SIEMENS

App
SIMATIC Energy Manager V1.17

Application Manual

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02/2024; V1.17
A5E49285137-AS

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠ DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠ WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠ CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Preface

1

1.1 Introduction

1.1.1 Function overview

Introduction

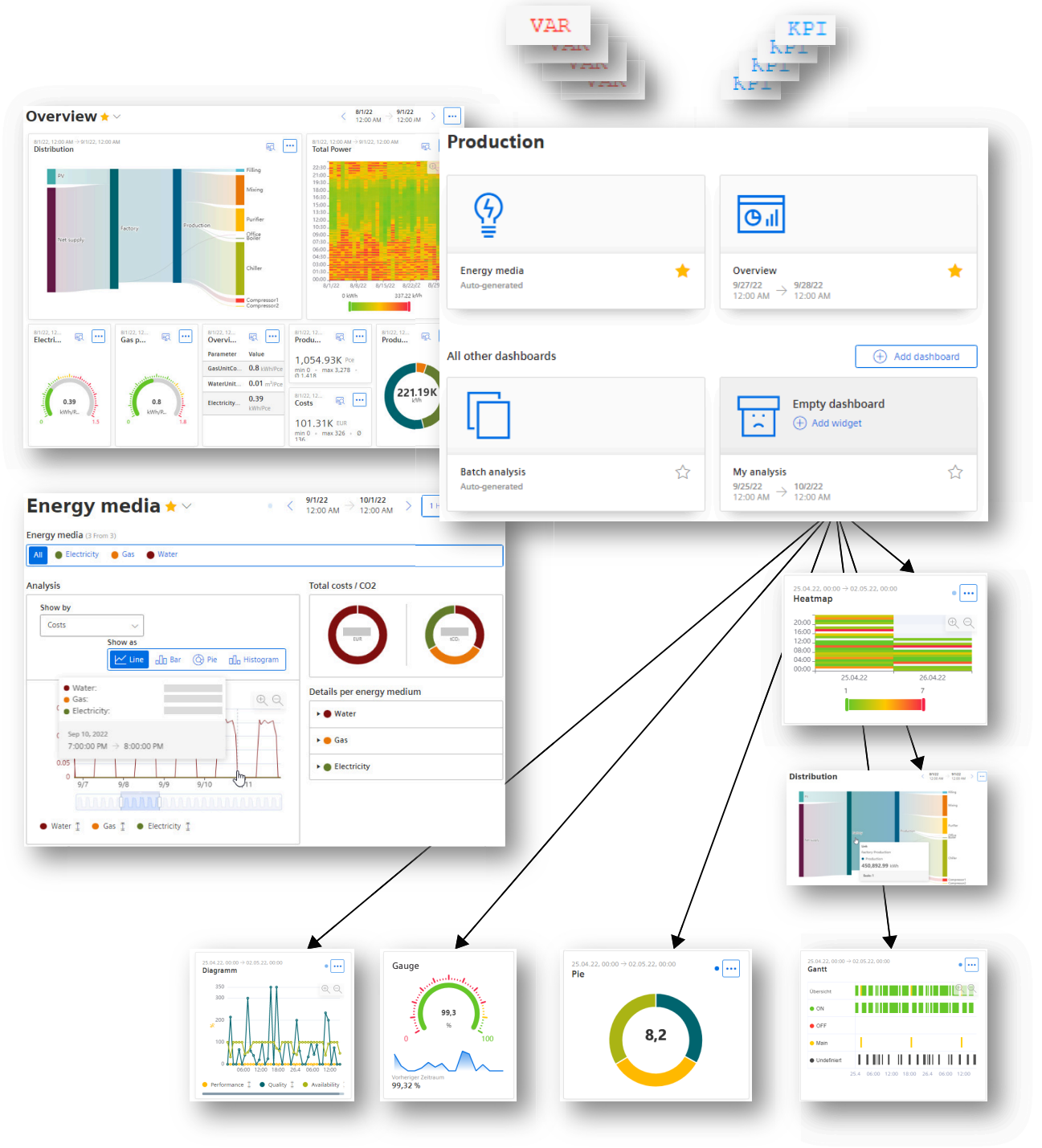
The SIMATIC Energy Manager app offers you the possibility to see when and where how much energy was consumed online at any time:

- You have access to the consumption data of machines and plants worldwide.
- Transparent energy management data to ISO 50001
- With individual KPI types and user-specific dashboards, you are creating a complete overview of the energy consumption of your machines, plants or entire production facilities from which you can subsequently derive measures for energy efficiency.
- You can create a KPI instance directly at the asset in the SIMATIC Energy Manager without having defined a KPI type beforehand.
- In the detail view of the widgets, you can create quick media analyses.
- Transparent listing of energy costs, energy consumption and CO_2 emissions of individual machines and all your production facilities around the globe. (Energy media analysis)
- You obtain valuable information on peaks in energy consumption, for example, to make informed decisions regarding optimization of energy efficiency and reducing energy costs.

The SIMATIC Energy Manager will help you make the transition from energy transparency to energy efficiency. The recorded energy data will provide you with more planning reliability. You can optimize processes and plants by analyzing and documenting the energy consumption, together with the process data, such as temperatures, pressures, etc. Use the collected energy data to make your procurement process even more precise.

If your plant is already energy-efficient, you can use the SIMATIC Energy Manager to ensure that it will stay this way. For example, you can quickly detect whether a filter is contaminated and replace it.

A dashboard is available for data and energy media analysis. Depending on your needs, you can use a variety of widget types on the dashboard:


VAR
KPI
Overview
Production
Energy media
Auto-generated
Overview
9/27/22 12:00 AM
9/28/22 12:00 AM
All other dashboards
Add dashboard
Batch analysis
Auto-generated
Empty dashboard
Add widget
My analysis
9/25/22 12:00 AM
10/2/22 12:00 AM
Energy media
Analysis
Total costs / CO2
Details per energy medium
Water
Gas
Electricity
Heatmap
Distribution
Diagramm
Gauge
99,3
99,32 %
Pie
8,2
Gantt

Browser recommendation

You require an HTML5-capable Internet browser to run the app.

The Google Chrome and Microsoft Edge browsers are supported. Google Chrome is recommended. You should preferably use 1920x1080 resolution.

The app can run on any mobile device with an HTML5-enabled browser. Tablets are recommended.

1.1.2 Validity of the documentation

The "SIMATIC Energy Manager V1.17" documentation is valid for the "Energy Manager" app.

Note

Timeliness of the documentation

The app is continuously developed and optimized. Therefore, it is possible that the documentation for individual new features and functions does not describe the actual scope of functions.

1.2 Legal information

1.2.1 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial cybersecurity concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit
https://www.siemens.com/cybersecurity-industry (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under
https://new.siemens.com/cert (https://www.siemens.com/cert).

1.2.2 Note on EU General Data Protection Regulation

Data protection

Siemens observes the principles of data protection, in particular the principle of data minimization (privacy by design). For the SIMATIC Energy Manager product, this means: the product processes / stores the following personal data: User name (first name and last name), email address, user role and app usage data (number of users; number of KPI instances; number of assets showing a media analysis).

No private or intimate data is processed or stored.

The above data are required for the login, the billing function and for the internal user administration (administrator can see the role and the status of other users). The storage of data is appropriate and limited to what is necessary, as it is essential to identify the authorized operators. The data needs to be maintained manually by you and if necessary, these can also be deleted. If you need support, please contact customer support.

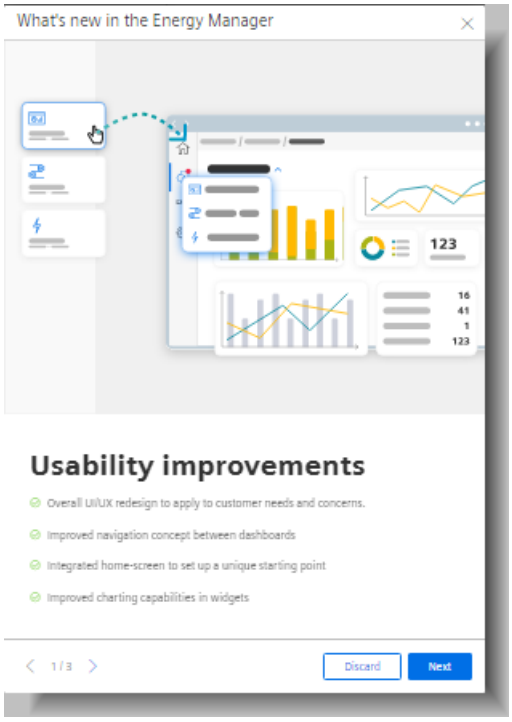
The above data will not be stored anonymously or pseudonymized, because the purpose (identification of the operating personnel) cannot be achieved otherwise.

The above data is protected against loss of integrity and confidentiality by state-of-the-art security measures.

What's new?

2

After you open the app for the first time, you will be welcomed with the display "What's new in the Energy Manager". The newly added features are presented here.



You can also call a presentation of the new features from the start page.

You can find the history of new features in all versions in the SiePortal (https://support.industry.siemens.com/cs/ww/en/view/109779179).

Version V1.17

Analyses at a glance

The "Analysis" view shows the dashboards for energy media analyses and batch analyses at a glance.

Batch analysis for multiple assets

Batch analysis is now possible for a selection of multiple assets. This allows you to compare the data of different batches from different production lines.

More detailed usage information

The "Usage information" view shows in detail which assets are using which resources. A direct link to a resource upgrade is provided.

New view in the "Duration Curve" widget

The "Duration Curve" widget offers the new "Scatter plot" view.

More user friendly

The legend display in chart views of widgets is now more user friendly.

More units added to selection lists

Grams, kilograms, and tons per m^3 are available as units for the CO_2 equivalent in the contract information.

New links on the start page

Give us your feedback. You can find a direct link on the start page.

You can display the app documentation in HTML format directly from the start page.

Get to know Energy Manager

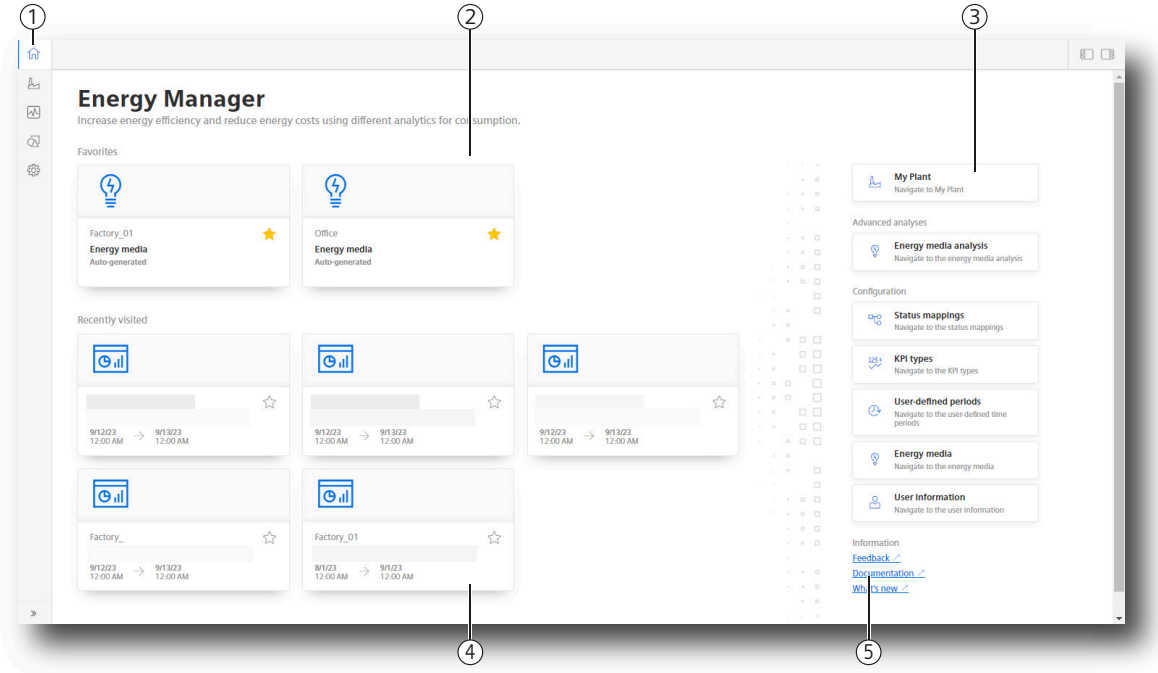
3

3.1 Structure of the app

3.1.1 Home page

Energy Manager

After the app is started, the start page is displayed.



1. Navigation bar
2. Favorite dashboards
3. Navigation
4. Last visited dashboards
5.
   - Feedback - Tell us what you think
   - Documentation - Display the Application Manual in HTML format.
   - What's new - link to the description of the new features

Dashboards marked as Favorite ⭐ and the last visited dashboards are displayed. This allows quick access to the analyses relevant to the user.

The start page offers access to the views of the app in the overview and in the side navigation bar:

	Home	Favorite and last visited dashboards
	My Plant (My Plant)	The My Plant (Page 15) is imported from the Asset-Manager. • Create dashboards for individual assets • Here you manage the dashboard configuration of the plants.
	Analysis	Overview of configured analyses: • Energy media (Page 70) • Batch analysis
	Configuration	Access to • Status mappings • KPI types (Page 35) • User-defined periods (Page 44) • Energy media (Page 71)
	Settings	Access to • User information (Page 25) (Changing the display language and the locale) • Usage information (Information on the number of users and KPI instances, etc.) • The user list • Designs (Page 29)

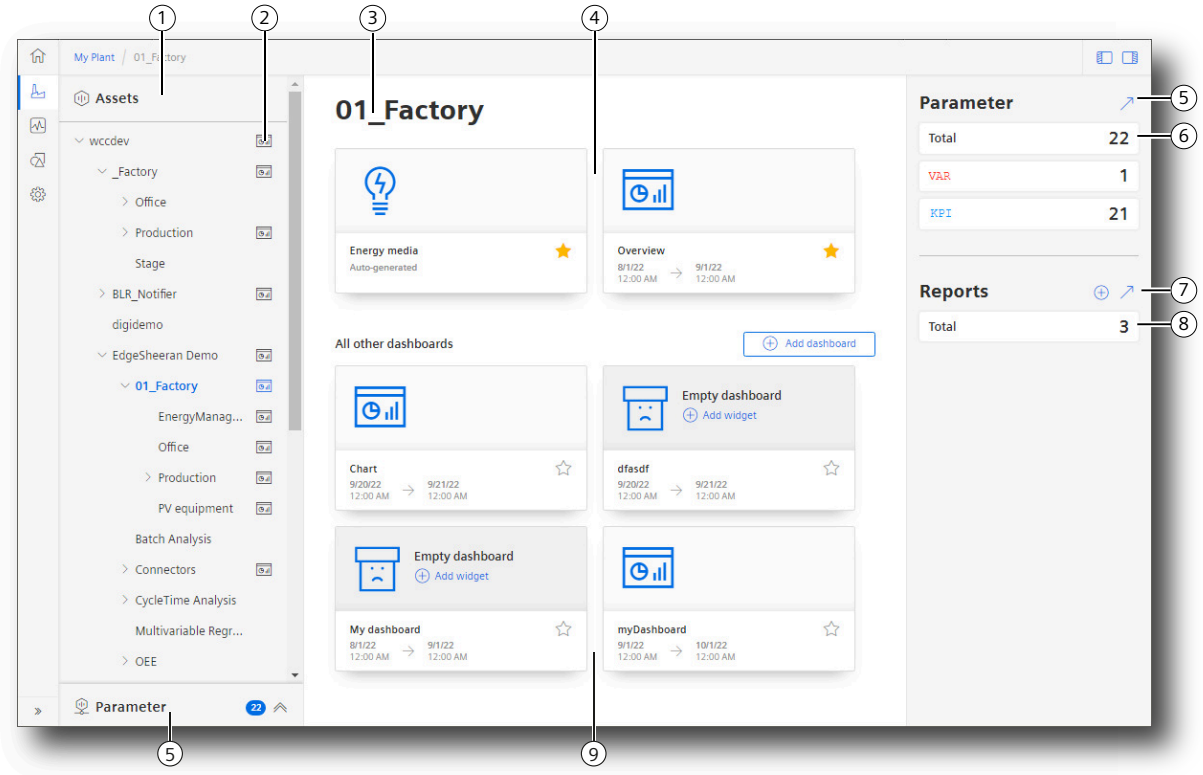
See also

Evaluating the production of individual batches (Page 95)

3.1.2 My Plant

"My Plant" view ("My Plant")

The "My Plant" view ("My Plant") displays the available assets.

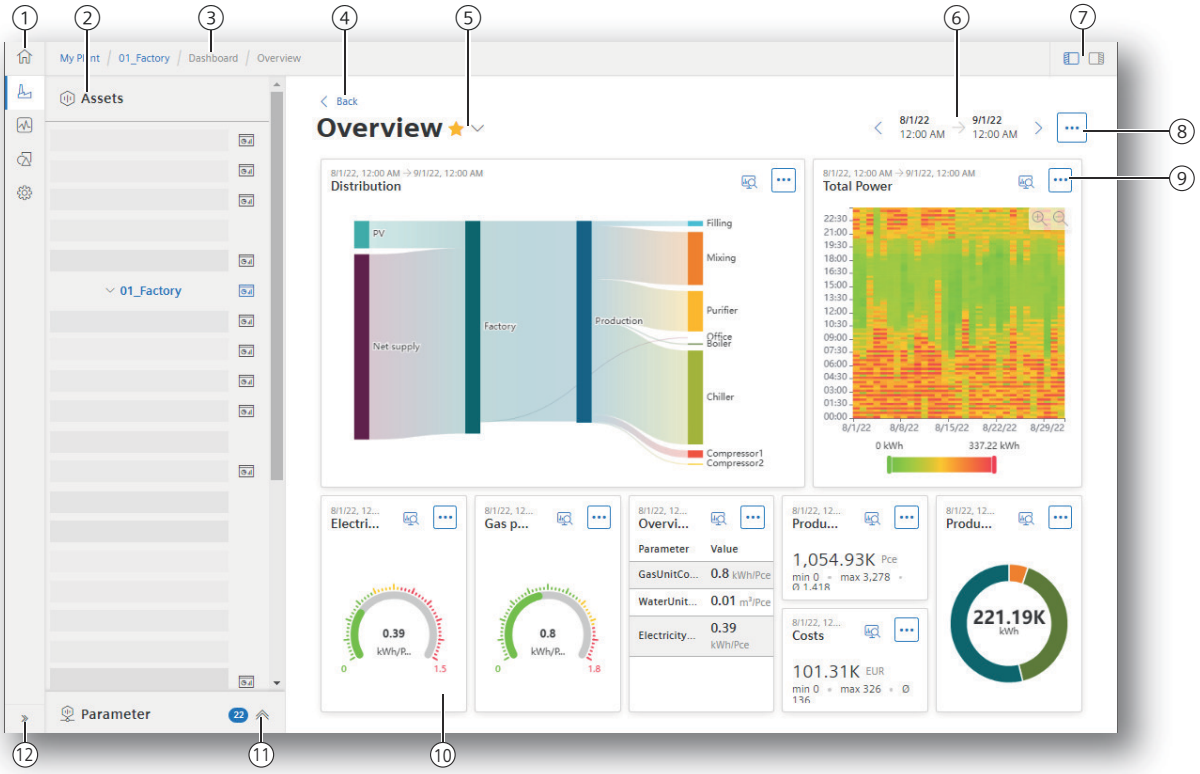


① Assets in the "My Plant" view ("My Plant")
② Number of dashboards created on the asset
③ Selected asset
④ Favorite dashboards available at the asset
⑤ Open parameter list
⑥ Overview of the variables and KPIs available at the asset
⑦ Open list of report configurations
⑧ Number of reports configured for the asset
⑨ More dashboards

Refreshes the assets display

Dashboard

The figure below shows a user-defined dashboard.



① Navigation bar - selection of a view
② Assets in the "My Plant" view ("My Plant")
③ Breadcrumb navigation
④ Navigation back
⑤ Overview of the dashboards at the asset / marking the asset as favorite
⑥ Displayed period, time navigation
⑦ Show/hide the navigation area left / right of the info panel
⑧ Menu button with options at a dashboard
⑨ Menu button with options on a widget
⑩ Widget
⑪ Show/hide parameter list
⑫ Show/hide texts of the navigation bar

The icon next to an asset indicates that at least one dashboard is available at the asset.

You can find more information on the Asset Manager here: Asset Manager system manual (https://documentation.mindsphere.io/MindSphere/apps/asset-manager/introduction.html)

3.1.3 Analysis

Overview

The "Analysis" view offers quick access to analyses of the energy media.

Displaying an analysis

1. Select the type of analysis.
   The overview of configured dashboards is displayed.
2. To display an analysis, click ↗ in the preview of the analysis.
   - or -
   Select an asset.
   The analysis is displayed for the selected asset.

See also

Overview of the energy media analysis (Page 70)

Evaluating the production of individual batches (Page 95)

Create reports (Page 146)

3.1.4 Using favorites

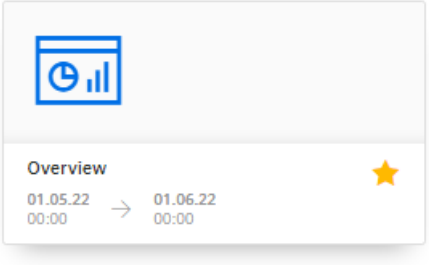
Description

To quickly get a display of the dashboards relevant for you, mark them as "Favorite".

Favorite dashboards are prominently displayed in overviews. In this manner, access to these dashboards is simplified.

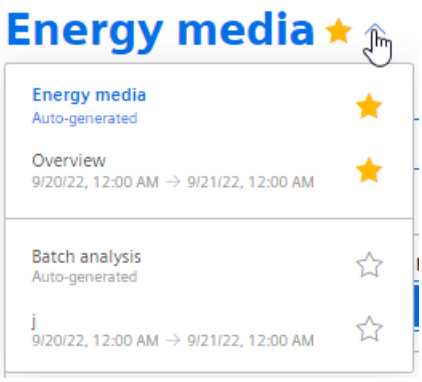
Procedure

1. To mark a dashboard as a favorite, click in the star on the dashboard.



2. To unmark it as a favorite, click the star again.

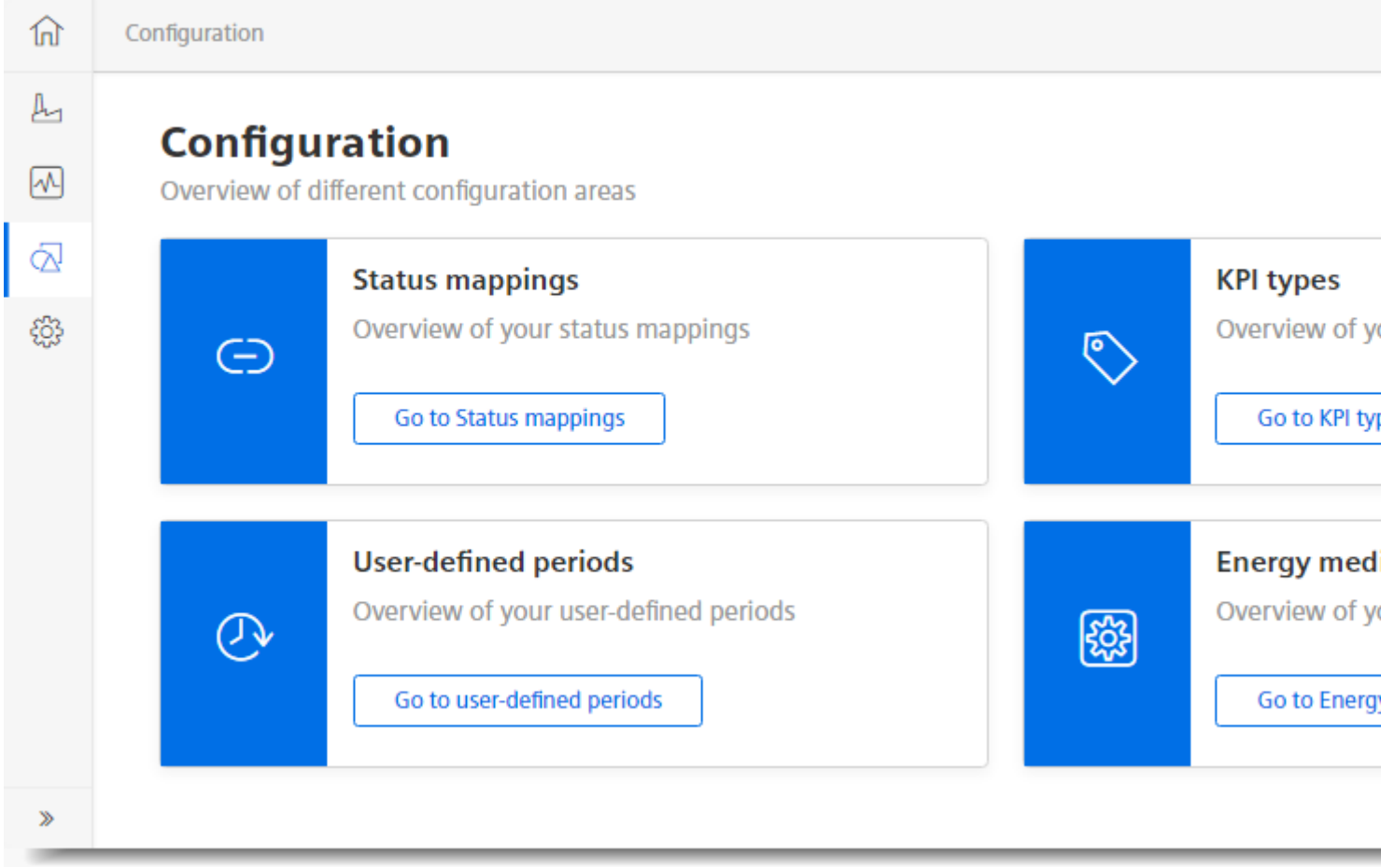
The "Favorites" function is also available in other selection lists and displays of dashboards.



3.1.5 Configuration

Overview

The "Configuration" view offers access to elements which are available for all assets and to the energy media overview.



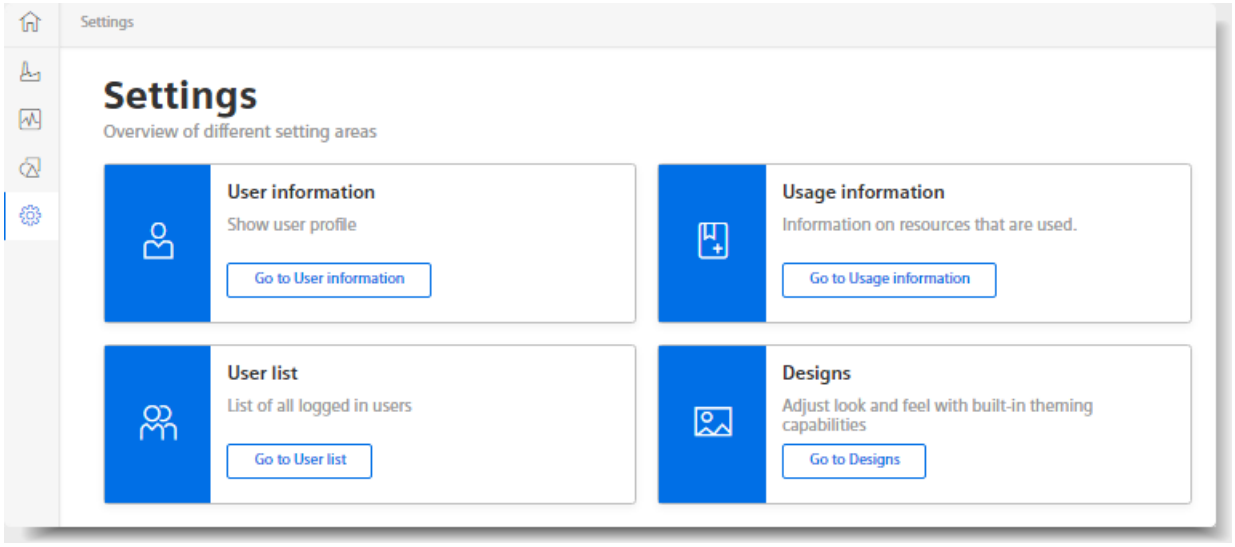
See also

User-defined periods (Page 44)
KPI types (Page 35)
Creating energy media (Page 71)

3.1.6 Settings

Overview

The "Settings" view offers access to information on users and the usage of the app.



See also

Adapting the app (Page 25)

3.2 Navigation in the app

In the views of the app, there are navigation elements which lead you quickly to the visualizations, information and configurations.

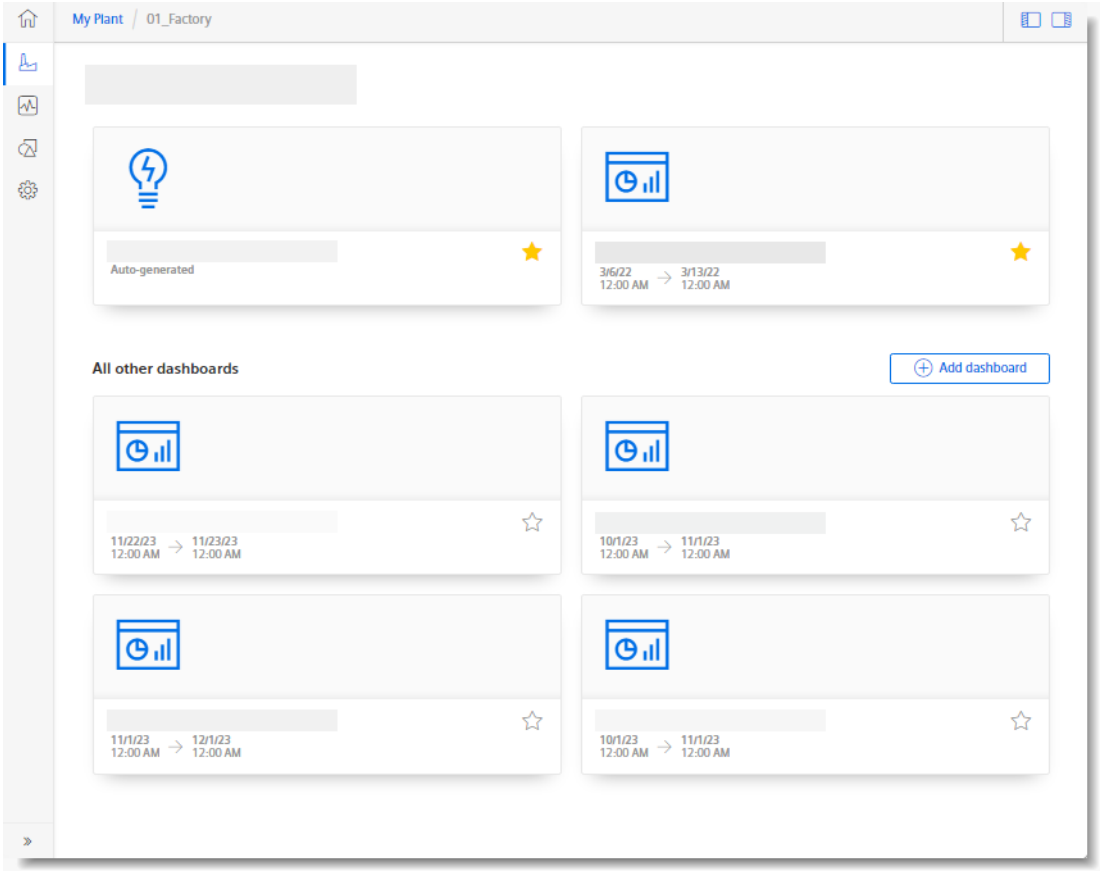
Overviews

The navigation bar leads to the overview views.

	My Plant (My Plant)
	Analysis

	Configuration
	Settings

The overview views at the assets of My Plant allow quick display of the existing dashboards. Here you can create automatically generated dashboards and user-defined dashboards.

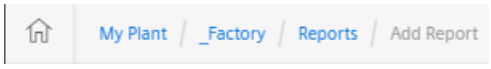


You can adapt the width of My Plant.

Breadcrumb navigation

The path that leads to the current view is displayed at the upper edge.

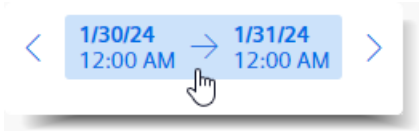
To access a previous view, click an individual entry.



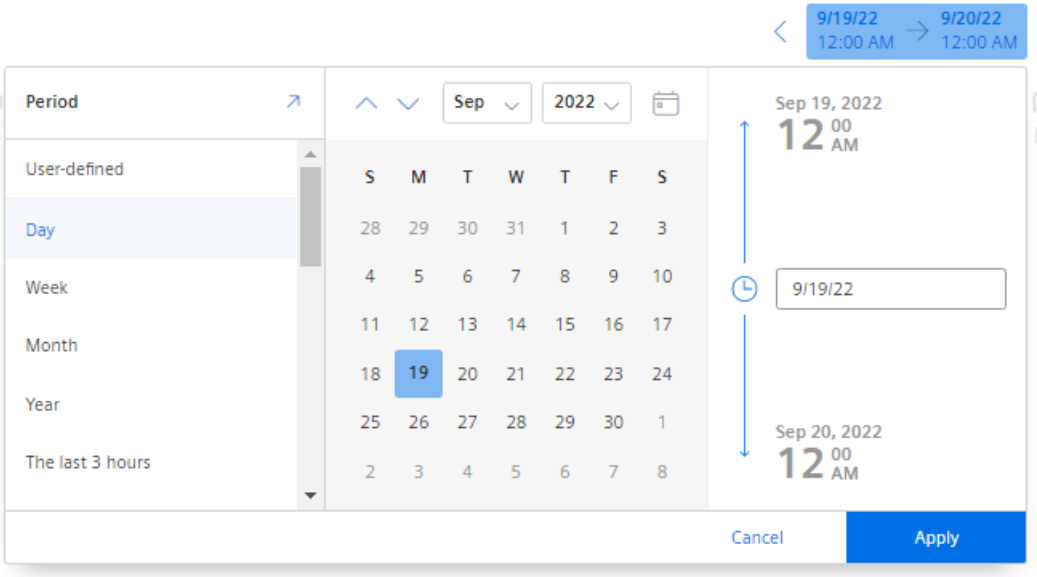
In addition, a link is displayed which returns you to the superordinate overview.

Displayed period, navigation in the time

Buttons to adjust the displayed period are available in dashboards and in the detail view of a widget.



- To move the displayed period, click < or >.
  The displayed period is moved by one offset which corresponds to the duration of the period.
- To specify a period, click the displayed period.
  The choice for the period and a calendar are displayed.



  – To determine the duration of the displayed period, select a period from the drop-down list.

  Note

  Week and last 7 days

  "Week" corresponds to a calendar week, beginning with the last Sunday.

  "Last 7 days" corresponds to the last 7 days, irrespective of the week day.

  This also applies for "Month" and "Year".

  "Today" corresponds to the period which includes the current date.

  – To use a user-defined period for the display, click "User-defined".
    Input fields for specifying the period are displayed.
  – Click ↗ to define a new user-defined period in general.
  – In the calendar, select the start date and if applicable, the end date and the time.
  – Select another month or another year from the drop-down lists.
  – To display the period that includes today's date "Today" once again, click .
  – Click "Apply".

The displayed period for the diagram display can be limited and moved below the display.

Showing / hiding a display area

Information areas and navigation elements can be shown and hidden, as required.

	Shows the texts for the navigation bar.
	Shows the list of available parameters at the selected asset.
	Shows or hides the list of assets on the left-hand side.
	Shows or hides the information panel on the right-hand side. For example. the overview of parameters, reports, KPI types.

Direct call of a dashboard via URL

- If you view a dashboard by directly calling a URL, you can hide My Plant retentively. Add the query parameter "`?leadingRegionCollapsed=true`" to the URL of the dashboard.

Menu button

On widgets and dashboards, relevant commands are contained in the menu of the button with 3 dots:

On automatically generated dashboards, for example:

- Editing settings
- Exporting data

At user-defined dashboards e.g.:

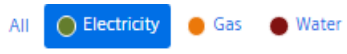
- Adding a widget
- Editing the layout of the dashboard
- Exporting a dashboard
- Editing a dashboard
- Deleting a dashboard

At widgets e.g.:

- Editing
- Deleting
- Copying
- Exporting data

Views

With energy media dashboards, the information for all or each individual energy medium can be displayed.

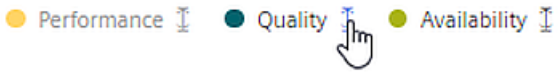


You open the detail views of a widget by clicking .

Widgets offer different detail views.

Adapting views

Parameters in visualizations can be shown or hidden.



If required, show the configured limit values.

Configuring the Energy Manager

4

4.1 Adapting the app

4.1.1 Changing the display language and color scheme

Note

User roles

This documentation describes the app for the user role "admin".

Users to whom other roles have been assigned might have limited rights and editing options.

User information

1. To show the user profile of the logged-in user, open "Settings" > "User information".
2. Click .

Language and locale

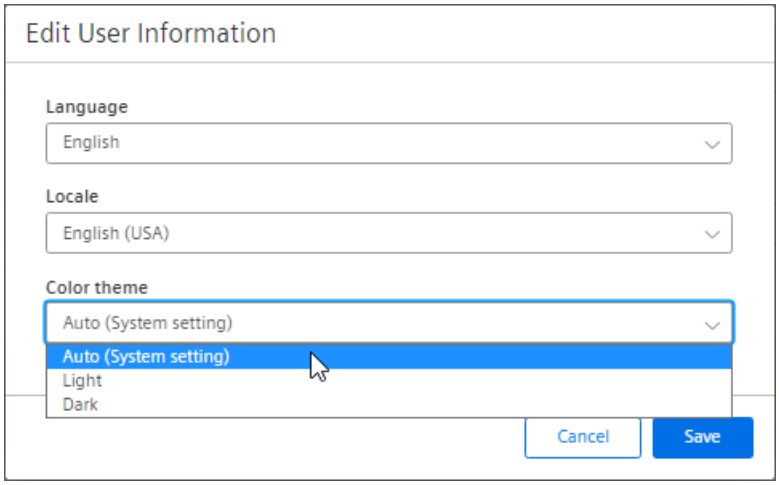
Here you can change the language and locale in which the app for the logged-in user is displayed.

The selection of the locale affects the display of numbers, such as decimal separators and dates. The locale can be selected independently of the user interface language.

Color scheme

Select your preferred color scheme for displaying the app:

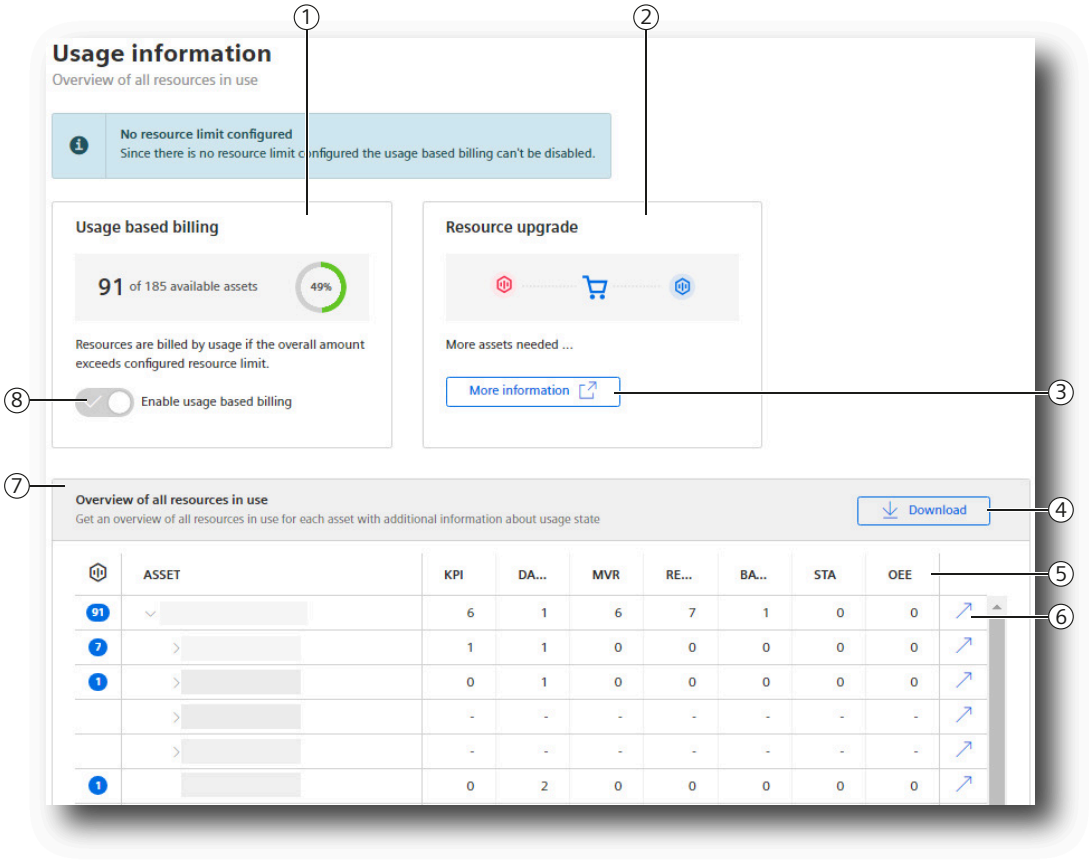
- Light
- Dark
- Automatic (system setting)



4.1.2 Displaying usage information

Usage information

An overview of all resources in use is displayed.



① Usage based billing
② Resource upgrade
③ Link to web shop with selection of suitable upgrades
④ Download resource list as CSV file
⑤ Resource type and usage status
⑥ Go to asset
⑦ Overview of all resources in use
⑧ Enable usage based billing

Usage based billing

If a resource limit is configured, select here whether usage-based billing is used when the resource limit is exceeded.

- Enabled: Assets can be created beyond the configured resource limit. These are billed based on usage.
- Disabled: You cannot create any additional assets when the resource limit is reached.

Resource upgrade

The "More information" link takes you to the Siemens web shop. Suitable upgrades are offered.

Overview of all resources in use

The table shows which asset is using which resources.

Resources in use can be:

- KPIs
- Dashboards
- Display of multivariable regression
- Reports
- ...

4.1.3 Displaying the user list

Procedure

To view the user list, select "Settings > User list".

Add / delete users

As an administrator, you can manage users as follows:

1. Select the settings in the overview page of the app.
2. Select the required user in the "Users" menu. The assigned roles are displayed.
3. Click "Edit direct assignment".
4. Add a user role or remove a user role and close the dialog.

You can find more information on user administration here: User management with "Settings" (https://documentation.mindsphere.io/MindSphere/apps/settings/Introduction.html).

Release user license

To release a user license, you can registered yourself as a user from the app:

1. Select the "Settings" view.
2. You can delete their account under "User information > User account".

4.1.4 Designs

To display the "Designs" view, select "Settings > Designs".

This view offers a choice of various color schemes to display the app.

Note

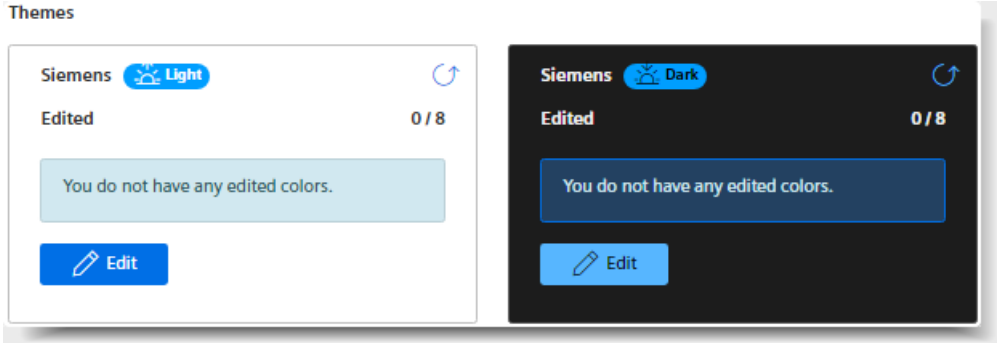
Administrator rights required

Administrator rights are required to change the design. Other users will only see the changes made.

Procedure

To customize the light and/or dark design, proceed as follows:

1. Select the topic you want to edit.

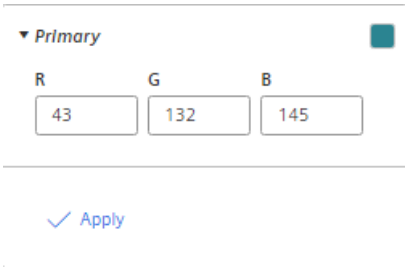


2. Click "Edit".
   The following color options are displayed:

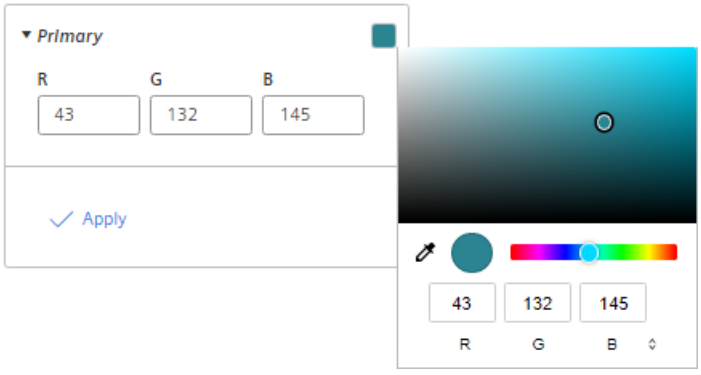
Color option	Description
Primary	Main color for the design, e.g. for buttons, menus and links
Font	Color for text elements, e.g. for labels and descriptions
Interface	Colors for the background
Success	Color for success messages
Warning	Color for warning messages
Error	Color for error messages
Info	Color for information messages
Overlay	Overlay color

3. Click the desired color option.
   The current color is displayed.

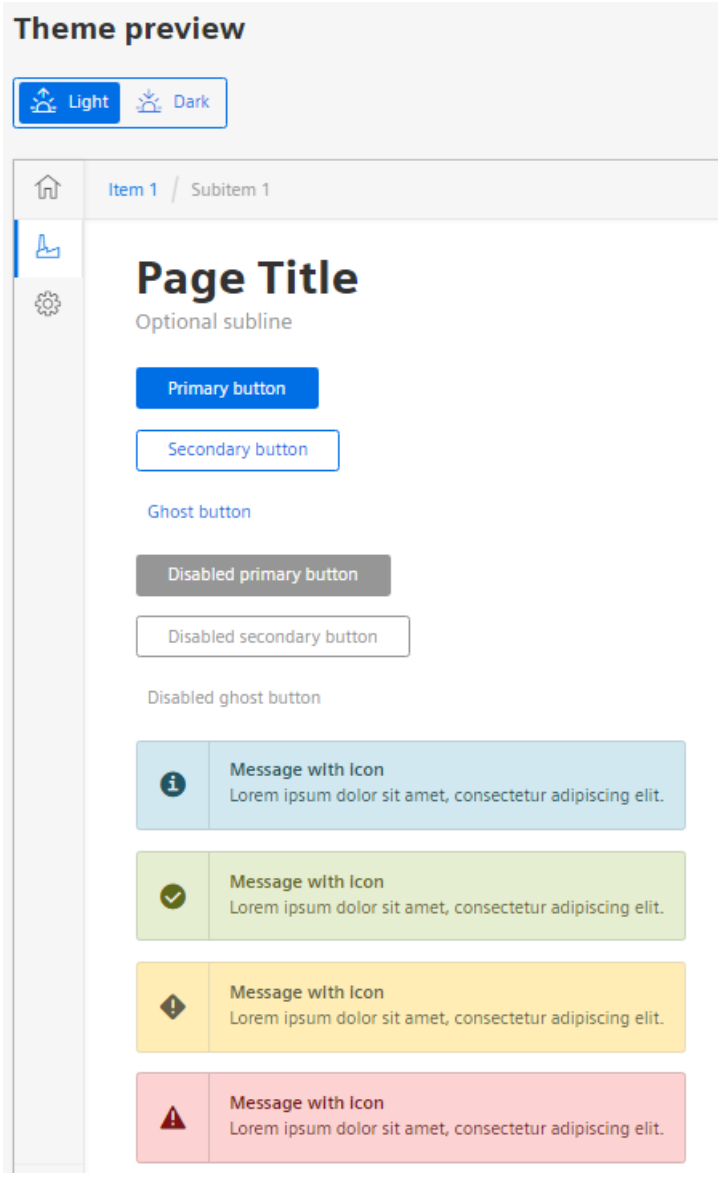
4. You have the following options to change the current color:
   – Enter the RGB colors of the desired color.



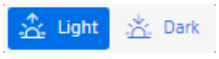
   – Open a color palette by clicking on the tile with the current color. Select a new color.



5. Click "Apply".
   The changes made are displayed in the "Theme preview" area.



6. To switch between the light and dark design for the preview, click



7. To reset a selected color, click "Reset".
8. When you have customized the color option as desired, click "Save".
   The saved design is now visible for all users.

Restoring the default settings

1. To reset the default settings in a design, click the icon in the corresponding design.
2. To reset the default settings in both designs, click "Delete".

4.2 Configuring types

You can create the types that you can use for all assets in the "Configuration" view:

- Status mappings (Page 32) should be used in the widget "Gantt" to visualize machine states.
- KPI types (Page 35) is to be used as a parameter in visualizations. KPI types are formed from a formula that connects operands and constants and time categories.
- User-defined periods (Page 44) make it possible to display visualizations for periods that are matched to your requirements.
- Energy media (Page 71) are used in the energy media analysis.

4.2.1 Status mappings

4.2.1.1 Creating status mappings

Description

You use status mappings in a widget of the type "Gantt" to visualize different values by colors and labels.

Status mappings are available for all assets of My Plant.

Displaying a list of status mappings

To display available status mappings and create a new status mapping, click "Status mappings" in the "Configuration" view.

The list of available status mappings is displayed.

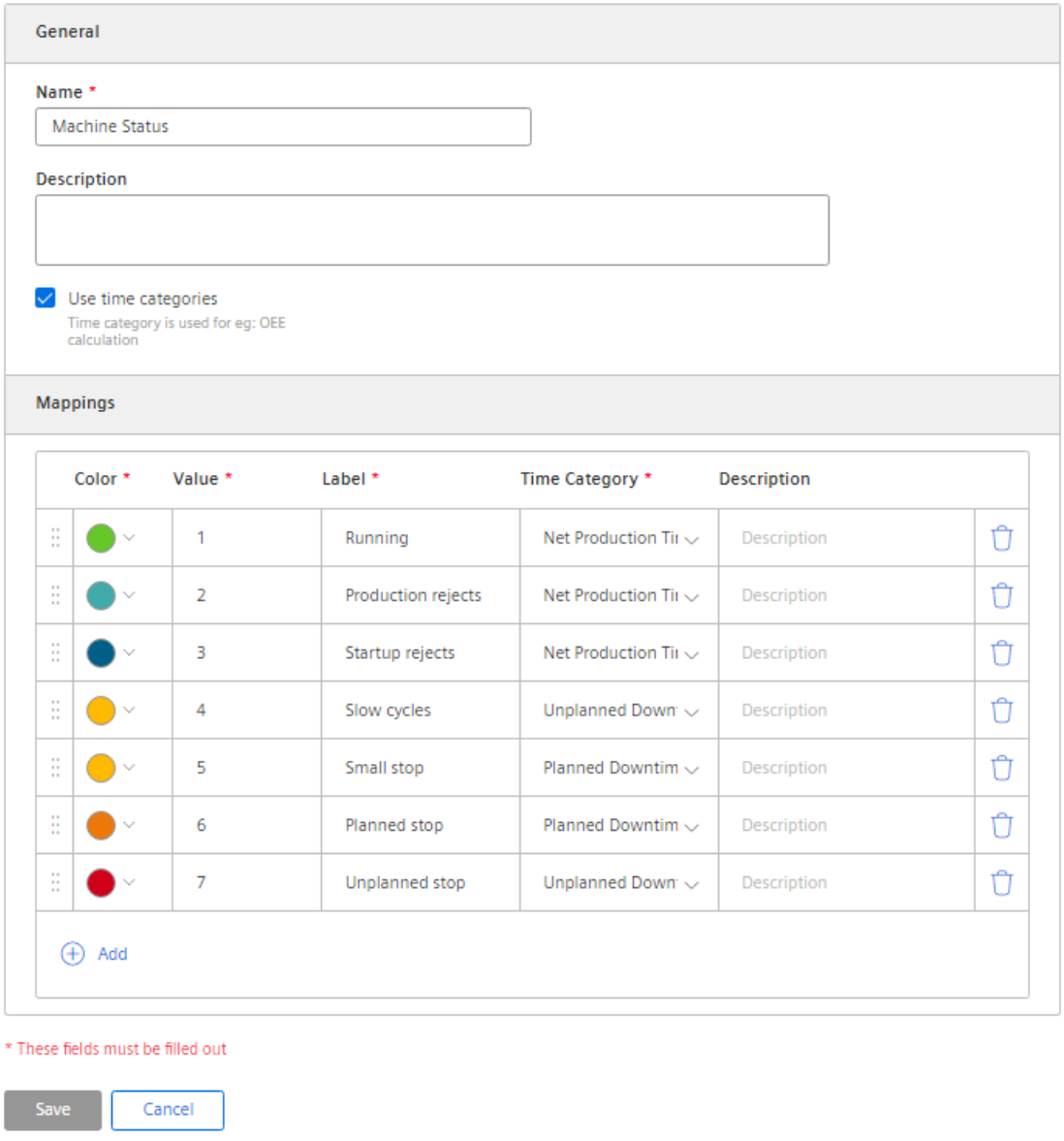
These status mappings are available for the creation of a widget of the type "Gantt".

Creating a status mapping

To create a status mapping, follow these steps:

1. Show the list of status mappings.
2. Click "Create new status mapping".
   The "Add status mapping" editor is displayed.
3. Assign a unique name and optionally a description.

4. Select the "Use time categories" check box if you want to map the status mapping in connection with the calculation of the productivity of your plant (overall effectiveness of equipment) to a KPI instance.
5. You assign a color, a label, a time category and optionally a description for each value that a variable can assume. The label is displayed in the widget for the selected machine status. If the parameter uses a value that is not defined in the "Status mapping" table, it is displayed with the status "Not defined" and the color white in the Gantt widget.



You use the created status mapping in connection with the "Gantt" widget. The order of the individual status mappings is reflected in the Gantt widget as shown in the table. You can change the order by dragging the ⁞⁞ icon.

Editing or deleting a status mapping

1. To edit an existing status mapping or delete it, click ... in the list of the status mappings.
2. Select "Edit" or "Delete".

See also

Visualizing machine statuses (Gantt) (Page 114)

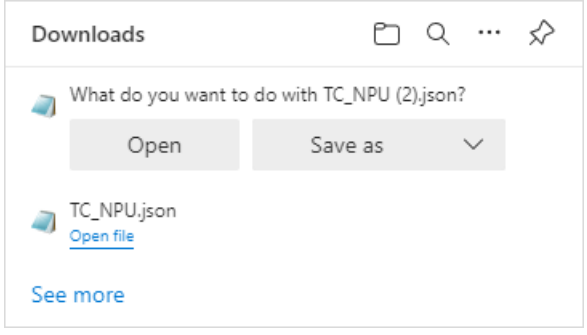
4.2.1.2 Exporting and importing status mappings

To be able to use status mappings on different devices, first export created mappings and import them into other environments.

Exporting status mappings

To export status mappings, follow these steps:

1. Select "Configuration > Status mappings" in the navigation toolbar.
   The list of the status mappings is displayed.
2. Click ... in an entry and select "Export" in the menu.
   The "Downloads" dialog box opens.

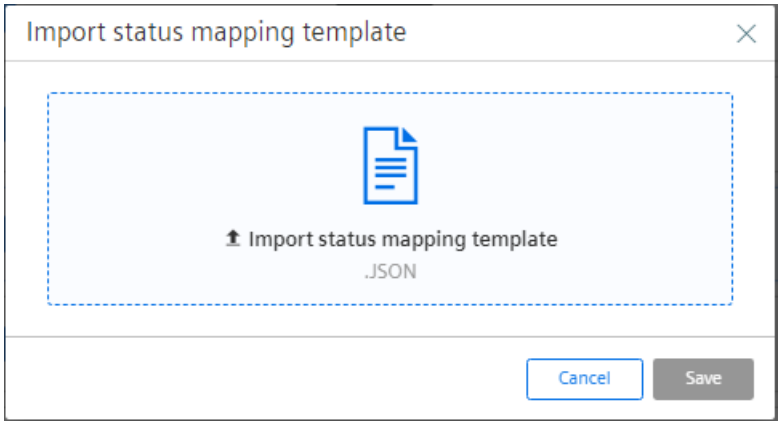


   - To display the Export file in text format, click "Open".
   - To save the Export file, click "Save as".
   - To display more exports, click "See more".
   - The toolbar in the dialog box has more options.

Importing a status mapping

To import status mappings, follow these steps:

1. Select "Configuration > Status mappings" in the navigation toolbar.
   The list of the status mappings is displayed.
2. Click "Import status mapping".
   The "Import status mapping template" dialog appears.



3. Click "Import status mapping template" to select a file for import.
4. Click "Save" to import the selected file.
   The imported status mappings are available and can be edited and used.

4.2.2 KPI types

4.2.2.1 Introduction to KPI calculations

Description

The abbreviation KPI stands for Key Performance Indicator.

A KPI type is a formula made up of operands, constants and operators. The definition and calculation of KPI types are plant-specific.

Example of a KPI type:

- Quality rate = Good Items / Total Items * 100

A KPI instance can be created either during the widget configuration in the "Parameter" step, or in the parameter list on the asset. The KPI instance can

- be derived from a KPI type (typed)
- or can be created typeless.

KPI types can be instantiated multiple times. When you make changes to the KPI type, these changes are also implemented in all KPI instances.

Note

Data in the buffer

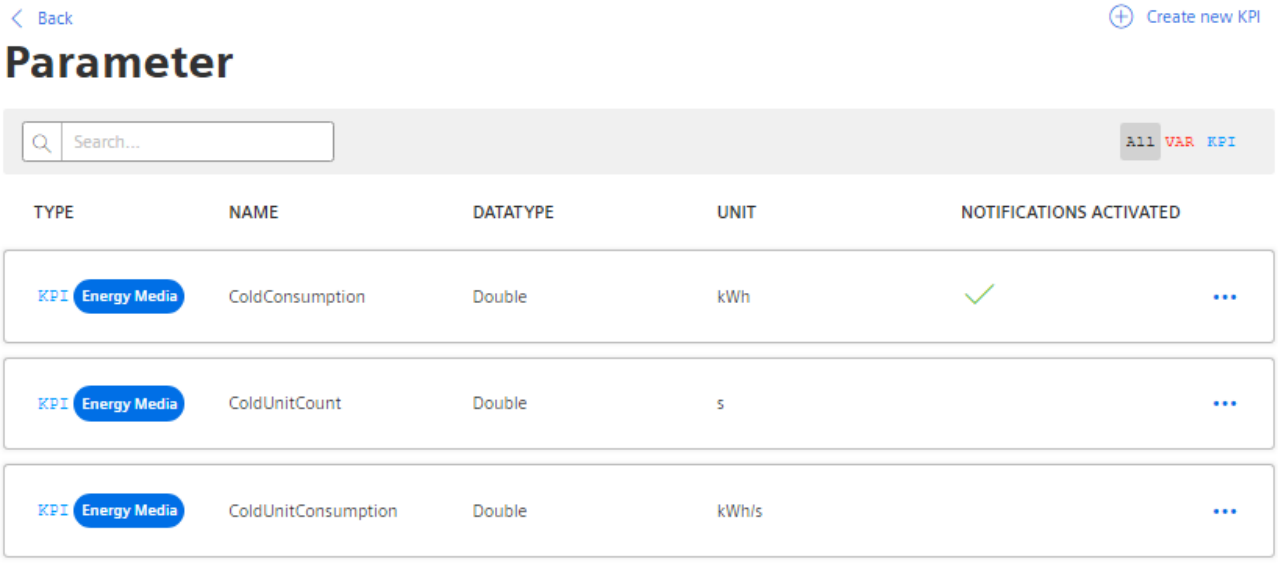
The KPIs are saved in a cache. If values in the platform were overwritten in the past (except for the current and last hour), it may take up to one hour before you can see the data or KPIs and aggregations based on them.

Automatically created KPI instances

KPI instances are created based on contract information for the individual energy media, the assigned variables, and KPI types as well as the reference mappings.

For automatically created KPI instances, you can define limits that trigger a notification when these limits are exceeded or not reached. The green check mark in the "Notifications activated" column shows that a notification has already been configured. More information on the configuration of notifications can be found here: "Activate notifications" for variables with numerical data type and KPI instances (Page 56).

In the parameter list, you can identify the automatically created KPI instances by the blue icon.



Structure of a KPI instance

The KPI instance is created as follows:

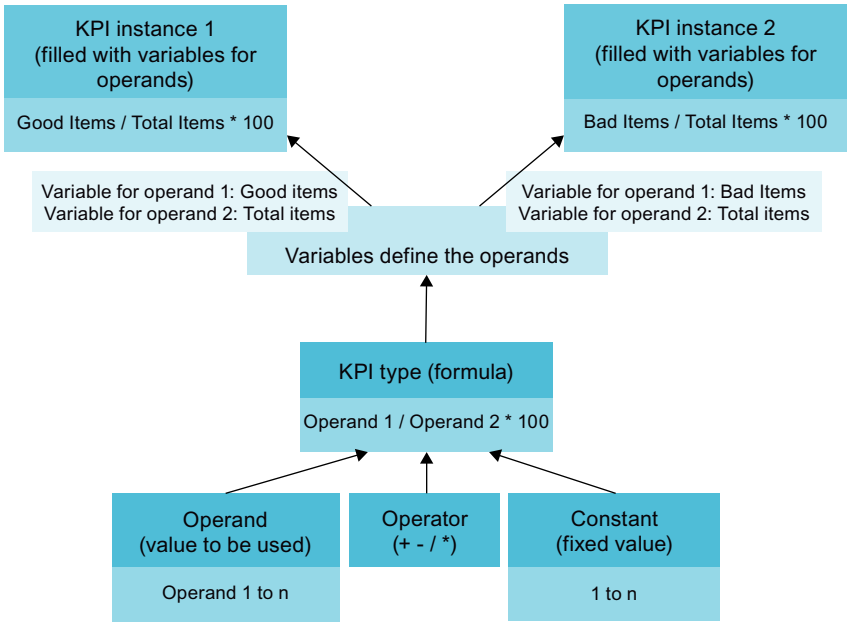
- Instantiate a KPI type including linked variables or KPI instances (typed; multiple use is possible)
  - **or** -
  Create a KPI instance directly and link it to variables or KPI instances (typeless).

Each KPI instance must be assigned to an asset, but variables from other assets can also be linked to the KPI instance.

The following figure shows the individual components that make up a KPI instance.

- Operands serve as placeholders that are later filled with actual values from the variables or KPI instances.
- Constants can only contain numerical values
- Operators

The following diagram shows the structure of the KPI type/instance concept:



Operands

Operands serve as placeholders that are later filled with actual values from the variables. They are created when creating a KPI type and defined during the instantiation of the KPI type. Operands must not contain spaces, mathematical symbols, or numbers at the beginning of the operand name. They can be moved and copied.

4.2.2.2 Creating a KPI type

Description

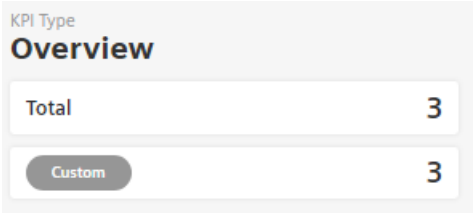
A KPI type is the template for a KPI instance which you visualize in a dashboard.

KPI types are created automatically, e.g. for the creation of an MVR dashboard. Independently of this, you can create your own user-defined KPI types.

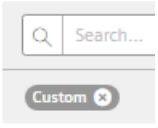
KPI instances can also be created as untyped when a widget is created.

Displaying a list of KPI types

1. To display available KPI types, click "KPI types" in the "Configuration" view.
   The list of available KPI types is displayed.
   KPI types are available for all assets of My Plant.
2. To display the formula for the calculation of the KPI type and further details, select the KPI type in the list.
   The information on the KPI type is shown in the information panel.
3. To filter the list by a category, click the corresponding category in the overview in the information panel.



4. To delete the filter again, click the display below the search field.

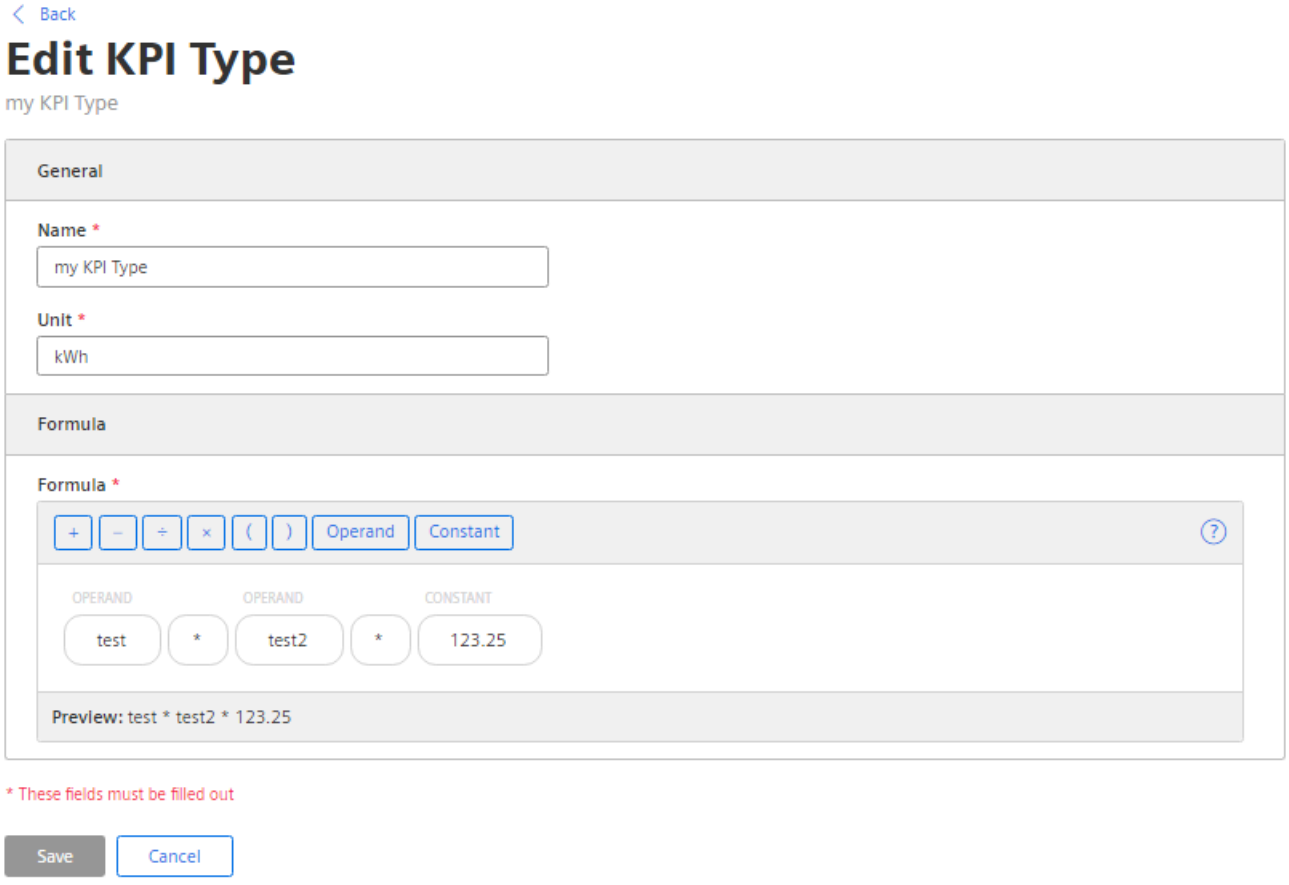


Creating a KPI type

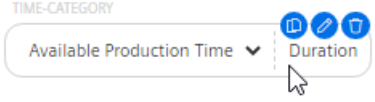
Follow these steps to create a KPI type:

1. Show the list of KPI types.
2. Click "Create new KPI type".
   The "Add KPI type" editor is displayed.
3. Assign a unique name and a unit.

4. To calculate the KPI type, use operands, constants and operators, which you can create directly for this purpose, to compose the formula in the formula editor.
   An operand is a placeholder that is later, during the creation of widgets, filled with actual parameters from the parameters or KPI instances.



5. Move already inserted elements of the formula with drag-and-drop.
6. To copy, edit or delete an element of the formula, move the mouse pointer over the element and select the corresponding icon.



Editing or deleting a KPI type

1. To edit an available KPI type or to delete it, click ... in the list of KPI types.
2. Select "Edit" or "Delete".
   Automatically generated KPI types (MVR) cannot be deleted in this view.

4.2.2.3 Creating and deleting KPI instances

KPI instances

KPI instances can be created either in the parameter list of the respective dashboard or when a widget is created. You can create the KPI instance either when configuring a widget or later by editing the widget again.

You have several options to create a KPI instance:

- You create a KPI type in the configuration and instantiate it either directly in the widget or in the parameter list. (typed)
- You create a new KPI instance directly in the widget or the parameter list. (typeless)

In the preview, you can see the formula it contains and which operand is linked to which variable.

New KPI instances cause costs. The number of currently used KPI instances is displayed in the "Settings" menu under "Usage information".

If all KPI instances are occupied, order additional KPI instances or delete a KPI instance that is no longer needed.

Note

Automatically created KPI instances

Automatic KPI instances are created additionally when you create energy media and assign contract information.

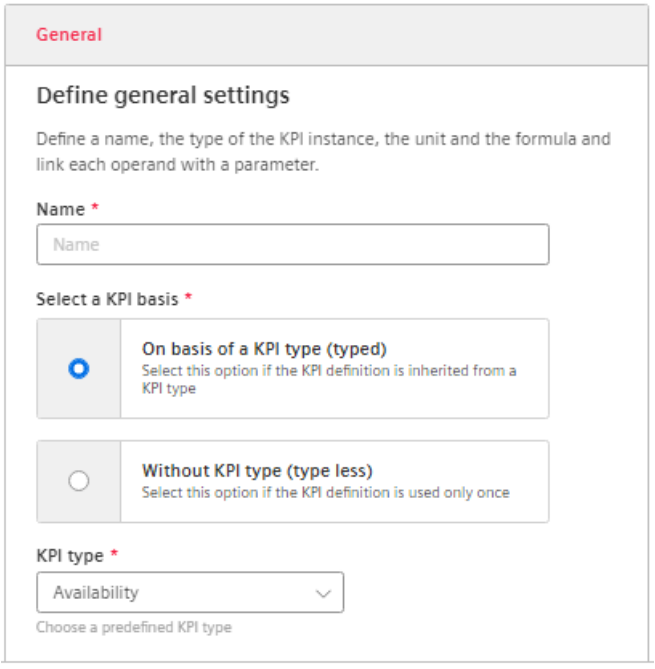
Creating a multivariable regression automatically generates KPI instances. These can not be edited.

Creating KPI instances based on a KPI type (typed)

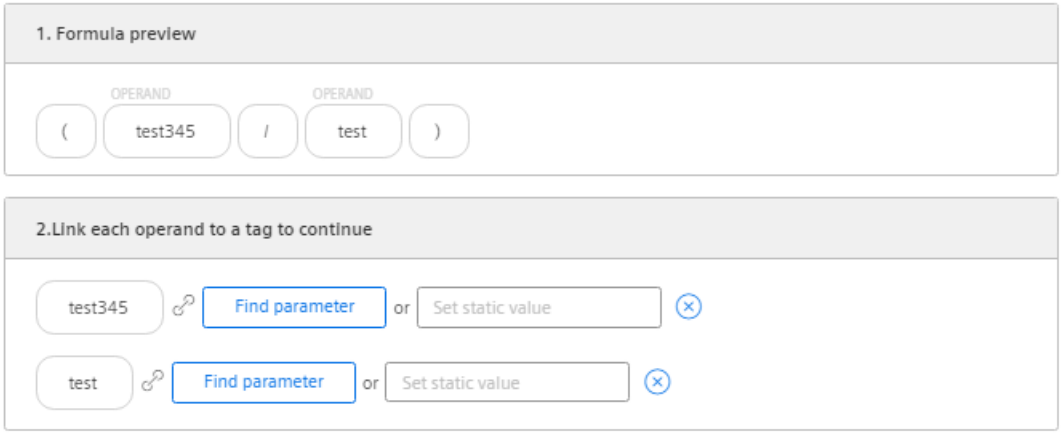
Follow these steps to create a KPI instance based on a KPI type:

1. Create a widget.
   - or -
   Open a widget for editing.
2. Go to the "Parameter" area
3. Click "Create a new KPI instance".
4. In the "General" area, you assign one unique KPI instance name per asset.

5. Select "On basis of a KPI type (typed)".



6. Select the desired KPI type. The preview shows the formula it contains.
7. Link all operands contained in the formula to a variable or a KPI type. If you assign a variable to the operand, you also need to select an aggregation function.

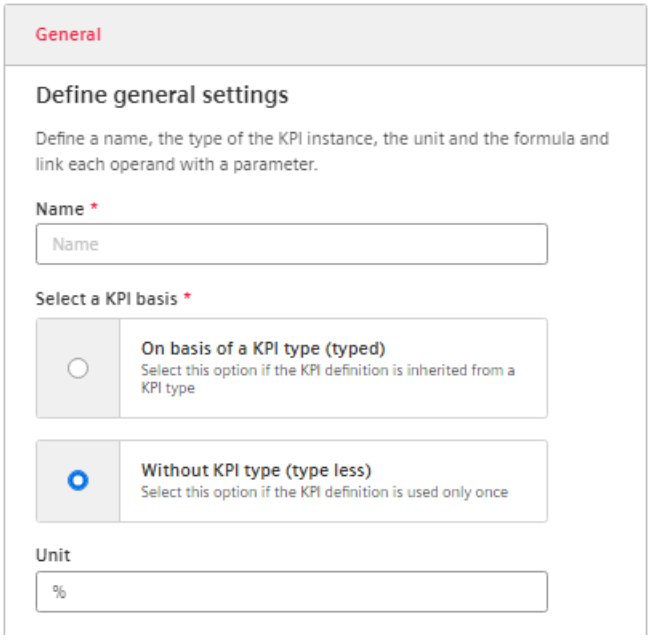


Creating KPI instances without KPI type (typeless)

Follow these steps to create a typeless KPI instance:

1. Create a widget.
   - or -
   Open a widget for editing.
2. Go to the "Parameter" area
3. Click "New KPI instance".

4. Click the "General" tab.
5. Assign a unique KPI instance name per asset.
6. Select "Without KPI type (typeless)".
7. Enter a unit.



8. Create the formula from constants, operands and operators.
9. Link all operands contained therein to a variable or a KPI type. If you assign a variable to the operand, you also need to select an aggregation function.

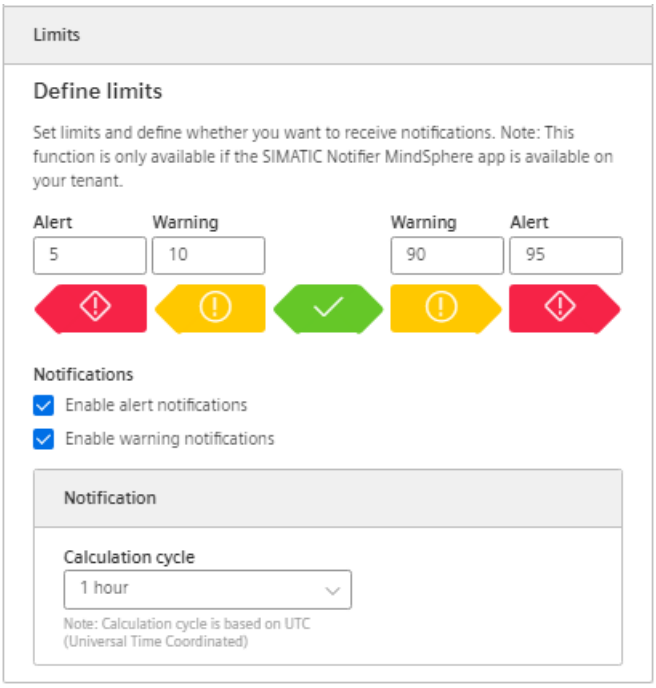
If you have already defined limits for the variable or KPI used, they are displayed preset in the widget. These limits can be overwritten.

Defining limits

You can define limits both for typed and for typeless KPI instances (user-based KPI instances).

To define the limits, follow these steps:

1. Go to the area "Limits".
2. Enter the limit values.



3. To receive notifications when a high or low limit value is violated, enable the function "Activate notifications".
   You can find additional information on the "Activate notifications" function here: "Activate notifications" for variables with numerical data type and KPI instances (Page 56)

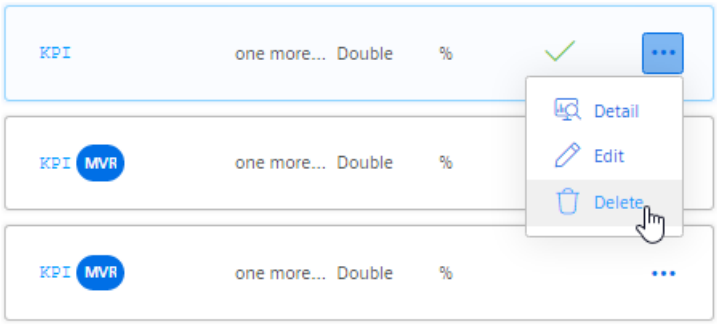
Deleting KPI instances

You can delete KPI instances from the parameter list of the asset.

Follow these steps to delete a KPI instance:

1. In My Plant ("My Plant"), select the asset in which the KPI instance is used.
2. Open the list of the parameters.

3. Select the KPI instance that is to be deleted.



4. Click ··· and select "Delete".

Note

No Undo

The KPI instance is deleted without confirmation and can not be restored.

See also

"Activate notifications" for variables of the data type "Bool" and "String" (Page 58)

4.2.3 User-defined periods

Description

A user-defined period defines a typed period. These types are used during visualization to record and display the data values of a parameter or KPI for this period.

The app makes common periods available as "Standard". You can create your own time periods.

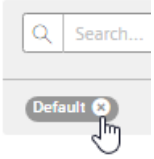
Examples of user-defined periods:

- 5 days
- Financial year
- Season (for a product)

Displaying a list of periods

1. To display available time periods and create a new time period, click "User-defined time periods" in the "Configuration" view.
   The list of the existing periods is displayed.
   Periods are available for all assets of My Plant.
2. To display information and a preview of the calculated time window, select the period in the list.
   The information on the period is shown in the information panel.

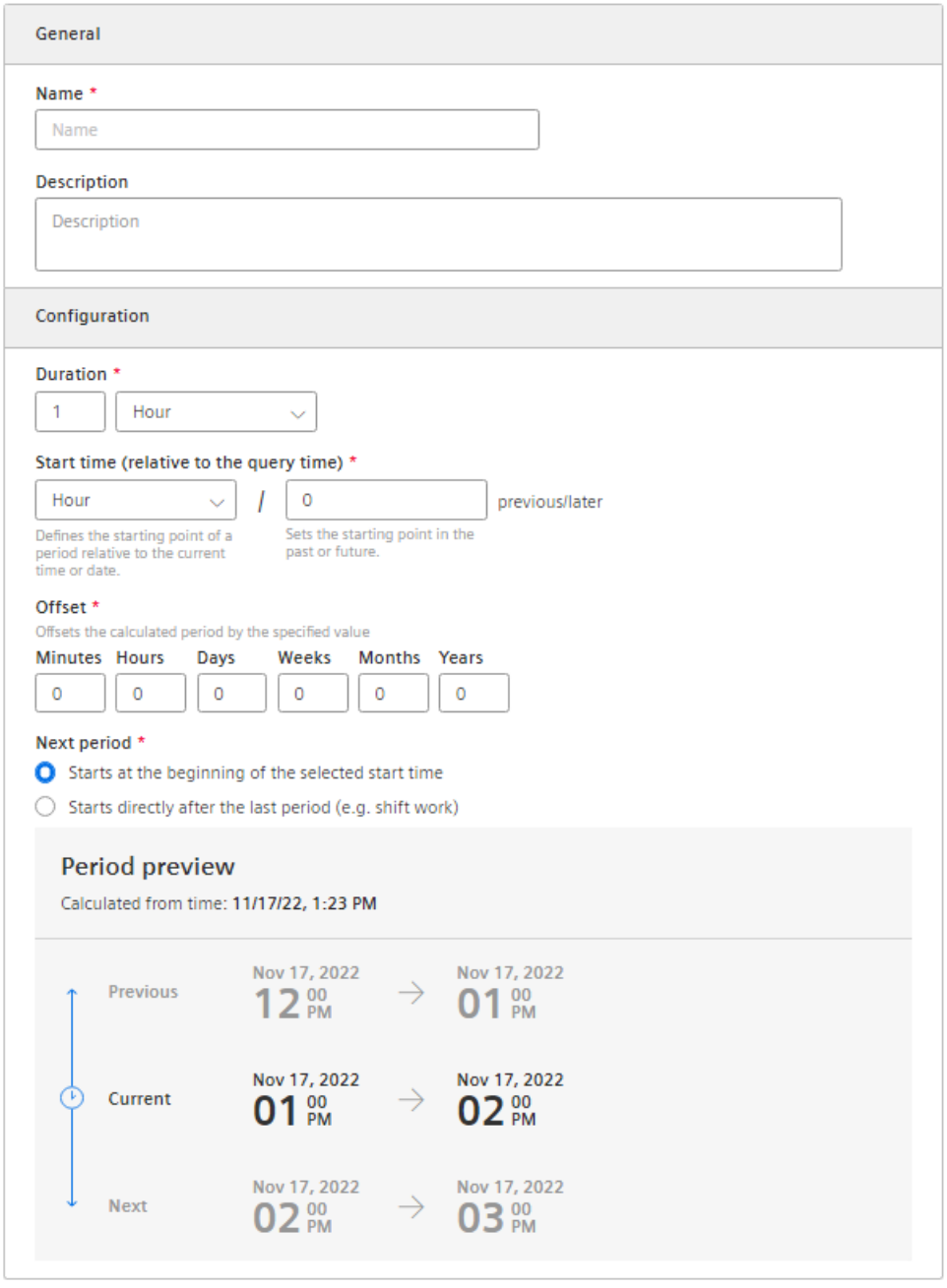
3. To filter the list by a category, click the corresponding category in the overview in the information panel.
4. To delete the filter again, click the display below the search field.



Creating a user-defined period

To create your own period, follow these steps:

1. Show the list of periods.
2. Click "Create new user-defined time period".
   The "Add user-defined time period" editor is displayed.



3. Assign a unique name and optionally a description.

4. Define the time window in the "Configuration" area.
   - **Duration**
     Enter a value for the duration of the period or select a value by clicking on the arrows in the input field.
     Select the unit of the period: Minute, hour, day, week, month or year.
   - **Start time (relative to query time)**
     Define the starting point of the period relative to the current date by specifying the unit of the distance to the current time: Minute, hour, day, week, month or year.
     Specify whether the starting point is in the past or the future starting from the current date. With a negative value you specify a start time in the future, with a positive value a start time in the past.
   - **Offset**
     Specify values by which the calculated period is moved.
   - **Next period**
     Specify the start time of the next period.
     "Starts at the beginning of the selected start time" starts the next period when the defined start time has been reached.
     "Starts immediately after the last period (e.g., with shift operation)" starts the next period at the end of the previous period.
5. Click "Save".

Note

Deleting or editing a user-defined time period

You can edit or delete user-defined periods.

Periods of the "Standard" category cannot be edited or deleted.

Result

You have defined a user-defined period that you can now use when selecting a period, for example, in a widget.

4.3 Setting parameters

4.3.1 Parameters in the Energy Manager

Parameters are the variables available in the app and the KPIs created at the asset.

The variables that are available on each asset were transferred from the plant to the platform using the Asset Manager. In SIMATIC Energy Manager , My Plant with all existing variables is mapped on this basis.

The name, data type, and unit of each variable are transferred from the platform.

You can display the list of available parameters for each asset and define settings and limit values for individual parameters.

Variables

You determine a unit and the acquisition category.

You specify the limit values for which notifications are sent on violation.

The settings differ depending on the data type of the variables.

Auto-generated KPIs

General settings and the formula are displayed but cannot be changed.

You specify the limit values for which notifications are sent on violation.

User-defined KPIs

You edit the general settings and the formula.

You specify the limit values for which notifications are sent on violation.

See also

Displaying a parameter list (Page 48)

4.3.2 Displaying a parameter list

Description

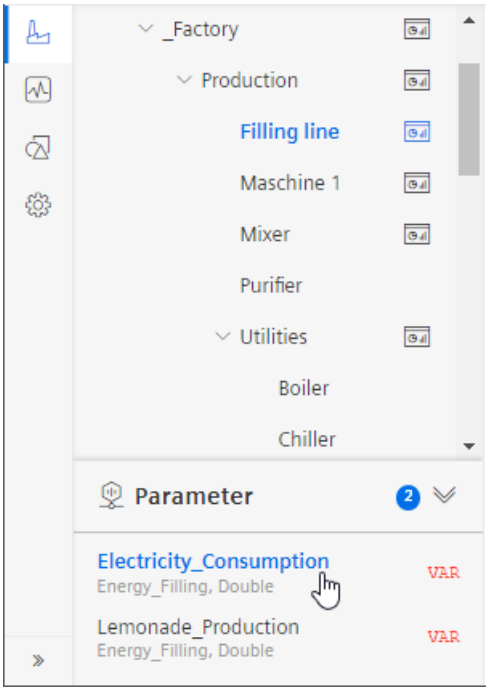
The parameter list is asset-specific.

To show details on a parameter or edit the settings for a parameter, select it in the parameter list.

Accessing values of a parameter or KPIs

To display the parameter list, proceed as follows:

1. Select an asset in My Plant.
2. To show the parameter list below My Plant, click on the double arrow .
   The parameter list is displayed.

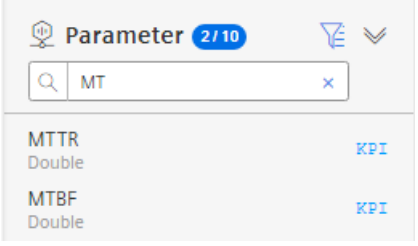


3. Click a parameter (VAR or KPI) The current values of the parameter are displayed on a diagram.

Filter parameter list

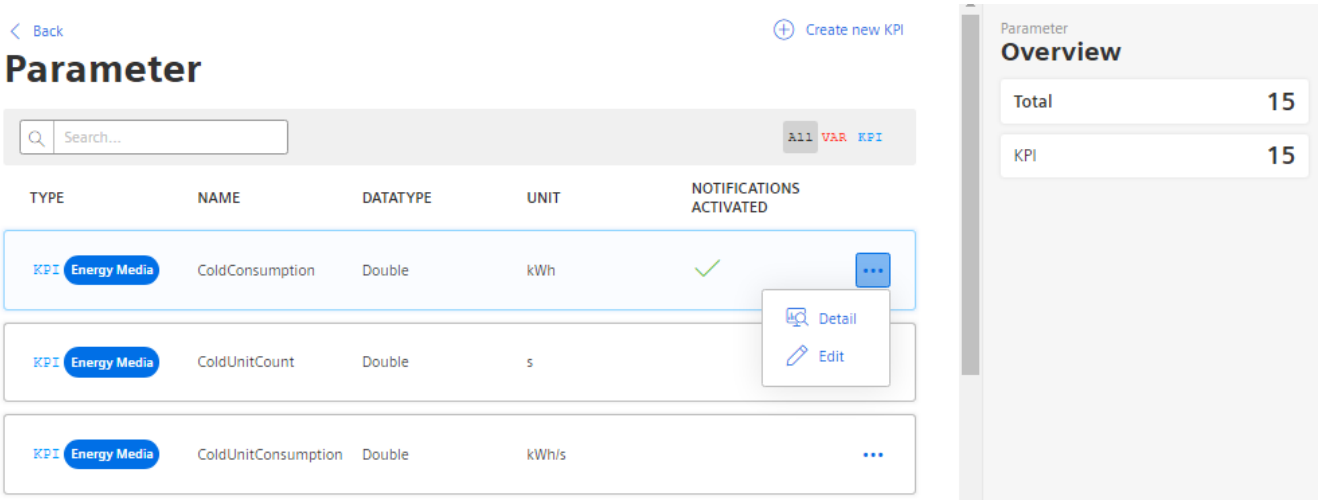
To filter the display of parameters, follow these steps:

1. Click the filter icon .
2. In the search box, type a string.
   The parameters whose names contain the character string are displayed.



Editing settings

1. Select an asset in My Plant.
2. Click ↗ next to "Parameter" in the information panel.
   The parameter list is displayed.



   Variables, automatically generated KPIs and user-defined KPIs are displayed.
3. To edit the settings for a parameter, click ⋯ and select "Edit".
   Editing differs for variables and KPIs.
4. To filter the list, click next to the search field on VAR or on KPI.

4.3.3 Displaying current values of a parameter

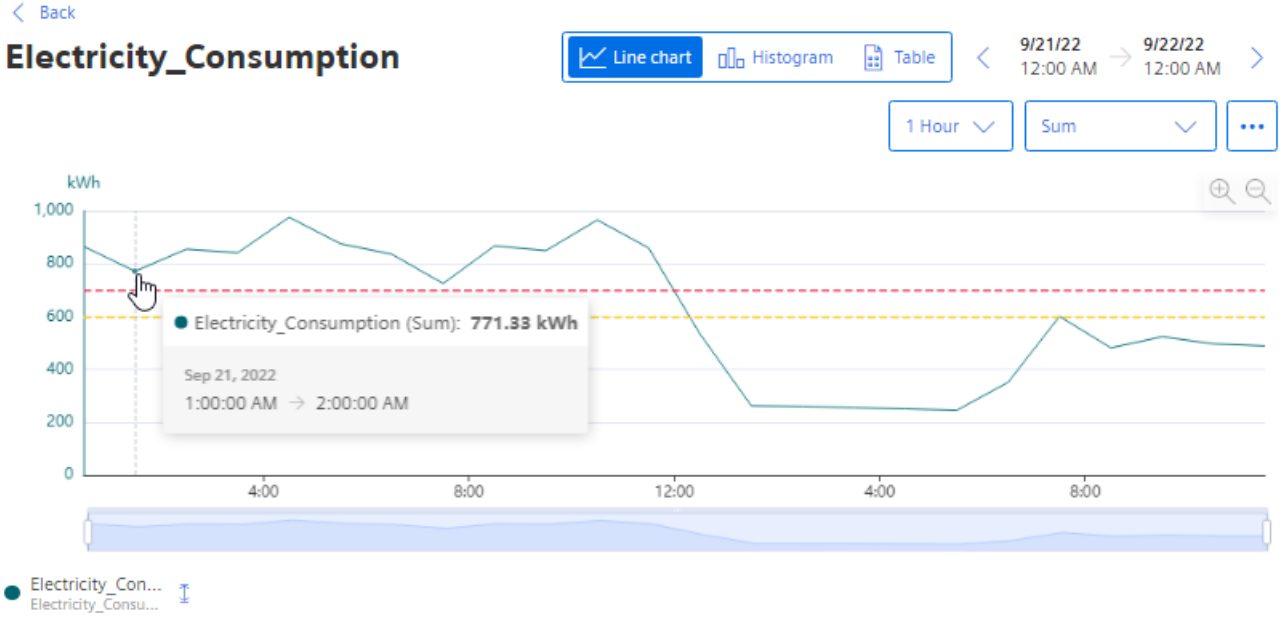
From the parameter list, you directly show the current values of a variable or a KPI instance. In this way, you find out whether and which values are currently available.

Procedure

To display the current values of a parameter, proceed as follows:

1. Show the parameter list.
2. Click ⋯ for the selected parameter.

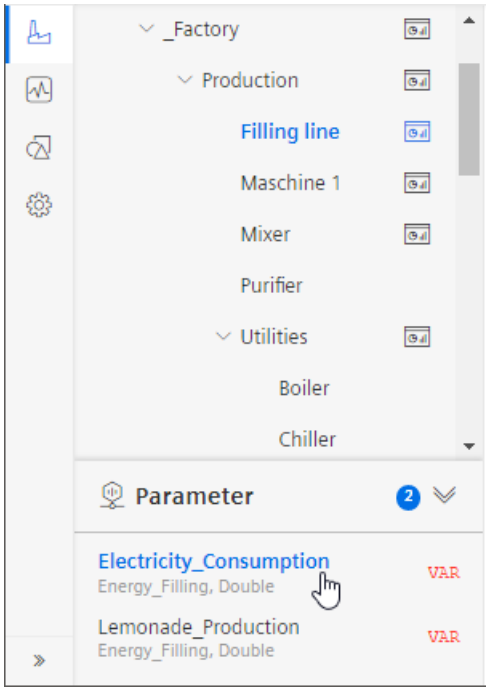
3. Select "Detail" in the drop-down menu.
   The preview of the current values is displayed.



4. To display a different period, use the navigation elements.
5. To edit the settings for the variable, click ··· in the preview and select "Edit".

Alternative procedure

1. Show the parameter list below the assets and click a parameter.



The graphical preview of the parameter values is displayed.

See also

Navigation in the app (Page 19)

4.3.4 Editing settings for variables

Requirement

You have opened a variable for editing in the parameter list.

Description

The properties of a variable can be defined.

- Unit
  You can either accept the transferred unit or specify your own unit.
- Acquisition category:
  Here you determine how the value is acquired and stored. The acquisition category is linked directly to an aggregation function. As soon as you use the variable in a widget, the respective aggregation function is automatically selected:
  - Process value (ProcessValue) => aggregation function: Average
  - Power value (Power) ⇒ aggregation function: Average
  - Consumption value (Energy) ⇒ aggregation function: Sum
  - Flow value (Flow) ⇒ aggregation function: Average
  - Quantity value (Amount) ⇒ aggregation function: Sum
  - Count value (Counter) ⇒ aggregation function: Counter
    When you select the acquisition category "Counter", you can define additional settings for each counter used.
    Additional information on the counting method of the individual counters can be found here: "Counter" acquisition category (Page 59)
  - Status value (State)
- "The value is aggregated" function
  If the value is not aggregated, the values are continuously (actual values) transferred to the platform when the value changes. The currently transferred value is valid until the next value is transferred to the platform. When the value is aggregated, the value is always valid for the last cycle, for example, 15 minutes.
  You can find additional information on the aggregation functions here: Aggregation functions (Page 62)

Note

Data gaps

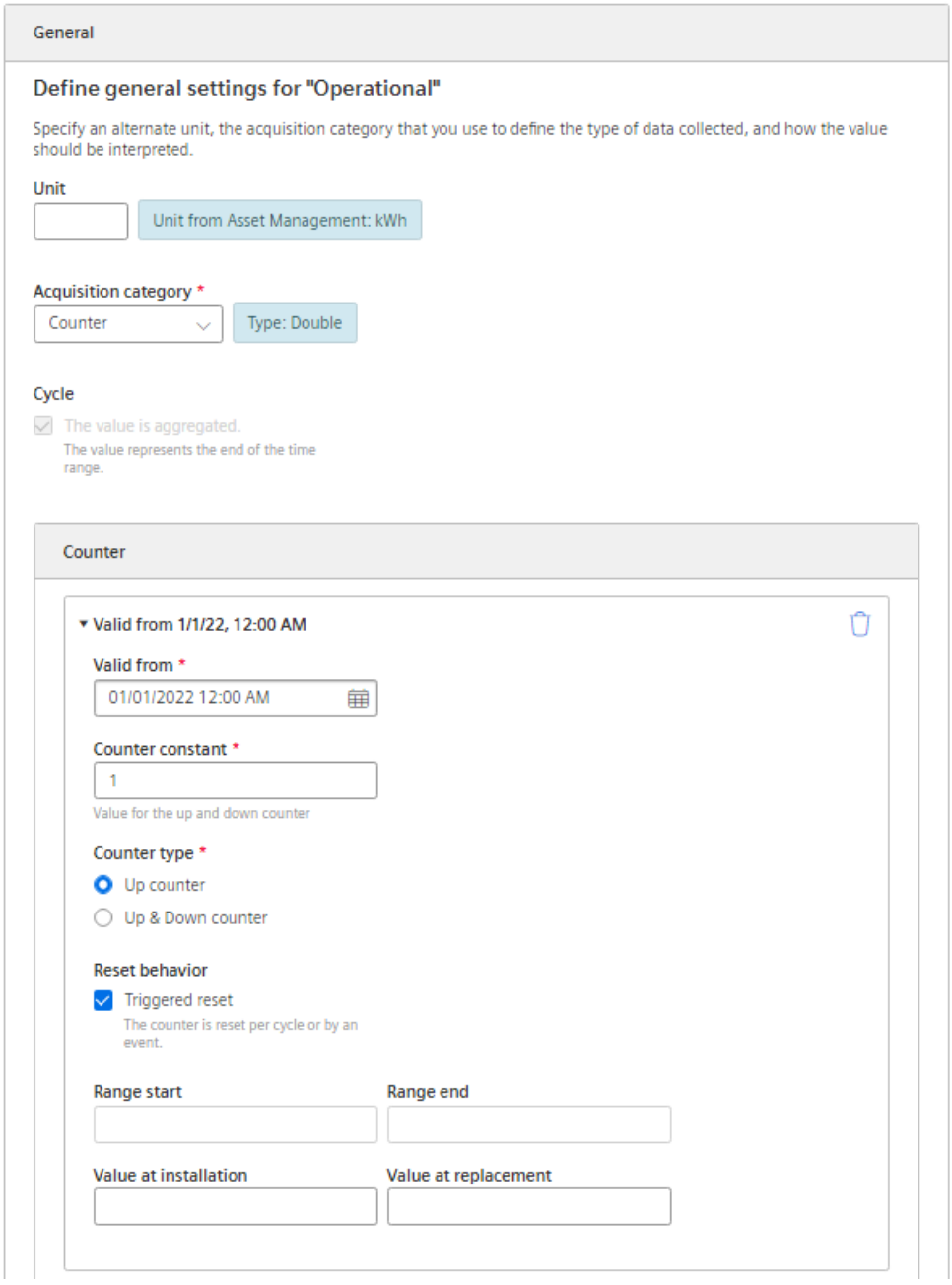
Data gaps occur, for example, when the connection to the network is interrupted. No data is transferred from the plant during the interruption.

When you have activated the "The value is aggregated" function and are using an acquisition category with the "Sum" aggregation function, data gaps will distort the final result.

Procedure

To extend the declaration of a variable, follow these steps:

1. In the parameter list, open a variable for editing.
2. Select the desired properties.
   In addition to the acquisition category, the data type of the variable is displayed.



Filtering variable values

If variables are assigned values that do not reflect reality, e.g. 0 (zero) in the event of a temporary connection failure, calculations and graphical representations are displayed in a distorted manner.

Enable filtering and specify a low and high limit. Values of the variables that are outside this range are not displayed and are not included in the calculation of KPIs.

Interpolation of variable values

If data points are missing in a time series of values, you can have them replaced.

Enable replacement and choose a strategy, e.g. interpolation.

4.3.5 Editing settings for KPI instances

Requirement

You have opened a KPI instance for editing in the parameter list.

Editing an automatically generated KPI

The settings of the automatically generated KPIs (energy media analysis, MVR) are displayed but cannot be edited in this view.

You can find information on activation of notifications in the section ""Activate notifications" for variables with numerical data type and KPI instances (Page 56)".

Editing a user-defined KPI

You can edit general settings and the formula of the KPI instance here.

You can find additional information on the settings in the section "KPI types (Page 35)".

You can find information on activation of notifications in the section ""Activate notifications" for variables with numerical data type and KPI instances (Page 56)".

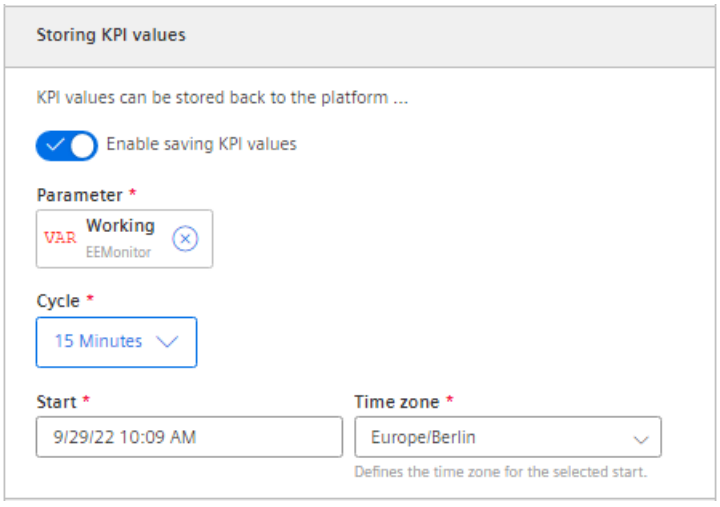
4.3.6 Saving the values of a KPI in a variable

The values of a KPI can be restored to a variable. The values are available for more calculations and visualizations even in other apps.

Saving KPI values

To save the values of a KPI in a variable, proceed as follows:

1. Open a KPI from the parameter list for editing.
2. Select the corresponding option in the "Saving KPI values" tab.



3. Select the variable in which the values are saved.
   - or -
   Create a new variable.
4. Select a cycle.
5. Select the start time at which saving should start.
6. To end saving of the KPI values, disable the option.

Creating a new variable for saving the KPI values

When you create a new variable, observe the following:

- The variable must receive a unique name that has not yet been used.
- The variable must be assigned to an aspect.
- The variable is created in Asset Management.
- Additional costs are incurred per variable. Note that aspects can be used multiple times.

4.3.7 "Activate notifications" for variables with numerical data type and KPI instances

Requirement

You have selected a variable in the parameter list and opened it for editing.

Description

For each variable, you can define high and low limits that trigger a notification when violated. This notification is displayed in the Notifier app and sent directly to the selected mobile device.

Note

SIMATIC Notifier

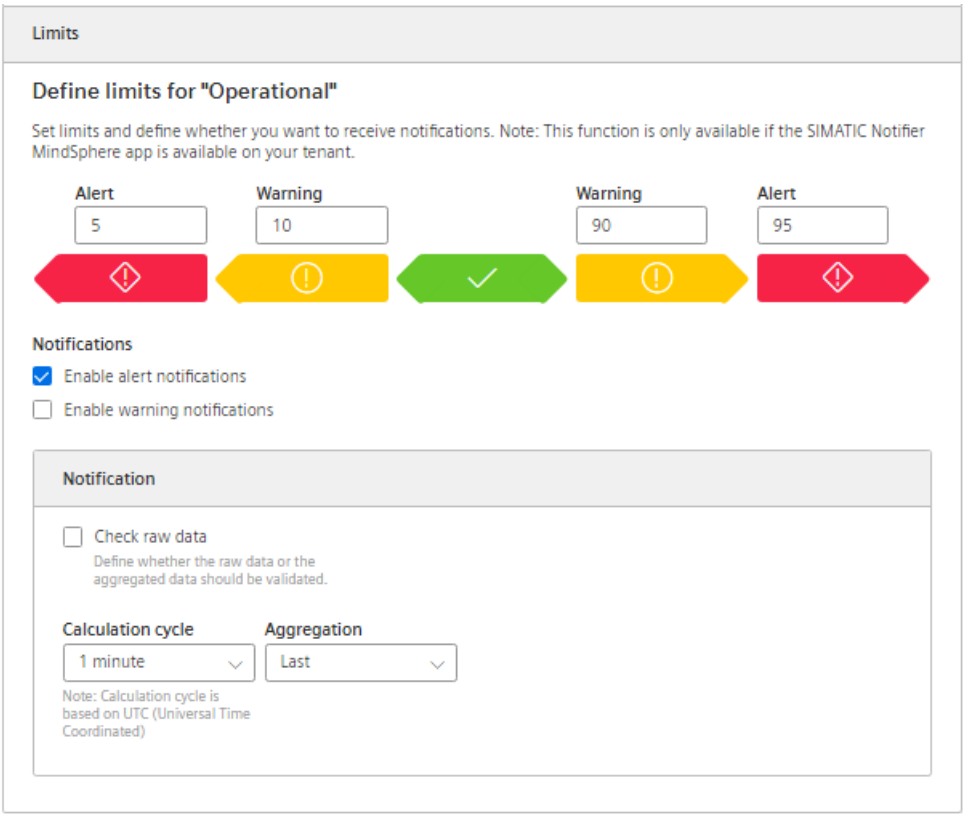
The SIMATIC Notifier must be installed and running so that you can use the "Activate notifications" function.

The limits defined for the variable are applied by default in the widget as soon as the variable is used. You can adapt the limits in the widget.

Procedure

To enable the "Activate notifications" function, proceed as follows:

1. In the parameter list, open a variable for editing.
2. Go to the area "Limits".



3. Enter the upper and lower values which trigger a warning and an alarm when violated.
4. Select the check box for corresponding notifications.

5. To apply raw data, select the "Validate raw data" check box.
   A fixed calculation cycle of 10 seconds is used.
6. When you use aggregated data, select the calculation cycle and the aggregation.
   The calculation cycle always starts at 00:00 UTC (Universal Time Coordinated), e.g. 00:00:00; 00:15:00; etc.
   The following aggregation functions are available: AUTOHOTSPOT.

4.3.8 "Activate notifications" for variables of the data type "Bool" and "String"

Description

For each variable of the "Bool" or "String" data type, you can define conditions that trigger a notification. This notification is displayed in the Notifier app and sent directly to the selected mobile device.

Note

Variables of the data type "Bool" or "String"

You can activate notifications for these variables.

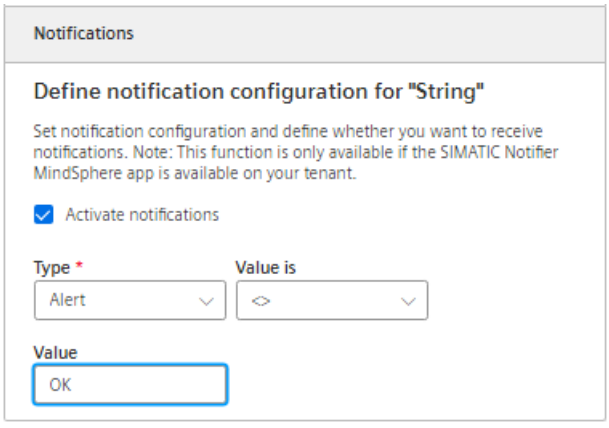
- You can only use a variable of the data type "String" as a parameter in a widget of the type "Value".
- You can use a variable of the data type "Bool" as a parameter in a widget or a KPI instance.

Limit values can be defined, but these limit values are not transferred to the widget.

Procedure

To enable the "Activate notifications" function, proceed as follows:

1. In the parameter list, open a variable of the data type "Bool" or "String" for editing.
2. Go to the area "Notifications".



3. Select the check box "Activate notifications".

4. Select a notification type:
   - Alert
   - Warning
5. Select "=" or "<>" as operator and enter a value:
   - For the data type "Bool": "True" or "False"
   - For the data type "String": Enter a value.
6. Click "Save".

Result

A green check mark appears in the parameter list next to the variable in the "Notifications activated" column.

4.3.9 "Counter" acquisition category

4.3.9.1 Define the acquisition category "Counter"

Requirement

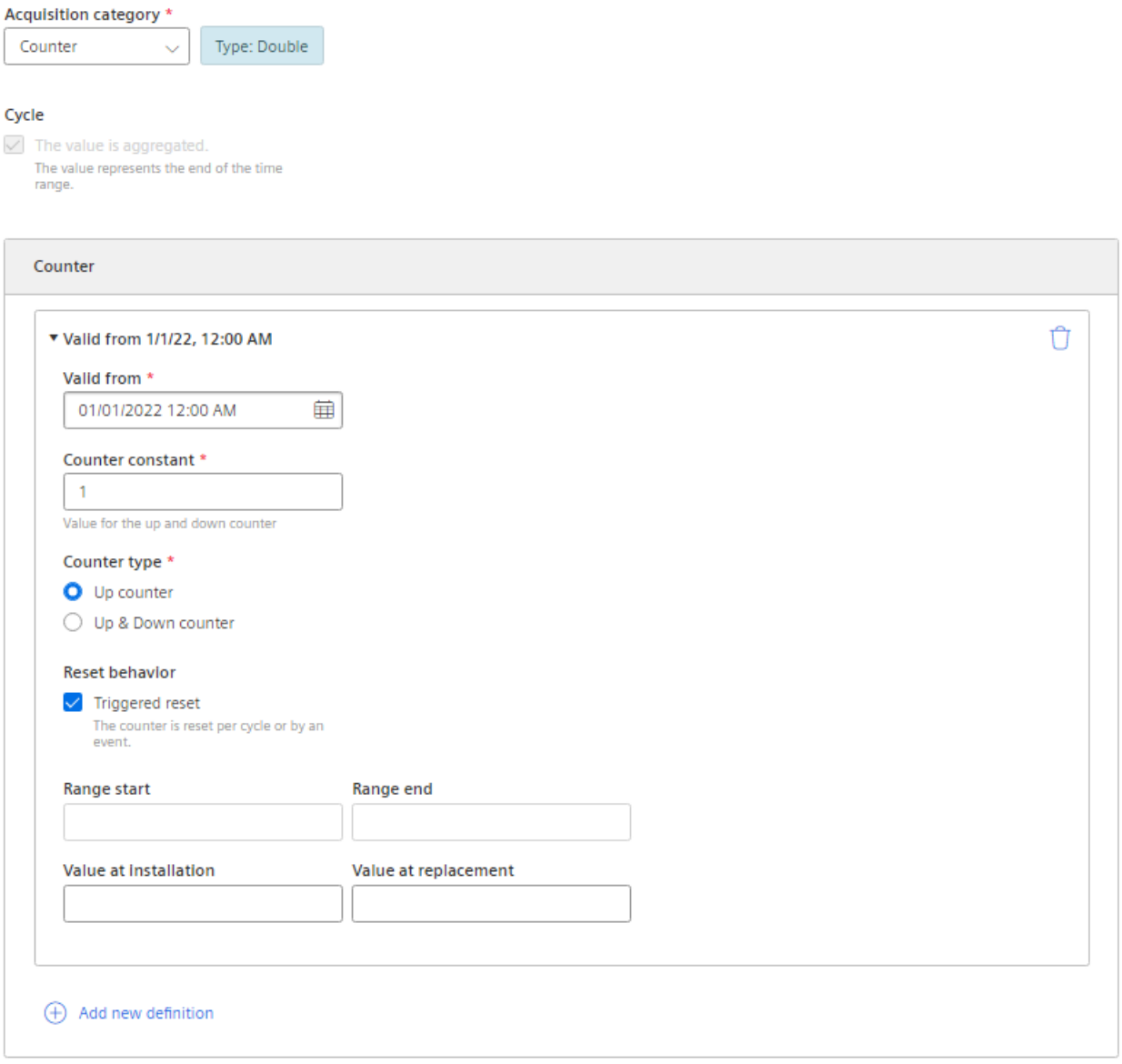
Note
Only with the Energy Manager and Performance Insight apps

This variable configuration is only required if you are working with the Energy Manager and Performance Insight apps.

You have opened a variable for editing.

You have selected the recording category "Counter" in the settings of a variable.

You have added a counter.



Description

You can define properties for each counter:

- Valid from
- Counter constant (value by which the counter is counted up or down, e.g. 1 kWh.)
- Counter type
  - Up counter = The counter can only count up. As soon as a subsequent counter value is less than the current one, it is treated as an overflow and the counter is restarted.
  - Up & Down counter = The counter can count up and down, e.g. a level counter.

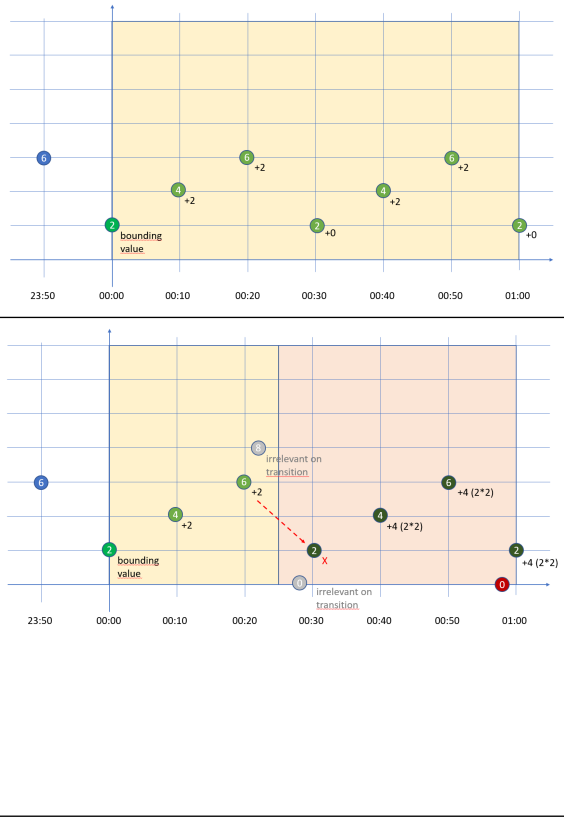
- Reset behavior (Only for an Up counter: You can specify whether the counter is reset daily or by an event, such as a defined overflow limit.)
- Start / End of the limit range
  Overflow limit. If you have not activated the reset behavior, the counter is automatically reset when it reaches the specified count limit.
- Value at installation
  You specify the actual value at which the counter is to start. (If the counter is not to start with the start value of the limit range.)
- Value at replacement of the counter

4.3.9.2 Counting method of the "Up" counter

Description

Only positive changes in value are recorded. The sum of the positive value changes between two points in time is output in each case. If the value remains the same between two points in time or is reduced, the value is not counted.

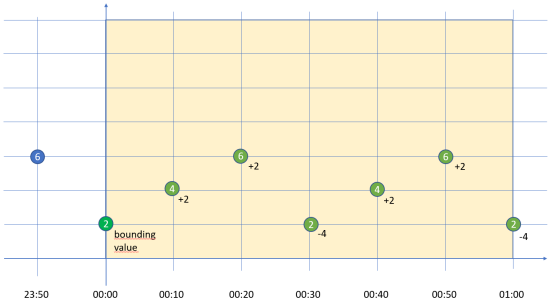
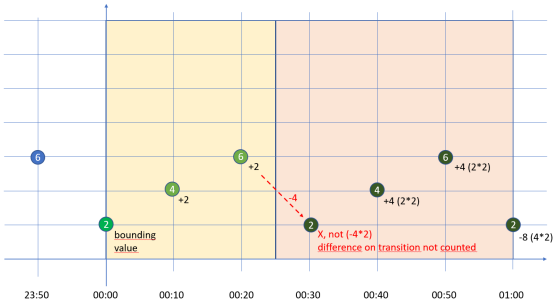
Depending on the settings you select for a counter, you will see different counter values as a result. By default, the "The value is aggregated" function is activated:

<table>
<tr><th>Settings</th><th>Explanation</th></tr>
<tr><td>Start and end of the limit range is not defined.
Result: + 2 + 2 + 0 + 2 + 2 + 0 = 8</td><td rowspan="2"> 
</td></tr>
<tr><td>When you change the counter, you can define different settings for each counter. This example shows the transition from one counter to the next:
<table>
<tr><td>Counter for the year 2018
00:00 - 00:25
Counter constant: 1
End of the limit range: 8
Result: + 2 + 2 = 4</td><td>Counter for the year 2019
00:25 - 01:00
Counter constant: 2
Start of the limit range: 0
Result: + 4 + 4 + 0 + 4 = 12</td></tr>
</table>
Final result: 4 + 12 = 16</td></tr>
</table>

4.3.9.3 "Up & Down" counting method of the counter

Description

Depending on the settings you select for a counter, you will see different counter values as a result. By default, the "The value is aggregated" function is activated. You cannot define any limit ranges for the "Up & Down" counter.

<table>
<tr><th>Settings</th><th>Explanation</th></tr>
<tr><td>Result: + 2 + 2 - 4 + 2 + 2 - 4 = 0</td><td> 
</td></tr>
<tr><td colspan="2">When you change the counter, you can define different settings for each counter. This example shows the transition from one counter to the next:
<table><tr><td>Counter for the year 2018
00:00 - 00:25
Counter constant: 1
Result: + 2 + 2 = 4</td><td>Counter for the year 2019
00:25 - 01:00
Counter constant: 2
Result: + 4 + 4 - 8 = 0</td></tr></table></td><td> 
</td></tr>
<tr><td colspan="2">Final result: 4 + 0 = 4</td></tr>
</table>

4.3.10 Aggregation functions

4.3.10.1 Description of aggregation functions

Description

The following aggregation options are available.

Aggregation types

- **Single value aggregations**
  A variable is aggregated by specifying the aggregation method and the calculation period. The result is a value that represents the values of the period for the respective aggregation.
  Calculation period: from[to], from exclusive, to inclusive
  Example: "I want the 'sum' of 'Variable X' from '2022 to 2023' to be calculated." => 1 value is returned that represents the summed values of the year.
- **Aggregation of multiple values**
  A single-value aggregation can be calculated multiple times for a specific period. The aggregation of multiple values is defined by the period and the aggregations of the individual values (consisting of calculation period and aggregation method). The result is multiple values where each value represents the values in this calculation period for the respective aggregation.
  Example: "I want the 'sum' of 'Variable X' to be calculated every day 'from 2022 to 2023'." => 365 values are returned, where each value represents the summed values of one day.
- **Precalculated aggregations**
  Aggregations can be scheduled to run continuously in the background. The other two aggregation types are calculated on request. This aggregation type enables calculation of aggregations on 'new-value-written'. That reduces the return time of the request and distributes the resource usage according to the written rate values, which prevents the peaks that occur with the other two aggregation types.
  A precalculated aggregation is defined using an aggregation and a desired execution cycle. The result is an additional sub-variable that stores the aggregation of each cycle.
  Example: "I want the 'sum' of 'Variable X' to be calculated 'every day'." => A new sub-variable is created in which a new value is stored every day that represents the summed values of the day.

Aggregation methods

Boolean values are interpreted in calculations as numeric values 0 and 1.

- **Sum**
  Returns the sum of the numeric values for the calculation period.
- **Count**
  Returns the number of values within the calculation period.
- **Average**
  Returns the arithmetic average of numeric values for the calculation period.
  All values are weighted the same. The result can be a floating-point number.
- **Min**
  Returns the lowest numeric value within the calculation period.
- **Max**
  Returns the highest numeric value within the calculation period.
- **First**
  Returns the first value within the calculation period.
- **Last**
  Returns the last value within the calculation period.

- **Counter**
  Returns the summed value changes of numeric values within the calculation period.
  With an up counter, only positive value changes are summed. Negative value changes are interpreted as a counter reset.
  In the case of a down counter, positive and negative value changes are summed.
  More precise settings can be made at the variable via the counter settings.
- **Step duration**
  Indicates how long the variable has a value and is thus not equal to 0 (NULL).
  Time that the variable actively supplies values.
- **Timer**
  Returns the time during which a value was not "false" (FALSE, NULL or empty string).
- **Time weighted average**
  Returns the time-weighted average of numeric values for the calculation period.
  The values are weighted differently, depending on how long they have been present. The longer a value was present, the more it is weighted.
- **Standard deviation**
  Returns the standard deviation of numeric values within the calculation period.
- **Variance**
  Returns the variance of numeric values within the calculation period.
- **ValueChanges**
  Indicates the updated value, if it has changed
- **Gantt**
  Indicates how long a value was valid, for example, how long a machine was in a certain state.
- **EnergyToPower**
  A consumption value is converted to power.
  This aggregation function can only be selected in combination with the acquisition category consumption value (Energy) and Counter.
- **PowerToEnergy**
  Power is converted to a consumption value.
  This aggregation function can only be selected in combination with the acquisition category power value (Power).
- **AmountToFlow**
  An amount value (per hour) is directly converted to a flow value.
  This aggregation function can only be selected in combination with the acquisition category amount value (Amount) and Counter.
- **FlowToAmount**
  A flow value (amount/h) is converted to a quantity value.
  The function calculates an estimated value for the upcoming period based on the current flow value.
  This aggregation function can only be selected in combination with the acquisition category flow value (Flow).

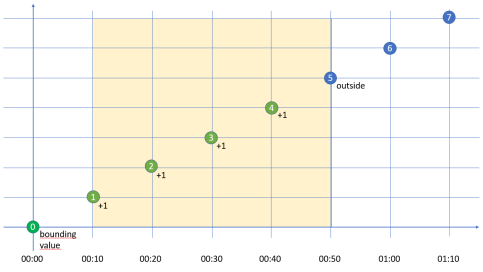
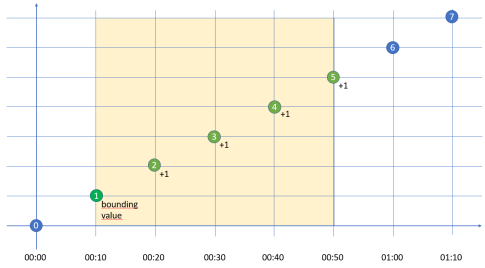
4.3.10.2 Aggregation functions in combination with the "The value is aggregated" function:

Description

For each variable and thus for each aggregation function, you can activate the "The value is aggregated" function:

"The value is aggregated" = not activated	"The value is aggregated" = activated
If the "The value is aggregated" function is not activated, actual values are transferred to the platform every 10 minutes, for example. The respective actual value is valid for 10 minutes, until the next actual value is transferred to the platform. If the time of the last reading operation is identical to the end of the specified time period, the last value is not read.	When the "The value is aggregated" function is activated, no actual values are transferred. Instead, the value that has already been calculated or processed in the last 10 minutes is transferred to the platform. Application example: One temperature measured value is recorded in the plant per minute, and an average value of the recorded values is then transferred to the platform every 10 minutes.
Result: Different results are calculated for the same time range, depending on the initial situation of how you want to collect data. Only the values marked in green are taken into account for the calculation of the result.	

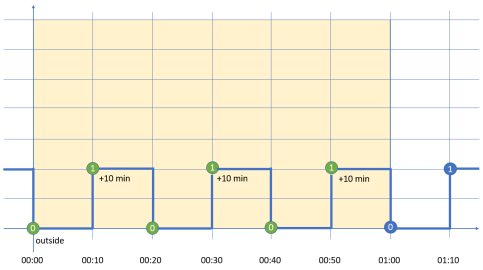
"Counter" aggregation function

"The value is aggregated" = not activated	"The value is aggregated" = activated
	
Calculation example: The calculation period is from 00:10 to 00:50. Result: 1 + 1 + 1 + 1 = 4	Calculation example: The calculation period is from 00:10 to 00:50. Result: 1 + 1 + 1 + 1 = 4

"Timer" aggregation function

The timer calculates the time period in which the variable was not "0". Unit = milliseconds.

For the timer, the "The value is aggregated" function is always = FALSE.

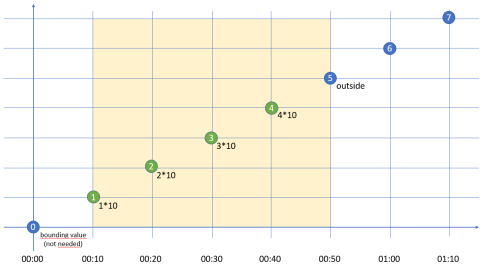
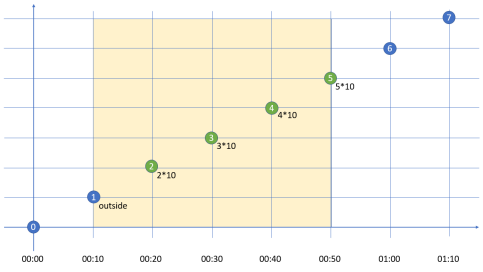


Calculation example:

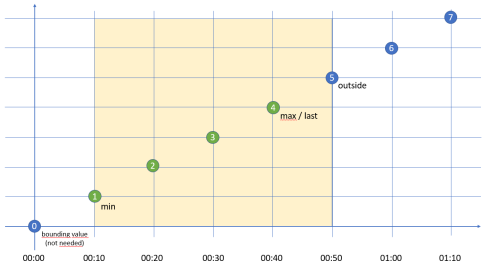
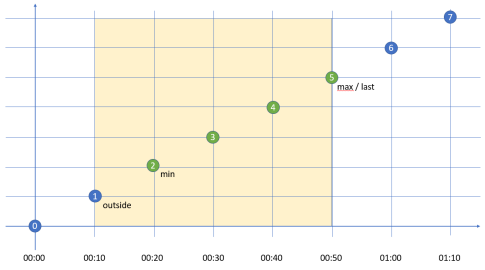
The calculation period is from 00:00 to 01:00.

Result: 10 min + 10 min + 10 min = 30 min => 30 * 60 * 1000 ms => 1,800,000 ms

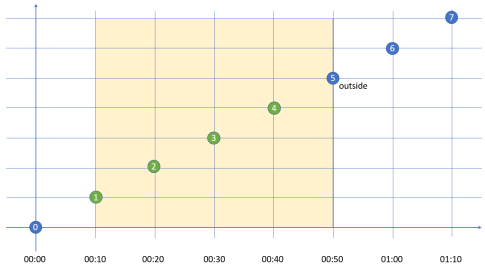
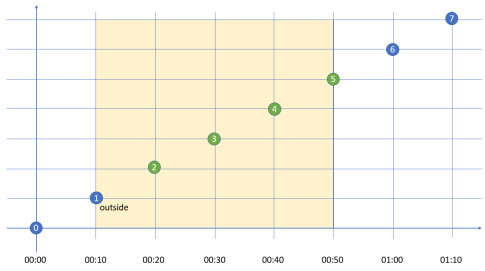
"Average" aggregation function

"The value is aggregated" = not activated	"The value is aggregated" = activated
	
Calculation example: The calculation period is from 00:10 to 00:50. (10 + 20 + 30 + 40) / 40 = 2.5 (average value across the calculation period)	Calculation example: The calculation period is from 00:10 to 00:50. (20 + 30 + 40 + 50) / 40 = 3.5 (average value across the calculation period)
The aggregation function determines the weighted average depending on the time interval (every 10 minutes). If the time interval changes within a time period, e.g. from 10 minutes to 12 minutes, the values with the time interval 10 minutes are first added together, and then divided by the number of read values. The values with the time interval 12 minutes are then added together, and divided by the number of values read. The weighted average is formed from the two results of the two time intervals (result1 + result2)/2=x.	

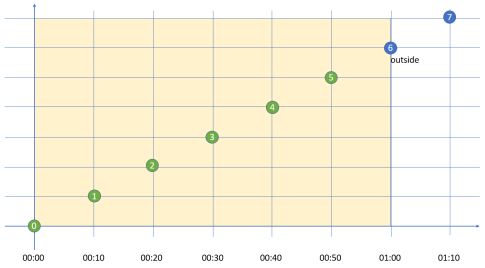
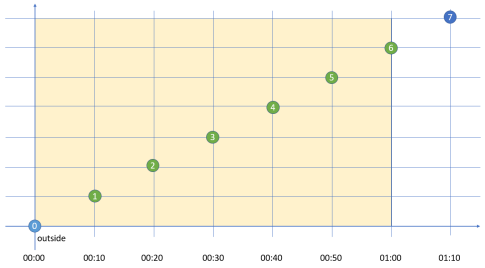
"Min", "Max" and "Last" aggregation functions

"The value is aggregated" = not activated	"The value is aggregated" = activated
	
Calculation example: The calculation period is from 00:10 to 00:50. Min: 1 Max: 4 Load: 4	Calculation example: The calculation period is from 00:10 to 00:50. Min: 2 Max: 5 Load: 5

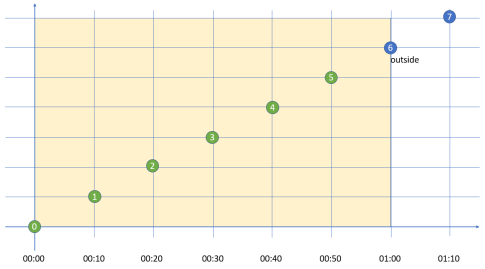
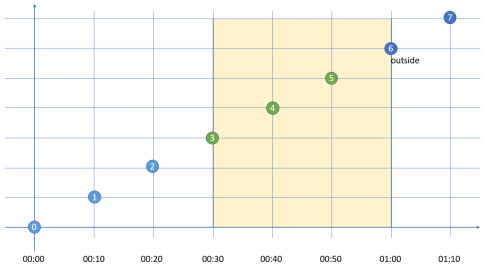
"Sum" aggregation function

"The value is aggregated" = not activated	"The value is aggregated" = activated
	
Calculation example: The calculation period is from 00:10 to 00:50. 1 + 2 + 3 + 4 = 10	Calculation example: The calculation period is from 00:10 to 00:50. 2 + 3 + 4 + 5 = 14

"AmountToFlow" aggregation function

"The value is aggregated" = not activated	"The value is aggregated" = activated
	
Calculation example: The calculation period is from 00:00 to 01:00. Sum: 0 + 1 + 2 + 3 + 4 + 5 = 15 AmountToFlow: Sum / time in hours = 15 / 1 = 15	Calculation example: The calculation period is from 00:00 to 01:00. Sum: 1 + 2 + 3 + 4 + 5 + 6 = 21 AmountToFlow: Sum / time in hours = 21 / 1 = 21

"EnergyToPower" aggregation function

"The value is aggregated" = not activated	"The value is aggregated" = activated
	
Calculation example: The calculation period is from 00:00 to 01:00. Sum: 0 + 1 + 2 + 3 + 4 + 5 = 15 AmountToFlow: Sum / time in hours = 15 / 1 = 15	Calculation example: The calculation period is from 00:30 to 01:00. Sum: 3 + 4 + 5 = 12 AmountToFlow: Sum / time in hours = 12 / 0.5 = 24

Example of process tags of BOOL data type

This example only applies when the "The value is aggregated" function is not activated:

- Only the values = "1" are added.
- Time intervals are only recorded when the new value = "1" (Timer).
- One value is read every 10 minutes between 10:00 a.m. and 11:00 a.m., i.e. six in total. One value is read every 12 minutes between 11:00 a.m. and 12:00 noon, i.e. five in total. Because the last reading operation takes place at 12:00 noon and the evaluation period also ends at 12:00 noon, the last value is not read. To evaluate the last value at 12:00 noon, you must set the end of the evaluation period to at least 12:01 p.m.

Time	Sum (BOOL)	INT	Timer (BOOL)	In minutes
10:00	1	1	1	+ 10
10:10	1	2	1	+ 10
10:20	1	3	1	+ 10
10:30	1	4	1	+ 10
10:40	1	1	1	+ 10
10:50	1	2	1	+ 10
11:00	0	0	0	
11:12	1	3	1	+ 12
11:24	1	4	1	+ 12
11:36	1	5	1	+ 12
11:48	1	2	1	+ 12
12:00	1	0	1	+ 12
Result	10	27		108 (1 h 48 min)
Aggregation function	Sum	Sum	Timer	Timer

Evaluation:

- The "Sum" aggregation function returns the result = 10
  All values = "1" between 10:00 a.m. and 11:48 a.m. are added.
- The "Timer" aggregation function returns the result = 108 minutes (1 h 48 min)
  The sum of all time intervals with the state "1" is recorded. The value "1" is read six times between 10:00 and 10:50, with 10-minute intervals between each read. This results in a sum of 60 minutes. No value is read at 11:00. The value "1" is read four times between 11:12 and 12:00. The time interval is 12 minutes each. This results in a sum of 48 minutes. The total is a sum of 108 minutes or 1 hour 48 minutes or 6,480,000 milliseconds.

4.4 Managing energy data

4.4.1 Overview of the energy media analysis

Description

You use the energy media analysis to manage and calculate energy data, such as power and gas from the machines and plants. In the configuration, you create all required energy media and can then define for each asset which energy data it requires. Using the stored contract information, you can then convert the consumption of the individual energy media directly into the resulting costs and CO_2 consumption.

The energy data is displayed transparently on automatically generated dashboards.

Requirement

To visualize and calculate the data from the plant, such as production figures, machine operating times, or water consumption, using KPIs, these figures must be transferred from the plant to the platform via the Asset Manager. The data structure of your plant is then automatically displayed in the app.

Configuring the energy media analysis

The energy media analysis is made up of several steps:

1. You edit existing energy media or create new ones.
   You can find additional information here: Creating energy media (Page 71)
2. You define for each asset which of the created energy media are required.
   You can find additional information here: Defining energy media for an asset (Page 72)
3. You define prices and other contract information, such as CO_2 consumption, for the desired energy media.
   You can find additional information here: Defining contract information for energy media (Page 75)
4. You analyze the energy data in the automatically generated dashboards.
   You can find additional information here: Displaying the energy media analysis (Page 79)

4.4.2 Configuring the energy media analysis

4.4.2.1 Creating energy media

Description

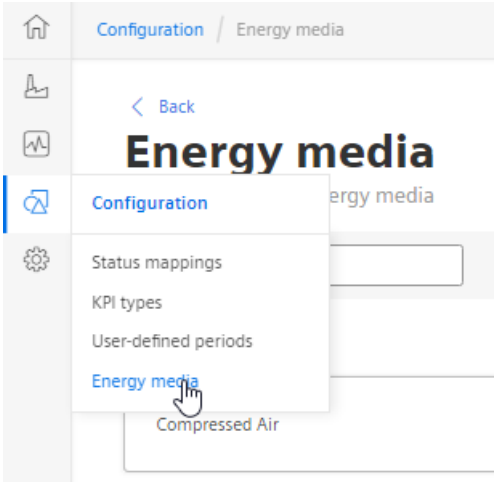
Some energy media are already supplied along with the SIMATIC Energy Manager app. You can also create additional energy media for each Tenant in the configuration or change existing energy media.

An energy medium that is used cannot be deleted.

Procedure

To create an energy medium, follow these steps:

1. Open the "Configuration" > "Energy media".



2. Click "Create new energy medium".

3. Assign a unique name and a description.
4. Assign a color to each energy medium.

Result

All energy media you have created are displayed in the list:

4.4.2.2 Defining energy media for an asset

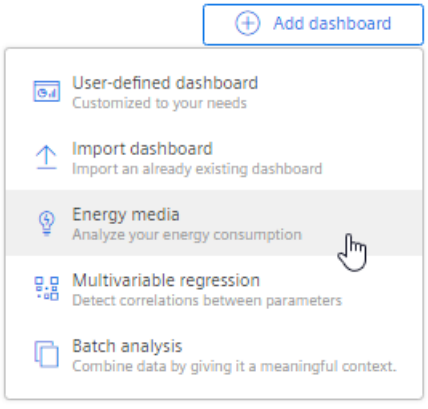
Description

For each asset, define which energy media is assigned to each. You assign variables to the energy media. You can also assign a reference value to the energy medium, for example, so that you can create a relationship between production quantities and energy consumption.

Procedure

To define energy media, follow these steps:

1. Select an asset in My Plant. The overview of the dashboards for the asset is displayed.
2. Click "Add dashboard" and select "Energy media".



3. Click "New row" to specify an energy medium.

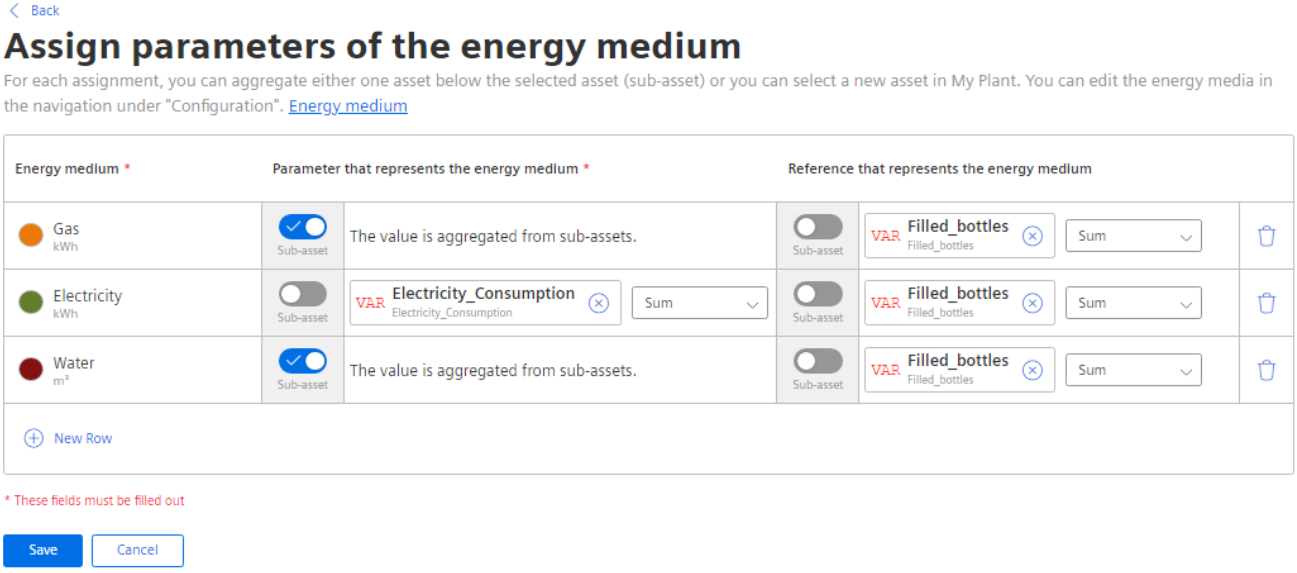
4. Assign a parameter to each energy medium. You can assign either an individual parameter that represents the respective energy medium or you can enable the "Sub-asset" button.

Note

Sub-asset

Enable the "Sub-asset" button when you have selected an energy medium in a higher-level asset of My Plant and want to show, for example, the energy consumption not only with the value of a single variable but the entire energy consumption of all lower-level assets.

5. In addition, you can also assign a reference value to each energy medium/parameter pair:

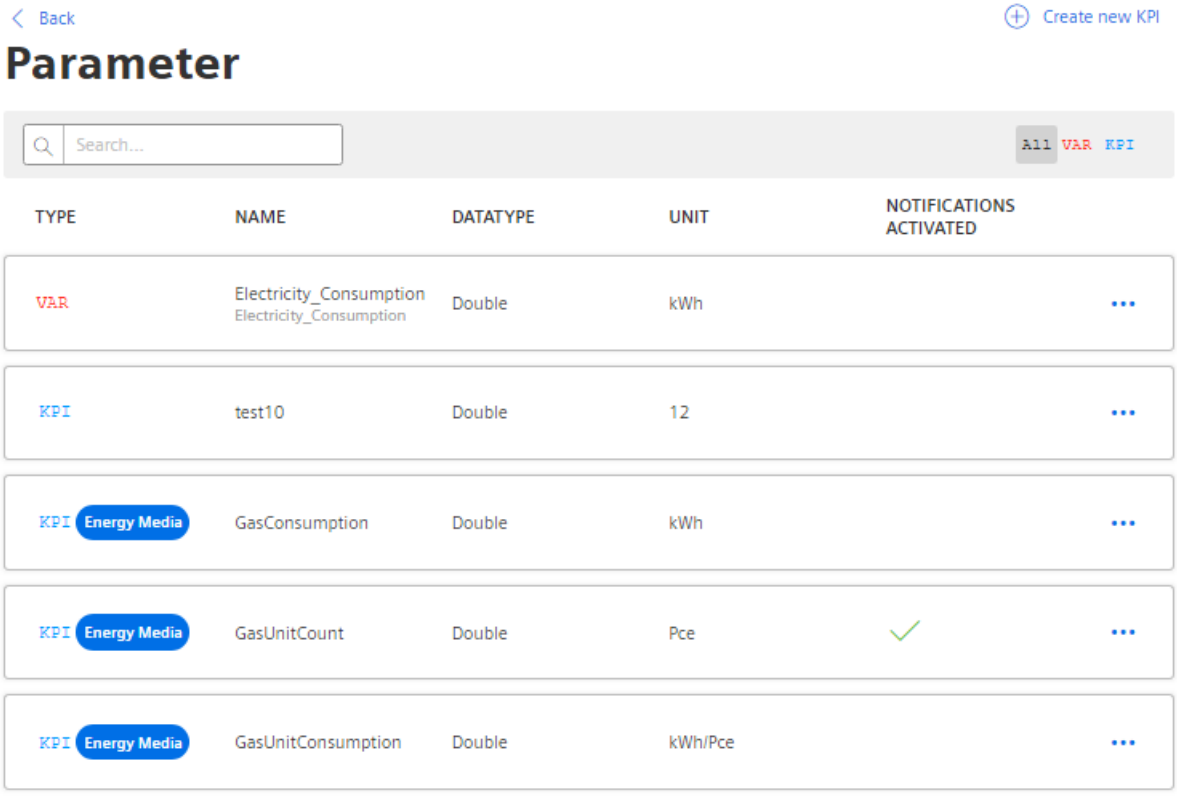


By assigning a reference, you define the energy medium more precisely. You can define, for example, that an asset consumes electricity. To do so, you assign the variable for electricity consumption "Electricity_Consumption" to the energy medium "Electricity" on the asset. You can also assign the variable for bottling "Filled_bottles" as a reference, for example, and calculate how much electricity was consumed per filled bottle (UnitConsumption = energy consumption per unit).

6. Click "Save".
You switch to the dashboard overview.

Result

By assigning parameters that represent an energy medium and references (xxxUnitxxx), the required KPI instances for energy media analysis are automatically created in the parameter list.



Clear all energy assignments for an asset

To delete all energy assignments for an asset, follow theses steps:

1. Display an energy media dashboard.
2. Click ⋯ and select "Edit energy media assignments".
   The list of assigned energy media is displayed.
3. Click "Delete".
4. Confirm that you want to delete all assignments.
   No energy media is assigned to the asset.
   The automatically generated dashboard is deleted.

4.4.2.3 Defining contract information for energy media

Description

You can store the following contract information for each energy medium:

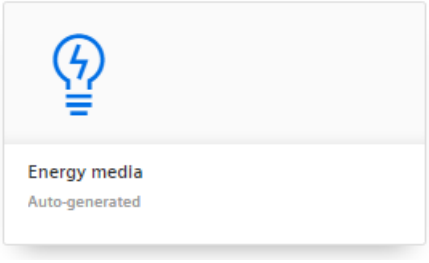
- Contract valid from
- Currency
- Costs
- CO_2 equivalent

We recommend defining the contract information per energy medium directly on the top-level asset. This ensures that all contract information for a new energy medium as well as all changes are transferred to the lower-level assets.

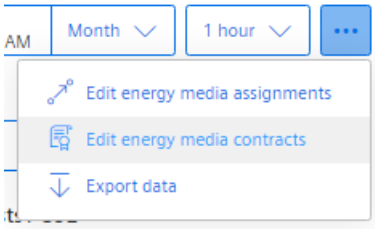
Procedure

To define contract information, follow these steps:

1. Go to My Plant and select an asset. The tiles of automatically generated and user-defined dashboards for this asset are displayed.
2. Select the energy media dashboard.



3. In the dashboard view, click ⋯.
4. From the drop-down menu, select "Edit energy media contract information".



The energy media list with the created contract information is displayed.

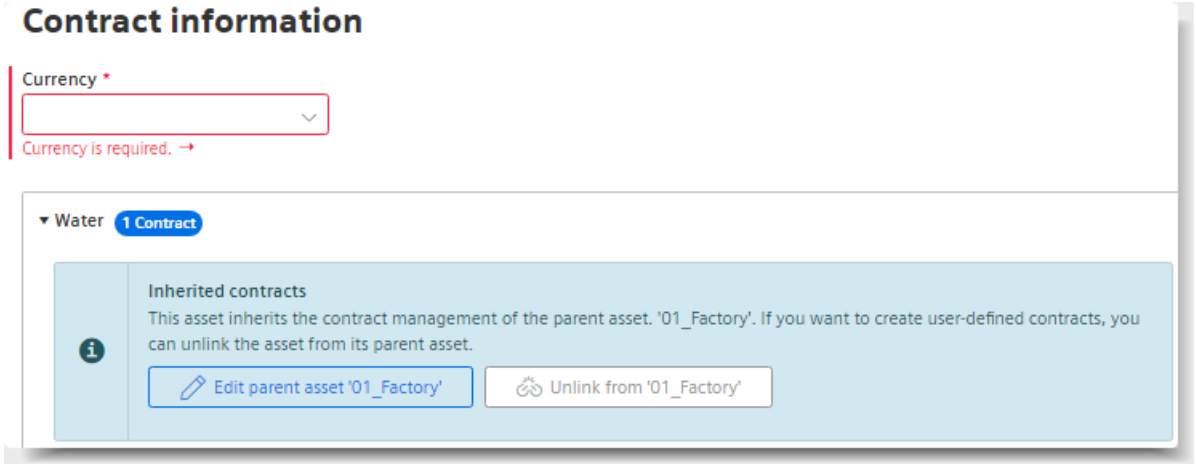
5. Click the medium you want to edit.

Note

Selecting currency

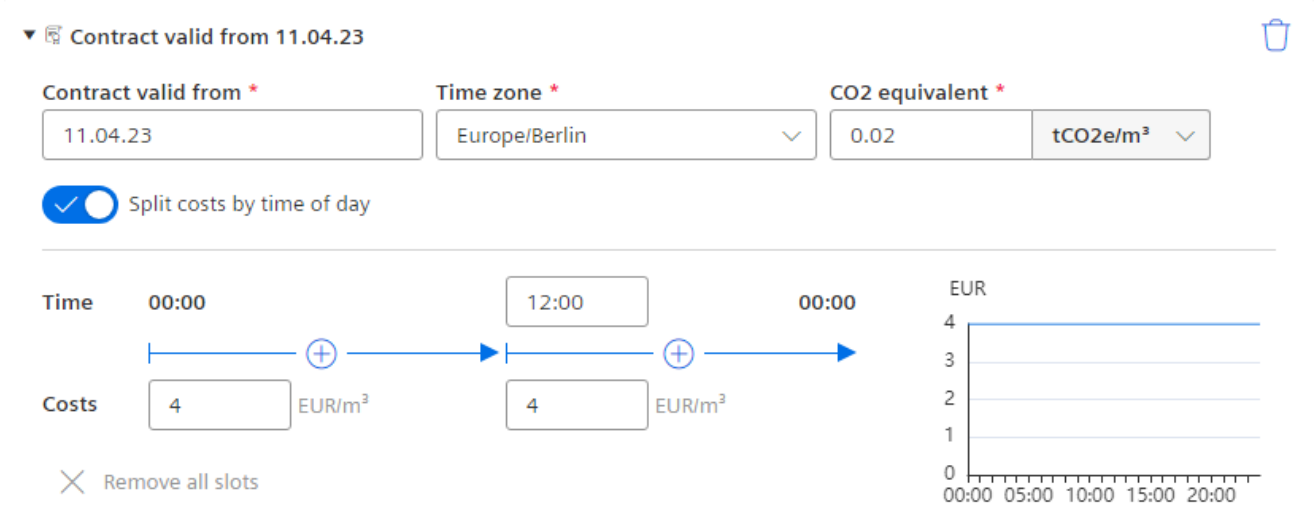
The currency is defined uniformly for all contracts in the contract definition.

6. If contract information is already available from a parent asset, it can be applied.



   - You can remove the link and create your own contract information.
   - You can jump to the parent asset and adapt the contract information for it.

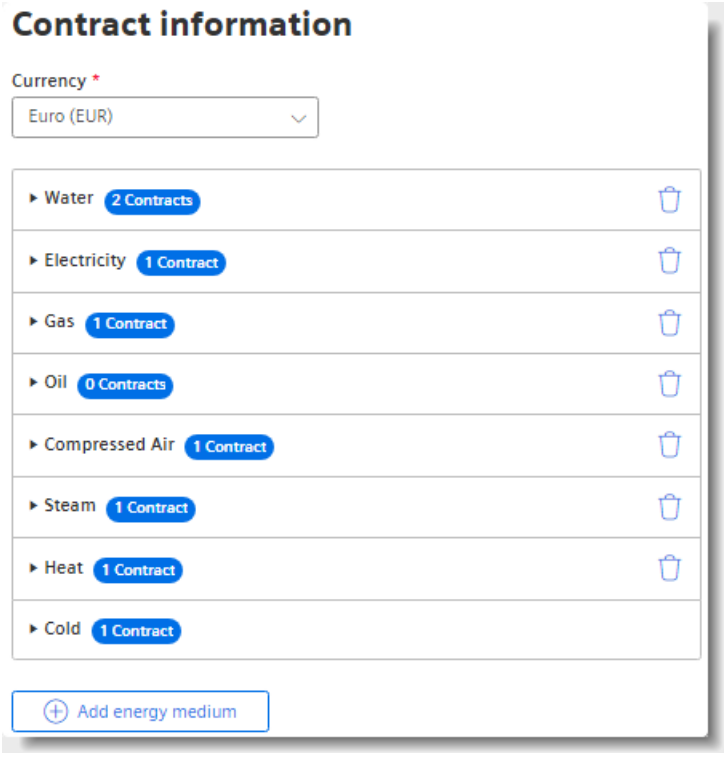
7. To specify costs by the hour during the course of the day, enable the "Split costs per time of day" option.



8. To insert a period, click ⊕.
9. Specify the start time and cost for each period.

Result

The list of energy media is displayed.



4.4.2.4 Deleting contract information for energy media

Description

You can delete created contract information again.

Procedure

To delete contract information, follow these steps:

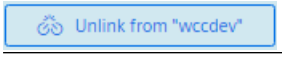
1. Open an energy media dashboard.
2. In the dashboard view, click ⋯.

3. From the drop-down menu, select "Edit energy media contract information". The energy media list with the created contract information is displayed.
4. Click the icon next to the entry that you want to delete.

Note

Energy medium is inherited from parent asset

When the energy medium is inherited from a parent asset, you cannot delete it directly. You must first undo the connection to the parent asset by clicking "Unlink from ...".



Result

The selected contract information for an energy medium is deleted.

4.4.2.5 Delete energy medium

You can delete an energy medium that you no longer use.

Procedure

To delete an unused energy medium, follow these steps:

1. Display the list of energy media.
   More information: Creating energy media (Page 71).
2. Select an energy medium.
3. Click ... .
4. Select "Delete".

Result

The energy medium is no longer available.

Operation 5

5.1 Displaying the energy media analysis

Description

The energy media analysis is automatically displayed in the energy media dashboard.

As soon as you have assigned a reference value to an energy medium, you will not only see the total for consumption, costs and CO_2 consumption but also the amount per unit, for example, per filled bottle.

Note

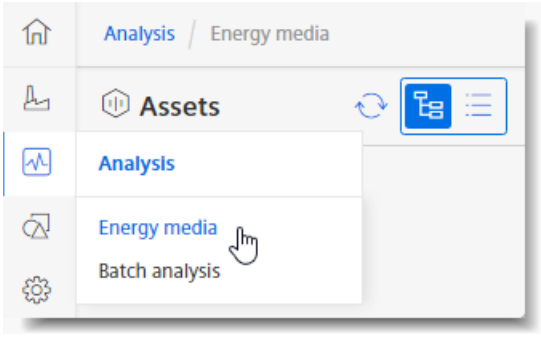
Automatic update

If the selected period for the dashboard or one of the widgets is in the future, the dashboard automatically updates every 30 seconds.

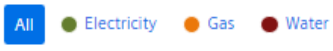
Procedure

To display the energy media analysis, follow these steps:

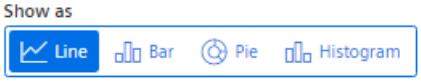
1. Go to "Analysis" and select "Energy media" in the navigation bar.



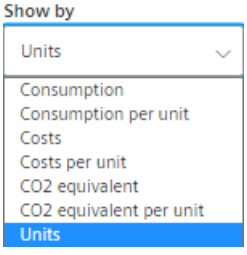
2. Select an ass ich the analysis is displayed.
   By means of , you can switch the display of the asset structure between the tree and list view.
   The energy media dashboard is displayed.
3. Have the information displayed for all or for each individual energy medium:



   – Have the data displayed as a line, bar, pie chart or histogram.

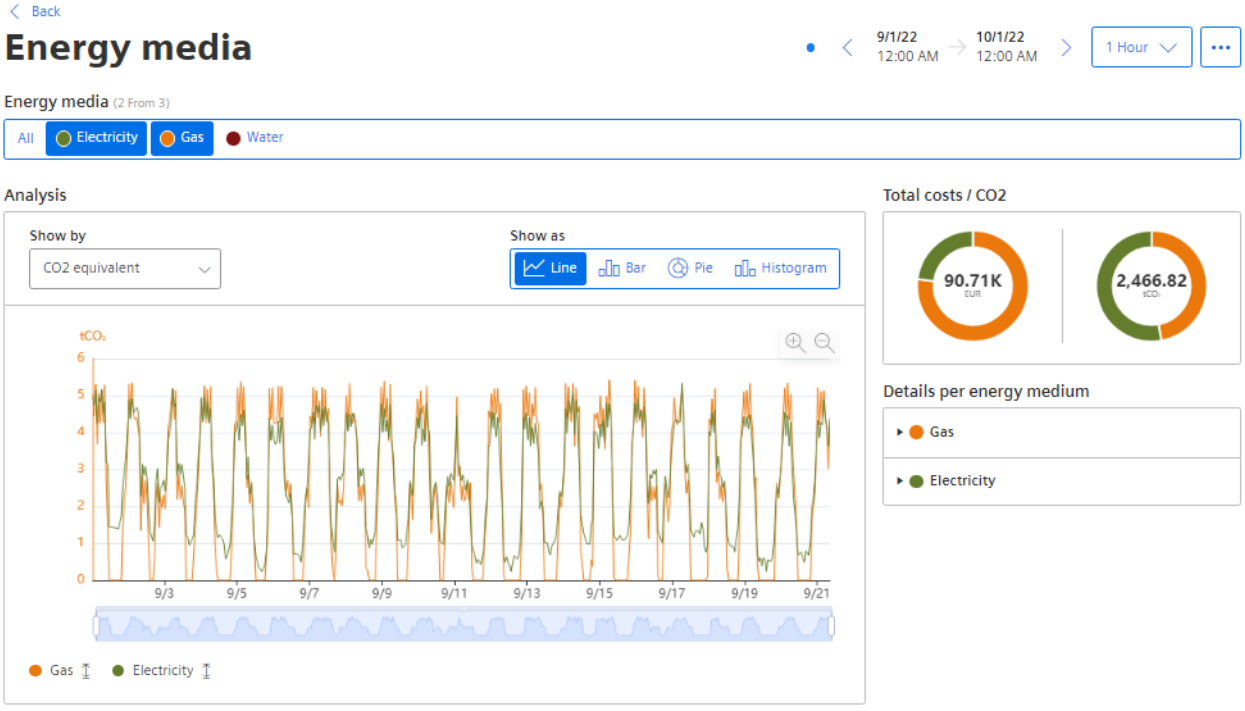


   – Select the criteria from the drop-down menu: Total consumption of the individual energy medium, Consumption per unit, Total costs, Costs per unit, Total CO_2 equivalent, CO_2 equivalent per unit, Units.



Result

The energy media analysis is displayed.



5.2 Configuring multivariable regression

5.2.1 Introduction to multivariable regression

Description

Multivariable regression puts a parameter (KPI, variable) in the context of other parameters and maps it as a linear regression model. This means the value of the output parameter can be determined via the input parameters and the regression model. (model result)

The energy consumption of a plant is influenced by certain factors such as ambient temperature, quantity produced and quantity filled. When the regression model and the input variables are known, you can determine the theoretical energy consumption.

In addition to the model, parameters are exported that determine the quality of the model. If an input quantity is used that has no relation to the output dimension, the correlation coefficient is 0. This means that the model is not trustworthy.

Different models can be calculated and saved for each asset and parameter. The saved models are available to the user in an automatically generated MVR dashboard. Here, the result of the model is compared with the actual value. To be able to detect the deviation, the

deviation and the cumulative deviation are also displayed in addition to the model result and the actual measured values.

After the KPIs, the model result and the deviation have been created for each model, a limit can be defined by means of a standard function. The limit value determines when the user will receive a notification, for example, from the Notifier.

You can create multiple models for each output parameter.

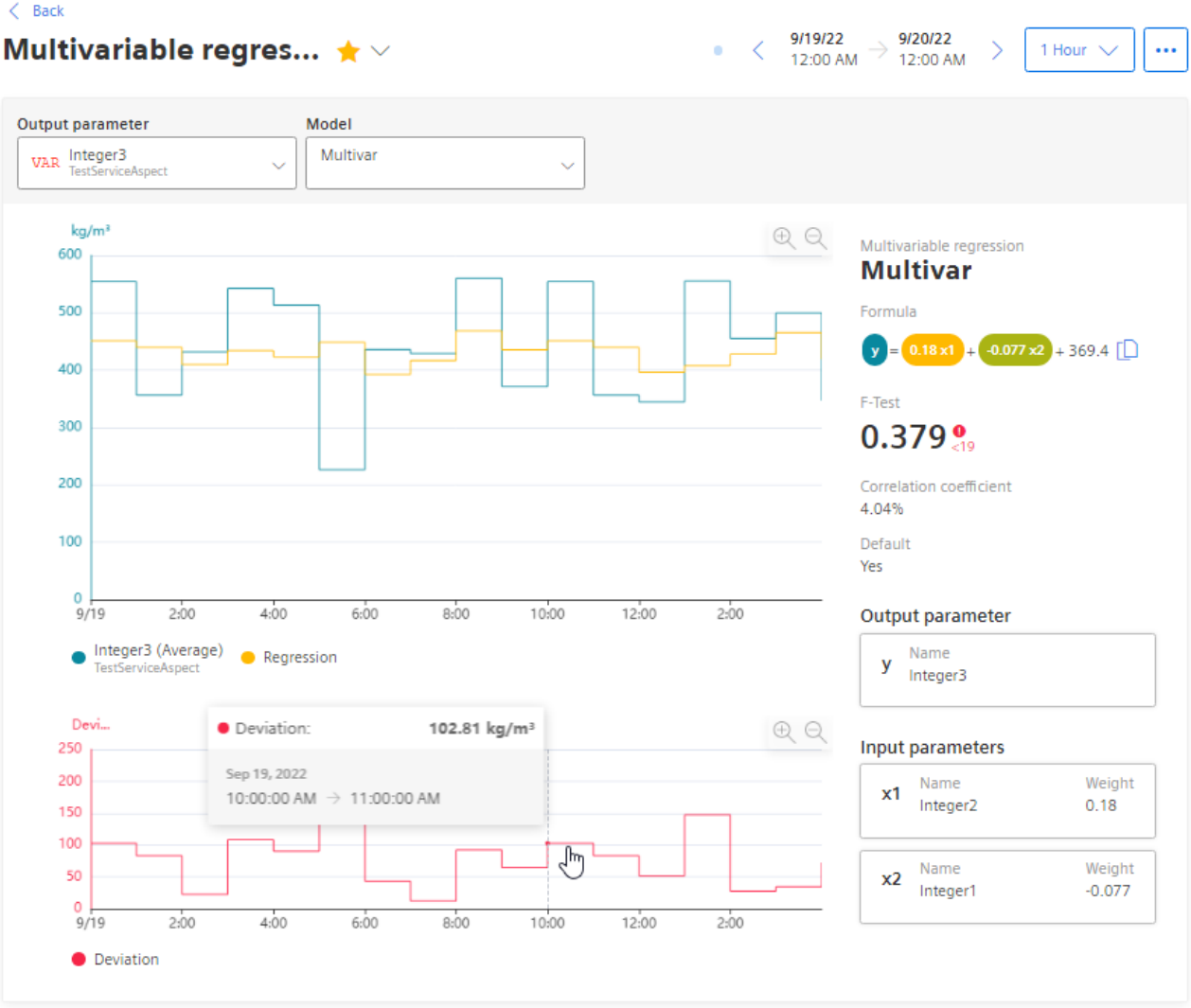
5.2.2 List of models for multivariable regression

An output parameter can be described by multiple, different models. For each output parameter, one model is selected as "Standard". The standard model is displayed when you open the MVR dashboard.

Displaying list of models

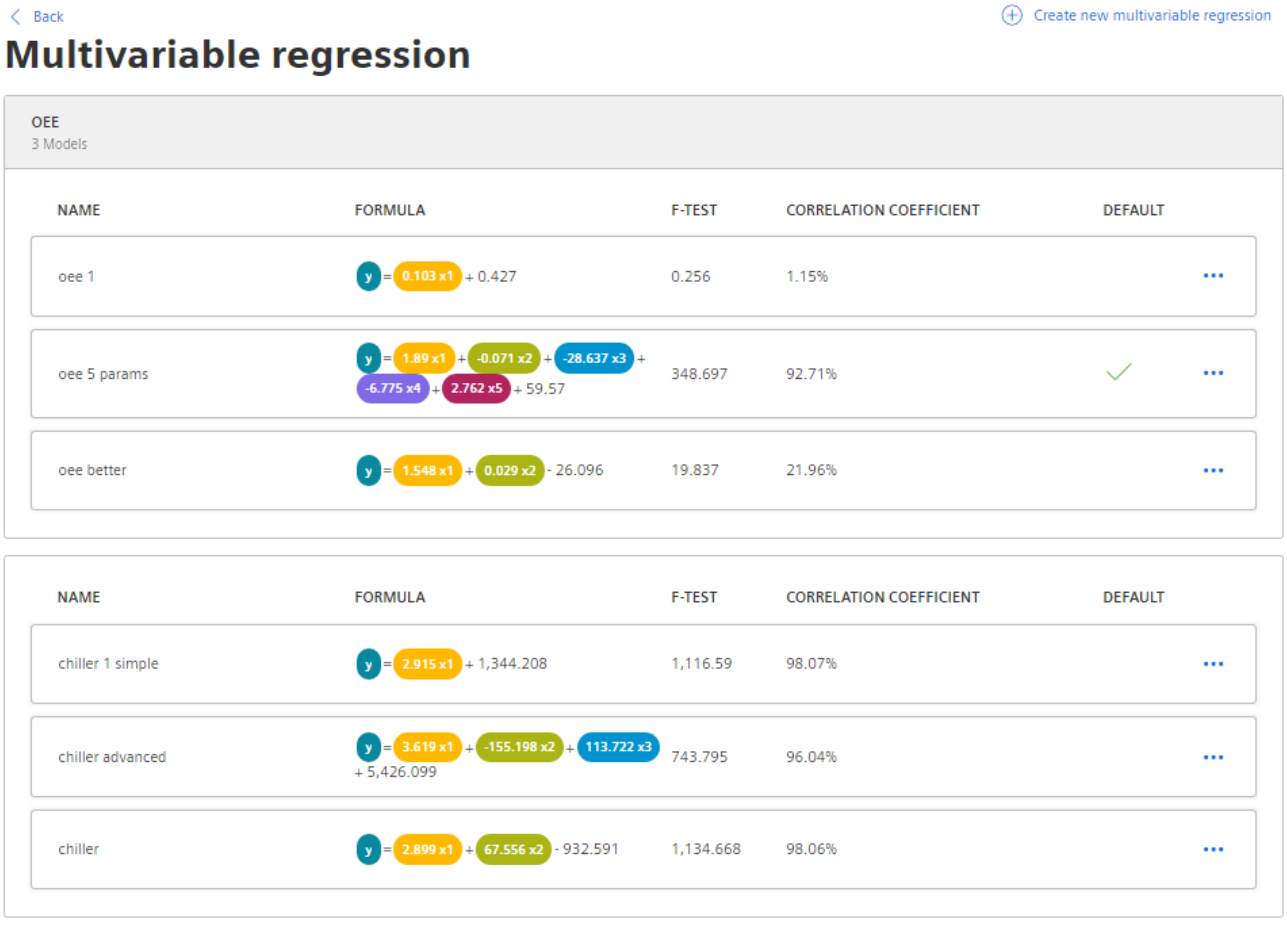
To display the models of the multivariable regression, proceed as follows:

1. Select an asset in My Plant.
   The overview of the dashboards for the asset is displayed. If models have already been created, an MVR dashboard is shown in the overview.
2. Select the MVR dashboard. The standard model is displayed on the dashboard.



3. To display the list of all created models, click ... and select "Multivariable regression list".

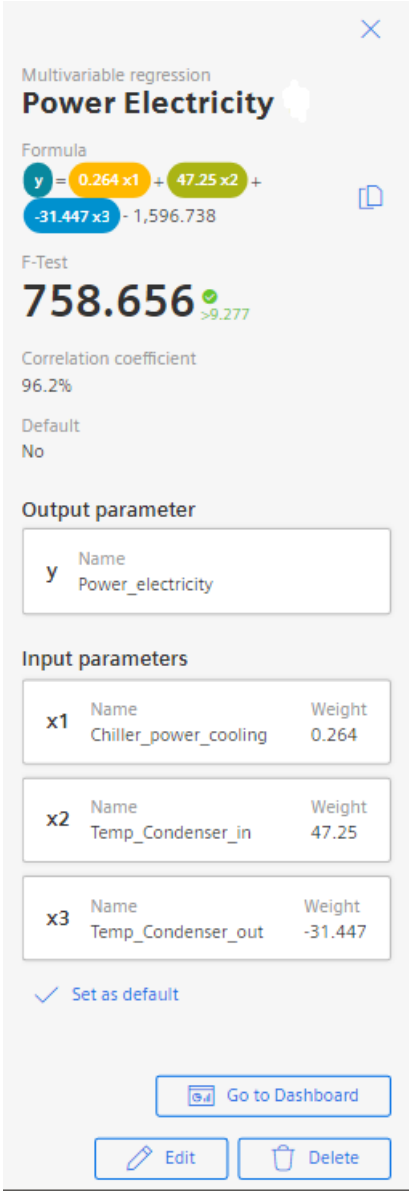
4. The overview of models available at the asset is displayed.



The standard model is marked with a green check mark.

5. To create a new model, click ⊕ "Create new multivariable regression".
6. To display the MVR dashboard, click ... and select "Go to dashboard".

7. To edit an existing model, click ... and select "Edit" .
8. To show details on a model, select the model.
   Details are displayed in the information panel on the right.



5.2.3 Creating a model

Description

As soon as you have created a model, an MVR dashboard is automatically created for the asset. You can create multiple models each for different input parameters.

The available models are grouped and visualized by parameter in this dashboard.

Note

Same time stamp required for variables

All variables in use must have synchronous time stamps for the values. The same type of aggregation must be selected for each variable to ensure synchronicity of the time stamps.

Note

Only use parameters with numerical data types

Multivariable regression is expressed through a mathematical formula. This means only variables with numerical values (Int32, Double, etc.) are permitted as parameters.

A parameter of String type can be additionally selected, for example, to designate production sections in the visualization by a descriptive name. Only the aggregation "Last" type is available for parameters of String type.

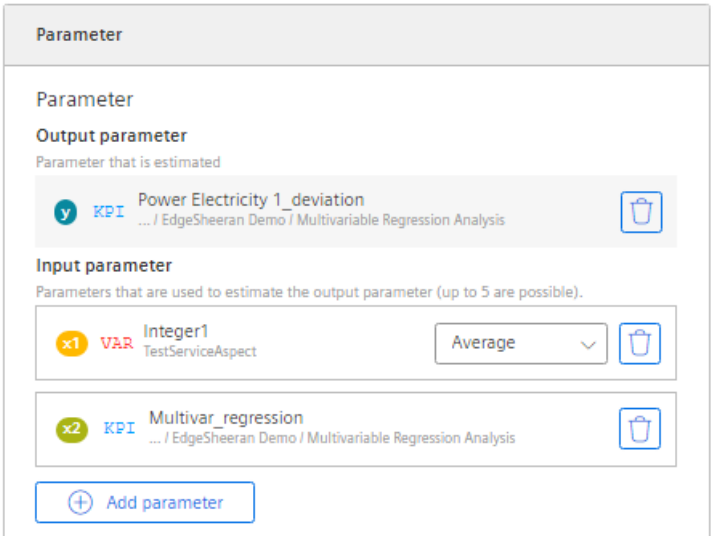
Procedure

To create a model, follow these steps:

1. Select an asset in My Plant. The overview of the dashboards for the asset is displayed.
2. Click "Add dashboard". in the overview view of the asset.

3. Select "Multivariable regression".
   The "Add multivariable regression" view is displayed.
4. Give the model a descriptive name.
   Based on the name, you later select the model for visualization from the existing models on the MVR dashboard.
5. Optionally enter a description.

6. Select the output parameter.
   This is the parameter whose dependency is represented by the values of the input parameters.
   The output parameter can be a variable or a KPI.



7. Select the input parameters.
   You can select up to 5 input parameters. These are the parameters for which you want to show how they influence the value of the output parameter.

Note

No formula and no model without values

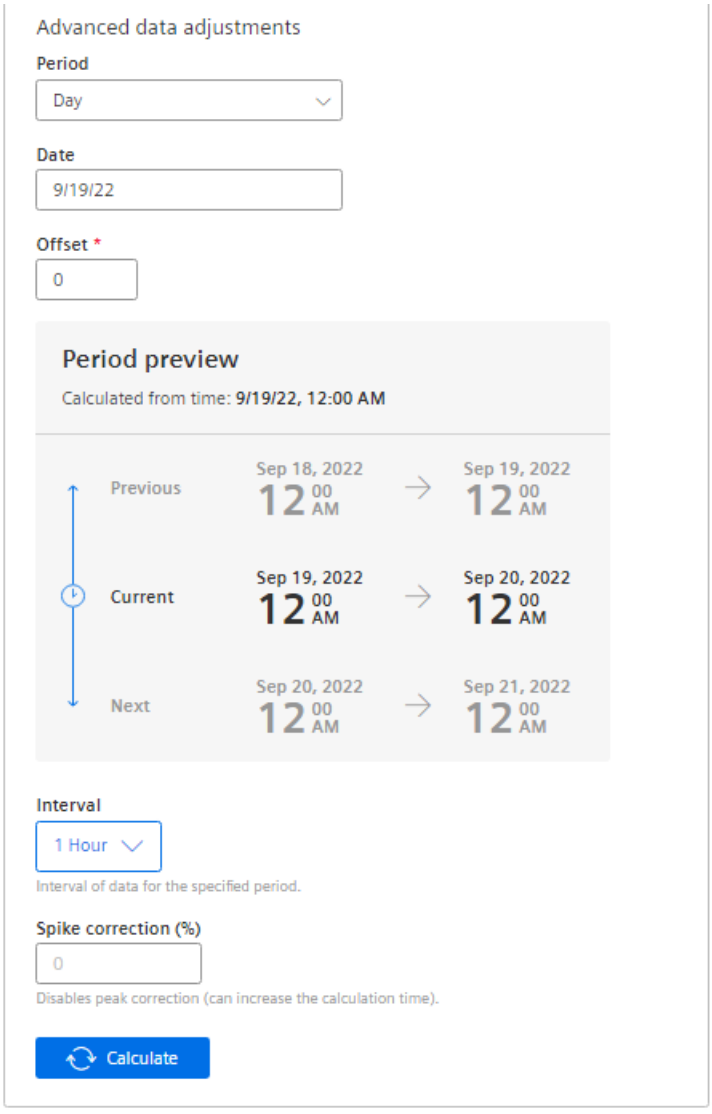
If no data is available for the selected analysis period, no formula can be calculated. You cannot save the model without a formula.

A warning shows the parameter for which there is no data.

Change the calculation period or select other parameters.

8. Select a type of aggregation for each variable.
   The time stamps of the aggregated values are to be identical.

9. Define the calculation period.



The calculation period is applied as the default in the visualization. The user can modify the calculation period on the dashboard.

10. Select the interval at which the data is acquired.
11. To ignore outliers in the analysis, enter a value for "Peak correction".
    The greater this value, the smoother the considered value chart.
    Values from 1% through 100% are permitted.
    If you do not specify a value, the value chart is not corrected.

12. Click "Calculate".

Note

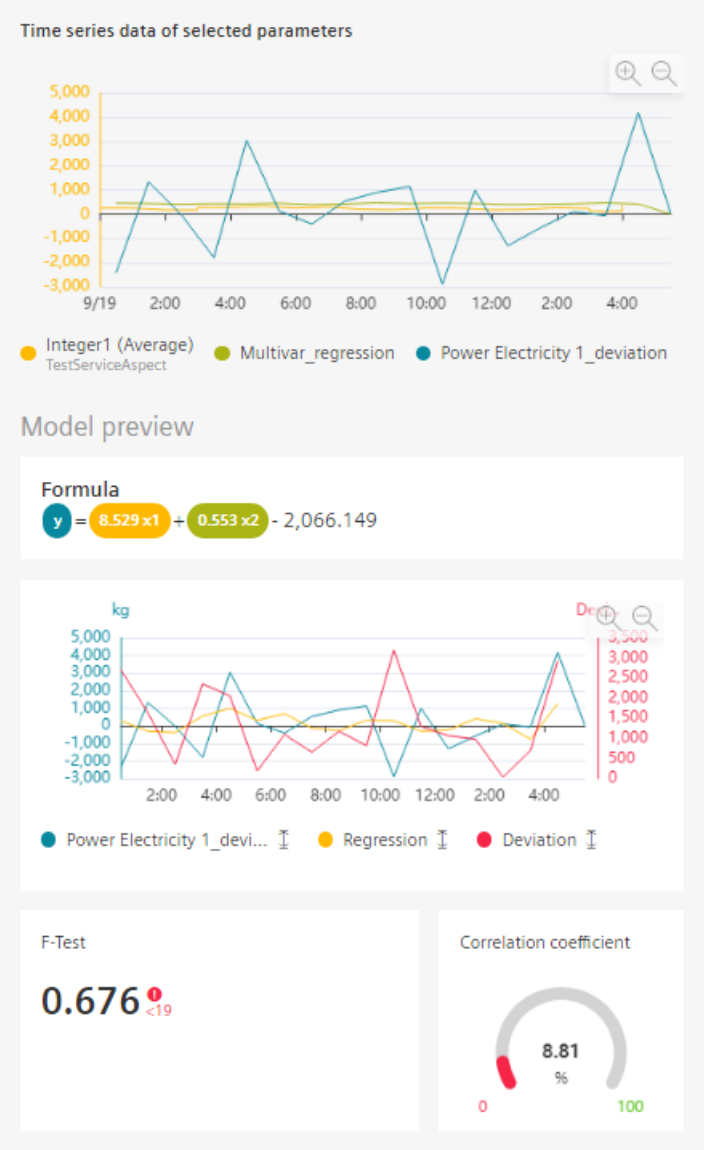
Variables with linear dependency

Variables are linearly dependent when the values are the same or a multiple of each other at all times.

No resources can be calculated for linearly dependent variables.

An error message is displayed when you select linearly dependent variables.

The formula that describes the interaction of the selected parameters during the selected period is calculated.
The preview of the visualization for the calculation time range is displayed.



If necessary, you can optimize the model (Page 90).

13. Confirm the creation of the two new KPI instances.
14. Save the model.

Result

You have created a model for the visualization of the multivariable regression.

After creating the first model for an asset, the MVR dashboard is created automatically.

A model can be used on the MVR dashboard for any other period to analyze the parameters.

Two new KPI instances are created.

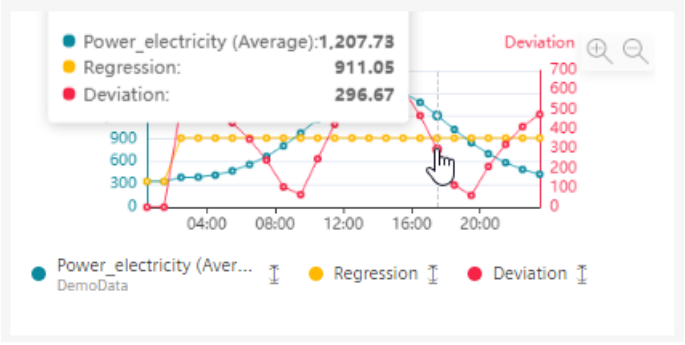
See also

User-defined periods (Page 44)

5.2.4 Optimizing the model

Description

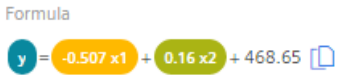
Optimize the model before you calculate it in case of insufficient data, an inadequate calculation period or results that are not satisfactory for other reasons. You can edit a saved model.



1. To show details on a data point, move the cursor over the graphic.
2. To show or hide a parameter, click it below the preview.
3. To zoom into the area, move the mouse pointer over the area while keeping the mouse button pressed.

The following is displayed in addition to the visualization preview:

- **Formula**



  The formula describes the relationship of the output parameter y to the input parameters x1, x2, etc.
  The formula cannot be edited.

- **Correlation coefficient**
  The correlation coefficient is the quality measure for the model: How well does the model describe the actual data? The lower the value of the correlation coefficient, the less trustworthy the model.
  The correlation coefficient can range from 0% to 100%. The higher the value, the better the model.
  If the correlation coefficient is < 60%, adjust the model. Access a larger data volume or select different parameters.

- **F-test**
  Indicates the significance of the model: Is the calculated model better than a random model? The greater the value of the F-test, the better the model. If the value is displayed in red, adjust the model. Select other parameters or a longer calculation period.

When you move the mouse pointer over the graphic, the details of individual data points are displayed in the tooltip.

To zoom in on the time range, move the mouse pointer above the desired area of the graphic while pressing the left mouse button.

Click on "Zoom out" to gradually show the view for a longer time range.

Click on "Reset zoom" to restore the original display.

Procedure

To optimize a model, follow these steps:

1. Use variables or KPIs as output parameters and input parameters for which data is available without gaps in the calculation time range.
2. If necessary, remove input parameters with insufficient data quality.
3. Select a calculation period during which the data quality is better.
4. Change the spike correction to mitigate the effect of extreme variable values.
5. Recalculate the formula after each change.
6. When you have achieved an acceptable result, save the model.

5.2.5 Visualizing MVR on the dashboard

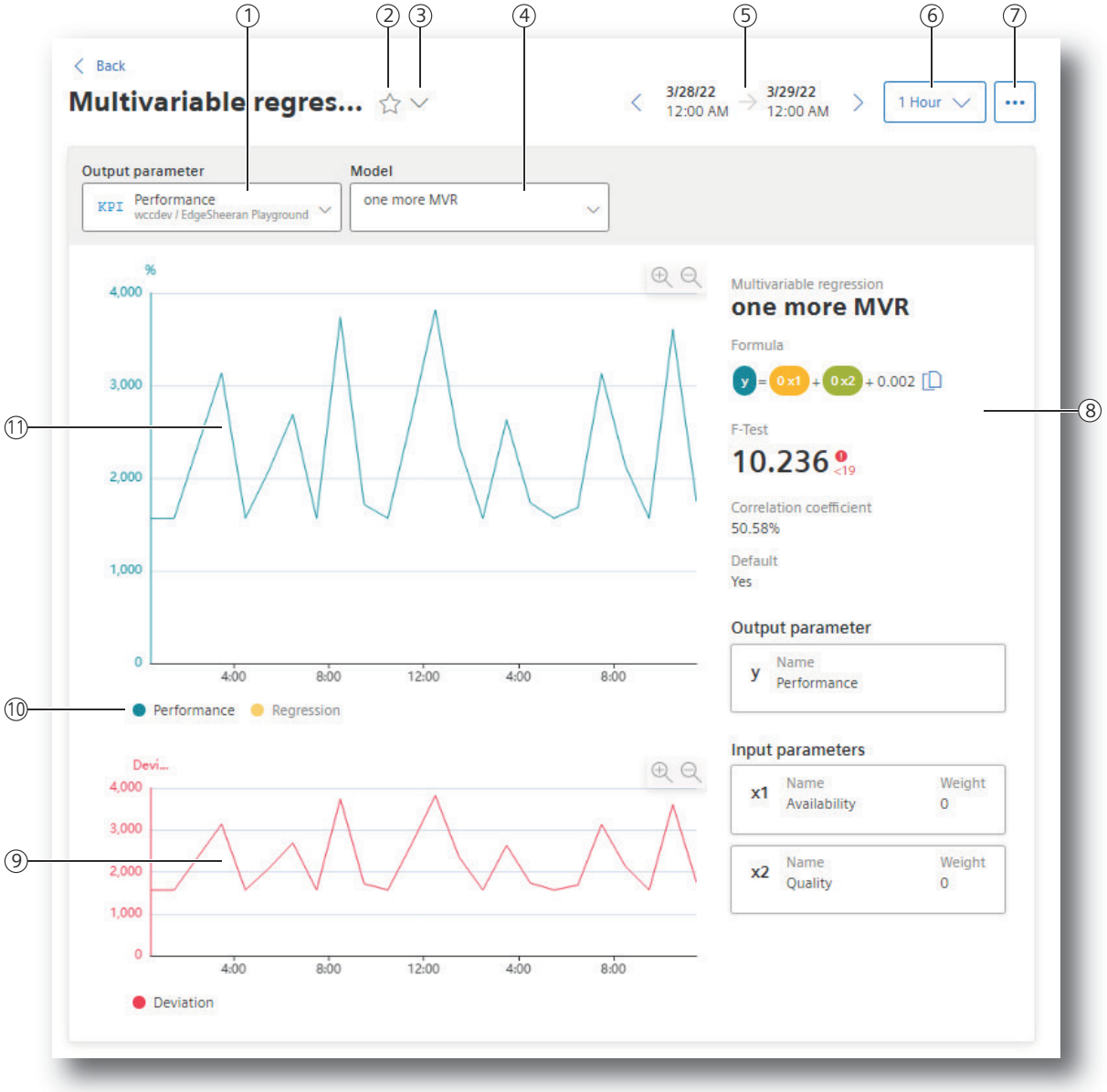
Display MVR dashboard

The MVR dashboard is available when at least one model has been created for the asset.

1. Select an asset in My Plant.
   An overview of the dashboards available on the asset is displayed.
2. Click "Multivariable regression".

The dashboard is displayed.

Visualizing multivariable regression



① Selection of the output parameter
② Marking the dashboard as Favorite
③ Displaying more dashboards on the asset
④ Selection of a model that describes the output parameter
⑤ Selection of the time range for the analysis
⑥ Selection of the calculation interval
⑦ Menu: "Multivariable regression list", "Edit selected multivariable regression", "Export data"
⑧ Characteristics of the model: Formula, F-test, correlation coefficient
⑨ Graphic display of the deviation

⑩ Showing and hiding the individual parameters and the limit values
⑪ Graphic representation of the output parameter and the regression

To visualize the multivariable regression in the dashboard, follow these steps:

1. Select the output parameter.
2. Select a model that describes this parameter.
3. Select the period for which the multivariable regression is visualized.
   You can apply the model to any time range in the past.
   See also: User-defined periods (Page 44).
4. Select the calculation interval.
   With the calculation interval you determine the granularity of the visualization. You determine, for example, whether data values of each minute or of each hour are considered.
5. Select which trends you want to show or hide.
   The following trends are offered:
   - the value trend of the output parameter
   - the regression
   - the deviation of the actual values from the model (Deviation)

Dashboard features

Note

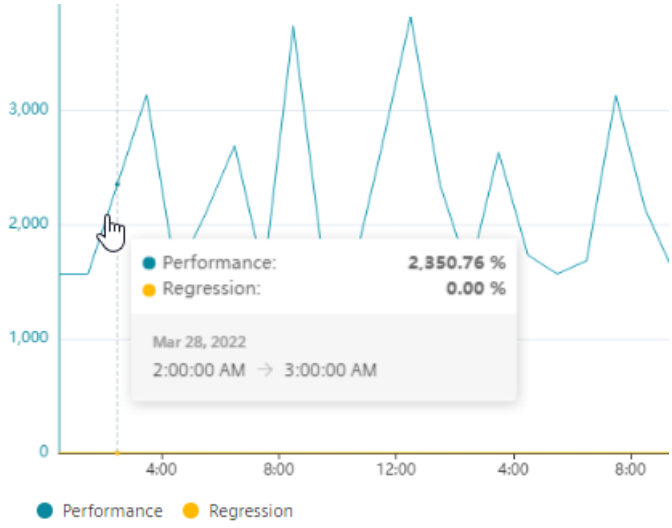
Automatic update

If the selected period for the dashboard or one of the widgets is in the future, the dashboard automatically updates every 30 seconds.

- Display of the existing models
  To display the list of the existing models and potentially create a new model, click ··· and select "Multivariable regression list".
- Description of the model
  The characteristics that describe the model are displayed:
  - Formula
  - F-test
  - Correlation coefficient

  You can copy the formula to the clipboard by means of .

- Detail view with mouseover
  When you move the mouse pointer over the graphic, the details of individual data points are displayed in the tooltip.



- You can find information on adjusting the displayed area in section "Navigation in the app (Page 19)".

5.3 Evaluating the production of individual batches

Batch analysis is used to compare parameters of individual batches. Production parameters such as materials and energy are put into context. The analysis is configured in each case for one product and the produced batches.

The configuration of the batch analysis creates an automatically generated dashboard.

Results are presented as a table. Here you can use the filter and sort functions to clearly display and compare the results that are relevant to you.

5.3.1 Configuring a batch analysis

Description

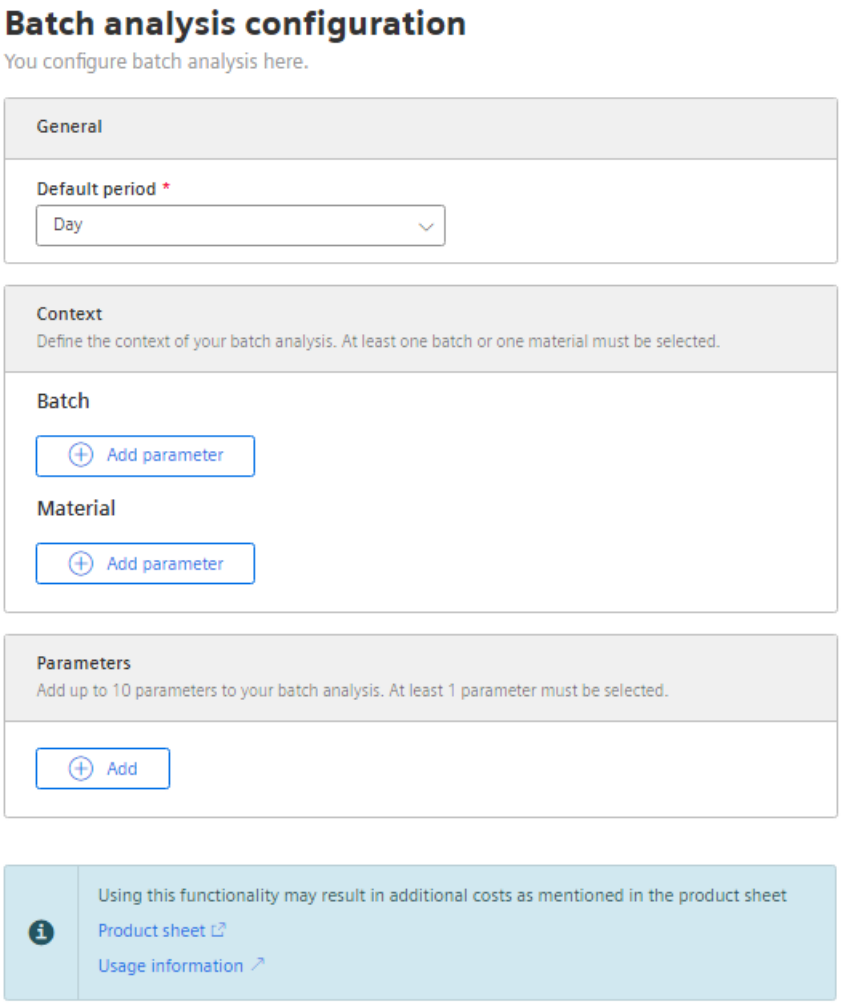
For each asset, you can create a dashboard for batch analysis. The dashboard is created automatically on the basis of the settings made by you.

Procedure

To configure batch analysis, proceed as follows:

1. Select an asset in My Plant.
2. Click "Add dashboard".

3. Select "Batch analysis".
   The "Batch analysis configuration" view appears.



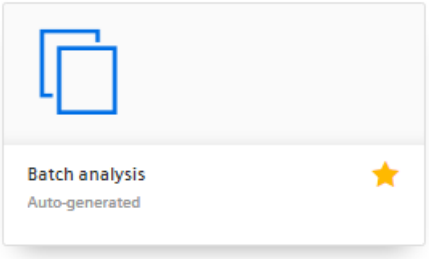
4. Select the default time period.
   The periods defined under "Configuration" are available for selection.
5. Select the parameter that represents the batch.
   This can be, for example, the batch number or a customer
6. Select the parameter that represents the material that will be produced.
   If only one material is produced, this information can be omitted.
7. Select one or more parameters to be compared for individual batches.
   The parameters can represent, for example, various cost factors (energy consumption, cost of raw materials) of production.
8. Click "Save".
   An automatically generated dashboard is created and is continuously supplied with data.
   The "Batch analysis" dashboard is displayed.

5.3.2 Displaying a batch analysis

Procedure

To display the "Batch analysis" dashboard, follow these steps:

1. Select My Plant in the navigation bar.
2. Select an asset.
   An overview of the dashboards available on the asset is displayed.
3. Click "Batch analysis".



The dashboard is displayed.

5.3.3 Evaluating a batch analysis

Description

The table shows the values for the produced batches for the selected period:

- Batch: Number of the batch
- Material
- Start, end and duration of production of the batch
- The parameters selected in the configuration

Note

Display of the calculation process

If a comprehensive display of values is requested, e.g. for a long period, not all entries are available immediately. A progress bar at the top visualizes the process of the calculation.

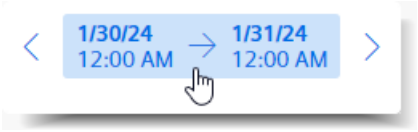
Note

Automatic update

If the selected period for the dashboard or one of the widgets is in the future, the dashboard automatically updates every 30 seconds.

Procedure

1. To display the analysis for a different time period, use the operator controls to navigate in time.



2. To filter the display, enter a string in the search field.
   All batches for which a cell contains the character string are displayed.
3. To sort the table, click in a column header.
4. To display individual batches or materials, enable the corresponding entries in the selection lists alongside the search field.

Example:

1. Filter the table by a batch number.
2. Sort by a parameter, e.g. energy consumption
   You can see at a glance which production of a batch was the most energy-intensive.

"Diagram" graphical representation

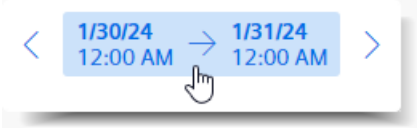
The graphical representation visualizes the time history of the individual parameters in relation to the individual batches.

5.3.4 Analyzing multiple assets

You can compare the production of multiple assets by merging and consolidating the analyses.

Procedure

1. Click "Analysis" in the navigation bar.
2. Click "Batch analysis".
3. Select the period for the analysis.

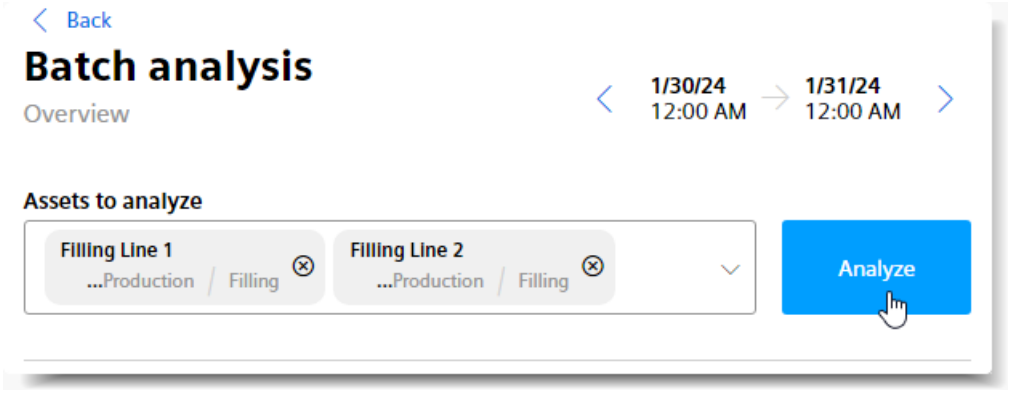


4. To display the dashboard for an asset, select the asset in My Plant.
5. To display the analysis for multiple assets, select the assets under "Assets to analyze".

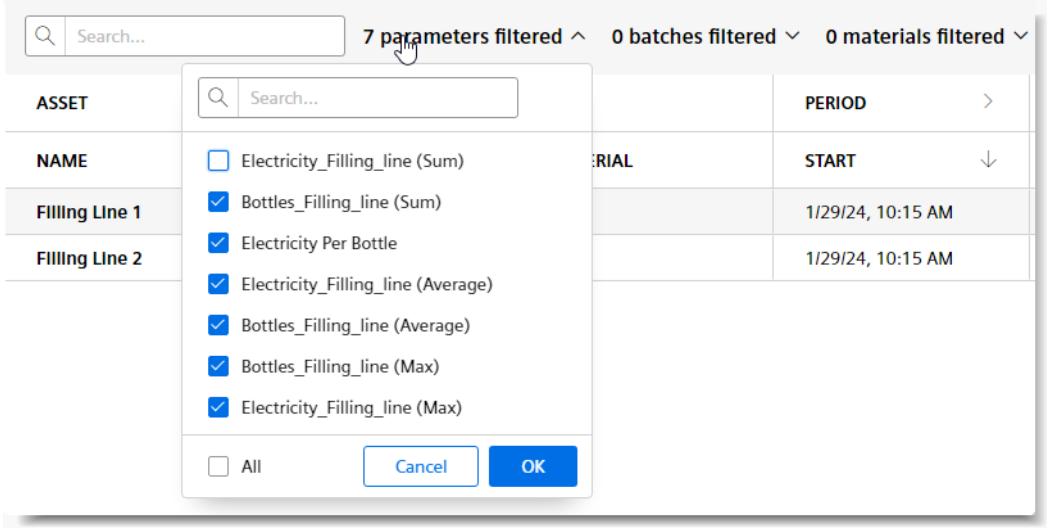
Note

Up to 10 assets can be selected.

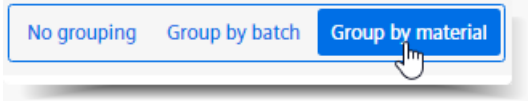
6. Click "Analyze".



7. You can filter the display by parameters, batches, and materials.



8. Group the display by batches or material.



9. To sort the display by a column, click in the column header.
10. To display more information on assets or periods, select › in the column header.

Note

Calculation of the displayed values

If the parameter basis was formed by dividing, e.g. for KPIs, the average of the values is displayed.

If the parameter represents a simple value, e.g. "filled bottles", the sum of the values is displayed.

5.3.5 Editing the configuration

Editing the configuration

To edit an existing configuration for batch analysis, follow these steps:

1. Select an asset in My Plant.
2. Display the "Batch analysis" dashboard.
3. Click ··· and select "Configuring batch analysis".
   The configuration is displayed and can be edited.

Deleting the "Batch analysis" dashboard

1. Open the configuration of the batch analysis.
2. Click .
   The batch analysis for the asset is no longer available.

5.4 Creating user-defined dashboards

5.4.1 Creating a dashboard

In addition to the automatically generated dashboards, you can create user-defined dashboards. In the process, you choose between different widgets for data visualization. You design the dashboard according to your needs.

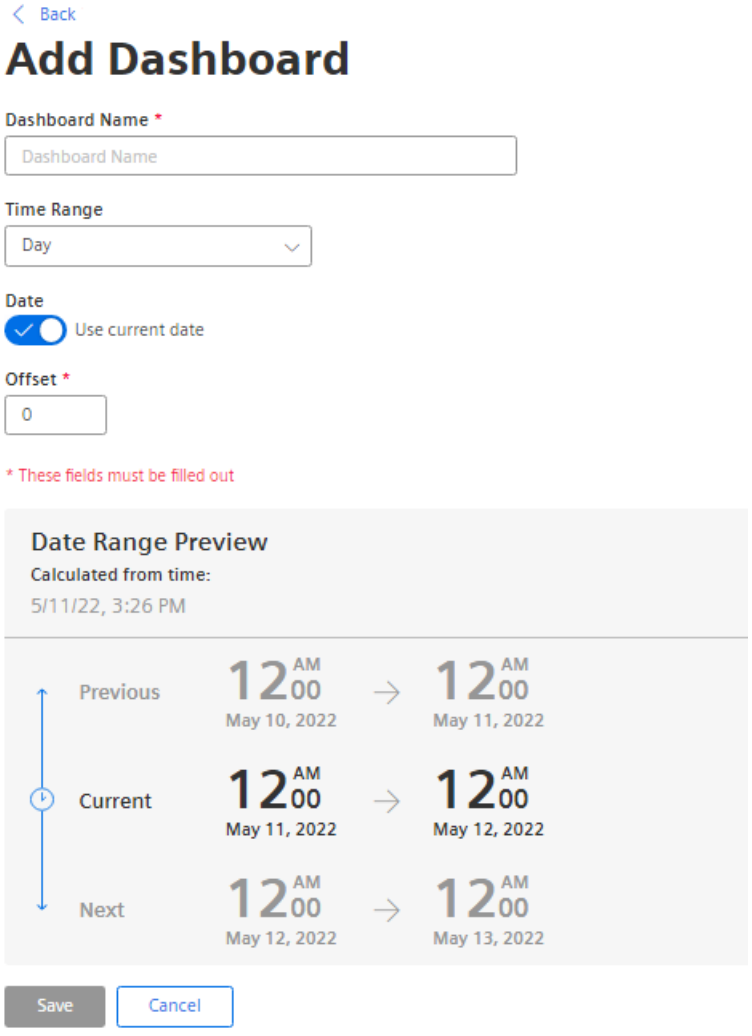
Procedure

To create a user-defined dashboard, follow these steps:

1. Select an asset in My Plant. The overview of the dashboards for the asset is displayed.
2. Click "Add dashboard" in the overview view.

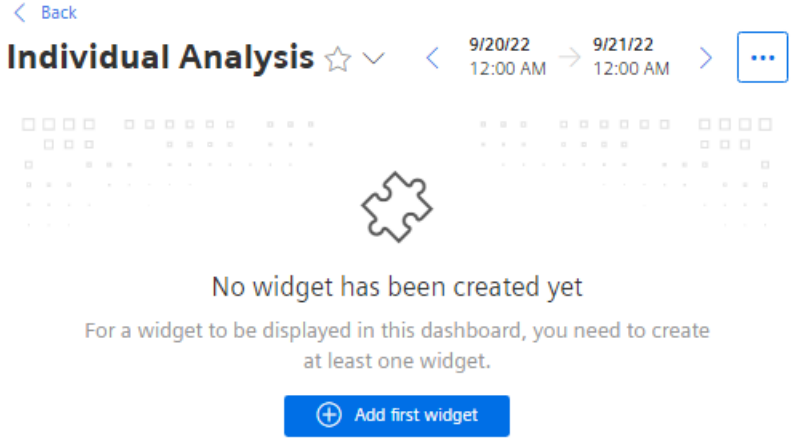
3. Select "User-defined dashboard".
   The "Add dashboard" view is displayed.

4. Enter a name for the dashboard.



5. Select the period for which the data will be visualized on the dashboard. This period can be changed at a later date by the user.
6. To move the period, specify an "Offset".

7. Click "Save".
   You have created a new, empty dashboard.



8. Create widgets at the dashboard.
   You can find more information in the "Creating widgets (Page 104)" section.

5.4.2 Structure of the dashboards

Overview

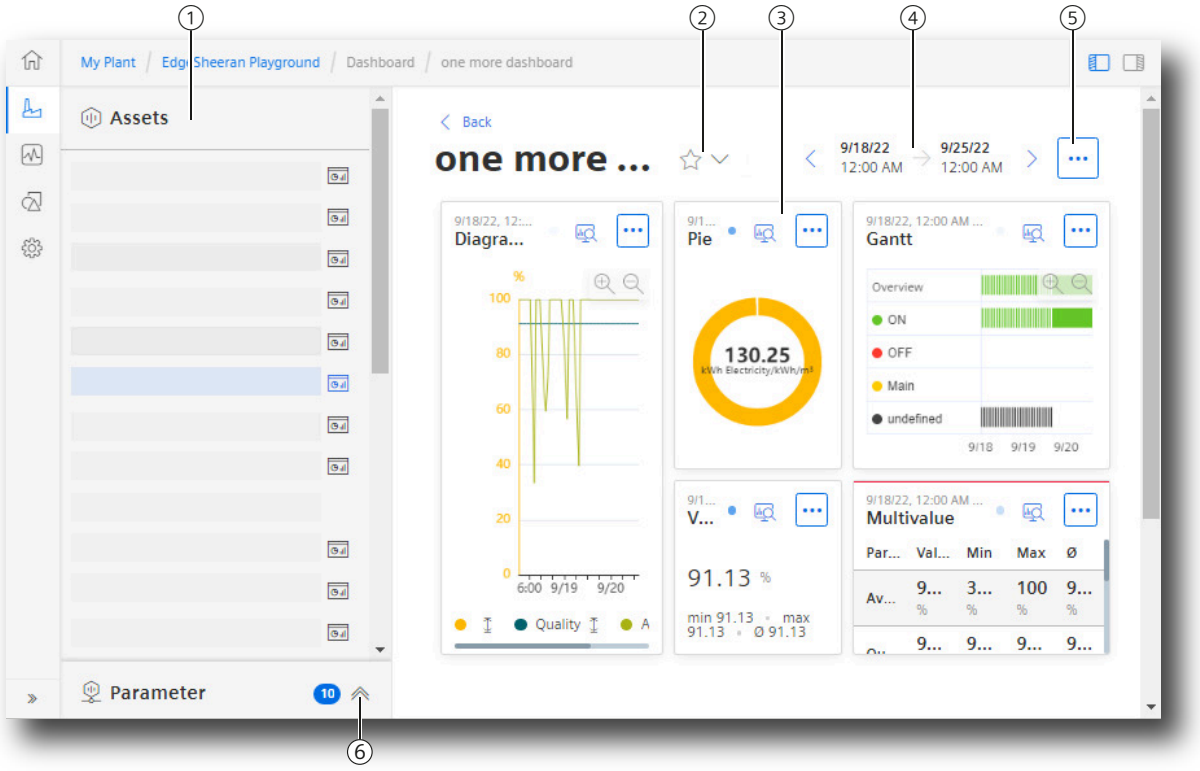
The dashboards contain a graphical representation of variables or KPI types. Widgets are used for the graphical representation. A maximum of 5 dashboards can be created per asset object within My Plant.

Note

Automatic update

If the selected period for the dashboard or one of the widgets is in the future, the dashboard automatically updates every 30 seconds.

The figure below shows the layout of a dashboard:



① My Plant

② Marking the menu with all dashboards of the asset / dashboard as Favorite

③ Widgets

Visualization of KPIs or variables

④ Period

⑤ Menu: "Add widget", "Adjust dashboard layout", "Export dashboard", "Edit dashboard", "Delete dashboard"

⑥ Parameter list

5.4.3 Creating widgets

5.4.3.1 Introduction to widgets

Description

The following widgets are available for data analysis:

Widget type		Description
	Diagramm	Displays the value of parameters as a chart over time. You can find more information here: Visualizing correlations (Diagram) (Page 110)
	Value	Displays the current value of one or more parameters. You can find more information here: Visualizing values (Value) (Page 113)
	Gannt	Shows you the status of a device at a glance using different color codes. For example, the status can represent the current state or the state within a specific period. This allows you to see at a glance, for example: • when the device started up and how long it was in the "RUN" operating state; • when it switched to the "STOP" mode and how long it remained in this state. You can find more information here: Visualizing machine statuses (Gantt) (Page 114)
	Gauge	Represents limits with colors. You can recognize at a glance whether or not limits are being exceeded. You can find more information here: Visualizing the violation of limit values (gauge) (Page 116)
	Pie	Shows a distribution of consumptions or quantities. Clicking on a segment highlights the segment and displays the corresponding value. You can find more information here: Visualizing the distribution of consumptions or quantities (Pie chart) (Page 118)
	Heatmap	Shows the intensity of data values. For example, you can display the energy consumption (green = low consumption; red = high consumption). You can find more information here: Visualizing the intensity of data values (Heatmap) (Page 119)
	Sankey	Represents the energy and material flows as arrows whose width is proportional to the flow rate. This helps you recognize, for example, how energy is flowing through your plant. You can find more information here: Visualizing energy flows (Sankey) (Page 122)
	Duration Curve	Visualizes a chart sorted by size. You can find more information here: Visualizing a chart sorted by size (Duration curve) (Page 123)

Widget type		Description
	3D bar	Visualization of three parameters as a 3-dimensional bar chart. You can find more information here: Visualizing relationships in 3D (3D bars) (Page 121).
	Image	Displays an image, such as a logo, on the dashboard. Suitable for presentation of dashboards on large screens. You can find more information here: Linking an image for presentation (Page 124)

In user-defined dashboards, you create, configure, and arrange widgets on the dashboard according to your needs.

You can edit, delete, copy and export the visualized data as a csv file for widgets that have been created once.

5.4.3.2 Create a widget

Requirement

- To visualize and calculate the data from the plant, such as production figures, machine operating times, or water consumption using KPIs, these figures must be transferred from the plant to the platform via the Asset Manager. The data structure of your plant is then automatically displayed in the app.
- At least one dashboard is created on the desired asset.

Adding a widget

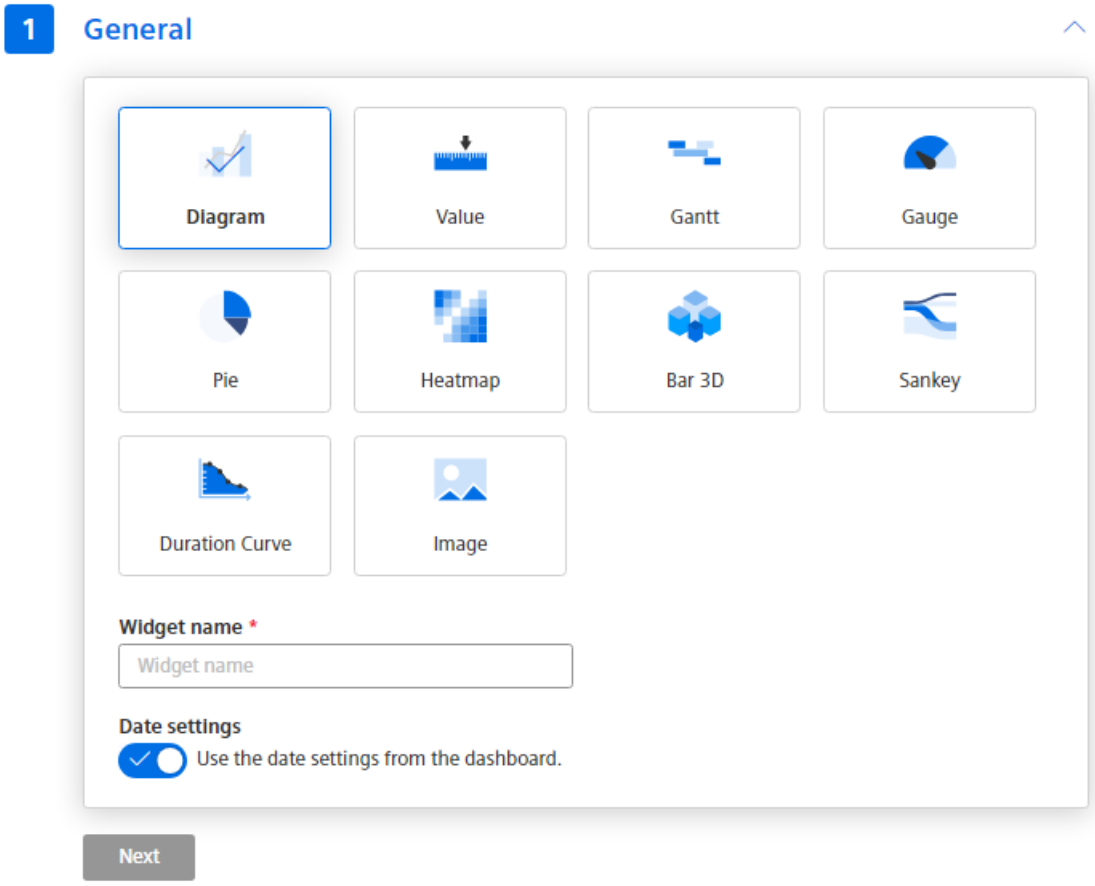
To add a widget to a user-defined dashboard, follow these steps:

1. Select the required dashboard or create a new one.
2. If no widget has been created yet, select "Add first widget".
3. If widgets have already been created, click ⋯ and select "Add widget".
   The "Add widget" wizard is displayed.

Widget configuration

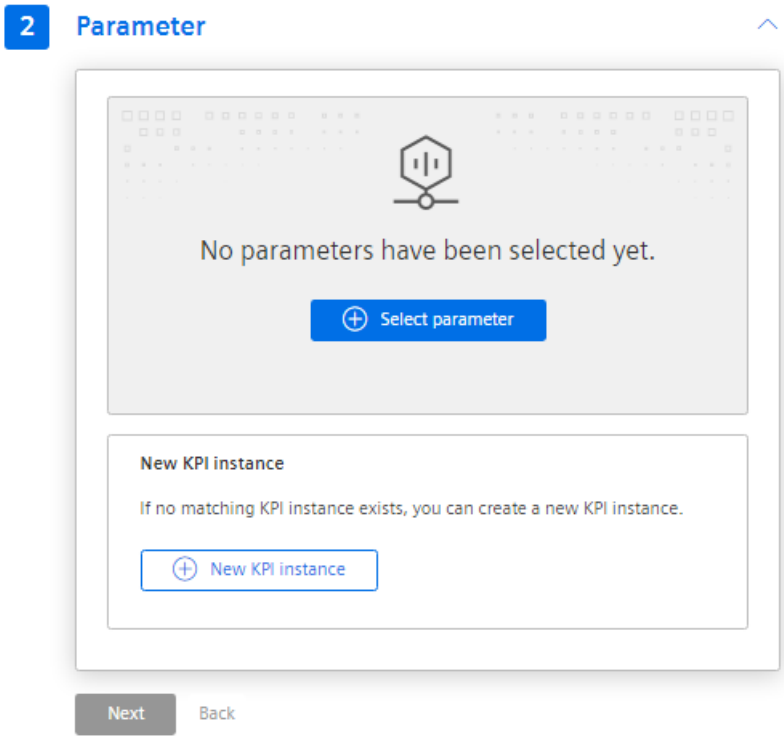
The creation of a widget takes place in 3 steps.

- Step 1 "General": Select the widget type



  - Assign a name to the widget.
  - Select whether the date settings from the dashboard are to be applied.
    If the widget uses date settings deviating from the dashboard, make the required specifications.
  - To apply the specifications, click "Next".
    Step 2 is displayed.

- Step 2 "Parameter": Parameter selection



  - Select the parameters that are visualized in the widget.
    A parameter of String type can be additionally selected, for example, to designate production sections in the "Diagram" detail view by a descriptive name. Only the aggregation "Last" type is available for parameters of String type.
  - Create a new KPI instance, if required.
    You can find further information in the section "Editing settings for KPI instances (Page 55)".
- Step 3 "Details": Additional settings
  These settings depend on the widget type, e.g. calculation period, y-axis.
- To create the widget, click "Create widget".
  The widget is displayed at the dashboard.
  To adjust the position and size of the widget, adjust the dashboard layout.
  For more information, see the "Adapting a user-defined dashboard (Page 140)" section.

Note

Switching between the steps

When all required specifications are available for the first time, you can switch to a step independently of the sequence and make changes.

If you change the widget type, you have to make the specifications again.

Defining date settings

With the date settings you define the time range from which the values are to be visualized. You can apply the dashboard date settings to a widget or define your own date settings for this widget.

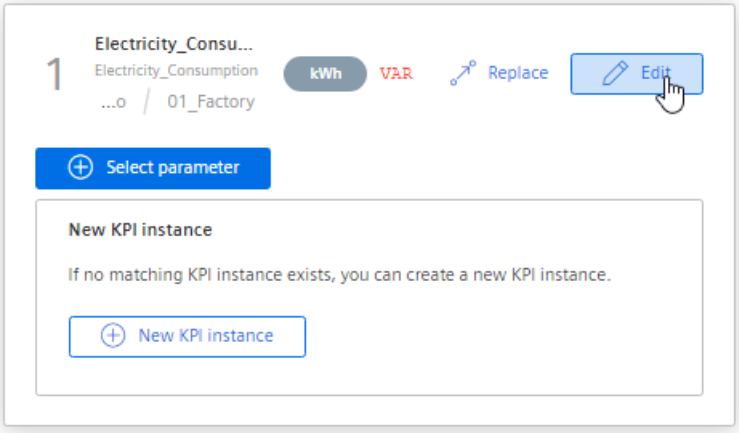
The following variants are possible:

- "Use the date settings from the dashboard" to use the time range that is defined in the dashboard.
  Changes to the date settings of the dashboard are applied in all widgets of the dashboard.
- To define a specific period, disable "Use the date settings from the dashboard".
  - Period
    Define the duration (e.g. week). The start and end times are given by the preset periods (day, week, month, year, etc.).
  - Use current date
    To manually enter the date and time of the start time, deactivate this option.
    The end time is determined through the "Period".
  - Offset
    Specify the number of days, weeks, months or years by which the start time should be postponed.
    The start time can be either in the future or in the past.

Procedure for selection of parameters

You can select either a variable or a KPI type as parameter. You can select up to 10 parameters.

1. To replace a selected parameter with another parameter, click "Replace".
2. To make further specifications for the selected parameter, click "Edit".



   - If required, enter an alternative label.
     This label is displayed in the legend in the detail view instead of the asset and the aspect name of a parameter.
   - Select an aggregation for each variable.
     You can find additional information on the aggregation functions here: Aggregation functions (Page 62).
     The same parameter can be visualized in a widget with different aggregations.
   - Specify details for the visualization of the parameter:
     Number of decimal places
     Color
     Type
   - Define limit values for warnings and alarms.
     Limit values are displayed in the detail view as dashed lines.
     If you have already defined limits for the parameter used, they are displayed preset in the widget. These limits can be overwritten.
3. In this step, you can create a new KPI instance and link the operands with the desired parameters.
   You can find additional information on KPI instances here: Introduction to KPI calculations (Page 35)

Widget-specific details

You can find additional information on the details of the widgets here:

- Visualizing correlations (Diagram) (Page 110)
- Visualizing values (Value) (Page 113)
- Visualizing machine statuses (Gantt) (Page 114)
- Visualizing the violation of limit values (gauge) (Page 116)

- AUTOHOTSPOT
- AUTOHOTSPOT
- Visualizing energy flows (Sankey) (Page 122)
- Visualizing a chart sorted by size (Duration curve) (Page 123)

5.4.3.3 Visualizing correlations (Diagram)

Description

The "Chart" widget displays the value of parameters as a diagram over time.

You can select a type of visualization for each parameter.

The following views are available in the detail view for the "Diagram" type:

- Line graph (Page 129)
- Histogram (Page 132)
- Regression (Page 133)
- Boxplot (Page 134)
- Table (Page 136)

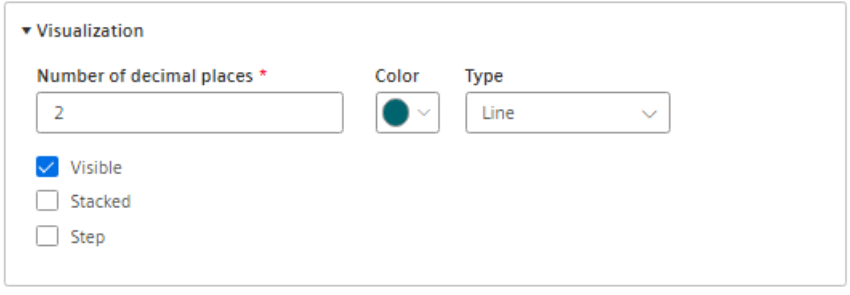
Use of variables of "String" and "Bool" type

To show more non-numeric information in the Tooltips, select string or bool-type variables. In this way, you can also visualize text for each data point, e.g. a batch number or the customer of a batch.

Procedure

To define widget-specific display options, follow these steps:

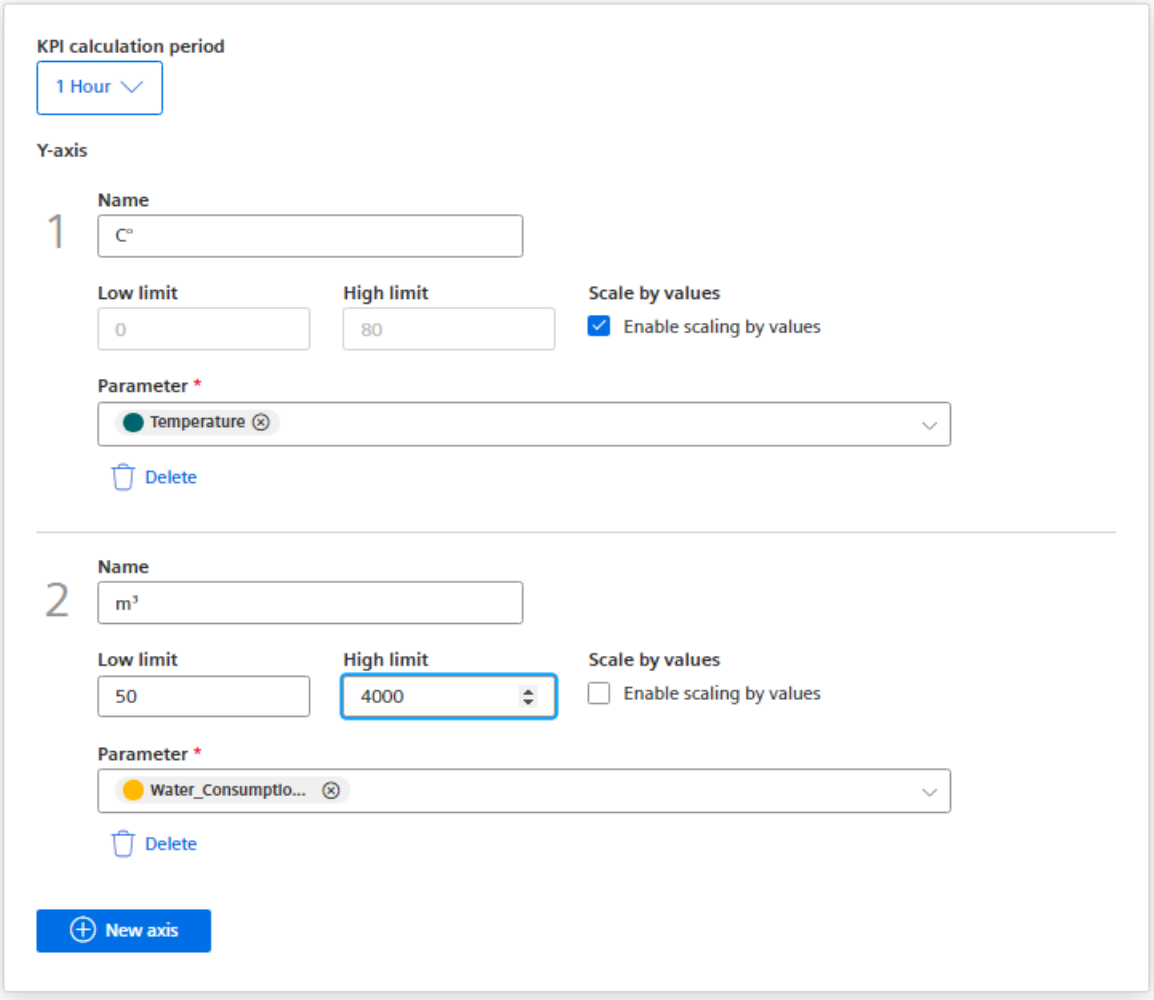
1. Create a new widget or edit the existing one.
2. In step 2, select a parameter which is visualized in the widget.
3. Click Edit and open the "Visualization" area.



4. For variables, you specify how many decimal places are displayed.
5. Select the color for the display of the parameter.

6. Select the type of the visualization.
   - Line chart (Line)
   - Spline curve
   - Area chart (Area)
   - Bar chart (Bar)
     The columns of several parameters are displayed stacked.
   - Scatter chart (Scatter)

7. Activate further options:
   - Select whether the value is to be visible.
   - With the bar chart, you can select whether the value is to be displayed stacked.
8. In step 3 "Details", you define the display of the y axes.
   For KPI instances, select the calculation period.



A y-axis is created for every unit that is assigned to a parameter. A maximum of 5 y axes can be defined per widget.
Each parameter is automatically assigned to a y axis. However, you can also manually assign the parameters to a different y axis.
You can define a low and high limit for each y axis. This means that you can only display a section between specific values in the widget.
Alternatively, you can enable "Scale by values". When the display is zoomed, the Y-axis adapts to display the range of values present.

5.4.3.4 Visualizing values (Value)

Description

The "Value" widget displays the aggregated value of a specific period. The value is derived either from a variable with a corresponding aggregation function or from a KPI result. The values of multiple parameters can be displayed in the widget.

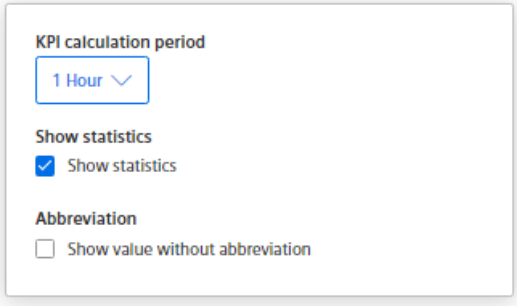
The following views are available for the "Value" type:

- Line graph (Page 129)
- Histogram (Page 132)
- Boxplot (Page 134)
- Table (Page 136)

Procedure

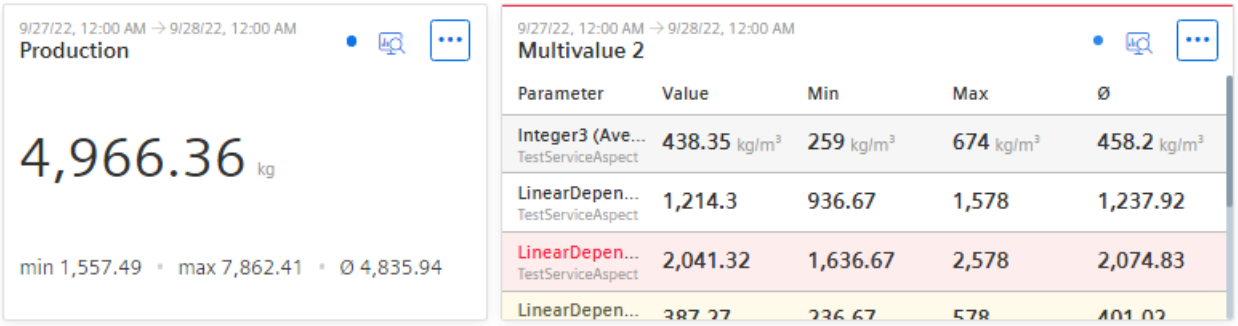
To define widget-specific display options, follow these steps:

1. Create a new widget or edit the existing one.
   A parameter of the String type can be additionally selected, for example, to designate production sections in the "Diagram" detail view by a descriptive name. Only the aggregation "Last" type is available for parameters of String type.
2. In step 3 "Details", you select whether the statistic is to be displayed.
   To display the value with all digits and decimal places instead of the abbreviated representation of large values, select the option "Show values without abbreviation".
   For KPI instances, specify the calculation period.



Result

The widget displays an individual value or multiple values.



The value corresponding to the selected aggregation is displayed. In addition, the minimum, maximum and average for the selected period are displayed.

When displaying multiple values, the violation of the upper limit is visualized by colored highlighting.

Note

Values of the statistical data

The displayed statistics is calculated from the calculated values in the cycle that is specified in the widget configuration.

5.4.3.5 Visualizing machine statuses (Gantt)

Description

The "Gantt" widget shows the status of a machine at a glance, e g. by using different color codes. The status can represent the current state or the state within a specific period.

This will help you recognize:

- When the machine started.
- How long it was in "RUN" mode.
- When it changed to "STOP" mode.
- How long it remained in this state.

In the detail view, the status indicators are displayed individually broken down.

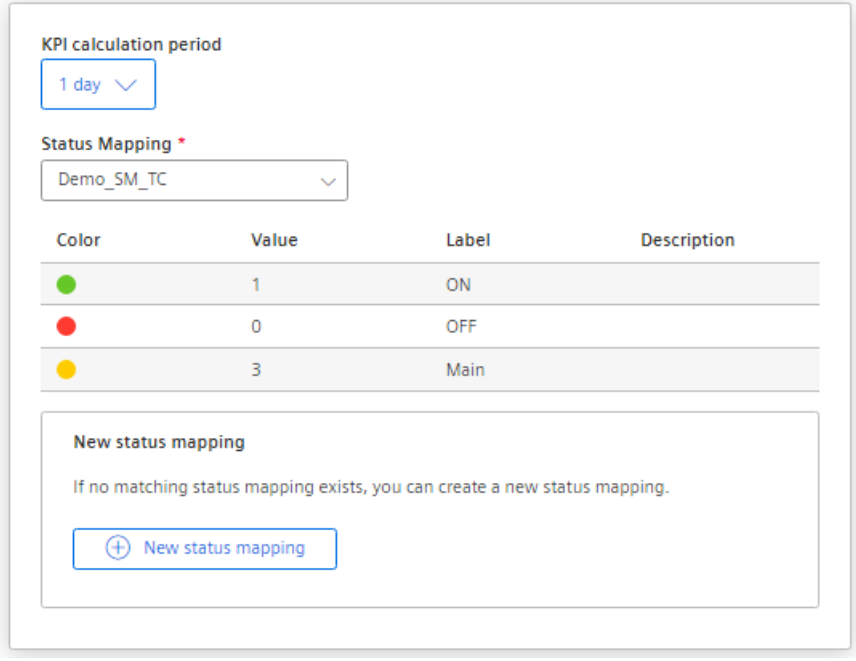
The following views are available for the "Gantt" widget:

- Gantt (Page 137)
- Table (Page 136)

Procedure

To define widget-specific display options, follow these steps:

1. Create a new widget or edit the existing one.
2. In step 3 "Details", select a status mapping from the drop-down menu. If no status mapping exists yet, you create one with "Create new status mapping".
   You can find information on creating a status mapping in the section "AUTOHOTSPOT".

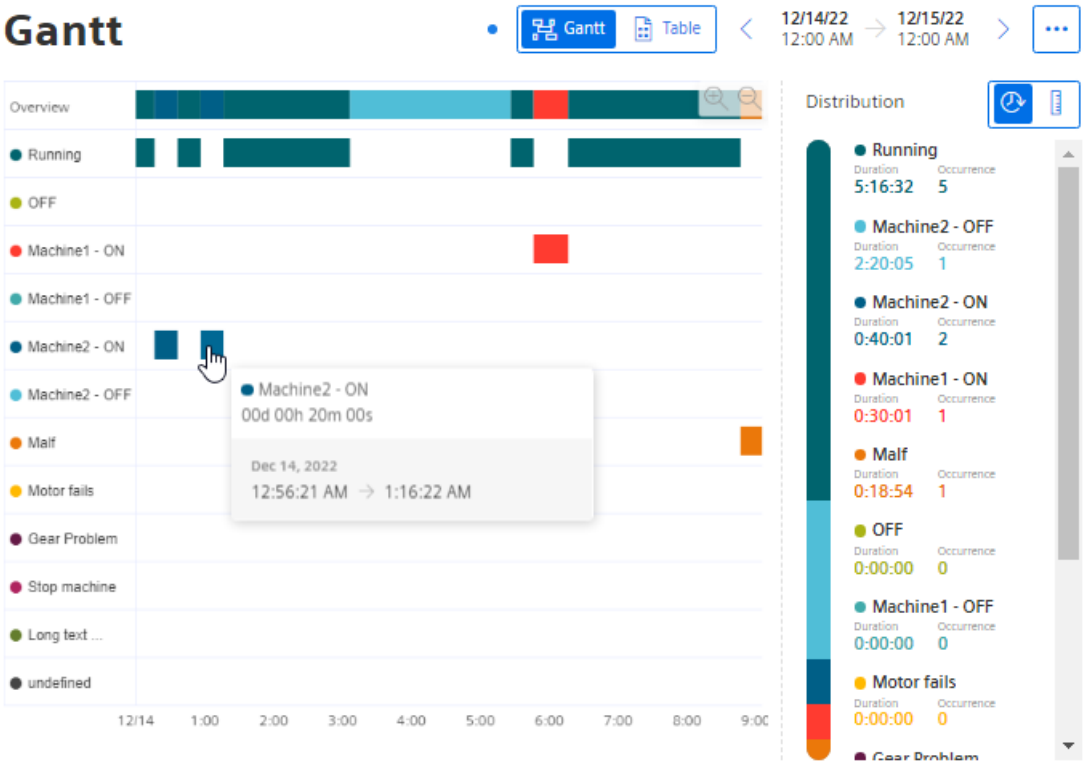


For KPI instances, specify the calculation period.

Result

The machine status is visualized according to the status mapping.

The tooltip shows, for each machine status, when this operating state occurred.



5.4.3.6 Visualizing the violation of limit values (gauge)

Description

The gauge (Gauge) visualizes limit values through colors. The gauge helps you recognize at a glance whether or not limits are being exceeded.

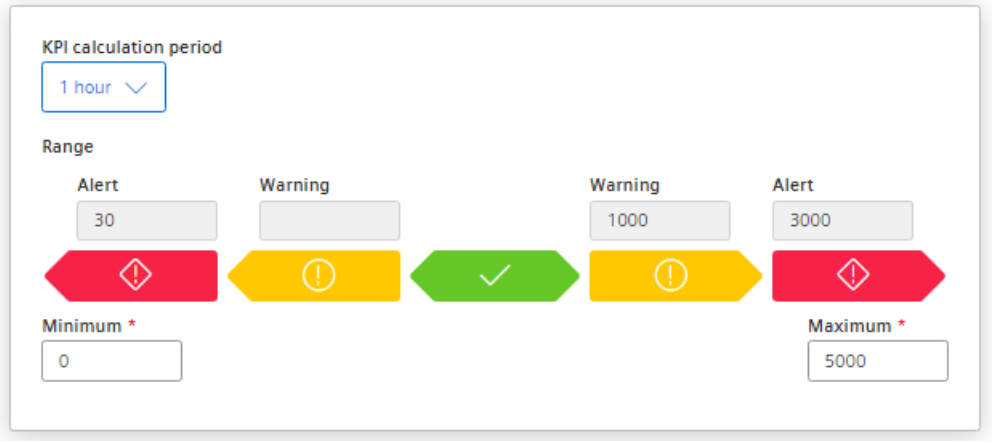
The following views are available for the gauge:

- Line graph (Page 129)
- Histogram (Page 132)
- Boxplot (Page 134)
- Table (Page 136)

Procedure

To define widget-specific display options, follow these steps:

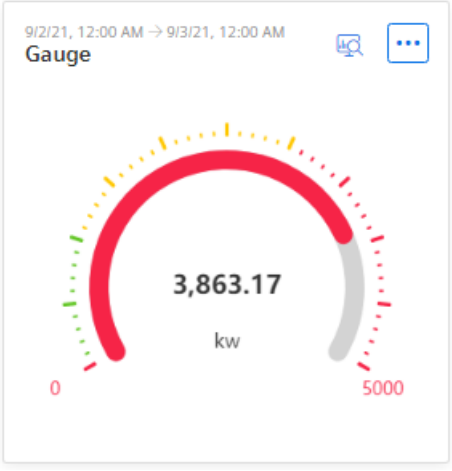
1. Create a new widget or edit the existing one.
2. In step 3 "Details", the limit values from the general display options are applied if you have already defined them there.
   Specify the value with which the display of the gauge scale starts and ends.



For KPI instances, specify the calculation period.

Result

The gauge in the example shows that the limit value has been exceeded.



The detail view shows the sequence and the defined limit values.

5.4.3.7 Visualizing the distribution of consumptions or quantities (Pie chart)

Description

The "Pie" widget visualizes the distribution of consumptions or quantities. Clicking on a segment highlights the segment and displays the corresponding value.

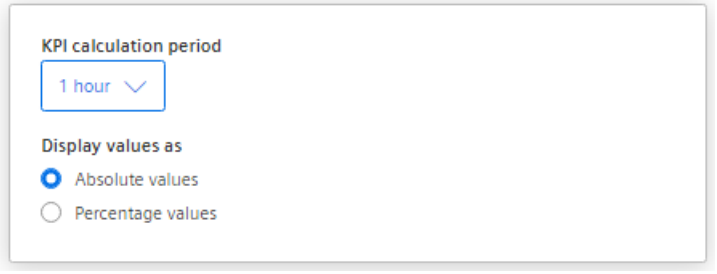
The following views are available for the pie chart:

- Line graph (Page 129)
- Histogram (Page 132)
- Regression (Page 133)
- Boxplot (Page 134)
- Table (Page 136)

Procedure

To define widget-specific display options, follow these steps:

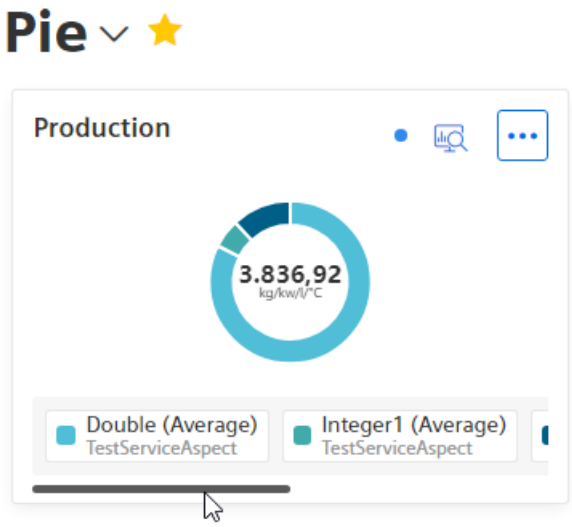
1. Create a new widget or edit the existing one.
2. In step 3 "Details", you specify whether the values are to be displayed as absolute or percentage values.



For KPI instances, specify the calculation period.

Result

The pie chart in the example shows you the percentage values of the selected parameters.



5.4.3.8 Visualizing the intensity of data values (Heatmap)

Description

The Heatmap widget visualizes the history of the intensity of data values. You can, for example, display the energy consumption (red = high energy consumption; green = low energy consumption), machine states or production quantities in a specific period.

The following views are available in the detail view of the Heatmap:

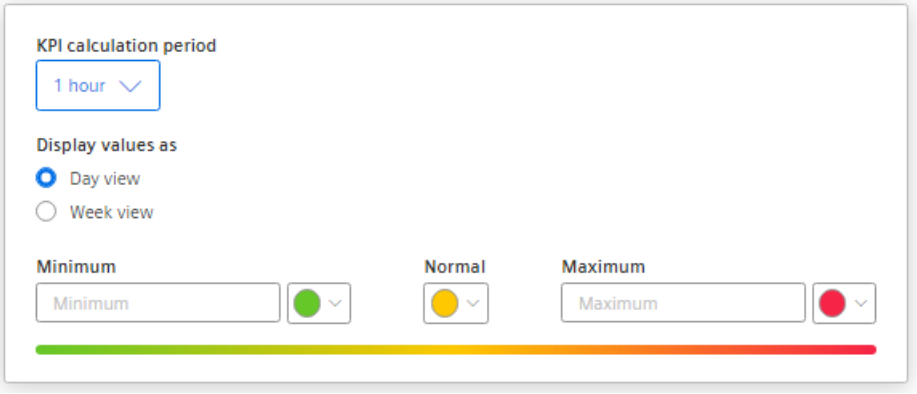
- Heatmap (Page 138)
- Line graph (Page 129)
- Histogram (Page 132)
- Boxplot (Page 134)
- Table (Page 136)

Procedure

To define widget-specific display options, follow these steps:

1. Create a new widget or edit the existing one.
2. In step 3 "Details", you define
   - The KPI calculation period
   - Whether the data is displayed in the day view or the week view.
   - The color in which the different intensities are to be displayed.

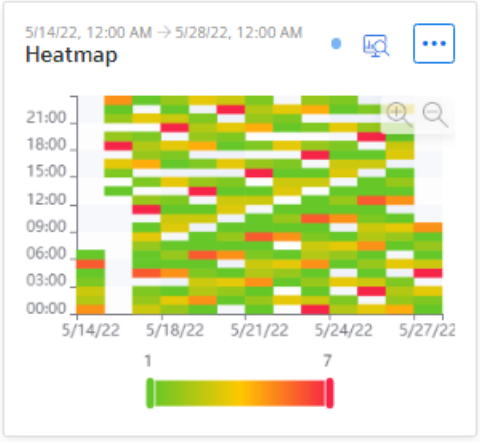
   If required, specify the values for minimum and maximum of the color scaling.



   - If you do not define fixed values, the lowest and the highest measured value is used for the color scale. In case of extreme peaks, the Heatmap may return a distorted picture.

Result

The Heatmap visualizes the data values according to the assigned color scale.



Machine statuses are displayed in color in the example:

- Green: Machines running
- Yellow: Planned and unplanned maintenance

- Red: Standstill
- White: No data available or hidden

5.4.3.9 Visualizing relationships in 3D (3D bars)

Description

The widget "3D bars" visualizes the relationship of three parameters in 3 dimensions.

The following views are available in the detail view:

- 3D bar (Page 139)
- Histogram (Page 132)
- Boxplot (Page 134)
- Table (Page 136)

Procedure

To define widget-specific display options, follow these steps:

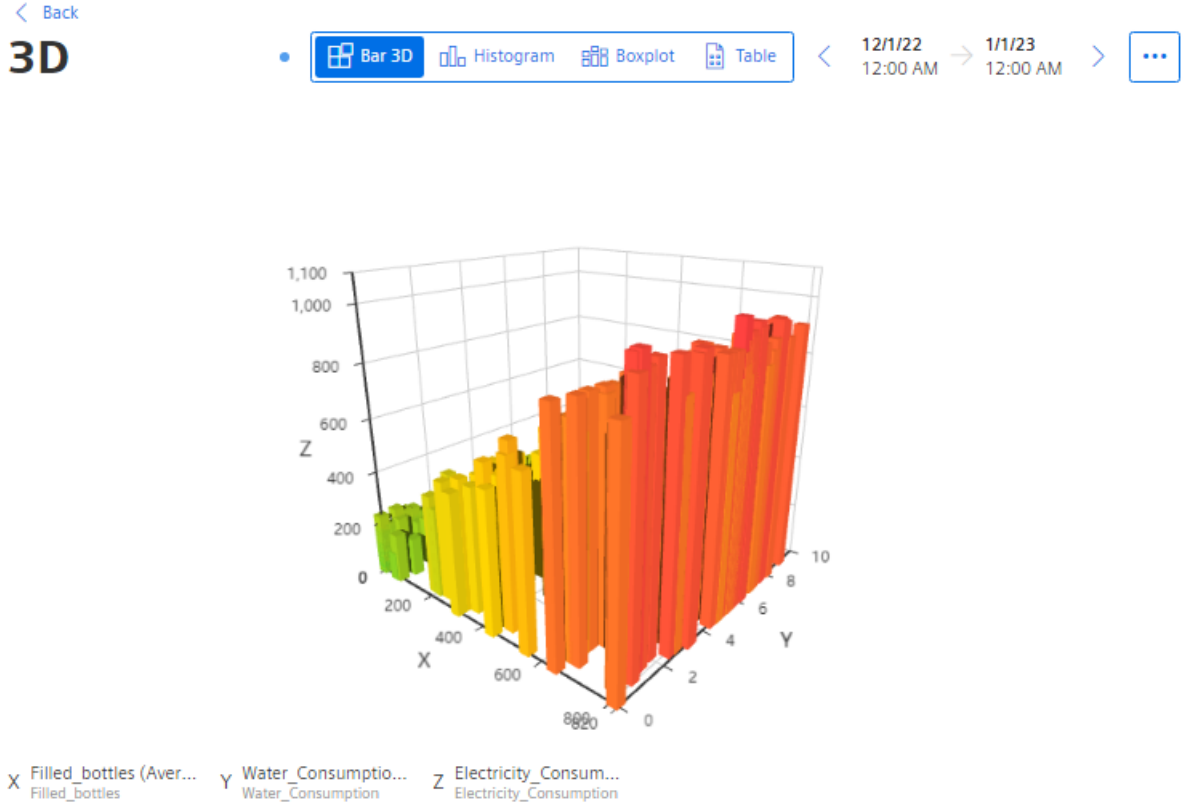
1. Create a new widget or edit an existing one.
2. In step 2 "Parameters", select exactly 3 parameters whose relationship is to be visualized.
   The values of the selected parameters must be available with the same time stamp.
3. In step 3 "Details", you define the KPI calculation period.
   You assign a parameter to each axis.
   You assign a name for each axis and determine the low limit and high limit.
   You specify the color in which the different intensities are displayed.

Result

The values are visualized in different views.

3D bar

The selected parameters are visualized in the detail view of the widget.



- To rotate the view, hold down the mouse button and move the mouse pointer over the view.
- To zoom in the view, use the mouse wheel.

5.4.3.10 Visualizing energy flows (Sankey)

Description

Using the energy flow diagram, you represent the energy flows as arrows whose width is proportional to the flow rate. This helps you recognize, for example, how energy is flowing through your plant.

Procedure

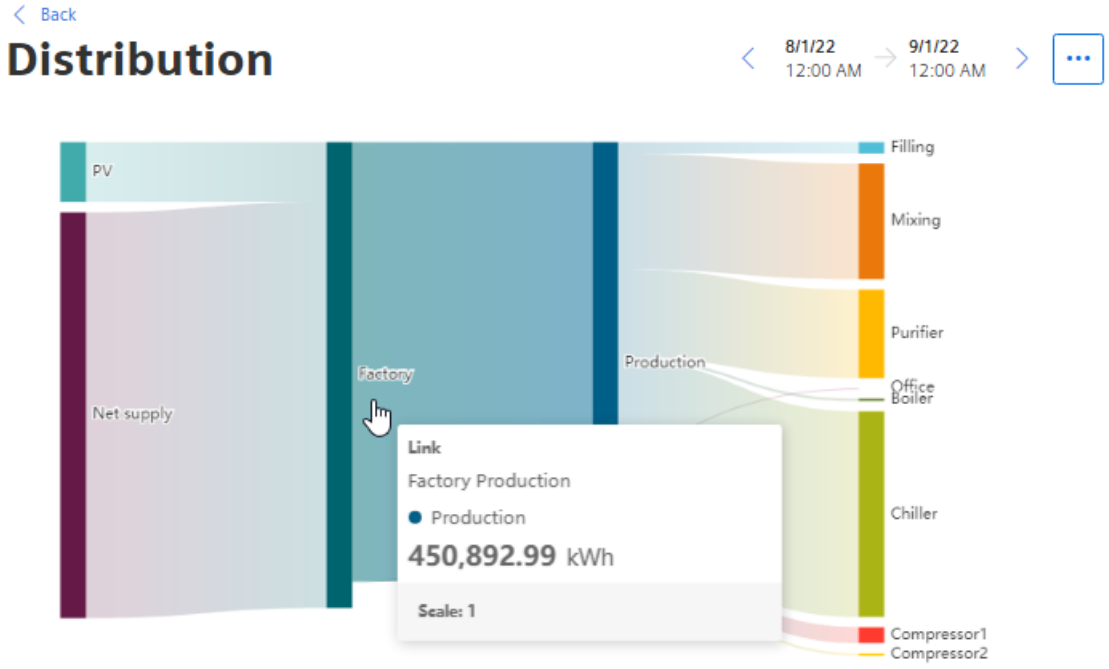
To define widget-specific display options, follow these steps:

1. Create a new widget of the type "Sankey" or edit an existing one.
2. In step 2, select a parameter which is visualized in the widget.
3. Click Edit to define the required node.
   You specify a link for each parameter from the source node to the destination node. This defines the volume flows.

4. Assign a node name and select a color for the node.
5. You can also scale each link so that you can still show the proportions of the arrows correctly even with different units, such as kilowatts or liters.

Result

The Sankey diagram shows you how the energy is flowing through the plant:



5.4.3.11 Visualizing a chart sorted by size (Duration curve)

Description

You can use the Duration Curve to display a chart sorted by size.

In the Duration Curve, the measured values of a specific period are displayed collected and sorted. The highest value is displayed on the far left, and the lowest value on the far right.

This way you can see, for example, how high the highest value was and how long this value was present. If you want to reduce the highest value to a lower value, you can see in the Duration Curve how often you must switch off the supply object every month for 15 minutes (active load management), for example, to achieve the lower value and thus conserve energy.

The following additional views are also available in the Duration Curve:

- Scatter plot (Page 140)
- Histogram (Page 132)

- Boxplot (Page 134)
- Table (Page 136)

Procedure

To define widget-specific display options, follow these steps:

1. Create a new widget of the type "Duration Curve" or edit the existing one.
2. In the "Details" area, you specify the maximum number of values to be displayed.

Result

The Duration Curve shows which value the parameter has assumed in the selected period for how long a time.

5.4.3.12 Linking an image for presentation

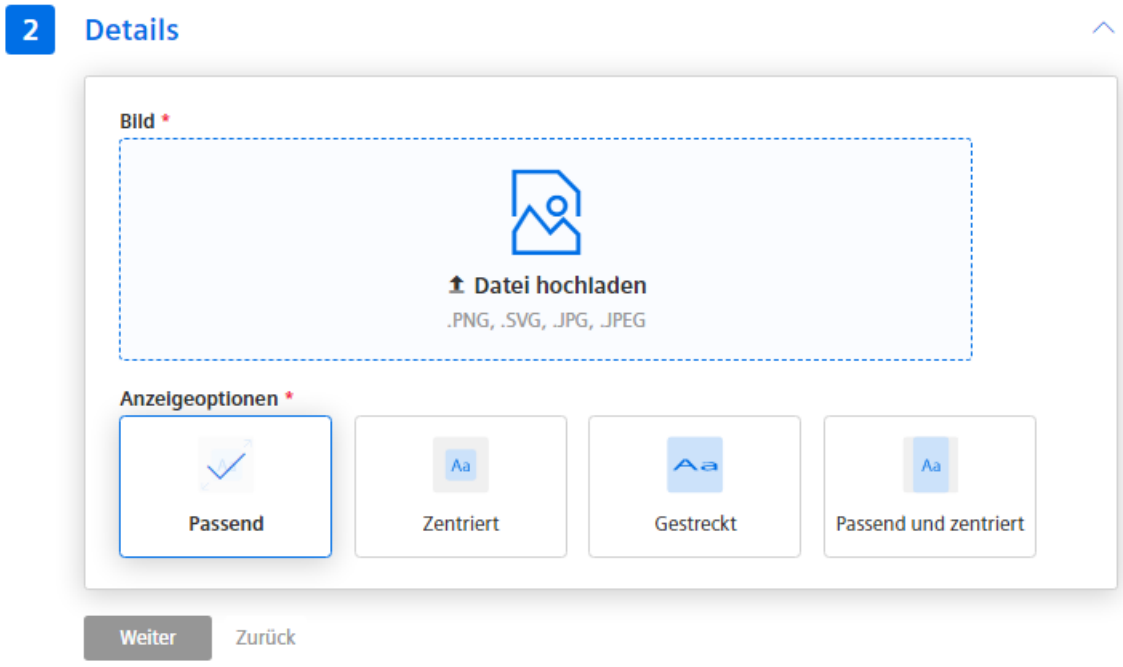
Description

You can use the Image widget to display an image on a dashboard.

Procedure

To define widget-specific display options, follow these steps:

1. Create a new widget or edit the existing one.
2. In step 2 "Details", upload an image file and define the display options.



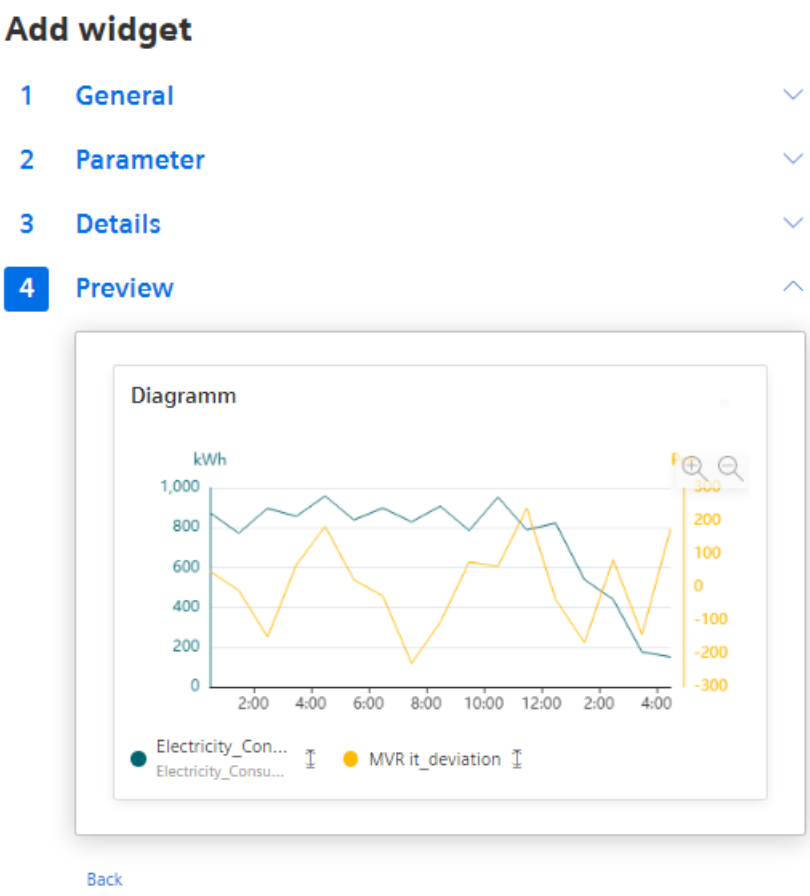
Step 3 shows a preview.

Result

The image is displayed on the dashboard.

5.4.3.13 Preview a widget

The last step in creating a widget shows a preview.



If the widget does not meet the requirements, adjust the widget before you create it. For example, add another y-axis if values are in different ranges.

5.4.4 Working with widgets

5.4.4.1 Editing widgets

Description

You can change a created widget.

Procedure

To change an existing widget, follow these steps:

1. In the widget, click ⋯.
2. In the drop-down menu, click "Edit".
   The widget wizard opens.
3. You can switch freely between steps 2 and 3 and change the details. The steps differ in the settings and depend on the widget type.
4. Select the last step and click "Create widget".

Result

All changes are applied to the widget and are displayed directly.

5.4.4.2 Copying widgets

Description

You can copy a widget and paste it to another dashboard.

Note

Widgets on an automatically created dashboard cannot be copied.

Procedure

To copy a widget, do the following:

1. Click ⋯ in the widget.
2. Select "Copy" from the drop-down menu.
   The widget is copied to the clipboard and can be pasted to any user-defined dashboard.
3. Switch to the dashboard in which the widget is to be inserted.
4. Click ⋯ in the dashboard.
5. Select "Paste widget".
   The widget configuration is displayed.
6. Configure the widget.
   Additional information on editing the configuration can be found in the section "Create a widget (Page 105)".
7. Click "Add widget".

Result

The copied widget is displayed in the dashboard.

5.4.4.3 Export widget data

Description

You can export the parameter data visualized in a widget as a csv file.

Procedure

To export the widget data, follow the steps below:

1. Click ··· in the widget or in the detail view of the widget.
2. Click ↓ "Export widget data".

Result

A CSV file is provided in the download folder.

5.4.5 Widget views

Different views are available for a widget in the detail view.

See also

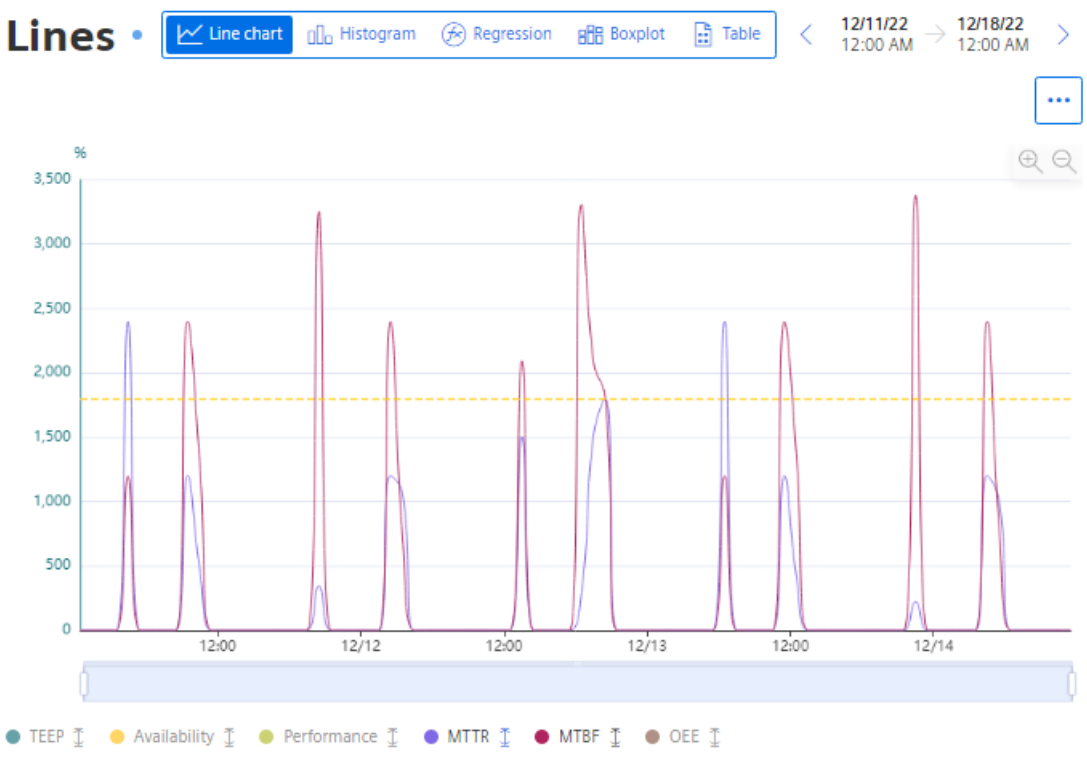
Scatter plot (Page 140)

5.4.5.1 Line graph

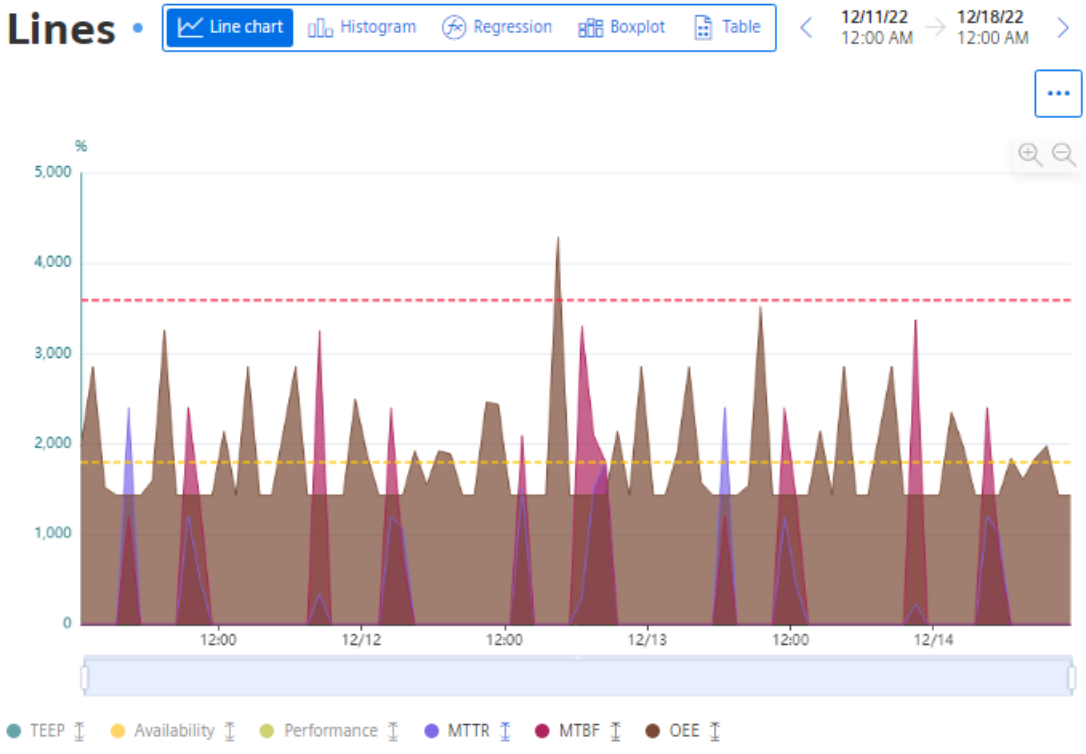
The value gradient of the individual parameters is displayed as a line. The detail view shows the graphs of all parameters in the colors that you have defined in the display options.

- Show/hide parameter: Click the parameter name below the display. The y-axis is automatically adjusted.
- Show/hide limit: Click ⌶ next to the parameter name
- Display details about a data point: Hover with the cursor over a data point.

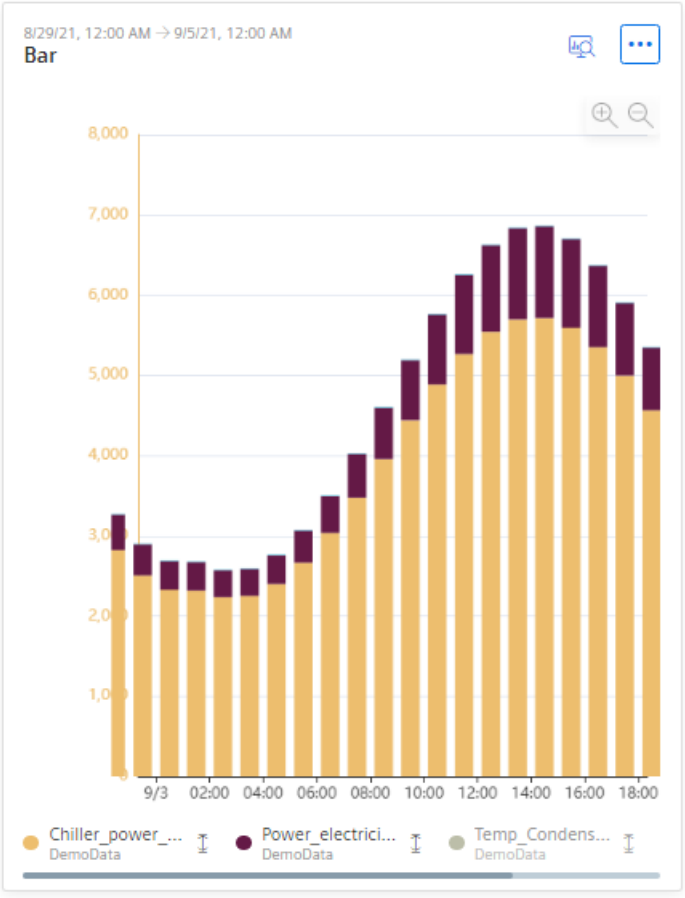
Visualization as spline curve



Visualization as area graph



Visualization as a stacked bar graph



5.4.5.2 Histogram

The histogram shows the frequency distribution of a selected parameter.

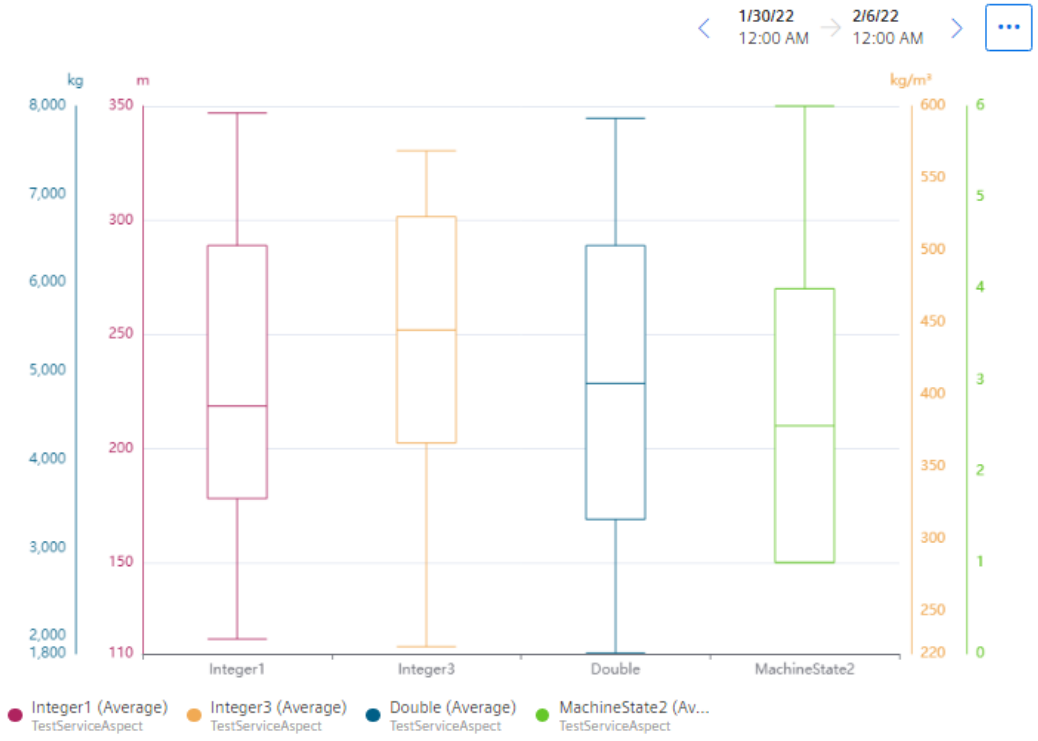
5.4.5.3 Regression

The regression analysis shows the relationship between two parameters.

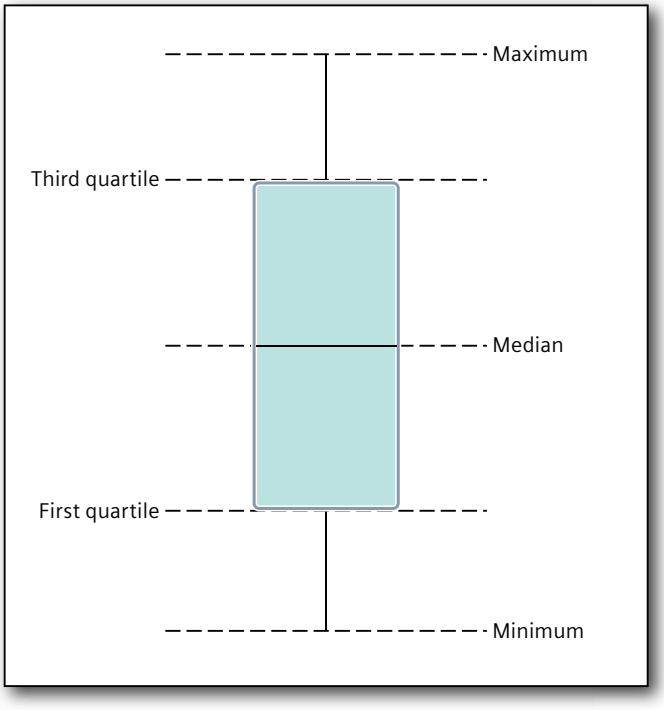
Select the parameter for the x-axis and the y-axis.

5.4.5.4 Boxplot

The boxplot display visualizes the statistical distribution of the values.



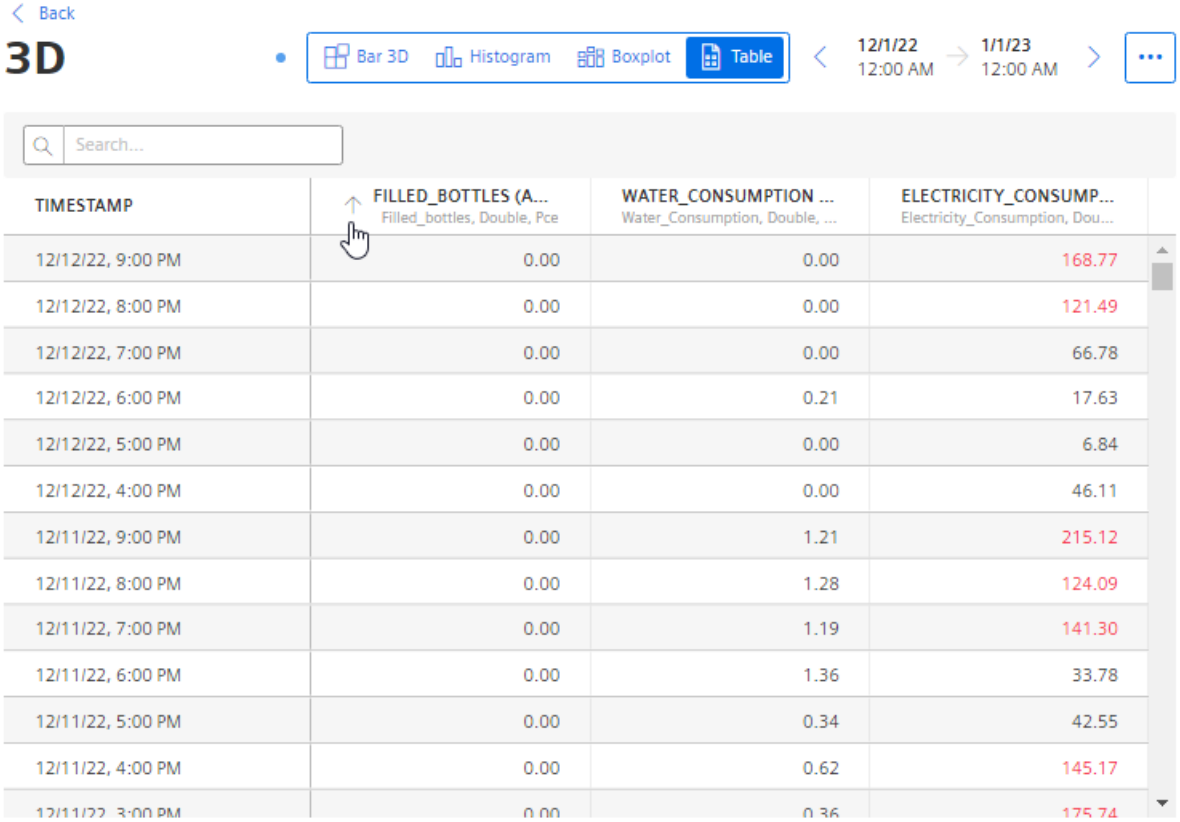
The box shows the range in which the middle 50% of the values lie. It is bounded by the upper, third and lower, first quartile.



Characteristic value	Description
Minimum	Smallest data value
First quartile	The smallest 25% of the values are less than or equal to this characteristic value
Median	The smallest 50% of the values are less than or equal to this characteristic value
Third quartile	The smallest 75% of the values are less than or equal to this characteristic value
Maximum	Largest data value

5.4.5.5 Table

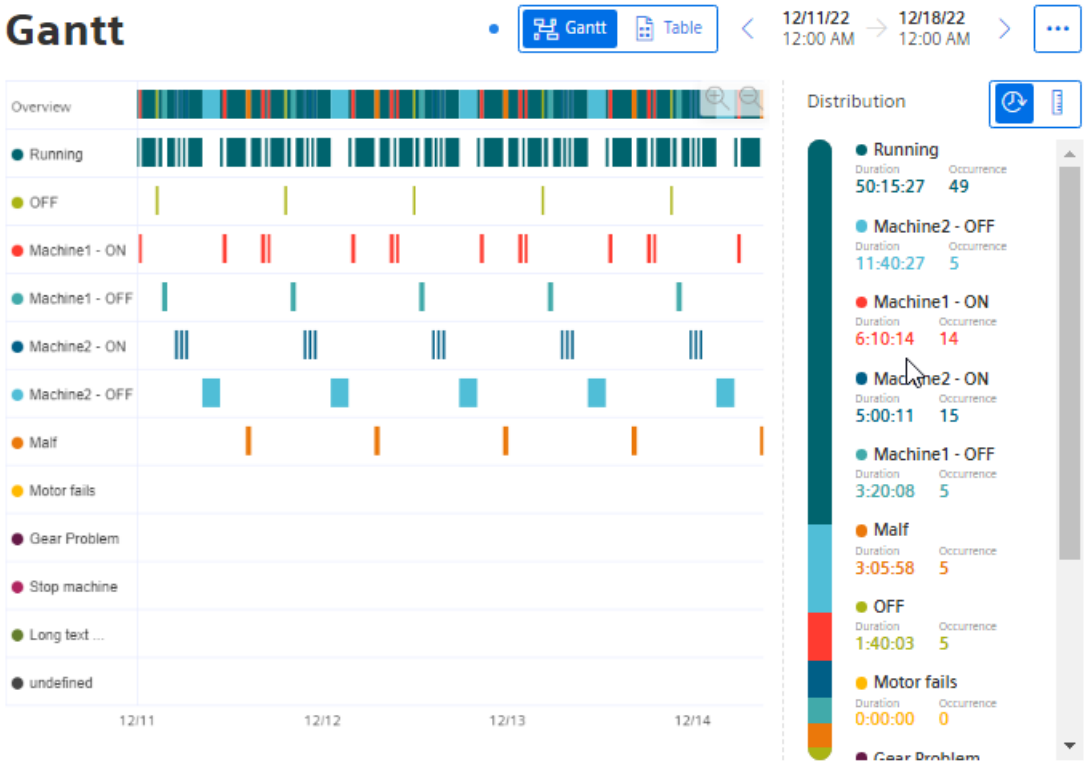
The values are displayed side-by-side in a table.



- Sort table: Click in the column header.
- Filter table: In the search box, type a string and click .

5.4.5.6 Gantt

Machine states are displayed broken down in the detail view.



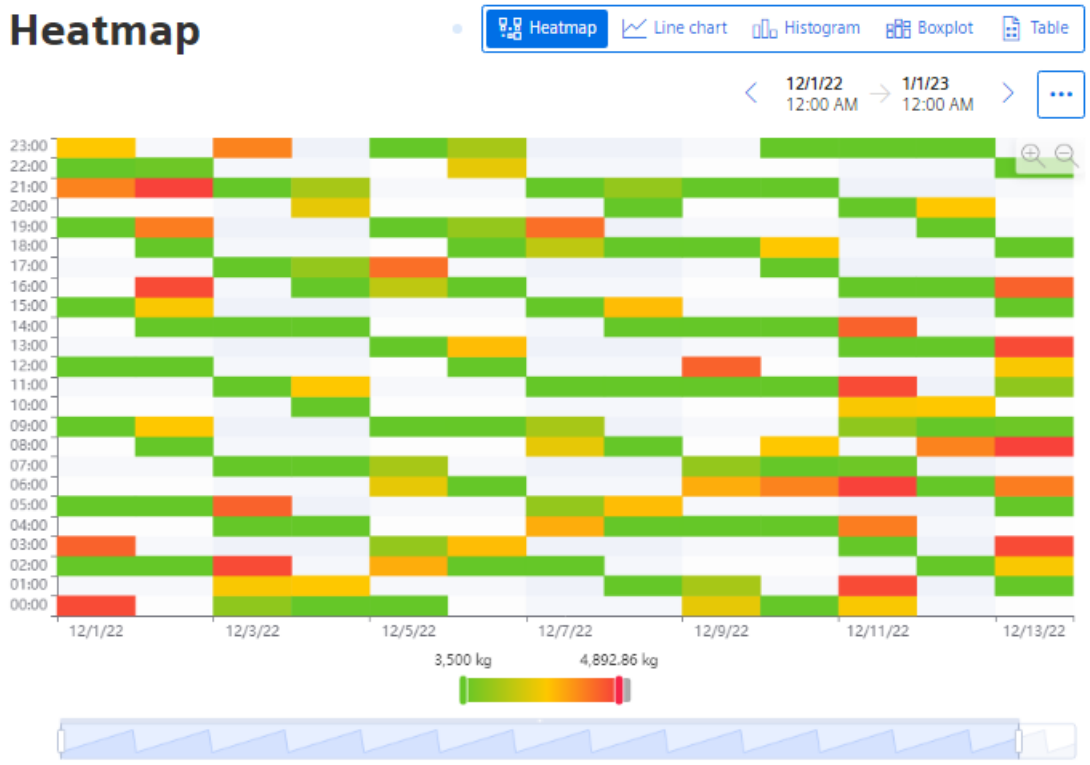
Distribution

shows the distribution by duration.

shows the distribution by number of the respective machine state.

5.4.5.7 Heatmap

The detail view Heatmap shows when and how often a parameter is in one of the value ranges.

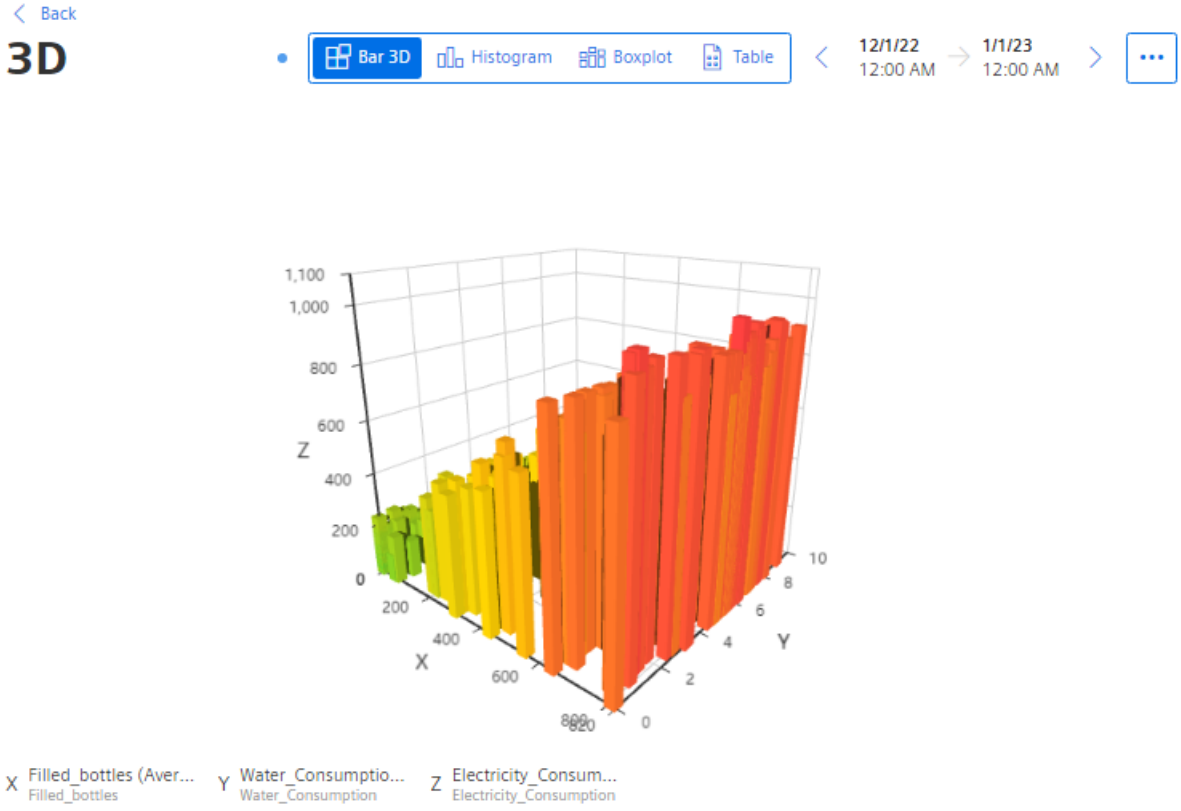


- Restrict display to individual values: Use the slider below the chart.

- To adjust the displayed time range: Use the slider below the chart.

5.4.5.8 3D bar

The 3-dimensional view visualizes the relationship between three parameters.



- Rotate view: While holding down the mouse button, move the cursor over the view.
- Zooming the view: Move the mouse wheel over the graphic.

5.4.5.9 Scatter plot

The "Scatter plot" detail view is available in the "Duration Curve" widget.

The view shows the raw data values underlying the Duration Curve.

5.4.6 Adapting a user-defined dashboard

Description

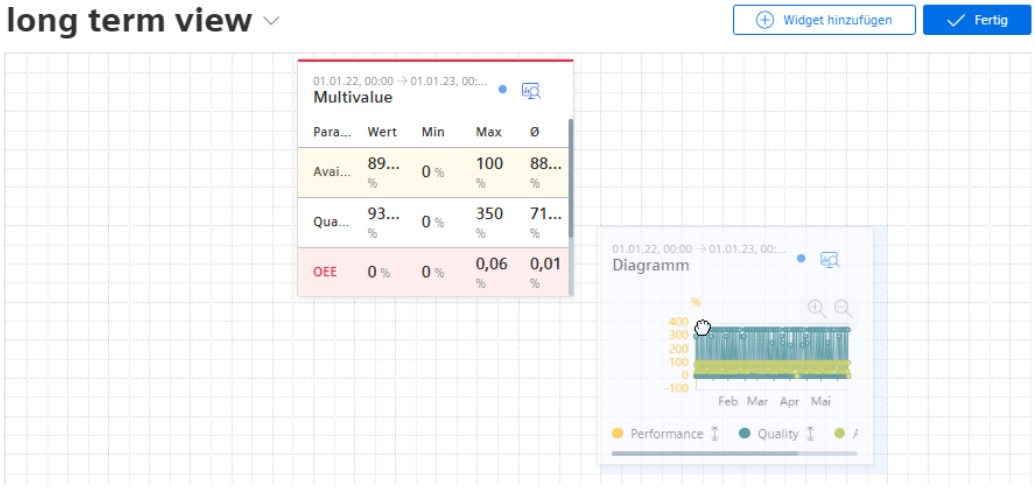
You can adjust the layout of a user-defined dashboard.

Procedure

To change the layout of a dashboard, follow these steps:

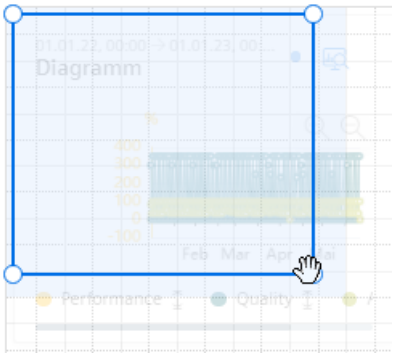
1. Click ··· in the dashboard.
2. Select "Adjust dashboard layout".
   The dashboard is in edit mode. Grid lines are displayed in the background of the dashboard.

3. To move a value, select the widget and drag it with the mouse to a different spot.



Permitted new positions for the widget are indicated through a blue shadow.

4. To select the size of a widget, select the widget and drag the corner point of the marking to a new position.



5. To add another widget to the dashboard, click "Add widget".
6. To finish editing, click "Finish".

5.4.7 Exporting and importing dashboards

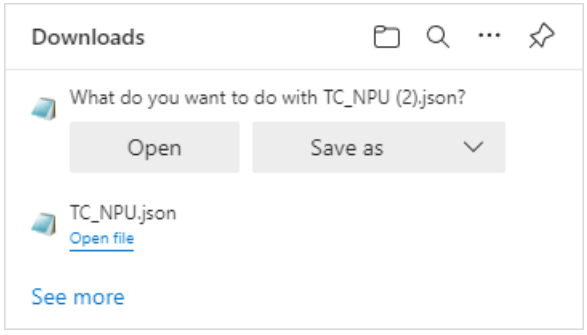
To be able to use status mappings that have been created on different devices, first export the user-defined dashboards and import them into other environments.

For a user-defined dashboard, export the dashboard in the file format JSON.

Exporting a user-defined dashboard

To export a dashboard, proceed as follows:

1. Display the dashboard.
2. Click ⋯.
3. To export a user-defined dashboard, select "Exporting a dashboard"
   The "Downloads" dialog box opens.

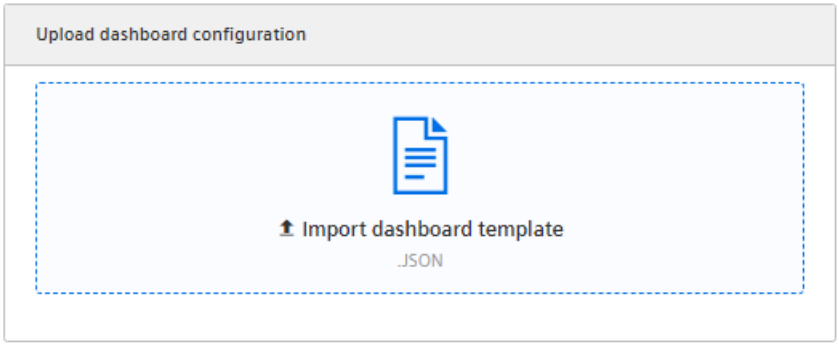


   – To display the Export file in text format, click "Open".
   – To save the Export file, click "Save as".
   – To display more exports, click "See more".
   – The toolbar in the dialog box has more options.

Importing a user-defined dashboard

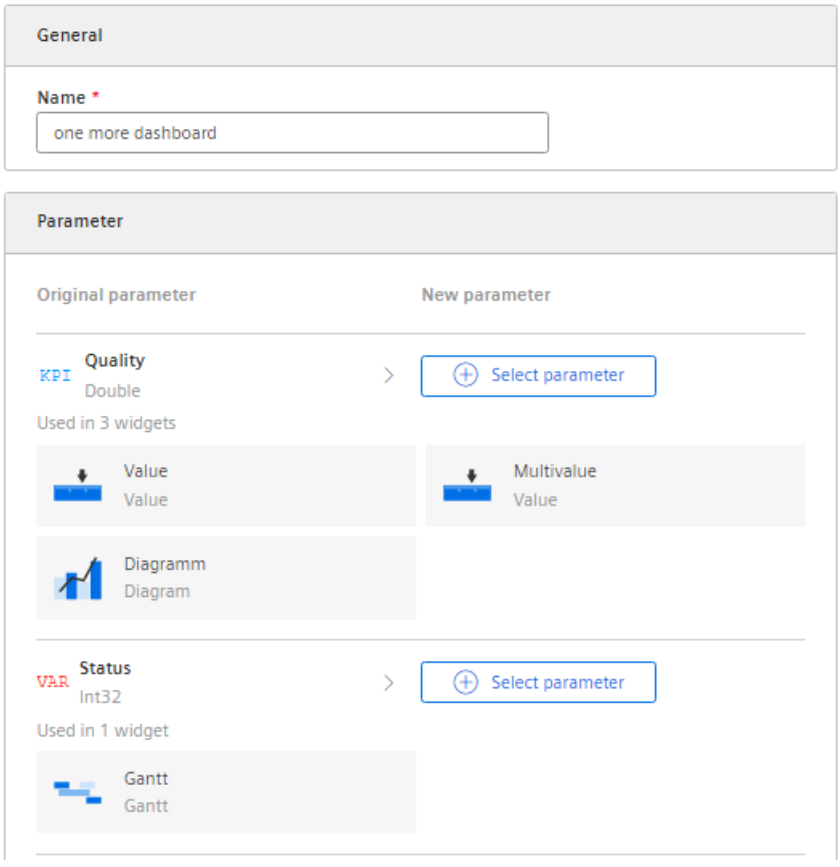
To import a dashboard, proceed as follows:

1. Select an asset in the navigation toolbar in My Plant.
2. Click "Add dashboard" and select "Import dashboard".
   The "Upload dashboard configuration" dialog box opens.



3. Click "Import dashboard template" to select a file for import.

4. Click "Save" to import the selected file.
   The configuration of the dashboard is displayed.



   Since not all parameters, configurations of types, and widgets are available in the environment, adjust the configuration of the dashboard before importing.

   – If the name of the dashboard is already in use on the asset, assign another name.
   – Replace the parameter used in the imported configuration with a parameter that is actually present on the asset.

   Status mappings and user-defined periods of the exported dashboard are also imported. Importing with erroneous data on parameters and configurations is not possible.

5. Click "Import dashboard".
   After a successful import, the "Go to dashboard" button is available.

Note

Maximum number of user-defined dashboards on an asset

The number of dashboards on an asset is limited to 5. No other dashboard can be imported once this number is reached.

5.5 Analyzing data

5.5.1 Using favorites

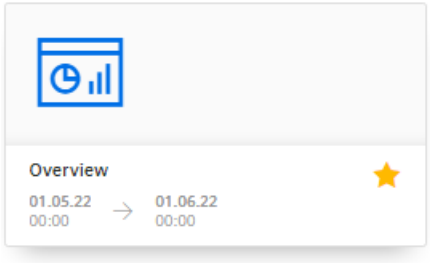
Description

To quickly get a display of the dashboards relevant for you, mark them as "Favorite".

Favorite dashboards are prominently displayed in overviews. In this manner, access to these dashboards is simplified.

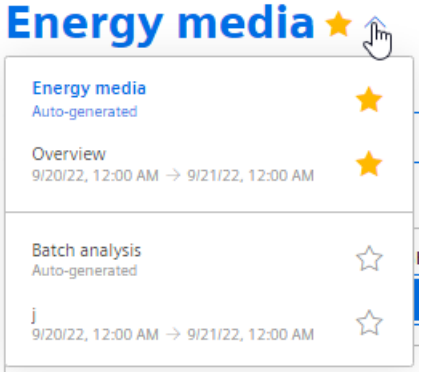
Procedure

1. To mark a dashboard as a favorite, click in the star on the dashboard.



2. To unmark it as a favorite, click the star again.

The "Favorites" function is also available in other selection lists and displays of dashboards.



5.5.2 Finding the analysis quickly

The app makes it easy for you to display analyses without time-consuming searches in the asset structure.

1. Under "Analyses" in the navigation bar, select the analysis type:
   - Energy media analysis
   - Batch analysis

   The configured dashboards are displayed.
2. To find a specific dashboard, use the Search field.
3. Use the sorting options to sort the dashboards by KPIs or visualization parameters.
4. Use the time navigation buttons to modify the displayed period for all displayed dashboards.

The app makes it easy for you to display analyses without time-consuming searches in the asset structure.

1. Under "Analyses" in the navigation bar, select the analysis type:
   - OEE analysis
   - Step time analysis
   - Batch analysis

   The configured dashboards are displayed.
2. To find a specific dashboard, use the Search field.
3. Use the sorting options to sort the dashboards by KPIs or visualization parameters.
4. Use the time navigation buttons to modify the displayed period for all displayed dashboards.

Display of assets

Displays the assets in the panel on the left

Refreshes the assets display

Shows the assets as a tree structure

Shows the assets as a flat list

Note

Grayed-out assets

Grayed-out assets in the tree structure indicate assets for which a dashboard has not yet been configured for the selected analysis.

5.6 Create reports

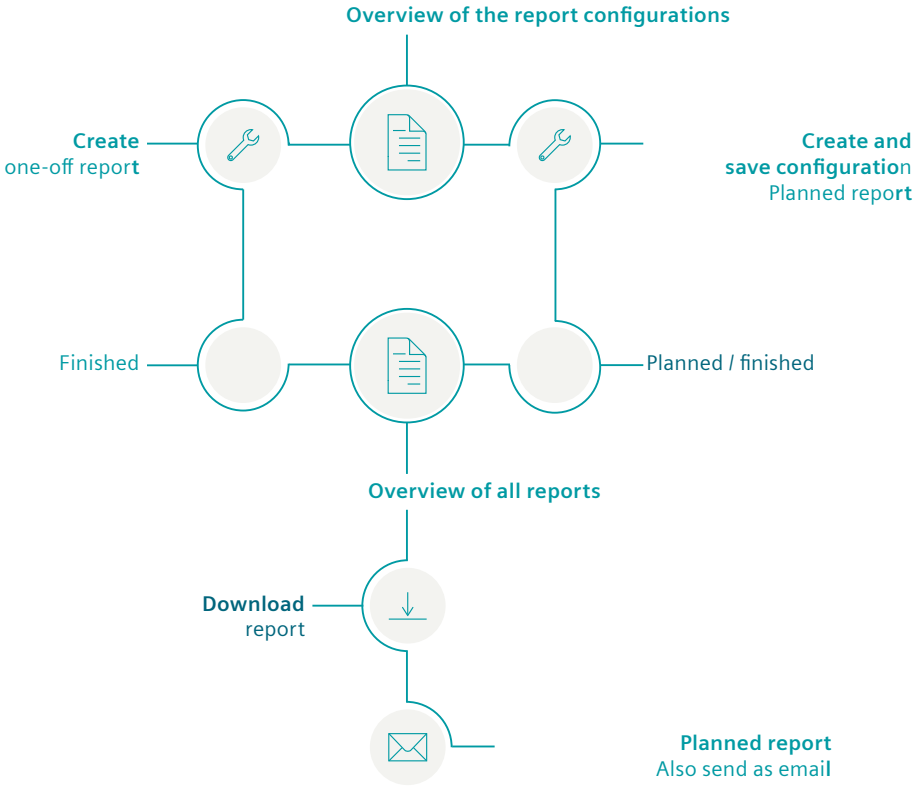
5.6.1 Introduction to Reporting

Description

Reports are a central component of the app. Reports are generated to complement the visualization of KPIs and variables on the dashboards. The reports provide selected information on productivity, energy consumption and costs at regular intervals without the recipient of the reports having to have access to the app. You can also generate a one-off immediate report whose configuration is not saved.

Reports are configured individually. Reports are generated as an Excel spreadsheet. You can use a self-designed template.

Reports can be downloaded and sent automatically via email.



Procedure

To configure and generate reports, proceed as follows:

1. Use the overview of the report configurations. (Page 147)
2. Configure a report. (Page 148)
3. View generated reports and download them. (Page 153)
4. Create an ad hoc report based on an existing configuration. (Page 154)

5.6.2 Overview of the report configurations

Introduction

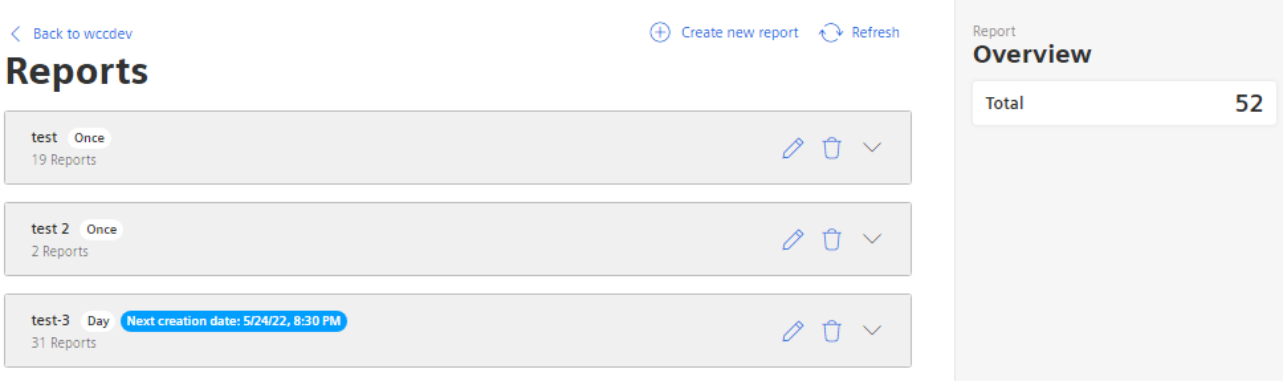
Reports are based on the configurations which are saved in the "Reports" view.

Here you manage all configurations, create new ones, edit the available ones and delete the unnecessary ones.

Procedure

To display an overview of the report configurations, follow these steps:

1. Select an asset in My Plant.
2. Click ↗ in the information panel next to the "Reports".
   The overview of configurations is displayed.



3. To create a new configuration, select ⊕ "Create new report configuration".
4. To edit a configuration, select "Edit" ✎.
5. To delete a configuration, select "Delete" 🗑.
   You cannot delete a configuration if reports are already available based on it.
6. To view the reports based on a configuration, click ∨ in the configuration display.
   The view is expanded.
7. To update the view, select "Refresh" ⟳.

The information panel displays the total number of reports issued for the asset.

5.6.3 Configuring reports

Description

To create a report once or with periodic planning, define a configuration. You define the following in the configuration which is saved:

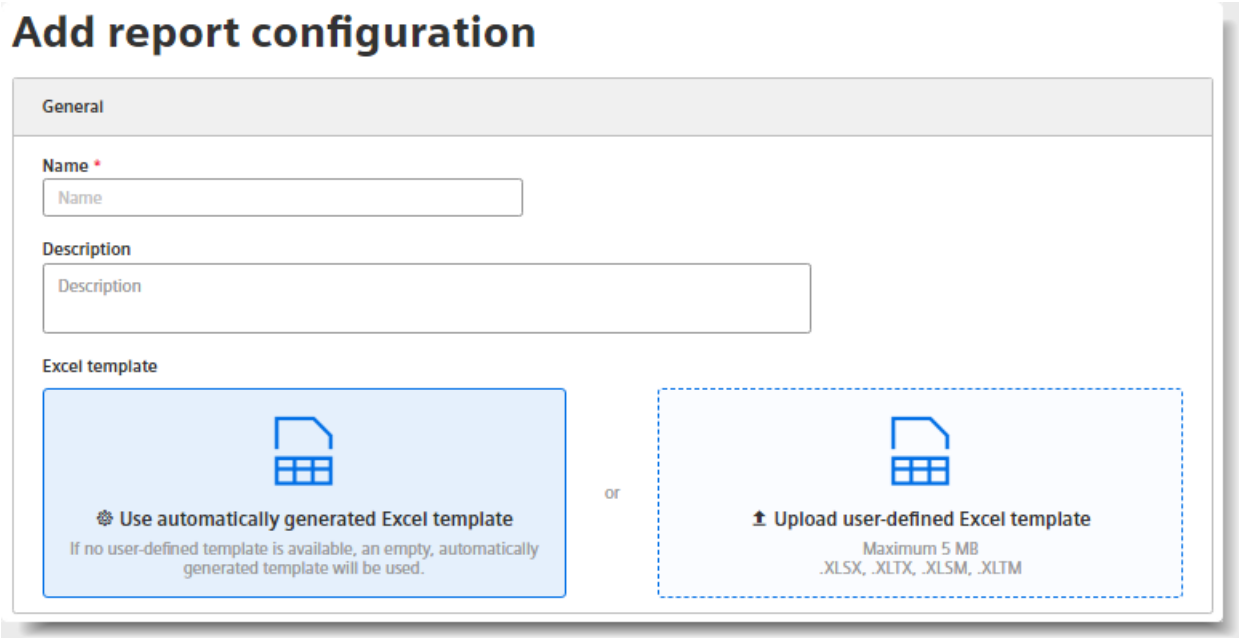
- Report interval: One-off or planned
- KPIs and variables that are reported
- Type of aggregation: Balance value or process values
- Placement of the values in a sheet of an Excel file
- Recipients of the report

A report consists of one or multiple areas. For example, the values of a year can be shown in one area, while the daily values of the last month are shown in an additional area.

Procedure

To configure a report, follow these steps:

1. Go to My Plant and select an asset. The tiles of automatically generated and user-defined dashboards for this asset are displayed.
2. Click ↗ in the information panel next to the "Reports".
   If a configuration has already been created, the overview is displayed.
3. To define a new configuration, select "Create new report configuration".
4. The "Add report configuration" editor appears.



5. Enter the name of the report.
   The name is shown as the subject in the sent email and in the overview of the reports.

6. Optionally enter a description for the report.
   The description makes it easier to assign the report.
7. Load an Excel file as a template for the report.

Note

Excel template

An Excel file is required to create the report.

- Permitted data formats XLSX, XLTX, XLSM and XLTM
- Minimum file size: 1 KB
- Maximum file size: 5 MB

You can use either an automatically generated template or a user-defined Excel template.

Note

User-defined Excel template

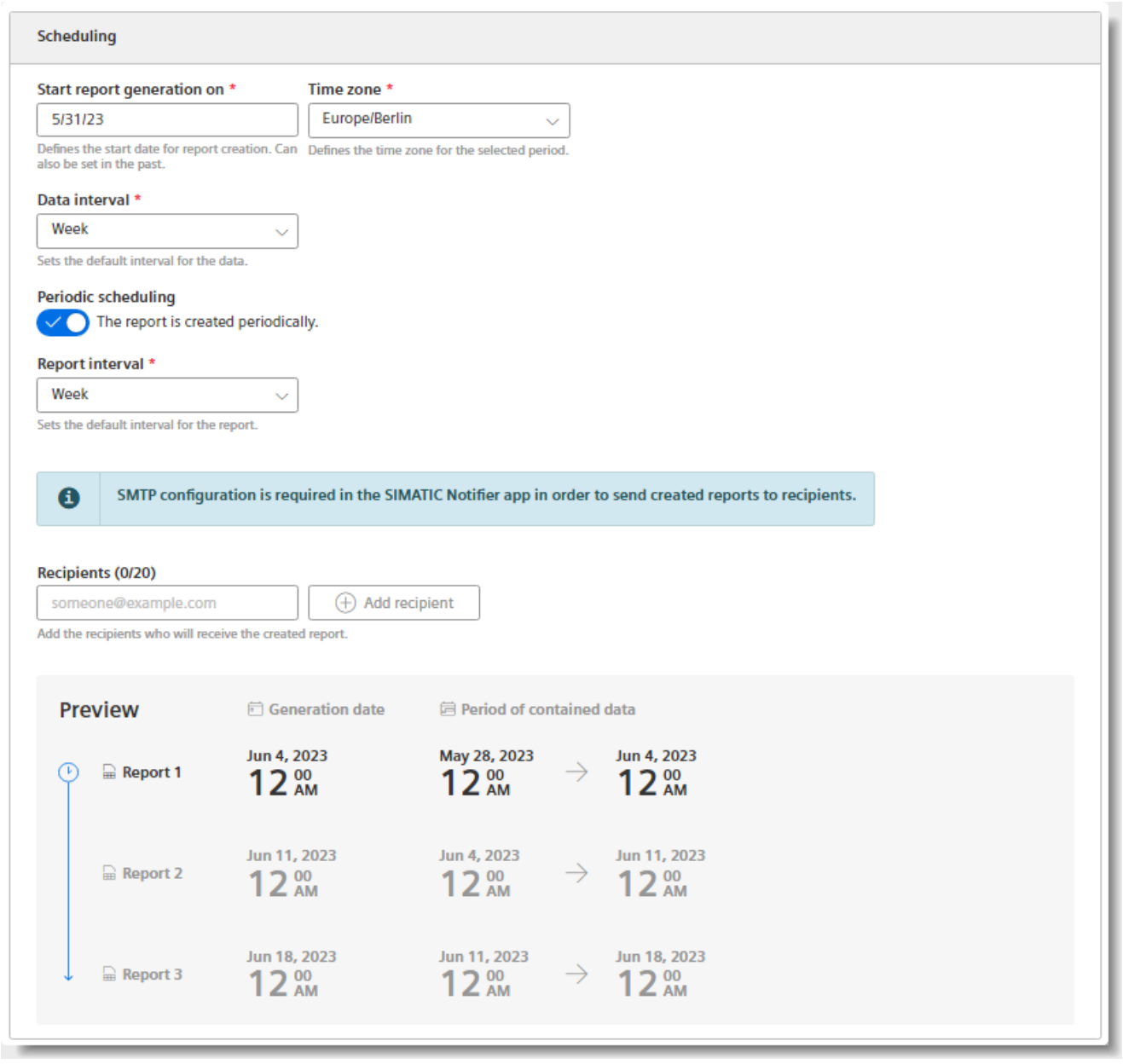
There are no further restrictions when designing the template.

When selecting the start cell within a range, ensure that elements of your template are not overwritten.

The template can, for example, contain a letter head, or recurring information on the location of the plant for each report. You can structure a template using pre-formatted, filled cells as headings.

If you do not upload a template, a blank Excel file is used as the basis for the report. You can replace the automatically generated template with your own template at any time.

8. Select the date on which you want the report generation to start.
   The date can lie in the past.

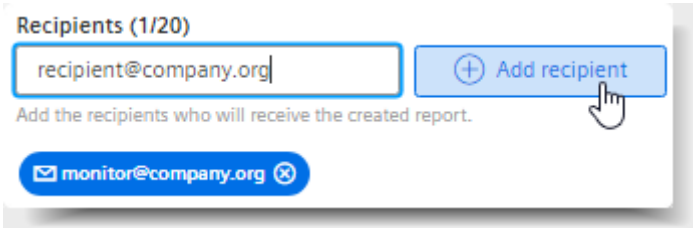


9. Select a time zone.
   The time zone is added as an offset to the start date.
10. Select the "Data interval".
    The report is generated for the first time when the interval after the start date is reached.
    Example: The start date is 01/01/2022. The interval is one week. The report is generated on 7 Jan. 2022.

11. To create a configuration for a report that is generated regularly based on the selected interval, activate the "Periodic scheduling" switch.

To generate a one-off report, deactivate the switch.

12. Specify up to 20 valid email addresses for sending a periodical report by email.



Note

One-off reports

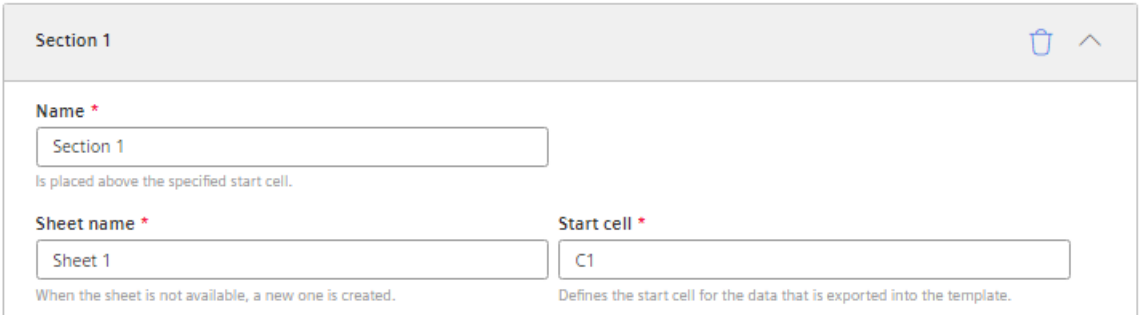
One-off reports are not sent via email.

13. Enter the name of the first section.

Note

Creating sections

You can create up to 20 sections with different configurations. The sections can be exported in different sheets of the Excel workbook.



The name is specified together with the report interval in the start cell of the report. The values are listed below.

14. Specify the name of the Excel workbook in which the section is exported.
If a sheet with that name does not exist in the template, it is created.

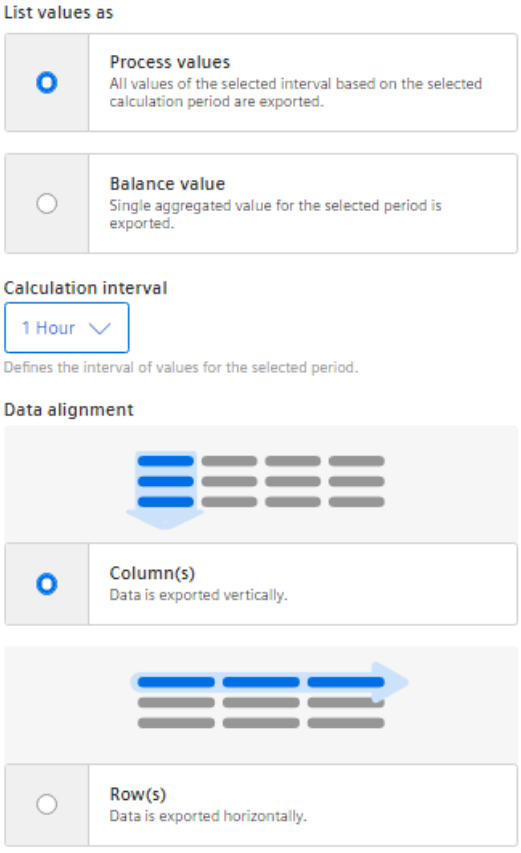
15. Enter the start cell as of which the values are exported.

Note

No check of the cell sections

There is no check as to whether the exported values will overwrite existing content.

16. Select whether a balance value or process values are exported in this section.
    - Balance value: Single value that results from the aggregation of the interval values.
      Example: The average value for one month.
    - Process values: All values that are available during the selected interval.
      Example: A value is exported for each day of a month.



17. Only for process values, select the interval of the calculation. The interval specifies how often a process value is output within the reporting period.
    Example: For the reporting period of one month, values are output every hour.
18. Select whether the data is arranged in columns or rows.

19. For new report configurations, add at least one parameter which is output in the area.

To change the sequence of the parameters, drag a parameter up or down by means of ⠿.

Note

Parameter selection

Maximum number per section: 50 parameters.

Parameters of the String type are not supported.

Note

Limited export to Excel

In a report, you can export a maximum of 500,000 cells to Excel.

20. You can add another value at any time by clicking ⊕ "Add parameter".
21. To create an additional section, select ⊕ "Add section".
22. To save the configuration, select "Save".

Result

- The configuration for a report has been created and saved.
- The "Reports" view is displayed.
- The periodic reports are generated as of the start date with the selected interval. The one-time reports are only created for the start date.

5.6.4 View report

Description

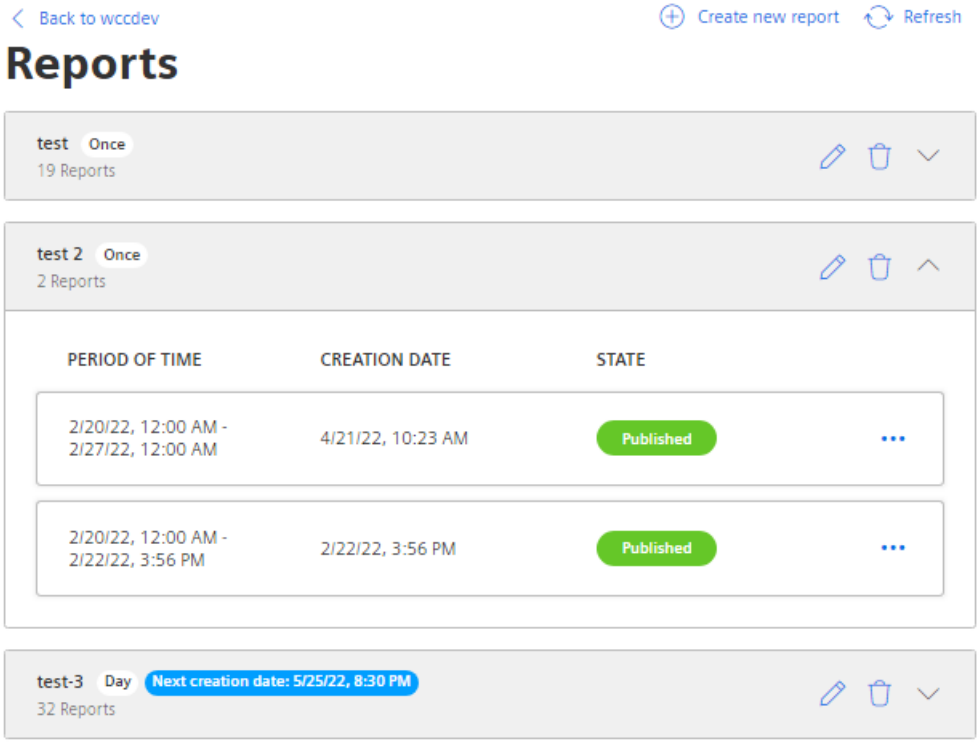
In the "Reports" view, both available and planned reports are displayed. You can see and download periodically generated and one-off reports.

If there are more than 500 reports in the app, the oldest reports are deleted.

Procedure

To display the overview of all reports, proceed as follows:

1. Select an asset in My Plant.
2. Click ↗ in the information panel next to the "Reports".
   The overview of configurations is displayed. Under each configuration, you find reports which were planned and created based on the configuration.
3. To view the reports based on a configuration, click ∨ in the configuration display.



   The view is expanded.

4. To download a report, click ••• and from the drop-down menu select "Download" ↓.
5. To create a report again after an error has occurred, select "Regenerate" ↻ in the row of the report.
6. To delete a report, select the report and click "Delete" 🗑.
   This way you delete the report and not the configuration.

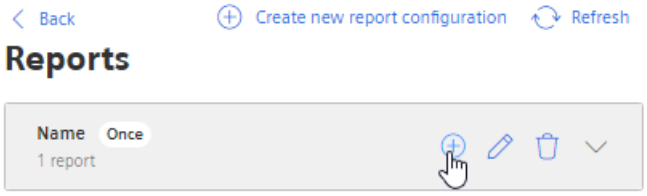
5.6.5 Creating an ad hoc report

Based on an available report configuration, a report can be created at any time. The report can be created for a past period of time.

Procedure

To create an ad hoc report based on an existing configuration, follow these steps:

1. Display the overview of configurations.
   More information: View report (Page 153).
2. In a report configuration, click "Create ad-hoc report".

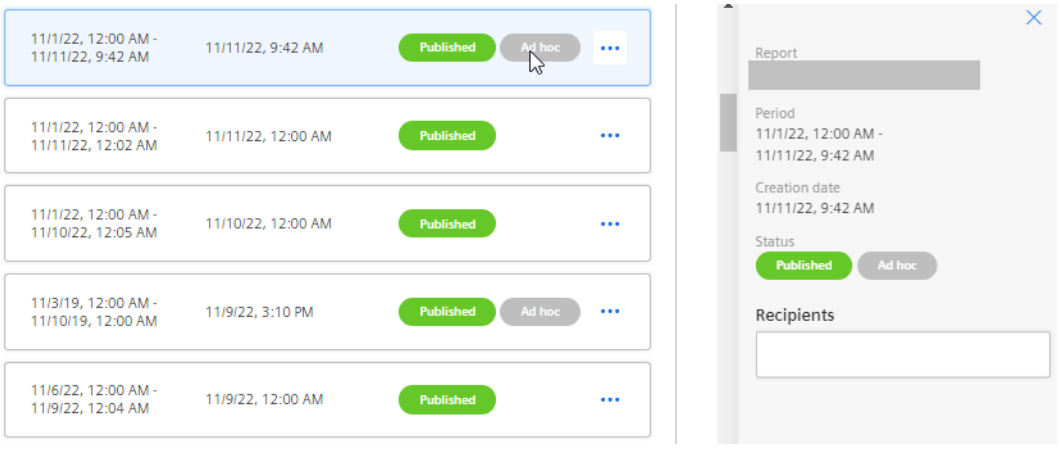


   The "Create ad-hoc report" dialog is displayed.
3. Specify the start date.
   The preview shows the period for which the report will be created.
4. Click "Add".

Result

A report is immediately created once based on the selected configuration.

The report appears in the list of reports and can be downloaded there.



Quality codes

6

Description

The quality code measures the quality of the connection from a data provider to the MindConnect element. This means that a value with quality code <> not equal to TRUE is ignored in the app, because the quality code is not transferred to the platform. This value is not included in the aggregation, not included in the calculation of KPIs, and not included in the dashboard.

The following table is based on the OPC UA standard and shows the quality codes possible for OPC UA and S7:

Quality code (hex)	Quality code (dec)	Quality	Description
0x00000000	0	GOOD	Good quality All values could be read.
0x00BA0000	12189696	GOOD_INCOMPLETE	Good quality Values may be incomplete. A least 1 value could be read.
0x002F0000	3080192	GOOD_OVERLOAD	The sampling interval has slowed down due to resource constraints.
0x40920000	1083310080	UNCERTAIN_INITIAL_VALUE	Uncertain initial value Quality of the value is worse than usual. It might still be possible to use the value.

The quality code has the binary 8-bit structure QQSSSSLL.

- Digits 1 and 2 (QQ) define the quality of the value.
- Digits 3 to 6 (SSSS) specify the sub-status of the quality.
- Digits 7 and 8 (LL) are optional and define possible limits.

Appendix

7

7.1 Abbreviations and acronyms

CSV	Comma separated values	File format of a text file which can be imported easily and in an uncomplicated manner into spreadsheet programs.
KPI	Key Performance Indicator	Key performance indicator
MTBF	Mean Time Between Failures	Mean time between failures
MTTR	Mean Time To Repair	Average repair time
MVR	Multivariable Regression	Description of a parameter using other parameters
OEE	Overall Equipment Effectiveness	Overall equipment effectiveness
TEEP	Total Effective Equipment Performance	Medium for the performance metrics