0,2345
- "0.0E0"  1,34E2  1,34E-003  -1,34E-03  -1,34E+03

Note: 1,34E+003 cannot be imported utilizing a pattern! A plus in the exponent is not supported. Use the standard format.

3.9 Syntax of Date Time Formats

The time format is defined via string pattern. Within this pattern all ASCII characters that are reserved as pattern characters are defined as seen below:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Presentation</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Era Ident</td>
<td>(Text)</td>
<td>AD</td>
</tr>
<tr>
<td>y</td>
<td>Year (year)</td>
<td>(Number)</td>
<td>2001</td>
</tr>
<tr>
<td>M</td>
<td>Month of year</td>
<td>(Text or number)</td>
<td>July or 07</td>
</tr>
<tr>
<td>d</td>
<td>Day of month</td>
<td>(Number)</td>
<td>10</td>
</tr>
<tr>
<td>h</td>
<td>Hour as am/pm (1~12)</td>
<td>(Number)</td>
<td>12</td>
</tr>
<tr>
<td>H</td>
<td>Hour of day (0~23)</td>
<td>(Number)</td>
<td>0</td>
</tr>
<tr>
<td>m</td>
<td>Minute of hour</td>
<td>(Number)</td>
<td>30</td>
</tr>
<tr>
<td>s</td>
<td>Second of minute</td>
<td>(Number)</td>
<td>55</td>
</tr>
<tr>
<td>S</td>
<td>Millisecond</td>
<td>(Number)</td>
<td>978</td>
</tr>
<tr>
<td>E</td>
<td>Day of week</td>
<td>(Text)</td>
<td>Tuesday</td>
</tr>
<tr>
<td>D</td>
<td>Day of year</td>
<td>(Number)</td>
<td>189</td>
</tr>
<tr>
<td>F</td>
<td>Week day of month</td>
<td>(Number)</td>
<td>2 (second Wednesday of month)</td>
</tr>
<tr>
<td>w</td>
<td>Week of year</td>
<td>(Number)</td>
<td>27</td>
</tr>
<tr>
<td>W</td>
<td>Week of month</td>
<td>(Number)</td>
<td>2</td>
</tr>
<tr>
<td>a</td>
<td>am/pm Markers</td>
<td>(Text)</td>
<td>PM</td>
</tr>
<tr>
<td>k</td>
<td>Hour (1~24)</td>
<td>(Number)</td>
<td>24</td>
</tr>
<tr>
<td>K</td>
<td>Hour as am/pm (0~11)</td>
<td>(Number)</td>
<td>0</td>
</tr>
<tr>
<td>z</td>
<td>Time zone</td>
<td>(Text)</td>
<td>Central European Standard</td>
</tr>
</tbody>
</table>

The number of characters in the pattern defines the format:

(Text): 4 or more characters - long version, < 4 - short version or abbreviation, if exists.
(Number): Minimum number of digits. Numbers with fewer digits are filled up with zeros. The year is shortened to two digits if there are two 'y'.

(Text or Zahl): With 3 or more characters as text, else as number.

All characters in the pattern outside the range of ['a'..'z'] and ['A'..'Z'] are treated as text with quotation marks. For example, characters like ';', ',', '.', '#' and '@' are included in the final text even if they are not surrounded by quotation marks.

A pattern containing an invalid character can not be used to create or recognise time information.

Sample for US Locale:

<table>
<thead>
<tr>
<th>Format Pattern</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;yyyy.MM.dd G 'at' hh:mm:ss z&quot;</td>
<td>1996.07.10 AD at 15:08:56 PDT</td>
</tr>
<tr>
<td>&quot;EEE, MMM d, &quot;yy&quot;</td>
<td>Wed, July 10, '96</td>
</tr>
<tr>
<td>&quot;h:mm a&quot;</td>
<td>12:08 PM</td>
</tr>
<tr>
<td>&quot;hh 'o'&quot;clock' a, zzzz&quot;</td>
<td>12 o'clock PM, Pacific Daylight Time</td>
</tr>
<tr>
<td>&quot;K:mm a, z&quot;</td>
<td>0:00 PM, PST</td>
</tr>
<tr>
<td>&quot;yyyyy.MMMMMM.dd GGG hh:mm aaa&quot;</td>
<td>1996.July.10 AD 12:08 PM</td>
</tr>
</tbody>
</table>

Application of date time formats:

- Formulas embedded in text
- ASCII Import

3.10 Overview of Commands

The following overview lists a selection of available commands:

<table>
<thead>
<tr>
<th>jBEAM component (Service)</th>
<th>Command</th>
<th>Parameter</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>HelpService</td>
<td>ActivateContextHelp</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ShowHelpDialog</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OpenCustomerSupport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LoggingService</td>
<td>StartLogging</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>StopLogging</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ScriptService</td>
<td>ExecuteScript</td>
<td>path</td>
<td></td>
</tr>
<tr>
<td></td>
<td>StopScript</td>
<td></td>
<td></td>
</tr>
<tr>
<td>jBEAM component (Service)</td>
<td>Command</td>
<td>Parameter</td>
<td>Comment</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------------------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>ProjectService</td>
<td>NewProject</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OpenProjectURL</td>
<td>path</td>
<td>syncMode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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4  Glossary

Interpolation

ASAM – Standards

ASAM steht für Association for Standardization of Automation and Measurement Systems. Es handelt sich um eine Standardisierungs-Organisation, die hauptsächlich von der internationalen Automobilindustrie unterstützt wird.

Die AMS arbeitet seit über 10 Jahren in verschiedenen Gruppen des CAT-Bereichs aktiv mit und begleitet die dort entwickelten Standardisierungsprozesse.

CEA – Components for Evaluation and Analysis of Measured Data


ODS – Open Data Services


Eine ATF(X) Exportkomponente erzeugt ODS-kompatible Dateien. Diese können dann einfach in eine ODS-Datenbank importiert werden.

Da jBEAM über 50 Datenformate unterstützt, kann die AMS auch mit wenig Aufwand Konverter entwickeln, die beliebige Versuchsdatenformate in ODS ATF(X)-kompatible Dateien umformt.

**MDF – Version 4**

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