

Industrial Edge

App Performance Insight for Industrial Edge V1.4


Application Manual


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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.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

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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Introduction

1.1 Security information

Security information

Siemens provides products and solutions with industrial security 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 security 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 security measures that may be implemented, please visit:

<https://www.siemens.com/industrialsecurity> (<https://new.siemens.com/global/en/company/topic-areas/future-of-manufacturing/industrial-security.html>)

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 latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under:

<https://www.siemens.com/industrialsecurity> (<https://new.siemens.com/global/en/company/topic-areas/future-of-manufacturing/industrial-security.html>)

1.2 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 Performance Insight for Industrial Edge 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 KPIs).

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

1.3 Security Information for Industrial Edge Apps

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.

1.3 Security Information for Industrial Edge Apps

Security information (assumptions/constraints) for Industrial Edge Apps is as follows:

- Only authorized internal operators will have access to Industrial Edge Device within a secure network using VPN connection.
- Perimeter firewall configuration responsibility lies with the end customer.
- The security guidelines for usage of USB Flash Drives in the shop floor area are applied accordingly.
- Creating users with appropriate access rights upon commissioning is the responsibility of the operator.
- The customer is responsible for configuring the application on the basis of the system requirements and technical capabilities of the documented App according to the Installation / User Manual such that the automation system performance is not impacted.
- The system is installed in an environment ensuring that physical access is limited to authorized maintenance personnel only. Managing unauthorized attachment of removable devices is the responsibility of the operator.
- The platform including hardware, firmware and operating system is securely configured and maintained by the operator.
- The operator is capable of protecting the environment from malware infection.
- Centralized IT security components (Active Directory, Centralized IT Logging Server) are provided and well secured by the operator and are trustworthy.
- The operator personnel accessing the system is well trained in the usage of the system and general information security aspects like password handling, removable media, etc.
- The operator is responsible for the CIA (Confidentiality, Integrity and Availability) of data stored outside the Industrial Edge Device.
- The operator is responsible for configuring the CPUs with appropriate read/write access levels (legitimization), and for configuring the Industrial Edge Apps using appropriate passwords for data collection from CPUs.
- The customer takes care about the time synchronization of Industrial Edge Management and Industrial Edge Device.

1.4 Overview of Industrial Edge

Siemens Industrial Edge is the next generation of digital automation. With Industrial Edge, you use intelligence and scalability of the cloud directly in your manufacturing - in a simple, high-performance manner and without your data leaving the manufacturing process. Industrial Edge combines local and high-performance data processing directly in automation with the advantages of the cloud: app-based data analysis, data processing and Infrastructure-as-a-Service concepts with central update functionality. In this way, you can quickly integrate apps into manufacturing and manage them with a high degree of automation.

Industrial Edge gives you the opportunity to continuously make changes to your automation components and plants, analyze large volumes of automation data to implement innovative functions, such as preventive maintenance, and to obtain maximum flexibility and thus productivity over the entire machine lifecycle.

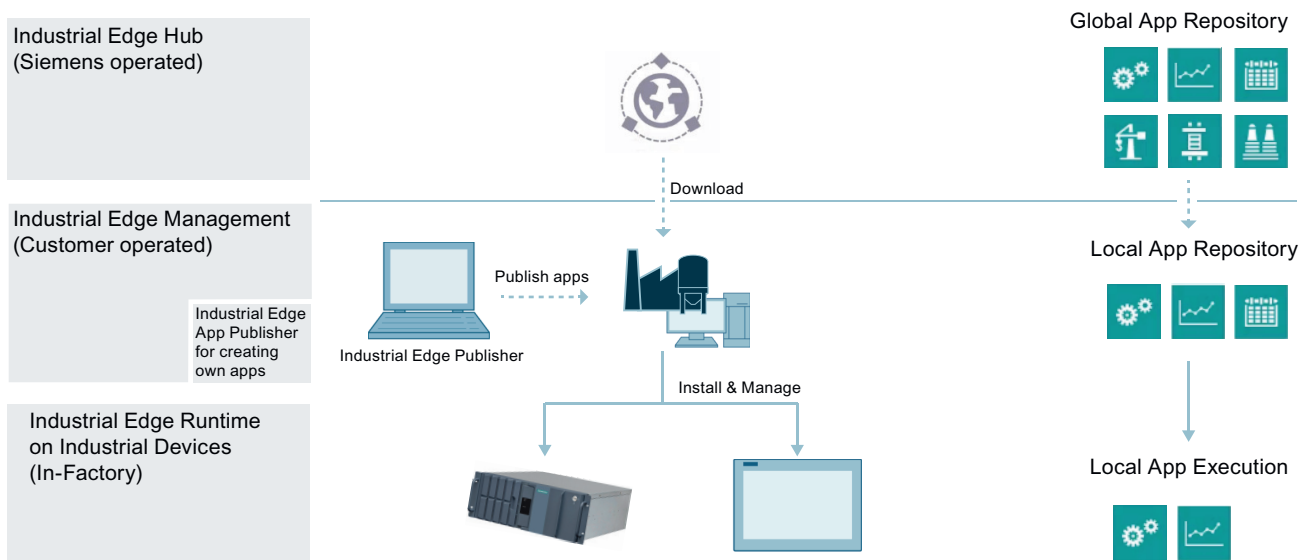
With the Industrial Edge Hub, an App Store is available to you where you can find all Siemens apps and 3rd-party apps. From here, you can manage all licenses for your apps and devices centrally and install updates for security issues, device firmware, apps and Industrial Edge Management.

You can monitor and manage distributed Edge devices centrally in the Industrial Edge Management. In this way, new apps and software functions, for example, can be installed on all connected Edge devices company-wide. Central software management thus minimizes the workload for performing maintenance and updates on individual devices.

On the individual Industrial Edge devices, you can start and run apps and keep statistics on an Edge device, for example.

With the Industrial Edge Publisher, you can develop your own Edge apps and make them available to other users in Industrial Edge Management.

Another component of the Industrial Edge ecosystem is Industrial Edge Runtime, which is installed on Edge Devices (IED) or Unified Comfort Panels (UCP) and on which the system, including all applications, ultimately runs.



Industrial Hub	Industrial Edge Management	Industrial Edge Runtime on Industrial Devices
Platform for purchasing apps and software, and for monitoring management systems	Centralized control level for managing devices, apps, and store floor users.	Software level for app container
<ul style="list-style-type: none"> • Central management location for apps, contributing to corporate standardization • Management of all licenses in use and thus easy cost estimates • Overview of all management system instances that are in use worldwide 	<ul style="list-style-type: none"> • Assignment of apps to the matching Edge devices (worldwide) • Specification of user rights (e.g. app installations) • Just a few clicks for app setup and security update cycles • Supervision of all operations using the centralized Admin view • Excellent usability for IT and OT users, helping to promote user adaptation and self-service 	<ul style="list-style-type: none"> • Installation of scalable apps on many different Edge devices • Supports use in industrial environments by <ul style="list-style-type: none"> – ensuring security and reliability – Providing comprehensive user management to meet the requirements of machine manufacturers and plant operators alike – Adhering to Company Policy Compliance, e.g. user management integration or IT/firewall specifications • Integrating device connectivity to cloud and automation systems

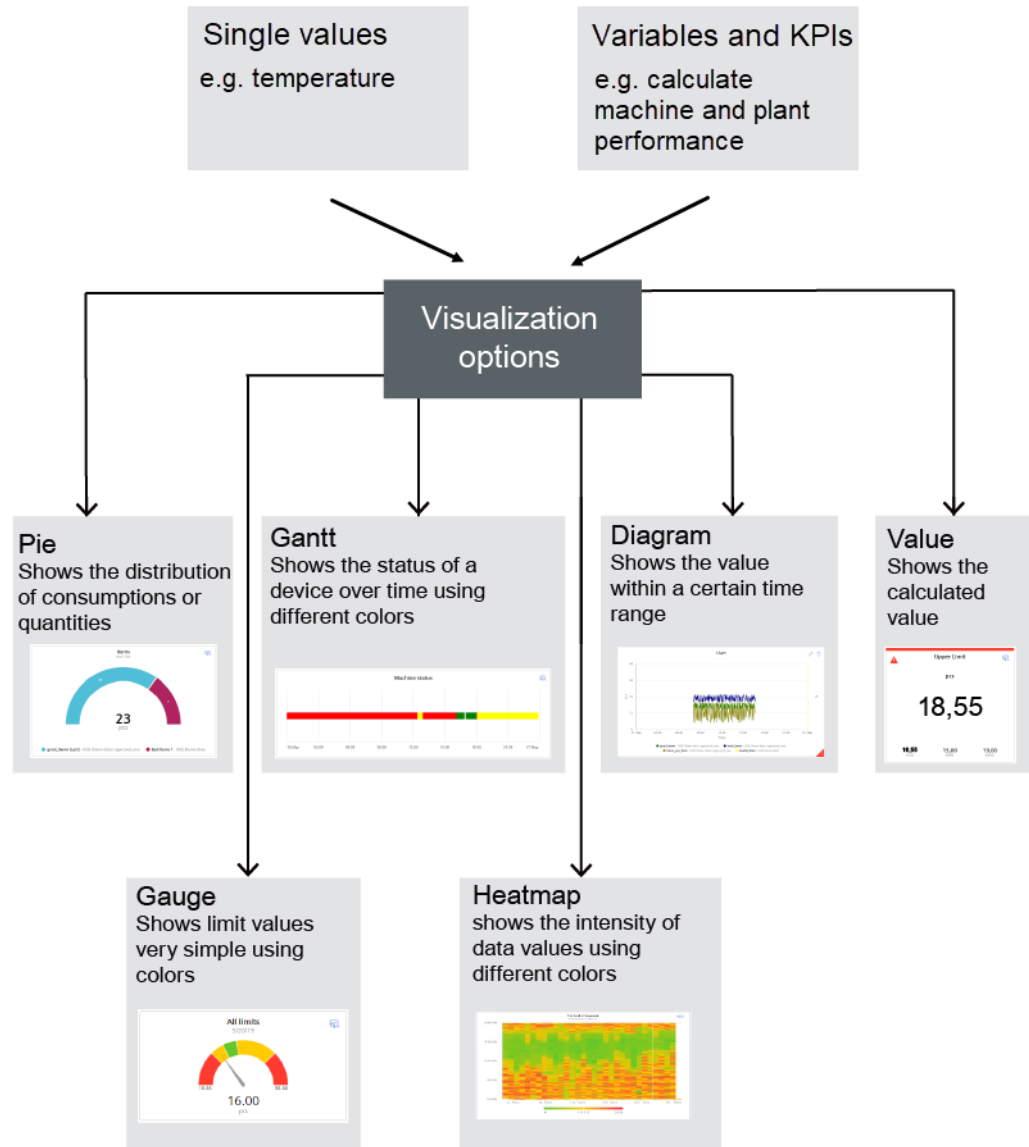
1.5 Function overview

Introduction

The App Performance Insight for Industrial Edge offers an online performance overview of machines, production lines or entire production sites.

- You have access to machine and plant performance data.
- You can use individual KPI types to calculate machine and plant performance, e.g. for overall plant efficiency or quality.
- In addition to the KPI type and KPI instance application in combination, you can also create a KPI instance directly at the asset without having defined a KPI type beforehand.
- Widgets allow you to visualize machine states and performance and configure flexible dashboards to monitor your plant.

- The detailed view of the widgets allows you to determine and compare production performance over different time periods. This will help you identify unused performance potential in retrospect.
- You obtain valuable information for accurate decision-making in order to optimize machine availability.



Browser recommendation

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

The Google Chrome and Microsoft Edge browsers are supported. We recommend the Google Chrome web browser. You should preferably use 1920x1080 resolution.

Internet Explorer is no longer supported as of version 11.

1.6 Application examples

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

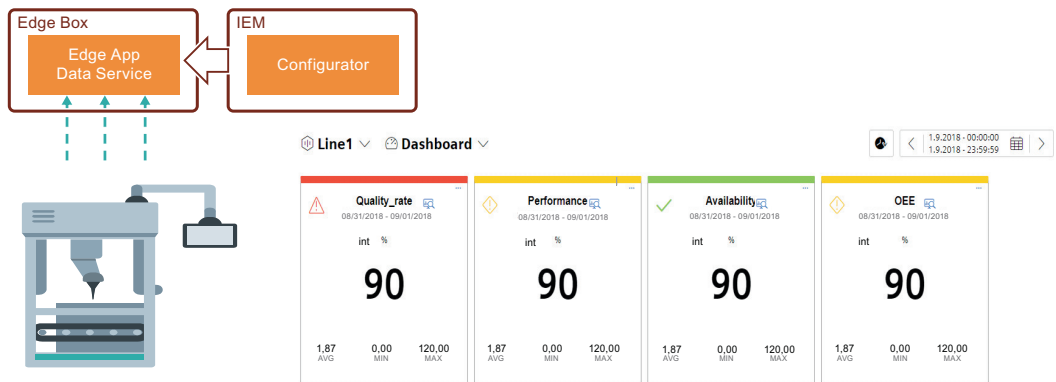
Expiration date of the trial version for the Panel

The trial version of the Performance Insight app is free of charge and expires on January 1, 2023. If you want to continue using the app, please order the appropriate license.

1.6 Application examples

Application example visualization

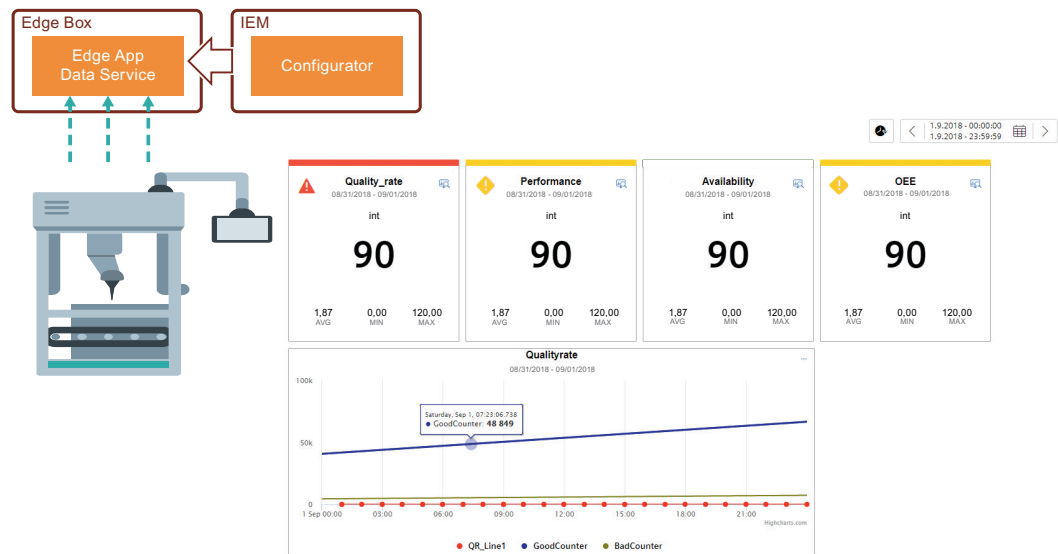
From the plant, you transfer data such as quality rate, power and availability to Data Service. You visualize the data in Performance Insight with widgets.



Application example KPI calculation

Raw data, such as production numbers, machine runtimes and water consumption, are transferred from production to the Data Service.

You use the transferred raw data to calculate and visualize indicators for your plant performance with the app.



1.7 Getting Started

Description

You can find a Getting Started for the Edge App Performance Insight here: Getting Started Performance Insight (<https://github.com/industrial-edge/performance-insight-getting-started>)

1.8 Abbreviations and acronyms

IED	Industrial Edge Device	
IEM	Industrial Edge Management	
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

Installation

2.1 Validity of the documentation

Description

The "Performance Insight for Industrial Edge" documentation is valid for the installation of the app on an Edge device as well as on a Unified Comfort Panel (UCP).

The differences are highlighted in the respective sections.

2.2 Overview of additional documentation

Overview

The following table lists additional documents that supplement this description, some of which are available on the Internet.

Documentation	Main contents
Industrial Edge Hub (https://iehub.eu1.edge.siemens.cloud)	This page describes the functions of the Siemens Industrial Edge platform and the functionalities of the Edge Management System.
System overview (https://new.siemens.com/global/en/products/automation/topic-areas/industrial-edge/simatic-edge.html)	This page provides an overview of all Edge solutions.

2.3 System requirements

Note the following system requirements for the installation of the Edge Apps.

Software requirements

The following Internet browsers are required:

- Google Chrome, Version \geq 72
- Firefox Version \geq 62
- Data Service

The Data Service app is available in the Industrial Edge Hub in the "Library" area. From there you can transfer the app to your Industrial Edge Management (IEM) and from there install it on your Industrial Edge Device (IED).

With the Data Service app you model the structure of your industrial process using the assets and aspects that you then need for the plant structure of the Edge apps.

Note

Installation of the apps

All apps must be installed on the same IED.

Hardware requirements

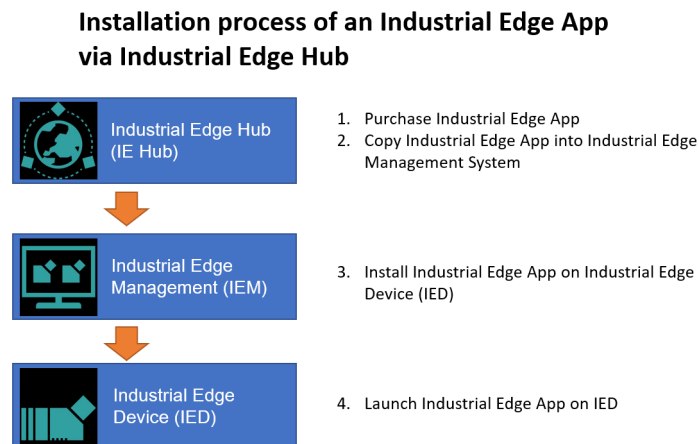
- A device on which the Industrial Edge Management (IEM) is running (VM - ISO: Version 1.0.8)
- An Edge device (IED) that is compatible with Industrial Edge Management:
 - IED Model: e.g. SIMATIC IPC 227E Nanobox, SIMATIC IPC 427E, IPC127E and IPC827E or Unified Comfort Panel (UCP)
 - Hard disk: At least 10 GB available
 - RAM: 2 GB available RAM
- The Edge device must be on board the Industrial Edge Management.
IEM, IED, and web browsers must be synchronous in the UTC time zone.

2.4 Installing the Performance Insight app on an IED

2.4.1 Overview of the installation process

Description

In the graphic below you can see the steps involved in the installation of an Industrial Edge app on an Industrial Edge device:



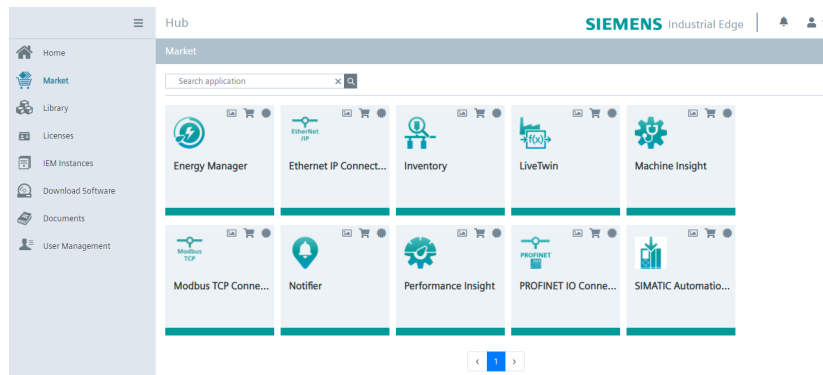
Additional information is available here:

1. Purchasing the Performance Insight app in the Industrial Edge Hub (Page 17)
2. Copying the Performance Insight app from the IE Hub to the IEM catalog (Page 18)
3. Installing the Performance Insight app on the IED (Page 19)
4. Starting the Performance Insight app on the IED (Page 21)

2.4.2 Purchasing the Performance Insight app in the Industrial Edge Hub



Description

The "Market" tab in the Industrial Edge Hub (IE Hub) contains the global app catalog via which you can buy Performance Insight app license in the Siemens Industry Mall.



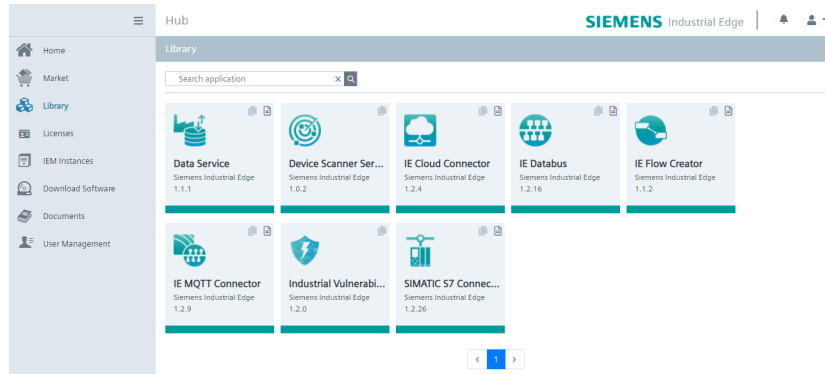
Procedure

To buy the license, follow these steps:

1. Click on the icon  in the Performance Insight tile. The Siemens Industry Mall website is loaded.
2. Purchase the license for the app.
3. As soon as you have purchased the license, the icon for the license status  turns green and the Performance Insight app is displayed in the "Library" tab of the IE Hub.

Result

You can see all apps for which you have purchased licenses in the "Library" tab:



From the "Library" tab, you can now transfer the Performance Insight app to your Industrial Edge Management (IEM) instance.


2.4.3 Copying the Performance Insight app from the IE Hub to the IEM catalog

Description

An IEM instance and an Internet connection are required to copy an app to the Industrial Edge Management catalog. With this functionality, you can copy the app directly into a catalog of one of your IEM instances.

Procedure

To copy an app into the IEM catalog, follow these steps:

1. Open the "Library" tab in the Industrial Edge Hub.
2. Click the icon  in the desired app tile.
The "Copy Application to IEM catalog" window opens. The layout of the window depends on whether the app contains links for open source software (OSS) and for the readme. The relevant file is downloaded when you click on one of the links. If the app does not support these links, the screen is shown without links.
3. In the selection list, select the IEM instance to which you want to copy the app.
4. Click "Copy".
The app is copied, and a corresponding job is created. You can follow the status of the job in the status window of the corresponding IEM instance.

2.4.4 Installing the Performance Insight app on the IED

Description

You can install and start the Performance Insight app in the catalog of the Industrial Edge Management (IEM) instance. To be able to use the Performance Insight app on your corresponding Industrial Edge Device (IED), you must install the following apps on this IED:

- Data Service app
With the Data Service app, you model the structure of your industrial process using assets and aspects and create the database for the Performance Insight app.
- Performance Insight app

Note

Industrial Edge Device (IED)

Both apps must be installed on the same IED.

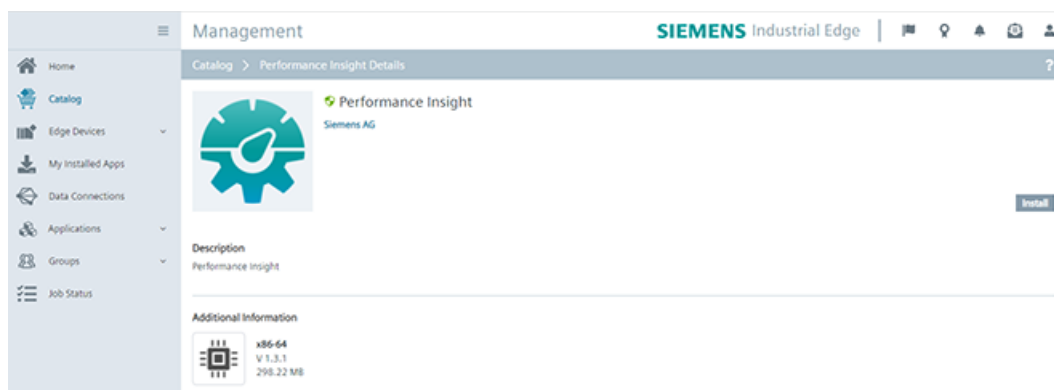
Requirement

- You must be logged onto the Industrial Edge Management (IEM).
- The two apps (Performance Insight and Data Service) have been copied into the catalog. You can find additional information here: Copying the Performance Insight app from the IE Hub to the IEM catalog (Page 18)

Procedure

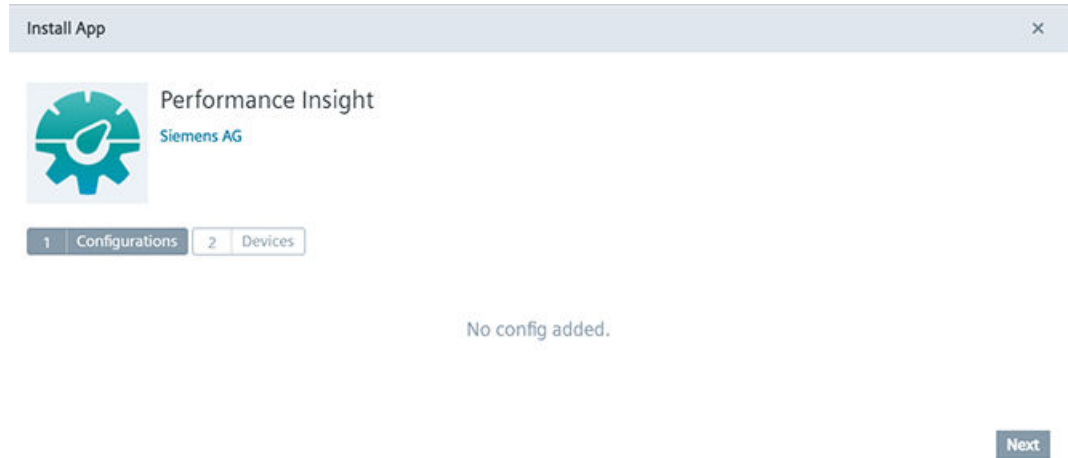
To install the Performance Insight app, follow these steps:

1. Open the "Catalog" tab.
2. Click on the "Performance Insight" tile.
The following dialog box opens:

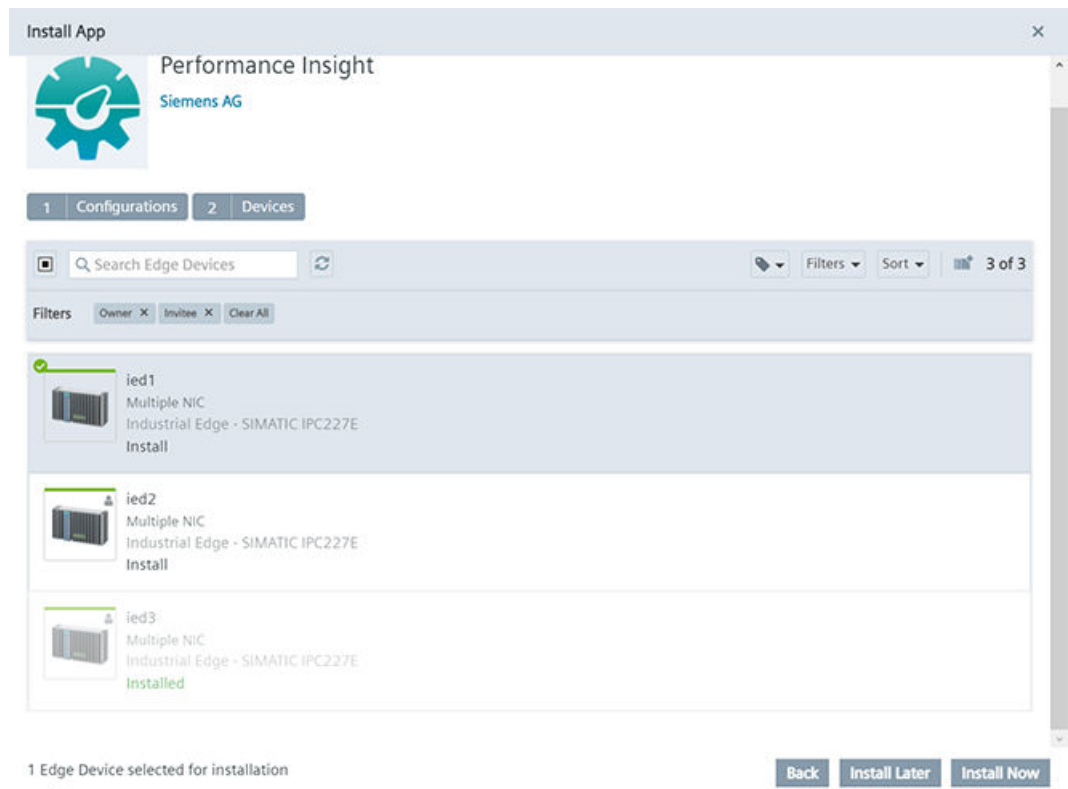


2.4 Installing the Performance Insight app on an IED

- 3. Click "Install".
The "Install App" dialog window is displayed.



- 4. You can see a table with all associated IEDs. Select one or more IEDs on which you want to install the app.



5. You have two options to continue:

- Click "Install Later" to schedule the date and time of the installation.
- Click "Install Now" to install the app immediately.

When you click "Install Now", you will receive the following message:



6. Click "Allow".

App installation is started on the selected IEDs.



Result

The Performance Insight app is listed in the "My Installed Apps" tab:



2.4.5 Starting the Performance Insight app on the IED

After you have installed the Performance Insight app and the Data Service app on the IED, the apps are displayed in the "Industrial Edge Management" in the "My Installed Apps" view.

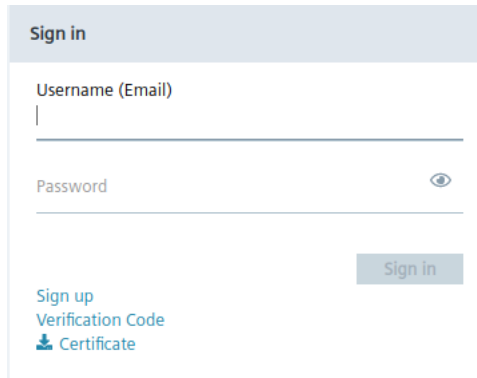
Requirement

All apps must be installed on the same Industrial Edge Device (IED).

Procedure

To start the Performance Insight app, follow these steps:

1. Open the start page of the IED by entering the following URL address:
"https:\\[IP address of the IED]"
2. Log in with "Email" and "Password":



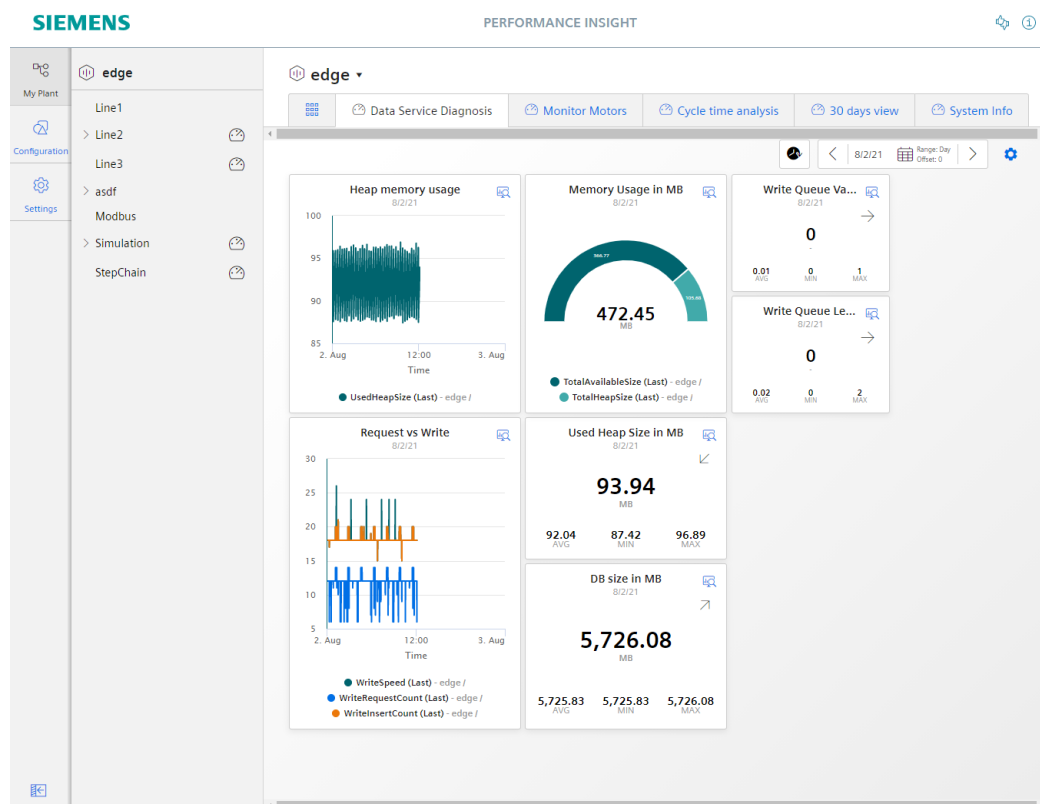
3. Open the "Apps" tab:



4. Click the Performance Insight tile to open the app in a new tab.

Result

The Performance Insight app is opened in a new tab sheet:



2.5 Installing the Performance Insight app on a Panel

2.5.1 Downloading and installing the Performance Insight app

Description

You can install and start the Performance Insight app on your Unified Comfort Panel (UCP) by downloading the APP files from the Siemens Industry Mall and transferring them to your Panel.

Requirement

- You need the APP files of the Data Service app.
With the Data Service app, you model the structure of your industrial process using assets and aspects and create the database for the Performance Insight app.
- You need the APP files of the Performance Insight app.

Note

Installation of the apps

The Data Service app must be installed on the same Panel as the Performance Insight app.

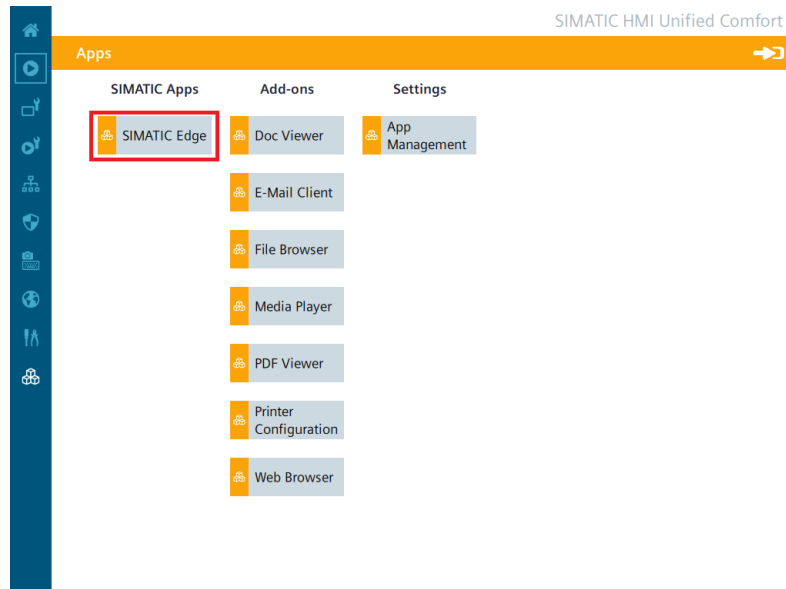
Procedure

To install the Performance Insight app and the Data Service app on your Panel, follow these steps:

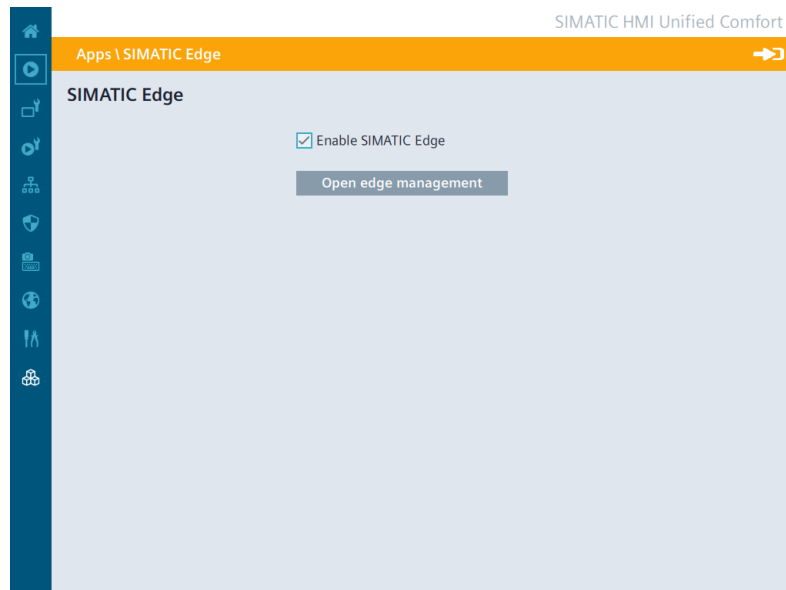
1. Download the app files from the Siemens Industry Online Support (SIOS).
2. Unzip the downloaded ZIP package.
3. Transfer the "DataServicex.x.app" and "Performancelnsightx.x.app" files to your Panel using a USB stick, for example.
4. Click the "Apps" tab or tile on your panel:



5. Click "SIMATIC Edge" under "SIMATIC Apps":



6. Select the "Enable SIMATIC Edge" option and click on "Open edge management":

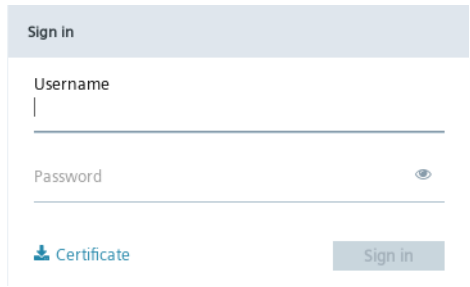


2.5 Installing the Performance Insight app on a Panel

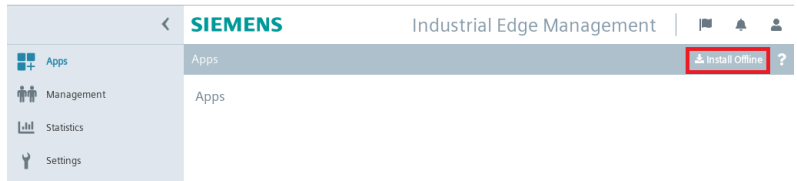
- 7. Log in to the Industrial Edge Management by clicking "Sign in":



- 8. Log in with "Username" and "Password":



- 9. Click "Install Offline":



The "Install Offline" window opens.

10. You have the following two options for selecting the APP files:

- If the files are on the storage medium, for example, a USB stick, then select "Storage Media" and click "Browse" in the "App File" area:

The screenshot shows the 'Install Offline' dialog box. At the top, there are two radio buttons: 'Storage Media' (which is selected) and 'Browse'. Below this, there are three sections for file selection: 'App File', 'Signature (Optional)', and 'Public Key (Optional)'. Each section has a text input field and a 'Browse' button. The 'App File' section is highlighted with a red rectangle. At the bottom right, there is an 'Install' button.

The storage area on the storage medium opens and you can select the required APP file.

- If you have copied the files from the storage medium, for example, a USB stick, to the system storage on the Panel, then select "Browse" and click "Browse" in the "App File" area:

The screenshot shows the 'Install Offline' dialog box. At the top, there are two radio buttons: 'Storage Media' and 'Browse' (which is selected). Below this, there are three sections for file selection: 'App File', 'Signature (Optional)', and 'Public Key (Optional)'. Each section has a text input field and a 'Browse' button. The 'App File' section is highlighted with a red rectangle. The 'Public Key (Optional)' section has two radio buttons: 'Enter manually' (selected) and 'Upload'. Below this, there is a text area for the 'Public key value' with a placeholder text: '-----BEGIN PUBLIC KEY-----
(Certificate value must be in PEM format)
-----END PUBLIC KEY-----'. At the bottom right, there is an 'Install' button.

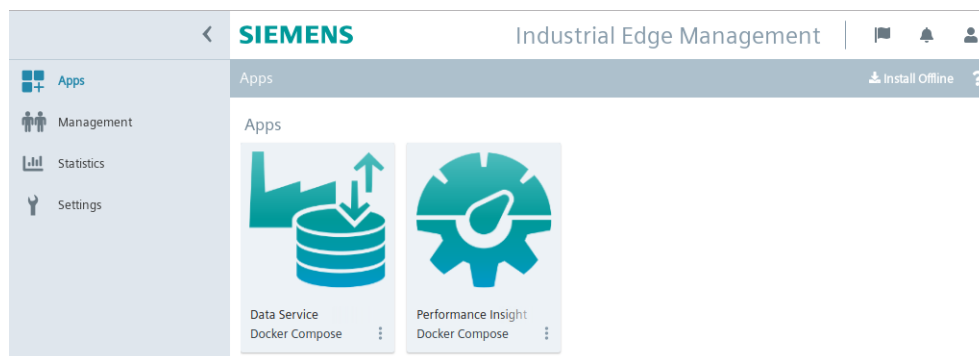
The system storage of the panel opens and you can select the required APP file.

11. Click "Install":

The screenshot shows a 'Tasks' window with a progress bar. The title is 'Tasks' and there is a status indicator '1 = 1'. The task is 'Installing application Performance Insight' and the progress bar is at 73%.

Result

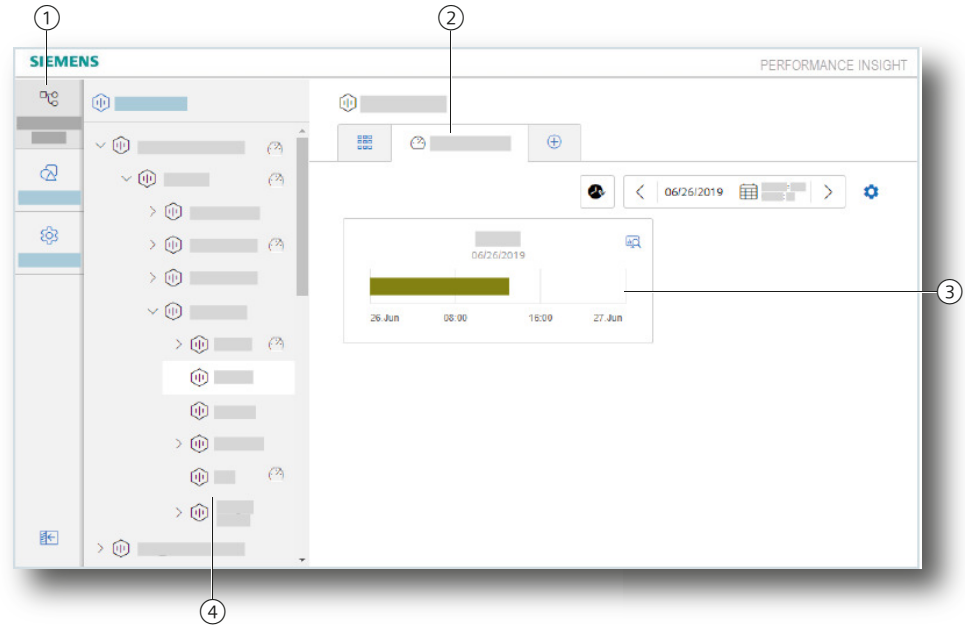
The Performance Insight app is installed on the Panel:





Structure of the app



Views in the app

The Performance Insight app shows the following tabs in the side navigation control:



- ① Navigation control
- ② Dashboards
- ③ Widget
- ④ My Plant

	<p>My Plant</p>	<p>My Plant is imported from the Data Service.</p> <ul style="list-style-type: none"> • Here you manage the dashboard configuration of the plants. • Here you create the KPI instances. • You can create dashboards and widgets for individual elements of My Plant.
		 Indicates that there is at least one dashboard within the asset.

	Configuration	<ul style="list-style-type: none">• Here you access the table with the status mappings.• Here you manage the KPI types.• Here you can view the list of configured periods and create additional periods. <p>The actual status mapping to a variable or a KPI type takes place during configuration of the Gantt widget.</p>
	Settings	<p>Here you manage</p> <ul style="list-style-type: none">• User information (including the language region and the user roles)• Usage information (including the number of users and KPI instances)• User list

Show user profile

User information



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



Here you can change the language and language region in which the app is displayed.

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

User roles and authorizations

You have the following authorizations in line with your user role:

Activities	Users	Administrator
Create and instantiate KPI types (typed)	-	x
Create KPI instances (typeless)	-	x
Create, edit and delete dashboards	-	x
Create, edit and delete widgets	-	x
Display dashboards	x	x
Display widgets	x	x
Create, edit and delete status mappings	-	x
Define limit values for variables and KPI instances and enable the "Activate notifications" function	-	x
Define a time model (time categories)	-	x
Define OEE settings for OEE analysis	-	x
Create multivariable regression	-	x
Create reports	-	x
Define your own time ranges	-	x
Create step time analysis	-	x

Note

User roles on Unified Comfort Panels (UCP)

The only user role on the Unified Comfort Panel is the administrator user role.

Usage information



In the usage information, you can view the number of assets at which dashboards were configured or KPI instances were created on a monthly basis.

When the maximum number of assets (3) has been reached, you must purchase an additional license. For licensing, only the assets at which dashboards were configured or KPI instances were created are counted.

Note

Automatically created KPI instances

Automatically created KPI instances are not included in the number of assets because they do not result in additional costs.

Note

Unified Comfort Panel (UCP)

You can currently not display any usage information on the Unified Comfort Panel because it is a test version.

Deleting users

To free up a user license, you can deregister yourself as a user from the Performance Insight app:

1. Open the "Settings" tab.
2. Under "User information > User account", click on the "Deregister" button.

Quality codes

Description

The quality code measures the quality of a value when it is transferred from a CPU via the connector to the Data Service and Performance Insight.

There are three different types of qualities:

- GOOD
- UNCERTAIN
- BAD

The Data Service saves all values, regardless of the type of quality, and forwards them to the Performance Insight. In the Performance Insight, the values are then taken into account or ignored according to their quality.

If the quality is GOOD or UNCERTAIN, the values are taken fully into account in the app.

What does it mean if the value has the quality BAD:

- This value is not taken into account when calculating KPIs.
- The value is also saved when the raw data is saved.

You can find additional information on the topic of quality code in the documentation of the Data Service: Data Service at Siemens Industry Online Support (<https://support.industry.siemens.com/cs/document/109781417/data-service-for-industrial-edge?dti=0&lc=en-WW>)

Presenting the productivity of a plant transparently (OEE analysis)

6

6.1 Overview of the overall equipment effectiveness (OEE)

Description

With the key performance indicator of the overall equipment effectiveness (Overall Equipment Effectiveness OEE) you calculate the productivity of a plant or its losses.

You use the Gantt widget to display overall equipment effectiveness transparently. The overall equipment effectiveness is a measure of the added value of a system.

The overall equipment effectiveness of a plant is defined as the product of the following three factors:

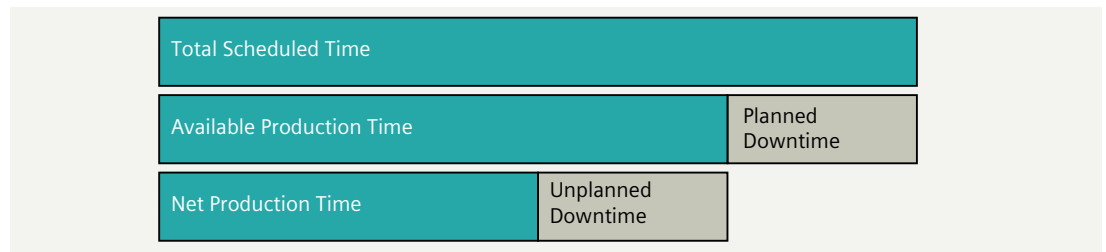
- Availability factor (e.g. whether there are fault times)
- Performance factor (e.g. whether the system is running at full load or reduced load)
- Quality factor (e.g. how much scrap is produced)

The range of value is between 0% and 100%.

Time model as extension of a plant status model

The time categories form the basis for the pre-defined time model. The corresponding time category can be assigned in the status mapping table. Thus, for each machine status, the time category to which the machine status belongs is defined.

In order to be able to calculate the key performance indicators for the overall equipment effectiveness, the following time categories are available:



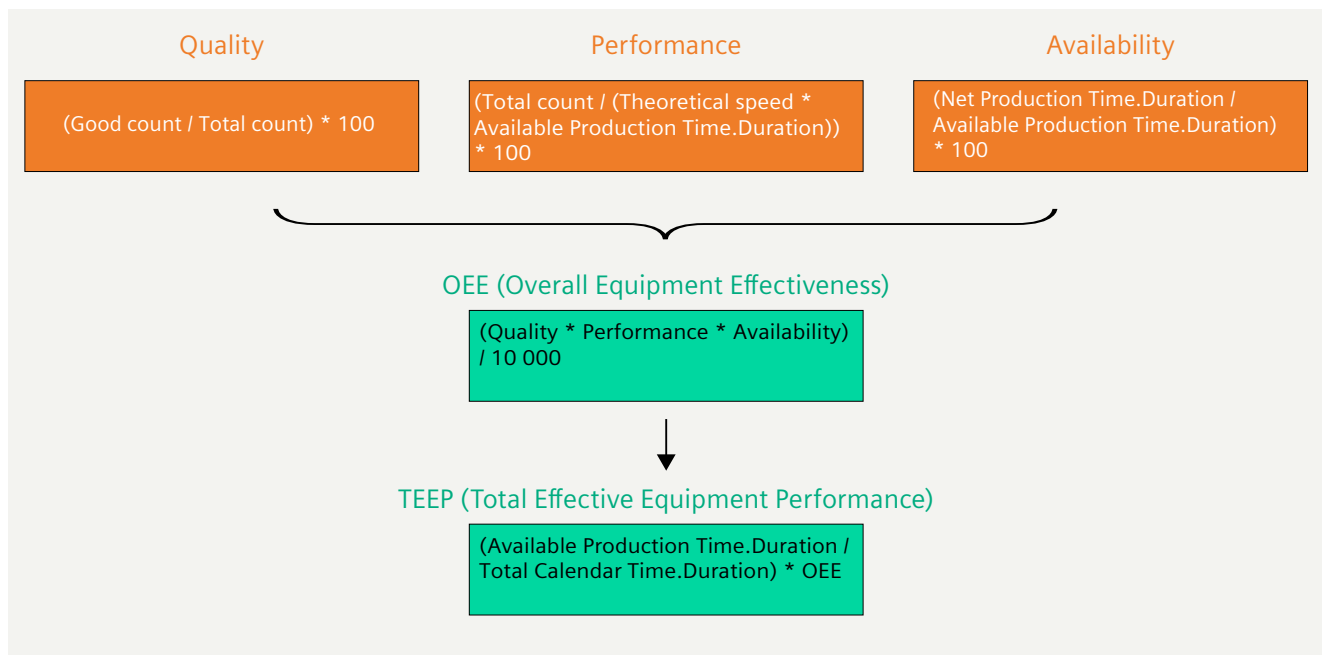
- Total Scheduled Time
The total number of hours available, for example, 1 week = 168 hours
- Available Production Time
The total number of hours available minus the planned downtimes, such as breaks => 168 hours - 21 hours = 147 hours

6.1 Overview of the overall equipment effectiveness (OEE)

- Net Production Time
The number of hours available after subtracting the planned downtimes minus the unplanned downtimes, such as malfunctions => $147 - (1.5 * 7) = 136.5$ hours
- Planned Downtime
Planned downtimes, for example, for maintenance
- Unplanned Downtime
Unplanned downtimes, for example, due to damage or lack of resources

OEE key performance indicators

In the figure below you can see the structure of the key performance indicators in order to ultimately get a meaningful figure for the productivity of your plant:



The following predefined key performance indicators (KPI types **OEE**) are available in Performance Insight to determine the productivity of your plant. You can edit the KPI types later.

- **TEEP (Total Effective Equipment Performance)**
TEEP is a means for the performance metric that provides insights into the capacity of your machine. TEEP takes into account unplanned downtime as well as planned downtime.
Formula for the key performance indicator:

$$\text{TEEP [\%]} = \frac{\text{Available Production Time.Duration}}{\text{Total Calendar Time.Duration}} * \text{OEE}$$

- **OEE (Overall Equipment Effectiveness)**
OEE is a means to calculate the productivity of a machine. OEE is a key performance indicator for unplanned downtimes or losses of a plant. Therefore, in the first step, the planned downtimes are deducted from the calendar time (24 hours, 7 days a week). Planned downtimes can be, for example:
 - No occupancy/manning
 - Planned maintenance
 - Pause
 - Strike
 - No product manufacturing

The remaining operating time is the basis for the overall equipment effectiveness and is therefore defined as 100%. From this 100%, the losses in performance, availability and quality are now deducted, resulting in the overall equipment effectiveness of the plant.
Formula for the key performance indicator:

$$\text{OEE [\%]} = \frac{\text{Availability} * \text{Performance} * \text{Quality}}{10\ 000}$$

- **Availability**
Availability is a means to include planned downtime. The availability factor is the ratio of the time until a fault occurs and the time that the function fails.
Formula for the key performance indicator:

$$\text{Availability [\%]} = \frac{\text{Net Production Time.Duration}}{\text{Available Production Time.Duration}} * 100$$

6.2 Getting Started

- Performance
Performance is a means include slow cycles and failures in the calculation. The performance factor is a measure of losses due to deviations from the planned machining time, minor failures (i.e. the downtimes that do not affect availability) and no-load operations.
Formula for the key performance indicator:

$$\text{Performance [\%]} = \frac{\text{TotalCount [pcs]}}{\text{TheoreticalSpeed} \left[\frac{\text{pcs}}{\text{s}} \right] * \text{Available Production Time.Duration[s]}} * 100$$

Note

Unit for "Theoretical speed"

The value for "Theoretical speed" must be defined in quantity/second because the duration function also returns the value in seconds.

- Quality
Quality is a means to calculate the loss due to defective parts and parts to be reworked.
Formula for the key performance indicator:

$$\text{Quality [\%]} = \frac{\text{GoodCount}}{\text{TotalCount}} * 100$$

- MTBF (Mean Time Between Failures)
MTBF is a means to calculate the average time between failures.
Formula for the key performance indicator:

$$\text{MTBF [s]} = \frac{\text{Net Production Time.Duration}}{\text{Unplanned Downtime.Occurence}}$$

- MTTR (Mean Time To Repair)
MTTR is a means to calculate the average repair time.
Formula for the key performance indicator:

$$\text{MTTR [s]} = \frac{\text{Unplanned Downtime.Duration}}{\text{Unplanned Downtime.Occurence}}$$

6.2 Getting Started

Description

You can find a Getting Started for using the OEE analysis here: Getting Started OEE Analysis (<https://github.com/industrial-edge/Performance-Insight-OEE-Dashboard>)

6.3 Creating status mapping with time categories

Description

Based on time categories, you can create a time model. In the "Status mapping" table, you assign the matching time category.

You can find information about the time model here: Overview of the overall equipment effectiveness (OEE) (Page 35).

Procedure

To create a status mapping, follow these steps:

1. Select "Configuration">"Status mappings".
2. Click on "New status mapping".
3. Assign a unique name and 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. You can assign a color, a label, a time category and a description for each value that a variable can assume. If a value that is not defined in the "Status mapping" table is used in the variable, it is displayed with the status "not defined" and the color white in the Gantt widget.

Name *

The status mapping name must be unique.

Description

Use time categories
Time category is used for eg: OEE calculation

	Color *	Value *	Label *	Time Category *	Description	
		1	NetProductionTime	Net Production Time	Description	
		0	PlannedDowntime	Planned Downtime	Description	
		2	UnplannedDowntime	Unplanned Downtime	Description	

[+ New row](#)

* These fields must be filled out.

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 using drag-and-drop operation.

6.4 Creating a KPI type with time category

Description

You create a new KPI type with time categories under "Configuration" > "KPI Types" or select one of the pre-defined OEE KPI types, such as Availability.

You can find more information on the pre-defined OEE KPI types, here: [Overview of the overall equipment effectiveness \(OEE\)](#) (Page 35).

Procedure

To create a KPI type, follow these steps:

1. Open the "Configuration"> "KPI types".
2. Click on "New KPI type".
3. Assign a unique name and a unit.

- To calculate the KPI, use operands, constants, time categories and operators to compose the formula that is used in the formula editor. You can create operands and constants directly for this purpose.

Note

Time category

The time category is used for the calculation of OEE key performance indicators. You select a time category and specify whether the duration or the number of events is used for the calculation.

An operand is a placeholder that is later filled with actual values from the variables or KPI instances.

Name *

Unit *

Formula editor *

+
-
÷
×
(
)
Operand
Constant
Time Category
?

TIME CATEGORY

(

Net Production Time
▼
Duration

/

TIME CATEGORY

Available Production Time
▼
Duration

)
*

CONSTANT
100

* These fields must be filled out.

Save
Cancel

🗑️ Delete

- Connect the operands to the variables or KPI instances transferred to MindSphere.

6.5 Defining OEE settings for an asset.

Description

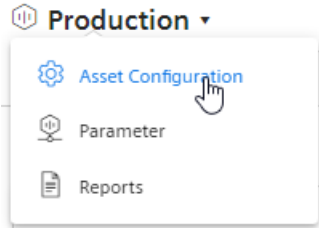
With this configuration, multiple OEE KPIs are immediately generated, used and displayed in the pre-defined OEE dashboard. The OEE dashboard is automatically created once you define the OEE settings.

6.5 Defining OEE settings for an asset.

Procedure

To define the OEE settings, proceed as follows:

- 1. Select an asset in My Plant.
- 2. Open the "Asset Configuration" by clicking on the arrow next to the asset name.



- 3. Click "Define OEE Settings".
- 4. Select a status mapping for your time model.
- 5. Select a parameter that represents the machine status.
- 6. Link each operand to a variable.
- 7. Click "Save".

Simulation > Asset Configuration > OEE Settings

Define OEE settings

This configuration immediately generates multiple OEE KPIs and uses them in the pre-configured dashboard.

1. Select a status mapping for your time model. *

ActiveState

Select a status mapping that is to be used for the KPIs.

2. Select a parameter that represents the machine status. *

VAR state
edge / Simulation

3. Link each operand to a tag to continue. *

TotalCount → VAR Product_Count (Eva Aspect) → Counter

TheoreticalSpeed (pcs/s) → 4

GoodCount → VAR Good_Count (Eva Aspect) → Counter

* These fields must be filled out.

Save Cancel Delete

Note**OEE analysis**

Once you have defined the OEE settings, an OEE dashboard is automatically created with the OEE analysis. This results in costs. The KPI instances required for the OEE analysis calculations do not incur any additional costs.

Result

By assigning a status mapping and a parameter representing the machine status, all the required KPI instances for the OEE analysis are automatically created in the parameter list:

Search		All	VAR	KPI	New KPI instance	
Name	Aspect name	Data type	Unit	Notifications activated		
KPI OEE	Quality	Double	%			
KPI OEE	Availability	Double	%			
KPI OEE	MTTR	Double	h			
KPI OEE	Performance	Double	%			
KPI OEE	TEEP	Double	%			
KPI OEE	OEE	Double	%			
KPI OEE	MTBF	Double	h			

6.6 OEE analysis

6.6.1 Displaying OEE analysis

Description

The OEE analysis is automatically displayed in the OEE dashboard.

6.6 OEE analysis

Procedure

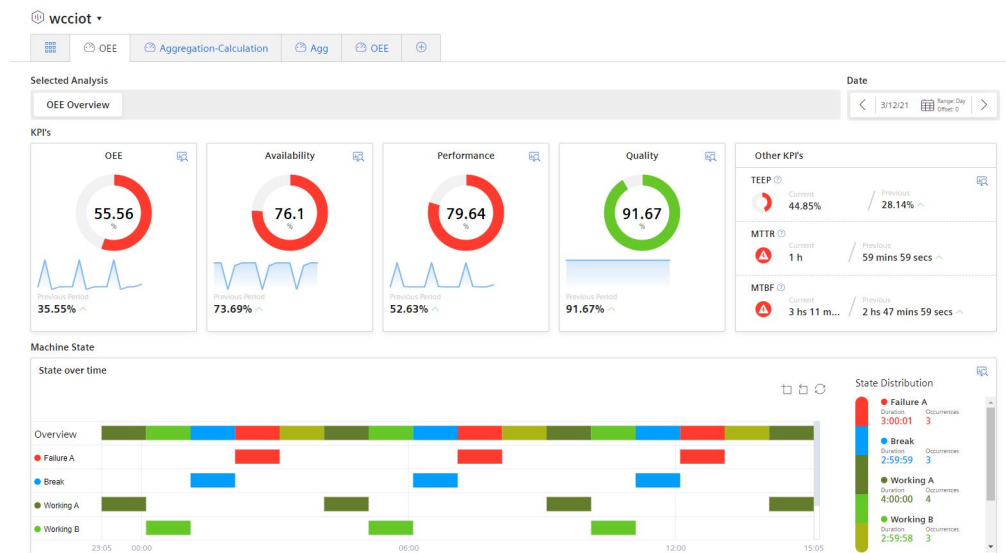
To display the OEE analysis, proceed as follows:

1. Select an asset in My Plant.
2. Click on the OEE dashboard.
The "OEE Overview" displays all OEE KPIs of the selected asset.
The colors of the pie charts indicate whether limits have been exceeded:
 - Green: Value within limits
 - Yellow: Value within the warning limits
 - Red: Value within the alarm limits
 - Blue: No limits have been specified.

The limits are pre-defined but can be adjusted for each KPI. You can find information on limits here: AUTOHOTSPOT

In the "Other KPIs" area, you can see the values of the KPIs TEEP, MTTR and MTBF. As soon as limit values have been defined for the KPIs MTTR and MTBF, the symbols for warning or alarm are displayed accordingly when they are violated.

In the "Machine State" view, the Gantt widget shows an overview of the individual machine status and a summary. Only the variables that have a value are displayed.

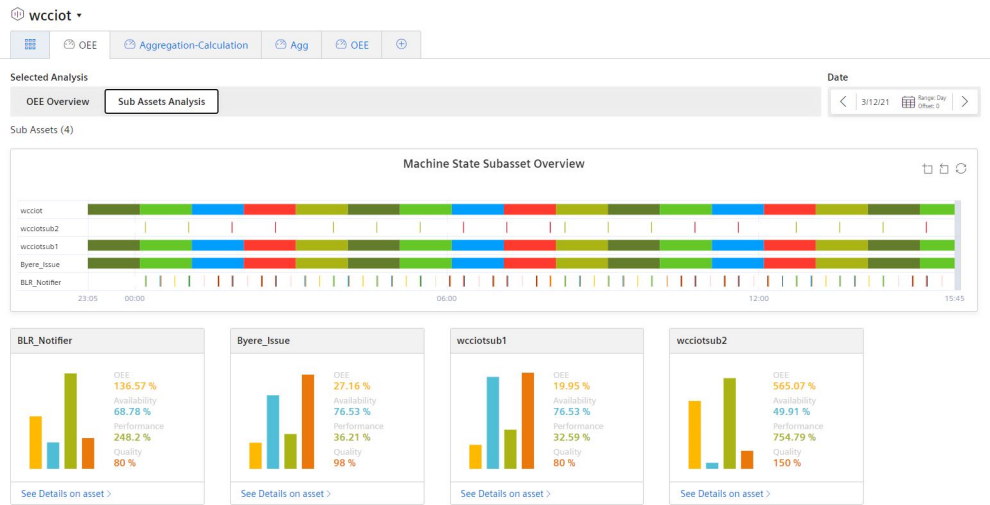


You can find more information on the OEE KPIs here: Overview of the overall equipment effectiveness (OEE) (Page 35)

You can find more information on the detailed views of the KPIs here: Widget views of OEE analysis KPIs (Page 45)

You can find more information on the detailed views of the Gantt widget here: Gantt widget views (Page 48)

3. The "Sub Assets Analysis" view shows all OEE KPIs of the sub-assets for each asset for which an OEE configuration has already been created.
The Gantt widget shows an overview of the complete line, as well as an overview for each sub-asset.



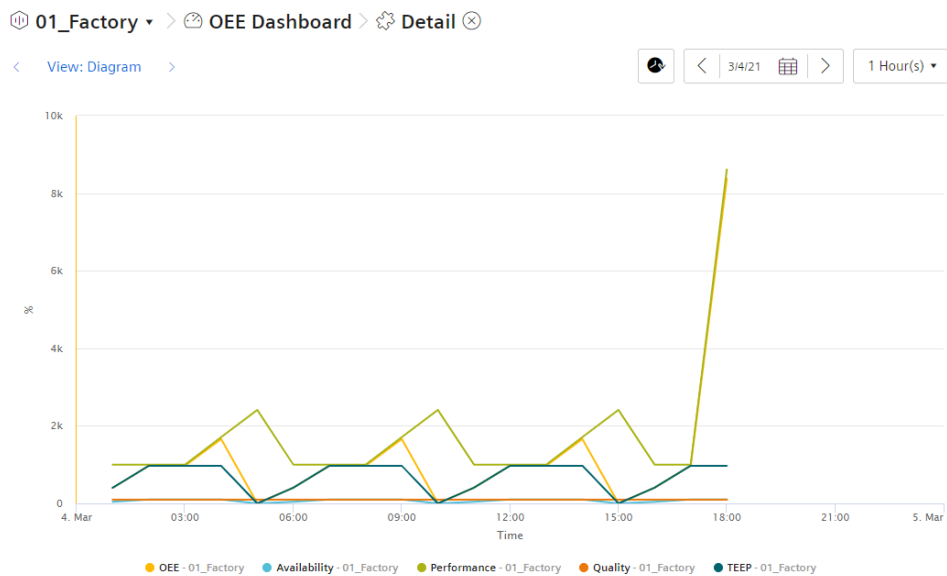
Once an OEE configuration has been created on one of the sub-assets, a separate OEE analysis is displayed. For more information, click "Show details on the asset".

6.6.2 Widget views of OEE analysis KPIs

6.6.2.1 Detail view

Description

To open the detail view, click the  icon in a KPI widget in the OEE analysis.



6.6 OEE analysis


All relevant KPIs are displayed (TEEP, OEE, Performance, Availability and Quality) in the detail view of a KPI widget.

- To hide a KPI or change the display, click on the KPI.



6.6.2.2 Histogram

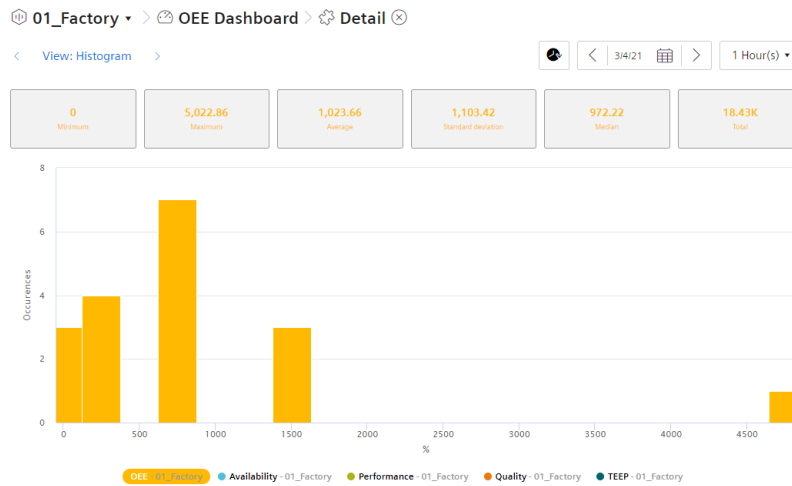
Description

1. Click the  icon in one of the KPI widgets in the OEE analysis.
2. To display the histogram, click on one of the arrow symbols below the navigation path.

< [View: Histogram](#) >

The histogram shows the history of the frequency distribution. A variety of statistic KPIs are available for this:

- Minimum
- Maximum
- Average
- Standard deviation
- Median (central value)
- Total



The data of all relevant KPIs (TEEP, OEE, Performance, Availability and Quality) are available in the histogram of each KPI widget.

6.6.2.3 Time comparison

Description

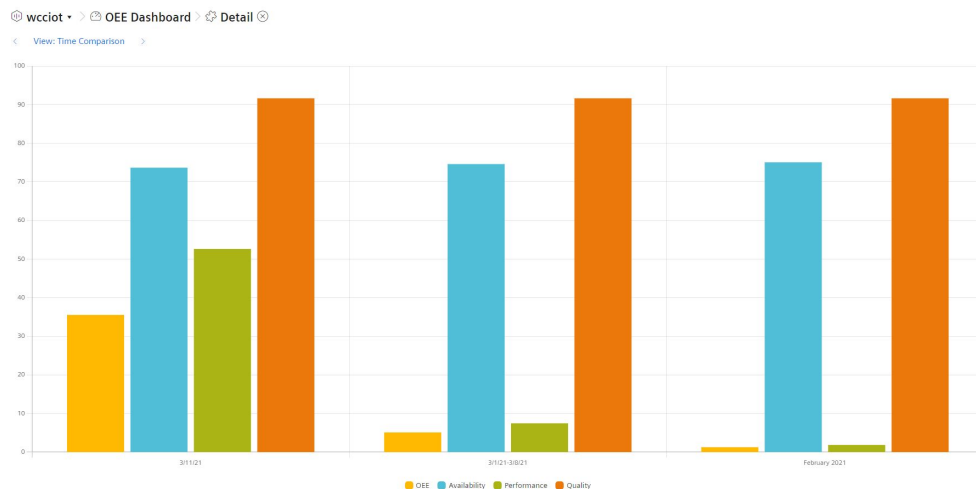
Click the icon in one of the KPI widgets in the OEE analysis.

To display the "Time Comparison" view, click on one of the arrow symbols below the navigation path.

< [View: Time Comparison](#) >

This view shows the KPI values of the respective previous day, week and month.

It is used to visualize the tendencies of the KPIs.



6.6 OEE analysis

The following KPIs are displayed in the "Time Comparison" view of each KPI widget: OEE, Performance, Availability, and Quality.

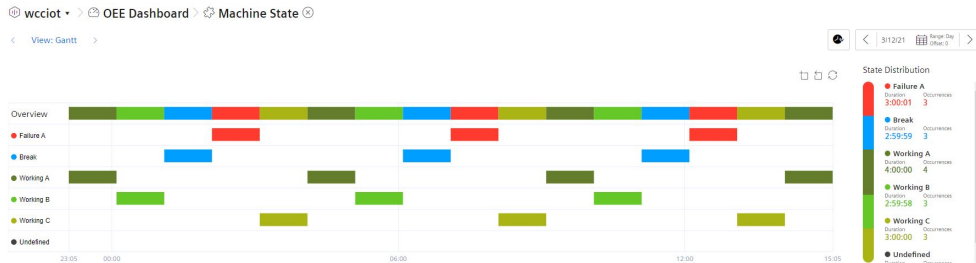
6.6.3 Gantt widget views

6.6.3.1 Detail view

Description

To show the detail view, click the  icon in the Gantt widget in the OEE analysis.

The Gantt widget shows you the status of multiple variables at a glance using different color indicators. For example, the status can represent the current state or the state within a specific time range.



Only the variables that have a value are displayed.

6.6.3.2 Time model

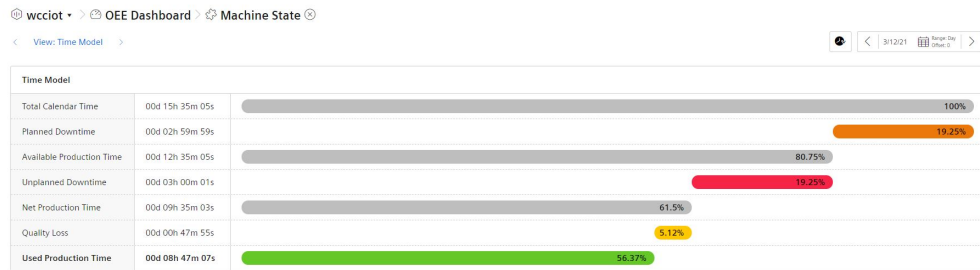
Description

To show the detail view, click the  icon in the Gantt widget in the OEE analysis.

To display the "Time Model" view, click on one of the arrow symbols below the navigation path.

< [View: Time model](#) >

The "Time Model" view shows an overview of the time categories used, such as the total calendar time, the proportions of planned and unplanned downtime, etc.



The quality loss is calculated based on the quality rate.

Example: If the net production time is 60% and the quality rate is 90%, then the quality loss is $60 * (1 - 0.9) = 5.4\%$.

Steps in the step time analysis

Steps are created for an asset as aspects in the Data Service and automatically applied in Performance Insight. You then specify limits for each step in the asset configuration. Every time a limit is violated, the step is evaluated as faulty and marked in red in the graphical display. This can be defined for a product or independent of the product.

Sequences in the step time analysis

A sequence is a run through all steps.

Process flow

To use the step time analysis efficiently, follow these steps:

1. Create the respective steps for the specific asset in the Data Service.
2. Define the limits for the created steps in the asset configuration in Performance Insight.
3. The data is displayed directly in the predefined dashboard.

See also

Defining limits (Page 52)

Displaying the step time analysis (Page 55)

Analysis views of the step time analysis (Page 56)

7.2 Defining limits

Description

In the asset configuration, you specify limits for each step. When a limit is exceeded, the step is evaluated as faulty in the step time analysis and displayed as such in the dashboard.

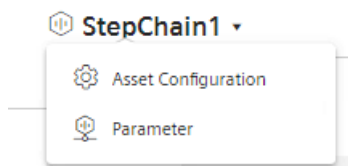
Procedure for setting limits

Product-dependent limits



You can define limits that are product-dependent. The requirement is that the asset was assigned the aspect type "StepChainAnalysis_InitialStep" in the Data Service.

To set limits for one or more steps, follow these steps:


1. Open the drop-down menu next to the asset name in the header bar:



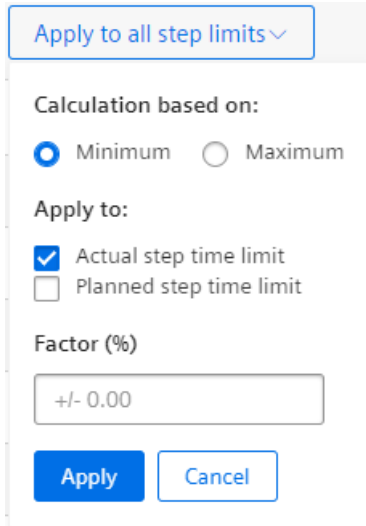
The asset configuration opens.

2. Select "Define limits".
3. Alternatively, click on the symbol  at the top right of the screen.
4. Select the product for whose steps you want to define limits. The user interface for configuring limits opens.
5. If necessary, assign a corresponding name under "Display name". The name appears behind the product name or behind the designation "Unassigned" for product-independent limit definitions.
6. Select a period whose data is to serve as basis for defining the limits. Display the current day by clicking on .
7. In the "Planned step time limit" column, specify the maximum permitted duration of each step. When the value is exceeded, the step is evaluated as faulty.

Note

You can use the preview to display the time series data of the respective step for the selected period. Click on  to open the preview.

8. Alternatively, you can automatically assign a limit to all steps using a mathematical function:



To use this function, follow these steps:

- Select whether you want to use the minimum or the maximum of the step as the initial value.
- Choose whether you want to apply the function to the actual or planned step limit.
- Specify a percentage that is added to the initial value.
- Click "Apply".
A limit is calculated for all steps based on the respective limits and entered in the "Planned step time limit" column.

9. Save the changes by clicking "Save".

Product-independent limits

You can define limits that are product-independent. The requirement is that the asset was assigned the aspect type "StepChainAnalysis_Step" in the Data Service.

To set limits for one or more steps, follow these steps:

1. Open the "Step time analysis" tab.
2. Click "Define limits".
3. Click "Unassigned".
The user interface for configuring limits opens.
4. Follow steps 4 to 6 of the product-dependent step definition as described above.

7.3 Displaying the step time analysis

Requirement

- You have created steps for the asset in the Data Service.
- You have defined limits.

Description

When the requirements mentioned above are met, the step time analysis is automatically displayed in the "Step time analysis" dashboard. The display of the step time analysis is divided up into two analysis views:

1. In the analysis "Overview", you can see all information of the sequences of a specific product for a specified period.
The colors in the graphic display give you an overview about violation of the limits you have set:
 - Gray: The step is within the defined limits.
 - Red: The step is outside the defined limits.
2. The analysis view "Trend" shows a graphical overview of the behavior of the individual steps. You can display one, several or all steps in an overview.

When you hover with the mouse pointer over the visualizations in the views, detailed information is displayed in tooltips.

See also

"Overview" view (Page 56)

"Trend" view (Page 59)

7.4 Analysis views of the step time analysis

7.4.1 "Overview" view

Description

By default, the analysis overview is displayed in the "Step time analysis" dashboard:



- ① Switching to the trend view
- ② Displaying the number of faulty sequences
- ③ Execution time of the faulty sequences
- ④ Selecting a product for which the step time analysis is to be displayed
- ⑤ Selecting a period for which the step time analysis is to be displayed
- ⑥ Downloading a report in CSV format
- ⑦ Switching to the limit definition in the Asset Configuration
- ⑧ Displaying the steps with highest fault rate
- ⑨ Sequence overview: Display and selection of a specific sequence for detailed display
- ⑩ "Show all sequences"
- ⑪ Sequence details: Displaying all sequences and defined steps in the selected period. When selecting a single step, the Trend view of the step opens.

The following options are available in this dashboard view:

Switching the analysis views

Use the button ① to switch between the analysis views "Overview" and "Trend".

Displaying the number of faulty sequences

The area ② "Display of faulty sequences" shows the percentage of faulty sequences of the total number of sequences within the period selected under ⑤. The faulty steps are displayed in red.

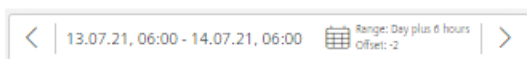
Execution time of the faulty sequences

The area ③ "Execution time of the faulty sequences" gives you information on the execution time of faulty sequences. It displays the minimum, maximum and average execution time in seconds.

Product selection

In the area ④ "Selected product", you select whether you want to display the step time analysis for all products or a specific product. Even product-independent limit definitions are displayed and listed as "Unassigned".

Selecting the analysis period



In area ⑤, you can specify a display period. You can change the day of the display period by switching to the previous day or next day using the arrows.

With the calendar selection, you have the option of specifying the following display periods:

- User-defined: Define the start and end date using the calendar selection
- Day: Displaying the selected day
- Week: Displaying the week of the selected day
- Month: Displaying the month of the selected day
- Year: Displaying the year of the selected day
- Last 3 hours: Displaying the last 3 hours
- Last 7 days: Displaying the last 7 days
- Last 14 days: Displaying the last 14 days
- Last 30 days: Displaying the last 30 days
- Day plus last 6 hours: Displaying the day selected in the calendar from 6:00 AM until 6:00 AM the following day.
- Week plus last 6 hours: Displaying the week of the selected day from Monday 6 AM until Monday of the following week at 6 AM.

If you have defined your own period (see section Defining your own periods (Page 133)), this period is also executed.

Downloading report

By pressing ⑥, you download a CSV file that contains the relevant data of the selected product for the selected period.

Switch to the limit definition


By pressing ⑦, you switch to the Asset Configuration. In the Asset Configuration, you can change or define the limits for a selected product.

Displaying steps with the highest error rate

In the area ⑧ "Top faulty steps", the three steps with the highest fault rate and the number of faults are displayed.

Sequence overview

The area ⑨ "Sequence overview" provides an overview of the sequences of the selected period. The representation varies depending on the length of the selected period. If you have selected a week as the display period, for example, 7 day segments are displayed in this area. Each segment contains the number of faulty steps and the period.

By clicking on a segment, you can see the data of the segment in the detailed view ⑪ and the display period changes to the hour display. By clicking on , you return to the view of the selected period.

When you hover with the mouse pointer over a segment, the detailed information of the respective step is displayed as a tooltip.

Detail view

The area ⑪ is the detail view. Here, you can see a graphical representation of the data of the sequences and their steps over the selected period. Faulty steps which exceed the time limit are shown in red. Steps marked in gray are within the limits. A red dashed line marks the total limit as of which an entire sequence is evaluated as being faulty.

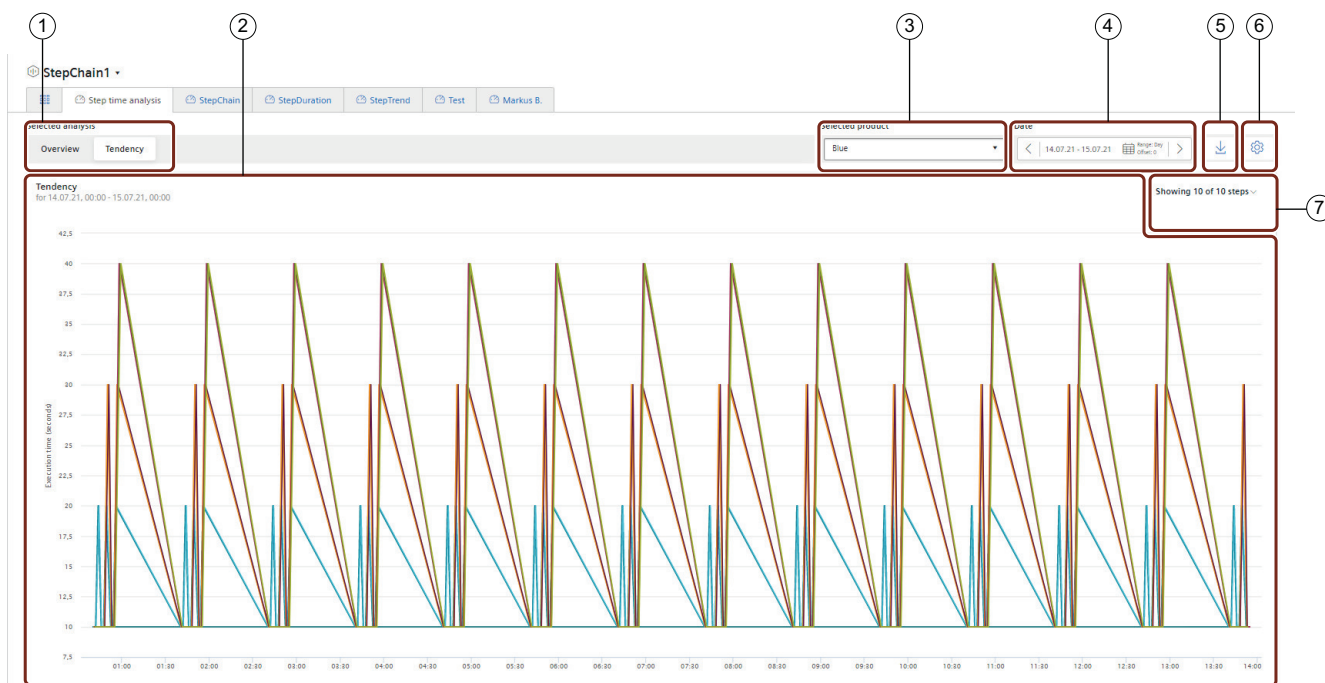
By moving the mouse pointer over the individual steps, you can see the details for the individual sequences.

By clicking on a single step, you open the trend view of the specific step. From there, you click on ① to return to the Overview view.

7.4.2 "Trend" view

Description

The trend view of the step time analysis provides detailed information about the behavior of individual steps within a defined period:



- ① Switching to the analysis view
- ② Graphical display of the individual steps
- ③ Selecting a product for which the step time analysis is to be displayed
- ④ Selecting a period for which the step time analysis is to be displayed
- ⑤ Downloading a report in CSV format
- ⑥ Switching to the limit definition in the asset configuration
- ⑦ Selecting the individual steps to be displayed

The following options are available in this dashboard view:

Switching the analysis view

Use the button ① to switch between the analysis views "Overview" and "Trend".

Trend

The "Trend" area ② gives you a graphical detail view of selected steps over a defined period. The steps are shown in different colors.

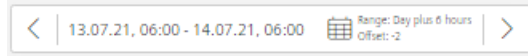
You can have details for a specific step shown at a time by moving the mouse pointer over that graph at the respective location.

By clicking on ⑦, you can select the steps you want to display. By default, the three steps with the most faults are displayed.

Product selection

In the area ③ "Selected product", you select the product for which you want to display the step time analysis.

Selecting the analysis period



In area ④, you can specify a display period. You can change the day of the display period by switching to the previous day or next day using the arrows.

With the calendar selection, you have the option of specifying the following display periods:

- User-defined: Define the start and end date using the calendar selection
- Day: Displaying the selected day
- Week: Displaying the week of the selected day
- Month: Displaying the month of the selected day
- Year: Displaying the year of the selected day
- Last 3 hours: Displaying the last 3 hours
- Last 7 days: Displaying the last 7 days
- Last 14 days: Displaying the last 14 days
- Last 30 days: Displaying the last 30 days
- Day plus last 6 hours: Displaying the day selected in the calendar from 6:00 AM until 6:00 AM the following day.
- Week plus last 6 hours: Displaying the week of the selected day from Monday 6 AM until Monday of the following week at 6 AM.

Report download

By pressing ⑤, you download a CSV file that contains the relevant data of the selected product for the selected period.

Switching to the limit definition

By pressing ⑥, you switch to the Asset Configuration. In the Asset Configuration, you can change or define the limits for a selected product.

Selecting the individual steps

By clicking in the area ⑦, you can remove steps from the graph or add additional steps to the graph whose data you want to display.

Variable declarations

8.1 Introduction to variable declarations

Description

The variables that are available on each asset were transferred from the plant using the Data Service . In Performance Insight for Industrial Edge, My Plant with all existing variables is mapped on this basis.

From the Data Service, the name, unit, data type, connector and the tags are transferred via the corresponding S7 connector for each variable.

See also

Variable declarations on the asset (Page 62)

Variable declaration in the widget (Page 68)

8.2 Variable declarations on the asset

Description

You can extend the declaration of each variable directly on the asset in the "Parameter" area by the following properties:

- Unit: You can either apply the unit from the Data Service or specify your own unit.
- Acquisition category:
You use the acquisition category to determine how the value was acquired. In addition, 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: Introduction to the "Counter" acquisition category (Page 68)
 - Status value (State)
- "The value is aggregated" function
If the value is not aggregated, the values are continuously (actual values) transferred when the value changes. The currently transferred value is valid until the next value is transferred. When the value is aggregated, the value is always valid for the last cycle, for example, 15 minutes.
We recommend that you activate the function.
You can find additional information on the aggregation functions here: Introduction to the aggregation functions (Page 71)

Note

Data gaps

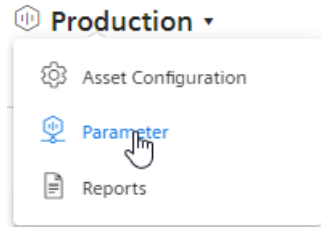
Data gaps occur, for example, when the connection to the network is interrupted. No data from the plant is transferred during the interruption.

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.

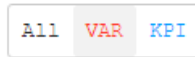
Procedure

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

1. Select an asset in My Plant.
2. Open the "Parameter" view by clicking on the arrow next to the asset name:



3. Filter the view so that only variables are displayed:



8.2 Variable declarations on the asset

- 4. Next to the variable, click on the "Edit" icon:



- 5. Select the desired properties.
In addition to the acquisition category, the data type of the variable that is transferred from the Data Service is displayed:

General Limits

Define general settings for "Var1"
Specify an alternative unit, the acquisition category with which you define the type of collected data, and the type how the value must be interpreted.

Unit
kWh Unit from the Asset Management:
Unit of measure

Acquisition category *
Counter Type: Int32
Select category

Cycle
 The value is being aggregated.
The value represents the end of the period.

Counter (1)

Valid from 1/1/22, 12:00 AM

Date (from) * 1/1/2022 m/d/yy **Time (from) *** 00:00:00 hh:mm:ss

Counter constant *
1
Value with which the counter is counted up or down

Counter type *
 Up counter Up and down counter

Reset behavior
 Event-triggered reset
The counter is either reset per cycle or due to an event.

Limit range start * 0 **Limit range end *** 1000000

Value during installation 0 **Value during replacement** 500

8.3 "Activate notifications" for variables of the data type "Integer" and KPI instances

Description

For each tag of the "Integer" data type and for KPI instances (user-defined and automatically created), you can define high and low limits that trigger a notification when these high or low limits are violated. This notification is displayed in the Notifier for Industrial Edge app and sent directly to the desired mobile device.

Note

Notifier for Industrial Edge

In order to use the "Activate notifications" function, the Notifier must be installed and running on the same Industrial Edge Device (IED).

The limits defined here for the tag or KPI instance are applied by default in the widget as soon as the tag or KPI instance is used. You can adapt the limits in the widget if necessary.

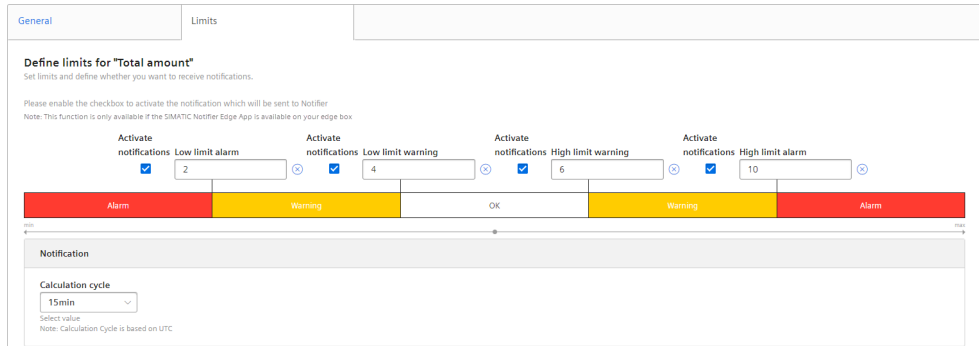
Procedure

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

1. Click on the required asset and open the "Parameter" area.
2. Click the "Edit" icon next to the desired tag or KPI instance, or create a new KPI instance.

8.3 "Activate notifications" for variables of the data type "Integer" and KPI instances

- 3. Click on the "Limits" tab.
You can select the check box for the respective notification next to the fields "Low limit alarm/warning" and "High limit alarm/warning". As soon as the function is activated and the specified high or low limit has been violated, a notification is triggered and sent to the mobile device.
- 4. You can also select the following settings in the "Notification" section:
 - For tags:
Select whether the raw data or the aggregated data should be validated.
If you want to validate the raw data, a fixed calculation cycle of 10 seconds is used.
If you want to validate the aggregated data, you need to select a calculation cycle and an aggregate function. The following calculation cycles are available:
1 min, 10 min, 15 min, 30 min, 1 hr, 2 hr, 8 hr, 1 day
The calculation cycle always starts at 00:00 UTC time (Universal Time Coordinated), e.g. 00:00:00; 00:15:00; ...
For example, if you define a calculation cycle of 15 minutes, the system checks every 15 minutes whether or not a high or low limit has been violated and sends a notification if necessary.
The following aggregation functions are available: Introduction to the aggregation functions (Page 71)
 - For KPI instances:
Select a calculation cycle:
1 min, 10 min, 15 min, 30 min, 1 hr, 2 hr, 8 hr, 1 day
The calculation cycle always starts at 00:00 UTC time (Universal Time Coordinated), e.g. 00:00:00; 00:15:00; ...
For example, if you define a calculation cycle of 15 minutes, the system checks every 15 minutes whether or not a high or low limit has been violated and sends a notification if necessary.



8.4 "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 for Industrial Edge app and sent directly to the desired mobile device.

Note

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

You can activate notifications for these tags.

- You cannot use a tag of the data type "String" as a parameter in a widget or a KPI instance.
- You cannot use a tag of the data type "Bool" as a parameter in a widget or a KPI instance.

Limits can also be defined, but these limits are not transferred to the widget.

Note

Notifier for Industrial Edge

The Notifier must also be installed on the same Industrial Edge Device (IED) so that you can activate the "Activate notifications" function.

Procedure

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

1. Click on the required asset and open the "Parameter" area.
2. Click the "Edit" icon next to the desired variable (Bool or String).
3. Click on the "Notification configuration" tab.

The screenshot shows the 'Notification configuration' interface. At the top, there are two tabs: 'General' and 'Notification configuration'. Below the tabs, the title is 'Define notification configuration for "Name_Boolean"'. Underneath, it says 'Set notification configuration and define whether you want to receive notifications.' and a note: 'Note: This function is only available if the SIMATIC Notifier Edge App is available on your edge box.' The main configuration area has three columns: 'Activate notifications', 'Type', and 'Value'. In the 'Activate notifications' column, there is a checked checkbox. In the 'Type' column, there is a dropdown menu with 'Alert' selected. In the 'Value' column, there is a dropdown menu with '=' selected. To the right of the 'Value' dropdown, there is another dropdown menu with 'True' selected.

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

8.6 "Counter" acquisition category

Result

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

8.5 Variable declaration in the widget

Description

When you create a widget, you can select one of the following aggregation functions for a variable in step 3 "Parameter":

- None (Only with diagram)
- Average
- Min
- Max
- Sum
- Last
- Counter
- Timer
- EnergyToPower
- PowerToEnergy
- AmountToFlow
- FlowToAmount

You can find additional information on the individual aggregation functions here: [Introduction to the aggregation functions \(Page 71\)](#)

8.6 "Counter" acquisition category

8.6.1 Introduction to the "Counter" acquisition category

Description

You can define properties for each counter:

- Installation date
- Installation time
- Counter constant (value by which the counter is counted up or down, for example, 1 kWh.)

- Counter types
 - 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. Not only can you calculate the consumption of an energy medium, for example, but you can also detect when energy is fed back.
- Reset behavior (Only for an Up counter: You can specify whether the counter per cycle is reset daily or by an event, such as a defined overflow limit.)
- 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 (Here you can 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

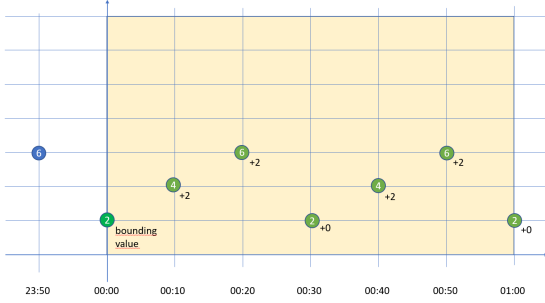
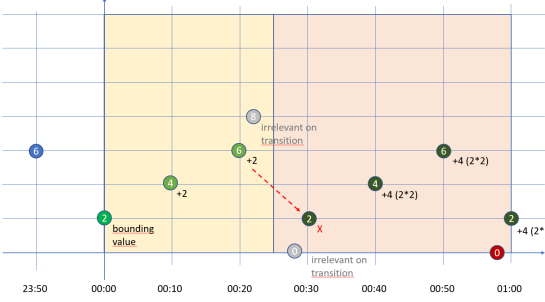
8.6.2 Counting method of the "Up" counter

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.

8.6 "Counter" acquisition category

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:

Settings	Explanation								
<p>Start and end of the limit range is not defined.</p> <p>Result: $+ 2 + 2 + 0 + 2 + 2 + 0 = 8$</p>									
<p>When you change the counter, you can define different settings for each counter. This example shows the transition from one counter to the next:</p>									
<table border="1"> <tr> <td data-bbox="347 863 533 953">Counter for the year 2018 00:00 - 00:25</td> <td data-bbox="539 863 724 953">Counter for the year 2019 00:25 - 01:00</td> </tr> <tr> <td data-bbox="347 961 533 1017">Counter constant: 1</td> <td data-bbox="539 961 724 1017">Counter constant: 2</td> </tr> <tr> <td data-bbox="347 1025 533 1081">End of the limit range: 8</td> <td data-bbox="539 1025 724 1081">Start of the limit range: 0</td> </tr> <tr> <td data-bbox="347 1089 533 1153">Result: $+ 2 + 2 = 4$</td> <td data-bbox="539 1089 724 1153">Result: $+ 4 + 4 + 0 + 4 = 12$</td> </tr> </table>	Counter for the year 2018 00:00 - 00:25	Counter for the year 2019 00:25 - 01:00	Counter constant: 1	Counter constant: 2	End of the limit range: 8	Start of the limit range: 0	Result: $+ 2 + 2 = 4$	Result: $+ 4 + 4 + 0 + 4 = 12$	
Counter for the year 2018 00:00 - 00:25	Counter for the year 2019 00:25 - 01:00								
Counter constant: 1	Counter constant: 2								
End of the limit range: 8	Start of the limit range: 0								
Result: $+ 2 + 2 = 4$	Result: $+ 4 + 4 + 0 + 4 = 12$								
<p>Final result: $4 + 12 = 16$</p>									

8.6.3 "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.

Settings	Explanation								
Result: $+ 2 + 2 - 4 + 2 + 2 - 4 = 0$									
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 border="1"> <tr> <td>Counter for the year 2018</td> <td>Counter for the year 2019</td> </tr> <tr> <td>00:00 - 00:25</td> <td>00:25 - 01:00</td> </tr> <tr> <td>Counter constant: 1</td> <td>Counter constant: 2</td> </tr> <tr> <td>Result: $+ 2 + 2 = 4$</td> <td>Result: $+ 4 + 4 - 8 = 0$</td> </tr> </table>	Counter for the year 2018	Counter for the year 2019	00:00 - 00:25	00:25 - 01:00	Counter constant: 1	Counter constant: 2	Result: $+ 2 + 2 = 4$	Result: $+ 4 + 4 - 8 = 0$	
Counter for the year 2018	Counter for the year 2019								
00:00 - 00:25	00:25 - 01:00								
Counter constant: 1	Counter constant: 2								
Result: $+ 2 + 2 = 4$	Result: $+ 4 + 4 - 8 = 0$								
Final result: $4 + 0 = 4$									

8.7 Aggregation functions

8.7.1 Introduction to the aggregation functions

Description

You use an aggregation function to select which value is to be output for a variable.

- Output the last read value with "Last".
- Use the other functions to gather summary information from the read values, for example, the sum of all read values.

8.7 Aggregation functions

The following aggregation functions are available:

Function	Meaning
Average	Calculates the time-weighted average value of the read values.
Min	Outputs the smallest read value.
Max	Outputs the largest read value.
Sum	Adds all read values.
Last	Outputs the last read value.
Counter	The sum of the positive value changes between two points in time is output in each case.
Timer	The Timer calculates the time interval in which the variable was not 0. Unit = milliseconds.
EnergyToPower	A consumption value can be converted into power. This aggregation function can only be selected in combination with the acquisition category consumption value (Energy) and Counter.
PowerToEnergy	Power can be converted into a consumption value. This aggregation function can only be selected in combination with the acquisition category power value (Power).
AmountToFlow	An amount (per hour) can be converted directly into 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) can be converted directly into an amount value. This aggregation function can only be selected in combination with the acquisition category flow value (Flow).

Note

Activating the interval in the first step of the Widget wizard

For this function to be executed, the aggregation function of the variable must not be set to "None" because the values are displayed directly in the widget without further processing in this case.

8.7.2 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
When the "The value is aggregated" function is not activated, actual values are transferred every 10 minutes, for example. The respective actual value is valid for 10 minutes until the next actual value is transferred. If the time of the last reading operation is identical to the end of the specified period, the last value is not read.	When the "The value is aggregated" function is activated, no actual values are transferred, but the value that has already been calculated or processed in the last 10 minutes is transferred. Application example: A temperature measured value is recorded in the plant every minute, and an average value of the recorded values is then transferred 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.	

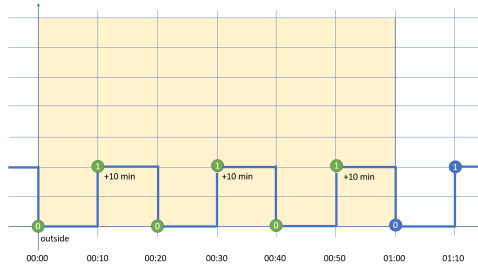
"Counter" aggregation function

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

"Timer" aggregation function

The timer calculates the time interval in which the variable was not "0". Unit = milliseconds.
For the timer, the "The value is aggregated" function is always = False.

8.7 Aggregation functions



Calculation example:

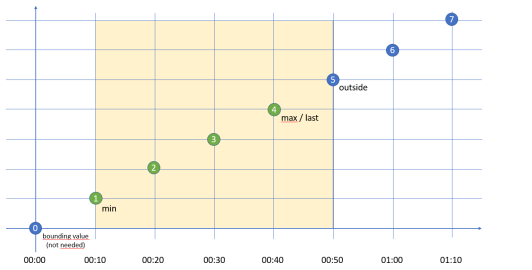
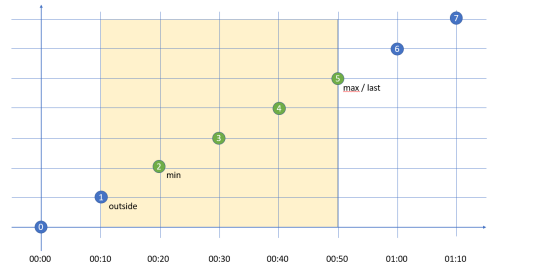
The calculation period is from 00:00 to 01:00.

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

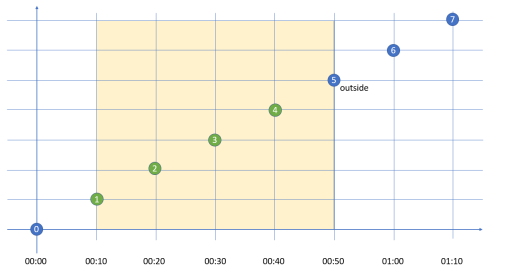
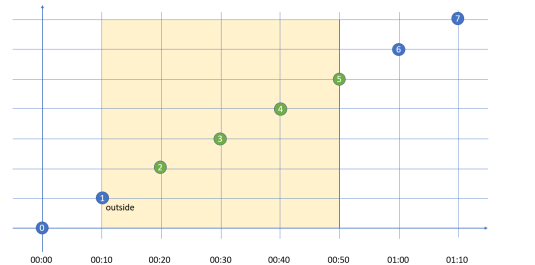
"Average" aggregation function

"The value is aggregated" = not activated	"The value is aggregated" = activated
<p>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)</p>	<p>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)</p>
<p>The aggregation function determines the weighted average depending on the time interval (every 10 minutes). If the time interval changes within a period, e.g. from 10 minutes to 12 minutes, then the values with the time interval 10 minutes are first added and divided by the number of read values. The values are then added together with the time interval 12 minutes 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.</p>	

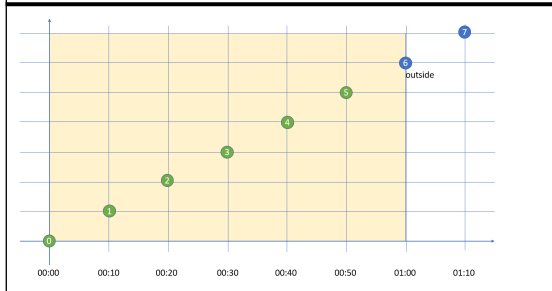
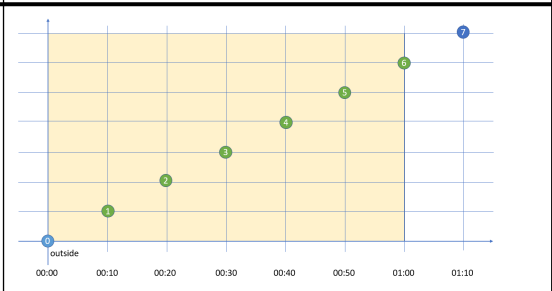
"Min", "Max" and "Last" aggregation functions

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

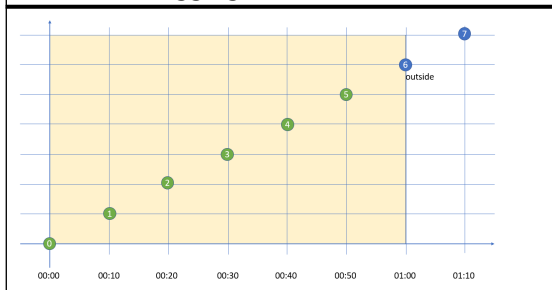
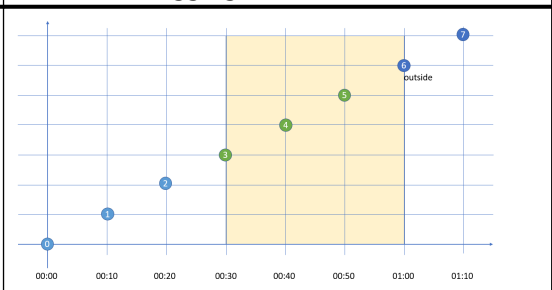
"Sum" aggregation function

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

"AmountToFlow" aggregation function

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

"EnergyToPower" aggregation function

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

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 p.m., i.e. five in total. Because the last reading operation takes place at 12:00 p.m. and the evaluation period also ends at 12:00 p.m., the last value is not read. To evaluate the last value at 12:00 p.m., 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 hour 48 minutes)
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.

8.7.3 Calculation example for the aggregation function EnergyToPower

Description

In the source system, the energy consumption is measured for a 15-minute period in kWh. For a detailed analysis, you want to display the power in the dashboard in a 2-hour interval. In this case you can use the variable with the consumption values (Var1) directly and select "EnergyToPower" as the aggregation function. In the dashboard, you configure the calculation period of two hours in the widget configuration.

Calculation: In the first step, the function calculates the energy consumption for the 2-hour period and then converts it into power.

Calculation example: Consumption 120 kWh for 2 hours = results in a power of $120 \text{ kWh} / 2 \text{ h} = 60 \text{ kW}$.

Requirement

You have declared a variable with the unit "kWh" and the acquisition category "Energy" (consumption value).

Procedure

To calculate the example in a widget, follow these steps:

1. Create the "Diagram" widget at an asset.
2. Enter 2 hours as the calculation period:

2. Define details

Enter a suitable widget name and complete the remaining information.

Widget name *

EnergyToPower

Date settings

Use the date settings from the dashboard.

Interval for the period

Calculation period *

2

Hour(s)

Define the interval for the desired period.

3. Select the previously declared variable and set "EnergyToPower" as the aggregation function:

3. Select parameter

Select KPI instances or variables (The data type 'string' is only available for single value widgets).

01	Var1 (EnergyToPower)	Path ... / Working Area X / Minute Values	Type VAR	Aggregation EnergyToPower
----	----------------------	--	-------------	------------------------------

Result


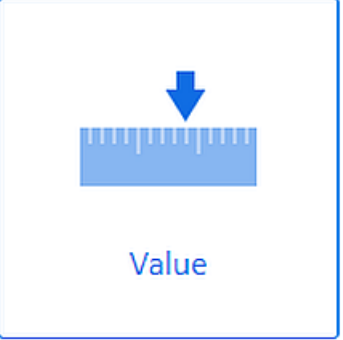

The value 60 is displayed in the dashboard for this 2-hour period.




Data analysis

9.1 Introduction to data analysis (widgets)

Description

The following widget are available for data analysis:

Widget type	Description
 <p style="text-align: center;">Diagram</p>	<p>Displays the value of variables or KPI calculations as a diagram over time.</p> <p>You can find additional information here: Visualizing correlations in the diagram (Diagram) (Page 86)</p>
 <p style="text-align: center;">Value</p>	<p>Displays the current value of a variable or a KPI.</p> <p>You can find additional information here: Visualizing individual values (Value) (Page 88)</p>
 <p style="text-align: center;">Gantt</p>	<p>Shows the status of a machine at a glance using different color codes. For example, the status can represent the current state or the state within a specific period.</p> <p>This allows you to see at a glance, for example:</p> <ul style="list-style-type: none"> • When the machine started up and how long it was in the "RUN" operating state. • When it switched to the "STOP" operating state and how long it remained in this state. <p>You can find additional information here: Visualizing machine statuses (Gantt) (Page 90)</p>

Widget type	Description
 <p data-bbox="488 538 579 570">Gauge</p>	<p data-bbox="791 278 1219 304">The gauge shows the limits using colors.</p> <p data-bbox="791 314 1430 370">You can recognize at a glance whether or not limits are being exceeded.</p> <p data-bbox="791 380 1430 436">You can find additional information here: Visualizing the violation of limit values (gauge) (Page 92)</p>
 <p data-bbox="507 912 549 944">Pie</p>	<p data-bbox="791 657 1430 742">The pie chart shows a distribution of consumptions or quantities. Clicking on a segment highlights the segment and displays the corresponding value.</p> <p data-bbox="791 753 1430 808">You can find additional information here: Visualizing the distribution of consumptions or quantities (Pie chart) (Page 94)</p>
 <p data-bbox="464 1289 592 1321">Heatmap</p>	<p data-bbox="791 1027 1430 1112">Shows the intensity of data values. For example, you can display the energy consumption (green = low consumption; red = high consumption).</p> <p data-bbox="791 1123 1430 1178">You can find additional information here: Visualizing the intensity of data values (Heatmap) (Page 96)</p>

Error display in the widget

If a network error occurs or an operand required to display the widget has been deleted, for example, the error symbol is shown in the bottom right corner of the widget.



9.2 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 using the Data Service. The data structure of your plant is then automatically displayed in the app.

At least one dashboard is created on the desired asset.

Widget configuration

A wizard will guide you through the individual steps when creating a widget. However, the first four steps are identical for all widget types:

- Step 1: Select the widget type

1. Select widget type

Select one of the widget types to visualize your data.

Diagram Value Gantt Gauge Pie Heatmap

- Step 2: Define details

2. Define details

Enter a suitable widget name and complete the remaining information.

Widget name *

Date settings

Use the date settings from the dashboard.

Interval for the time range

Calculation period *

1 Hour(s)

Define the interval for the corresponding time range.

- Step 3: Select parameters

3. Select parameter

Select KPI instances or tags.

No parameter was selected.

Select parameter

New KPI Instance

If no matching KPI instance exists, you can create a new KPI instance.

New KPI Instance

9.2 Create a widget

- Step 4: Define general display options

Navigation: < Cancel | 1 Type | 2 Details | 3 Parameter | 4 General display options | 5 Diagram - Display options | < Back | Continue >

Create new widget > Diagram > Diagram

4. Define general display options

Define the general display options for the selected parameters.

01 Filled_bottles (Sum) <small>Path: ... / Production / Filling</small>	Type: VAR	Aggregation: Sum		
Alternative label <input type="text"/> <small>Optionally, you can specify an alternative label for the display in the widget.</small>	Number of decimal places * <input type="text" value="2"/> <small>The values in the widget are displayed according to the specified number of decimal places.</small>	Color <input type="color" value="#0070C0"/> <small>Select the color which is to be used for displaying the parameter values.</small>		
Limits <small>Optional. The limits are used to display general restrictions.</small>				
Low limit alert <input type="text"/>	Low limit warning <input type="text"/>	High limit warning <input type="text"/>	High limit alert <input type="text" value="120"/>	
Alert	Warning	OK	Warning	Alert

Note: The notifications have been activated for this tag.

- Step 5: Define widget-specific display options

Navigation: < Cancel | 1 Type | 2 Details | 3 Parameter | 4 General display options | 5 Diagram - Display options

Create new widget > Diagram > Diagram


5. Diagram - Define display options

Define the widget specific display options.

01 Filled_bottles (Sum) <small>Path: ... / Production / Filling</small>	Type: VAR	Aggregation: Sum
Type <input type="text" value="Line"/> <small>Shows how the parameter will be displayed.</small>	Further options <input checked="" type="checkbox"/> Visible <input type="checkbox"/> Stacked <small>Shows whether the parameter is displayed stacked with another one.</small>	
Y-axis (1)		

Procedure for creating the general steps of a widget

To create a widget, follow these steps:

1. Either click "Create first widget" or click  and "New widget" and select a widget type.
2. Assign a name and define the date settings:

Define 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 available for setting your own date:

- Default: "Use the date settings from the dashboard" to use the time range that is defined in the dashboard.
- You disable "Use the date settings from the dashboard" to define a specific time range. You have the following options to do this:
 - Default: "Use current date" and enter the duration (e.g. week) under "Time range". The start and end time are given by the predefined time ranges (day, week, month, year, etc.). If you prefer, you can also disable "Use current date" and enter the start date and start time manually. The end time is calculated based on the duration under "Time range". Under "Offset", you can enter 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.

If you use the dashboard date settings for the widget, all changes to the date settings are displayed directly in all widgets of the dashboard.

Define interval:

You can also specify an interval at which the values are to be displayed, for example, every 5 minutes, every 2 hours, etc.

3. You can select either a variable or a KPI type as parameter. Up to 10 parameters can be defined.
 - For each variable you can select one of the aggregation functions (Average, Min, Max, Sum, Last, Counter, Timer, EnergyToPower, PowerToEnergy, AmountToFlow, FlowToAmount). You can find additional information on the aggregation functions here: [Introduction to the aggregation functions \(Page 71\)](#)
 - In this step, you can also directly create KPI instances and link the operands with the desired parameters. You can find additional information on KPI instances here: [Introduction to KPI calculations \(Page 101\)](#)

9.3 Visualizing correlations in the diagram (Diagram)

4. In the general display options, you can assign an alternative label for the variable or KPI type. This label is then displayed in the legend in the detail view instead of the asset and the aspect name of a parameter.

In this step, you can also enter the limit values for warnings and alerts.

- Red = the alert limit was violated
- Yellow = the warning limit was violated

The limit values are also displayed in the detail view as dashed lines.

You can also specify the number of decimal places and a color for each parameter in which the graph is displayed in the detail view.

If you have already defined limits for the variable or KPI used, these are displayed in the widget as pre-setting. However, these limits can be overwritten at any time.

5. In this last tab, you specify all widget-specific details. You can find additional information on the respective details of the widgets here:
 - Visualizing correlations in the diagram (Diagram) (Page 86)
 - Visualizing individual values (Value) (Page 88)
 - Visualizing machine statuses (Gantt) (Page 90)
 - Visualizing the violation of limit values (gauge) (Page 92)
 - Visualizing the distribution of consumptions or quantities (Pie chart) (Page 94)
 - Visualizing the intensity of data values (Heatmap) (Page 96)

9.3 Visualizing correlations in the diagram (Diagram)

Description

Displays the value of variables or KPI calculations as a diagram over time. The following diagram types are available:

- Line graph (Line)
- Bar graph (Bar)
The columns of several parameters can be stacked.
- Area graph (Area)
- Spline curve
- Scatter diagram (Scatter)

The following views are available for the diagram type:

- Detail view
- Histogram
- Regression

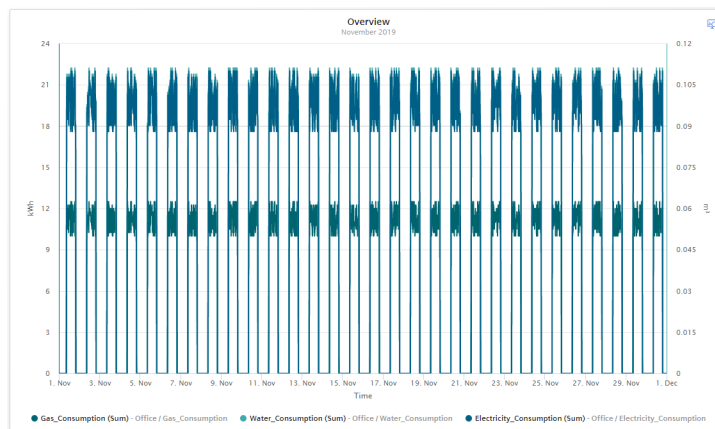
Procedure

To define widget-specific display options for a bar graph, follow these steps:

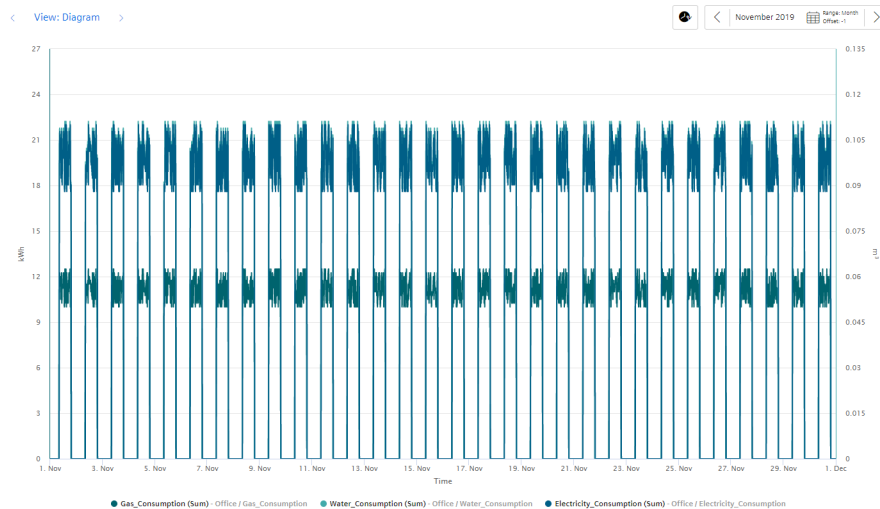
1. You select the diagram type in step 5 when creating a widget of the type "Diagram". You can specify whether the value should be visible and/or stacked in the case of a bar graph.
2. A Y-axis is created for each unit that a parameter provides. A maximum of 5 Y-axes can be defined per widget.
Each parameter 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.

Result

As a result, you see a line graph:



In the detail view of the example, you can see the graphs of the parameters "Gas_Consumption", "Water_Consumption" and "Electricity_Consumption" in the colors that you have defined in the display options:

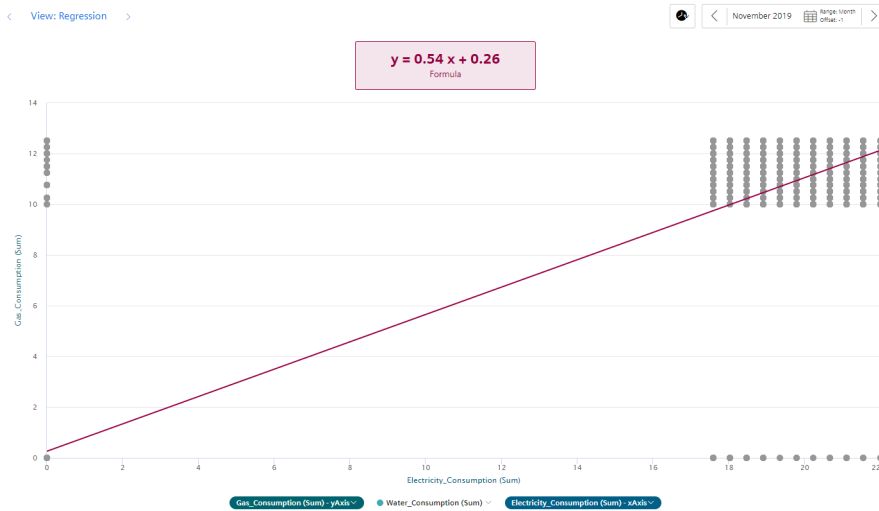


9.4 Visualizing individual values (Value)

In the histogram of the example, you can see the frequency distribution of the parameter "Electricity_Consumption":



In the regression analysis of the example, you can see the correlation between the two parameters "Gas_Consumption" and "Electricity_Consumption":



9.4 Visualizing individual values (Value)

Description

Displays the aggregated value of a specific time range. The value is derived either from a variable with a corresponding aggregation function or from a KPI result.

The following views are available for Value:

- Detail view
- Histogram

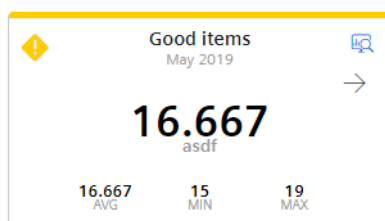
Procedure

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

1. In step 5 when creating a widget of the type "Value", you select whether the statistics (average, minimum, maximum) should be displayed.

Result

The result in the example shows an individual value that violated the warning limit. A yellow bar and the warning symbol are therefore displayed.



The arrow visualizes the tendency of the displayed value.

The statistical data of average (AVG), minimum (MIN) and maximum (MAX) are displayed in the bottom line if they were activated in the last step.

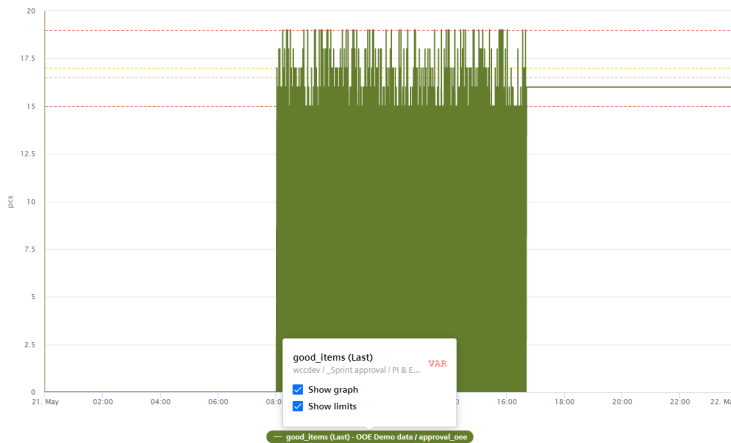
Note

Values of the statistical data

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

View of the detail view with activated limit values:

9.5 Visualizing machine statuses (Gantt)



9.5 Visualizing machine statuses (Gantt)

Description

The Gantt widget shows the status of a machine at a glance using different color codes. The status can represent the current state or the state within a specific time range.

This will help you recognize:

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

In the detail view, you can see all status displays broken down individually.

Procedure

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

1. In step 4 when creating a widget of the type "Gantt", you select a status mapping from the drop-down list. If no status mapping exists yet, you create one with "Create new status mapping".

Result

The result in the example shows the machine status:

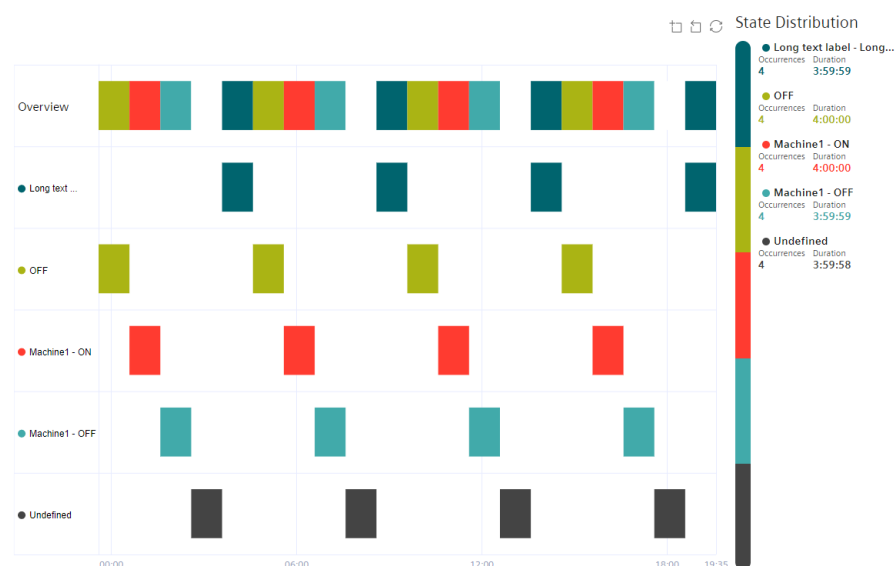
- Red: Machine 1 in RUN mode
- Blue: Machine 1 in OFF mode

The tooltip offers more information extending beyond the selected time range of the widget. In the figure below, you can see that the machine status with the color "Blue" was present on March 4, 2021, from 6:35 AM to 7:35 AM. Using the tooltip for each machine state you can see exactly

when this operating state occurred. In the case of the blue machine state, this is of particular importance, for example, to determine immediately when the machine stopped.



The individual values are displayed itemized in the detail view:



9.6 Creating status mappings for the "Gantt" widget

Description

Using a status mapping, you represent changes of the variable value in the "Gantt" widget.

You can assign a color, a label, a description and a time category to a value (machine status).

Based on a time model, you can calculate how long the machine was in a specific time category or how often one of the assigned machine statuses was in a specific time category.

These calculations are the basis for determining the OEE KPI (Overall Equipment Effectiveness) and the TEEP KPI (Total Effective Equipment Performance).

You can find additional information about the productivity of a machine or plant here: [AUTOHOTSPOT](#)

Status mappings

You create status mappings either when you create a Gantt widget or in the "Configuration" tab. The "Configuration" tab shows the status mappings that already exist.

Creating and editing a status mapping

To create a status mapping, follow these steps:

1. Open "Configuration" > "Status mapping".
2. Click on "New status mapping".
3. Assign a unique name and 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 equipment effectiveness) to a KPI instance.
5. You can assign a color, a label, a time category and a description for each value that a tag can assume.

If a value that is not defined in the status mapping table occurs in the variable, it is displayed with the status "not defined" and the color white in the Gantt widget.

Name *

G_NPU

The status mapping name must be unique.

Description

Description

Use time categories
Time category is used for eg. OEE calculation

Color *	Value *	Label *	Time Category *	Description
■	1	NetProductionTime	Net Production Time	Description
■	0	PlannedDowntime	Planned Downtime	Description
■	2	UnplannedDowntime	Unplanned Downtime	Description

+ New row

* These fields must be filled out.

Save Cancel Delete

You use the created status mapping in connection with the "Gantt" widget. The order of each state mapping is reflected in the Gantt widget in the same way as shown in the table. You can change the order using drag-and-drop.

9.7 Visualizing the violation of limit values (gauge)

Description

You can use the gauge to represent limits according to colors. The gauge helps you recognize at a glance whether or not limits are being exceeded.

The following views are available for the gauge:

- Detail view
- Histogram

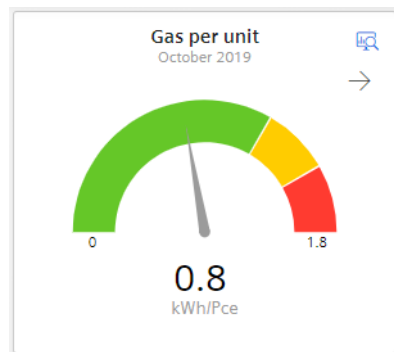
Procedure

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

1. In step 5 when creating a widget of the type "Gauge", the limit values from the general display options are applied if you have already defined them there.
2. Specify the value with which the gauge scale starts and ends.

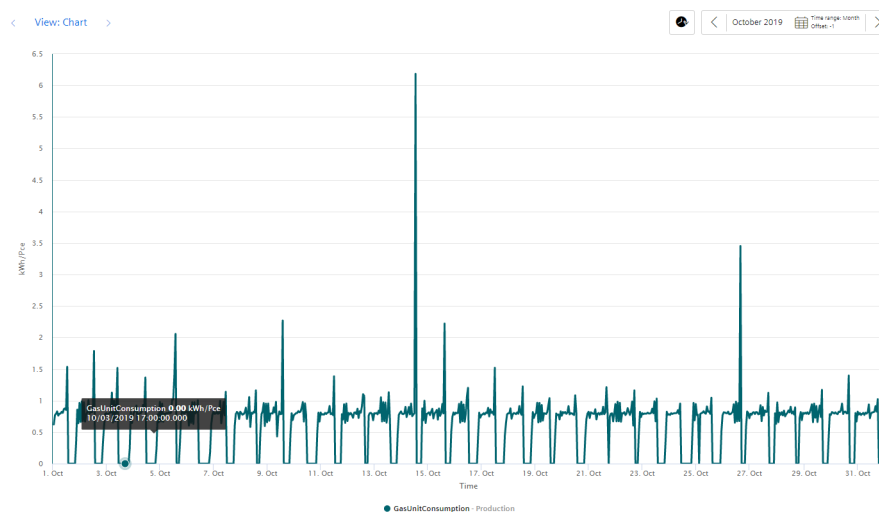
Result

The gauge in the example shows you that the gas consumption per unit is in the acceptable range (green):



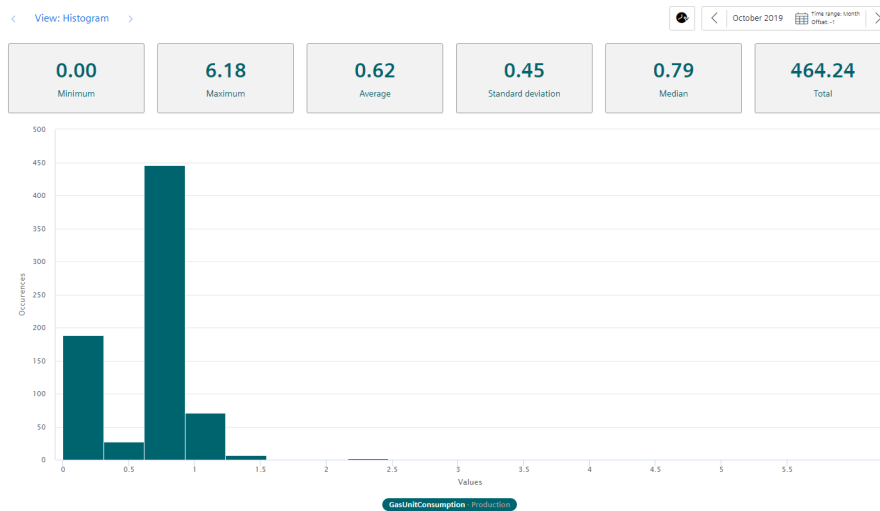
The arrow at the top right shows the tendency of the displayed value.

In the detail view, you see the graph of the KPI instance "GasUnitConsumption" in the color that you have defined in the display options:



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

The histogram in the example shows the frequency distribution of the KPI instance "GasUnitConsumption":



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

Description

Using the pie chart, you can represent 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:

- Detail view
- Histogram
- Regression

Procedure

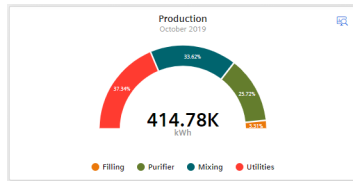
To define widget-specific display options, follow these steps:

1. In step 5 when creating a widget of the type "Pie chart", you specify whether the values are to be displayed as absolute or percentage values.

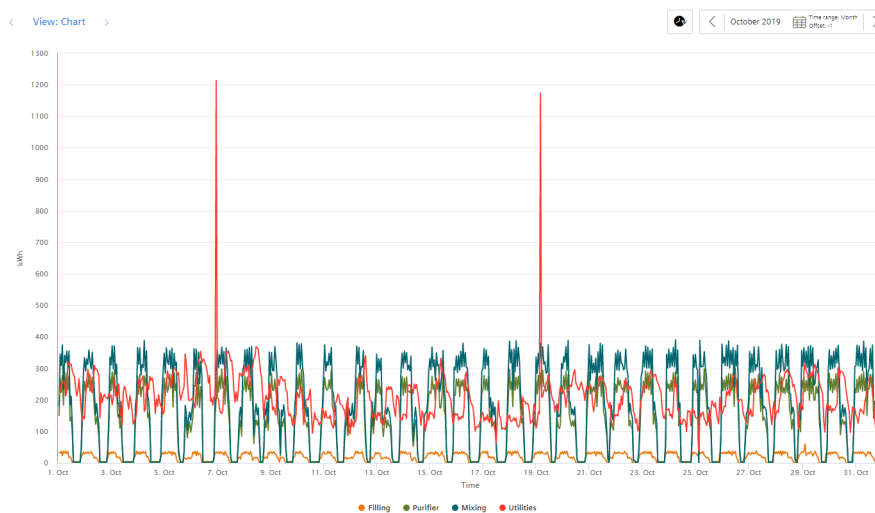
9.8 Visualizing the distribution of consumptions or quantities (Pie chart)

Result

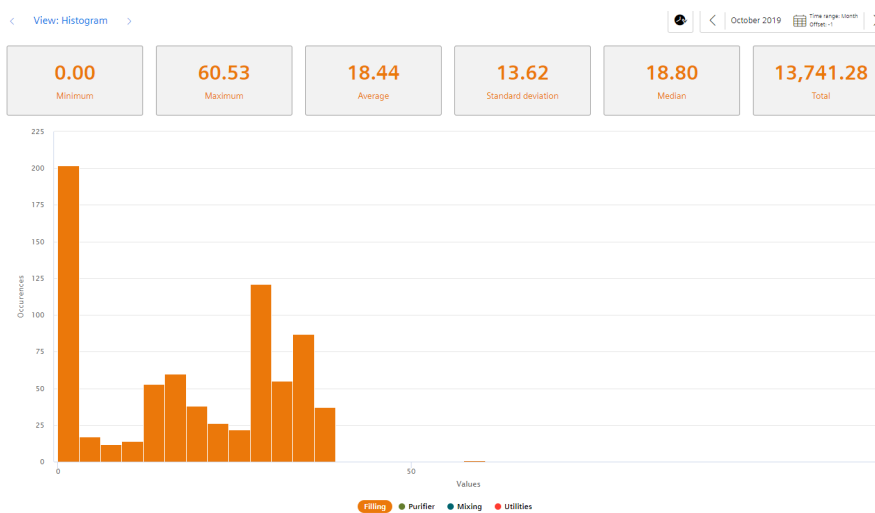
The pie chart in the example shows you the percentage values of the parameters "Filling", "Purifier", "Mixing" and "Utilities":



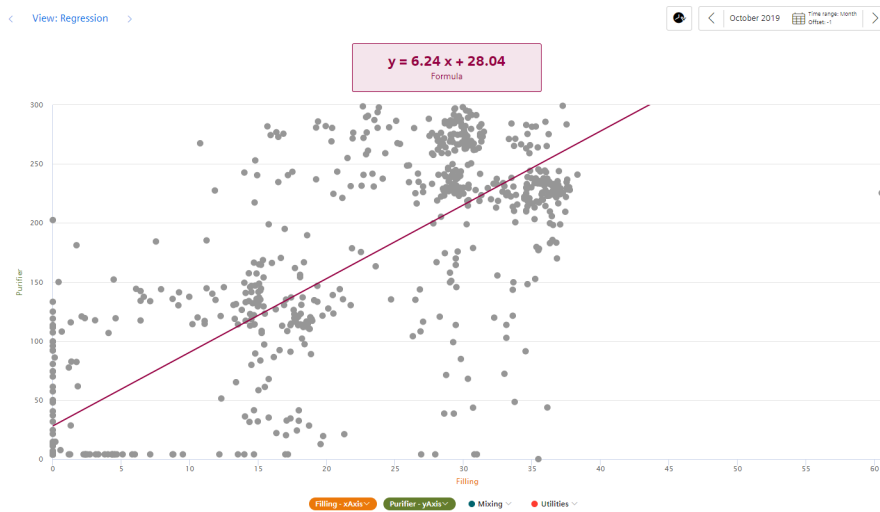
In the detail view, you can see the graphs of all four parameters in the colors that you have defined in the display options:



The histogram shows the frequency distribution of the "Filling" parameter:



In the regression analysis, you can see the correlation between the two parameters "Filling" and "Purifier":



9.9 Visualizing the intensity of data values (Heatmap)

Description

Using the Heatmap, you can visualize the intensity of data values over time. You can, for example, display the energy consumption (red = high energy consumption; green = low energy consumption), temperatures or production quantities in a specific time range.

The following views are available for the Heatmap:

- Detail view
- Histogram

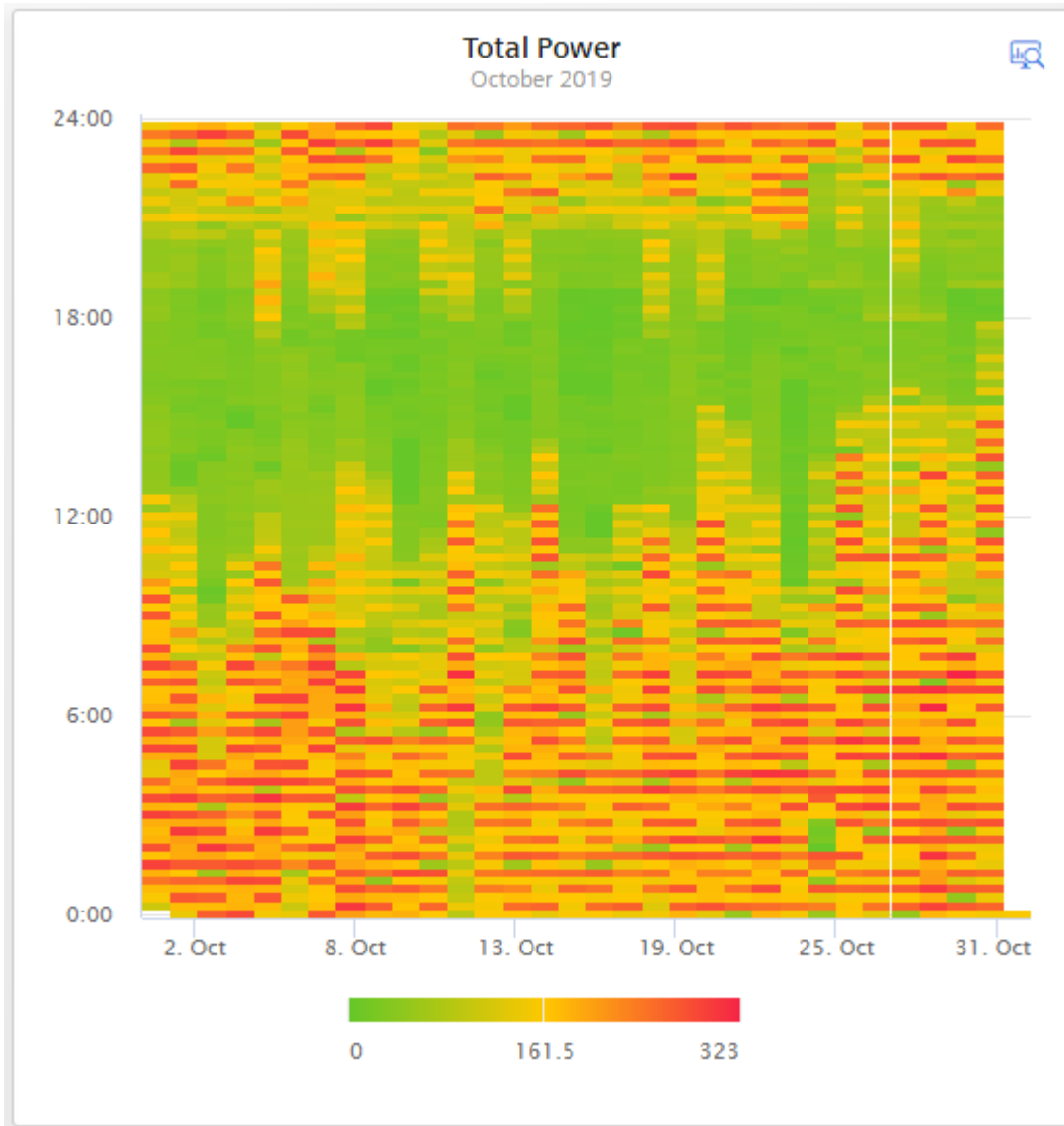
Procedure

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

1. In step 5 of creating a widget of the type "Heatmap", you specify:
 - Whether the data is displayed in the day view or the week view.
 - The color in which the different intensities are going to be displayed.
 - You can enter a fixed range for the color scaling.
If you do not define fixed values, the lowest and the highest measured value is used for the color scale. If there is an extreme peak, this can cause the heatmap to give a distorted picture.

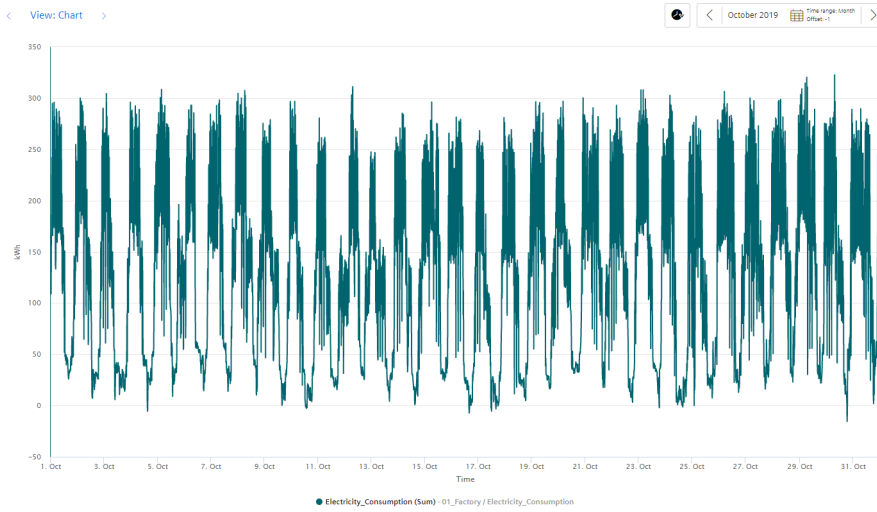
Result

The Heatmap in the example shows the energy consumptions for the entire month of October (y-axis), broken down for each day (x-axis). You can see at a glance that frequent energy peaks occurred between 0:00 and 12:00 o'clock and that energy consumption was lower in the afternoon and evening.

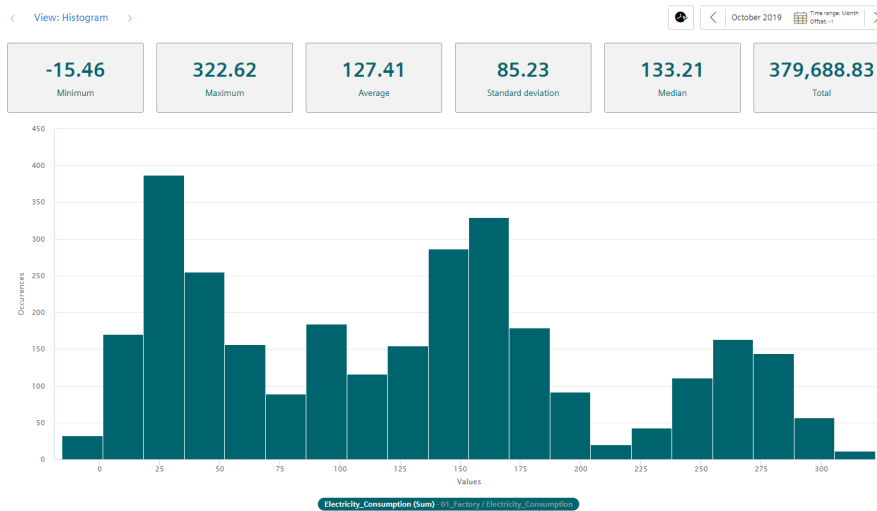


In the detail view, you can see the graph of the "Electricity_Consumption" parameter in the color that you have defined in the display options:

9.10 Editing widgets



The histogram in the example shows the frequency distribution of the "Electricity_Consumption" parameter:



9.10 Editing widgets

Description



You can change a created widget.

Note

Widgets on the automatically created OEE dashboard cannot be edited.

Procedure

To change an existing widget, follow these steps:

1. Click the  icon on the dashboard.
The dashboard is now in edit mode.
2. Click the  icon in the desired widget.
The widget wizard opens.
3. You can switch freely between steps 2 and 5 and change the details accordingly.
4. Select the last step and click "Finish".
5. Click "Finish" in the dashboard.

Result

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

9.11 Copying widgets

Description




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

Note

Widgets on the automatically created OEE dashboard cannot be copied.

Procedure

To copy a widget, do the following:

1. Click the  icon in the dashboard.
The dashboard is in edit mode.
2. Click the  icon in the widget.
The widget is copied to the clipboard and can be pasted to any dashboard.
3. If there is sufficient space available in the desired dashboard, you can paste the widget using the  icon.
The widget wizard opens.
4. You can switch freely between steps 2 and 5 and change the details.
5. Select the last step and click "Finish".
6. Click "Finish" in the dashboard.

Result

The copied widget is displayed in the dashboard.

9.12 Export widget data

Description




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

You can do this with the following widgets:

- Diagram
- Gantt
- Heatmap

Procedure

To export the widget data, follow the steps below:

1. In the dashboard, click the icon  in the widget.
Or
2. Open the details view of the widget  and click  Export widget data.

Result

A .csv file is created that contains, for example, information about local_time, UTC_time and the parameters used.

KPI calculations (key figures)

10.1 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

$$\text{Quality [\%]} = \frac{\text{GoodCount}}{\text{TotalCount}} * 100$$

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

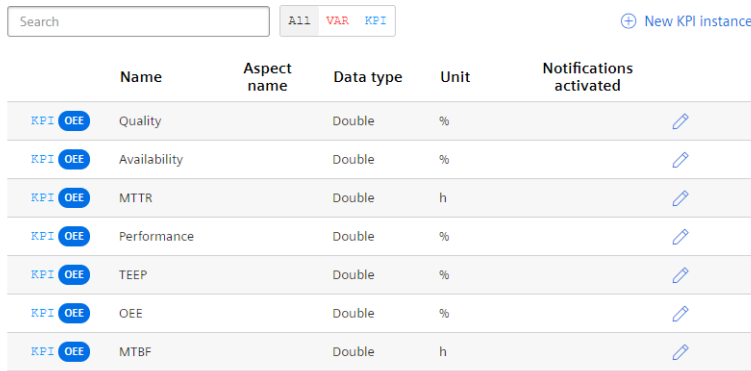
The KPIs are saved in a buffer (cache). If values were overwritten in the past (except for the current and last hour), it may take up to one hour before you will be able to see the data or KPIs and aggregations based on them.

Automatically created KPI instances

KPI instances are created automatically as soon as the configuration for an OEE analysis has been made on an asset.

For automatically created KPI instances, you can define limits that trigger a notification when the high or low limits are violated. 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 of the data type "Integer" and KPI instances (Page 65)

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



The screenshot shows a web interface for managing KPI instances. At the top, there is a search bar and a filter menu with options 'All', 'VAR', and 'KPI'. A '+ New KPI instance' button is located in the top right. Below the filter menu is a table with the following columns: Name, Aspect name, Data type, Unit, and Notifications activated. The table contains seven rows of KPI instances, each with a 'KPI OEE' icon and an edit icon.

Name	Aspect name	Data type	Unit	Notifications activated
KPI OEE Quality		Double	%	
KPI OEE Availability		Double	%	
KPI OEE MTTR		Double	h	
KPI OEE Performance		Double	%	
KPI OEE TEEP		Double	%	
KPI OEE OEE		Double	%	
KPI OEE MTBF		Double	h	

Automatically created KPI instances do not generate any additional costs.

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 may contain no spaces, mathematical symbols or numbers at the beginning of the operand name. They can be moved and copied.

Structure of a KPI instance

The KPI instance is created as follows:

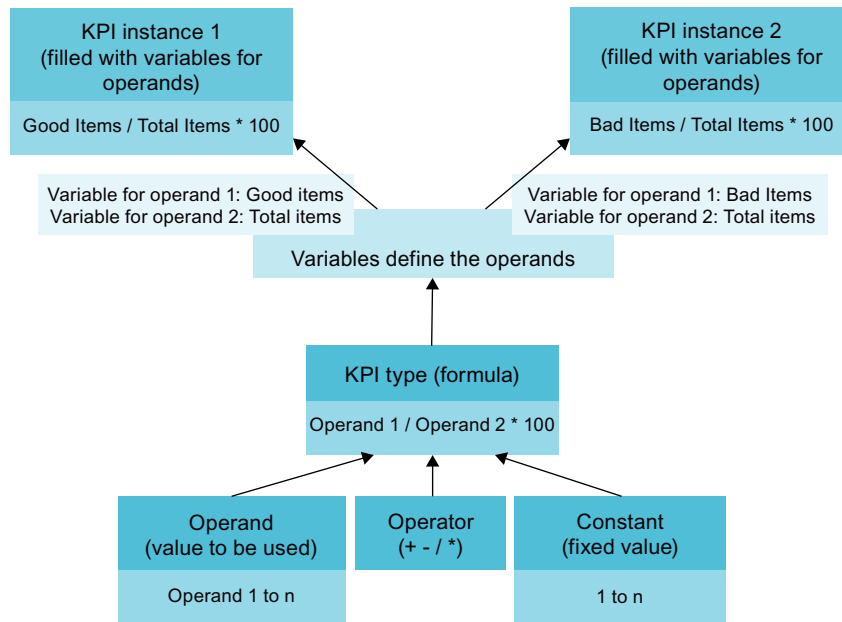
- Instantiate a KPI type including linked variables or KPI instances (typed; multiple use is possible).
- or -
- Create a KPI instance directly and link it to variables or KPI instances (typeless).

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:



10.2 Creating KPI types

Description

Created KPI types are displayed in the "Configuration" tab.

Here you can create new KPI types.

Procedure

Follow these steps to create a KPI type:

1. Select "Configuration" > "KPI types".
All KPI types are displayed.
2. Click on "New KPI type".

10.3 Creating and deleting KPI instances

3. Assign a unique name and a unit.
4. In the formula editor, use operands, constants, time categories and operators to compose the formula that is used to calculate the KPI. You can create operands and constants directly for this purpose.
In the formula editor, use operands, constants, time categories and operators to compose the formula that is used to calculate the KPI. You can create operands and constants directly for this purpose.

Note

Time categories

The time category is used for the calculation of OEE key performance indicators. You can select the time category and specify whether the duration or the number of events is used for the calculation.

An operand is a placeholder that is later filled with actual values from the variables or KPI instances.

Name *

Unit *

Formula editor *

Calculator toolbar: +, -, ÷, ×, (,), Operand, Constant, Time Category, ?

Formula: (Net Production Time TIME CATEGORY Duration / Available Production Time TIME CATEGORY Duration) + 100 CONSTANT

* These fields must be filled out.

Connect the operands with the variables or KPI instances.

10.3 Creating and deleting KPI instances

KPI instances

KPI instances can be created either in the parameter list of the respective dashboard or in the 3rd step when a widget is created. You can create the KPI instance either when creating 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**Unified Comfort Panel (UCP)**

There are currently no costs on a UCP because the trial version of the Performance Insight app is available until March 31, 2021.

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 step 3 "Parameter".
3. Click "Create a new KPI instance".
4. Click the "General" tab.
5. Assign a unique KPI instance name per plant object.
6. Select "On basis of a KPI type (typed)".

10.3 Creating and deleting KPI instances

7. Select the desired KPI type. The preview shows the formula it contains. When you select a KPI type with time categories, you have the option of linking a status mapping and a parameter for the machine status.
8. 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.

The screenshot shows the 'General' tab of a KPI configuration interface. At the top, there are two tabs: 'General' (selected) and 'Limits'. Below the tabs is a section titled 'Define general settings' with a sub-instruction: 'Define a name, the type of the KPI instance, the unit and the formula and link each operand with a parameter.' A blue information box contains the text: 'Costs for one KPI instance incurs costs. Creating a KPI instance incurs costs.' Below this is a text input field for 'KPI instance name *' with the placeholder 'Enter a KPI instance name.' The 'Select a KPI basis' section has two radio buttons: 'On basis of a KPI type (typed)' (selected) and 'Without KPI type (type less)'. The 'KPI type' dropdown is set to 'Availability'. The '1. Formula preview' section shows a formula:
$$\frac{\text{Net Production Time}}{\text{Available Production Time}} \cdot \text{Duration} \cdot 100$$
 The '2. Choose parameter representing your machine status' section shows a dropdown with 'Working' selected. The '3. Choose a status mapping that represents your time model' section shows a dropdown with 'G_NetProductionTime' selected.

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 step 3 "Parameter".
3. Click "Create a new KPI instance".
4. Click the "General" tab.
5. Assign a unique KPI instance name per plant object.
6. Select "Without KPI type (typeless)".
7. Enter a unit.

8. Create the formula from constants, operands and operators.
If you select a time category, you also have the option of linking a status mapping and a parameter for the machine status.
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.

Define general settings for "Total amount"

Define a name, the type of the KPI instance, the unit and the formula and link each operand with a parameter.

i **Costs for one KPI**
 Creating a KPI instance incurs costs.

KPI instance name *

Select a KPI basis

On basis of a KPI type (typed)
Select this option if the KPI definition is inherited from a KPI type

Without KPI type (type less)
Select this option if the KPI definition is used only once

Unit *

1. Formula editor

+
-
*
/
()
Operand
Constant
Time Category
?

OPERAND
Total

OPERAND
-

OPERAND
Good

+

TIME CATEGORY
Net Production Time
Duration

2. Choose parameter representing your machine status ?

VAR **Working** ×
EEMonitor

3. Choose a status mapping that represents your time model ?

G_NetProductionTime

4. Link each operand to a tag to continue. ?

Total
↗

VAR **Total** ×
EEMonitor

Average

Good
↗

VAR **Working** ×
EEMonitor

Average

If you have already defined limits for the variable or KPI used, these are displayed in the widget as pre-setting. These limits can be overwritten.

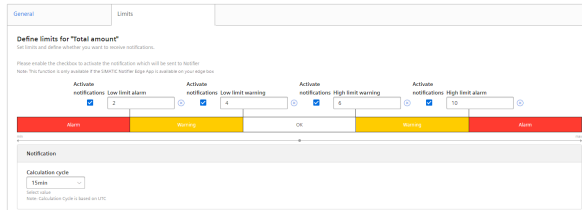
Defining limits

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

10.3 Creating and deleting KPI instances

To define the limits, follow these steps:

1. Click the "Limits" tab.
2. Enable the "Activate notifications" function for a limit area, for example, low limit alarm.
3. Enter a limit.



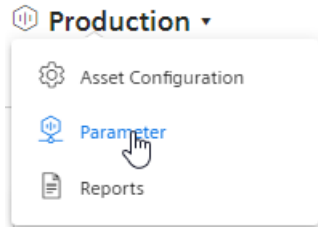
You can find additional information on the "Activate notifications" function here: "Activate notifications" for variables of the data type "Integer" and KPI instances (Page 65)

Deleting KPI instances


You can delete KPI instances in the parameter list on the asset.

To delete a KPI instance in the parameter list, follow these steps:

1. Under "My Plant", open the dashboard in which the KPI instance is used.
2. Next to the plant object, click the arrow and select the "Parameter" view.



The list with all variables and KPI instances used is displayed.

3. Click on the "Delete"  in the parameter list.

Note

No Undo

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

Creating multivariable regression

11.1 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 using the input parameters and the regression model. (model result)

The energy consumption of a plant is influenced by certain factors, such as ambient temperature, produced quantity and filled quantity. 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. It could be that you used an input variable that stands in no relation to the output variable. In this case the correlation coefficient would be 0, which means that the model is not trustworthy.

Different models can be calculated and saved for each asset and parameter. Users can access the saved models in a predefined MVR dashboard; here, the result of the model can be compared with the actual value. To better recognize the deviation, the deviation and the cumulative deviation are 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 determines when the user will receive a notification, for example, from the Notifier.

You can create multiple models for each output parameter.

11.2 Creating a model

Description

As soon as you have created a model, an MVR dashboard is automatically created for the asset. 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

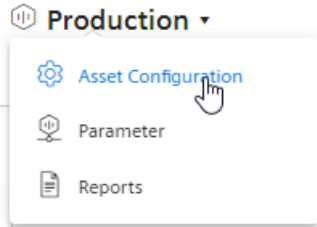
Only use parameters with numerical data types

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

Procedure

To create a model, follow these steps:

1. Open the "Asset Configuration" of the asset.



2. Select "Multivariable regression".



	<p>Define OEE settings</p> <p>Here you can select the status mapping for your time model and a parameter that represents the machine status for the asset. By doing so, you create a predefined OEE dashboard based on OEE KPIs.</p>
	<p>Multivariable regression</p> <p>To enable multivariable regression analysis, configure and create models for parameters.</p>

If models have already been created, you will see an overview. One 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.



3. To create a new model, click "New model" . To edit an existing model, click "Edit" .
4. Give the model a descriptive name. Based on the name, the model is selected for visualization from the existing models on the MVR dashboard.
5. Define the calculation time range. The calculation time range is applied as default in the visualization. The user can adjust the calculation time range on the dashboard.
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 parameter or a KPI.
7. Select the input parameters. You can select up to five input parameters. These are the parameters for which you want to show how they influence the value of the output parameter.
8. Select a type of aggregation for each parameter. The time stamps of the aggregated values are to be identical.
9. Select the period for which the data will be analyzed. For more information, refer to: "Working with periods (Page 132)".
10. To ignore outliers in the analysis, enter a value for "Spike 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.

11. Click "Calculate".

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.

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 114).

12. 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.

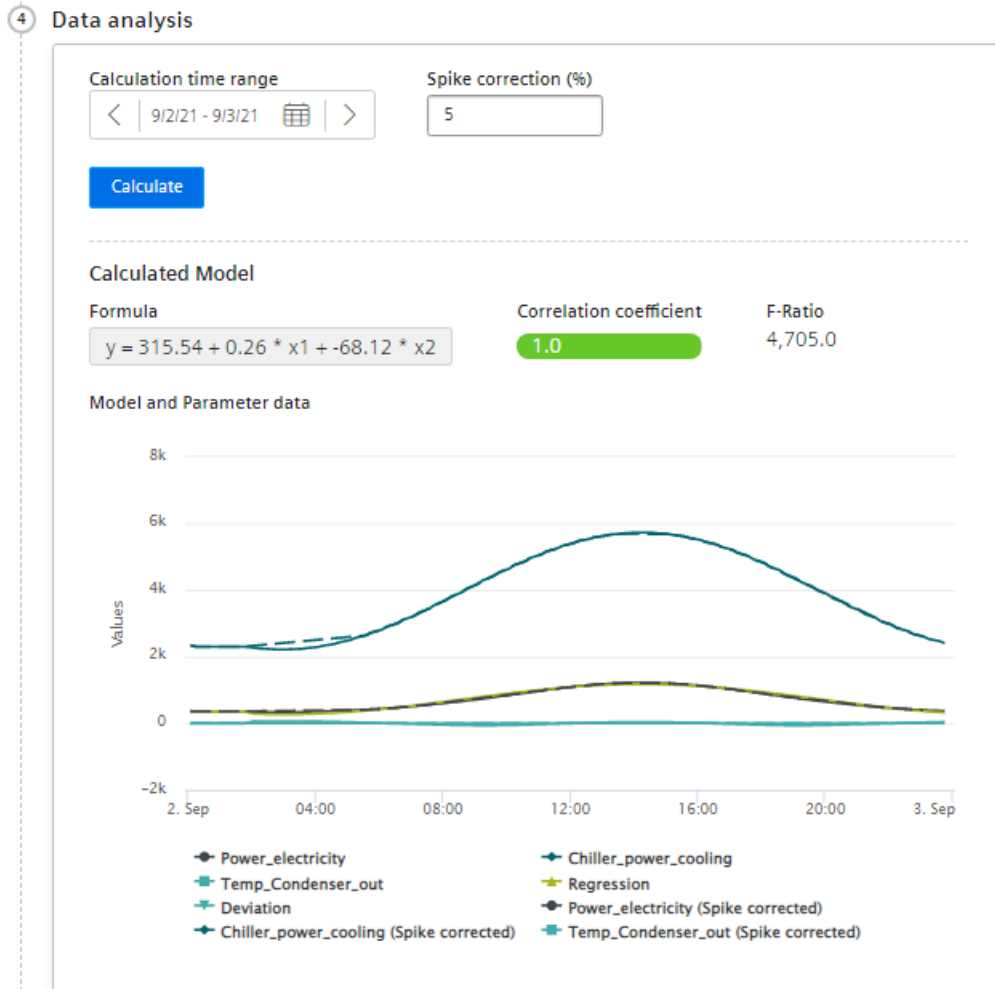
A model can be used on the MVR dashboard for any other period to analyze the parameters.

Two new, fee-based KPI instances are created.

11.3 Optimizing the model

Description

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



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 x_1 , x_2 , etc.
The formula cannot be edited.
- **Correlation coefficient**
Quality measure for the model
The color background explains the value:
 - Green: Model can be used for its intended purpose
 - Yellow: Model should be optimized
 - Red: Underlying data is insufficient
- **F-Ratio**
Indicates the significance of the model.
The greater the value, the better the model.

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

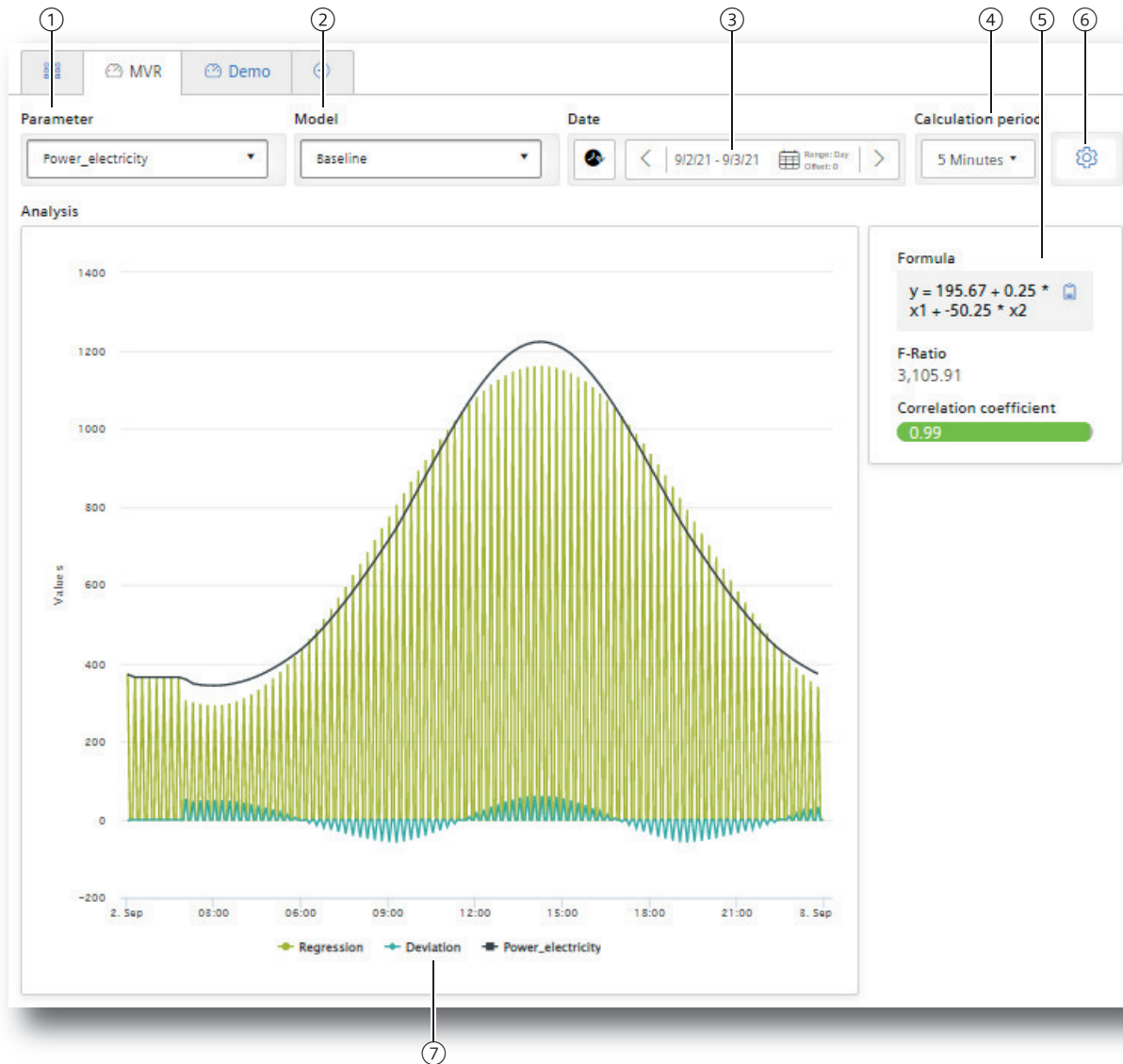
To optimize a model, follow these steps:

1. Use variables or KPIs as output parameter and input parameters for which data is available without gaps in the calculation time range.
2. Remove any input parameters with inadequate data quality.
3. Select a calculation time range 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.

11.4 Visualizing on the dashboard

MVR dashboard

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



- ① Selection of the output parameter
- ② Selection of a model that describes the output parameter
- ③ Selection of the time range for the analysis
- ④ Selection of the calculation interval
- ⑤ Characteristics of the model: Formula, F-Ratio, Correlation coefficient
- ⑥ Switching to model overview
- ⑦ Showing and hiding the individual parameters

Procedure

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

1. Select the parameter ①.
2. Select a model ② that describes this parameter.
3. Select the time range ③ for which the multivariable regression is visualized.
You can apply the model to any time range in the past.
See also: Working with periods (Page 132).
4. Select the calculation interval ④.
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 ⑦.
The following trends are offered:
 - the value trend of the output parameter
 - the regression
 - the deviation of the actual values from the model

Dashboard features

- Display of the existing models



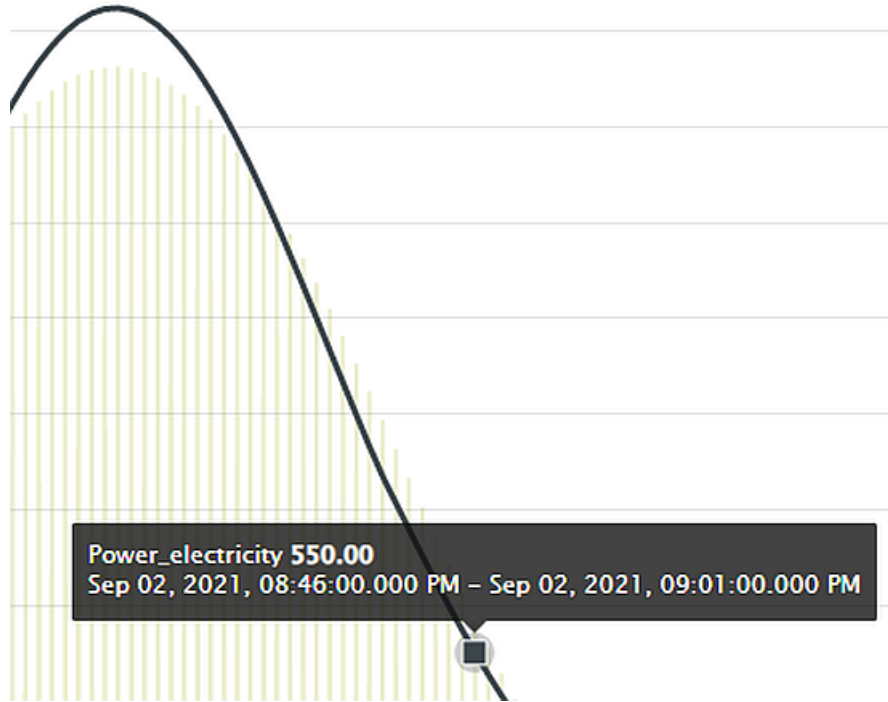
To display the overview of the existing models and potentially create a new model, click on "Settings" ⑥.

- Description of the model
The characteristics that describe the model are displayed ⑤:
 - Formula
 - F-Ratio
 - Correlation coefficient

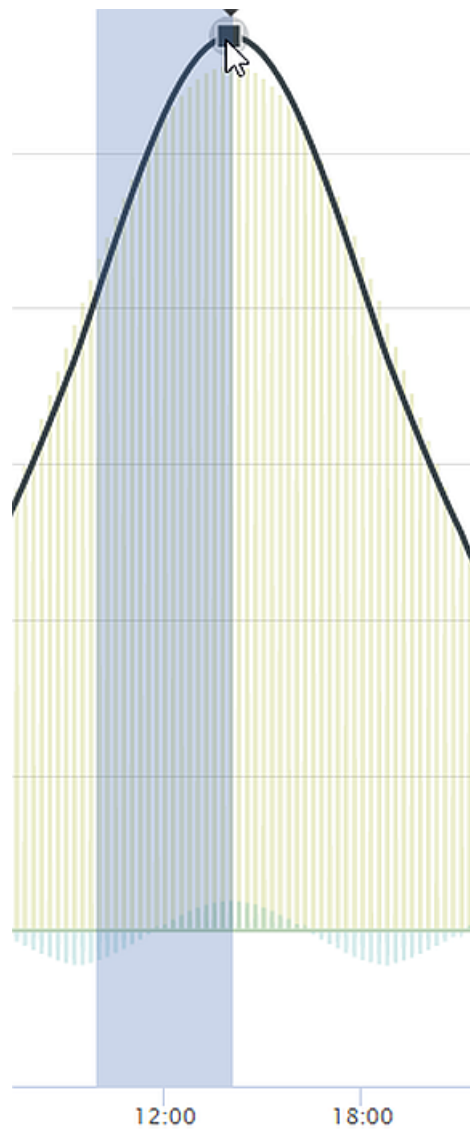
You can copy the formula to the clipboard.



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



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



After you have released the mouse button, the selected area is shown in detail (zoomed in).



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



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

Creating reports

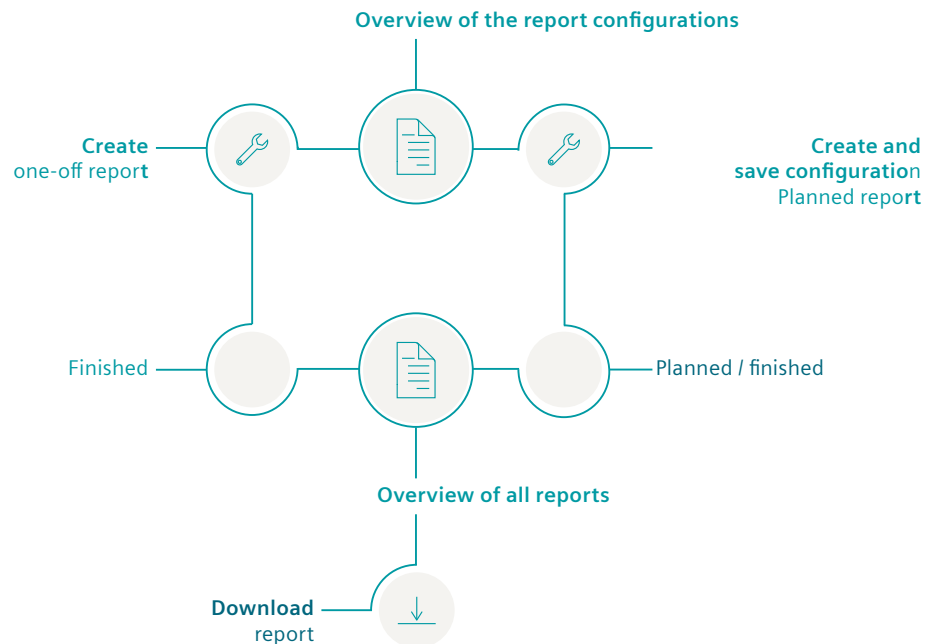
12.1 Introduction to Reporting

Description

Reports are a central component of the app. Reports are generated to complement the visualization of KPIs and variables on the dashboards. Reports provide selected information on productivity, effectivity, machine utilization and more at regular intervals without the recipient of the reports needing 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.



Procedure

To configure and generate reports, proceed as follows:

1. Configure a report. (Page 123)
2. View generated reports and download them. (Page 128)
3. Use the overview of the report configurations. (Page 122)

12.2 Overview of the report configurations

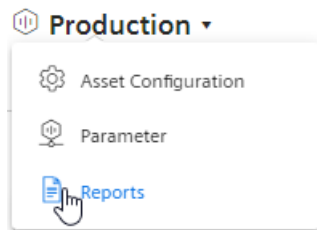
Introduction

Reports are based on a configuration. This is saved and displayed in the "Overview of all reports". Here, you can create a new configuration. Configurations can be edited and deleted.

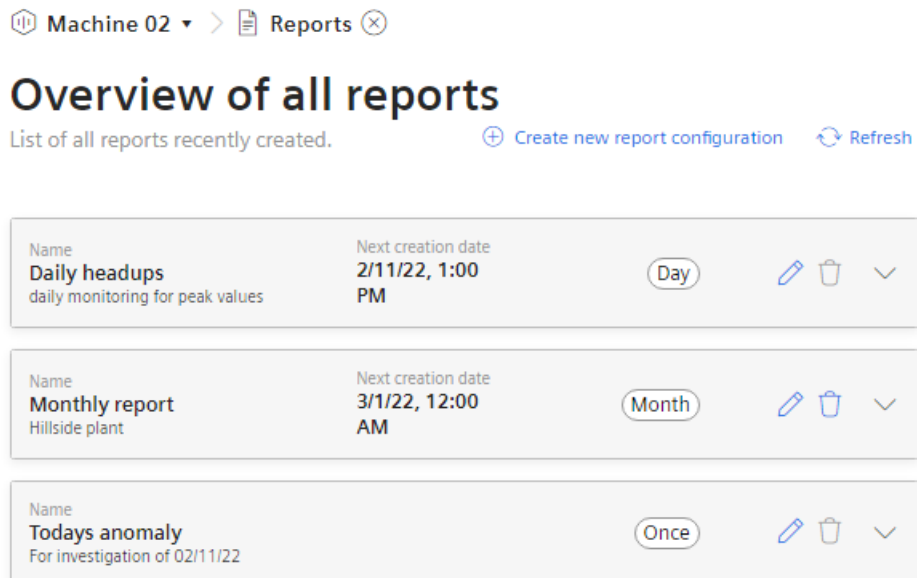
Procedure





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

1. Open the "Reports" of the asset.



The overview of configurations is displayed.



2. To create a new configuration, select  "Create new report configuration".
3. To edit a configuration, select "Edit" .
4. To delete a configuration, select "Delete" .
A configuration for which reports are available cannot be deleted.
5. To view the reports based on a configuration, click  in the configuration display.
The view is expanded.

12.3 Configuring reports

Description

A report is configured either for a planned periodical or a one-off generation.

The configuration for a report is saved.

You define the following for a report:

- 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

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. Open the "Reports" of the asset.
If a configuration has already been created, the overview is displayed.
2. Select "Create new report configuration".
3. The "Create report configuration" editor opens.

1 Base data

Name *

Description

Excel template
A template has to be uploaded. It can't be deleted anymore but replaced.


Upload file
Maximum 5 MB
.XLSX, .XLTX, .XLSM, .XLTM

4. Enter the name of the report.
The name is mentioned in the overview of all reports.
5. Enter a description for the report.
The description makes it easier to assign the report.

6. Upload an Excel file as report template.
The template can be an empty file. The template can, for example, already be structured as filled cells that are pre-formatted by headlines. The template can, for example, contain a letter head or recurring information on the location of the plant for each report.
If you do not upload a template, a blank Excel file is used as the basis for the report. When editing the configuration for a regularly generated report again, you see a note that an automatically generated Excel file is being used. You can replace the automatically generated template with your own template.

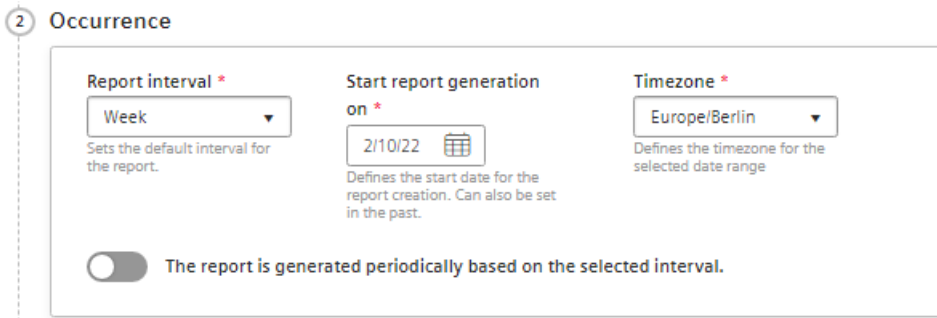
Note

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
-

7. Select the "Report interval".
8. Select the date on which you want the report generation to start.
The report is generated for the first time when the interval after the start date is reached.



Example: The start date is 1/1/22. The interval is one week. The report is generated on 1/7/22.

9. Select a time zone.
The time zone is added as an offset to the start date.
10. To create a configuration for a report that is generated regularly based on the selected interval, activate the switch.



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



Note

One-off reports

The configuration for one-off reports is not saved.

11. 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.

3 Sections

Values ^

Section name *

Is placed above the specified start cell.

Sheet name * **Start cell ***
When the sheet is not available, a new one is created. Defines the start cell for the data that is exported to the Excel file.

List values as

Process values
All values of the selected interval based on the selected calculation period are exported.

Balance value
Single aggregated value for the selected period is exported.

Calculation interval

Defines the interval of values for the selected period.

Data alignment

Columns Data is exported in columns. **Rows** Data is exported in rows.

Parameter (2/50) *
At least one parameter must be added.

! If 'Aggregation: None' and 'Data alignment: Row' is selected, there is a limit of 16,384 data points that can be exported.

1:	^	v	Chiller_power_cooling (Average) <small>DemoData wccdev,EdgeSheeran Demo,Multivariable Regression Analysis,Machine 02</small>	VAR	Average ▾	🗑️
2:	^	v	Power_electricity (Average) <small>DemoData wccdev,EdgeSheeran Demo,Multivariable Regression Analysis,Machine 02</small>	VAR	Max ▾	🗑️

[+ Add parameter](#)

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

12. Select a time zone.

The time zone is added as an offset to the start date.

13. Specify the name of the Excel workbook sheet in which the section is exported.

If a sheet with that name does not exist in the template, it is created.

14. 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.

15. Select whether a balance value or process values is to be 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.

16. For process values only: Select the interval for the calculation.

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.







17. For process values only: Select whether the display is in columns or rows.


18. Select the parameters that are exported in the section.

Parameter (2/50) *

At least one parameter must be added.

 If 'Aggregation: None' and 'Data alignment: Rows' is selected, there is a limit of 16,384 data points that can be exported.

1:	 	<p>Chiller_power_cooling (Average) DemoData wccdev,EdgeSheeran Demo,Multivariable Regression Analysis,Machine 02</p>	VAR	<div style="border: 1px solid #ccc; padding: 2px;">Max ▾</div> 
2:	 	<p>Power_electricity (Average) DemoData wccdev,EdgeSheeran Demo,Multivariable Regression Analysis,Machine 02</p>	VAR	<div style="border: 1px solid #ccc; padding: 2px;">Average ▾</div> 

 Add parameter

Note

Parameter selection


Maximum number per section: 50 parameters.

Parameters of the type String are not permitted.

Note

Limited export to Excel

In a report you can export a maximum of 500000 cells to Excel.

- To add a parameter to the report, select  "Parameter".
- Select the type of the parameter aggregation.

Note

Too many process values through "None" aggregation

If "Aggregation: None" and "Data alignment: Rows" is selected, there is a limit of 16,384 data points that can be exported.

- To change the order of the parameters, click on the arrows in front of the parameter name.

19. To create an additional section, select  "Add section".

20. To save the configuration, select "Save".

Result

- The configuration for a report has been created and saved.
- The "Overview of all reports" is displayed.
- The report is generated as of the start date with the selected interval.
- or -
The report is generated once on the start date.

12.4 View report

Description

The planned and generated reports are shown in the "Overview of all reports". Periodically generated and one-off reports are shown here.

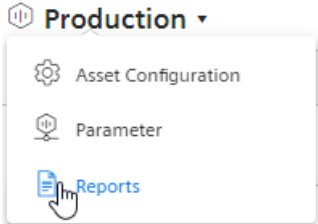
The reports can be downloaded.

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. Open the "Reports" of the asset.



The overview of all reports is displayed.

Overview of all reports

List of all reports recently created.

[+ Create new report configuration](#) [Refresh](#)

Name Daily headups daily monitoring for peak values		Next creation date 2/11/22, 1:00 PM	Day			
	Time range 2/9/22, 1:00 PM-2/10/22, 1:00 PM	Creation date 2/10/22, 1:58 PM	Published		Download	
	Time range 2/8/22, 1:00 PM-2/9/22, 1:00 PM	Creation date 2/10/22, 1:48 PM	Published		Download	

Name Monthly report Hillside plant		Next creation date 3/1/22, 12:00 AM	Month			
 No reports available for this configuration. Next report will be created at 3/1/22, 12:00 AM						






Name Todays anomaly For investigation of 02/11/22			Once			
	Time range 2/9/22, 10:00 PM - 2/10/22, 1:42 PM	Creation date 2/10/22, 1:42 PM	Published		Download	

Figure 12-1 Overview

The overview is also displayed after you have created and saved a configuration. The reports are shown grouped by report configurations.

- 2. To view the reports based on a configuration, click in the configuration display. The view is expanded.

12.4 View report

3. To download a report, select "Download" .
4. To create a report again after an error has occurred, select "Refresh"  in the row of the report.
5. To delete a report, select "Delete" .
This way you delete the report and not the configuration.
6. To create a new configuration, select  "Create new report configuration".
7. To load the view again, select "Refresh" .

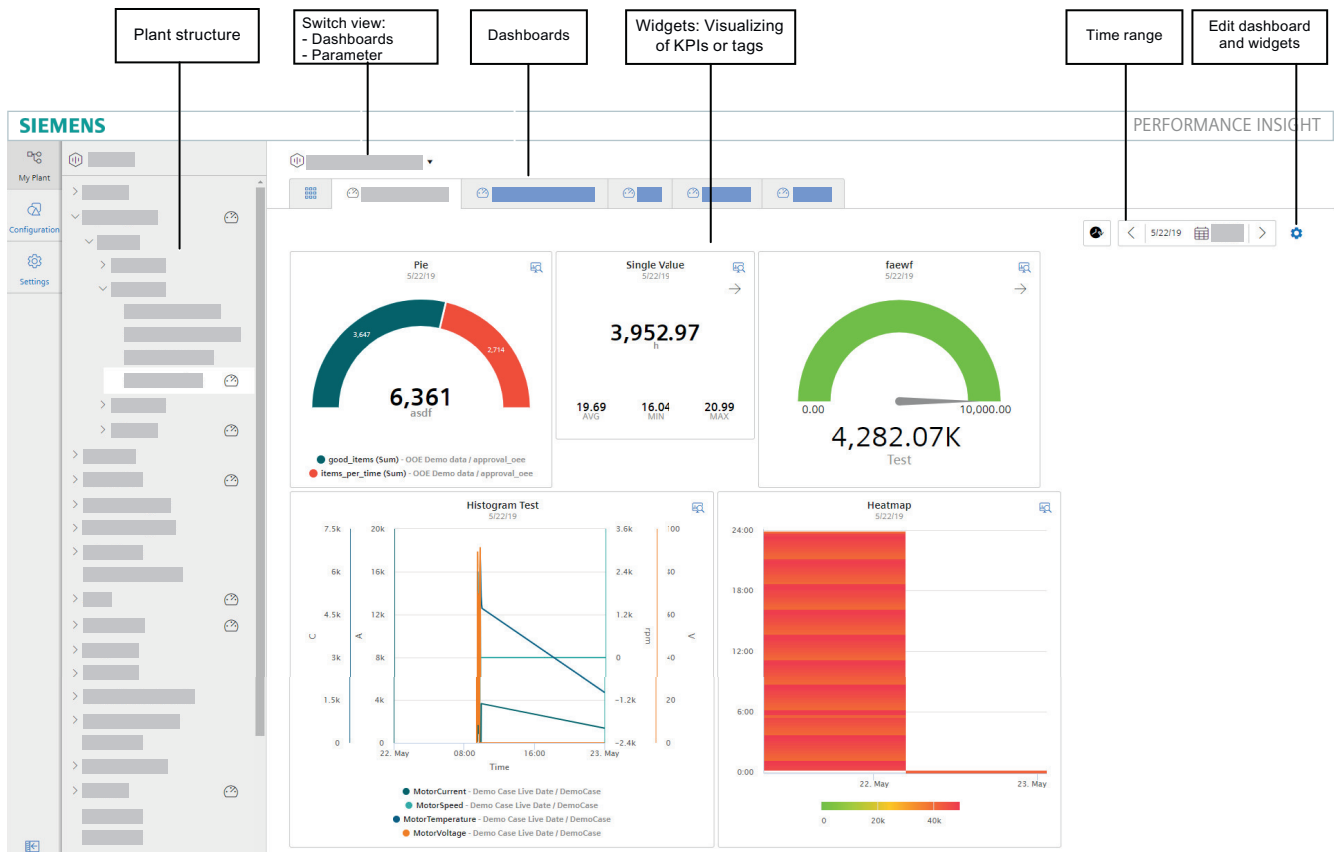
Creating dashboards

13.1 Structure of the dashboards

Overview

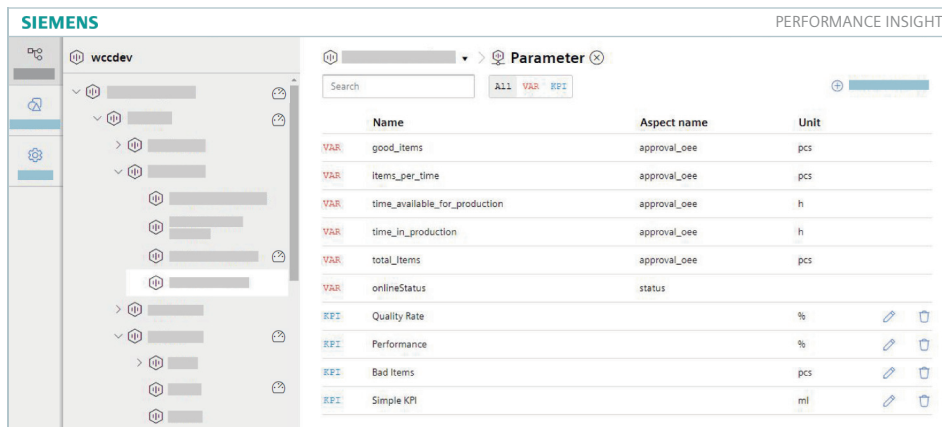
The dashboards contain a graphical representation of variables or KPI types. Widgets are used for the graphical representation. A maximum of 5 dashboards can be created per asset object within My Plant.

The figure below provides an overview of the structure of a dashboard:



Parameter overview

You can switch the view of the parameters using the drop-down list of the plant object. Here you can create additional KPI instances. The list of existing KPI instances and variables that were created for the selected plant object or a lower-level plant object can be seen below.



13.2 Working with periods

13.2.1 Setting the period in dashboards and widgets

Description

For each dashboard and each individual widget, you can define a specific period for which the values of all parameters are to be read and displayed in the widgets.

You can either use predefined periods (day, week, month, year, etc.) or define your own periods. You can find additional information here: [Defining your own periods \(Page 133\)](#)

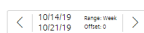
The values of the current date are always displayed by default. You can use the left < and right > arrows to jump forward or backward day by day. As soon as you deviate from the current day, -1 (one day back) or 1 (one day forward) is displayed accordingly as offset.

The current date is displayed again when you click on the symbol 📅.

If you select "The last 3 hours" as the period, for example, then you can specify an exact time from which the last three hours are to be displayed.

Result

The values of the parameters for the period from 14.10.2019 to 21.10.2019 are displayed in all widgets of the dashboard.



13.2.2 Defining your own periods

Description

You can define your own periods and use them in the settings for periods. You define these periods in the configuration. A preview shows you how the values selected affect the period you want to define.

Procedure

To define your own period, follow these steps:

1. Open the configuration.
2. Click "Periods > New period".
The detail window for creating a period is displayed.
3. Assign a name to the period in the "General" area. If necessary, you can add a description.
4. Define the period under "Configuration". The following options are available:
 - **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 the current/defined 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**
Enter a value or select a value by clicking on the arrows in the input field by which you want to offset the calculated period.
Select the unit for the offset: Minute, hour, day, week, month or year.
 - **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".


Result

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

Widget views

14.1 Detail view

Description

In the detail view, you can display the load profile of the parameters, for example, or an enlarged view of the widget. To open the detail view, click  in the widget. The functions of the detail view depend on the widget type.

For a widget of the "Diagram" type, the detail view contains the following functions, for example:

- Showing and hiding individual lines
- Showing and hiding limits
- Output of detailed values when you move over the line with the mouse
- Zooming in on the diagram



14.2 Histogram

Description

In addition to the detail view, you can also display the Histogram if you want to see the curve of the frequency distribution. A variety of statistic KPIs are available for this:

- Minimum
- Maximum
- Average
- Standard deviation
- Median (central value)
- Total



14.3 Regression analysis

Description

In the x-y display, the production amount is mapped on the x-axis and the energy consumption is mapped on the y-axis. By using the regression line, you can determine, for example, whether too much energy is being consumed for a specific production amount. This is the case when the dot is above the regression line.

The regression analysis is available for the widgets "Pie chart" and "Diagram":

