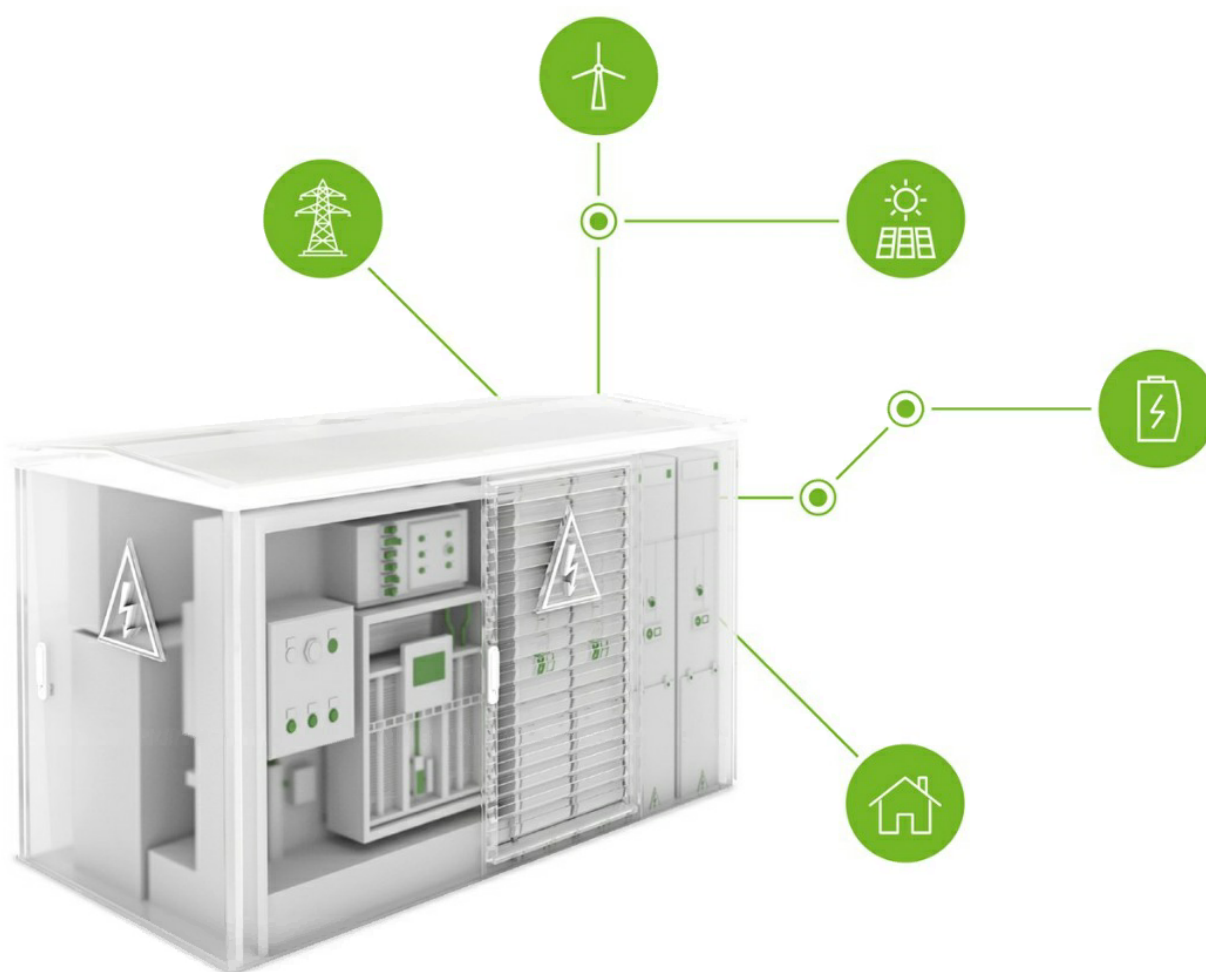


WAGO Application Grid Gateway Professional



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Every conceivable measure has been taken to ensure the accuracy and completeness of this documentation. However, as errors can never be fully excluded, we always appreciate any information or suggestions for improving the documentation.

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We wish to point out that the software and hardware terms as well as the trademarks of companies used and/or mentioned in the present documentation are generally protected by trademark or patent.

WAGO is a registered trademark of WAGO Verwaltungsgesellschaft mbH.

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1 Provisions

1.1 Typographical Conventions

Number Notation

100	Decimals: Normal notation
0x64	Hexadecimals: C-notation
'100'	Binary: In single quotation marks
'0110.0100'	Nibbles separated by a period

Text Markups

<i>italic</i>	Names of paths or files
bold	Menu items, entry or selection fields, emphasis
Code	Excerpts from program code
>	Selection of a menu point from a menu
"Value"	Value entries
[F5]	Identification of buttons or keys

Links

	Link to a topic in a document
	Link to a separate document
	Link to a website
	Link to an email address
Glossary	Link to a glossary entry

Sequence of Action

- ✓ This symbol identifies a precondition.
- 1. Action step
- 2. Action step
 - ⇒ This symbol identifies an intermediate result.
- ➔ This symbol identifies the result of an action.
- Individual action step

Lists

- Lists, first level
 - Lists, second level

Figures

Figures in this documentation are for better understanding and may differ from the actual product design.

Warning Messages

DANGER

Type and source of hazard

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

- Action step to reduce risk

WARNING

Type and source of hazard

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

- Action step to reduce risk

CAUTION

Type and source of hazard

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

- Action step to reduce risk

NOTICE

Type and source of malfunction (property damage only)

Indicates a potentially hazardous situation which, if not avoided, may result in damage to property.

- Action step to reduce risk

Information Notices

Note

Information

Indicates information, clarifications, recommendations, referrals, etc.

1.2 Legal Information

Subject to Change

The instructions, guidelines, standards, etc., in this manual correspond to state of the art at the time the documentation was created and are not subject to updating service. The installer and operator bear sole responsibility to ensure they are complied with in their currently applicable form. WAGO GmbH & Co. KG retains the right to carry out technical changes

and improvements of the products and the data, specifications and illustrations of this manual. All claims for change or improvement of products that have already been delivered – excepting change or improvement performed under guarantee agreement – are excluded.

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Third-party trademarks are referred to in the product documentation. The "®" and "™" symbols are omitted hereinafter. The trademarks are listed in the Appendix: Protected Rights.

Licenses

The software and related components are protected by license mechanisms. A license key is required for productive use of the software without time restriction. The software can also be used fully without a license key for 30 days. This trial period only includes the days of actual use. Access without a license key is no longer possible after the trial period. Depending on the type of software license, an Internet connection may be required to activate the license. Please refer to your license certificate for the corresponding information.

Depending on the functionality required, one or more licenses are required (see also Sprungziel: Kopiervorlage). The purchased license keys will be sent to you by email after your order. You need the WAGOupload software in order to load the purchased licenses.

General information on the terms of use of WAGO software can be found in the WAGO software license agreement at General Terms and Conditions: <https://www.wago.com/de/d/softwarelicence>

2 Security

2.1 General Safety Regulations

- This documentation is part of the software. Therefore, keep the documentation for the entire service life of the software. Pass on the documentation to the next user of the software. In addition, ensure that any supplement to this documentation is included, if necessary.
- Any actions related to the use of WAGO software may only be performed by qualified staff with sufficient knowledge to use the respective PC system.
Steps in which files are created or changed on a PC system may only be performed by qualified employees with sufficient knowledge in the administration of the PC system used in addition to file creation or modification.
Steps that change the PC system's behavior within a network may only be performed by qualified employees with sufficient knowledge of administration of the responsible network.
- Set up permissions management for authorized persons.
 - Digital access may only be made by authorized persons.
- Comply with the laws, standards, guidelines, local regulations and accepted technology standards and practices applicable at the time of installation.

2.2 Indirect Safety

- If automation solutions are implemented that can lead to personal injury or significant property damage in the event of failure, you must take appropriate measures to ensure that the system remains in a safe operating state even in the event of failure.
- Give all products in a network different IP addresses.
- Never connect a PC on which a DHCP server is installed to a global network. Larger networks usually already have a DHCP server, which can cause collisions that lead to network breakdown.
- Use only the latest security software.
- Uninstall or disable all software components or programs on your PC that are not required for the intended use.
- If problems occur with access to connected devices, check whether the required runtime system is enabled. For programs developed with **e!COCKPIT**, **e!RUNTIME** must be selected as the runtime system. For programs developed with CODESYS 3.5, CODESYS V3 must be selected as the runtime system. Use a software tool (which depends on the hardware) to perform the check or use the Web-Based Management system.

3 Function Description

The application can be used to transmit the measured values of the medium voltage, transformer, low-voltage outlets, valve position messages and temperatures from a substation to the grid control system. The communication uses the IEC60870 protocol. Commands and setpoints can also be received and processed. External measurement systems, such as short-circuit/ground-fault direction indicators, can be parametrized via Modbus. The entire parameterization can be transferred to other stations if necessary. Measurement data simulation allows new substations to be commissioned on the grid control system on the station builder's end without the field side being connected.

The application is based on a "publish-subscribe" model, which enables resource-efficient data acquisition and can handle any number of data sinks. "Subscribing" to data points as a routing method is the basis for all configurations. An integrated MQTT broker can be used to supplement external software components.

3.1 Software Concept

The application is a classic gateway software solution primarily intended to link data points collected via fieldbuses and local I/O interfaces to data points from other communication protocols. The data architecture follows the publish-subscribe model. This means that all protocol drivers publish incoming and acquired data in a structured way via an internal API. Other software components must subscribe to the data points that are to be transmitted or output. Configured subscribers are automatically notified via the API as soon as a source data update arrives. For example, immediately after being acquired, measured values can be sent as spontaneous measured values via 60870 protocols through Modbus queries or output on other interfaces. The transition between protocols/interfaces involves no delay. Besides up-to-date instantaneous values, the subscription system also supports calculation of interval values like minimums, maximums and averages. If necessary, the quality bits (individually or as a bit set) or the timestamp can also be subscribed to as data values. The subscription system is the core of the application and user interface and is represented in every software component by the  **Select Data Point**  **25** dialog. Beyond simple data linking, the application includes automation functions such as implementation of various logic functions, integration of the WAGO power plant controller and control of adjustable distribution transformers.

3.2 Supported Products

Table 1: Supported Products

Category	Item No.	Description
Controllers	750-8112	Controller PFC100; 2nd Generation; 2 x ETHERNET, RS-232/-485
	750-8112/025-000	Controller PFC100; 2nd Generation; 2 x ETHERNET, RS-232/-485; Ext. Temperature
	750-8210*	Controller PFC200; 2nd Generation; 4 x ETHERNET
	750-8210/025-000*	Controller PFC200; 2nd Generation; 4 x ETHERNET; Ext. Temperature
	750-8210/040-000*	Controller PFC200; 2nd Generation; 4 x ETHERNET; Extreme
	750-8212*	Controller PFC200; 2nd Generation; 2 x ETHERNET, RS-232/-485
	750-8212/025-000	Controller PFC200; 2nd Generation; 2 x ETHERNET, RS-232/-485; Ext. Temperature
	750-8212/040-000	Controller PFC200; 2nd Generation; 2 x ETHERNET, RS-232/-485; Extreme
	750-8212/025-001	Controller PFC200; 2nd Generation; 2 x ETHERNET, RS-232/-485; Telecontrol technology; Ext. Temperature
	750-8212/025-002	Controller PFC200; 2nd Generation; 2 x ETHERNET, RS-232/-485; Telecontrol technology; Ext. Temperature; ECO
	750-8212/040-001	Controller PFC200; 2nd Generation; 2 x ETHERNET, RS-232/-485; Telecontrol technology; Extreme
	750-8302	Controller PFC300; 2 x ETHERNET, RS-485
	751-9301	Compact Controller 100; 8DI 4DO 2AI 2AO 2NI1K/PT1K 1RS485; 2 x ETHERNET; SD
	751-9401	Compact Controller 100; 8DI 4DO 2AI 2AO 2NI1K/PT1K 1RS485; 2 x ETHERNET, CAN, CANopen; SD
	751-9402	Compact Controller 100; 8DI 8DIO 2AI 2AIO 2NI/PT 2RS485; 2 x ETHERNET; SD
	752-8303/8000-002	Edge Controller; 2 x ETHERNET, 2 x USB, 1 x USB-C, HDMI, CAN, DI/DO, RS-232/485, Audio; Control
Serial Interfaces	750-650	RS-232 C Serial Interface; 9600 baud; None; 8/1 bits
	750-652	RS-232/485 Serial Interface
	750-1652	RS-232/485 Serial Interface
	750-653	RS-485 Serial Interface; 9600 baud; None; 8/1 bits
SD Memory Card	758-879/000-001	2 GB SD memory card
	758-879/000-2108	8 GB SD memory card
Software License	2759-0290/****-****	e!RUNTIME IEC60870 slave single license
Digital Input Modules	All digital input and output modules are supported.	
Digital Output Modules		
Power Measurement Modules	750-494	3-Phase Power Measurement Module; 480 VAC/1 A
	750-494/000-001	3-Phase Power Measurement Module; 480 VAC/5 A
	750-494/025-001	3-Phase Power Measurement Module; 480 VAC/5 A
	795-495	3-Phase Power Measurement Module; 690 VAC/1 A
	750-495/040-000	3-Phase Power Measurement Module; 690 VAC / 1 A / XTR
	750-495/000-001	3-Phase Power Measurement Module; 690 VAC/Rogowski Coils

Category	Item No.	Description
	750-495/000-002	3-Phase Power Measurement Module; 690 VAC/5 A
	750-495/040-001	3-Phase Power Measurement Module; 690 VAC / 5 A / XTR
	750-495/040-002	3-Phase Power Measurement Module; 690 VAC / Rogowski coil / XTR
	750-495/040-010	3-Phase Power Measurement Module; 20 kVAC; 300 A; extreme
RTD/PT100 Modules	All temperature input modules from WAGO are supported.	
Analog Input Modules	All analog input and output modules from WAGO are supported.	
Analog Output Modules		
End Modules	750-600	End module
	750-600/040-000	End module XTR

* These devices require both a Grid Gateway license and an IEC-60870 license.

3.3 Supported Browser

The following browsers have been successfully tested with the application:

- Google Chrome
- Mozilla Firefox
- Microsoft Edge
- Apple Safari

Note

More Browsers

The use of other browsers is possible. Functional restrictions cannot be ruled out in this case.

3.4 System Limits

The system is basically designed for operation with up to 32 local bus modules. The actual number and the permissible module configuration depend on the application and operating conditions and must be checked on a project-specific basis.

Table 2: Modbus Subscribers

	Number of Data Points (Max.)	Number of Devices (Max.)
Modbus® subscribers, generic devices	10000 (independent of function code)	50
Modbus® servers		4
Number of devices per onboard serial interface	/	5

i Note

5000 data points can be configured via the IEC 60870 telecontrol protocol

The 5000 data point limit applies to IEC servers and clients together. However, it is also possible to use all 5000 data points for the server.

Table 3: IEC 60870 Protocol

	Number of Data Points (Max.)	Number of Devices (Max.)
IEC 60870 Server		3
IEC 60870 devices/substations		5
Messages/commands (IEC 60870 servers and devices together; number available per device)	5000	

Table 4: Sparkplug

	Number of Devices (Max.)	Number of Metrics per Device (Max.)
Sparkplug	30	50

4 Installation

4.1 Installation PFC 2. Generation

1. Open the **Solutions** page in the WAGO Download Center:
<https://downloadcenter.wago.com/solution>
2. Download your software package as a zip archive.

Note

Your software package may not be available!

Customer-specific solutions may not be available from the Download Center. If they are not, contact your WAGO representative.

Note

The existing settings are retained!

The configuration parameters as well as the user administration and WBM settings are cached during installation and are retained after the update.

Note

You need the WAGOupload software!

The following steps require you to have downloaded the current version of the "WAGOupload" software. The software is available at www.wago.com for download free of charge.

Note

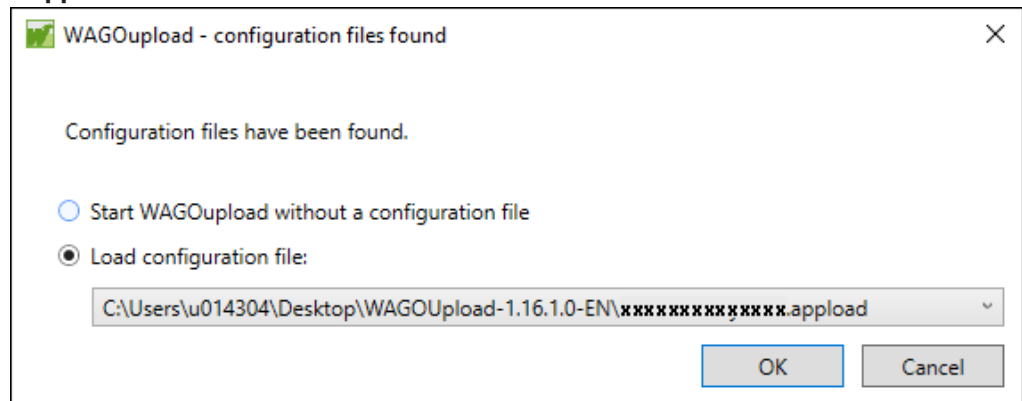
Transfer tutorial for applications using WAGOupload!

You can find the tutorial "WAGOupload – Transfer Applications" on YouTube. This video shows how to use the WAGOupload software to transfer applications to one or more devices.

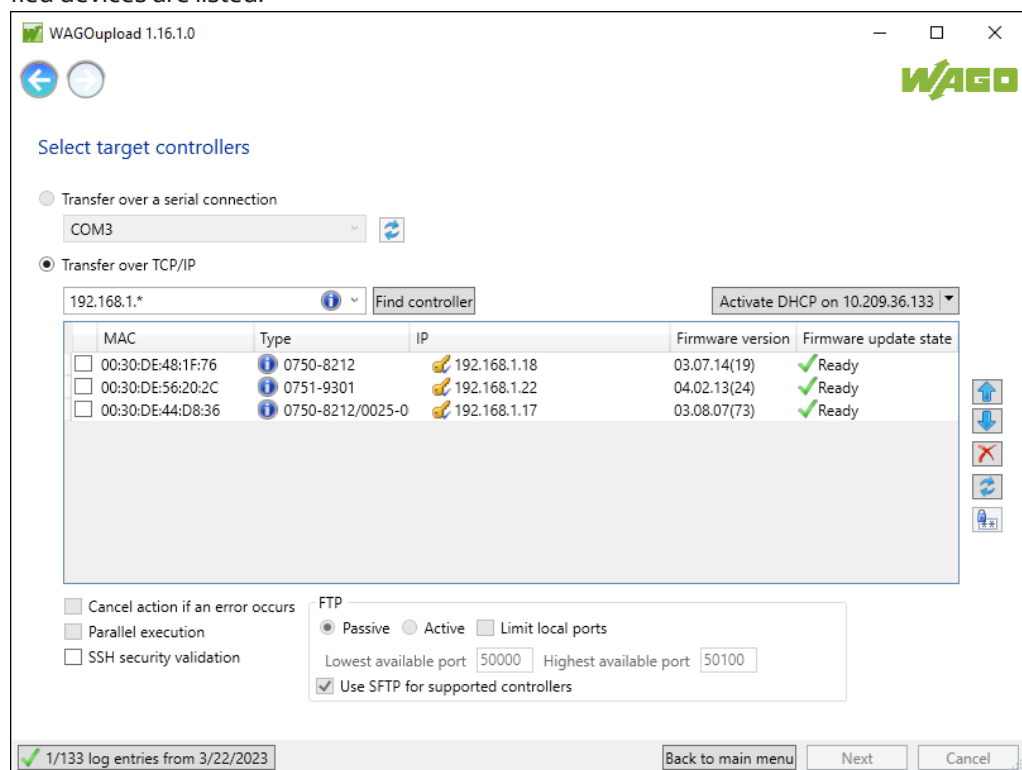
3. Launch the "WAGOupload" software.

4. Select the "Install a CODESYS or *e!RUNTIME* Application" menu item.

Note: If the WAGOupload execution file ".exe" is in the same directory as the installation file ".appload," WAGOupload starts in a simplified view. Steps 3 to 4 are skipped.



5. Select the folder for your controller from the directory structure.
6. **For native installation:** During initial installation, in the first step select the preparation file with the filename format "*_prepare.appload" and click [Next].
For installation of a DockerAE image: During initial installation, in the first step select the preparation file with the filename format "firmware_*.appload" and click [Next].
 ⇒ These files apply the necessary basic settings, but they do not yet transfer an executable application to the device.
7. In the dialog, enter your controller's IP address or open the Search function. The identified devices are listed.



Note: The target controller must have an IP address to allow installation via WAGOupload!

8. Select the controller to install the file on and click **[Next]**.

Note: Make sure that the SSH security check is disabled!

⇒ A summary of the settings previously made appears. Then you can start the installation process by clicking **[Next]**.

9. Repeat the steps to install the application installation file with the filename format "*.apload" for your respective controller. You can choose from two installation routines:
 - **Install application and licenses:** The selected application is installed first. Once the installation is complete, the licenses required by the application are transferred to the target controller. If the required licenses are already on the controller, no licenses are transferred.
 - **Install application only:** Only the selected application is installed. If licenses are required to operate the application, they must be transferred to the controller manually.

Note

During initial commissioning, the passwords may change!

During initial commissioning, the passwords of the controller may change if the passwords of the hardened firmware are adopted. You will then be prompted during the installation process to enter the strong password as user "root", see section  **Changing Passwords** [▶ 17].

Note

WAGOUpload manual

Detailed information on using WAGOUpload can be found in the software manual, which is also available for download at  www.wago.com.

4.1.1 Update an Existing System

If you want to update an existing system without resetting its configuration, use the file with the extension ".apload". These versions are set up in such a way that they back up the existing configuration and automatically restore it after the update. The update provides the required application version.

Note

The existing settings are retained!

The following settings are retained during an update:

- Passwords
- WBM settings
- VPN and TLS certificates
- VPN configuration files
- Application settings

4.1.2 Changing Passwords

Note

Change the default passwords!

The default passwords are preset upon delivery and documented in the PFC device manual. Change your passwords according to your needs, since the default passwords do not provide sufficient protection!

- The minimum password length is 12 characters.
- Passwords must contain at least one character from the following sets:
 - Upper case letters (A-Z)
 - Lower case letters (a-z)
 - Digits (0-9)
 - Special characters (z. B. +, -, @, ...)

The Grid Gateway application and the Linux operating system share common user management via Privileged Access Management (PAM). The application uses its own user groups to represent the authorization for the visualization. As a result, you can use "admin" with the same credentials system-wide. New users created in the application's user administration have no additional rights on the Linux level.

- It is possible to change Grid Gateway users' passwords **in the future** via the application's user management (see  [Users \[p. 37\]](#)).
- The passwords of the Linux operating system can be changed as follows:
 1. Connect the controller to a PC via the X1 network interface.
 2. Start a terminal program on your PC.
 3. Log in to the controller as "root."
 4. Change the password for the user with the "passwd <username>" command.

Note

Centralized management via an LDAP server

Because the user management for the application and visualization is based on the Linux® PAM system, connection to an LDAP server is possible. WAGO offers a separate installation package for this.

4.2 WBM Settings

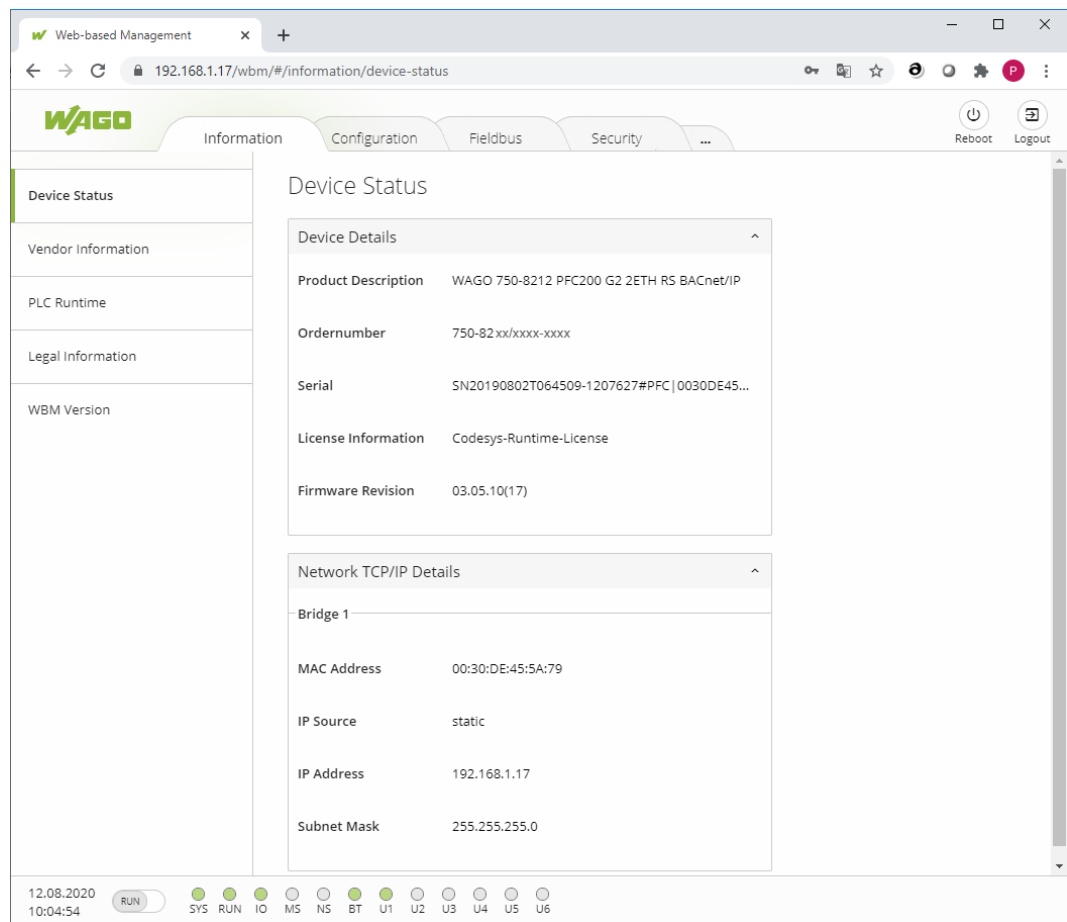


Figure 1: WBM Settings

You can call up Web-Based Management (WBM) in the Internet browser by entering the following: "https://<Controller-IP>/wbm" (here: `https://192.168.1.17/wbm`). A login dialog appears. By entering the WAGO default user "admin" and the associated password (see table at Change Password), the page above opens.

As long as the password corresponds to the initial state as delivered, a security message is displayed on the page. Bypassing of the security message (Default Password Security message: you are using the default password!) must be approved to open the WBM.

Set Date and Time

The date and time can be set in the Web-Based Management system of the application controller on the **Clock** tab in the navigation bar. These settings are described in detail in the controller manual. We recommend synchronizing the time at regular intervals, as the system clock tends to drift.

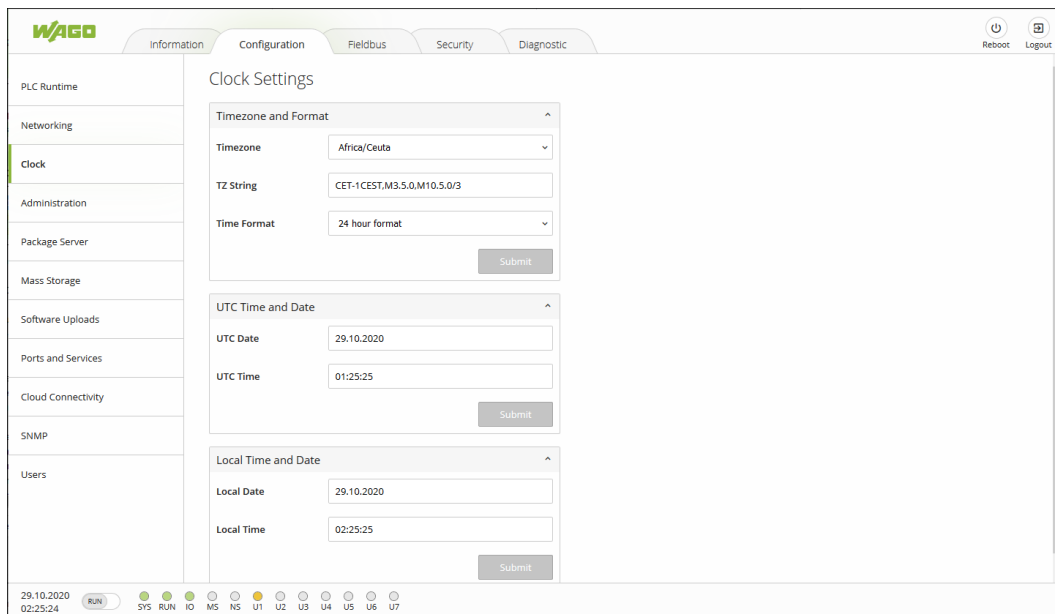


Figure 2: Set Date and Time

Synchronization via NTP Server

NTP clients can be set in the Web-Based Management system of the controller in the **Ports and Services > NTP Client** menu.

These settings are described in detail in the controller manual.

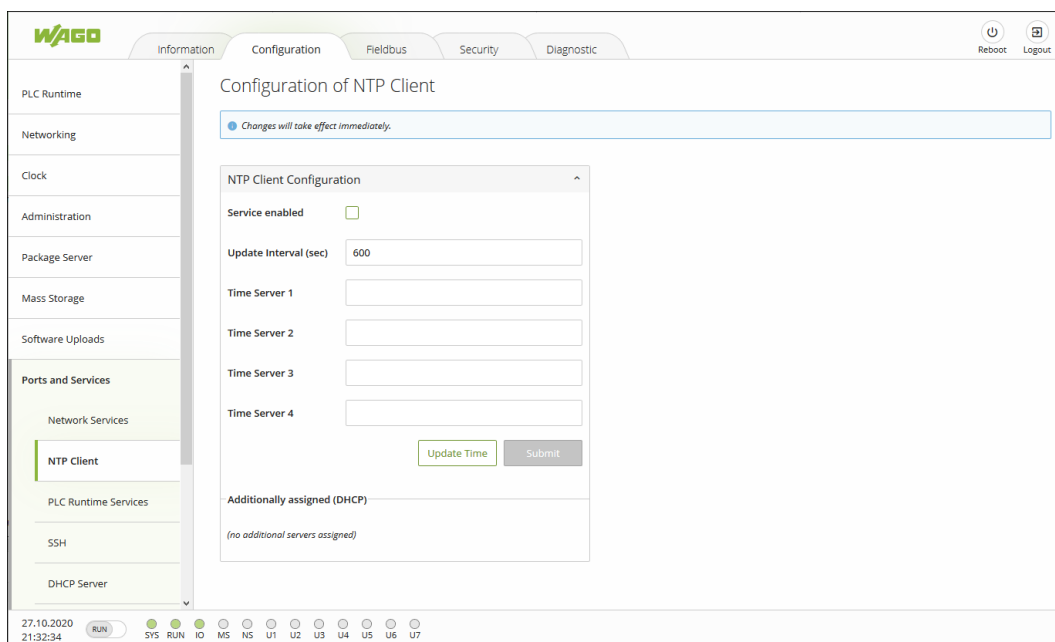


Figure 3: Synchronization via NTP Server

4.3 Applying/Generating a Configuration File

There are various project-specific options for applying a configuration:

1. A configuration must be created and saved

- ✓ You need to have successfully installed the Grid Gateway application; see [🔗 Installation PFC 2. Generation \[p. 14\]](#).
- 1. Configure the entire application for your planned application; see [🔗 Operating the Application \[p. 79\]](#).
- 2. Then click the **[Save]** button.
- ➔ The controller's user LEDs indicate when the new .cnf file has been fully processed. The finished configuration is saved on the controller as "application.cnf" and can be downloaded as a backup file via the  icon.

2. A configuration exists and needs to be updated

- ✓ The Grid Gateway application must be preinstalled on the controller and have a default configuration. The "application.cnf" file must already exist.
- Use WinSCP or WAGOupload to transfer the updated "application.cnf" file to the directory "/home/codesys_root/ggw3" on your controller.
Note: The filename and path must be correct!
- ➔ This station-specific configuration only works for this controller at one location.

3. The configuration is rolled out via two files at different locations

This configuration is applied if a whole series of stations need to be set up according to the same scheme. The goal is to always use the same configuration, possibly with slight differences, such as the number of transformer fields. There are two files:

- *typical.json*: template; predefined skeleton that serves as the basis for configuring the various stations
- *application-settings.json*: contains station-specific details

Each controller has a different application settings file, but always the same typical file. Both files are provided by WAGO on a project-specific basis. Adjustments to the application-settings file can be made via the application's operator UI.

5 WAGO Application Grid Gateway Professional

5.1 User Interface

5.1.1 Logging On as a User

After you open the application, or when you have logged out, you must log in with your user data.

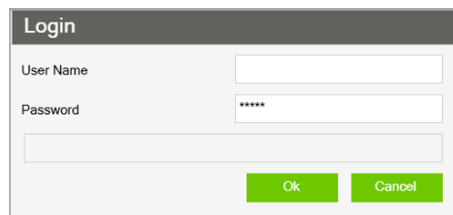

 A login dialog box titled "Login". It contains two input fields: "User Name" and "Password". The "Password" field is masked with six asterisks. Below the password field is a small, empty rectangular box. At the bottom right of the dialog are two green buttons: "Ok" and "Cancel".

Figure 4: Login

The first time the application is launched, two Linux user groups are created:

- **"appadmin"** group with user **"admin"**
- **"appuser"** group with user **"user"**

Table 5: Roles and Rights

User	Rights	Password
admin	All	wago
user	▪ Read ▪ Temporarily "force" individual values; see Dashboards [p. 26] ▪ Save and download configuration ▪ Reboot system	

5.1.2 General Buttons

Icon	Description
	Clear all limit overruns
	Notify all
	Download of the configuration
	Language selection (in progress)
	Reboot system
[Dismiss]	The settings are removed again.
[Save]	The settings of the current page are applied. The current configuration is saved internally as a file.

5.1.3 "Select Data Point" Dialog

Using the "Select Data Point" dialog, you can subscribe to data points throughout the entire user interface; see [🔗 Software Concept \[► 9\]](#).

Source Tab

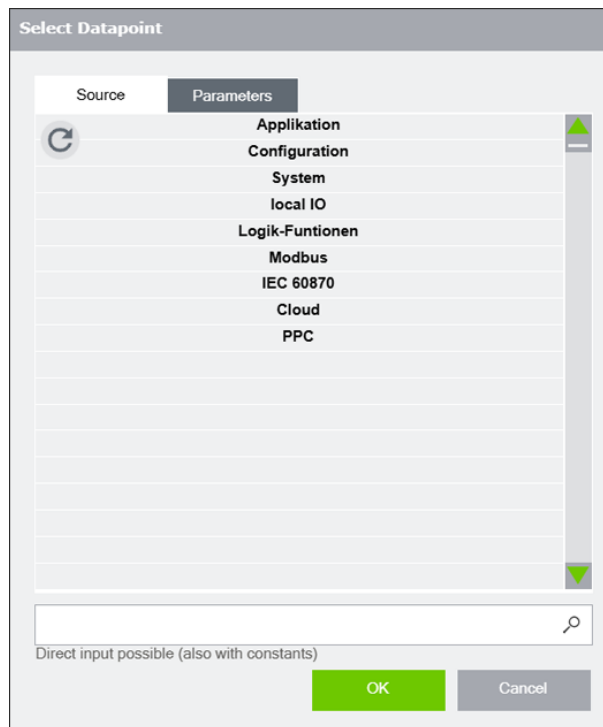


Figure 5: Select Data Point

In the "Select Data Point" dialog, you can navigate to your data point by clicking on the entries marked in **bold** on the "Source" tab. The hierarchical structure corresponds to the representation on the [🔗 Dashboards \[► 26\]](#) tab.

Parameters Tab (Binary Data)

Select Datapoint

Source

Parameters

Aggregate:

Instant value

Bit #

0

OV

Ausgelöst durch:

Change

Direct input possible (also with constants)

OK

Cancel

Figure 6: Select Data Point: Parameters

Drop-Down List	Description
Aggregate	Instantaneous Value: The measured value of the selected data point is taken over and transmitted unchanged. Quality bits: You can subscribe to the data source's quality bits: • OV: overflow (overrange) • CY: carry (arithmetic overflow) • BL: blocked • SB: substituted • NT: not topical • IV: invalid • upd: The data point has been updated at least once. • all: The entire quality bit structure is subscribed to as a bit set.
Bit #	Here you can select the first or second bit from the subscribed value (True or False). Note: This is useful for double-point information messages, since bit #0 is set for OFF and bit #1 is set for ON with such switch messages.
Triggered by:	Here you can specify when the subscriber to the value receives a change notification: • Change: only when the value changes • Update: when the data source is updated by its data acquisition routine; the value does not need to have changed

Settings Tab (Analog Data)

Select Datapoint

Source Parameters

Aggregate: Instant value

Interval: T#15m OV

Ausgelöst durch: Change

☐ Schwellwertänderung: 0

☐ Kumulierte Änderung: 0

Melde-Mindestabstand: T#1s

Direct input possible (also with constants)

OK Cancel

Figure 7: Select Data Point: Parameters

Drop-Down List	Description
Aggregate	Instantaneous Value: The measured value of the selected data point is taken over and transmitted unchanged.
	Quality Bits: You can subscribe to the data source's quality bits; see the table above for the definition.
	Timestamp: subscribes to the data source's timestamp as a time value
	Average: subscribes to the average of the measured values, which is calculated periodically
	Interval Maximum: subscribes to the maximum measured value that occurs within the specified interval
	Minimum Interval: subscribes to the minimum measured value that occurs within the specified interval
	Moving Average: A moving average is calculated from the measured values and transferred.
	Maximum Total: subscribes to the largest value since the application started; a reset command has not yet been implemented
	Minimum Total: subscribes to the lowest value since application started; a reset command has not yet been implemented
Interval	Here you can set the interval for the selected calculation.
Triggered by:	Here you can specify when the subscriber to the value receives a change notification: Change: only when the value changes Update: when the data source is updated by its data acquisition routine; the value does not need to have changed
	Note: All subscribers with the same threshold change or cumulative-change parameters are notified simultaneously!
Threshold change	Checking this box enables threshold evaluation for the "Change" trigger mode. The subscriber is only notified if the change in the data source's value from the previous reading exceeds the threshold value entered.

Drop-Down List	Description
Cumulative change	Checking this box enables cumulative threshold evaluation for the "Change" trigger mode. The subscriber is notified as soon as the sum of past value changes in the data source exceeds the threshold entered. Thus whenever data is acquired, the magnitude of the change from the source is added up until the threshold is reached.
Minimum reporting interval	Here you can specify whether the subscriber's updates should require a minimum time interval.

5.1.4 Dashboards

5.1.4.1 Overview

After installation, the application starts under **Dashboards > Overview**. This is a simplified dashboard users can configure to display emergency-stop states, counter values and measurements, for example, as shown in the figure below.

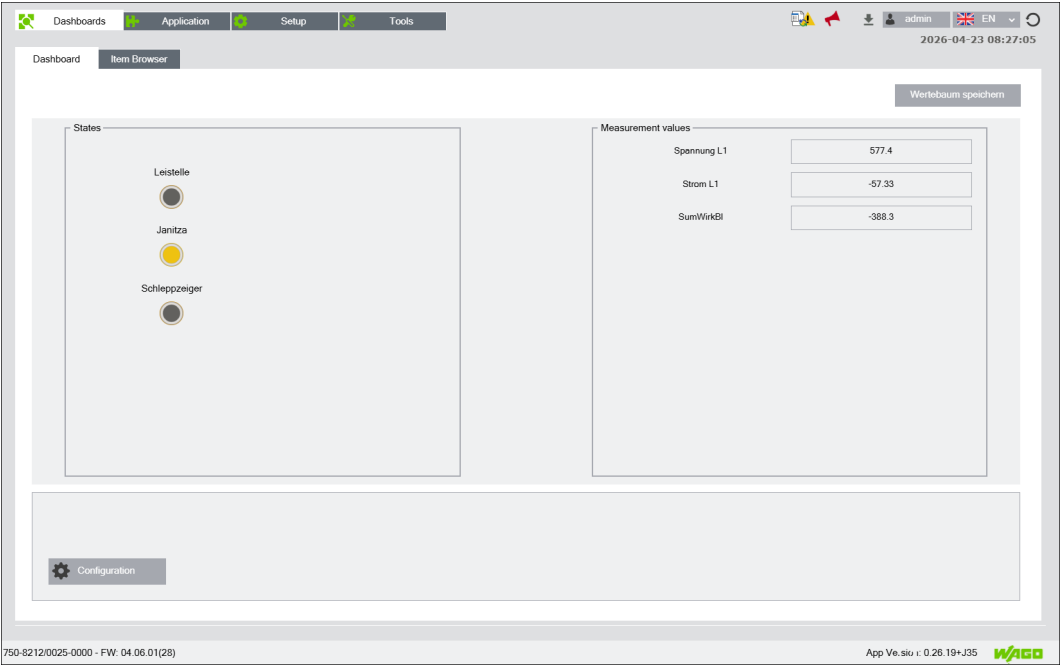


Figure 8: Dashboards, Overview

Name	Description
[Save value tree]	The configuration, including the value tree, is saved.
[Configuration]	Clicking this button opens the following dialog: Dashboard Configuration .

Dashboard Configuration

In the **States / Signals / Indicators / Measurements** areas, you can select values from the Item Hub to display on the dashboard. **Buttons** can be used to trigger signals, e.g., to acknowledge an emergency-stop state.

Dashboard Configuration

State / Signals / Indicators

	Titel	Source
1	Not-Aus	/local IO/3: 750-455 AI 4
2		
3		
4		
5		

Buttons

	Name	Signal length
1	Quittieren	T#60ms
2	Not-Aus auslösen	T#0ms
3		T#0ms
4		T#0ms
5		T#0ms

Measurement values

	Titel	Quelle
1	IO	/local IO/3: 750-455 AI 4
2		
3		
4		
5		
6		
7		
8		
9		
10		

OK

Cancel

Figure 9: Dashboards, Detail View

Name	Description
Title / Name	Here you can assign a name.
Source	Clicking within the column allows you to subscribe to a data point; see section “Select Data Point” Dialog [p. 25] dialog.
Signal length	Here you can specify how long the button maintains the pressed state (TRUE). The default value of 0 ms results in a single pulse (item value: false -> button pressed, -> true -> false).

5.1.4.2 Item Browser

The Item Browser shows the data in the data layer. The first time it opens, the Item Browser has no data yet. Once modules – such as [Modbus devices \[p. 55\]](#) or [I/Os \[p. 44\]](#) – have been created in the application, or a configuration file has been loaded, that data appears here.

After the initial start, data that the application provides by default appears when you click the  button; see the figure. For a tabular representation, see the **Default Values** section below.

Note: The button for updating appears after parameterization each time the data volume changes.

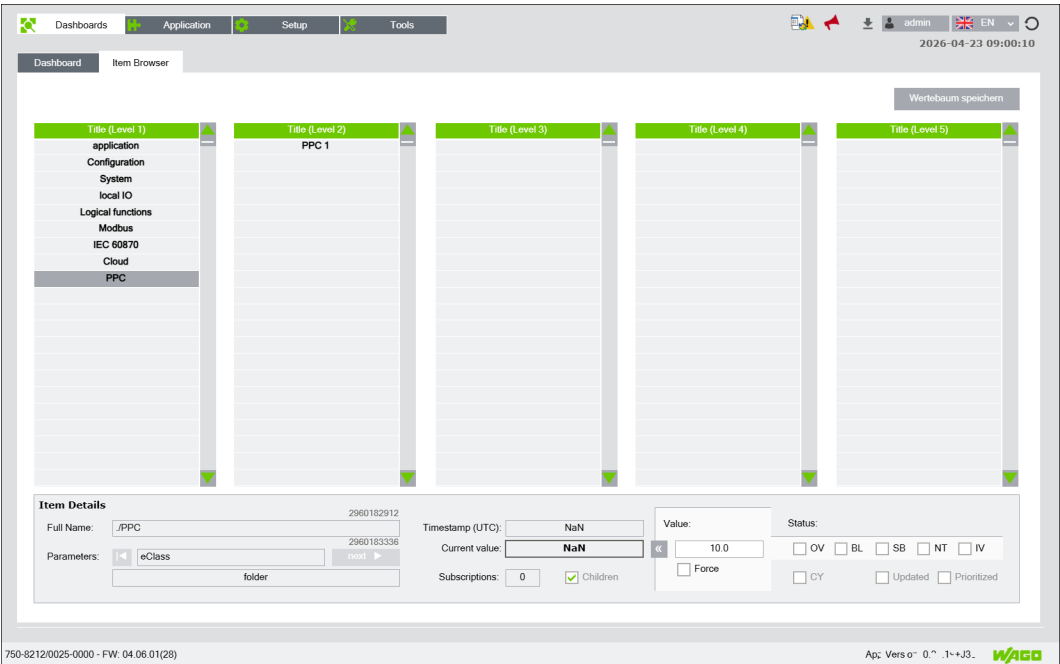


Figure 10: Dashboards, Item Browser

The representation of the various levels is structured hierarchically. All entries marked in **bold** have additional subentries. Clicking on an entry displays the corresponding parameters in the "Item Details" area:

Item Details

Figure 11: Dashboards, Detail View

Name	Description
Full Name	the full datapoint name including path.
Parameters	Specific data added by the system or the protocol that generates the value.
Timestamp	Time of the last acquisition of the value of the data point; by default, the current time according to the setting in the WBM.
Current Value	This shows the last recorded value of the data point according to the selected entry.
Subscriptions	The number of subscribers indicates how many data sinks process this data point further.
Value to force	You can enter an alternative value in this field and apply it by clicking the [<<] button.
Force	If this box is checked, an alternative value specification taken from the field above is applied permanently; it cannot be updated by the actual data source.
Status	Quality characteristics of the data points that meet the 60870 standard: OV = overflow (the signal was outside the defined value range) BL = blocked (acquisition or transmission was blocked) SB = substituted (the value was replaced, e.g., forced, or a placeholder value if acquisition failed) NT = not topical (the value could not be acquired, e.g., because the device cannot be reached) IV = invalid (the value is invalid due to OV or NT or for other reasons)

Default Values

Level 1 Name	Level 2 Name	Level 3 Name	Level 4 Name	Description
Configuration				This shows the configured data.
	Modified			
System				Contains data about the system.
	System Time			
	Start Time			
	Device Data	Product Number		
		Firmware Version		
		Application Version		
		Created on		
		IP Addresses	1	Can be used for server services that should only be bound to an IP address (planned).
			2	
	System Status			Serves to continuously monitor the application to check the load.
		Number of Restarts		
		Uptime		
		CPU Load		
		Data Points Created		
		Data Points Subscribed to		
		Data Point Updates		
		Data Point Processing		
		Dynamic Memory		
	Test Data			Can be used as needed to test transmissions.
		NEVER		
		FALSE(SPI)		
		TRUE(SPI)		
		2xBOOL(DPI)		
		INT(i16)		
		DWORD(u32)		
		REAL(f32)		
		TOGGLE		
		COUNTER		
	Task Manager	PLC Cycle Time		
		PLC Cycle Duration		
		Average Duration, Total		
		Prioritized	CPU Costs	
		Item Hub		

Level 1 Name	Level 2 Name	Level 3 Name	Level 4 Name	Description
		Visu		
		View		
		System		
		Local IO		
		Modbus		
		IEC 60870		
		EventLogger		
		DataLogger		
Events				
LogData				
Local IO	E.g., Generic DI 1			
Modbus	Server 1	Connection		
IEC 60870	Status			
	1	Connection		

5.1.5 Application

5.1.5.1 Variables

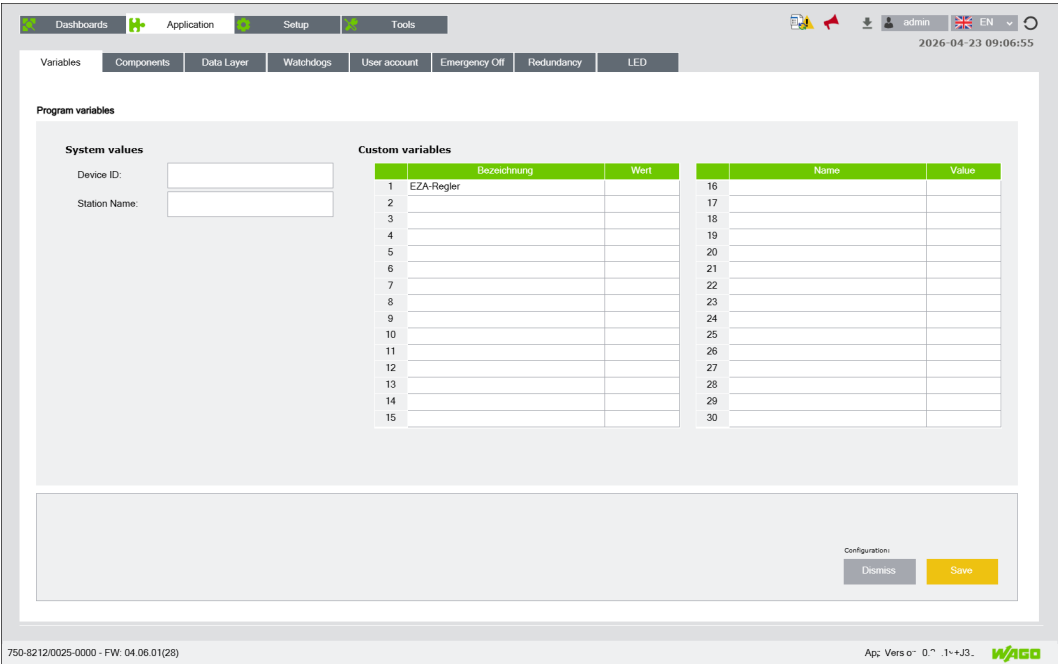


Figure 12: Application / Variables

Name	Description
System Values	
Device ID	When the application launches for the first time, the hostname is loaded from WBM. The name can be changed, and the field can be freely edited. Note: The device ID can be inserted into the filename for the data logger using the wildcards (wildcard: "%ID").
Station Name	This field can be freely edited. The station name appears in the header at the top right; this can be helpful if multiple systems exist.
Custom Variables	
	Here you can create up to 30 free variables. These can be subscribed to perform calculations for logic functions or to provide custom values, for example. ▪ Name: Here you can enter a name for the variable. ▪ Value: Here you can enter a value.

5.1.5.2 Components

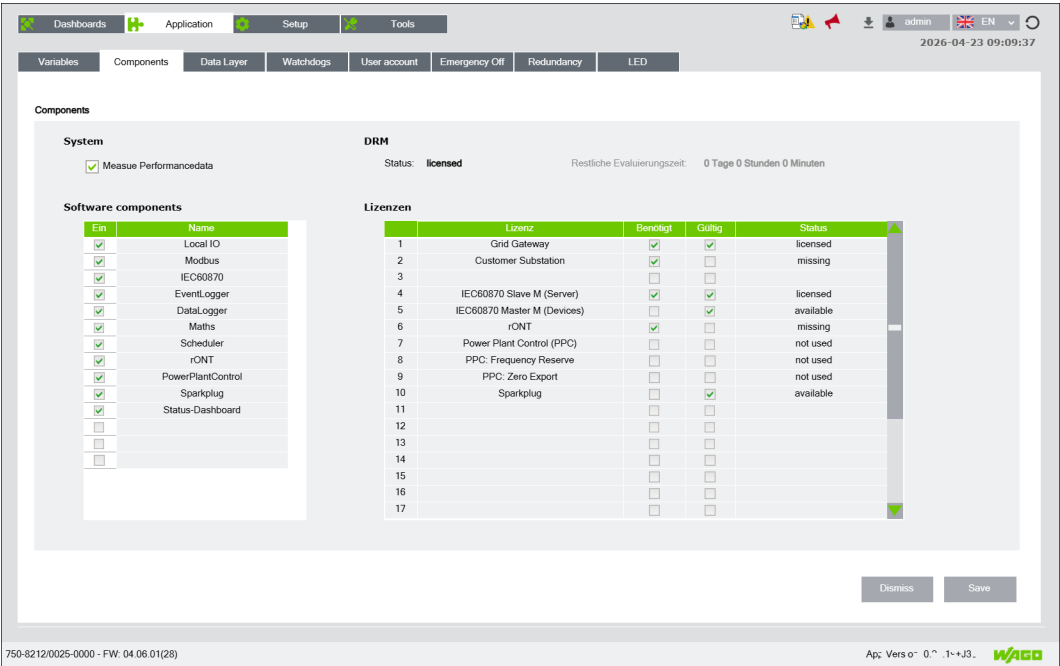


Figure 13: Application / Components

Name	Description
System	
Collect Performance Data	When this box is checked, the Item Browser shows under System > Tasks > CPU Costs how much time the system components need for their execution; see section Dashboards [p. 26] . Note: The box is unchecked by default.
Software Components	
ON	Here you can disable the available software components so that they are no longer executed and no longer displayed.
Name	List of all available software components
Licenses	
Needed	This indicates whether a license is required and whether it is valid and available.
Valid	
Status	

5.1.5.3 Data Layer

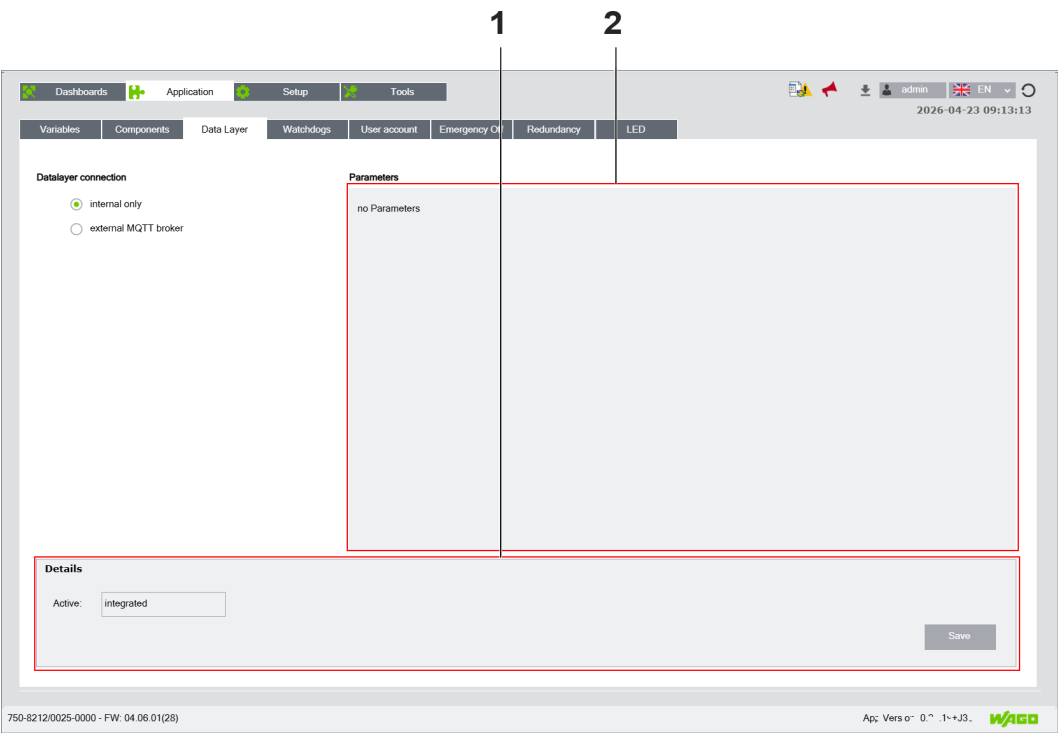


Figure 14: Application / Data Layer

Data Layer Used

By default, all parameterized data is managed internally on the controller in the CODESYS data layer. Checking the corresponding box allows the data memory to also be managed with an MQTT broker, which can be located on an external device. This enables cross-communication among different controllers within a network, for example, so the data is available to all subscribers.

Number	Description
1	Indicates the selected connection status
2	If "MQTT Broker" is selected, this shows the adjustable parameters; see the table below. Host:127.0.0.1Username:admin TCP Port:1883☐ TLSPassword:**** Client ID:PFC200V3-44D836-GH = Device IDPayload Format:raw plain values ☒ Use Client-ID as Topic-PrefixMax. send rate:1/sec Topic Prefix:PFC200V3-44D836-GH ☒ Cache all Datapoints locally Note: 'Activated' means MQTT subscribe "#" and all datapoints from external data layer will be cached. Helpful during commissioning. If deactivated, only value subscribed by local application will be cached.

MQTT Parameters

Name	Description
Host	By default, this shows the data of the current device on which the application is running. If the MQTT service is located on a different device, you must enter the corresponding access credentials here.
Username	
TCP Port	
TLS	
Password	
Client ID	By default, this shows the current device ID; see 🔗 Variables [p. 32] .
Use Client ID as Topic Prefix	If this box is checked, the client ID is used as a prefix for each data point.
Payload Format	Here you can select the format for the data that is exchanged with the MQTT broker: ▪ Unformatted Raw Values ▪ JSON Value + Parameters: JSON string with additional parameters
Max. Transmission Rate	Here you can enter the maximum frequency with which the data can be sent to the MQTT broker. This serves to avoid overloading.
Topic Prefix	Here you can enter an individual prefix as an alternative to the client ID. Note: For example, if a configuration contains multiple wind farms, you can enter an individual prefix here to distinguish the data points in the common data space among the stations.
Cache All Data Points Locally	Enabled: All data points from the external data layer are cached on the controller. Disabled: Only subscribed data points are cached on the controller (this function is planned).

5.1.5.4 Watchdogs

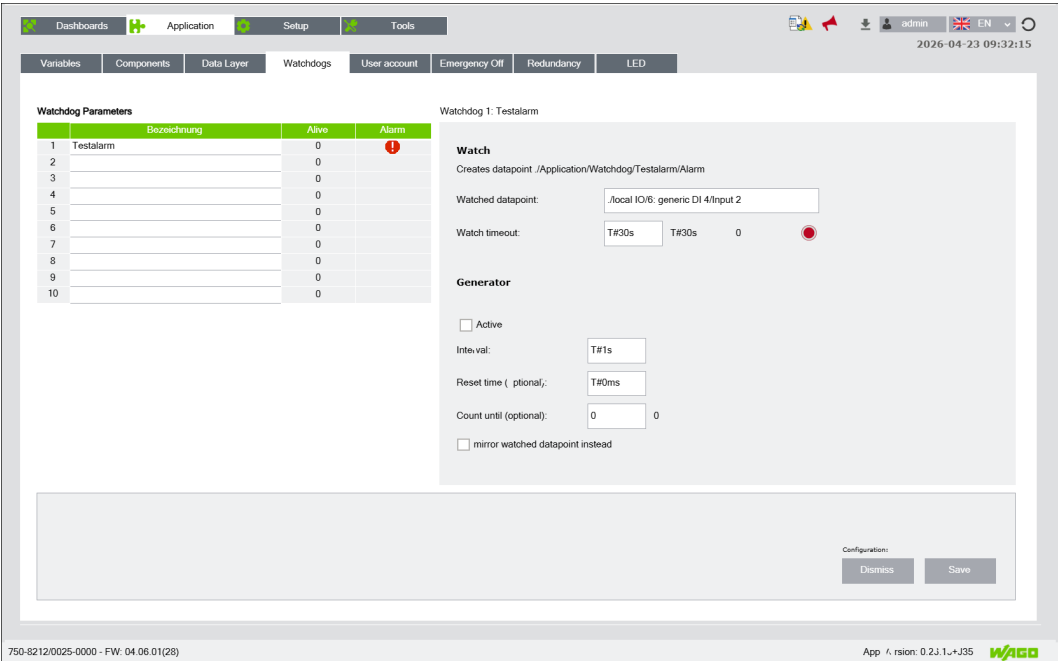


Figure 15: Application / Watchdogs

Watchdog Parameters

Up to 10 Watchdogs can be created.

Name	Description
Name	Here you can enter a name for the watchdog.
Alive	This shows the current value of the generator.
Alarm	This shows the current monitoring status: Empty field: no error Red warning triangle: error

Watchdog 1 ... 10

Name	Description
Monitoring	
Watched Data Point	By clicking within this column, you can select a data point from the system for monitoring; see section "Select Data Point" Dialog [p. 25] .
Watched Timeout	Here you can enter the time period within which the monitored data point must change before an error is indicated. The LED to the right indicates the status of the monitoring: Red: error; the value has not changed during the monitoring time Gray: value changes continuously The error status is transferred to the data layer as a data point <code>"/Application/Watchdog/<name>/Alarm."</code>
Generator	This function can be used to generate a data point to start monitoring the connection to an external device, for example. The data point is represented in the data layer under <code>"/Application/Watchdog/<name>/Alive"</code> ; see Dashboards [p. 26] .
Active	Checking this box enables the generator function.
Interval	Here you can enter a counting interval for the generator.
Reset Time	Here you can enter a reset time after which the generator value is reset to "0" and the counting process restarts.

Name	Description
Count up to (optional)	Here you can enter the value up to which counting should take place.
Mirror watched data point instead	If this box is checked, the monitored data value mentioned above is sent back.

5.1.5.5 Users

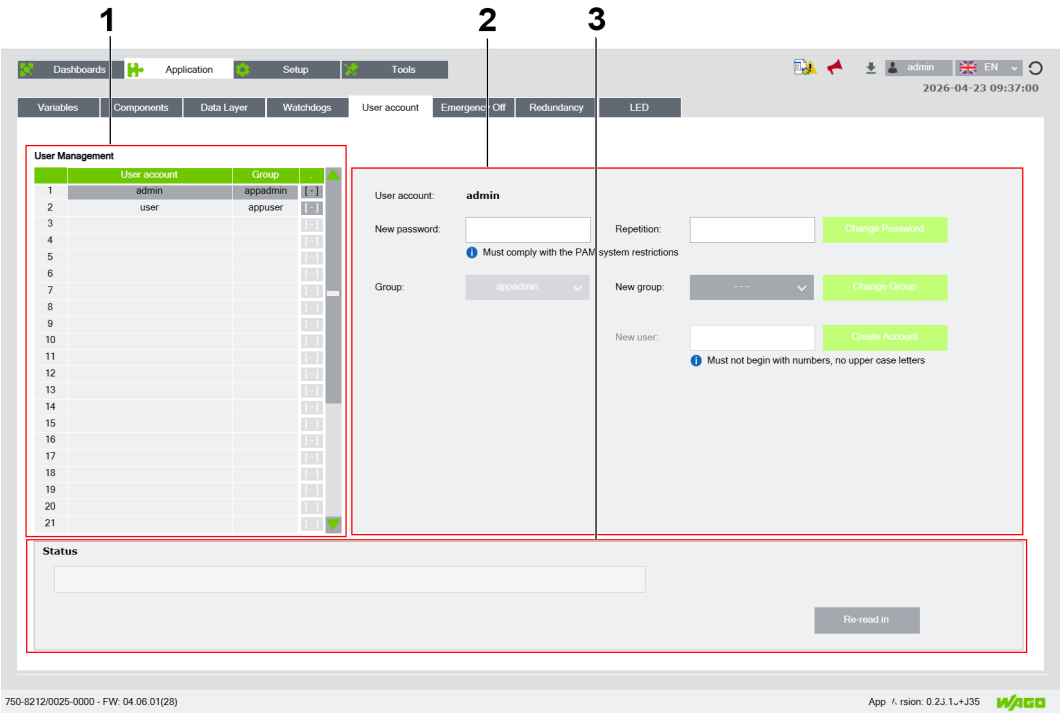


Figure 16: Application / Users

1: List of Users

Number / Name	Description
User	Upon delivery, there are two user groups ("appadmin" and "appuser"). The default users "admin" and "user" are assigned to these groups.
Group	
[...]	This button can be used to delete entries.

2: Create User

Note

Observe the requirements for secure passwords!

Passwords must consist of 12 characters; they must contain at least one character from the following groups:

- Upper case letters (A–Z)
- Lower case letters (a–z)
- Numerals (0–9)
- Special characters (e.g. +, -, @, ...)

Name	Description
New Password	Here you can assign a new password for the user.

Name	Description
Repeat	Here you must repeat the new password. Clicking the [Change Password] button saves the new password.
Group	This shows the group to which the selected user is assigned.
New Group	Here you can select a new group for the selected user. Two groups are available: "ap-admin" and "appuser."
New User	Here you can enter a new username. Clicking the [Create User] button saves the new user with the password and group.

3: Status

Clicking the **[Re-Read In]** button reads in Linux users created outside the application again.

5.1.5.6 Emergency Off

Figure 17: Application / Emergency Stop

Name	Description
Trip by input:	Here you can subscribe up to 16 sources (items) that trigger an emergency stop condition. Clicking within the "Source" field opens the "Select Data Point" Dialog [► 25] dialog. As soon as the subscribed item has the value TRUE, the state switches to emergency stop.
Quit by:	Here you can subscribe up to 16 sources that reset an emergency stop condition. Clicking within the "Source" field opens the "Select Data Point" Dialog [► 25] dialog. As soon as the subscribed item has the value TRUE, the emergency stop condition is reset. Note: The acknowledgement can be performed via a digital input, an IEC-60870 or Modbus® command or a button on the dashboard, for example. To create a button on the dashboard, see section Overview.

Note

Triggering and acknowledgement are linked by logical OR!

All signals are linked with the logical OR operator and returned. The pulse from any one of the 16 signals is sufficient to trigger and reset an emergency stop.

After an emergency stop is triggered, four items are created in the Item Browser under **Application > Emergency Stop**:

- **Trigger:** switches once to TRUE and then back to FALSE; the state does not change back to TRUE until it is triggered again
- **Triggered:** remains permanently TRUE during an emergency stop (even after a reboot); the action that should follow the signal – e.g., a message to the control center via an IEC-60870 command – must be specified in the configuration. For this purpose, it is necessary to subscribe to the "Triggered" data point in the **60870-Server** menu.
- **Acknowledgement:** switches once to TRUE and then back to FALSE
- **Acknowledge:** remains TRUE for 5 s during the acknowledgement period

5.1.5.7 LED

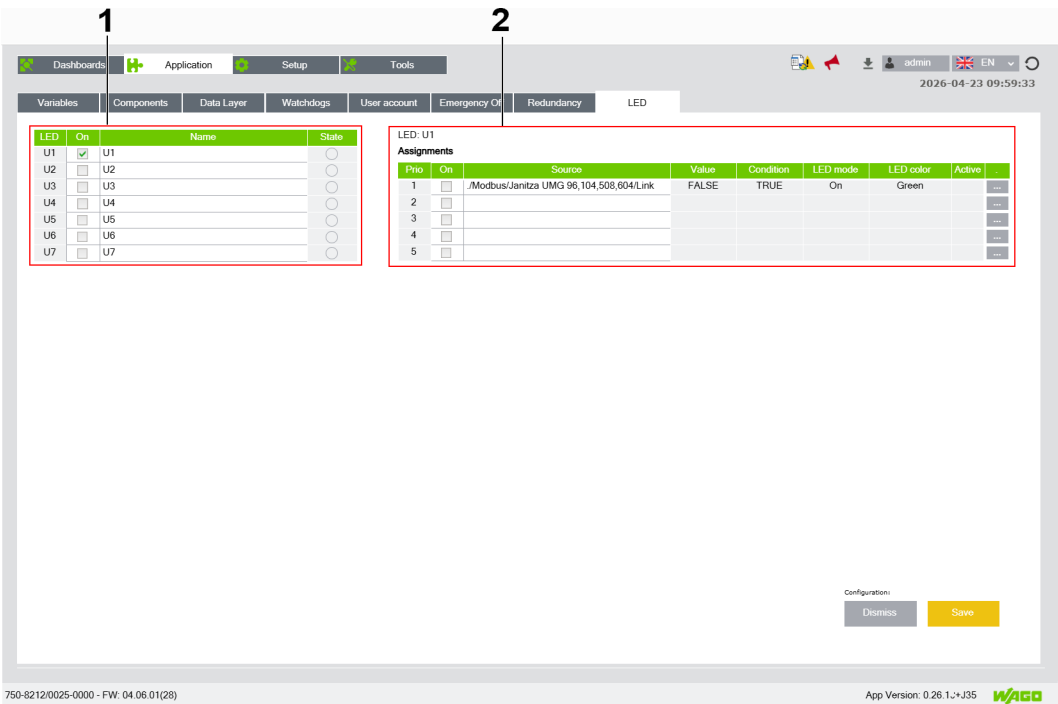


Figure 18: Application / LED

Number	Description
1	This lists the available LEDs of the connected controller. On: This enables the selected LED so that up to five assignments can be parameterized in the area on the right. Name: list of available LEDs; to edit the name, click the corresponding cell in the column State: When active, this shows the currently configured LED color.
2	Up to five assignments can be configured per LED. Prio: The assignments are prioritized from 1 to 5, where 1 = highest priority. On: The LED assignment settings do not become active until this box is checked. Source: Clicking within this column allows you to subscribe to a data point; see section “Select Data Point” Dialog [p. 25]. Value: This shows the current state of the data point (TRUE or FALSE). Condition: The condition specifies the state of the source value in which the LED assignment becomes active. LED mode: Here you can set the LED mode to which it should switch when the condition is met. LED color: Here you can set the LED color that should be displayed when the condition is met. Active: Green marking indicates which assignment is currently active. ...: Opens a dialog to configure the selected LED; see Details [p. 41].

5.1.5.7.1 Details

Details

Assignment

Condition:

☐ FALSE ☒ TRUE

LED mode:

On

▼

LED color 1:

Green

▼

LED color 2:

Green

▼

Blink time 1:

T#500ms

Blink time 2:

T#500ms

OK

Cancel

Figure 19: LED, "Details" Dialog

Name	Description
Condition	Here you can change the condition from "TRUE" to "FALSE" or vice versa.
LED Mode	Three modes are available: ▪ On: LED is on (default value) ▪ Off: LED is off ▪ Flash: The LED flashes in two colors. Once this option is selected, the parameters to set are enabled.
LED Color 1	Three colors are available: ▪ Green ▪ Red ▪ Yellow
LED Color 2	The same three colors are also available for the second flashing color.
Flash Time 1	Here you can specify how long each color should flash.
Flash Time 2	

5.1.6 Setup

5.1.6.1 I/O

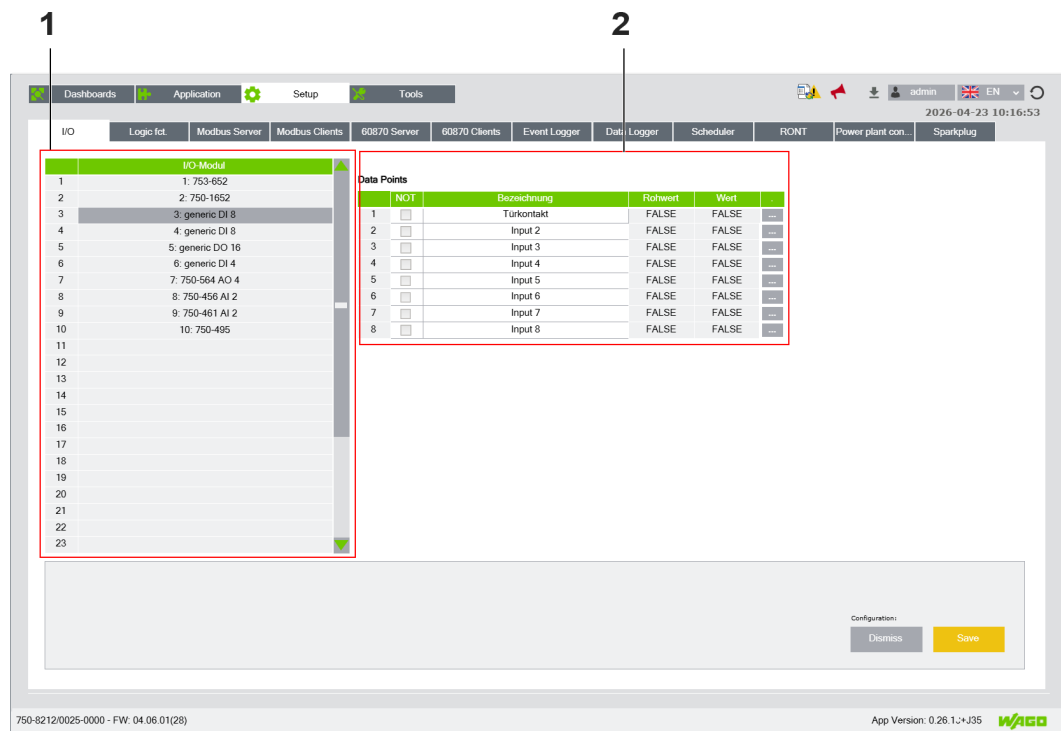


Figure 20: Parameterization / I/O

Number	Description
1	This lists the I/O modules connected to the local bus. Once an I/O module is selected, the channels are displayed on the right in the data point list and can be parameterized.
2	Here you can parameterize the individual channels of the selected I/O module. The parameters differ depending on the module selected; see the description below (AO, DO, AI, DI).

Configuration of I/O Modules

Module	Description
Analog Output Module (AO):	Factor: Here you can specify a scaling factor for the measured value. Offset: Here you can specify a value to add to the measured value. Name: for example, AO 6.1 = first channel of the analog output module connected at position 6 Source: Clicking within this column allows you to subscribe to a measured value; see section "Select Data Point" Dialog [p. 25]. Raw Value: This shows the subscribed input value of the channel. Value: This shows the configured output value of the channel.
Digital Output Module (DO):	NOT: Checking this box inverts the digital output. Name: for example, DO 6.1 = first channel of the digital output module connected at position 6 Source: Clicking within this column allows you to subscribe to a data point for the selected channel; see section "Select Data Point" Dialog [p. 25] Bit: This shows the selected bit of the data point that was subscribed to. Raw value: This shows the subscribed input value of the channel (True or False). Value: This shows the configured output value of the channel (True or False).

Module	Description
Analog Input Module (AI):	NOT: disabled Name: Here you can change the predefined name. Raw Value: This shows the received raw value of the channel. Value: This shows the configured output value. See the options in the dialog for configuring [45]. ...: Clicking this opens the dialog for configuring [45] the module.
Digital Input Module (DI):	NOT: Checking this box inverts the digital input. Name: Here you can change the predefined name. Raw Value: This shows the received input value of the channel (True or False). Value: This shows the configured output value of the channel (True or False). ...: Clicking this opens the dialog for configuring [45] the module.
Power Measurement Modules	Received values from connected power measurement modules are stored in the Item Hub; here in the data point area, they are only displayed. Clicking the [Customize] button opens a dialog to configure the power measurement module.  Note: Information about the parameters shown can be found in the product manual for the module in the download area at www.wago.com.
Interface Modules	Here, the modules are only displayed. They can be configured in the 60870 Server/Clients area in the dialog "Interface Parameters" Dialog [72].

5.1.6.1.1 Configuration Dialog

Türkontakt

Input filter

☐ Flutter lock

Maximum changes:

2

Watch timeout:

T#1s

Lock time:

T#1m

Quali bits on lock:

☐ IV

☐ SB

☐ BL

Unit:

-

☒ no filter

☐ Deadband filter

Bandwidth:

0

☐ Simple Lowpass

Coefficient:

0.8

Scaling

I-factor

1

Offset

0

☐ Zero-point suppression

Zero-point:

0

Deadband:

1

Quali bits on suppression:

☐ IV

☐ NT

☐ SB

OK

Cancel

Figure 21: IO, Configuration Dialog

Name	Description
Active only for digital modules:	
Flutter Lock	Checking this box enables the flutter lock and allows it to be configured. Flutter lock locks the input when the signal source changes its state too frequently. Default setting: The input is locked for one minute if the signal changes more than twice within one second.
Maximum changes	Here you can enter the maximum number of permitted changes within the specified monitoring period.
Watch Timeout	Here you can enter the monitoring time.
Lock Time	Here you can enter the amount of time the signal is locked.
Quality Bits for Lock	Here you can select the quality bits of the data point that are set when flutter lock is enabled. • IV: invalid • SB: substituted • BL: blocked
Active only for analog modules:	
Unit	Any unit can be selected from the drop-down list (for temperature signals, "°C" is the default setting).
No Filter	If this option is selected, no filter is applied.

Name	Description
Deadband Filter	If this option is selected, a value is only accepted if it changes by the amount of the deadband. This value can be entered in the Bandwidth input field.
Simple Low-Pass	If this option is selected, signals with frequencies below the cutoff frequency pass; signals with higher frequencies are attenuated. The entry in the "Coefficient" field determines the behavior of the filter.
Factor	Here you can specify a scaling factor for the measured value.
Offset	Here you can specify a value to add to the measured value.
Zero Point Suppression	Checking this box enables zero-point suppression; it can be configured to previous small measurement signals in the zero range from being transmitted.
Zero Point	Here you can enter the zero point.
Deadband	Here you can enter a deadband around the zero point. When zero-point suppression is enabled, all values from the zero point up to the value of the deadband entered are filtered and not transmitted.
Quality Bits for Lock	Here you can enable the quality bits of the data point that are set in the event of zero-point suppression.

5.1.6.2 Logic Function

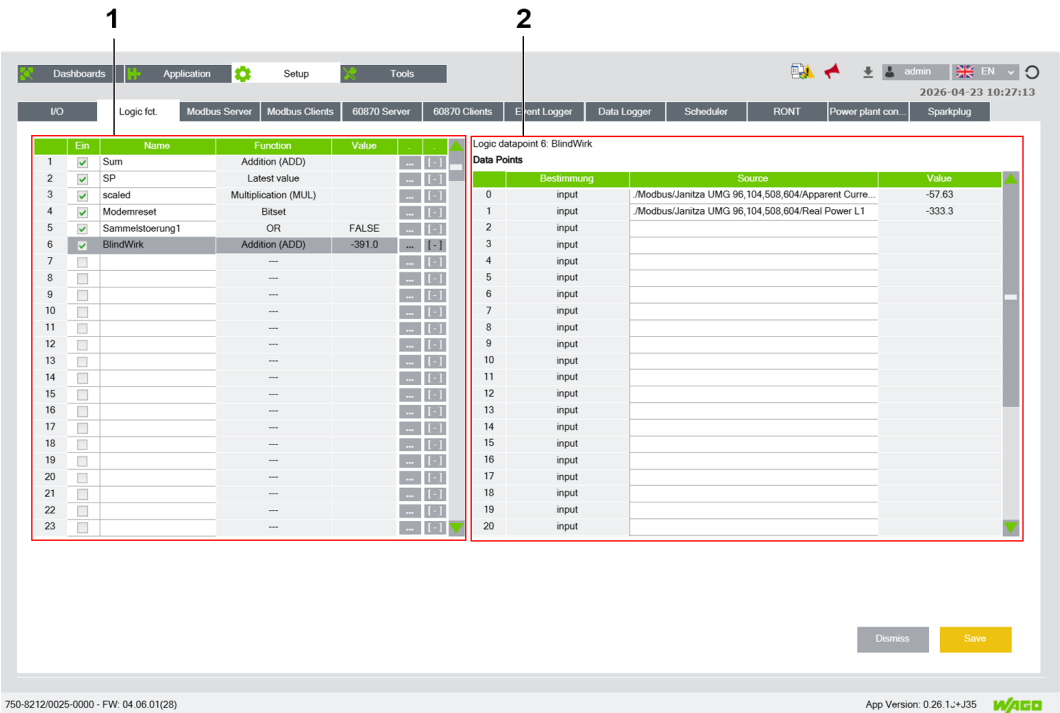


Figure 22: Parameterization / Logic Function

Number	Description
1	Various logic functions can be set up in the left area. ▪ On: The logic function is not enabled until this box is checked. ▪ Name: Here you can enter a name for the logic function. The result is displayed in the Item Hub under this name and can be subscribed to from there (e.g., for the power plant controller). ▪ Function: This shows the function selected in the “Details” Dialog [p 47]. ▪ Value: This shows the calculated value. ▪ [...]: Clicking this button opens a dialog for parameterizing the logic function; see “Details” Dialog [p 47]. ▪ [-]: This button can be used to delete entries.
2	Data points for the calculation can be subscribed to in the right area. At least two data points must be selected per logic function. ▪ Purpose: indicates the intended use of the value (e.g., interval of a timer) ▪ Source: Clicking in the field allows you to subscribe to a data point (e.g., a setpoint from the grid operator; see section “Select Data Point” Dialog [p 25].) ▪ Value: shows the raw value received from the data source

5.1.6.2.1 "Details" Dialog

Details

Output

Function: Exclusive Or (XOR) ▼

Negate: ☐ Unit: - ▼

Datenübernahme:

☐ Qualitätsbits aller Quellen verodert übernehmen

☐ Alle Quellen müssen aktualisiert sein (xUpdated)

Default value:

☐ Initial value: FALSE

☐ persist last received value:

☐ save with expiration: T#0ms

Quali bits:

☒ NT

☐ IV

☐ SB

Bei fehlerhaften Quellen (NaN, NT, IV):

☒ hold last received value

☐ NaN

☐ Substitute: FALSE

☐ ungültige Quellen ignorieren

☐ ungültige Quellen trotzdem verwenden

Quali bits:

☒ NT

☐ IV

☐ SB

OK Cancel

Figure 23: Logic Functions, "Details" Dialog

Name	Description
Function	Here you can select from the logic functions stored internally (AND, OR, EQUAL ...).
Scaling Factor	Here you can enter the scaling factor, i.e. the ratio of the target value to the raw value (only for numerical functions).
Negate	Checking this box inverts the Boolean signal ("True" becomes "False"; only for binary functions).
Unit	Here you can enter the unit of the captured signal.
Apply Quality Bits	Checking this box applies the data source's quality bits as a bit set.
Suppress Invalid Results	Checking this box suppresses invalid results. As long as a value is marked as invalid, the logic function will not perform any calculation until a valid value is present in the input data.
Wait for Source Data Availability	When this box is checked, the logic function calculation does not start until all sources have been successfully subscribed to. Only then will the calculated value be updated in the Item Hub.
Default Value	
Initial Value	Here you can enter a default value that will be used after a restart or when the device is set up for the first time. If no valid value is available, the initial value is used in order to avoid invalid values.
Persist Last Received Value	If this box is checked, the last value received is restored after a controller restart.

Name	Description
Save with Expiration Time	Here you can enable an expiration time via the checkbox and set it in the input field. If this time has elapsed, the last value received will not be restored after a restart.
Qual. Bits	Here you can select the quality attributes that should be transmitted with the default value: NT = not topical (the value could not be acquired, e.g., because the device cannot be reached) IV = invalid (the value is invalid) SB = substituted (the value was replaced, e.g., forced, or a placeholder value if acquisition failed)

5.1.6.3 Modbus Server

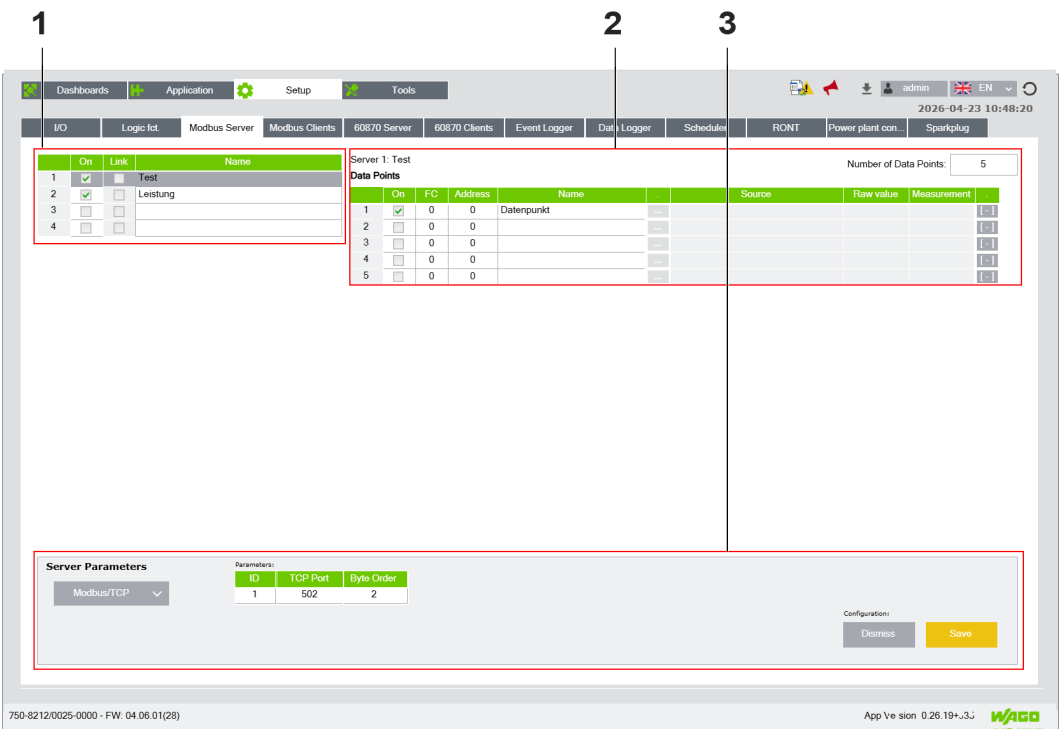


Figure 24: Parameterization / Modbus Server

Number / Name	Description
1	Here you can create up to four Modbus® servers. • On: The Modbus® server is not enabled until this box is checked. • Link: This indicates whether a communication link exists. • Name: Here you can enter a name for the Modbus® server.

Number / Name	Description
2	After entering the number of data points in the field at the top right, you can create the data points for the selected Modbus® server here. Up to 10000 data points can be created and parameterized. ▪ On: The data point is not enabled until this box is checked. ▪ FC: Entering the function code (FC) here specifies how the Modbus® register is accessed, e.g., read or write. ▪ Address: Here you can enter the Modbus® register to write to. ▪ Name: Here you can enter a name for the data point. ▪ ...: Clicking this button opens a dialog for entering additional parameters; see 🔗 “Register Details” Dialog [p. 51] ▪ Source: Clicking within this column allows you to subscribe to a data point; see section 🔗 “Select Data Point” Dialog [p. 25]. ▪ Raw Value: This shows the original value received. ▪ Measured Value: This shows the converted physical value. ▪ [-]: Use this button to delete entries.
3	Server Parameters From this drop-down list, you can select the transfer protocol: ▪ Modbus/RTU ▪ Modbus/TCP The adjustable parameters of the relevant protocol, which depend on the selections made, are shown on the right; see: ▪ 🔗 Modbus/TCP Parameters [p. 49] ▪ 🔗 Modbus/RTU Parameters [p. 49]
Com Port	If Modbus/RTU is selected, the interface can be selected here and parameterized using the  icon; see 🔗 “Interface Parameters” Dialog [p. 50].

5.1.6.3.1 Modbus/TCP Parameters

Parameters	Description
ID	Here you can enter the device ID of the Modbus subscriber.
TimeOut	Modbus Clients Only: Here you can set the time for the device's response before an error is detected.
ByteOrder	Here you can reverse the byte order of a data point's process data.
TCP Port	In this field, you can enter the port address for the Modbus/TCP communication.

5.1.6.3.2 Modbus/RTU Parameters

Parameters	Description
ID	Here you can enter the device ID of the Modbus subscriber.
TimeOut	Modbus Clients Only: Here you can set the time for the device's response before an error is detected.
ByteOrder	Here you can reverse the byte order of a data point's process data.
Com Port	Here you can select the interface. The  icon opens the 🔗 “Interface Parameters” Dialog [p. 50] dialog.

5.1.6.3.3 "Interface Parameters" Dialog

Figure 25: Interface Parameters

Item	Description
Interface Type	Here you can select the interface type: • RS-232 • RS485 (HD) • RS422 (FD)
Baud rate	Here you can set the transmission speed in bauds: • 300 • 600 • ... • 115200
Parity	From this drop-down list, you can select the parity bit for detecting transmission errors: • None • Odd • Even
Stop Bits	From this drop-down list, you can select the number of stop bits: • 1 • 1.5 • 2
Flow Control	Note: Only available for full-duplex lines (RS232, RS422) Using the drop-down list, you can specify whether flow control should be applied to prevent buffer overflows at the receiver: • Default: setting made via the Device Manager or I/O-CHECK • None • XON/XOFF
Terminating Resistor	Note: Only available for 750-1652 Module and RS422/RS485 Using the drop-down list, you can switch on the termination resistor integrated into the module: • Default: setting made via the Device Manager or I/O-CHECK • Disabled • Enabled
Bias Network	Note: Only available for 750-1652 Module and RS422/RS485 From the drop-down list, you can select a suitable biasing network. This ensures that all receiver inputs have a voltage difference of more than 200 mV between RxD+ and RxD– if no sender is enabled. • Default: setting made via the Device Manager or I/O-CHECK • Disabled • 620 Ω • 1200 Ω

5.1.6.3.4 "Register Details" Dialog

5.1.6.3.4.1 Register

Figure 26: Modbus® Device, Register Details

Item	Description
Data type of the register(s)	From this drop-down list, you can select the data type in which the data point is read or provided in the Modbus® register: • Boolean • Integer 16 • Integer 32 • Integer 64 • Unsigned 16 • Unsigned 32 • Unsigned 64 • Float 16 • Float 32 • Float 64
Scaling Factor	Clicking within the field opens the "Select Data Point" Dialog. Here you can enter the scaling factor, i.e., the ratio of the target value to the raw value, in the lower field (numerical). Alternatively, the value of a data point can be subscribed to as the scaling factor.
Unit	Here you can enter the unit of the captured signal.
Default Value	
Initial Value	Here you can enter a default value that will be used after a restart or when the device is set up for the first time. If no valid value is available, the initial value is used in order to avoid invalid values.
Persist Last Received Value	If this box is checked, the last value received is restored after a controller restart.

Item	Description
Save with Expiration Time	Here you can enable an expiration time via the checkbox and set it in the input field. If this time has elapsed, the last value received will not be restored after a restart.
Qual. Bits	Here you can select the quality attributes that should be transmitted with the default value: NT = not topical (the value could not be acquired, e.g., because the device cannot be reached) IV = invalid (the value is invalid) SB = substituted (the value was replaced, e.g., forced, or a placeholder value if acquisition failed)
On connection error	
Hold last value	When this option is selected, the data point's last value is retained if the connection is interrupted.
NaN	If this option is selected, a data point is placed in the data layer even if it does not exist and is therefore invalid.
Substitute value	If this option is selected, you can enter a substitute value for an invalid data point in the field.
Qual. Bits	See description above.

5.1.6.3.4.2 Input Filter

Register Details FC 3

Register Input filter Request

☐ Flutter lock

Maximum changes: Quali bits on lock: ☐ IV ☐ SB ☐ BL

Watch timeout:

Lock time:

☒ no filter

☐ Deadband filter Bandwidth:

☐ Simple Lowpass Coefficient:

☐ Auf gültigen Registerwert prüfen (zzgl. IV bei NaN)

Minimum (NaN = none) Quali bits on fault: ☐ IV ☐ OV

Maximum: (NaN = keins)

Figure 27: Modbus® Device, Register Details / Input Filter

Name	Description
Flutter Lock	When flutter lock is active, monitoring of the number of signal changes for a data point within a time period can be performed and suppressed. This period is called the monitoring window. If an unusually high number of signal changes occur within the monitoring window, this may indicate faulty sensors or process instabilities.
Maximum changes	Here you can set the maximum number of signal changes within the monitoring period.
Watch Timeout	Here you can set the monitoring period.
Lock Time	Here you can set the time period during which signal changes are suppressed.
Quality Bits for Lock	Here you can select quality bits. If flutter lock is active, these are transmitted together with the value from the Modbus® device.
No input filter	If this option is active, no filter is applied.
Deadband Filter	If the option is selected, a value is only accepted when it changes by the amount of the deadband. This value can be entered in the Bandwidth field.
Simple Low-Pass	If this option is selected, signals with frequencies below the cutoff frequency pass; signals with higher frequencies are attenuated. The entry in the Coefficient field determines the behavior of the filter.
Check for valid register value (including IV for NaN)	If this box is checked, you can enter a minimum or maximum value for checking the input value here. If the received value is greater than or less than the values specified here, this may indicate a faulty device. In case of an error, quality bits can be selected that mark the value as invalid. Additionally, the software checks for a NaN (Not a Number) value.
Qual. bits on fault	Here you can select the quality bits. If the function is active, these are transmitted together with the value from the Modbus® device.

5.1.6.3.4.3 Query

Figure 28: Modbus® Device, Register Details / Query

Name	Description
Modbus Request	
Request Mode	Using the drop-down list, you can determine how the Modbus® query should be performed: • Continuously • Timer (cyclic): The query is performed cyclically, and the "Query interval" input field is enabled for a time entry. • Data Point Update: The query is performed when the subscribed data point is retrieved again. The "Data Point" field is enabled. • Data Point Change: The query is performed when the value of the subscribed data point changes. The "Data Point" field is enabled. • Rising Edge: The query is performed when the signal switches from "0" (low) to "1" (high). • Falling Edge: The query is performed when the signal switches from "1" (high) to "0" (low). • ON-active (>0): The query is performed when the signal = 1. • OFF-active (=0): The query is performed when the signal = 0.
Prioritized Tripp	The selected data point is prioritized and is not processed according to the job list to ensure that the value change reaches the device as quickly as possible.
Data Point	Opens the "Select Data Point" Dialog to select a data point for the "Data Point Update" and "Data Point Change" modes.
Request Interval	Here you can enter the interval at which the queries should be performed. Note: Only available for "Timer" query mode
Timestamp	
System Time at Acquisition	When this option is enabled, the system time is sent as the timestamp during a Modbus® query.

Name	Description
Separate Data Point	When this option is enabled, a data point can be selected as the timestamp. Clicking within the field opens the "Select Data Point" Dialog.
Only When Valid, use System Time	Checking this box ensures that only a valid data point can serve as the timestamp. Otherwise, the system time is used. Note: Available for the "Separate Data Point" option

5.1.6.4 Modbus Clients

The screenshot shows the 'Modbus Clients' configuration page in the WAGO Application Grid Gateway Professional. The interface includes a top navigation bar with tabs like 'I/O', 'Logic fct.', 'Modbus Server', and 'Modbus Clients'. The main area is divided into four numbered sections:

- Device List:** A table listing Modbus devices with columns for 'On' (checkbox), 'Device Name', and 'Status'. Devices include 'Janitza UMG 86,104,508,604', 'Wago 2857-0570', 'Plexlog', 'Kries Grid-Inspector IKI-50 F1', and 'Ecolap VPD'.
- Data Points:** A table for 'Device 4: Ecolap VPD' showing 'Data Points' with columns: 'On' (checkbox), 'FC' (Function Code), 'Address', 'Name', 'Source', 'Raw value', and 'Measurement'. Data points include 'Betriebsart', 'Stufenstellung', 'Hochschalten', and 'Runterschalten'.
- Composed Jobs:** A table showing 'Composed Jobs (3)' with columns: 'Unit ID', 'FC', 'Address', 'Length', 'Trigger', 'Interval', 'Trigger source', 'Error', and 'Response'. Jobs include '+0 3 1 2 continuously', '+0 6 3 1 continuously', and '+0 6 4 1 continuously'.
- Device Details:** A section for 'Device Details' with a 'Modbus/TCP' dropdown, 'IP Address' field, and a table of parameters: 'ID', 'TimeOut', 'Pause', 'ByteOrder', 'Aufrufwiederh.', 'Max Fehlerzähler', 'Reset Fehlerzähler', 'Max Fehlerrate', 'Überw. Zyklen', 'Max cycle time', and 'TCP Port'. Below this is a 'Status' table with columns: 'Aktiv', 'Link', 'Antwortzeit [ms]', 'Cycle time [s]', 'letzter Fehler', 'Fehlerrate', 'Ausgefallen', 'Fehlerzähler', and 'Errorrate [%]'. There are also 'Dismiss' and 'Save' buttons.

Figure 29: Parameterization / Modbus Clients

Number / Name	Description
1	Here you can create Modbus devices. [+]: This button can be used to load templates with existing data points into the table. [-]: This button can be used to delete entries. On: The Modbus device is not enabled until this box is checked. Device Name: Here you can enter a name for the Modbus device.
2	On: The data point is not enabled until this box is checked. FC: Entering the function code (FC) here specifies how the Modbus register is accessed, e.g., read or write. Address: Here you can enter the Modbus register to write to. Name: Here you can enter a name for the data point. ...: Clicking this button opens a dialog for entering additional parameters; see "Register Details" Dialog [p. 58]. Value: This shows the original value received. Source: Clicking within this column allows you to subscribe to a data point; see section "Select Data Point" Dialog [p. 25].
3	The list of created jobs shows which Modbus requests the system generates for the above data points.

Number / Name	Description
4	Device Details From this drop-down list, you can select the transfer protocol: ▪ Modbus/RTU ▪ Modbus/TCP The adjustable parameters of the relevant protocol, which depend on the selections made, are shown on the right; see: ▪ Modbus/TCP Parameters [► 49] ▪ Modbus/RTU Parameters [► 49]
Com Port	If Modbus/RTU is selected, the interface can be selected here and parameterized using the  icon; see "Interface Parameters" Dialog [► 72] .
[Save as Template]	Clicking this button saves a created Modbus device as a template; see section Loading or Saving Templates [► 80] .

5.1.6.4.1 "Register Details" Dialog

Register DetailsFC 3

RegisterInput filterRequest

Data Type of Register/s:Unsigned 16

Scaling Factor:1

Unit:-

Default value:

☐ Initial value:#NaN

☐ persist last received value:

☐ save with expiration:T#0ms

Quali bits:

☒ NT

☐ IV

☐ SB

On connection loss:

☒ hold last received value

☐ NaN

☐ Substitute:#NaN

Quali bits:

☒ NT

☐ IV

☐ SB

OK

Cancel

Figure 30: Modbus Device, Register Details

Item	Description
Data type of the register(s)	From this drop-down list, you can select the data type in which the data point is read or provided in the Modbus® register: - Boolean - Integer 16 - Integer 32 - Integer 64 - Unsigned 16 - Unsigned 32 - Unsigned 64 - Float 32 - Float 64
Scaling Factor	Here you can enter the scaling factor, i.e. the ratio of the target value to the raw value (numerical).
Unit	Here you can enter the unit of the captured signal.
Use When Not Received	- NaN, Marked Invalid: If this box is checked, a data point is placed in the data layer even if it does not exist and is therefore invalid. - Substitute Value: If this box is checked, you can enter a substitute value for an invalid data point in the field.
Persist Last Received Value	If this box is checked, the last values received remain valid even after a restart.

5.1.6.5 60870 Server

The screenshot displays the '60870 Server' configuration window. It features a top navigation bar with tabs for Dashboards, Application, Setup, and Tools. The main area is divided into three numbered sections:

- Section 1: Server List** - A table with columns 'Ein', 'Bezeichnung', and 'Link'. It lists three servers: 'Server 1', 'Server 2', and 'Kisters ProCos'.
- Section 2: Field List** - A table with columns 'Ein', 'Feldname', and a checkbox. It lists various fields like 'Station', 'Batterieblock 1', 'Batterieblock 1 Control', etc.
- Section 3: Data Points** - A table with columns 'Ein', 'ID', 'IOA', 'Bezeichnung', 'Quelle (Meldung/Rückmeldung)', '2. Quelle', and 'Wert'. It lists data points such as 'Wirkleistung am NAP', 'Blindleistung am NAP', etc.

At the bottom, the 'Server Parameters' section includes fields for '60870-5-101', 'ASDU address' (1), 'COM port' (COM1), and 'Configuration' (Configuration). A 'Library State' indicator shows '100 Connected: FALSE'.

Figure 31: Parameterization / 60870 Server

Number / Name	Description
1	Here you can create up to three 60870 servers. [+]: Clicking this button opens a dialog for selecting server templates that are installed on the system. Note: Once the template is selected, the defined fields and data points are overwritten when the template is loaded. [-]: This button can be used to delete the servers. On: For the 60870 server to be enabled and the data points to be created in the Item Hub, this box must first be checked. Name: Here you can enter or change the name for the 60870 server. Link: A green checkmark indicates whether a connection to the server exists.
2	Here you can create various fields for the 60870 server (input field, transition field, power plant, etc.). On: The field is only enabled if this box is checked. Unneeded fields can be switched off so that the associated data points are not created in the Item Hub. Field name: Here you can enter a name for the field. [-]: This button can be used to delete entries.

Number / Name	Description
3	Here you can create the data points for the field selected on the left. ▪ [-]: This button can be used to delete entries. ▪ tk: Here you can enter the data type according to the IEC 60870 standard. ▪ IOA: Here you can enter a unique object address for the selected object type. ▪ ...: This button can be used to enter additional parameters, which depend on the data type (tk) entered; see Data Point Details [p. 60]. ▪ Name: Here you can enter a name for the data point. ▪ Source (Message / Response): Clicking within this field allows you to subscribe to a data point (e.g., the measured value of a Modbus® device; see section "Select Data Point" Dialog [p. 25]). ▪ 2: In this column, you can subscribe to an optional second data point; see section "Select Data Point" Dialog [p. 25]. Note: This is only possible for double-point information messages! ▪ Value (RM): This shows the value received or sent. For commands with an integrated response, this response is added in parentheses.
4	Server Parameters From the "Type" drop-down list, you can select the server type: ▪ Off ▪ 60870-5-101 ▪ 60870-5-104 Ed 1 Multi-Master ▪ 60870-5-104 Ed 2 Multi-Link ▪ 60870-5-104 Connection Established by Substation Com Port: If "60870-5-101" is selected, the interface can be selected here and parameterized using the  icon; see "Interface Parameters" Dialog [p. 72]. Configuration: Clicking this button opens a dialog to configure the selected server; see Server Settings Configuration [p. 62]. ASDU address: Here you can enter the station address to use for the telegram-level connections. Source address (substation): Here you can enter the source address of the substation.

5.1.6.5.1 Data Point Details

Name	Description
MESSAGES:	
Transfer on Item Update	If this box is checked, the data point is transmitted every time the subscribed item is updated (i.e., even if the item contains the same value repeated in sequence). If the box is not checked, the data point is transmitted according to the "Transmission Interval" and "Transmission Hysteresis" settings.
Transmission Interval	From this drop-down list, you can select a transmission interval: • Non-cyclic • 1 s • 5 s • 10 s • 15 s • 30 s • 1 m • 10 m • 15 m • 30 m • 1 h
Invert	Checking this box inverts the Boolean signal ("True" becomes "False").
Minimum Transmission Interval	Here you can specify the interval between spontaneous measured value transmissions. If the measured value being acquired changes quickly, this interval can be used to reduce the number of spontaneous transmissions.
Fault Position Suppression (tk3)	Here you can enter a time period that suppresses signal transmission in the event of signal interference. After the amount of time entered here has elapsed, the transmission takes place. With double-point information messages, incorrect switch positions cause signal interference (e.g., signal A: 0 and signal B: 0). In the telecontrol protocol, the switch positions must be active in opposite directions.
Transmission Hysteresis, Absolute	Here you can specify the threshold at which a new measured value should be reported. The static hysteresis compares the measured value last transmitted to the current measured value. If the difference is greater than or equal to the value entered, transmission is initiated. Value "0": The value is not transmitted in the event of a change.
Transmission Hysteresis, Integral	Here you can specify the threshold at which a new measured value should be reported. The integral hysteresis sums differences. The time base for the summation can be selected from the "Interval" drop-down list. The difference between the current measured value and the last measured value transmitted to the control center is calculated. If the sum exceeds the value entered, transmission is initiated. Value "0": The value is not transmitted in the event of a change.
Scaling, Factor before Sending	Here you can enter the scaling factor, i.e. the ratio of the target value to the raw value (numerical).
Exclude from GI	If this box is checked, a message is not transmitted within a general interrogation.
Store telegrams on connection interruption	If this box is checked, then, for each data point, you can enable temporary storage of the protocols in the event of disconnection. The size of the storage can be set in the configuration dialog.
Quality identifiers	
IV/NT	Here you can select an alternative source for the quality bits in addition to the data point: • Data point itself • Separate source: enables the "Source" input field. Clicking within the field allows you to subscribe to a data point; see section "Select Data Point" Dialog • Disabled
COMMANDS:	
Invert	Checking this box inverts the Boolean signal ("True" becomes "False").

Name	Description
Accept command permanently (tk45, tk46) regardless of command identifier	If this box is checked, the command execution time from the command telegram is ignored for incoming commands. As a result, the command value is applied to the data layer permanently and not set to "0" after the execution time.
Command has integrated response	If this box is checked, a second tab appears in the detail dialog to configure a data point for the command response.
Allow OFF to OFF and ON to ON	Note: This requires an integrated response to be enabled for the command. Checking this box allows a repeated command. If the box is not checked, the system stores the last state (from the last command or a parameterized response) and rejects receipt of a repeated command.
Locking	
Per item	Checking this box allows command lock to be activated by a subscribed data point. This data point can be selected by clicking within the field; see section "Select Data Point" Dialog.
Via IV flag of the response	When this box is checked, a received command is rejected if the parameterized response has set the quality bit "IV." This prevents commands being output to a faulty receiver (e.g., I/O or Modbus®).
Via NT qualifier of the response	When this box is checked, a received command is rejected if the parameterized response has set the quality bit "NT."
Default Value	
Initial Value	Here you can enter a default value that will be used after a restart or when the device is set up for the first time. If no valid value is available, the initial value is used in order to avoid invalid values.
Persist Last Received Value	If this box is checked, the last value received is restored after a controller restart.
Save with Expiration Time	Here you can enable an expiration time via the checkbox and set it in the input field. If this time has elapsed, the last value received will not be restored after a restart.
Qual. Bits	Here you can select the quality attributes that should be transmitted with the default value: NT = not topical (the value could not be acquired, e.g., because the device cannot be reached) IV = invalid (the value is invalid) SB = substituted (the value was replaced, e.g., forced, or a placeholder value if acquisition failed)

5.1.6.5.2 Server Settings Configuration

5.1.6.5.2.1 General Information

Server Parameters

General | Connection | Befehlsoptionen

Max telegram length: 240

COT der Archivwerte: 48

Combined transmission of messages: Deaktiviert

Synchronize clock: NTP

Validity timeout: T#10m

Timestamp includes: ☒ Sommerzeit SU ☒ Weekday DOW

General interrogation: Zeitstempel bei GA nicht mit übertragen (normkonform)

Herkunftsadresse Unterstation: 0

Reset command (QRP): Kein Neustart, nur speichern

Counters: Betriebsart B

Local storage: 30s

Reset: ☐

Message archive: Keine Pufferung

Buffer size [kB]: 64

OK Cancel

Figure 32: 60870-5-101 Configuration, General

Name	Description
Maximum telegram length	Here you can enter the maximum telegram length in bytes. The permissible range is 64 ... 253 bytes. Factory setting: 253 bytes.
COT archive values	Here you can enter the cause of transmission (COT) of the archive values for analog and counter values; a cause of transmission from the private area (48–63) is normally used. Archive values allow cyclic transfer of minimum, maximum or average values for analog objects with timestamps, as well as transfer of sum or difference values for counter objects with timestamps.
Combined transmission of message objects	Here you can specify whether message objects should be transferred in combined form. - Disabled - Structured transmission according to the standard (only objects without timestamps) - Structured transmission for all objects in the reporting direction
Synchronization clock	Various settings can be used to synchronize the time: Only system time (no synchronization) NTP: Settings such as the server IP and update interval can be configured via the WBM. Protocol-specific: Synchronization is performed via the 60870 protocol with type identifier 103.
Validity Timeout	Here you can specify a time period within which the synchronization must take place. If no synchronization occurs after the valid time period has ended, the system time is marked as invalid (IV identifier).
Timestamp includes	Summer time SU: If this box is checked, the “Central European Summer Time” (MEST) setting is also transmitted in the timestamp. One bit is used for this purpose. Weekday DOW: If this box is checked, the current day of the week is also transmitted in the timestamp. One bit is used for this purpose.

Name	Description
General interrogation	Here you can specify how objects should behave in the event of a general interrogation. The following behaviors are available for selection: • Timestamp not transferred with GI (standards-compliant) • Timestamp transferred with GI
Source address of substation	Here you can enter the source address of the telecontrol substation.
Reset command (QRP)	Here you can define the further behavior of the application when a process reset qualifier is received. The options are: • Restart only if QRP:1: Save the process reset qualifier and restart the fieldbus controller if QRP=1. • No restart, just save: Save process reset qualifier and do not restart the fieldbus controller. • Restart for any QRP: Save the process reset qualifier and always restart the fieldbus controller.
Counters	Here you can select one of the specified counter actions per IEC 60870. The options are: • Mode A: local freeze, spontaneous transmission The counter values are cyclically frozen in the status server and then transmitted to the master (with transmission cause 3, "Spontaneous"). • Mode B: local freeze, transmission after interrogation The counter values are cyclically frozen in the status server. The restored values are transmitted as soon as the master has sent a general counter query. • Mode C: freeze and transmission after interrogation The counter values are frozen as soon as the master has sent the telegram "Freeze counter" (with or without reset). The restored values are transmitted as soon as the master has sent a general counter query. • Mode D: freeze after interrogation, spontaneous transmission The counter values are frozen as soon as the master has sent the telegram "Freeze counter" (with or without reset). The restored values are then transferred to the master (with cause of transmission 3 "Spontaneous").
Local Storage	Here you can select the time interval at which the counter values are cyclically frozen in the status server and then transmitted to the master.
Reset	This box must be checked in order for a reset to be performed.
Message archive	If the connection to the remote station is not available, messages and measured values to be sent are buffered. The following options are available: • No buffering • Buffering (RAM) • Buffer (filesystem)
Buffer size [kB]	Here you can enter the buffer size. The telegrams are temporarily stored in buffer memory if, for example, there is no connection. If a memory overflow occurs, the oldest telegrams are overwritten. Values from 0 kB to 256 kB can be entered. If 0 kB is entered, telegrams are not buffered. The size of the buffer depends on the type of information object and its address size.

5.1.6.5.2.2 60870-5-101 Connection

Server Parameters

General Connection **Befehlsoptionen**

Link layer: unsymmetrisch Response delay: T#1s Cycle time link test: T#15s

Legth of link address: 1 Byte

Link address: 1

Length of ASDU address: 1 Byte

Length of IOA address: 3 Byte

Length of COT (include origin address): 1 Byte

Use E5 acknowledge: Nicht verwenden

Communication permission:

OK Cancel

Figure 33: 60870-5-101 Configuration, Connection

Name	Description
Link layer	Here you can choose between symmetrical and asymmetrical communication: Symmetrical: 1-to-1 communication between two devices (client and server) Asymmetrical: bus operation between client and multiple servers, where the client queries the servers cyclically one after the other
Response delay	Here you can set the time the client waits for a response to its queries from its communication partner.
Cycle time link test	Here you can enter the cycle time for querying the state of the link/connection level. If the time is set to "t#0s," querying is disabled. Note: This parameter can only be set if a symmetrical connection is selected!
Link address length	Here you can select the length of the link address: - n.a. 1 byte 2 bytes
COT length	Here you can select the length of the COT address (COT = C ause of T ransmission). 1 byte 2 bytes (with source address)
Use E5 acknowledge	Here you can determine how the single character "E5" should be used. - Do not use - Pos. acknowledgement - Pos. acknowledgement + no data
Communication permission	If the Sprungziel: Kopiervorlage is active, the data point <code>"/application/Redundancy/IsActive"</code> can be subscribed to here. If two controllers are connected by a single serial cable, only one controller can send signals at a time. Communication enable ensures that the connection is only established when the active communication partner has been subscribed to. Clicking within the field opens the "Select Data Point" Dialog [p. 25] dialog.

5.1.6.5.2.3 60870-5-104 Connection

Server Parameters

General Connection **Befehlsoptionen**

K W T1 T2 T3

Master connections

TCP Port

IP Filter ☐

	Master 1	Master 2	Master 3	Master 4
Allowed IP 1	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Allowed IP 2	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Allowed IP 3	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Allowed IP 4	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0

Communication permission:

OK Cancel

Figure 34: Configuration 60870-5-104 Ed. 1 (Multi-Master)

Name	Description
Parameter	
K	Here you can specify the maximum number of telegrams that can be sent before waiting for acknowledgment.
W	Here you can specify the maximum number of telegrams that can be received before sending acknowledgment.
T1	Here you specify how much time the sender should wait for acknowledgement from the slave.
T2	Here you can specify how much time the sender should wait if no data telegrams can be transmitted. The receiver acknowledges the data telegrams after at most this amount of time. Note: Select a value less than the value in the "Parameter T1" field.
T3	Here you specify how much time there can be no communication between the master and status server before a test telegram is sent to check the connection.
Master connections	Here you can enter the max. number of masters.
TCP Port	The registered port for IEC 60870 is preset here.
IP filter	If this box is checked, incoming connections can be filtered for permitted IP addresses.
Master 1 ... 4	Here you can enter up to four IP addresses that are filtered out as permissible.
Communication permission	If the Sprungziel: Kopiervorlage is active, the data point <code>"/application/Redundancy/IsActive"</code> can be subscribed to here. If two controllers are connected by a single serial cable, only one controller can send signals at a time. Communication enable ensures that the connection is only established when the active communication partner has been subscribed to. Clicking within the field opens the "Select Data Point" Dialog [> 25].

5.1.6.5.2.4 60870-5-104 Connection (Connection Established by Substation)

The screenshot shows the 'Server Parameters' dialog box with the 'Connection' tab selected. Within this tab, the 'Befehlsoptionen' sub-tab is active. The configuration parameters are as follows:

- K**: 12
- W**: 8
- T0**: T#0ms
- T1**: T#15s
- T2**: T#10s
- T3**: T#20s
- TCP Port**: 2405
- IP Address**: (empty field)
- StartDT sent by**: Master (dropdown menu)
- Communication permission**: (empty field)

At the bottom right, there are 'OK' and 'Cancel' buttons.

Figure 35: Configuration 60870-5-104 Connection Established by Substation, Connection

Name	Description
Parameter	
K	Here you can specify the maximum number of telegrams that can be sent before waiting for acknowledgment.
W	Here you can specify the maximum number of telegrams that can be received before sending acknowledgment.
T1	Here you specify how much time the sender should wait for acknowledgement from the slave.
T2	Here you can specify how much time the sender should wait if no data telegrams can be transmitted. The receiver acknowledges the data telegrams after at most this amount of time. Note: Select a value less than the value in the "Parameter T1" field.
T3	Here you specify how much time there can be no communication between the master and status server before a test telegram is sent to check the connection.
TCP Port	The registered port for IEC 60870 is preset here.
IP address	Here you can enter the IP address of the substation.
StartDT sent from	Master: The master establishes the physical connection; communication is started by the control center. Substation: The substation establishes the physical connection and starts the communication.
Communication permission	If the Sprungziel: Kopiervorlage is active, the data point <code>"/application/Redundancy/IsActive"</code> can be subscribed to here. If two controllers are connected by a single serial cable, only one controller can send signals at a time. Communication enable ensures that the connection is only established when the active communication partner has been subscribed to. Clicking within the field opens the "Select Data Point" Dialog [p. 25].

5.1.6.5.2.5 Command Options

Server Parameters

Befehlsoptionen

Ausführungszeit: Default (T#2s), Long (T#5s), Short (T#500ms)

Ausführungsweise (S/E): Direkte Ausführung (v), Auswahl-/Ausführungszeit: T#5s

Herkunftsadr. in Antworten: Herkunftsadresse spiegeln (v)

Befehlsprüfungen:

☐ 1-Aus-N-Verriegelung (nur ein Befehl zur selben Zeit)

☐ Check origin address of control side
Allowed origin address: 0

☐ Check command ID
Allowed command ID: 0

Behaviour of commands on equal values during process: Akzeptieren (v)

Befehle mit Zeitstempel:

☒ Akzeptiere Befehle nur bei aktueller Systemzeit (kein IV-Bit)

Check validity time: Always (v)

Validity timeout: T#0ms

☐ Use local systemtime in responses

OK Cancel

Figure 36: Configuration 60870-5-101, Command Options

Name	Description
Execution Time	
Default	Here you can enter the time available for default execution of an IEC-60870-compliant command.
Long	Here you can enter the time available for long execution of an IEC-60870-compliant command.
Short	Here you can enter the time available for short execution of an IEC-60870-compliant command.
Execution Mode (S/E)	Here you can select the execution mode: Direct Execution Selection + Execution: The command must be selected before it is executed.
Selection/Execution Time	Here you can enter a time window during which the command can be executed after being selected. The execution time determines the amount of time that a command state should be present on the associated digital outputs.
Source Addr. in Responses	The configured source address is used in the command response sent. The following options are available: Use Own Source Address (COT11) Mirror Source Address (COT 6.7.10): In the sent command response, the source address received in the command is used.
Command Checks	
1-out-of-N Interlock (Only One Command at a Time)	If this box is checked, further commands received during the execution of a command are rejected until a valid acknowledgement is received or the command time expires.
Check Source Address of Control System	If this box is checked, commands can be checked. A value can be entered in the "Allowed origin address" input field. If the received source address does not match the specified value, a negative acknowledgment is sent. Source address = 0 -> no check.
Check Command ID	If this box is checked, commands can be checked. You can enter a value in the "Allowed Command ID" field. If the received command identifier does not match the specified value, a negative acknowledgment is sent.

Name	Description
Behavior for Commands with Same Value during Command Execution	If a command is resent by the communication partner while the previous command has not yet completed, the repeated command can be accepted or rejected at the protocol level.
Timestamped Commands	
Accept Commands Only with Current System Time	When this box is checked, commands with an embedded timestamp are not accepted if the controller's system time is invalid.
Check Validity time	Here you can specify how the validity period is checked: • Always • Only with Current System Time
Validity timeout	Here you can specify a time period within which the synchronization must take place via object 103. If no synchronization occurs after the valid time period has ended, the system time is marked as invalid (IV identifier).
Use Local System Time in Responses	If this box is checked, the controller time is sent as feedback. Otherwise, the time from the received command is sent as feedback.

5.1.6.6 60870 Clients

The screenshot displays the '60870 Clients' configuration window. It features a table for client management (ID, Station/Device Name, Status) and a detailed configuration section for a selected client. The configuration section includes parameters for communication (Link Addr, Lange, ASDU Lange, COT Lange, ES-Mode, ICA Lange, Linktest, Link Addr) and synchronization (Herkunftsfeld, General Interrogation, Clock Synchronization, ASDU). The interface is labeled with numbers 1 through 4 corresponding to the sections described in the caption.

Figure 37: Parameterization / 60870 Clients

Number / Name	Description
1	Here you can create up to five devices or stations that communicate via IEC 60870. • [+]: Here you can select a predefined template. • [-]: Use this button to delete entries. • On: This box must be checked in order to enable the 60870 client. • Station/device name: Here you can enter a name for the 60870 client. • Status: This indicates the connection status of the device/the station: Red exclamation mark: configured server (peer) not reachable/connected Green checkmark: connected

Number / Name	Description
2	Here you can create various fields for the 60870 client (input field, transition field, power plant, etc.). On: The fields are not enabled until this box is checked. Note: Conversely, unneeded fields can be disabled; the associated data points (right) are then not created. Field name: Here you can enter a field name. [-]: This button can be used to delete entries.
3	Here you can enter the data points for the selected devices, fields or groups. On: The data point is not enabled until this box is checked. tk: Here you can enter the data type according to the IEC 60870 standard. IOA: Here you can enter a unique object address for the selected object type. Name: Here you can enter a name for the data point. ...: This button can be used to enter additional parameters, which depend on the data type (tk) entered; see 🔗 Data Point Details [p. 60]. Source: After correctly entering a standard-compliance data point type, you can subscribe to a data point by clicking within this field (e.g., the measured value of a Modbus® device; see section 🔗 "Select Data Point" Dialog [p. 25]). Value: shows the value received or command sent [-]: This button can be used to delete entries.
4	Device Details From this drop-down list, you can select the server type: Off 60870-5-101 60870-5-104 The adjustable parameters of the server according to the standard, which depend on the selections made, appear on the right; see: 🔗 60870-5-101 Connection [p. 64] 🔗 60870-5-104 Connection [p. 65] 🔗 60870-5-104 / 60870-5-101 Parameters [p. 70]
IP address	If 60870-5-104 is selected, you can enter the IP address here.
Local D-Sub Port	If "60870-5-101" is selected, the interface can be selected here and parameterized using the  icon; see 🔗 "Interface Parameters" Dialog [p. 72] .
[Save as Template]	Clicking this button adds the device to the template list and makes it available as a download file.

5.1.6.6.1 60870-5-101 Connection

Parameters	Description
Asymmetr.	Symmetrical or asymmetrical connection. This parameter must match the remote communication partner's. TRUE = symmetrical FALSE = asymmetrical
Link Address Length	Here you can enter the length of the link address: 1 byte 2 bytes
ASDU Length	Here you can select the length of the address field of the ASDU: 1 byte 2 bytes
COT Length	Here you can select the number of bytes required to address the information objects: 1 byte 2 bytes
E5 Mode	Here you can determine how the single character "E5" should be used.
IOA Length	Here you can set the length for the unique object address.
Link Test	Here you can enter a timeout for an explicit connection test at the protocol level.

Parameters	Description
Link Addr.	Here you can enter the link address.

5.1.6.6.2 60870-5-104 Connection

Parameters	Description
TCP Port	Here you can enter the port address for TCP communication.
wK	Here you can specify the maximum number of telegrams that can be sent before waiting for acknowledgment.
wW	Here you can specify the maximum number of telegrams that can be received before sending acknowledgment.
T0	Here you can set the delay value for establishing a new connection.
T1	Here you specify how much time the sender should wait for acknowledgement from the slave.
T2	Here you can specify how much time the sender should wait if no data telegrams can be transmitted. The receiver acknowledges the data telegrams after at most this amount of time. Note: Select a value less than the value in the "Parameter T1" field.
T3	Here you specify how much time no communication between the master and slave can occur before a test telegram is sent to check the connection.

5.1.6.6.3 60870-5-104 / 60870-5-101 Parameters

Parameters	Description
Source Address	If the slide switch is activated, you can enter the WAGO controller's source address in this field.
General Interrogation	Here you can configure the execution of general interrogations with the substations (via type identifier 100): ▪ Never: no general interrogation ▪ Cyclic: at an adjustable interval ▪ Start: once upon connection ▪ Start+Cyclic: at an adjustable interval
Time Synchronization	If cyclic synchronization is selected, you can set the interval here. ▪ Never: no time synchronization ▪ Cyclic: at an adjustable interval ▪ Start: once upon connection ▪ Start+Cyclic: at an adjustable interval
ASDU	Here you can enter the station address to use for the telegram-level connections.

5.1.6.6.4 "Interface Parameters" Dialog

Figure 38: Interface Parameters

Item	Description
Interface Type	Here you can select the interface type: ▪ RS-232 ▪ RS485 (HD) ▪ RS422 (FD)
Baud rate	Here you can set the transmission speed in bauds: ▪ 300 ▪ 600 ▪ ... ▪ 115200
Parity	From this drop-down list, you can select the parity bit for detecting transmission errors: ▪ None ▪ Odd ▪ Even
Stop Bits	From this drop-down list, you can select the number of stop bits: ▪ 1 ▪ 1.5 ▪ 2
Flow Control	Note: Only available for full-duplex lines (RS232, RS422) Using the drop-down list, you can specify whether flow control should be applied to prevent buffer overflows at the receiver: ▪ Default: setting made via the Device Manager or I/O-CHECK ▪ None ▪ XON/XOFF
Terminating Resistor	Note: Only available for 750-1652 Module and RS422/RS485 Using the drop-down list, you can switch on the termination resistor integrated into the module: ▪ Default: setting made via the Device Manager or I/O-CHECK ▪ Disabled ▪ Enabled
Bias Network	Note: Only available for 750-1652 Module and RS422/RS485 From the drop-down list, you can select a suitable biasing network. This ensures that all receiver inputs have a voltage difference of more than 200 mV between RxD+ and RxD– if no sender is enabled. ▪ Default: setting made via the Device Manager or I/O-CHECK ▪ Disabled ▪ 620 Ω ▪ 1200 Ω

5.1.6.7 Event Logger

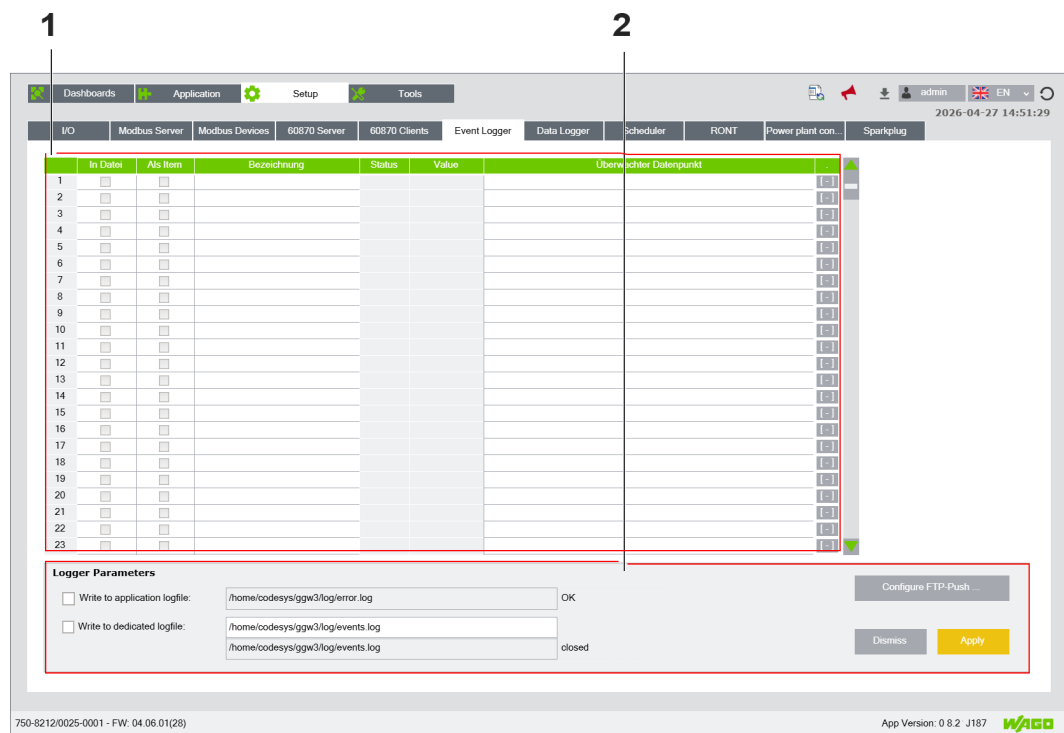


Figure 39: Parameterization / Event Logger

Number / Name	Description
1	Here you can set up data points of the data layer to monitor. To File: When this box is checked, messages are written to a file; see also Logger Parameters. As Items: When this box is checked, messages are written to the application's data layer as items. Name: Here you can enter a name for the event logger. Status/Value: This shows the current status and the value currently being read. Monitored Data Point: By clicking within this field, you can subscribe to a data point; see section "Select Data Point" Dialog [p. 25]. [-]: This button can be used to delete entries.
2 Logger Parameters	Write to application log file: When this box is checked, the messages are written to the application's log file; the filename and path are preset. Write to dedicated log file: When this box is checked, the messages are written to your own log file. The file can be saved to the working directory of CODESYS or to an SD card (/media/sd/log). Using wildcards, you can parameterize the filename to include predefined values; see the tooltip.
[Configure FTP Push]	Clicking this button opens the FTP Push [p. 73] dialog. Here you can set up transfer of a log file to an external FTP server provided by the customer.

5.1.6.7.1 FTP Push

FTP-Push

☐ Activate Service

Server / Pfad:

IP-address[/path]

Protokoll:

☒ FTP☐ FTPS☐ FTPES

Username:Password:

Curl-Parameter:

--cacert /etc/certificates/cert.pem

Timeout:

T#10s

☐ After transmission, rename on server

(*.xyz is usable)

☐ After transmission, delete locally

☐ After transmission, move locally

OK

Cancel

Figure 40: FTP Push

Name	Description
Activate Service	The log file is not uploaded to an external FTP server until this box is checked.
Server / Path:	Here you can enter the IP address of the FTP server.
Log	Here you can select the protocol (encrypted or unencrypted).
Username/Password	Here you can enter the authentication data for the FTP server.
Curl Parameters	Here you can enter the path and name of the security certificate. The certificate can be uploaded via Web-Based Management using the menu: Certificates > Security .
Timeout	
After transmission re-name on server	After checking this box, you can enter an alternative name for the file in this field; this name becomes valid after the upload. The filename can be formatted on a daily basis using wildcards; see the tooltip.
After transmission, delete locally	If this box is checked, the file is deleted after transfer (this function is planned).
After transmission, move locally	If this box is checked, the file is moved locally after transfer. You can enter the storage location in the field (this function is planned).

5.1.6.8 Data Loggers

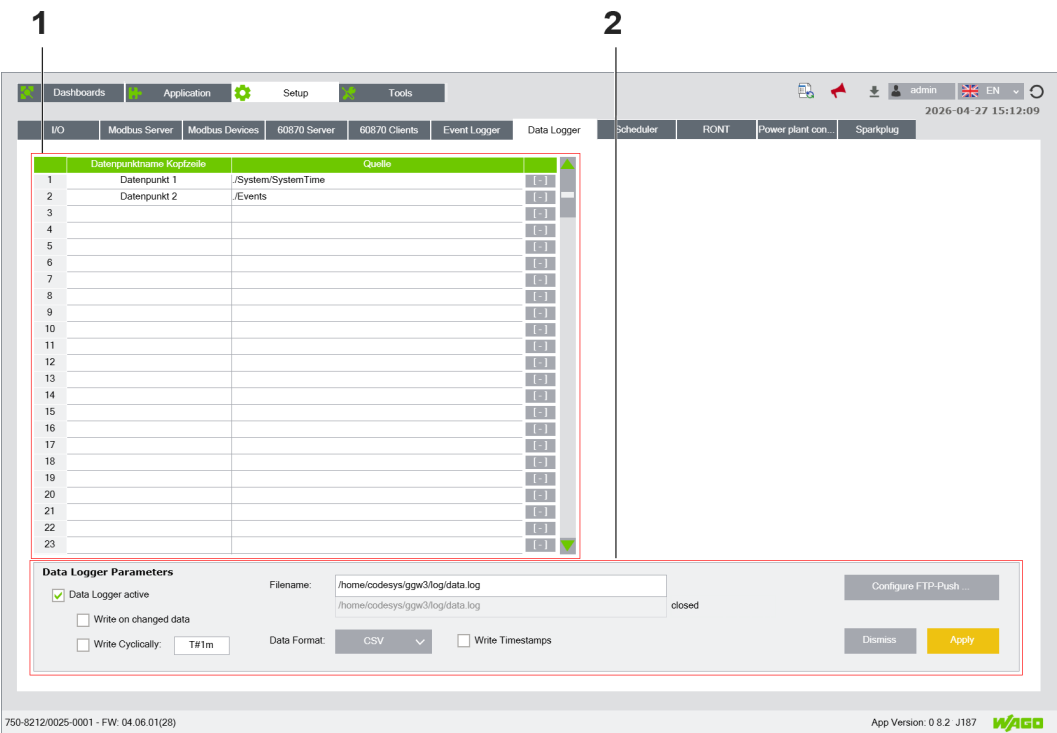


Figure 41: Parameterization / Data Loggers

Number / Name	Description
1	Here you can specify the data points to log. ▪ Data Point Name / Header: Here you can enter a name for the data logger. ▪ Source: Clicking within the field allows you to subscribe to a data point; see section “Select Data Point” Dialog [p. 25]. ▪ On change: If this box is checked, logging occurs only when the data changes, regardless of the specified cycle. ▪ [-]: This button can be used to delete entries.
2	Data Logger Parameters ▪ Data Logger active: This box must be checked to enable the data logger. ▪ Filename: The file can be saved to the working directory of CODESYS or to an SD card (/media/sd/log). Using wildcards, you can parameterize the filename to include predefined values; see the tooltip. ▪ Write Cyclically: If this box is checked, logging is performed cyclically; the cycle can be specified in the input field. ▪ Data Format: Here you can choose among the following formats: – Comma separated list (CSV) – Tabbed TXT list – List with field formatting (Excel CSV) ▪ Write Timestamp: If this box is checked, the timestamp is also logged.
Logrotate	If a max. file size or a max. file age is entered, a new file is created automatically when either of these limits is reached. Note: Modifying the filename prevents old files from being overwritten!
[Configure FTP Push]	Clicking this button opens the FTP Push [p. 73] dialog. Here you can set up transfer of a log file to an external FTP server provided by the customer.

5.1.6.9 Sparkplug

Communication with the Sparkplug specification is based on the MQTT principle. The communication participants are the Edge Node and the devices. The Edge Node represents a substation (digital substation). It resides at a higher level than the connected devices and contains station-specific information, such as door contacts, alarm detectors, etc. The associated devices send data to a central cloud information platform.

Message Types:

- NBIRTH (Node Birth): registration of a device (Edge Node) with the MQTT broker
- DBIRTH (Device Birth): registration of a sensor/device under a node
- NDEATH (Node Death): deregistration or unexpected failure of a node
- NDATA/DDATA: transmission of process data
- DDEATH (Device Death): deregistration or unexpected failure of a device

The screenshot displays the WAGO Application Grid Gateway Professional interface for Sparkplug configuration. It is divided into three main sections:

- Section 1: Node Configuration** - A table listing nodes with columns: On (checkbox), Name, Section, and Status. The first node is 'modbus_11' with section 'Z1'. Below it is 'modbus_12' with section 'J1Q12', which is highlighted with a red box.
- Section 2: Device Configuration** - A table listing devices with columns: Ein (checkbox), Bezeichnung, Einheit, Wert, Zeitstempel, and Status. The first device is 'deviceType' with unit 'r/o'. Below it is 'serialNumber' with unit 'r/o'. The device 'RTMMXU1.TotVAr.mag' with unit 'MVA' is highlighted with a red box.
- Section 3: Cloud Service Configuration** - A section for configuring the cloud service. It includes a 'Connection' status (FALSE) and a 'Function stopped: License required!' message. There are buttons for 'Dismiss' and 'Save'.

Figure 42: Parameterization / Sparkplug

Number / Name	Description
1	Here you can create up to 30 devices. ▪ On: Here you can enable/disable the top node and the devices below it by clicking within the field. Note: When the node is enabled/disabled, the entire cloud service is switched on or off at the same time. ▪ Name: Here you can change the predefined name. ▪ Field: Here you can change the predefined field name. ▪ Status: This displays the following status messages: – Metrics assigned to Edge Node (Node) – Source device not available (Devices) – OK – Invalid Object – Unknown ▪ [...]: Clicking this button opens a dialog to configure the devices; see "Device Details" Dialog [p. 76]. ▪ [-]: This button can be used to delete entries.

Number / Name	Description
2	Here you can parameterize the data points of the selected devices. Up to 50 metrics (data points) can be created. ▪ On: Here you can enable/disable data points by clicking within the field. ▪ Name: Here you can change the predefined name. ▪ Unit: Here you can change the predefined unit. ▪ Value: This shows the value currently being read. ▪ Timestamp: This shows the time of the last reading of the data point. ▪ r/o: indicates that the data point can only be read from the cloud and cannot be written to ▪ [...]: Clicking this button opens a dialog to configure the data points; see 🔗 "Metric Details" Dialog [p. 77]. ▪ [-]: Here you can delete the entry.
3	Cloud Service: ▪ On: Here you can switch the cloud service on or off. ▪ Edge Node Name: This shows the name of the substation. ▪ Status: This shows the status (OK, INVALID_OBJECT, UNKNOWN) ▪ [Connection]: Clicking this button opens the WBM to configure the cloud connection.

5.1.6.9.1 "Device Details" Dialog

Figure 43: Sparkplug, Device Details

Name	Description
Transmission Interval	Here you can enter a transmission interval for updating the values.
Transmit on changed value	When this box is checked, only a changed value is updated. The two settings correspond to each other: ▪ Box checked, transmission interval = 0: Values are only transmitted when a change occurs. ▪ Box unchecked, transmission interval = 60: Values are transmitted every 60 sec., regardless of whether they have changed. ▪ Box checked, transmission interval = 60: Values that changed during this period are transmitted every 60 sec. Note: If a value changes multiple times within the transmission interval, only the last change is sent!
Connection status	Opens the 🔗 "Select Data Point" Dialog [p. 25] dialog. Here you can subscribe to a data point that sends a message if the connection is lost, for example.
Negate	Checking this box inverts the Boolean signal ("True" becomes "False").

5.1.6.9.2 "Metric Details" Dialog

Metric DetailsIwareMaker

Metric

Data source:

./Configuration/Variables/HardwareMaker

Prefix:

Properties

Unit:

—

—

Cloud-Datentyp:

String80

Timestamp

Source:

Data Source

Time is local:

☒

OK

Cancel

Figure 44: Sparkplug, Metric Details

Name	Description
Data source	Opens the ⓘ "Select Data Point" Dialog [➤ 25] dialog to select the signal source.
Prefix	Here you can select a prefix to categorize the metric: ▪ None ▪ NodeControl ▪ DeviceControl ▪ Properties ▪ Field name ▪ GroupID_1_Field name
Unit	Here you can select various units of measurement along with the corresponding unit prefixes. ▪ ... ▪ Milli ▪ Kilo ▪ Mega
Cloud data type	Here you can select the cloud data type.
Timestamp	
Source	Here you can select a timestamp that is sent with the value: ▪ Data source (default) ▪ System time ▪ External time (After this is selected, an external source can be subscribed to via the ⓘ "Select Data Point" Dialog [➤ 25] dialog.)
Time is local time	If this box is checked, the time set on the computer (UTC) is used as the timestamp.

5.1.7 Tools

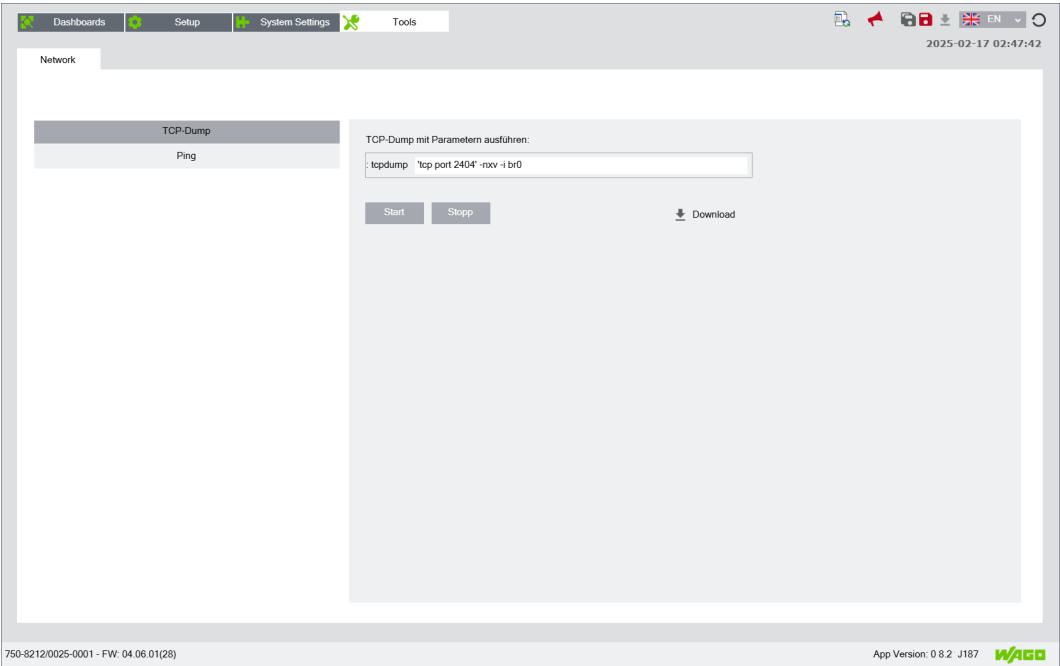


Figure 45: Tools / Network

Name	Description
TCP Dump	This export function can be used to temporarily log network traffic using the Linux “tcpdump” tool. Note: For details of the possible parameters within the command, refer to the online documentation for the Linux “tcpdump” command. Clicking the [Start] button starts logging network traffic with the specified parameters. The function runs until [Stop] is pressed or the controller restarts.
Ping	Here you can enter an IP address to test whether the device is reachable. Once the [Start] button is pressed, the device status is indicated.

5.2 Operating the Application

5.2.1 Parameterization

5.2.1.1 Parameterizing a Modbus Server

1. Navigate to the **Modbus Server** menu.
2. In the table on the left, click in the "Name" column and assign a name for the Modbus server.
3. Activate your Modbus server using the "On" checkbox.
4. In the field above the table on the right, specify the number of your data points.
Note: The maximum number of data points is limited by the current memory load. If too many Modbus registers are requested, the application jumps back to the previous value.
5. Create your data points one after the other with Modbus function codes, register addresses and names.
6. Click in the "Source" column of the data points.
 - ⇒ The  **Select Data Point dialog [> 25]** opens.
7. Subscribe to the value of a measuring device, for example.
 - ⇒ The entire path appears in the column.
8. Use the "On" checkboxes to activate the data points.
 - ➔ Once the connection has been successfully established, the measured value that is received appears in the column of the same name.

Information on the individual parameters can be found in section  **Modbus Server [> 48]**.

5.2.1.2 Parameterizing Modbus Clients

1. Navigate to the **Modbus® Clients** menu.
2. Click in the "Label" field and assign a name for the device.
3. Activate the device by checking the "On" box.
4. Click the **[+]** button to select a predefined template.
 - ⇒ The templates contain the basic data points for the device, including the registers. Section  **Loading or Saving Templates [> 80]** lists the available templates.
5. Select a Modbus® protocol from the "Device Details" drop-down list.
6. Edit the parameters to the right of the drop-down list according to the protocol selected.
7. Create the data points for your device in the table at the top right using the **[+]** button.
8. Activate the data points by checking the "On" boxes.
9. Click the **[...]** button.
 - ⇒ The  **"Register Details" Dialog [> 51]** opens.
10. In the dialog, set the data point parameters according to the device data sheet.
11. Finally click the **[Save]** button.

- ➔ The application attempts to establish a connection to the device and read the values. If the connection is established without errors, the status of the query interval and response time is indicated in the table below.

Note: If multiple devices are attached to one serial interface via a bus system, the interval is greater, because all the devices are queried in series. If the interval is too large for the specific application, it is advisable to split up the bus line.

The Modbus® device that was created appears under  **Dashboards** [[▶ 26](#)] in the Item Browser once you press the  button. The Item Browser shows data points that are read out by the device, as well as quality features such as errors, interval times, etc.

Information on the individual parameters can be found in section  **Modbus Clients** [[▶ 55](#)].

5.2.1.2.1 Loading or Saving Templates

When a template is selected, the data point list is populated with a specified number of data points. When the data points are transferred to the data point list, they already have function codes, descriptions, addresses and data types. The following templates are available by default:

- ComPassB
- ComPassB2
- ComPassBs
- IKI50_F1
- IKI50_F2
- Janitza
- PLMulti_2
- PQI_DA
- SIE_PAC3200
- SINEAX_AMx000
- Wago 2857-0570
- Wago MID 879-30x0

You can add your own templates to this list with Add:

1. Click the **[Save as Template]** button for a device that has been created.
 - ➔ The device is added to the template list and is available as a download file. You can load the file onto your computer and transfer the configuration to other stations via WinSCP.
 2. Click the **[+]** button to open the dialog for the template.
 3. Click the  button.
- ➔ The new template is loaded into the list.

5.2.1.3 Parameterizing a 60870 Server

In the following example, we want values to be transmitted from a Modbus® client or a 60870 client to the control center via the 60870 server.

- ✓ You need to have already created a Modbus® client, a 60870 client or an I/O module in the application.
1. Navigate to the **60870 Server** menu.

2. First select the server type from the "Server Parameters" drop-down list.
 - ⇒ The relevant parameters, which depend on the selection, appear to the right of the drop-down list.
3. Enter the parameters in the fields.
4. Click in the "Field Name" field in the table on the left and assign a name (input field, transition field, etc.).

Note: You can create at most 24 fields per station.
5. If applicable, group your fields by clicking on the checkboxes.
6. In the table on the right, create the data points you need for each of your fields.
7. Enter the data type in the "tk" field (single/double-point information, step position, measured value, etc.).
8. Enter a unique object address for the selected object type in the "IOA" column.
9. Assign names for the data points in the "Name" input field.
10. For a "Message" data type, click in the "Source (Message/Response)" field to select a data point whose value you want to subscribe to.
 - ⇒ The "Select Data Point" dialog opens; see section [🔗 "Select Data Point" Dialog \[► 25\]](#).
11. Finally click the **[Save]** button.
 - ➔ The application attempts to establish a connection to the server and transmit the subscribed values to the control center. If the connection is successful, the values that are read appear in the "Value (RM)" column.

The data points that were created appear under [🔗 Dashboards \[► 26\]](#) in the Item Browser once you press the  button. The Item Browser shows data points that are read out by the device, as well as quality features such as errors, interval times, etc.

Information on the individual parameters can be found in section [🔗 60870 Server \[► 58\]](#).

5.2.1.4 Parameterizing 60870 Clients

In the following example, we want to establish a connection to a customer substation. The customer substation needs to send data from various fields to the application.

1. Navigate to the **60870 Clients** menu.
2. First select the telecontrol protocol from the "Device Details" drop-down list.
 - ⇒ The relevant parameters, which depend on the selection, appear to the right of the drop-down list.
3. Enter the parameters in the fields.
4. Enter the IP address of the customer substation.
5. In the "Station / Device Name" field, assign a name for the client (e.g., customer substation) and enable the client.
6. In the table below, click in the "Field Name" field and assign names for the required fields (input field, transition field, etc.).

Note: You can create at most 24 fields per station.
7. If applicable, group your fields by clicking on the checkboxes.
8. In the table on the right, create the data points you need for each of your fields.

9. Enter the data type in the "tk" field (single/double-point information, step position, measured value, etc.).
10. Enter a unique object address for the selected object type in the "IOA" column.
11. Assign names for the data points in the "Name" input field.
12. For a "Command" data type – for example, one that is relevant for a power plant – click in the "Source" field to subscribe to the command.
 - ⇒ The "Select Data Point" dialog opens; see section [🔗 "Select Data Point" Dialog \[▶ 25\]](#).
13. Finally click the **[Save]** button.
 - ➔ The application attempts to establish a connection to the customer substation in order to receive the values. If the connection is successful, the values that are read appear in the "Value" column.
The data points that were created appear under [🔗 Dashboards \[▶ 26\]](#) in the Item Browser once you press the  button. The Item Browser shows data points that are read out by the device, as well as quality features such as errors, interval times, etc.

Information on the individual parameters can be found in section [🔗 60870 Clients \[▶ 68\]](#).

5.2.1.5 Parameterizing an I/O Module

In the following example, we want to send a command from the control center to the channel of a digital output.

- ✓ You need to have created a command in the [🔗 60870 Server \[▶ 58\]](#) menu, e.g., a type 45 switching command.
1. Navigate to the **I/O** menu.
 2. Click in the "Source" column of a channel of your digital output.
 - ⇒ The [🔗 "Select Data Point" Dialog \[▶ 25\]](#) opens.
 3. Subscribe to the switching command you created (**IEC 60870 > Server > ...**).
 - ⇒ The entire path appears in the column.
 4. If necessary, invert the signal by checking the "NOT" box.
- ➔ As soon as the switching command has arrived at the digital output, the `FALSE` value changes to `TRUE` in the "Raw Value" column. The output state on the channel changes from `off` to `on`.

Information on the individual parameters can be found in section [🔗 I/O \[▶ 44\]](#).

5.2.1.6 Parameterizing an Event Logger

The following example shows the creation of an event logger for monitoring connection states:

1. Navigate to the **Event Logger** menu.
2. Click in the "Monitored Data Point" column.
 - ⇒ The [🔗 "Select Data Point" Dialog \[▶ 25\]](#) opens.
3. Click through the entries marked in **bold** until you reach the data point you want to monitor, such as a Modbus device.

4. Select the "Connection" item and click **[OK]**.
 - ⇒ The selected data point appears, indicating the path.
5. Assign a name in the "Name" column.
6. Check the "To File" and/or "As Items" box(es) to write the event to a file and/or place it in the internal data layer.
7. If you want to write the event to the application log file, check the "Write to Application Log" box.
8. If you want to write the event to your own log file, check the "Write to Own Log File" box and enter the path in the field.
 - ⇒ The file can be saved to the working directory of CODESYS or to an SD card (/media/sd/log).
9. Click the **[Save]** button to subscribe to the data point.
 - ➔ Whenever the subscribed value changes, such as when a connection to a Modbus device is disconnected, a message is written to the log file. Depending on which boxes have been checked, the messages are written to your own log file, to the application log file or as items in the internal data layer. The data points stored in the internal data layer are shown in the  **Dashboards** [\[> 26\]](#).

Information on the individual parameters can be found in section  **Event Logger** [\[> 72\]](#).

5.2.1.7 Parameterizing a Data Logger

The following example shows the creation of a data logger for monitoring connection states:

1. Navigate to the **Data Logger** menu.
2. Click within the "Source" column.
 - ⇒ The  **"Select Data Point" Dialog** [\[> 25\]](#) opens.
3. Click through the entries marked in **bold** until you reach the data point you want to monitor, such as a Modbus device.
4. Select the "Connection" item and click **[OK]**.
 - ⇒ The selected data point appears, indicating the path.
5. Assign a name in the "Data Point Name Header" column.
6. Check the "Data Logger On" box to write the event to a file and place it in the internal data layer.
7. Enter the storage location in the field.
 - ⇒ **Note: The file can be saved to the working directory of CODESYS or to an SD card (/media/sd/log).**
8. Check the "Log Cyclically" and/or "Log upon Data Change" box as needed.
9. Select the format you want from the "Data Format" drop-down list.
10. Click the **[Save]** button to subscribe to the data point.
 - ➔ Whenever the subscribed value changes, such as when a connection to a Modbus device is disconnected, a message is written to the log file. Depending on which boxes have been checked, the messages are written to your own log file, to the application log file or as items in the internal data layer. The data points stored in the internal data layer are shown in the  **Dashboards** [\[> 26\]](#).

Information on the individual parameters can be found in section [🔗 Data Loggers \[► 74\]](#).

5.2.1.8 Configuring Sparkplug

- ✓ You must have either created your signal sources in the application as data points (Modbus® devices, I/O modules, etc.) or loaded a completed configuration from a file (application.cnf).
- 1. Select the top entry "Node" in the left pane.
 - ⇒ The data points of the entry appear in the right pane.
- 2. Change the name and the field name if necessary.
- 3. Click the [...] button.
 - ⇒ The [🔗 "Device Details" Dialog \[► 76\]](#) dialog opens.
- 4. Configure the transmission type and the Boolean value if necessary.
- 5. Click in the "Connection status" field.
 - ⇒ The [🔗 "Select Data Point" Dialog \[► 25\]](#) dialog opens.
- 6. Subscribe to a data point that reports the connection status.
- 7. Click **[OK]**.
- 8. Select a data point in the area on the right.
- 9. Change the name if necessary.
- 10. Click the [...] button.
 - ⇒ The [🔗 "Metric Details" Dialog \[► 77\]](#) dialog opens.
- 11. Configure your data point and then click **[OK]**.
- 12. Configure all the data points for the Node entry one after the other.
- 13. Repeat steps 1 to 12 for the next entry in the left table.
- 14. Check the "On" box for all entries that should send to the cloud.
- 15. Enable the Cloud service and click **[Save]**.
- ➔ The configuration is saved and the Sparkplug function is now active.

5.2.2 Making System Settings

5.2.2.1 Commissioning an MQTT Broker

- ✓ To install an MQTT broker on your local controller later, you will need an IPK file provided by WAGO.
- 1. In WBM, navigate in the menu to **Configuration > Software Uploads**.
- 2. In the "Software File" field, upload the IPK file.
- 3. Click the **[Install]** button.
 - ⇒ The Docker container with the MQTT broker is started.
- 4. In the application, navigate in the menu to **Application > Data Logger**.
- 5. Check the "external MQTT broker" box.
- 6. Enter the following address in the "Host" field: 127.0.0.1
Note: If the MQTT service is running on a different device, enter the host address of the external device here.

7. Set the remaining parameters in the dialog; see [🔗 Data Layer \[► 34\]](#).
 8. Finally, click **[Save]**.
- ➔ All the configured data is now also available in the MQTT broker.

5.2.2.2 Managing Users

Create a New User

1. Navigate in the menu to **Application > Users**.
 2. Click within an empty row in the table on the left.
 3. Assign a password that meets the password requirements; see [🔗 Users \[► 37\]](#).
 4. Reenter the password.
 5. Select a group from the “New Group” drop-down list.
 6. Assign a name in the “New User” field and click the **[Create User]** button.
- ➔ Once the new user has been saved successfully, it appears in the table on the left.

Assign Users to a New Group

7. Click within the corresponding row in the table on the left.
 8. Select a new group from the “New Group” drop-down list and click the **[Change Group]** button.
- ➔ Once the new user account has been saved successfully, it appears in the table on the left with the new group. Depending on the priority, the user moves one row higher or lower.

Change Password

9. Click within the corresponding row in the table on the left.
 10. Assign a new password that meets the password requirements; see [🔗 Users \[► 37\]](#).
 11. Reenter the password and click the **Change Password** button.
- ➔ The new password is saved.

5.3 Application Examples

5.3.1 Reading Out Short Circuit and Ground Fault Indicators (Measurement Devices via Modbus)

In the following application example, multiple Modbus devices are read out to monitor a medium-voltage switchgear unit and low-voltage outputs simultaneously.

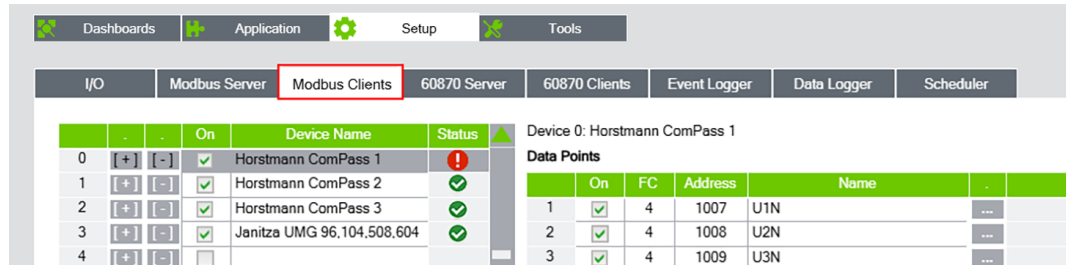


Figure 46: Reading Out Short Circuit and Ground Fault Indicators

1. Navigate in the menu to **Parameterization > Modbus Devices**.
 2. In the table on the left, click in the column with the [+].
 3. Select a device (e.g., Horstmann ComPass B or Janitza) from the dialog that opens.
⇒ The data points from the template appear in the table on the right.
 4. Activate the device by checking the "On" box.
 5. Activate the data points by checking the "On" boxes.
 6. Repeat steps 2 to 4 for all Modbus devices.
 7. Finally click the **[Save]** button.
- ➔ The application attempts to establish a connection to the devices and read out the values. If the connection is established without errors, the status of the query interval and response time is displayed in the table below. The Modbus® devices that were created appear under **Dashboards [► 26]** in the Item Browser once you press the **↺** button.

For more information, see section **Modbus Clients [► 55]**.

5.3.2 Monitoring Modbus Devices via CSV/FTP Push or Cloud

In the following application example, the data of multiple Modbus devices is recorded via a data logger and sent either via FTP to an external server or via MQTT to a cloud.

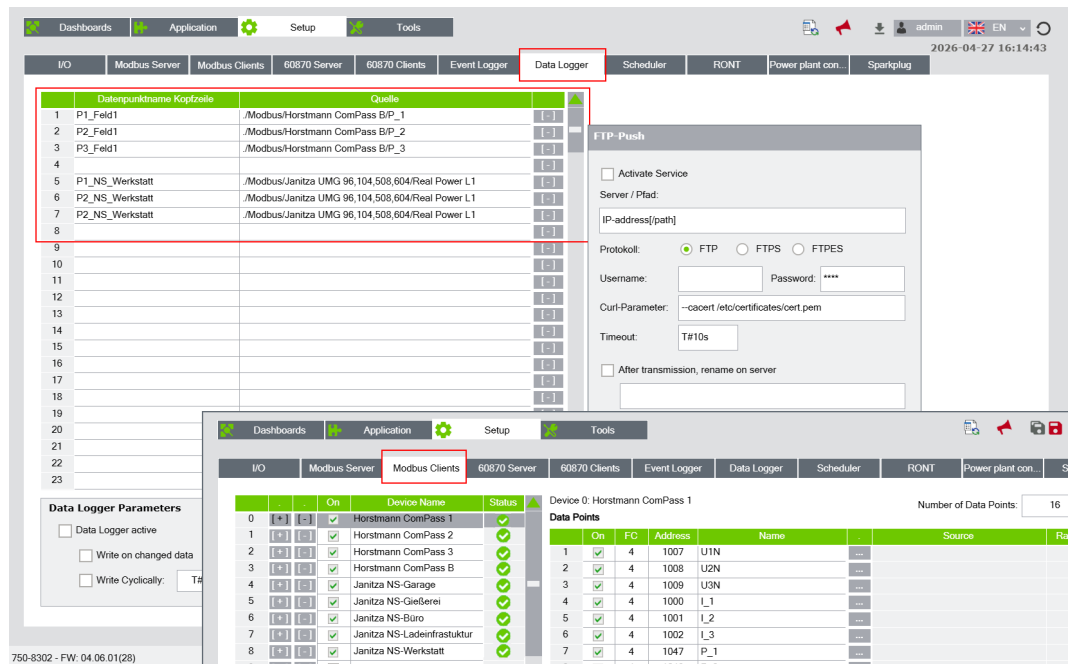


Figure 47: Monitoring Modbus Devices via CSV/FTP Push or Cloud

✓ You need to have added various devices and switched them on in the **Modbus Devices** menu; see section [Parameterizing Modbus Clients \[p. 79\]](#).

1. Navigate in the menu to **Parameterization > Data Logger**.
2. In the "Data Point Name Header" column, provide column names for the log file in CSV format.
3. In the "Source" column, select the Modbus device you created; see ["Select Data Point" Dialog \[p. 25\]](#).
4. In the "Data Logger Parameters" area, specify the interval at which the data from the Modbus devices should be written to the log file.
5. If necessary, edit the filename with wildcards.
Note: That way, you can parameterize the name to include predefined values; see the tooltip.
6. Enable the data logger with the checkbox.
7. If you want the log data to be sent to an external server via FTP, click the **[Set up FTP Push ...]** button.
⇒ The "FTP Push" dialog opens.
8. Enable the service via the checkbox.
9. Enter the IP address and other required data and then click **[OK]**.
10. If you want the log data to be sent to a cloud via MQTT, you must first enable the MQTT broker in the [Data Layer \[p. 34\]](#) menu.
11. Parameterize your Webserver in the "Parameters" area.
12. Finally click the **[Save]** button.

For more information, see section [Data Loggers \[p. 74\]](#).

5.3.3 Setting Up the Application as a Remote I/O Coupler

In the following application example, the data of the local I/O modules is either sent to the cloud via MQTT or provided via a Modbus / IEC 60870 server. The process image of all the connected I/O modules can be represented via Modbus registers.

Cloud

Note

Data points of the I/O interfaces are automatically transported via MQTT!

The data points of the I/O interfaces on the local bus are automatically transported via MQTT. MQTT cannot yet be used to set digital or analog outputs.

1. Navigate in the menu to **Application** > **Data Layer** [▶ 34].
2. Enable the MQTT broker.
3. Parameterize your Webserver in the "Parameters" area.
4. Finally click the **[Save]** button.

Modbus servers

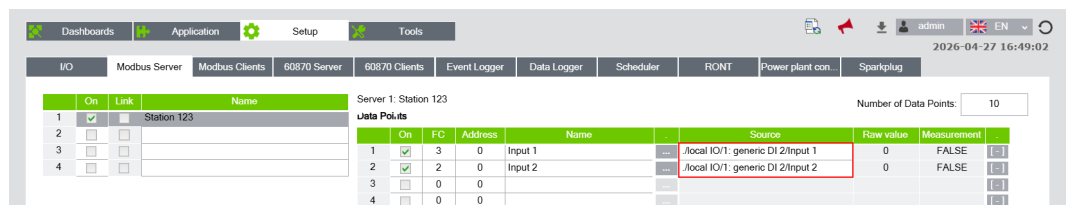


Figure 48: Providing I/O Data for Modbus Servers

5. Parameterize the Modbus server according to the description in section **Parameterizing a Modbus Server** [▶ 79].
6. Subscribe to the data points of your locally available I/O modules in the "Source" column. If you parameterize registers with write access, you can then assign them to digital or analog outputs later:
7. To do so, navigate in the menu to **Parameterization** > **I/O** [▶ 44].
8. Subscribe to the corresponding data points of the Modbus server for the respective outputs.

IEC 60870 Server

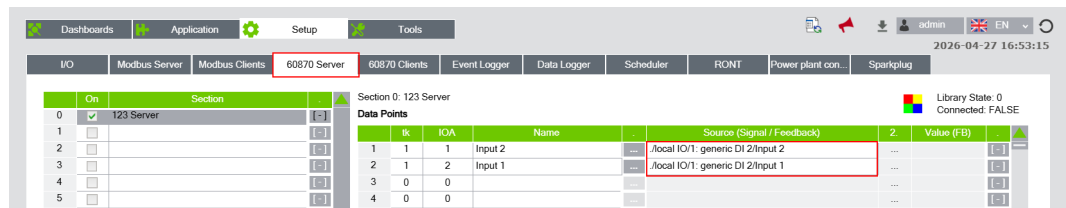


Figure 49: Providing I/O Data for IEC 60870 Servers

9. Parameterize the 60870 server as described in section [Parameterizing a 60870 Server](#) [[▶ 80](#)].
10. Subscribe to the data points of your locally available I/O modules in the “Source” column.
If you parameterize command objects (tk=45–63), you can then assign them to digital or analog outputs later:
11. To do so, navigate in the menu to **Parameterization** > [I/O](#) [[▶ 44](#)].
12. Subscribe to the corresponding data points of the Modbus server for the respective outputs.

For more information, see sections [I/O](#) [[▶ 44](#)], [Modbus Server](#) [[▶ 48](#)], [60870 Server](#) [[▶ 58](#)] and [Data Layer](#) [[▶ 34](#)].

5.3.4 Setting Up a Bidirectional Modbus TCP/RTU Gateway

In the use case described below, the profile of a Modbus device, which is connected serially via Modbus RTU, is mirrored in the application and made available via TCP over a Modbus server. This allows communication from Modbus TCP to RTU and vice versa.

Note

Corresponds to the functionality of item number 879-9000

This application corresponds to the functionality of the WAGO communication module, which expands a WAGO energy meter and other Modbus RTU slaves with ETHERNET access.

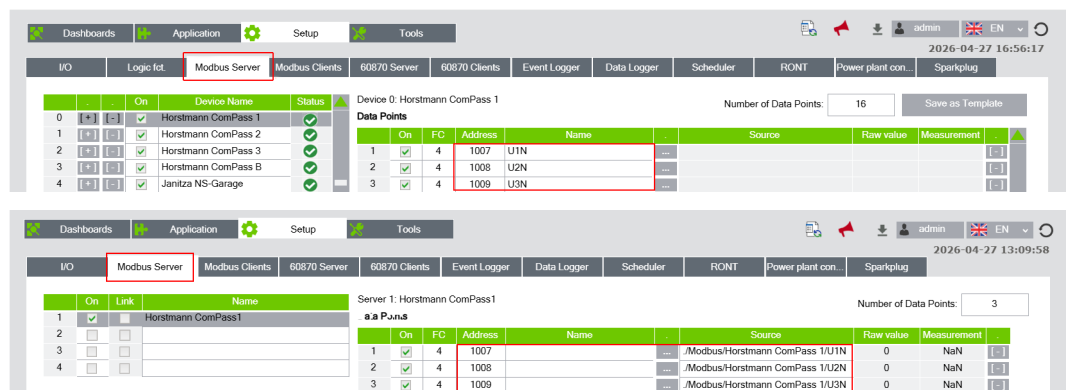


Figure 50: Setting Up a Bidirectional Modbus TCP/RTU Gateway

1. Navigate in the menu to **Parameterization > Modbus Devices**.
2. In the table on the left, click in the column with the [+].
3. Select a device (e.g., Horstmann ComPass B or Janitza) from the dialog that opens.
⇒ The data points from the template appear in the table on the right.
4. Activate the device by checking the "On" box.
5. Activate the data points by checking the "On" boxes.
6. Finally click the **[Save]** button.
7. Parameterize the Modbus server according to the description in section [Parameterizing a Modbus Server \[p. 79\]](#).
8. Subscribe to the data points of your Modbus devices in the "Source" column.

For more information, see sections [Modbus Server \[p. 48\]](#) and [Modbus Clients \[p. 55\]](#).

5.3.5 Setting Up the IEC 60870 Interface for Control Centers

In the following application, a customer substation is parameterized in the **60870 Server** menu, i.e., a network operator interface is represented as an IEC-60870 server. Various fields are created (see below), each with its own set of data points. The digital signals from the local bus and the measured values from the Modbus devices are entered into the data point image of the network operator.

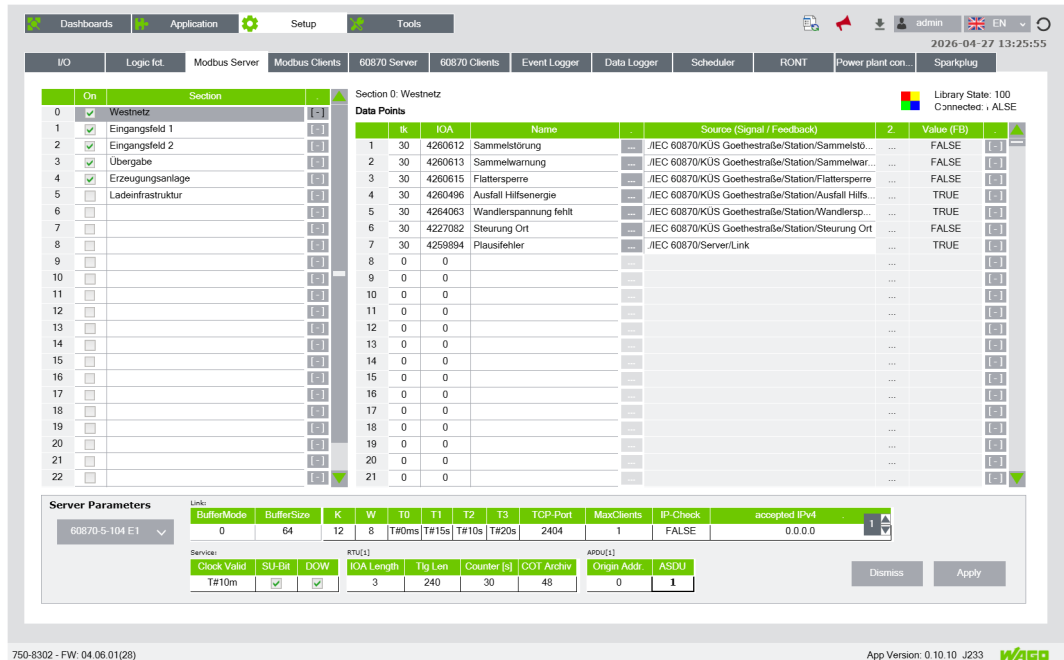


Figure 51: Setting Up the IEC 60870 Interface for Control Centers

- Parameterize the 60870 server as described in section [Parameterizing a 60870 Server \[► 80\]](#).

For more information, see section [60870 Server \[► 58\]](#).

5.3.6 Setting Up a Network Operator Gateway with Media Discontinuity

The application described below involves one-to-one mirroring of an IEC 60870 server profile onto an IEC 60870 client profile and translation from the IEC 60870-5-104 protocol to IEC 60870-5-101 or vice versa.

Through the client connection, the data from the customer substation is queried via IEC 60870-5-101 (serial connection). The server then functions as a gateway and subscribes to this data so it can be read out from the control center via IEC 60870-5-104. The media discontinuity in the transmission chain occurs between the customer and control center networks, which are separated from each other.

The screenshot displays the 'Setup' tab of the WAGO Application Grid Gateway Professional software. The '60870 Clients' configuration is active, showing 'Device 1 / 0: Station'. The 'Data Points' table lists the following entries:

tk	IOA	Name	Value
1	30	4260612	Sammelstörung
2	30	4260613	Sammelwarnung
3	30	4260615	Flattersperre
4	30	4260496	Ausfall Hilfsenergie
5	30	4264063	Wandlerspannung fehlt
6	30	4227082	Steuerung Ort

The '60870 Server' configuration is also visible, showing 'Section 0: Westnetz'. The 'Data Points' table lists the following entries:

tk	IOA	Name	Source (Signal / Feedback)
1	30	4260612	/IEC 60870/KUS Goethestraße/Station/S
2	30	4260613	/IEC 60870/KUS Goethestraße/Station/S
3	30	4260615	/IEC 60870/KUS Goethestraße/Station/F
4	30	4260496	/IEC 60870/KUS Goethestraße/Station/A
5	30	4264063	/IEC 60870/KUS Goethestraße/Station/W
6	30	4227082	/IEC 60870/KUS Goethestraße/Station/S
7	30	4259894	/IEC 60870/Server/Link
8	0	0	
9	0	0	
10	0	0	
11	0	0	
12	0	0	
13	0	0	
14	0	0	
15	0	0	
16	0	0	
17	0	0	
18	0	0	
19	0	0	
20	0	0	
21	0	0	
22	0	0	

The 'Server Parameters' section shows the following settings:

Link	BufferMode	BufferSize	K	W	T0	T1	T2	T3	TCP-Port	MaxClients	IP-Check	accepted IPv4
60870-5-104 E1	0	64	T2	8	T#0ms	T#15s	T#10s	T#20s	2404	1	FALSE	0.0.0.0

The 'Device Details' section shows the '60870-5-101' protocol selected.

Figure 52: Setting Up a Network Operator Gateway with Media Discontinuity

1. Parameterize the customer substation first; see section [Parameterizing 60870 Clients](#) [► 81].
2. Then mirror the data for the server; see section [Parameterizing a 60870 Server](#) [► 80].

For more information, see sections [60870 Server](#) [► 58] and [60870 Clients](#) [► 68].

6 Appendix

6.1 Modbus Error Codes

Name	Hexadecimal Value	Decimal value
OK	16#00	0
NOT_SUPPORTED_FUNCTION	16#01	1
ILLEGAL_ADDRESS	16#02	2
ILLEGAL_DATA	16#03	3
SLAVE_DEVICE_FAILURE	16#04	4
SLAVE_DEVICE_BUSY	16#06	6
MEMORY_PARITY_ERROR	16#08	8
GATEWAY_PATH_UNAVAILABLE	16#0A	10
EXTENDED_SLAVE_ERROR	16#90	144
NOT_ALLOWED_BROADCAST	16#95	149
CRC_ERROR	16#96	150
ILLEGAL_NUMBER_OF_POINTS	16#97	151
OVERRUN	16#98	152
TIME_OUT	16#99	153
TX_TIME_OUT	16#9A	154
INVALID_IDENTITY_OBJECT	16#9B	155
NOT_SUPPORTED_MEI_TYPE	16#9C	156
NOT_SUPPORTED_OBJECT_ID	16#9D	157
ILLEGAL_OBJECT_LENGTH	16#9E	158
INVALID_MB_BASE_FC_OBJECT	16#9E	160
INVALID_TRANSPORT_CHANNEL	16#A0	240
INVALID_PARAMETER	16#F1	241
ILLEGAL_ADDRESS_RANGE	16#F2	242
TX_BUFFER_TOO_SMALL	16#F3	243
INVALID_FRAME_LENGTH	16#F4	244
INVALID_POINTER	16#F5	245
INVALID_FRAMETYP	16#F6	246
BUSY	16#FF	255
DM_LOWERBOUND	16#100	90368
DM_UPPERBOUND	16#200	90624
DM_AREA_CONFLICT	16#300	90880
DM_NO_SPACE_FOR_AREA	16#400	91136
DM_ACCESS_DENIED	16#500	91392
DM_INVALID_INTERFACE_REFERENCE	16#900	92416
UNKNOWN	16#FFFF	1507327

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