Visualization and Dashboard

Version 5.12

Manual

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Content

1 General

1.1 General

ⓘ This manual assumes knowledge in the use of FORCAM FORCE IIOT.
If you do not have any knowledge of using FORCAM FORCE IIOT, take the time to familiarize yourself with the basics.

We recommend that you use our Academy.

The FORCAM Academy (https://forcam.com/academie/) provides the knowledge to effectively use the methods for digital transformation and the technologies for the Smart Factory.
Based on lean manufacturing and TPM methods, our institute team will guide you to initiate changes in the company and to use the technologies correctly.

1.2 Concept

This manual explains and describes the FORCAM FORCE IIOT performance analysis in the form of visualizations and dashboards. It also describes how to create your own visualizations and dashboards.

Visualizations provide a clear real time representation of the current situation on the shopfloor. Dashboards are views in which multiple visualizations can be displayed along with reports as widgets in an overall view, thus providing the clearest form of performance analysis.

For information about reports, see the **Manual "Reporting"**.

2 Visualization

Path: Performance analysis > Visualization > Views

An editor provides a set of basic graphic elements for creating custom visualizations. These can also be used (i.e., nested) as group elements in other visualizations.
Graphic elements can be assigned to a workplace to visually display operating states and production progress. Group elements for visualizing a single plant or machine can be integrated into the factory hall layout or any other design background for visualizing entire production facilities. Any end device with a suitable Internet browser can be used for displaying the visualization. We recommend Internet Explorer version 10 or higher.

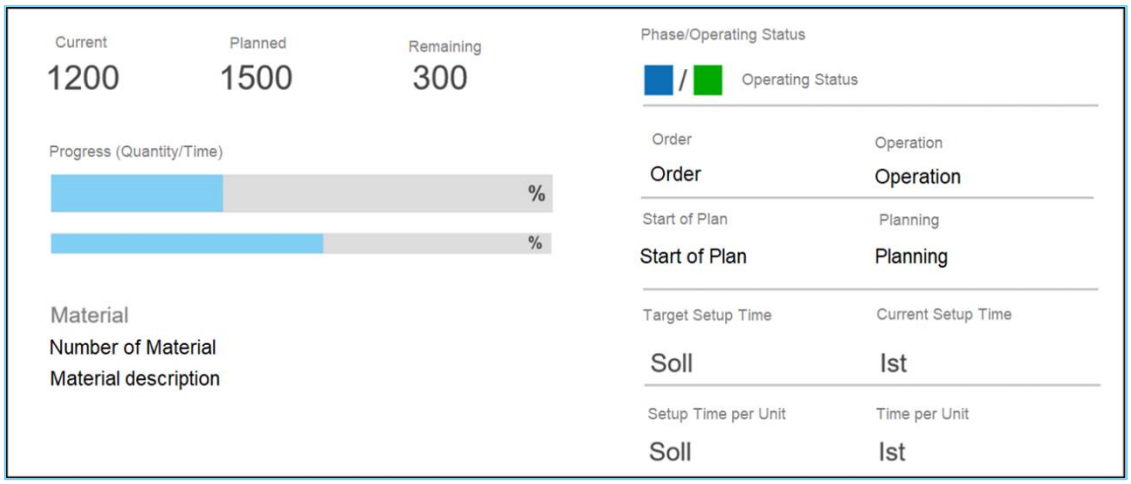


Fig. 1: Visualization

The graphic elements can be linked to the data available in FORCAM FORCE IIOT. This can be used, for example, to create a machine element in which the operating state is shown in a certain color. In addition, the order, operation start, operation status, the quantity produced, etc. can be displayed.

ⓘ Besides the default view, the Visualization is available as RISC view (see section Error! Reference source could not be found.).
The RISC view is based on the RISC architecture and offers addition functions and better performance.

A visualization consists of the following elements:

- Rectangle
- Text
- Picture
  Graphic formats supported by the browser
- Button
- Lines
- HTML page
- Self-defined group element

To create a new visualization:

1. Click **New** in the top bar.
2. Enter the name of the visualization.
3. Enter the description of the visualization.
4. Enter the width and height of the visualization in pixels.
5. Select refresh rate.

➔ The visualization updates the included data according to the selected time in seconds.

6. Click on **Save**.

➔ The visualization appears in the navigation area.

ⓘ To change these properties, click **Settings** in the top bar.

To access the editor for Visualizations:

1. Select the Visualization in the navigation area.
2. In the top menu bar, click on **Edit**.

To edit a visualization:

1. Select the desired visualization in the navigation area.
2. Click **Settings** in the top bar.
3. Make desired changes and click **Save**.
4. Click on **Edit** in the upper bar.
5. Make desired changes and click the **Save** icon in the top bar.

To copy a visualization:

1. Select the desired visualization in the navigation area.
2. Click on **Settings** in the top bar.
3. Change settings if necessary.
4. Click on **Save**.

➔ The copy appears in the navigation area below the original visualization.

2.1 View: Icons and functions

The editor for visualizations consists of a central editing area surrounded by bars with various functions. The left bar (1) contains elements for visualization. The top bar (2) has functions for viewing and editing. The functions bar (3) at the right are used to edit the appearance and settings of elements.

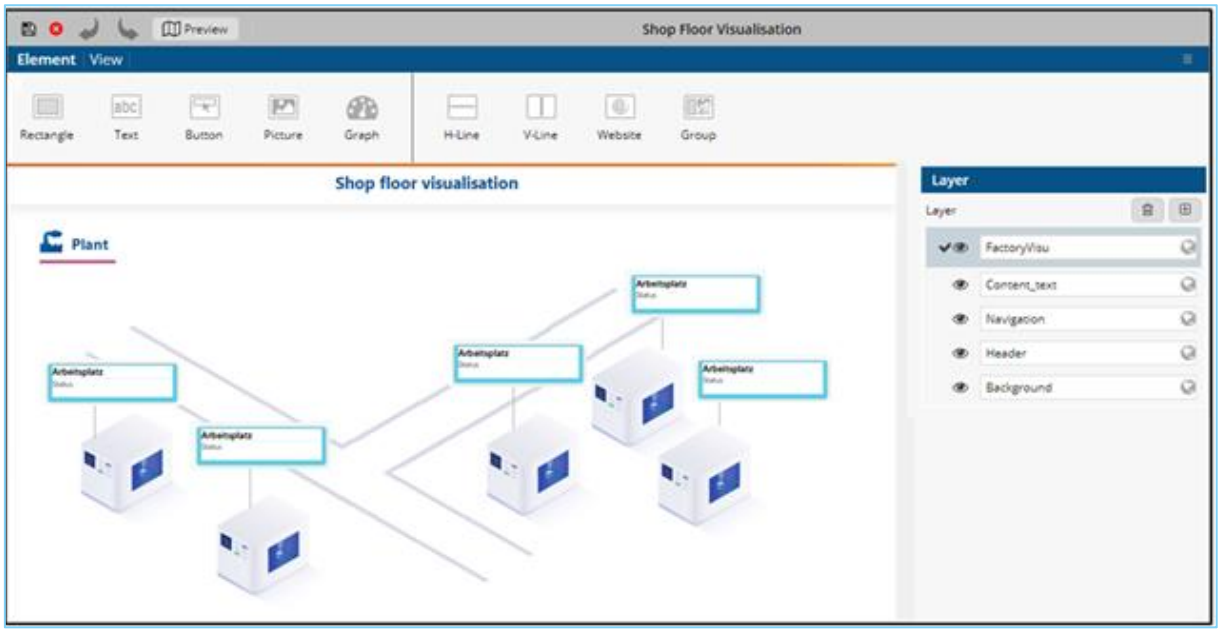


Fig. 2: Editor for visualizations

2.1.1 Elements for visualization

Each element can be moved from the bar to the editing area using drag-and-drop. Table 1 gives an overview of all available elements. Inserting and editing elements is described starting from section 2.1.

Table 1: Visualization elements

Element	Description
	Rectangle
	Text field
	Image
	Button
	Horizontal line
	Vertical line
	Website
	Group element (add already existing visualization)

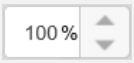
2.1.2 Inserting elements

1. Click on the desired element in the left bar and drag-and-drop it into the editing area.
2. Resize the element at the blue arrows.
3. Determine the element's position level on the layer.
   Move the element to the front or back of the current layer via the icons below it, which appear when the element is selected. Move the element to another layer using the **Layer** icons.
4. In the right bar under **Common** enter the name and tooltip of the element.
5. Select and assign a workplace by clicking the **Edit** icon.
6. Under **Text**, enter and format the text that you want to appear in the element.
7. Format the background of the element as desired under **Background**.
   An uploaded image fills the background of the element.
8. Under **Line**, format the element's frame as desired.
9. Link the element to an action under **Button**:
   a. HTML:
      Calls up a website. Add URL by clicking on the **Enter URL** icon.
   b. REPORT:
      Calls up a report. Select the report by clicking in the input field.
   c. VIEW:
      Calls up a visualization. Select the visualization by clicking in the input field.
10. Click **Save** in the top bar.

2.1.3 View and edit

The functions summarized in Table 2 provide options for editing elements and changing the display size.

Table 2: Icons for Editing

Icon	Description
	Undo step
	Repeat step
	Moves the editing area to the original position (top left)
	Delete element
	Copy element
	Insert element
	Preview of the visualization in an external window
	View zoom ratio
	Zoom in
	Zoom out
	Restore original size of the view
	Optimal zoom. Matches the view to the size of the display.

2.1.4 Appearance and settings

Each element can be edited in appearance and function. The following settings are possible for elements:

ⓘ The available functions depend on the selected element.

Table 3: Element Setting Definitions

General	
Name	Internal element name. This name is not displayed in the visualization.
Tooltip	Text that appears when the mouse hovers over the element
Workplace assignment	Selection of a workplace to be linked to the element
Size	
Width	Dynamic development of an element width
Height	Dynamic development of an element height
X Position	Dynamic position of an element on the X axis
Y Position	Dynamic position of an element on the Y axis
Text	
Text	Text that is to appear inside the element. The text overlays background image and color
Font	
Text color	
Horizontal alignment	Horizontal alignment of the text within the element
Vertical alignment	Vertical alignment of the text within the element
Background	
Color	
Transparency	Degree of transparency of the selected background color
Image	Background image placed on the background color. The image overlays the background color.

Line	
Color	Color of the element frame or of the line
Thickness	Thickness of the element frame or of the line
Button	
Action	Activity that the element is to carry out after being activated: – HTML: Calls up a website – REPORT: Calls up a report – VIEW: Calls up a visualization

2.1.5 Editing layers

Elements can be placed on different layers in the visualization. The **foreground** and **background** layers are predefined. Elements on the **foreground** layer overlap elements on the **background** layer. Elements placed on the **foreground** layer cannot be edited if the **background** layer was selected, and vice versa. Elements can be copied from one layer to another.

Fig. 3: Layer selection

To copy an element from one layer to another:

1. Select the desired element in the editing area.
2. Click on the **Duplicate** icon in the top menu bar.
3. Under **Layer** in the top bar, select the layer to which the element is to be copied. If necessary, add further layers by creating a new layer.
4. Click **Ok**.

➔ The element is inserted in the selected layer. It can only be edited on the layer.

5. Click **Save** in the top bar.

ⓘ Layers can be moved up or down in the **Layers** area via drag-and-drop.

To show or hide a layer:

1. Select the desired layer under **Layers** in the lower right corner of the screen.
2. Click on the eye icon.

➔ The layer and all elements on this layer are shown or hidden.

ⓘ To edit an element of a lower layer that is overlapped by an element of a higher layer, the higher layer must first be hidden.

2.2 Dynamic content

Dynamic visualization objects have parameters whose values are calculated dynamically according to a formula at runtime. Formulas are combinations (operators) of logical or numeric expressions or arbitrary strings.
Elements in the visualization can include content such as values, color, or size from an assigned workplace and automatically change it according to the actual state of the workplace. The included parameters can be edited to create desired formulas and to display data flexibly.
Dynamic content can be configured in fields where the **Edit formula** icon is available. It becomes available after clicking on **dynamic**.

Fig. 4: Showing the configuration of dynamic content

Before a dynamic field can be configured, an element must be assigned to a workplace.

ⓘ It is possible in some cases that a workplace-independent dynamic field is not updated. In these cases, a workplace must first be assigned to the field. The workplace can be removed after the first update.

To assign a workplace to an element:

✓ An element is placed in the editing area.

1. Select element to which a workplace is to be assigned.
2. Expand the **Common** section in the bar on the right.
3. Click on icon **Edit** icon in the “choose workplace” field.
4. In the pop-up window, select the desired workplace and click **OK**.

✓ The name of the selected workplace appears in the **Choose workplace** field. The field is non-editable.

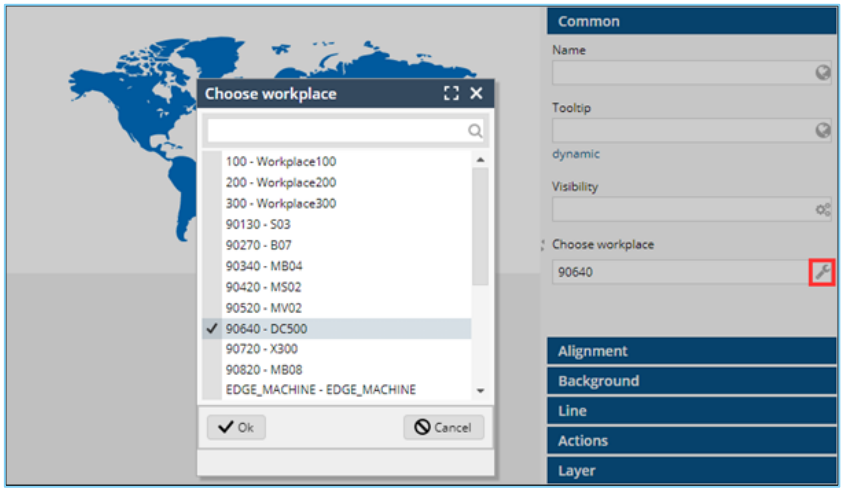


Fig. 5: Assigning a workplace to an element

2.2.1 Value

Any information that can be recorded at a workplace can be included and dynamically displayed in the visualization. Examples are workplace name, operating state or duration of a malfunction.

To assign a dynamic value to an element:

✓ An element is placed in the editing area.

1. Select element to which a dynamic value is to be assigned.
2. Expand the **Text** section in the bar on the right.
3. Click on **dynamic** under the **Text** field.
4. Click on the **Edit formula** icon.
5. In the formula editor (next dialog), double-click the desired parameter whose value is to be mapped in the element.
6. If necessary, edit the formula in the left area of the formula editor.
7. Click **OK**.

➔ Since the value is dynamic, it is only shown out of editing mode.

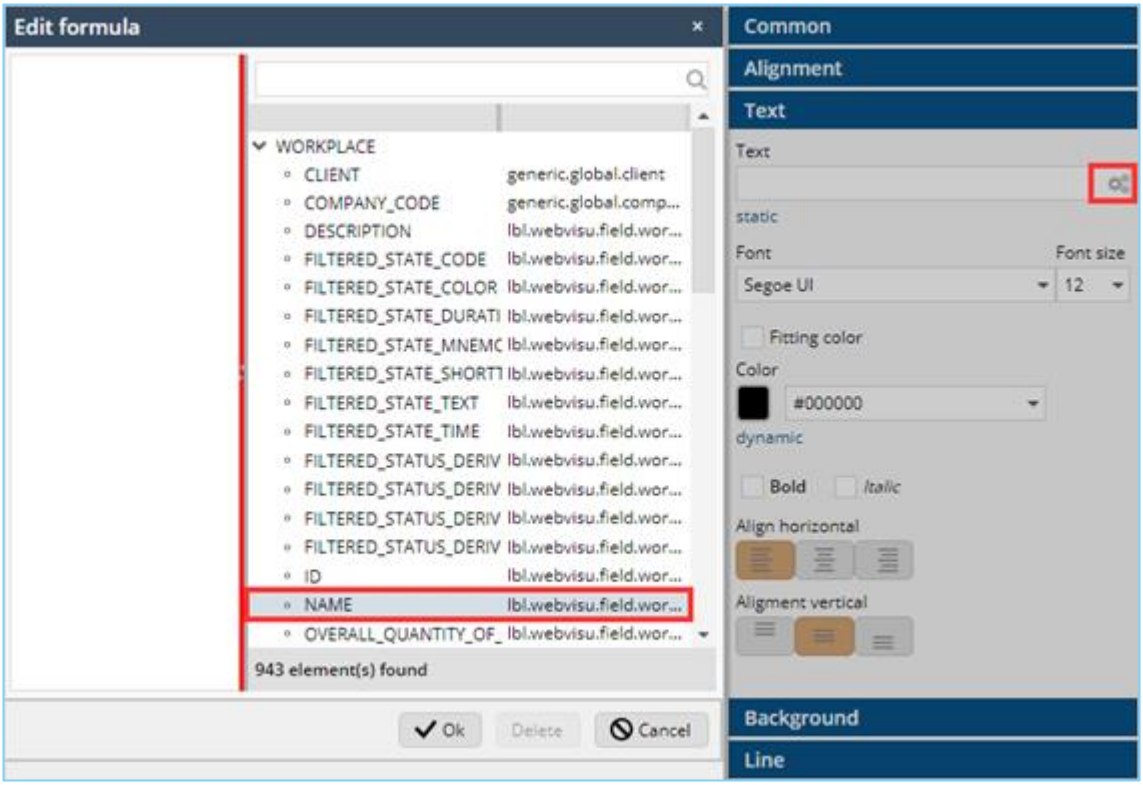


Fig. 6: Assigning the workplace name as a dynamic value

The following table contains values that are commonly used in visualizations. It is also possible to define additional fields with their own attributes (see section 2.3).

Table 4: Dynamic values and their description

Parameter	Description
Header data	
OPERATION:ORDER	Order number
OPERATION:ORDER_SPLIT	Order split
OPERATION:OPERATION	Operation number
OPERATION:OPERATION_SPLIT	Operation split
Default values	
OPERATION:MAT_NUMBER	Material number
OPERATION:MAT_DESCRIPTION	Material description
OPERATION:TARGET_QUANTITY	Target quantity
OPERATION:TARGET_START	Scheduled start
OPERATION:TARGET_END	Scheduled end
Recorded values	
OPERATION:YIELD_QUANTITY	Yield
OPERATION:SCRAP_QUANTITY	Scrap quantity
OPERATION:REWORK_QUANTITY	Rework quantity
OPERATION:TEMP_QUANTITY	Uncategorized quantity
OPERATION:USER1 (-USER10)	User fields (1-10)
Workplace-related data	
WORKPLACE:CLIENT	Client
WORKPLACE:COMPANY_CODE	Company code
WORKPLACE:PLANT	Plant
WORKPLACE:NAME	Workplace
WORKPLACE:DESCRIPTION	Workplace description

WORKPLACE:STATE_TIME	Start time of the workplace status
WORKPLACE:STATE_DURATION	Duration of the workplace status
WORKPLACE:STATE_MNEMONIC	Workplace status mnemonic
WORKPLACE:STATE_SHORTTEXT	Short text of the workplace status
WORKPLACE:STATE_TEXT	Workplace status
WORKPLACE:STATUS_DERIVED_DESCRIPTION	Operating state
WORKPLACE:STATUS_DERIVED_MNEMONIC	Mnemonic for operating state
WORKPLACE:STATUS_DERIVED_SHORTDESCRIPTION	Short text of the operating state

2.2.2 Color

Any information assigned with a color at a workplace can be included and dynamically displayed in the visualization. An example of information assigned with a color is the operating state. The color in the visualization changes depending on the respective state.

To assign a dynamic color to an element:

✓ An element is placed in the editing area.

1. Select element to which you want to assign a dynamic color.
2. Expand the **Background** section in the bar on the right.
3. Under the **Color field**, click on **dynamic**.
4. Click on the Edit formula icon.
5. In the formula editor (next dialog), double-click on the desired parameter that the element is to assume the color of.
6. If necessary, edit the formula in the left area of the formula editor.
7. Click **OK**.

➔ Since the color is dynamic, it is only displayed outside the editing mode.

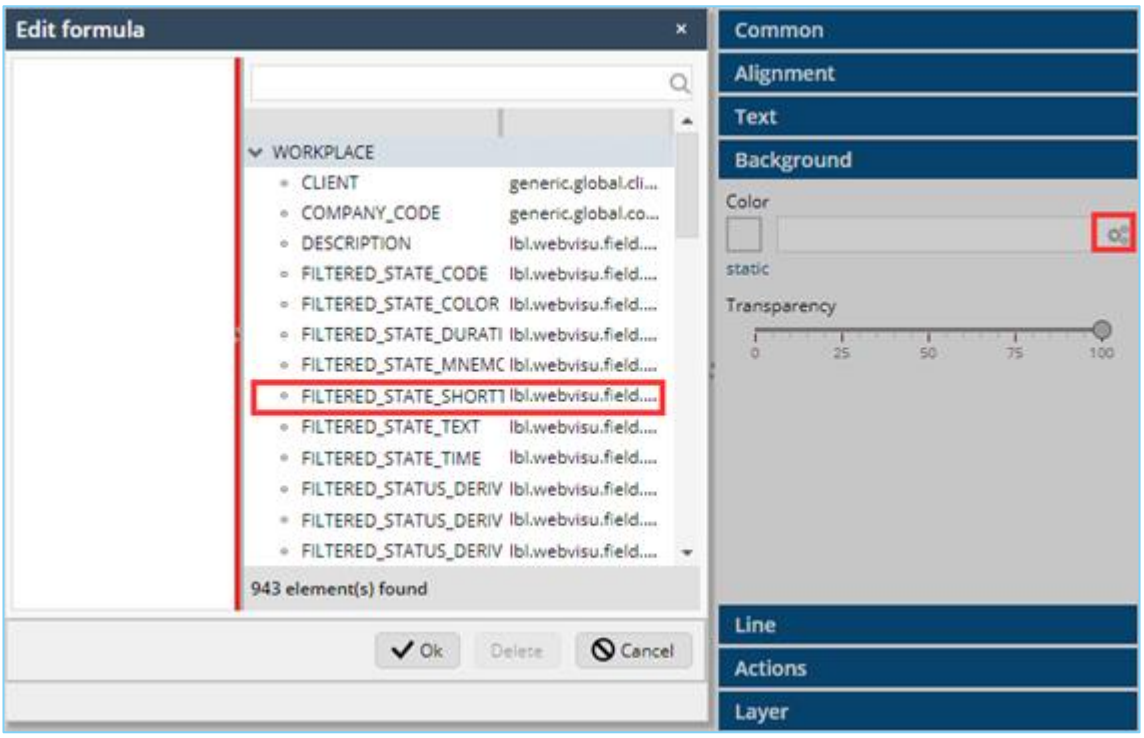


Fig. 7: Assigning the color of the operating state as a dynamic value

The following table contains colors that are commonly used in visualizations:

Table 5: Dynamic colors and their description

Parameter	Description
OPERATION:PHASE_COLOR	Operation phase color
WORKPLACE:STATUS_DERIVED_COLOR	Operating state color

Example of dynamic background color
The formula in the following example colors the background according to the value of a variable:

if OEE:MONTH_OEE < 50 then "#FF0000"
else if OEE:MONTH_OEE < 75 then "#FFFF00"
else "#00FF00"

2.2.3 Size

The width, height and X and Y position of elements can be varied dynamically. The formula determines which parameters are to influence the size of the element. The dynamic size is usually used for displaying dynamic progress bars:

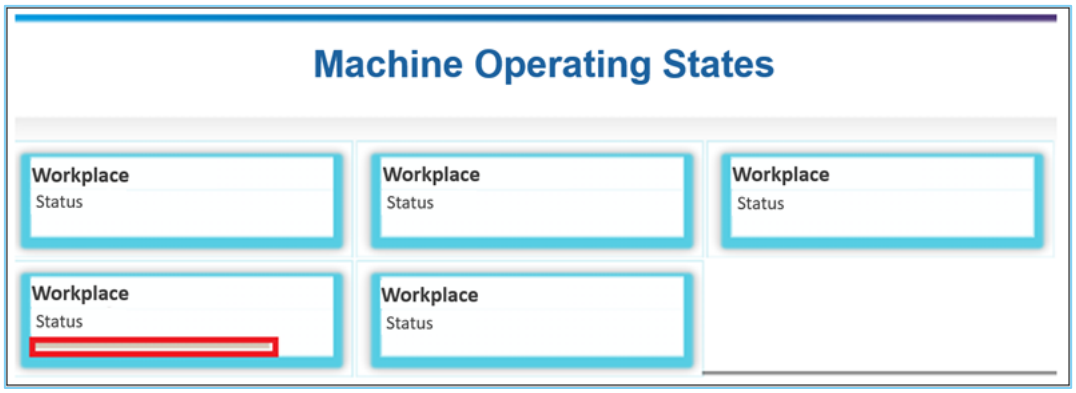


Fig. 8: Simple progress bar in the visualization

The progress bar Fig. 8 is a simple rectangle with a static color. The width of the bar was set to 200 pixels. It has been configured to change dynamically according to a formula. According to this formula, the width of the progress bar starts at 0 pixels and can reach a maximum width of 200 pixels, depending on the desired progress:

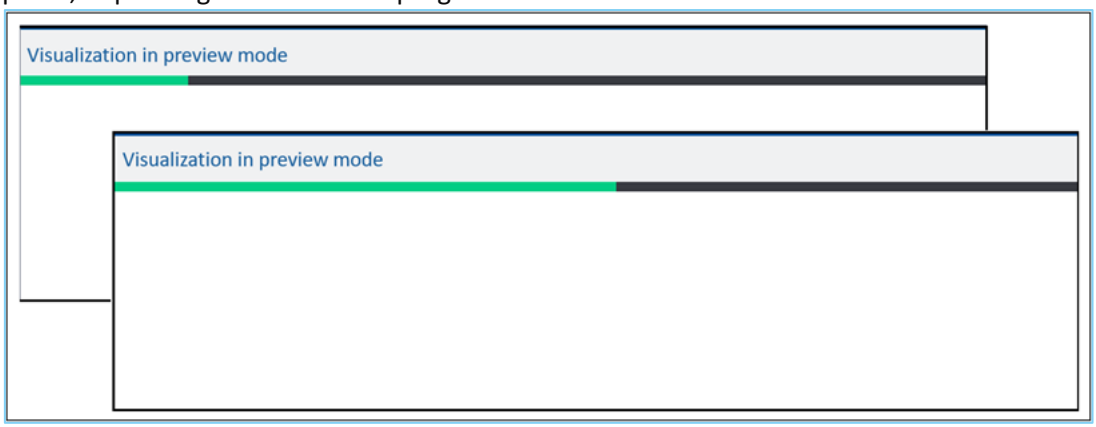


Fig. 9: Time development of a simple progress bar

The dynamic size of an element is configured by a formula that incorporates recordable values (see Table 3 in section 2.2.1). Formulas for sizes are very flexible and can be configured individually as needed.
The progress bar above was configured according to the following formula:

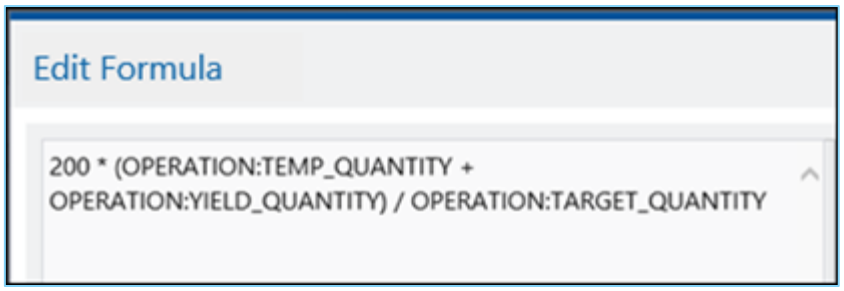


Fig. 10: Formula for a dynamic progress bar (example)

The formula contains the following expressions:

- The maximum width of the bar is 200 pixels.
- Underlying parameters are uncategorized quantity, yield and target quantity.
- he produced quantity (uncategorized + yield) divided by the target quantity gives the current status (percentage) of the produced quantity compared to the target quantity.
- The bar becomes wider with each additional quantity produced.
- The bar reaches the maximum width when the produced quantity equals the target quantity.

To assign a dynamic size to an element:

✓ An element is placed in the editing area.

1. Select the element to which you want to assign a dynamic size.
2. Expand the **Size** section in the bar on the right.
3. Click on the **Edit formula** icon under the desired size field.
4. In the formula editor (next dialog), double-click on the desired parameter and edit the formula in the left area.
5. Click **OK**.

➔ Since the size is dynamic, it is displayed only outside the edit mode.

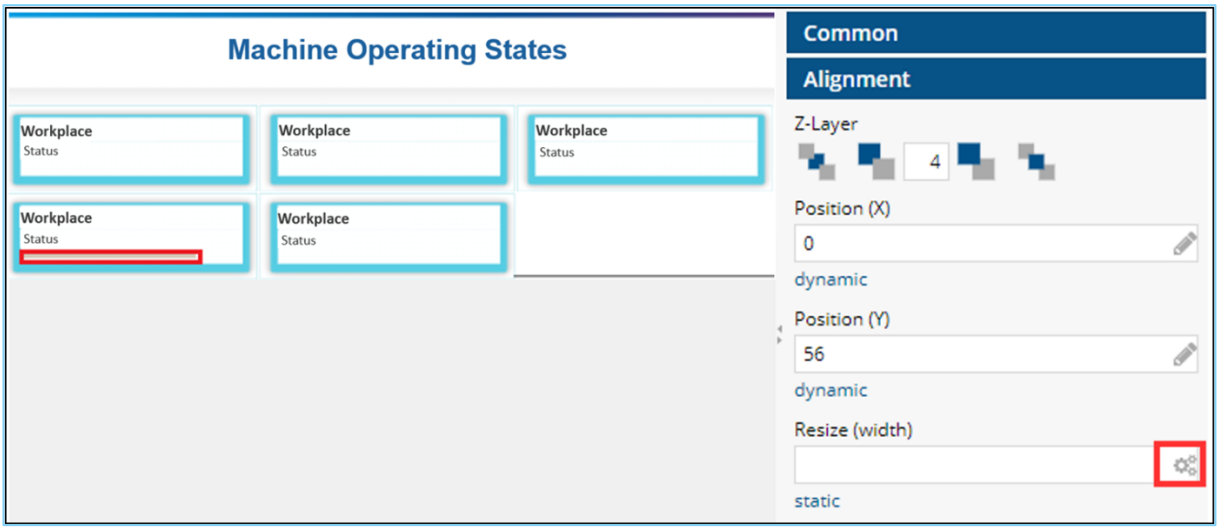


Fig. 11: Assigning a dynamic width using a formula

2.2.4 Tacho

With the RISC view, the tachometer has been implemented as a new element (element diagram). The gauge is a graphical display that can be joined to a workplace to dynamically indicate the development of data by a gauge needle. The gauge is particularly suitable for cases where a value is increasing or the increase of a value is to be made visible at a glance.

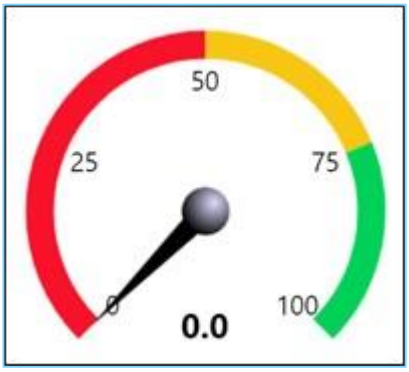


Fig. 12: New gauge element in RISC view

The gauge is configured in the Graph tab.
This is where you can set which dynamic value of the workplace is to be displayed.
The limit values can be set as desired and marked by different colors.
The following figure shows an example configuration of a gauge.
In this case, the scrap quantity of an operation is set as a dynamic value.
The limits are defined in such a way that a scrap quantity of up to 10 is no problem and 10 to 20 is still acceptable.
Above a quantity of 20, the gauge needle moves into the red range and thus indicates a scrap quantity that is too high.

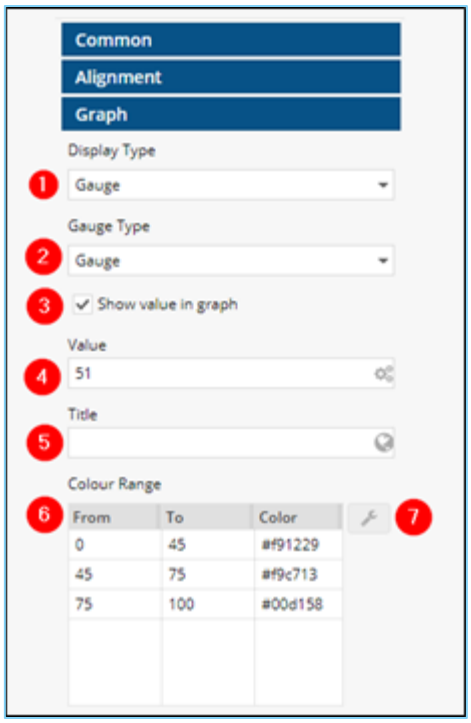


Fig. 13: Example configuration of a gauge

(1) Display type:
Display form of the graphic. Currently, only the measurement display indicating values by an arrow or needle is available (see (2)).

(2) Gauge type:
- Gauge
- Level meter
- Odometer

(3) If a check mark is set, the current value of the needle is displayed in the gauge.

(4) Displayed value:
The value can be entered manually and thus displayed statically.
By clicking on the Edit icon, it is possible to enter a formula (see section 2.2.1) by which the value is dynamically obtained and displayed (here: OPERATION:SCRAP_QUANTITY to display the scrap quantity of an operation).

(5) Title of the graphic:
The title appears in the center of the gauge, below the level meter and above the odometer.

(6) Values and color ranges of the graphic:
The values entered here determine the minimum and maximum value of the display.
Each display type is divided into three sections. Each section can be assigned its own color (default colors are green, yellow, and red). In Fig. 13 these are entered manually and are therefore static (example: From 0 to 10 the needle moves in the green range).
See section 2.2.5 to configure a dynamic color range.

(7) Opens the configuration of values and color ranges (see section 2.2.1ff).

2.2.5 Configuration of the dynamic value and the color range

The values of a gauge and the corresponding color ranges can be generated dynamically. Existing values can be adopted from a workplace.
As an example, in this section, a gauge is configured as follows:
The gauge is intended to show an individual value of a workplace as a limit value. The color range is to remain static:

- In the Workbench, the number 42 is entered in a user field 1 of the corresponding workplace.
- An additional field for limit values is created in New Office. The SQL query of the additional field queries the content of user field 1 and defines it under the mnemonic T1.
- In the editor, the additional field appears below the formulas for dynamic content.
- The value under T1 is assigned to the desired value range and given to the gauge as a limit value. The limit value changes dynamically when the value in the workplace changes.

To configure a dynamic value:

1. Enter a value in a user field in the Workbench configuration.
   For detailed configurations of the Workbench, see the manual **Master Data and System Configuration**.
2. Create a new additional field in New Office.
   a. Assign a unique name and namespace.
   b. Enter SQL query.
      The following SQL query queries the content of user field 1 and defines it under the mnemonic **T1**:
      ```
      SELECT wp.ID AS WORKPLACE_ID, ud.UF_01 AS T1 FROM FR_MD_WORKPLACE wp
      JOIN FR_MD_USER_DATA ud ON ud.ID = wp.USER_DATA_ID WHERE
      @WORKPLACE(wp.ID)
      ```
   c. Create columns **WORKPLACE_ID** and **T1**

Field	Key	Data Type
WORKPLACE_ID	thresholds:WORKPLACE_ID	Zeichenkette
T1	thresholds:T1	Zahl

Fig. 14: Columns of the additional field for dynamic limit values

3. In the editor, select the gauge and enter dynamic value.
   a. Under Color ranges, select a desired value and click on the **Edit** icon.

Colour Range

From	To	Color
0	45	#f91229
45	75	#f9c713
75	100	#00d158

Fig. 15: Open color range editing

b. In the following dialog click on **dynamic** under the desired value or color and open the formula editor via the **Edit formula** icon.

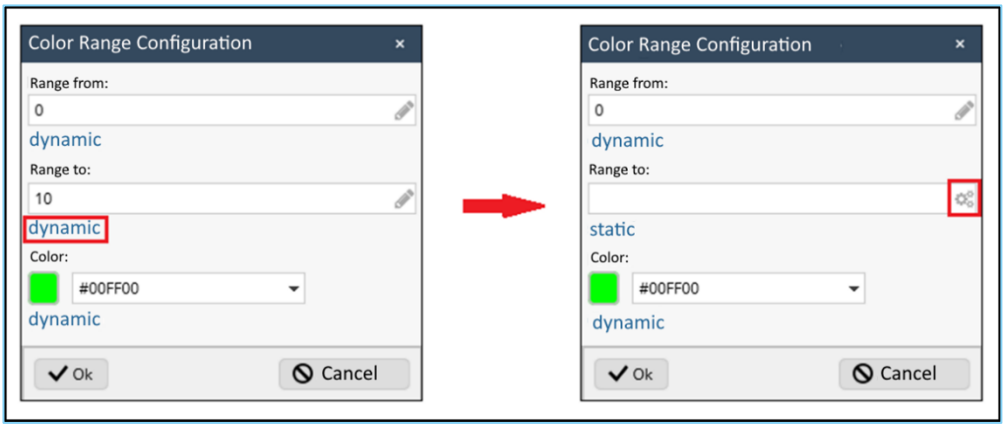


Fig. 16: Switching to dynamic value

c. Enter the desired formula and confirm.

4. Save.

2.2.6 Graphics library

In RISC view, graphics are inserted directly into the editing area. After selecting and positioning a graphic element into the editing area, a pop-up dialog opens where images can be searched and added. Images that have been used before remaining in the dialog and can be selected from now on. The dialog then becomes the graphics library.

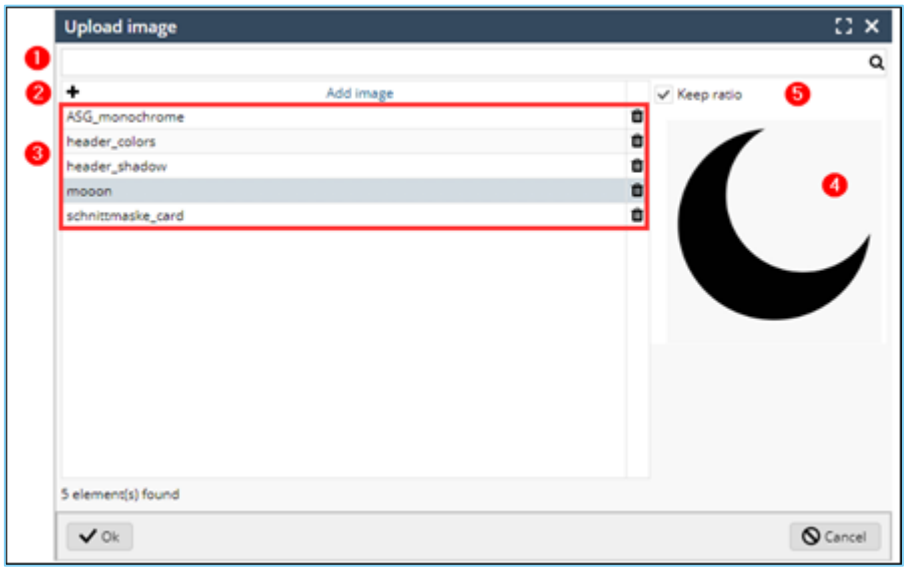


Fig. 17: Adding an image (RISC view)

(1) Search field for saved images
(2) Uploads a local image
(3) List of all uploaded images
(4) If a check mark is set, the aspect ratio of the graphic is kept in the visualization.
(5) Preview of the image selected in (3)

An added image will be uploaded by the system. To upload a graphic, a path must first be defined in the system. The system saves all images in this directory. The path should not be local, it must be on the install server.

The path is saved in the system configuration of the Workbench. For detailed configurations of the Workbench, see the manual **Master Data and System Configuration**.

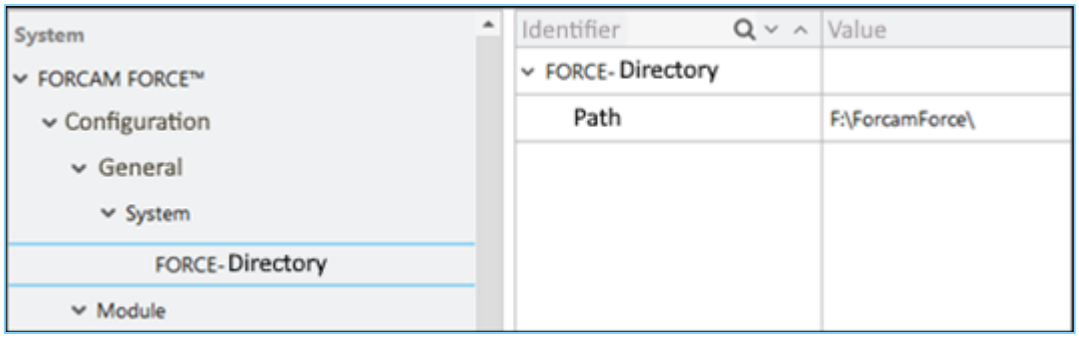


Fig. 18: Path for graphics library

2.2.7 Edit Formula

Linking a formula to dynamic content is not limited to just selecting the formula. Formulas can be edited manually, e.g., to add static content, to connect several parameters via operators or to format a time specification.

To add a static text to a formula:
Static texts are inserted into the formula between quotation marks. To display the text and the formula side by side, they are connected with a plus operator.

Example:
"status " + (WORKPLACE:STATUS_DERIVED_DESCRIPTION) + "ignore"
Here static texts are inserted before and after the formula and connected by operators. The blank after or before the quotation mark is necessary to separate the texts by a blank in the display as well.

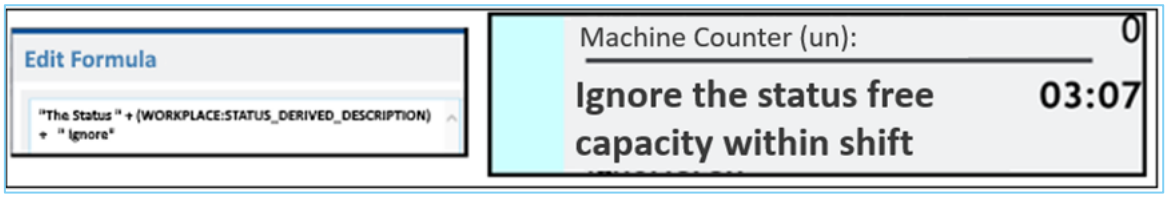


Fig. 19: Static text inside the formula and final display

To format a duration:
The formatting of the duration is started by adding FORMATDURATION and supplemented by the desired display of the duration.

Example:
FORMATDURATION(6000000, "HH:mm")
Here the number in parenthesis is recognized as milliseconds and converted to hours and minutes. The final display is 01.40.

Typical use case:
FORMATDURATION (WORKPLACE:STATE_DURATION,"HH:mm").
The duration of the workplace status is read as milliseconds and formatted into the display of hours and minutes.

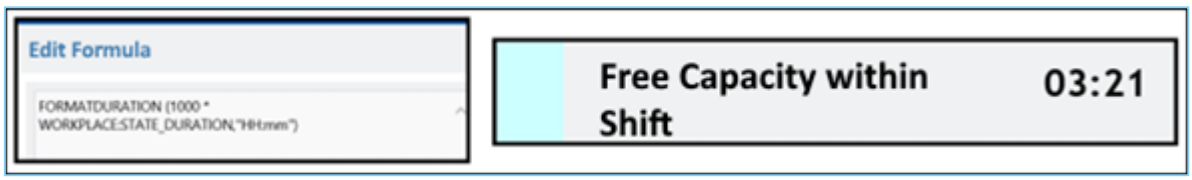


Fig. 20: Formatted duration as formula and final display

2.2.8 Operators

Formulas are links (operations) of numeric or logical expressions or arbitrary strings. A variety of operators allows flexible design of formulas in the visualization. The following tables contain all available operators.

Table 6: Numerical operators

Operation	Formula
Addition	<numeric expression1> **+** < numeric expression2>
Subtraction	<numeric expression1> **-** < numeric expression2>
Multiplication	<numeric expression1> ***** < numeric expression2>
Division	<numeric expression1> **/** < numeric expression2>
Exponent	<numeric expression1> **^** < numeric expression2>
Sine	**sin**(<numeric expression>)
Cosine	**cos**(<numeric expression>)
Tangent	**tan**(<numeric expression>)
Unary minus	**-** <numeric expression>
Bitwise AND	<numeric expression1> **AND** < numeric expression2>
Bitwise OR	<numeric expression1> **OR** < numeric expression2>
Bitwise inversion	**NOT** <numeric expression>
Square root	**SQRT** <numeric expression>

Table 7: Logical operators

Operation	Formula
Logical AND	<Boolean expression1> **AND** <Boolean expression2>
Logical OR	<Boolean expression1> **OR** <Boolean expression2>
Negation	**NOT** <Boolean expression>

Table 8: String operators (processing of strings)

Operation	Formula
Concatenation	<string1> **+** <string2>
Substring	**SUBSTRING**(<string>, <numeric expression1>, <numeric expression2>) **SUBSTRING**(<string>, <numeric expression1>) <numeric expression1> is the initial index of the substring, starting with 0. <numeric expression2> is the index of the first character that is no longer contained in the substring. If <numeric expression2> is missing, the substring goes to the end of the original string.
Convert string to number	**TONUMBER**(<string>) <String> is converted to a number. If <string> does not represent a number, the result is 0.
Convert number to string	**TOSTRING**(<numeric expression>) **TOSTRING**(<numeric expression>, <string>)
String length	**LENGTH**(<string>)
Examples	
Formula	**Result**
SUBSTRING("hamburger", 4, 8)	urge
TONUMBER ("10") + 2	12
LENGTH("hamburger")	9

Table 9: Format details

Control parameters	Effect
[.decimals]	Number of decimals to be displayed. The last decimal is rounded. If a minimum length is indicated and the number of decimals is not specified, the integer is rounded, and all decimals are hidden.
[Minimum length]	The minimum length of the displayed number including decimal point and the displayed decimals. If the specified minimum length is smaller than the number (including decimal point and the displayed decimals), the specification is ignored. If a minimum length greater than the number to be converted (including decimal point and the displayed decimals) is specified, the result string is filled.
[-]	If **-** is specified, the formatting is aligned to the left, otherwise aligned to the right.
[0]	By specifying **0**, the string is filled with leading zeros up to the minimum length if aligned to the right, otherwise with blanks.
[x] or [X]	If **x** or **X** is specified, the information is displayed in hexadecimal format with lowercase or uppercase letters, respectively. In this case, decimals are always truncated.

Examples	
Formula	**Result**
TOSTRING(3.1, "03.3")	3.100 (minimum length is ignored)
TOSTRING(3.1, "07.3")	003.100 (minimum length causes 2 leading 0)
TOSTRING(255, "06X")	0000FF
TOSTRING(10, "x")	A
TOSTRING(2.9992, "03.3")	2,999
TOSTRING(2.9999, "03.3")	3.000 (rounding)
TOSTRING(29.1, "-09.3")	29.100... (blank lines to the right because of preceding "-")

Table 10: Comparison operators

Operation	Formula
Same	<expression1> **=** <expression2> <expression1> **==** <expression2>
Unequal	<expression1> **!=** <expression2> <expression1> **<>** <expression2>
Less than	<numeric expression1> **<** <numeric expression2>
Less than or equal to	<numeric expression1> **<=** <numeric expression2>
Greater than	<numeric expression1> **>** <numeric expression2>
Greater than or equal to	<numeric expression1> **>=** <numeric expression2>

ⓘ <expression1> and <expression2> must respectively be of the same type (logical, numeric or string).

2.2.9 Grouping elements

Several elements can be grouped into one element to edit them simultaneously or assign the same function to them. The grouping only refers to the selected elements. This does not combine the elements into a single element.

To group elements:

6. Click New in the top bar.
   Or
   Left click with the mouse in a free area and move over several elements with the CTRL key held down.
7. Assign the desired function to the grouped element.
8. Drag the grouped element larger/smaller as necessary using the blue arrows.
9. End grouping by left clicking in a free area.
10. Click on Save in the top menu bar.

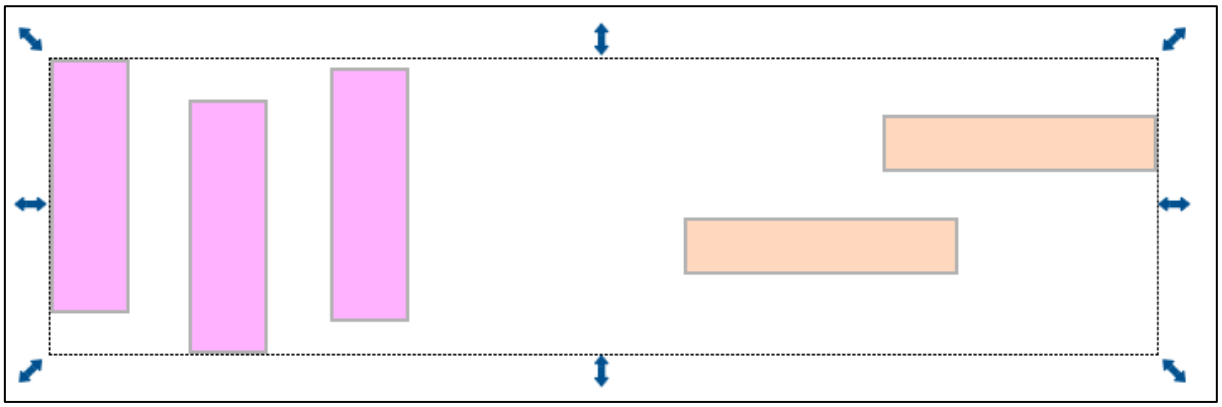


Fig. 21: Grouped elements

2.2.10 Visualization of a machine (sample)

Visualizations are generally used to display machines with dynamic content. This section presents an example of a visualization with production-relevant data and mentions all necessary configurations.

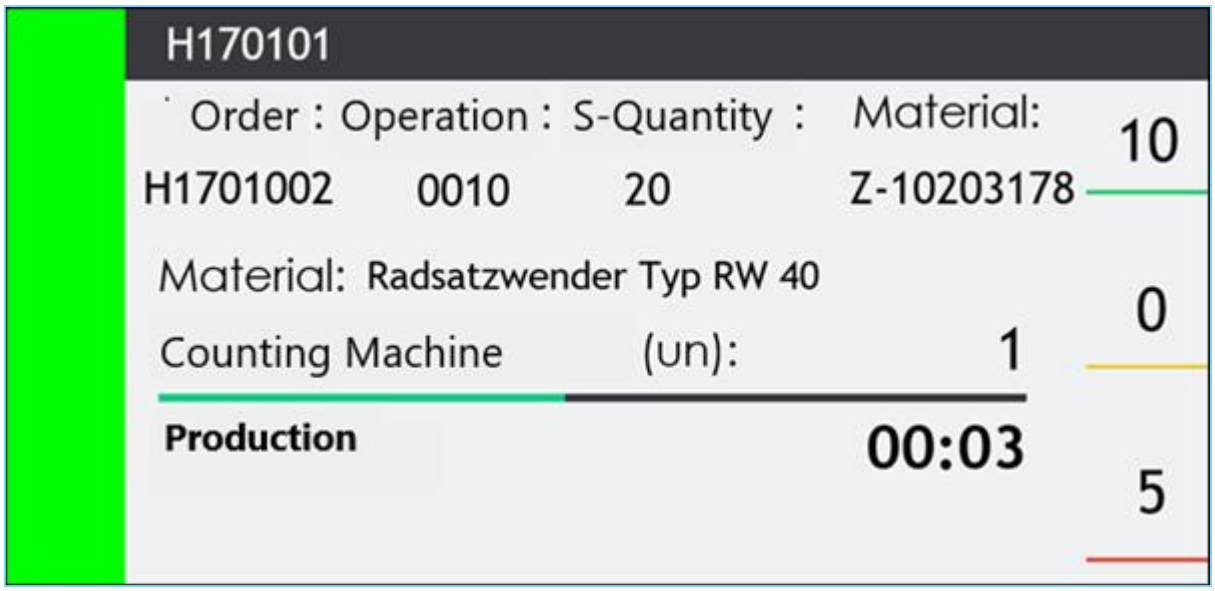


Fig. 22: Visualization of a machine with production-relevant data (sample)

The visualization in Fig. 22 represents a machine in realtime. All mapped data is received directly from the machine and generated dynamically. This visualization has 14 dynamic contents in total, which are filled only after an update or in preview mode. Fig. 23 shows the upper visualization in the raw editing mode:

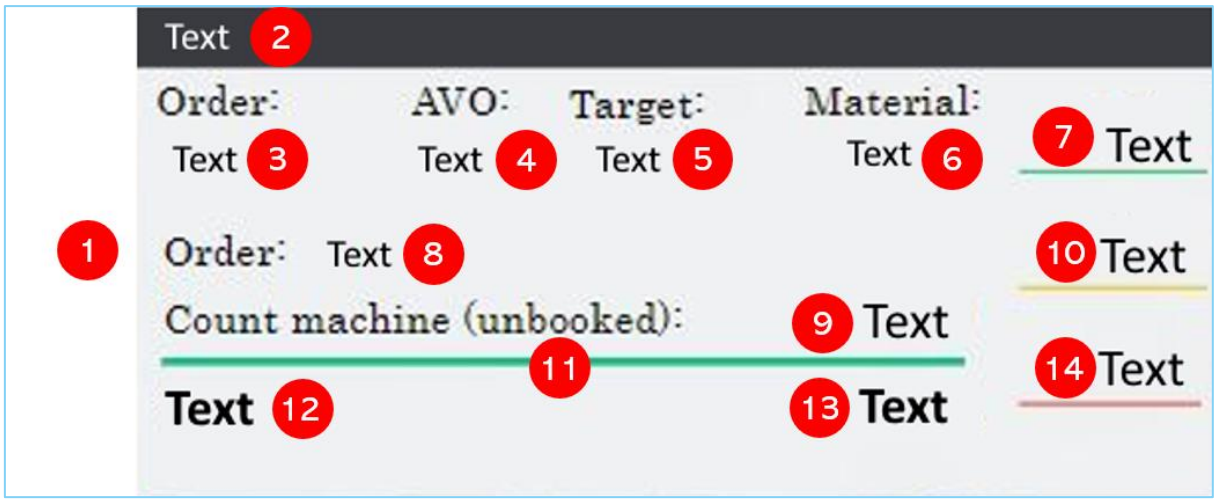


Fig. 23: Visualization of a machine in the raw form before generating dynamic content

The following table explains the numbered content from Fig. 23:

Table 11: Configuration of the sample visualization of a machine

	Content	Formula
1	Operating state color	WORKPLACE:STATUS_DERIVED_COLOR
2	ERP number of the workplace	WORKPLACE:NAME
3	Order number	OPERATION:ORDER
4	Operation number	OPERATION:OPERATION
5	Target quantity	OPERATION:TARGET_QUANTITY
6	Material number	OPERATION:MAT_NUMBER
7	Booked yield quantity	OPERATION:YIELD_QUANTITY
8	Material description	OPERATION:MAT_DESCRIPTION
9	Number of unposted quantities	OPERATION:TEMP_QUANTITY
10	Booked rework quantity	OPERATION:REWORK_QUANTITY
11	Progress bar of the operation	200 * (OPERATION:TEMP_QUANTITY + OPERATION:YIELD_QUANTITY) / OPERATION:TARGET_QUANTITY
12	Operating state	WORKPLACE:STATUS_DERIVED_DESCRIPTION
13	Duration of the operating state	FORMATDURATION (1000 * WORKPLACE:STATE_DURATION, "HH:mm") To convert the recorded milliseconds into minutes, the duration is multiplied by 1000.
14	Booked scrap quantity	OPERATION:SCRAP_QUANTITY

The visualization of a machine can be integrated into a factory hall layout together with other machines. This way, an entire production hall is mapped and shows the status of the machines with all relevant data in its entirety through constantly updated content:

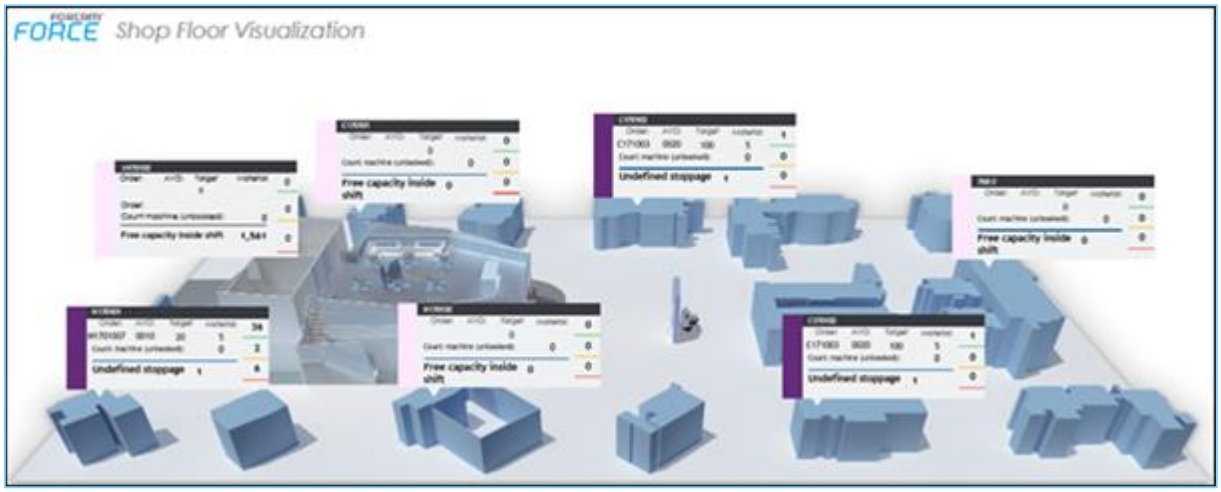


Fig. 24: Display of a production hall with several machine visualizations

2.3 Additional fields

Path: Performance Analysis > Visualization > Additional Fields

In addition to predefined values (see section 2.2), it is possible to create additional fields.
Custom attributes can be defined with the help of SQL expressions.
These are used in visualizations to display desired data.

⚠ Utilizing additional fields requires in-depth knowledge of SQL programming as well as FORCAM FORCE IIOT database structures. If necessary, it is recommended to contact FORCAM's Professional Service for assistance.

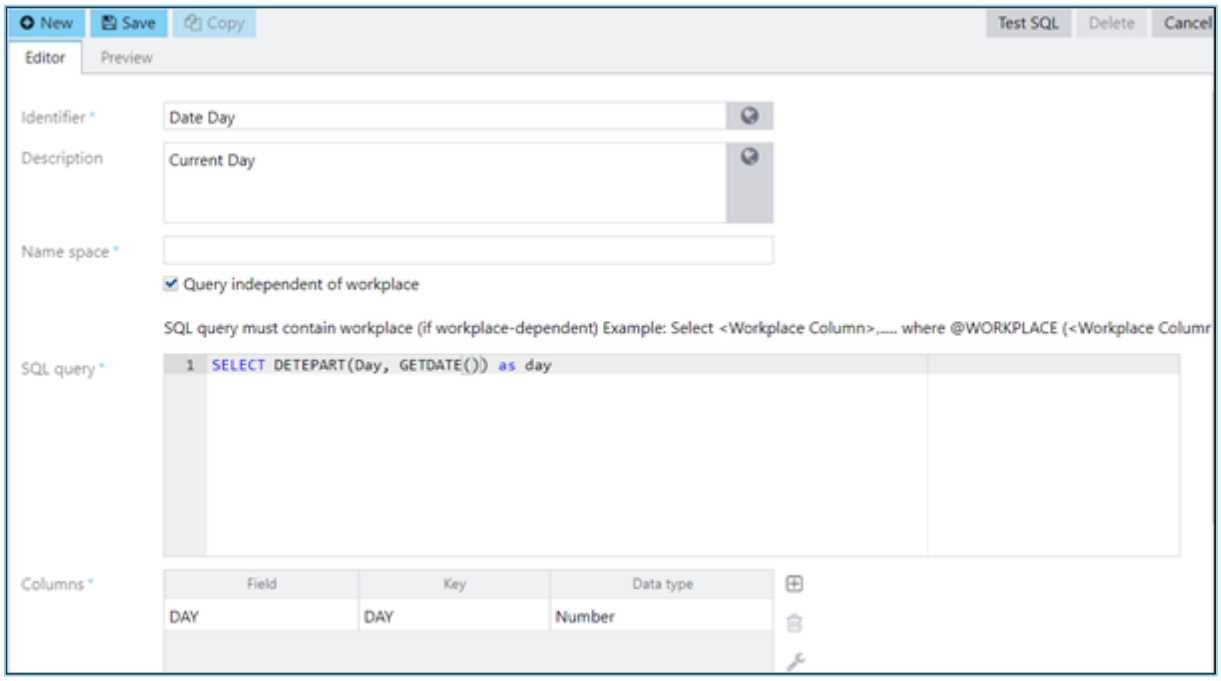


Fig. 25: Self-defined additional fields

To create an additional field:

1. Click **New** in the top bar.
2. Enter the name and description of the additional field.
   The additional field appears below these entries in the formula editor.
3. Enter namespace.
   The namespace appears as a node in the formula editor. The additional field appears under this node.
4. Determine workplace dependence.
   The SQL query must contain the workplace to retrieve data to be displayed by it. However, there is data that does not require a workplace, as it obtains general information from the server, for example (such as date and time). If a check mark is put **at Query independent of workplace**, no workplace needs to be specified. Otherwise, an additional field must be marked as the workplace ID.
5. Enter SQL query.

6. Click on the **Add** icon in the **Columns** field.
   Each column specified in the SQL query must be selected here.
   a. Select a field in the next dialog.
      The previously entered SQL query determines the field selection.
   b. Select data type.
      Determines the format that the data is to be displayed in (e.g., string for day, number for hour, etc.).
   c. Set as workplace ID.
   d. Click on **Apply**.
7. Click **Save** in the top bar.

ⓘ Clicking **Test SQL** in the upper right corner of the screen checks the syntax of the SQL query for errors.
Clicking **Preview** in the top bar displays the workplace, key, and value according to the SQL query.

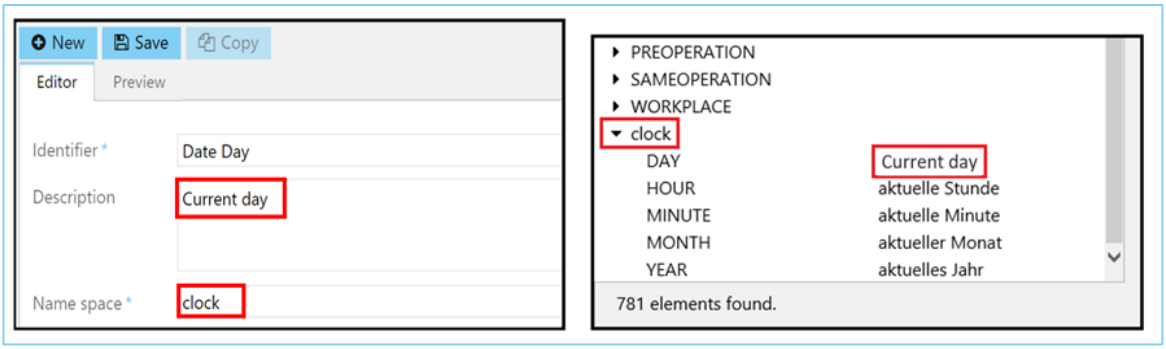


Fig. 26: Entries for creating additional fields displayed in the formula editor

Example:
The SQL query and column configuration from Table 12 outputs the current day.
Fig. 26 shows SQL queries for the current day, month and year and the output value in the visualization.

Table 12: SQL query and column configuration for displaying the current day

Value	Content
Query independent of workplace	Yes
SQL query	SELECT DATEPART(Day, GETDATE()) as day
Field	DAY
Key	clock:DAY
Data type	String
Output value	14 (for the date 2017-03-14)

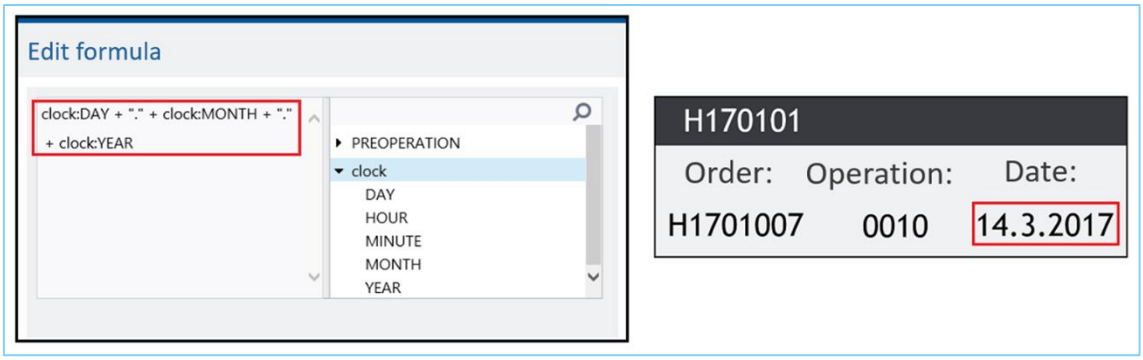


Fig. 27: SQL queries for the current date and the output value in the visualization

2.4 RISC View

Path: Performance analysis > Visualization > RISC View

Neben der Standard-Ansicht ist die Visualisierung als RISC-Ansicht verfügbar. Die RISC-Ansicht beinhaltet alle in Kapitel 5 bereits genannten Funktionen. Neben einer verbesserten Performanz bietet die RISC-Ansicht einige neue Funktionen.
Dieser Abschnitt fasst die wichtigsten Neuerungen und Unterschiede im Vergleich zur Standard-Ansicht zusammen.

Place element

Elements can be placed in the editing area using more than just drag-and-drop.
Clicking on an element and then clicking in the editing area will also make it appear.

Resize elements

Elements selected in the editing area (through selection) can be dragged smaller/greater at its edge or corner with the mouse button pressed.

Edit element: Z Layer

If an element is selected, tabs with various editing options appear on the right side of the screen. The Alignment tab (previously Size) offers the Z Layer function in addition to the previous size and position settings. This function specifies the order in which elements overlap each other.
An element with a higher position number overlaps one with a lower number.

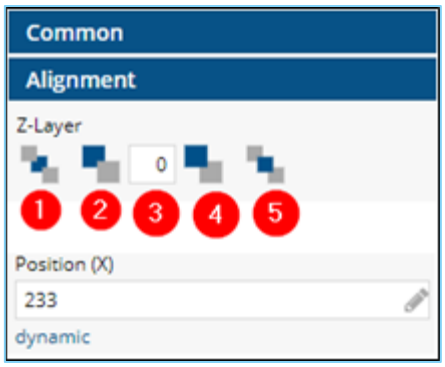


Fig. 28: Layer function in view

(1) Moves the selected element to the very bottom.
It is overlapped by all other elements.
(2) Moves the selected element down one place.
(3) Indicates the location of the selected element.
(4) Moves the selected element up one place.
(5) Moves the selected element to the very top.
It overlaps all other elements

Edit element: Layer

By default, the **foreground** and **background** layers are predefined in the visualization. In the RISC view, individual elements in the **Layer** tab can be moved to another layer by clicking on the desired layer.

ⓘ An element is editable only on the layer on which it is located.
For example, if an element is in the background layer, it can only be edited if the background layer is selected in the editing area.

Alignment

Elements can be aligned in different ways using corresponding buttons in the upper tab.
They can be centered horizontally or vertically or aligned to specific positions. Elements can also be evenly distributed horizontally or vertically.
The edges of the elements are stacked in the desired alignment.

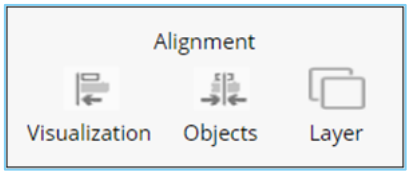


Fig. 29: Align elements in the Visualization

- Visualization:
  Aligns elements to the editing area of the visualization
  Example:
  Selecting Align right aligns all selected elements to the right edge of the editing area
- Objects:
  Aligns the edges of elements with each other
  Example:
  Selecting Align right aligns all selected elements so that their right edges are on a line.
- Layer:
  Moves elements to the selected layer

3 Dashboard

Path: Performance Analysis > Dashboard

Dashboards are views where multiple reports and visualizations can be displayed as widgets in an overall view. A dashboard can be compiled from existing standalone reports (no multi-reports) as well as visualizations.
The individual widgets in a dashboard can be enlarged (expand widget icon) and shrunk again (contract widget icon).

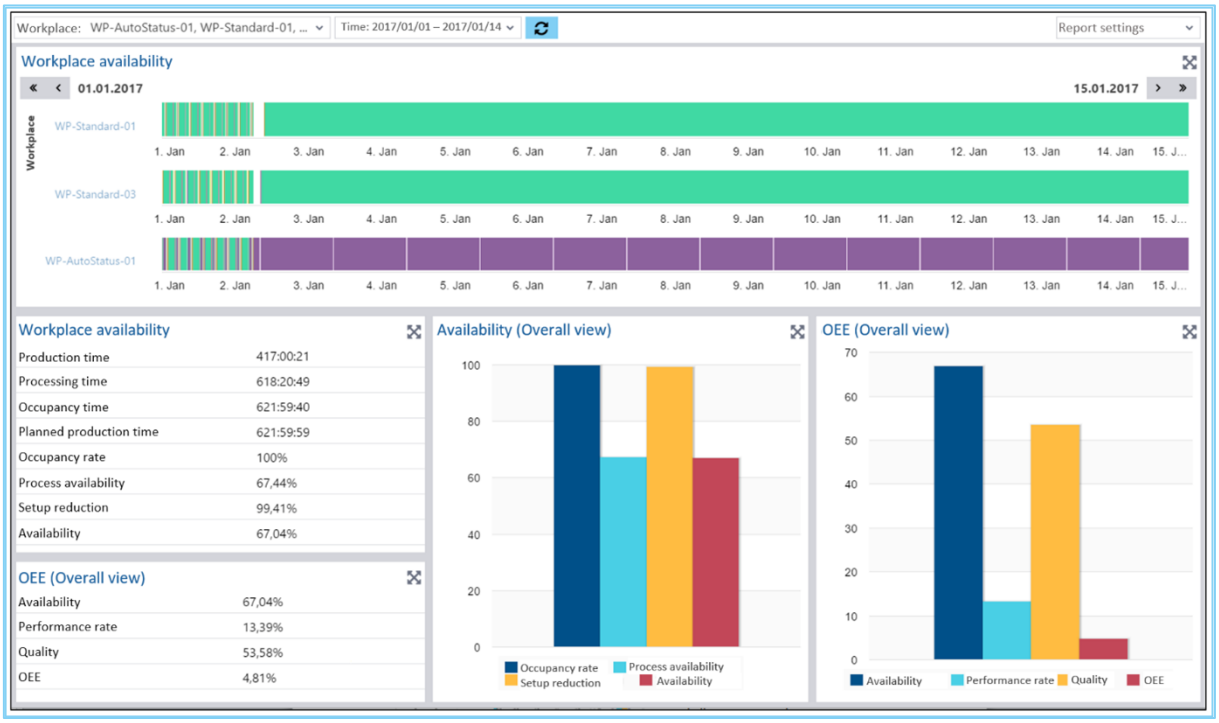


Fig. 30: Dashboard with widgets for availability and OEE (example)

Initially, the dashboard is created with general configurations.
Any reports and visualizations can be imported after that.

3.1.1 Create a dashboard

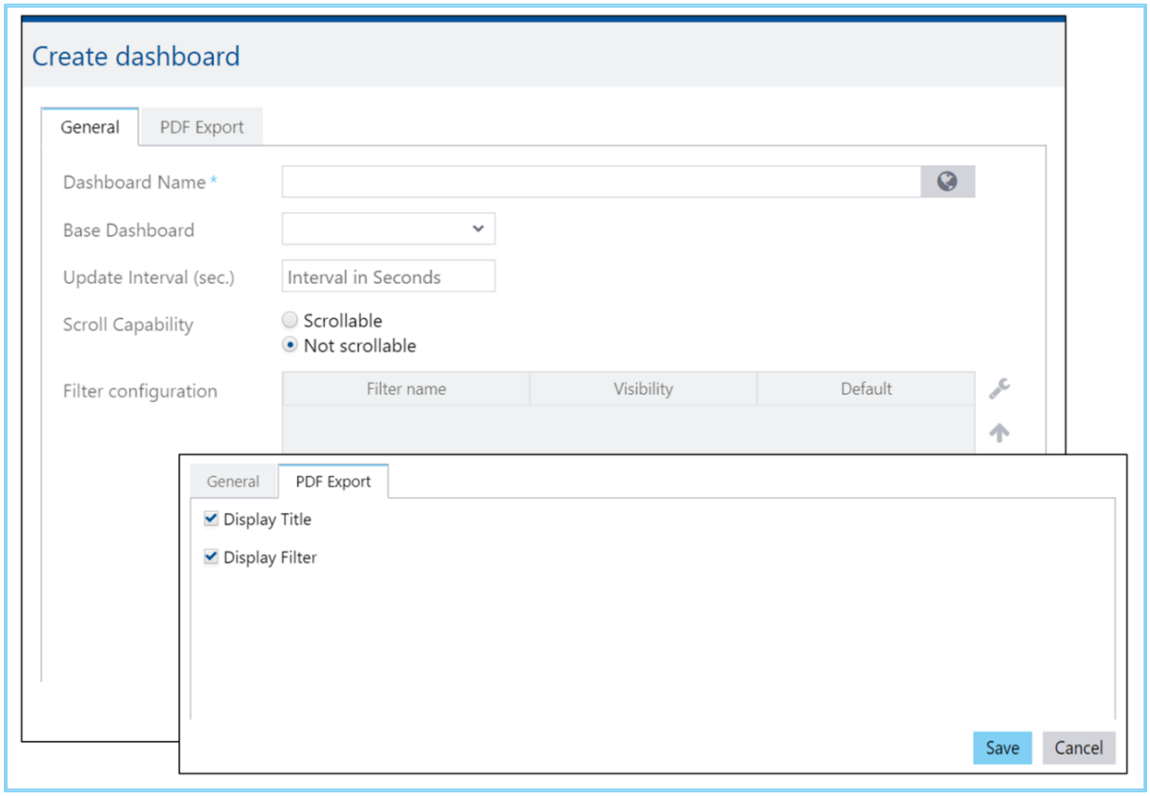


Fig. 31: Dialog for creating a dashboard

To create a new dashboard:

1. Click New in the top bar.
2. Enter dashboard name.
3. Select base dashboard (optional).
   An existing dashboard to be copied and modified if necessary.
4. Enter update interval.
   If the dashboard is displayed in a new tab, the time (in seconds) entered here determines the refresh rate of the dashboard.
5. Set scroll capability of the dashboard.
   If scrollable is selected, the dashboard will have a scrollbar on the right edge.
6. Set filter visibility in the filter configuration area.
   Filters are only visible when a dashboard is first created if there was base dashboard selected initially. Otherwise, filters become visible only after widgets are added and the dashboard is saved (see section 3.1.2).
   Each filter can be edited using the Edit **Visible**, **Invisible** or **Grouped** icons. Grouped filters appear in the dashboard under the filter More... (see Fig. 32).
7. Select the PDF Export tab for more settings for exporting PDFs.
   a. Check Display Title to show the title of the report as a heading in the exported PDF.
   b. Check Display Filter to display the selected filter configuration at the top of the exported PDF.
8. Click on Save.

ⓘ The scroll capability cannot be changed later (after the dashboard has been created).

⚠ ⚠ Scrollable dashboards cannot be exported and therefore cannot be sent as auto reports.

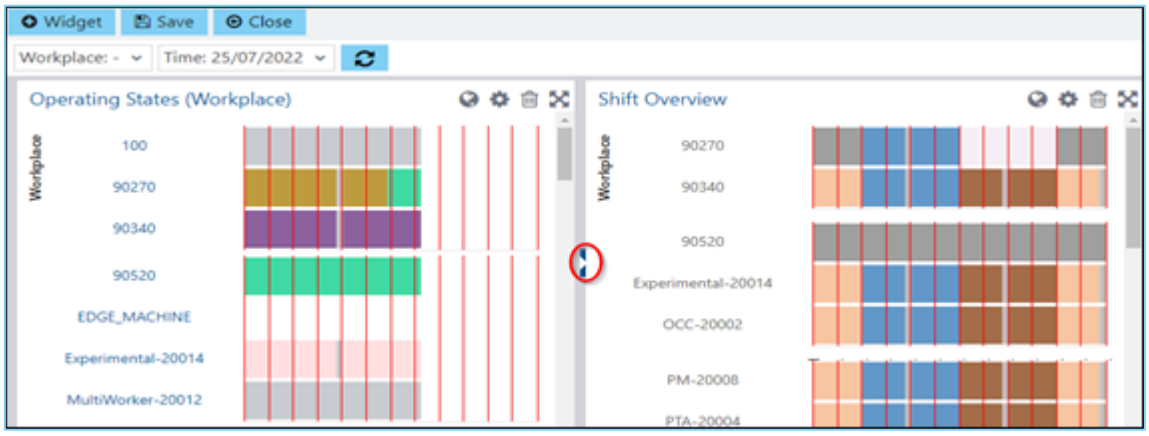


Fig. 32: Composition and scaling of widgets

3.1.2 Adding widgets

A report or visualization can be added to a dashboard multiple time.
There is no limit to the number of widgets possible in a dashboard.

To add reports/visualizations to a dashboard:

1. Click on the desired dashboard in the navigation area.
2. Click on **Edit** in the upper bar.

➔ The view changes to edit mode.

3. Click on + **Widget** in the upper bar.
4. In the pop-up window, select desired report/visualization/web application and click **Add**.
5. Repeat steps 3 and 4 as often as required.
6. Resize widgets by clicking on the edge of it holding the mouse button down and dragging it larger or smaller (optional).
   If you only want to change the size of the selected widget (optional), keep the CTRL key held down also.
7. Configure filters of a widget (optional).
   The widget's filter configuration is prioritized over the dashboard's global filter.
   a. In the upper right corner of the widget click on the **Edit** icon.
   b. Configure filters of the widget as desired.
   c. Click the **Move** icon in the upper right corner.
8. Move widgets (optional).
   Move the widget to the desired position by holding down the mouse button at the top edge.
9. Click **Save** in the top bar.

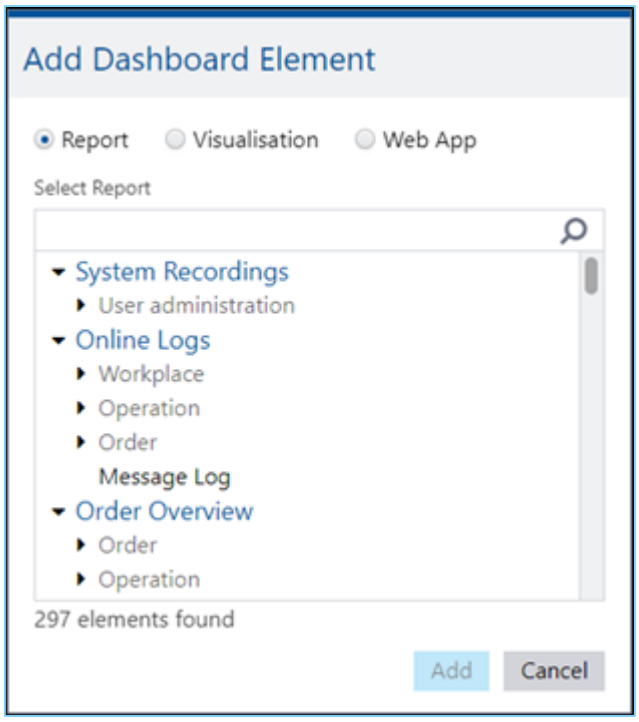


Fig. 33: Dialog for adding widgets

3.1.3 Editing widgets

To edit widgets:

1. Select the desired dashboard in the navigation area.
2. Click on **Edit** in the upper bar.
3. Use the blue arrows at the edge of the widget to drag it larger or smaller.
4. Click the **Edit widget** icon to select the filters for the widget locally.
   A local filter applies only to the corresponding widget. The local filters take precedence for the widget over the global filters of the dashboard.
5. Click the **Delete** icon to delete the widget.
6. Click **Save** in the top bar.

4 Annex

4.1 Change Log

Table 13: List of all changes with release version 5.11.16

Date	Type	Description	Section
2021-07-28	Created	Content of this manual transferred from Manual - Performance Analysis and revised according to introductory text	
2021-07-28	Added	Warning that defines a scope of deeper knowledge of SQL and database structures of FORCAM FORCE	2.10
2021-07-28	Edited	Clarification that dashboards do not contain multi-reports	3
2021-07-28	Added	Description of additional tab for PDF export	3.1.1

4.2 Table of figures