SIEMENS

SICAM Q200 7KG97

Class A Power Quality Instrument and Power Monitoring Device

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Class A Power Quality Instrument and Power Monitoring Device

SICAM Q200 7KG97

V2.70

Manual

E50417-H1040-C606-B2

NOTE

For your own safety, observe the warnings and safety instructions contained in this document, if available.

Disclaimer of Liability

Subject to changes and errors. The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

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Version of the product described: V2.70

Preface

Purpose of the Manual

This manual describes the application, functions, installation, commissioning, and operation of the Class A Power Quality Instrument and Power Monitoring Device Q200.

Target Audience

This manual is intended for project engineers, commissioning, and operating personnel in electrical systems and power plants.

Scope

This manual is valid for the Class A Power Quality Recorder and the Multifunctional Monitoring Device SICAM Q200.

Indication of Conformity

This product complies with the directive of the Council of the European Communities on harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2014/30/EU) and concerning electrical equipment for use within specified voltage limits (Low Voltage Directive 2014/35/EU).

This conformity has been proved by tests performed according to the Council Directive in accordance with the generic standard EN 61000-6-5 (for EMC directive) and with the product standard EN 62586-1 (for Low Voltage Directive) by Siemens AG.

The device is designed and manufactured for application in an industrial environment.

The product conforms with the international standards of EN 62586 and the German standard VDE 0415.

Standards

<table>
<tr><td colspan="2">This product is UL-certified to Standard UL 61010-1, third edition, based on the Technical data.
(UL File No.: E228586)</td></tr>
<tr><td>IND. CONT. EQ.
69CA</td><td>Open-type Measuring Equipment
2UD1</td></tr>
<tr><td colspan="2">For further information see UL database on the Internet: http://ul.com.
Select Online Certifications Directory and insert E228586 under UL File Number.</td></tr>
</table>

Additional Support

For questions about the system, contact your Siemens sales partner.

Customer Support Center

Our Customer Support Center provides a 24-hour service.

Siemens AG
Smart Infrastructure – Protection Automation
Customer Support Center

Tel.: +49 911 2155 4466
E-Mail: energy.automation@siemens.com

Training Courses

Inquiries regarding individual training courses should be addressed to our Training Center:

Siemens AG
Siemens Power Academy TD
Humboldtstraße 59
90459 Nuremberg
Germany

Phone: +49 911 9582 7100
E-mail: poweracademy@siemens.com
Internet: www.siemens.com/poweracademy

Notes on Safety

This document is not a complete index of all safety measures required for operation of the equipment (module or device). However, it comprises important information that must be followed for personal safety, as well as to avoid material damage. Information is highlighted and illustrated as follows according to the degree of danger:

DANGER

DANGER means that death or severe injury **will** result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid death or severe injuries.

WARNING

WARNING means that death or severe injury **may** result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid death or severe injuries.

CAUTION

CAUTION means that medium-severe or slight injuries **can** occur if the specified measures are not taken.

✧ Comply with all instructions, in order to avoid moderate or minor injuries.

NOTICE

NOTICE means that property damage **can** result if the measures specified are not taken.

✧ Comply with all instructions, in order to avoid property damage.

NOTE

Important information about the product, product handling or a certain section of the documentation which must be given attention.

Qualified Electrical Engineering Personnel

Only qualified electrical engineering personnel may commission and operate the equipment (module, device) described in this document. Qualified electrical engineering personnel in the sense of this document are people who can demonstrate technical qualifications as electrical technicians. These persons may commission, isolate, ground and label devices, systems and circuits according to the standards of safety engineering.

Proper Use

The equipment (device, module) may be used only for such applications as set out in the catalogs and the technical description, and only in combination with third-party equipment recommended and approved by Siemens.

Problem-free and safe operation of the product depends on the following:

- Proper transport
- Proper storage, setup and installation
- Proper operation and maintenance

When electrical equipment is operated, hazardous voltages are inevitably present in certain parts. If proper action is not taken, death, severe injury or property damage can result:

- The equipment must be grounded at the grounding terminal before any connections are made.
- All circuit components connected to the power supply may be subject to dangerous voltage.
- Hazardous voltages may be present in equipment even after the supply voltage has been disconnected (capacitors can still be charged).
- Operation of equipment with exposed current-transformer circuits is prohibited. Before disconnecting the equipment, ensure that the current-transformer circuits are short-circuited.
- The limiting values stated in the document must not be exceeded. This must also be considered during testing and commissioning.

Selection of Used Symbols on the Device

No.	Symbol	Description
1		Direct current, IEC 60417, 5031
2		Alternating current, IEC 60417, 5032
3		Direct and alternating current, IEC 60417, 5033
4		Earth (ground) terminal, IEC 60417, 5017
5		Protective conductor terminal, IEC 60417, 5019
6		Caution, risk of electric shock
7		Caution, risk of danger, ISO 7000, 0434
8		Protective Insulation, IEC 60417, 5172, Safety Class II devices
9		Guideline 2002/96/EC for electrical and electronic devices

No.	Symbol	Description
10	EAC	Guideline for the Eurasian Market
11		Mandatory Conformity Mark for Electronics and Electrotechnical Products in Morocco

OpenSSL

This product includes software developed by the OpenSSL Project for use in OpenSSL Toolkit (*http://www.openssl.org/*).

This product includes software written by Tim Hudson (*tjh@cryptsoft.com*).

This product includes cryptographic software written by Eric Young (*eay@cryptsoft.com*).

Table of Contents

1 Introduction

1.1 User Information

Application

The SICAM Q200 device is a multifunctional device with power quality class A and energy class 0.1S certifications.

The device is characterized by the following properties:

- Power Quality instrument - Class A (PQI - A) for all normative IEC 61000-4-30 Ed.3 and IEC 62586-1/2 Ed.2
- Third-party certifications at class 0.1S for energy, complying with IEC 62053-22, IEC 62053-23, and IEC 62053-24
- Voltage frequencies in the range from 2 kHz to 150 kHz
- Transient detection with 1.024 MHz (1-µs resolution)
- Web browser for parameterization and evaluation, full PQ analysis, and easy-to-read analysis according to EN 50160 and IEEE 519 standards
- Complete cybersecurity features, including HTTPS, RBAC, security logs, and digital signed firmware
- Fixed installation, indoor
- For application in EMC environment, Class G

The device measures voltages up to 480 V in 1-phase systems and in 3-wire and 4-wire systems (with neutral phase). The input circuits for voltage measurement can be used in IT, TT and TN networks. To ensure galvanic separation for current measurements, the lines connected to the current measurement inputs are galvanically separated from the current transformers.

If external voltage and current transformers are not used, the device can process rated input alternating voltages of up to $V_{Ph\text{-}N}$ = 230 V (110 V for UL condition), $V_{Ph\text{-}Ph}$ = 400 V (290 V for UL condition) and rated input alternating currents up to 5 A.

The energy management functions also allow determining load profiles and settings up to 8 tariffs. In addition to the measuring function, the device provides records of the measured values and records and forecasts the load profile in programmable time intervals. Long-term data and events are analyzed and output as reports according to voltage-quality standards, for example EN 50160 and IEEE 519.

The integrated Web Server can be used to set the parameters and display the measured values on HTML pages of the connected computer. With the graphic display on the front panel, a limited parameterization via softkeys can be carried out and measured values are shown at display.

To communicate with control systems and other process automation equipment and to transmit, for example, operational measured values, metered values, indications, and load profiles, the device provides 2 configurable Ethernet interfaces and an RS485 interface with 2 connectors for serial communication. The serial communications are also used for realizing slave devices with Modbus serial connections, gateway, and Modbus master functions.

To transmit data files for power quality in PQDIF (IEEE 1159.3) and waveforms in COMTRADE, the device uses the Ethernet interfaces via the IEC 61850 protocol. For example, the data files in PQDIF and COMTRADE can be transmitted to the SICAM PQS system and SICAM PQ Advisor software.

The device has optionally 2 binary input/output modules. Each module has 3 binary inputs and 3 binary outputs (relays). You can use the binary input as an external trigger to generate the synchronization pulse for the load profile. You can use the relay output to give indications or use the relay output as an energy pulse output.

Security

To ensure a high level of security (for example IT industry), the access to the device is controlled by the role-based access control (RBAC).

Further security features are:

- HTTPS
- FTPS

- Automatic logout after a timeout of no action
- Audit log
- Syslog
- Firmware with digital signature
- Simple Network Management Protocol v3 (SNMPv3)
- Disabling of ports
- Modbus TCP as read only

Measured Quantities

The following measured quantities can be recorded or calculated:

- Power frequency
- Magnitude of supply voltage
- Flicker
- Supply voltage dips, swells, and interruptions
- Voltage unbalance
- Voltage harmonics and interharmonics
- Rapid voltage changes (RVC)
- Current magnitude
- Current harmonics and interharmonics
- Current unbalance
- Emissions 2 kHz to 9 kHz
- Emissions 9 kHz to 150 kHz
- Active, reactive, and apparent power
- Active, reactive, and apparent energy
- Power factor and active power factor
- Harmonic power
- Voltage and current THDS (Subgroup Total Harmonic Distortion) and TDD (Total Demand Distortion)
- Phase angles
- Harmonic phase angles

The uncertainty of operational measured quantities is compliant to the IEC 62586-1 product standard, class A (leading standard), the IEC 61000-4-30, Ed. 3 power quality standard.

For detailed information on measured values and measured quantities, see chapter *2.5.4 Measurands* and the Technical data in chapter *13 Technical Data*.

Functionality of Records

The device can record measured values, events, and load profiles in parameterizable time intervals. The following types of records are used:

- Measurement records:
  Recording of PQ measured quantities acc. to IEC 61000-4-30 (for example, frequency and voltage magnitude) and non-PQ measured quantities (for example, currents and power) as well as parameterized periods, for example, 10-second frequency, voltage aggregation, current, and power, emissions 2 kHz to 9 kHz, and emissions 9 kHz to 150 kHz

- Trend records:
  Long-term recording and monitoring of the voltage-change history within a parameterized time period in programmable tolerance ranges; 1/2 cycle RMS values
- Waveform records:
  Recording of voltage and current sampled values with 40.96 kHz (at 50 Hz, about 819 samples per system period) using programmable triggers
- Event records:
  Recording of voltage events (acc. to IEC 61000-4-30: swells, dips, interruptions)
- Load-profile records:
  Recording of load profiles determined on the basis of 10/12 cycles (50 Hz/60 Hz)

The device hosts a 2 GB micro SD card for storing the records.

Energy Management

As part of the energy management, the device records load profiles according to the *Fixed Block* or *Rolling Block* method for all power quantities and provides load-profile forecasts for the parameterized intervals. Additionally, it is possible to calculate up to 8 tariffs (TOU = Time of Use). Synchronization is processed with external or internal triggers.

Communication

The device has 2 Ethernet ports which can be used as 2 independent Ethernet interfaces (in different networks) or as 2 ports of the integrated Ethernet switch (in 1 network). Ethernet supports the device parameterization, transmission of measured values, metered values, load profiles, and indications/events and the time synchronization with NTP. The supported Ethernet communication protocols are HTTPS, IEC 61850, FTPS, Modbus TCP, SNMPv3, and DNP3 IP.

The RS485 interface (1 interface with 2 connectors) allows Modbus RTU master and Modbus RTU slave protocols/functionalities.

Email Notification

The device supports sending email alerts about power quality events and indication changes. The emails are sent via an SMTP server.

Time Synchronization

During operation, the device needs the date and time for all time-relevant processes. This ensures that a common time basis exists when communicating with peripheral devices and enables time stamping of the process data.

The following types of time synchronization can be executed:

- External time synchronization via Ethernet NTP (preferred)
- External time synchronization via fieldbus
- Internal time synchronization via RTC (if external time synchronization is not available)

Parameterization

Parameters are set using an internal Web browser with HTML pages from the connected computer (preferred).

In addition, a parameterization of the device is possible with use of the 4 softkeys and display on the front of the device. Not all parameters can be changed.

1.2 Device Overview

It is a multifunctional device for detection, calculation, recording, evaluation, display, and transmission of measured electrical quantities with the following properties:

Device Properties

All devices consistently provide the following properties:

- Device type:
  - Class A Power Quality Instrument and Power Monitoring Device with a 2 GB micro SD card
  - Panel flush-mounting device with display for measured values and parameterization
  - Plastic case 192 mm/7.56 inch x 96 mm/3.78 inch x 134.6 mm/5.3 inch (W x H x D)
  - Web server for parameterization, visualization, and data management
  - Transmitting measured values using communication protocols
  - Degree of protection:
    - Front: IP40 (standard)
    - Front: IP54 (with separate seal between housing and switch panel)
    - Terminals: IP20 (behind switch panel)
- Input and output circuits:
  - 4 inputs for alternating voltage measurements
  - 4 inputs for alternating current measurements
  - Up to 2 binary modules; each binary module has:
    - 3 binary inputs, for example, for synchronization pulses of the load profile or external triggers
    - 3 binary outputs (relay contacts)

- Measurement acc. to standard IEC 61000-4-30 Ed. 3, class A
- Measured quantities:
  - Voltage V
  - Current I
  - Phase angle φ
  - System frequency f (fundamental)
  - 10-s frequency
  - Active power P (accuracy class 0.1S; ANSI C12.20 current accuracy class 0.2 and current rating class 10)
  - Reactive power Q
  - Apparent power S
  - Energy measured values W
  - Active power factor cos φ
  - Power factor PF
  - Voltage and current harmonics up to 63rd, voltage and current interharmonics up to 49th, and voltage harmonics in the range from 2 kHz to 9 kHz and from 9 kHz to 150 kHz
  - THDS, THDR, THD-2650, TDD, and K-Factor
  - Crest factors
  - Flicker acc. to IEC 61000-4-15
  - Mains signaling voltage
  - Harmonics phase angles, harmonic power
- Measurements for evaluation and supervision
  - Minimum/mean/maximum values
  - Event detection: voltage dips, voltage swells, voltage interruptions
  - Limit violations
  - Energy management (load profiles, load forecasting, and tariffs)
  - Rapid voltage change (RVC)
  - Transient detection
- Communication interfaces
  - Communication via Ethernet:
    - Only Modbus TCP protocol
    - Modbus TCP protocol, IEC 61850 server protocol, and/or FTPS secure file transfer
  - Serial communication via RS485
    - Protocol Modbus RTU slave
    - Protocol Modbus RTU master protocol and gateway function

- Data export
  - CSV data
    CSV for load profiles
  - PQDIF data
    IEEE1159.3: PQDIF for PQ records (events, measurements, records)
  - COMTRADE data
    IEC 60255-24/IEEE Std C37.111: Measuring relays and protection equipment – Part 24: Common format for transient data exchange (COMTRADE for power systems) for fault records
- Internal Ethernet switch
- Certificates
  - CE certification
  - UL certification

Characteristics of Specification

Function Symbols	Function	Class acc. to IEC 61000-4-30	Range	Additional Information
f	Power frequency	A	50 Hz (±15 %): 42.5 Hz to 57.5 Hz 60 Hz (±15 %): 51.0 Hz to 69.0 Hz	Magnitude of the supply > 2 V required
U	Magnitude of the supply voltage	A	10 % to 200 % U_{din}[1]	–
P_{st}, P_{lt}	Flicker	A	P_{st}: 0.2 to 10	Acc. to IEC 61000-4-15
U_{dip}, U_{swl}	Supply voltage dips and swells	A	–	–
U_{int}	Supply voltage interruptions	A	–	–
u_0, u_2	Supply voltage unbalance	A	Measuring range for u_0 and u_2: 0.5 % to 5.0 %	–
U_h	Voltage harmonics	A	10 % to 200 % of Class 3 of IEC 61000-2-4	–
U_{ih}	Voltage interharmonics	A	10 % to 200 % of Class 3 of IEC 61000-2-4	–
Under/over	Under/over deviation	–	–	–
RVC	Rapid voltage change	A	–	–
I	Magnitude of current	A	10 % FS to 150 % FS	Crest factor of 3
i_0, i_2	Current unbalance	A	–	–
I_h	Harmonic currents	A	–	–
I_{ih}	Interharmonic currents	A	–	–

Ordering Information

You can obtain the order information for the device from the catalog **SICAM – Power Quality and Measurements** with an order key or from *https://new.siemens.com/global/en/products/energy/energy-automation-and-smart-grid/power-quality-measurement.html*.

1 For example, an instrument specified for range of U_{din} = [100 V to 400 V] shall meet the uncertainty requirement for at least 10 V to 600 V for class A.

NOTE

This document describes all functions and features available in the device with a maximum equipment. You can find the individual equipment of your device in the ordering variant or the catalog mentioned above.

Scope of Delivery

The delivery comprises the following components depending on the ordering code:

- A device according to the ordering code (see catalog)
- Battery (insulated in the battery compartment of the device)
- A 2 GB micro SD card
- Assembly elements
- Product Information

Accessories

You can order the following accessories:

- Device manual, download available at *https://new.siemens.com/global/en/products/energy/energy-automation-and-smart-grid/power-quality-measurement.html*
- Service kit IP54
- Connectors for alternating voltage inputs
- Various cables as listed in the following tables:

Table 1-1 Cable Length

	Cable Length
Ethernet patch cable (double-shielded (SFPT), LAN connector plugs on both sides)	0.5 m
	1.0 m
	2.0 m
	3.0 m
	5.0 m
	10.0 m
	15.0 m
	20.0 m

1.3 Device Design

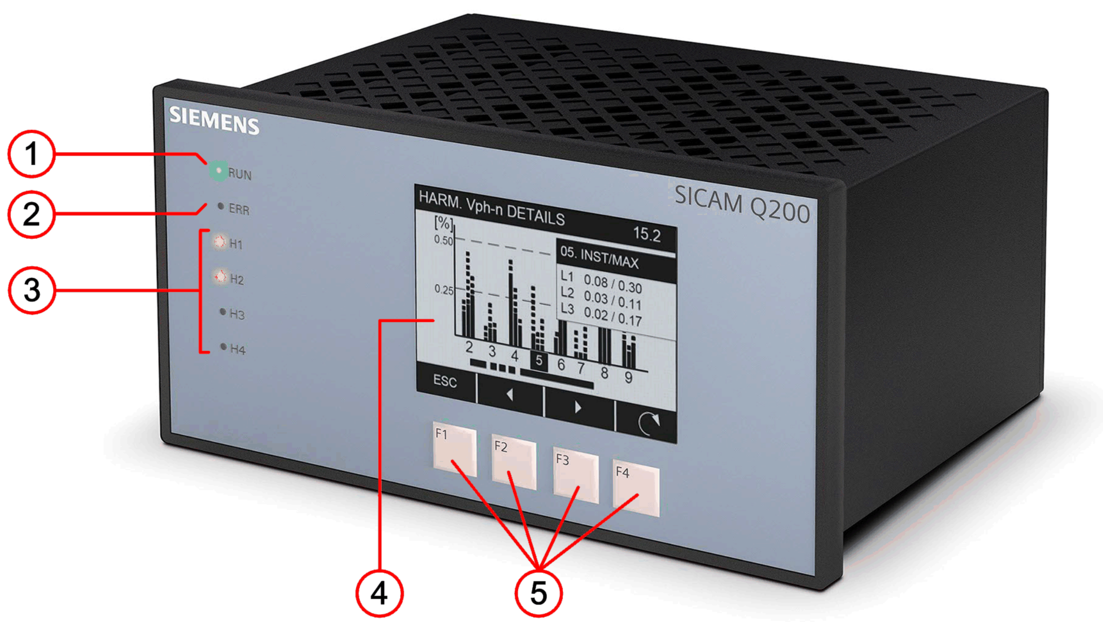
Mechanical Design

The device is designed for panel flush-mounting. The electrical modules are installed in a plastic case with the dimensions (W x H x D) 192 mm (7.56 inch) x 96 mm (3.78 inch) x 134.6 mm (5.3 inch).

The front side of the device contains the display, 4 softkeys located under the display, and 6 LEDs. The LEDs H1 to H4 and the LED ERROR can be parameterized. The green LED RUN signals the correct operation of the device.

All inputs and outputs are located at the rear of the device, as well as the communication interfaces and the power-supply input. A lithium battery is located under the removable cover of the battery compartment. The 2 GB micro SD card is inserted behind a removeable cover.

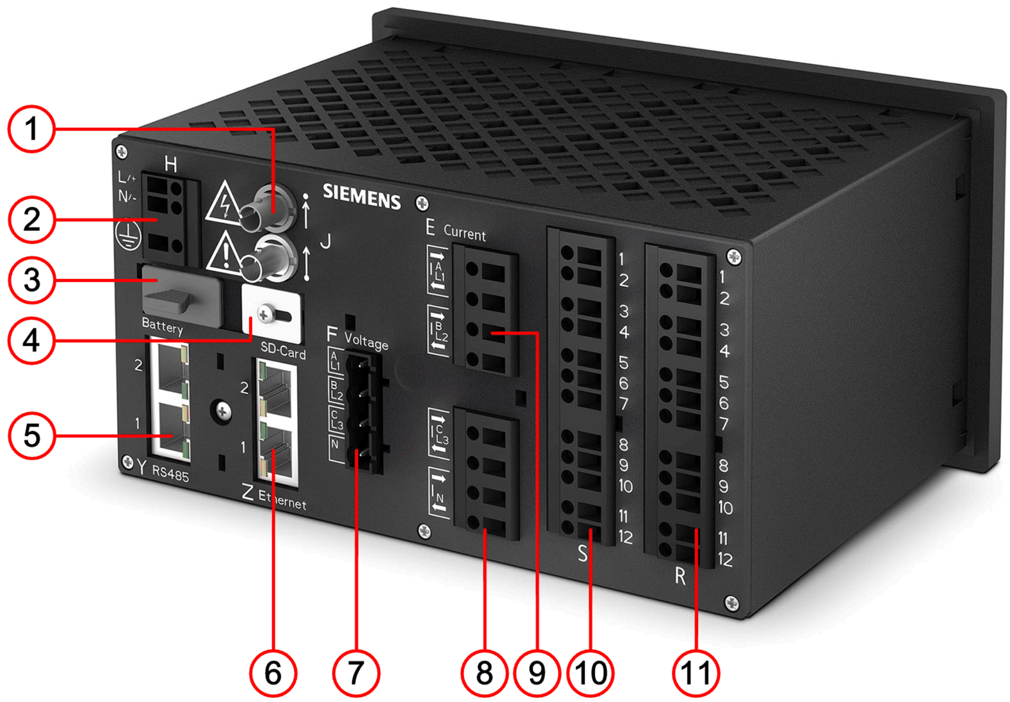
The device has 2 clips at the top and at the bottom or both sides for assembly in a switch panel. For devices according to degree protection IP54, see chapter *10.3 Assembly*.



[le_Q200_front side, 2, --_--]

Figure 1-1 Layout of SICAM Q200 – Front Side

(1)	LED RUN
(2)	LED ERROR for error configuration
(3)	LEDs H1 to H4 for free configuration
(4)	Display
(5)	Softkeys F1 to F4



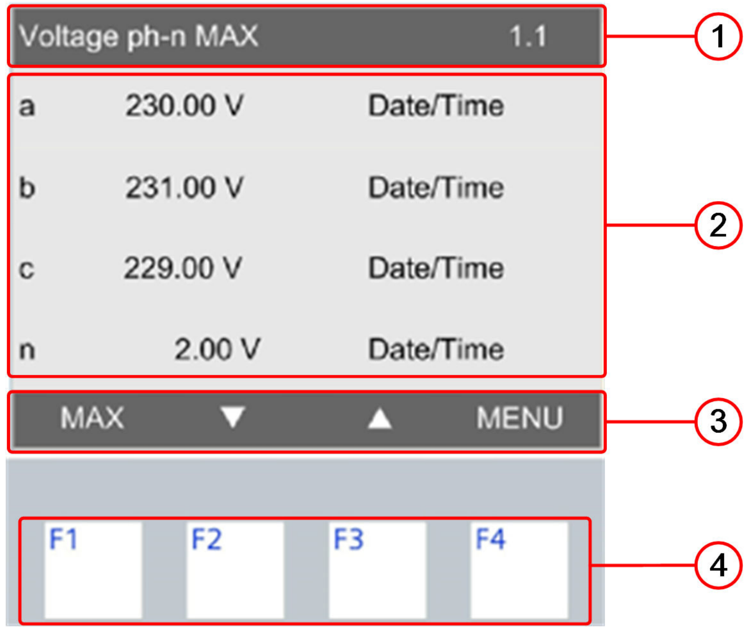
[le_Q200_rear-side, 2, --_--]

Figure 1-2 Layout of SICAM Q200 – Rear Side

(1)	Optical interfaces J (input, output)
(2)	Terminal block H for power supply
(3)	Battery compartment
(4)	Cover of micro SD card
(5)	Serial interface Y (2 parallel ports, RS485)
(6)	2 Ethernet interfaces Z1 and Z2
(7)	Terminal block F for voltage measurement
(8)	Terminal block E for current measurement (phase I_C and neutral phase I_N[2])
(9)	Terminal block E for current measurement (phases I_A and I_B)
(10)	Terminal block S, 3 binary inputs and 3 binary outputs
(11)	Terminal block R, 3 binary inputs and 3 binary outputs

2 Depending on the configuration for **AC Measurement**, the 4th physical current input can be used as I_N, I_4, or can be selected as **not connected**.

Display and Softkeys

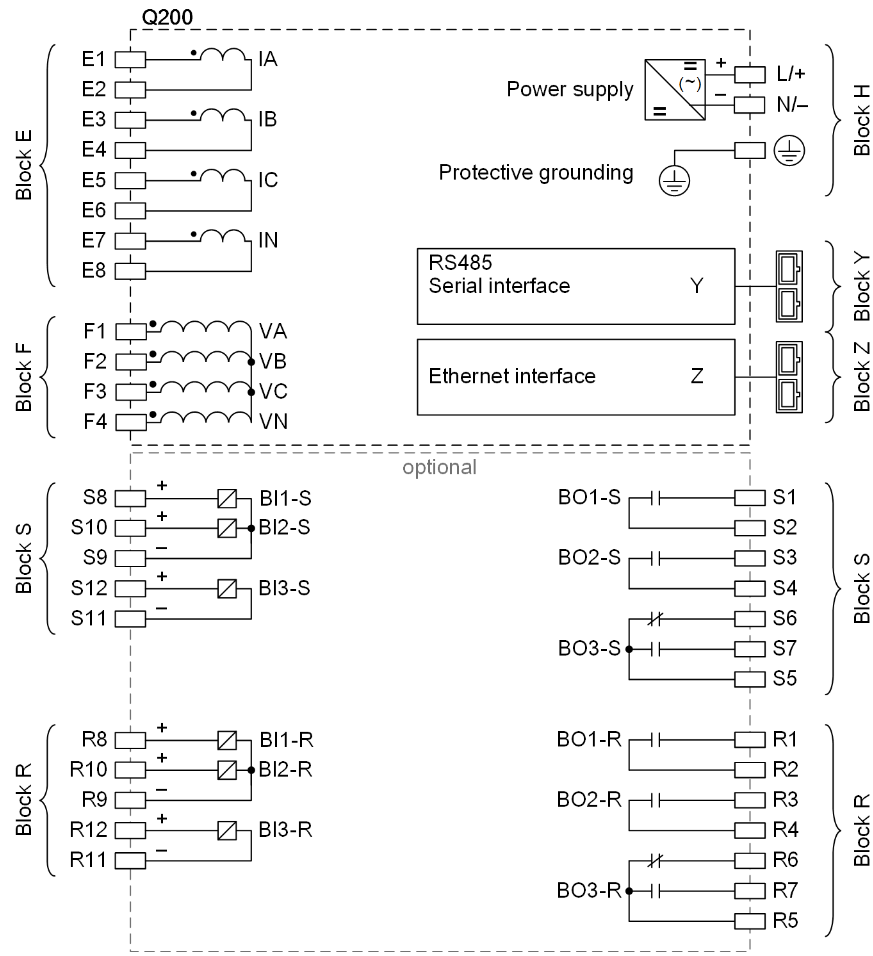


[le_Q100_HMI_front side, 1, --_--]

Figure 1-3 Display and Softkeys

(1) **Title**: Shows the name of the current display
(2) **Display**: Shows parameter settings, measured values, and diagrams
(3) **Current functions of the softkeys**
(4) **Softkeys**: Selects screens or settings at the device

Terminal Diagram of the Rear Plate



[dw_connection_diagram_q200, 2, en_US]

Figure 1-4 Terminal Diagram of the Rear Plate

2 Basic Functions

2.1 Activation and Cancel of the Configuration Change

When you have changed the configuration via Web pages, you must either enable it as the active set of parameters or cancel it.

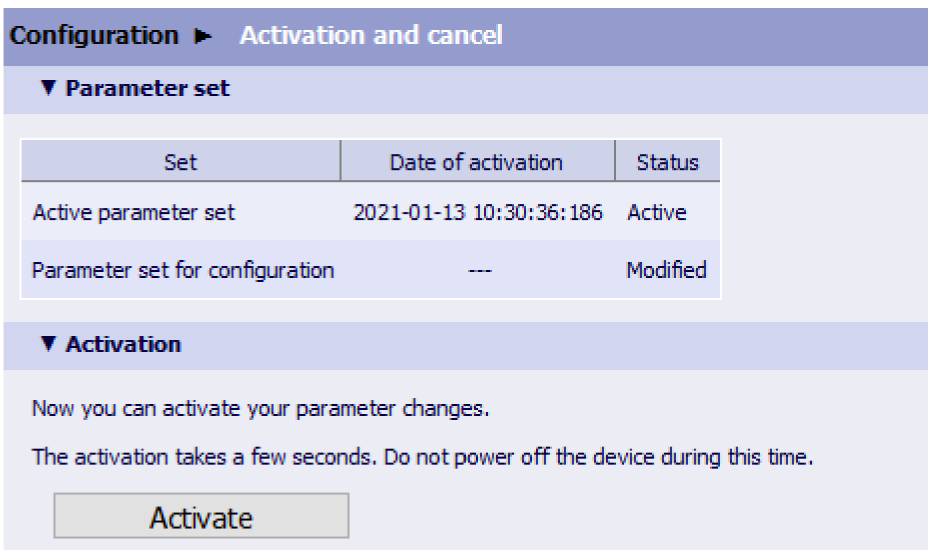
NOTE

If you have finished the configuration, click **Send** in the respective dialog.

Activating the Set of Parameters

To activate the configuration change in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Activation and cancel**.



[sc_Activation, 3, en_US]

Figure 2-1 Configuration Tab, Activation

- Click **Activate**.
  If the configuration causes the device to restart, reconnect to the device after the restart.
  The modified set of parameters is loaded as the active set of parameters into the device and the new parameters take effect immediately.
  The active and passive set of parameters are listed in the **Activation** window in the **Set** column for your information.

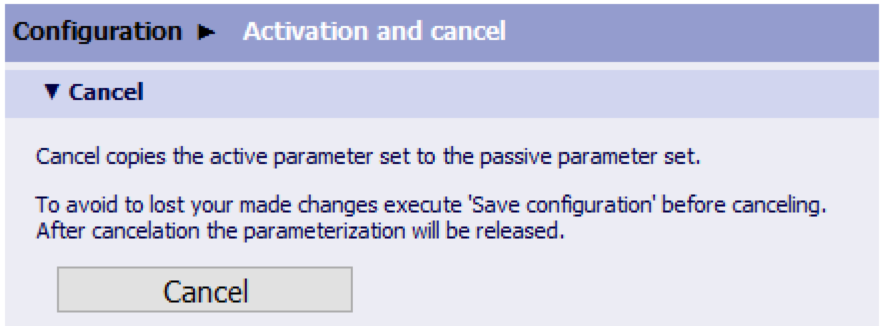
NOTE

Keep the device powered on for at least 30 s after clicking **Activate**.

Cancel

To cancel the configuration change in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Activation and cancel**.



[sc_Cancel, 2, en_US]

Figure 2-2 Configuration Tab, Cancel

NOTE

After clicking **Cancel**, the parameterization is released and can be run from a different computer if necessary.

2.2 Device and Language

2.2.1 Configuration via Web Pages

Configuration of Device and Language

To configure the **Device name** and **Language** in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Device and language**.
- Configure the respective parameters according to the following table.

Table 2-1 Settings for Device and Language

Parameter	Default Setting	Setting Range
Device name	DEVICE	Max. 31 ASCII characters Max. 16 non-ASCII characters
Language	English (US)	ENGLISH (US) User language according to **User language preselection**: DEUTSCH (DE) or CHINESE (CN)

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

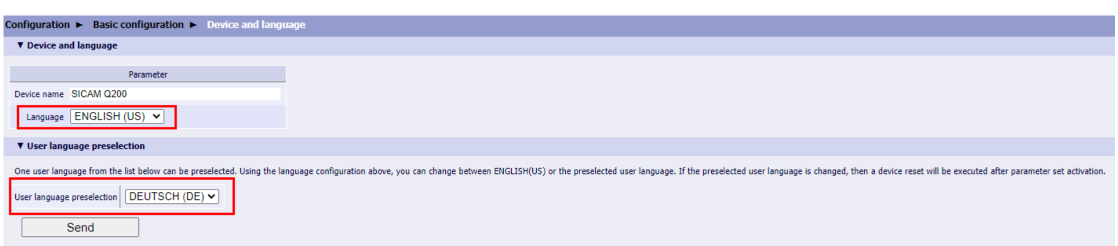
Configuration of the User Language Preselection

NOTE

The user language can be preset, for example when starting the user interface for the first time. DEUTSCH (DE) is set by default.

To configure the **User language preselection** in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Device and language** under **Basic configuration**.



[sc_language_configuration_q200, 1, en_US]

Figure 2-3 Configuration Tab, User Language Preselection

- Configure the respective parameters according to the following table.

Table 2-2 Settings for User Language Preselection

Parameter	Default Setting	Setting Range
User language preselection	DEUTSCH (DE)	**Option User language preselection**: *CHINESE (CN)* You can select the following **Languages**: • ENGLISH (US) or • CHINESE (CN) **Option User language preselection**: *DEUTSCH (DE)* You can select the following **Languages**: • ENGLISH (US) or • DEUTSCH (DE)

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

NOTE

If you change the user language, the device will restart after clicking the **Send** button and subsequently activating the settings.

[sc_language_restart, 2, en_US]

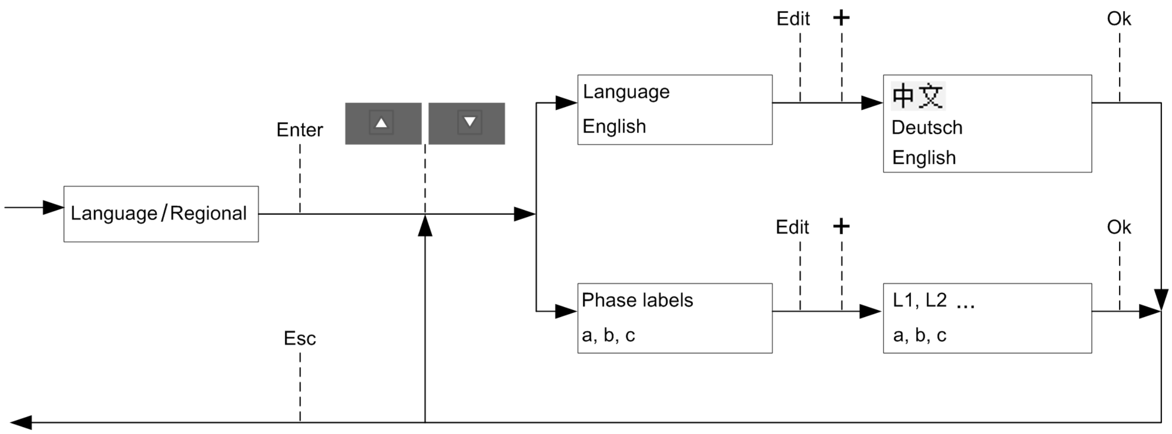
Figure 2-4 Restart Information

- After a successful restart, connect to the device again.
- Enter the user name and the password.
- Click the **Log on** button.

2.2.2 Configuration via Display

Submenu Device and Language

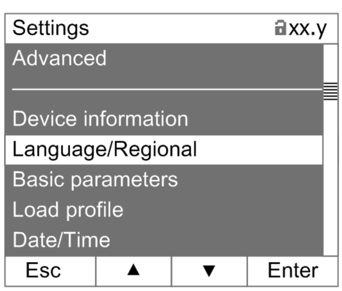
In the main menu, select **Settings** → **Language/Regional**. The displayed number is 32.2.



[dw_submenu_language_regional, 1, en_US]

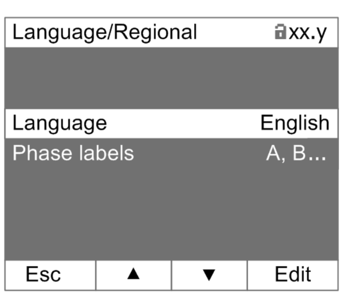
Figure 2-5 Configuration Language/Regional

The following interface displays are available:



[dw_display_language_regional, 1, en_US]

Figure 2-6 Language/Regional



[dw_display_language, 1, en_US]

Figure 2-7 Language

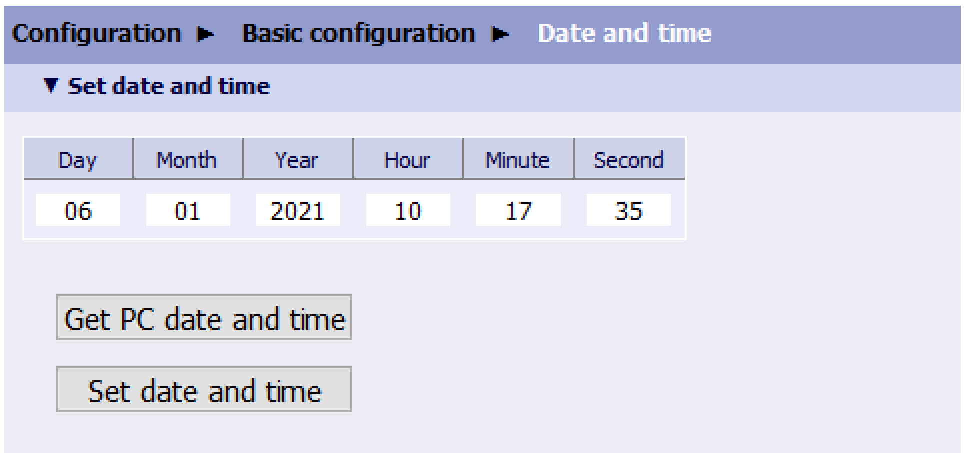
2.3 Date/Time

2.3.1 Configuration via Web Pages

Setting Date/Time

To change the date/time settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Date and time**.



[sc_preset_date_time, 4, en_US]

Figure 2-8 Configuration Tab, Date and Time

- You can either get the date and time from the connected computer or adjust it manually.

Getting the PC Date and Time

- Click **Get PC date and time**.
  The computer time is displayed in the fields of the window and applied in the device.

Setting the Date and Time Manually (24-hour format)

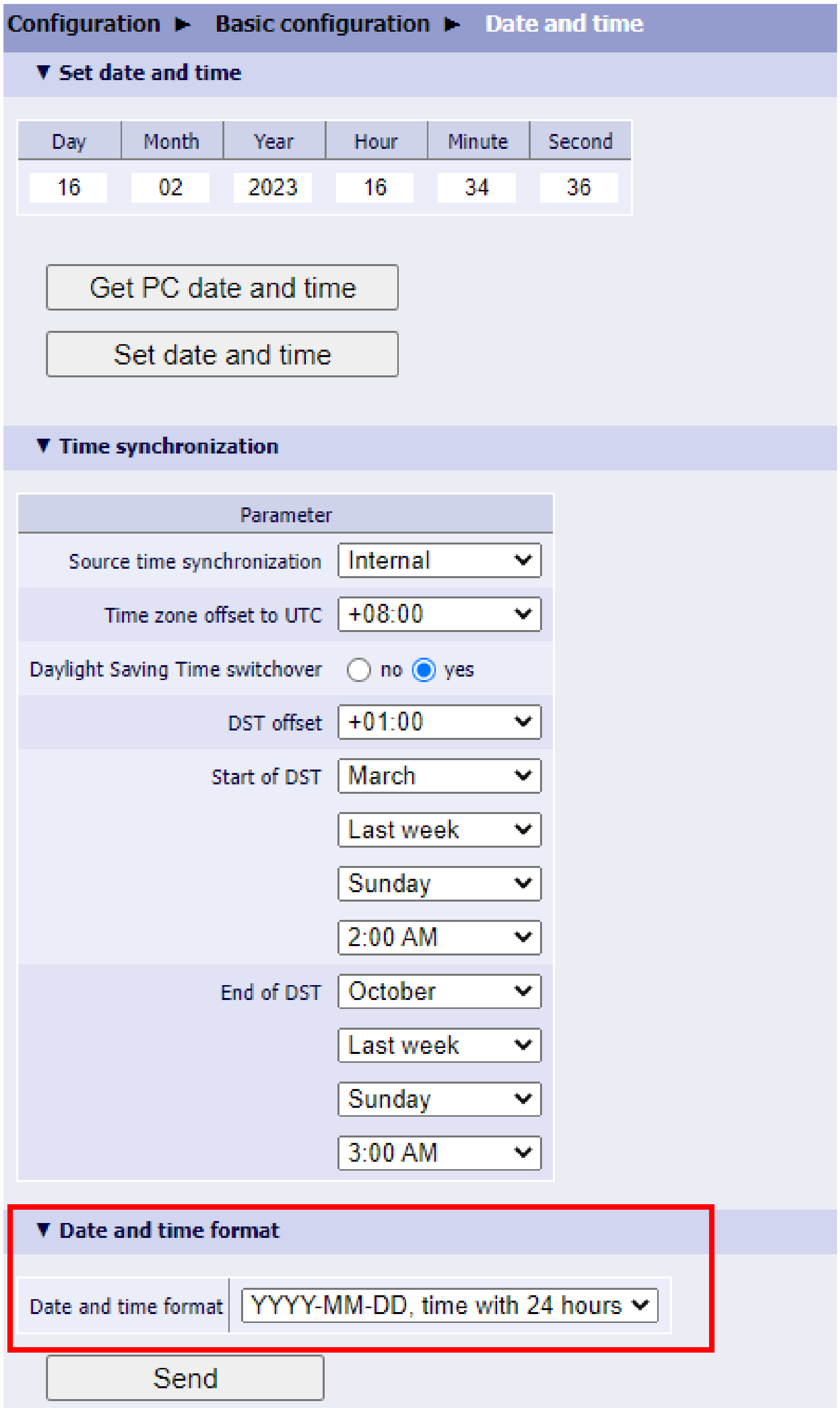
- Enter the desired time into the fields **Day** (format dd), **Month** (format mm), **Year** (format yyyy), **Hour** (format hh), and **Minute** (format mm).
- Click **Set Date and time**.
  The time you have entered is displayed in the fields of the window and applied in the device.

The **Action was successful** indication is displayed on the status bar.

Date and Time Format

To change the date and time format, proceed as follows:

- Go to the bottom of the **Date and time** configuration page.



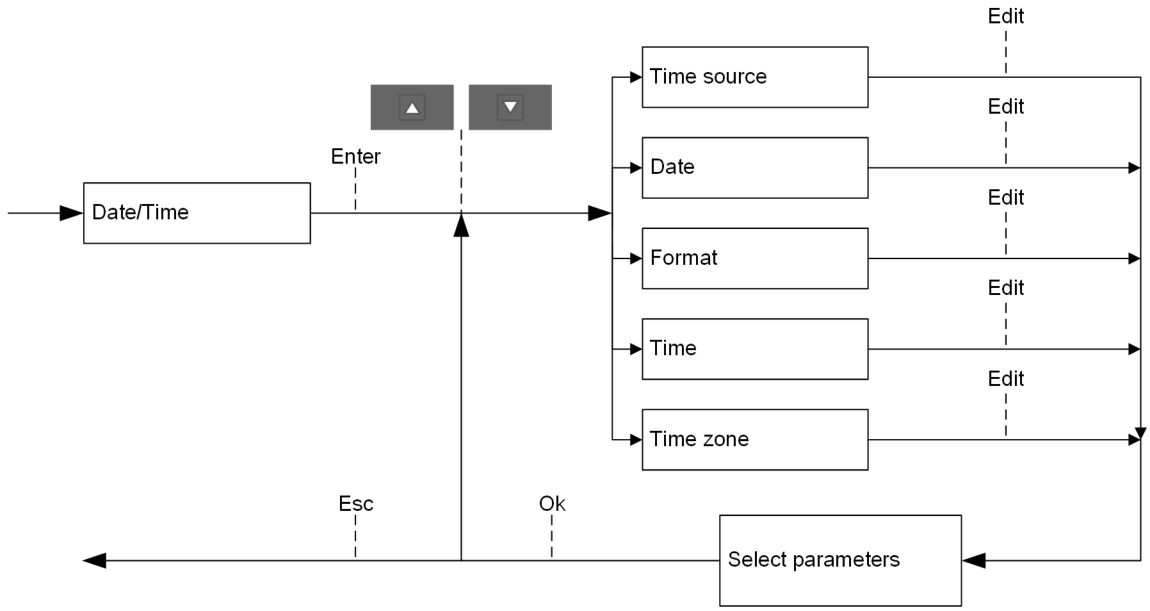
[sc_date_format, 1, en_US]

Figure 2-9 Date and Time Format

- Select the format you prefer from the drop-down list.
- Click **Send**.

2.3.2 Configuration via Display

Submenu Date/Time



[dw_submenu_date-time, 2, en_US]

Figure 2-10 Submenu Date/Time

2.4 Time Synchronization

2.4.1 Function Description

General

During operation, the device needs the date and time for all time-relevant processes. The term time is used throughout this section to refer to both the date and the time.

The time synchronization in the device is necessary to guarantee a common time basis for the communication with peripheral devices and time stamping of the process data.

The device supports both external and internal time synchronization. The type of time synchronization is specified during the parameterization. The external time synchronization from an NTP server is preferred.

NOTE

The time format is described in detail in the RFC 5905 (Request for Comments 5905 for NTP).

Internal Time Keeping

Time Format

The internal time is kept in UTC (Universal Time Coordinated) from 01.01.2000, 00:00 to 31.12.2099, 23:59.

To display the local time, for example on the HTML pages, you can configure a local time correction factor and the automatic adjustment to daylight saving time during parameterization.

FAIL Status Bit

The **FAIL** status bit implemented in the the device signals with **0** that the time is **valid** and with **1** that the time is **invalid**.

The status of the FAIL bit corresponds to the **Clock error** operational indication, see chapter *14 Operational Indications and Operating Parameters*.

The following table lists the time stamps of events or indications for the displayed operational, error, and audit logs according to status bit set/not set using the example of date *2016-09-26, time 13:49.35246*:

Table 2-3 FAIL Status Bit for Time Synchronization via NTP Server

FAIL	Output
0	2016-09-26 13:49.35:246
1	2016-09-26 13?49?35?246

DST Status Bit

With **1**, the DST status bit implemented in the device signals that the local daylight saving time is active. The operational indication **Daylight saving time** is displayed.

External Time Synchronization per NTP

General

To synchronize the time via an external source, the device is equipped with an SNTP Client (SNTP = Simple Network Time Protocol) that can be connected to 2 NTP servers (NTP = Network Time Protocol), the primary and the secondary (redundant) NTP server.

NTP is used for external time synchronization via Ethernet. The SNTP client sends a time request to the NTP server once a minute. The time synchronization error is ±1 ms referred to UTC time of the NTP server.

The time stamp of the NTP server has a 64-bit format. Counting is accomplished in seconds and fractions of seconds.

Time-Synchronization Procedure

The device was set to external time synchronization **(Ethernet NTP)** during parameterization. After switching on or resetting the device, the FAIL bit is first set to **1** (= invalid). The device sends a time request to the NTP server. After receiving the time information from the NTP server via Ethernet, the FAIL bit is set to **0** (= valid) and the internal timer (RTC) is updated. The SNTP client repeats the time request to the NTP server cyclically once every minute.

If the primary NTP server fails (for example, no response to a request twice or one of the criteria at **Redundant NTP server** satisfied) and if the secondary NTP server is operational (always polled in parallel), the device switches to the secondary NTP server. The FAIL bit remains = 0. In this case, the operational indication **Primary NTP Server Error** is displayed, see chapter *14 Operational Indications and Operating Parameters*.

If the secondary NTP server is also invalid, the FAIL bit will be set to 1 after the programmable timer **error indication after** has expired, and the **Clock Error** indication is output.

Redundant NTP Servers

The time synchronization supports a primary and a secondary NTP server. Different IP addresses are set for both of the NTP servers.

The device cyclically polls both NTP servers once every minute, but during normal operation it is synchronized by the primary NTP server. The device automatically switches to the secondary NTP server if one of the following criteria is met:

- No response from the primary NTP server to 2 successive requests
- **Alarm** indication is set in the time information of the primary NTP server
- Primary NTP server responds with 0
- Message runtime in the network is > 5 ms
- Stratum of the primary NTP server is 0 (unknown) or > 5

Switching to the secondary NTP server is prevented if:

- The secondary server does not provide better time information (see criteria that initiate the switch from the primary to the secondary NTP server; **Secondary NTP Server Error** indication was already output)
- The secondary server has recently been available for less than 10 minutes.

In these cases, the device is not externally synchronized anymore. The device uses the internal clock (on milliseconds time basis) and the last valid drift. After the programmable time delay, the device reports **Clock Error** (see chapter *14 Operational Indications and Operating Parameters*).

Switching Back from the Secondary to the Primary NTP Server

While the device is synchronized by the secondary NTP server, it continues to cyclically poll the primary NTP server. The device will only switch back to the primary NTP server if it receives correct time information and if none of the criteria for **Redundant NTP Servers** are fulfilled anymore.

External Time Synchronization via Fieldbus

The external time synchronization via fieldbus is used if the device is connected to the systems control via the protocol **Modbus RTU** using the RS485 interface.

The time information can also be transmitted from the systems control via **Modbus TCP** or **IEC 61850** using Ethernet interfaces. When using the Ethernet connection, Siemens recommends to synchronize the device from an NTP server.

When using the external time synchronization via fieldbus, the client should send a message containing the time information to the device in 1-minute cycles.

The time synchronization error using the Modbus RTU protocol is ±20 ms maximum.

Internal Time Synchronization via RTC

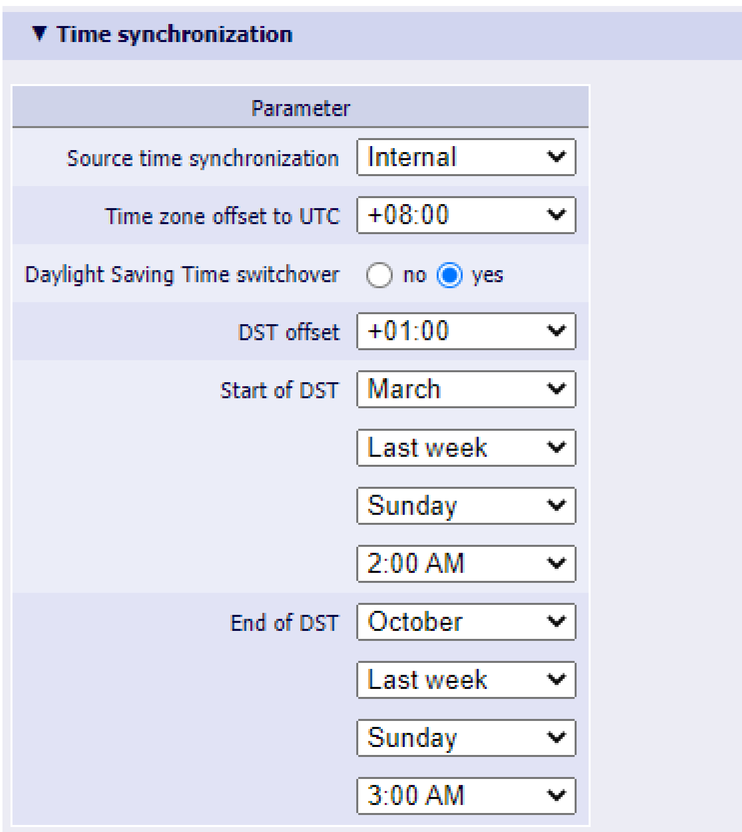
Besides the external time synchronization, the internal time synchronization is also possible using the battery-buffered RTC (Real-Time Clock). Due to the reduced accuracy, RTC should only be used in case of a failure or of the unavailability of the external time synchronization.

2.4.2 Configuration via Web Pages

Configuration of the Time Synchronization

To change the time synchronization settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Date and time**.



[sc_admin_time_sync_q200, 1, en_US]

Figure 2-11 Configuration Tab, Time Synchronization

- Configure the respective parameters according to the following table.

Table 2-4 Settings for Time Synchronization

Parameter	Default Setting	Setting Range
Source time synchronization	Internal	Internal Ethernet NTP Fieldbus
Time zone offset to UTC	+00:00	-12:00 to +13:00 (hours) (in increments of 0.5 h)
Daylight Saving Time switch-over	yes	no yes

Parameter	Default Setting	Setting Range
DST offset	+01:00	0:00 to +2:00 (hours) (in increments of 0.5 h)
Start of DST	March Last week	January to December First week Second week Third week Fourth week Last week
	Sunday 2:00 AM	Sunday to Saturday 12:00 AM to 11:00 PM (in increments of 1 h)
End of DST	October Last week	January to December First week Second week Third week Fourth week Last week
	Sunday 3:00 AM	Sunday to Saturday 12:00 AM to 11:00 PM (in increments of 1 h)
Additional Parameters if the Source is Ethernet NTP (Communication Ethernet bus protocol is set to Modbus TCP or IEC 61850)		
Primary NTP server IP Address	0.0.0.0	Any No polling of the NTP server if 0.0.0.0 is entered
Secondary NTP server IP Address	0.0.0.0	Any No polling of the NTP server if 0.0.0.0 is entered
Error indication after	10 min	2 min to 120 min
Additional Parameters if Source is Fieldbus		
Error indication after	10 min	2 min to 120 min

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

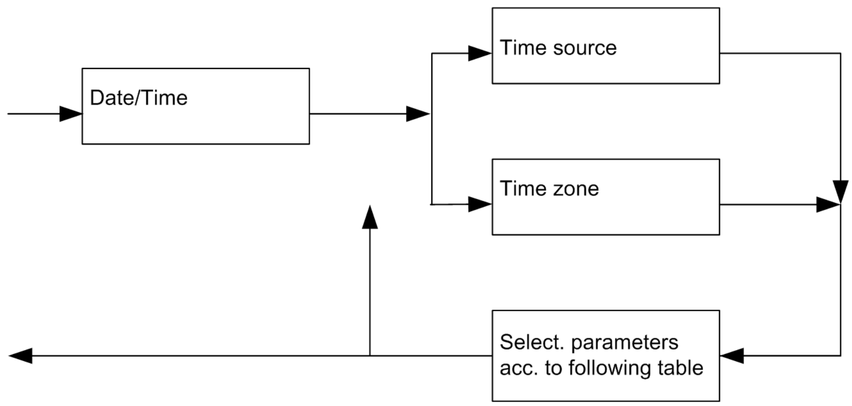
NOTE

NTP protocol: The SNTP client in the device is activated or deactivated during configuration of the time synchronization. **Ethernet NTP** can be selected as **Source time synchronization**. Associated IP addresses of the NTP servers can be entered.

In case of 2 Ethernet interfaces it is automatically detected via which interface the NTP server can be reached.

2.4.3 Configuration via Display

Submenu Time Synchronization



[dw_submenu_time_synchronization, 1, en_US]

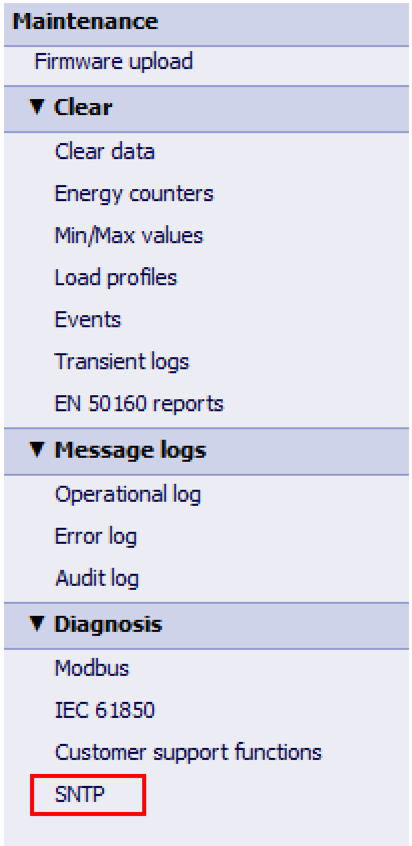
Figure 2-12 Submenu Time Synchronization

Table 2-5 Settings for Time Synchronization

Parameter	Default Setting	Setting Range
Time source	internal	internal Ethernet NTP Fieldbus
Time zone	00:00	-12 to +13 (hours) (in increments of 0.5 h)

2.4.4 SNTP Diagnosis

If you select **Ethernet NTP** as the **Source time synchronization**, configure the relevant parameters, and activate them, the entry **SNTP** is visible under the **Diagnosis** menu in the navigation window of **Maintenance**.

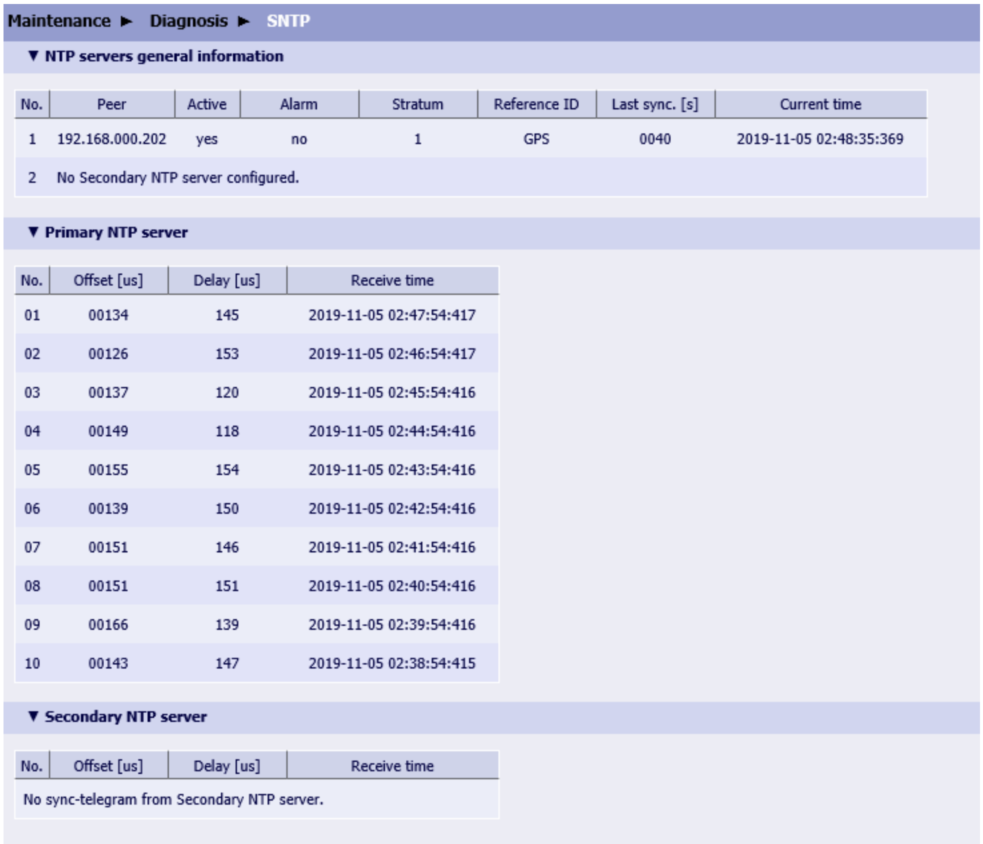


[sc_Maintenance with SNTP, 3, en_US]

Figure 2-13 SNTP Menu, Maintenance

To view the SNTP diagnosis in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **SNTP**.



Maintenance ► Diagnosis ► SNTP

▼ NTP servers general information

No.	Peer	Active	Alarm	Stratum	Reference ID	Last sync. [s]	Current time
1	192.168.000.202	yes	no	1	GPS	0040	2019-11-05 02:48:35:369
2	No Secondary NTP server configured.						

▼ Primary NTP server

No.	Offset [us]	Delay [us]	Receive time
01	00134	145	2019-11-05 02:47:54:417
02	00126	153	2019-11-05 02:46:54:417
03	00137	120	2019-11-05 02:45:54:416
04	00149	118	2019-11-05 02:44:54:416
05	00155	154	2019-11-05 02:43:54:416
06	00139	150	2019-11-05 02:42:54:416
07	00151	146	2019-11-05 02:41:54:416
08	00151	151	2019-11-05 02:40:54:416
09	00166	139	2019-11-05 02:39:54:416
10	00143	147	2019-11-05 02:38:54:415

▼ Secondary NTP server

No.	Offset [us]	Delay [us]	Receive time
No sync-telegram from Secondary NTP server.			

[sc_SNTP Diagnosis, 2, en_US]

Figure 2-14 Diagnosis, SNTP

The following messages are listed in the tables and the meaning of each column is explained here:

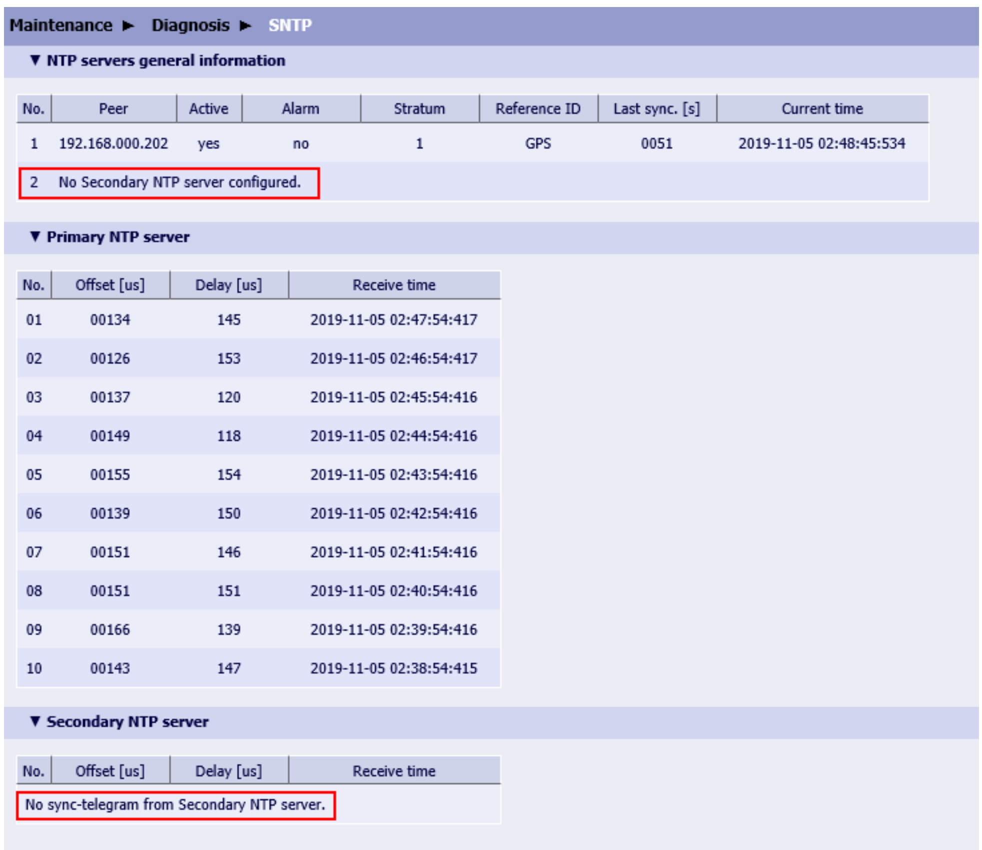
Parameter	Explanation
NTP servers general information	
No.	Serial number
Peer	IP address of the NTP server configured in the **Time synchronization** tab
Active	The NTP server is active or not.
Alarm	The device receives an error indication from the configured NTP server or not.
Stratum	The level of the reference clock: • 1 = the time server directly connects to a time reference (for example, GPS, PPS). • 2 to 15 = the time server is synchronized via network.
Reference ID	The time reference of the NTP server (for example, GPS or PPS for stratum 1 server, and IP address for other stratums)
Last sync. [s]	The time duration since last synchronization
Current time	Current time
Primary NTP server/Secondary NTP server	
No.	Serial number
Offset [µs]	The difference between the new time and the device time. If the value is positive, the server is faster.
Delay [µs]	Round-trip delay
Receive time	The time received from the primary/secondary NTP server

NOTE

The table of **Primary NTP server** or **Secondary NTP server** lists the latest 10 telegrams. The older telegrams are automatically overwritten. You cannot delete the telegrams manually.

If no primary or secondary NTP server is configured (IP address 0.0.0.0 is entered during the time-synchronization configuration), the following message appears:

- A message (**No Primary NTP server configured.** or **No Secondary NTP server configured.**) appears in the table of **NTP servers general information**.
- A message (**No sync-telegram from Primary NTP server.** or **No sync-telegram from Secondary NTP server.**) appears in the corresponding table.



Maintenance ▶ Diagnosis ▶ SNTP

▼ NTP servers general information

No.	Peer	Active	Alarm	Stratum	Reference ID	Last sync. [s]	Current time
1	192.168.000.202	yes	no	1	GPS	0051	2019-11-05 02:48:45:534
2	No Secondary NTP server configured.						

▼ Primary NTP server

No.	Offset [us]	Delay [us]	Receive time
01	00134	145	2019-11-05 02:47:54:417
02	00126	153	2019-11-05 02:46:54:417
03	00137	120	2019-11-05 02:45:54:416
04	00149	118	2019-11-05 02:44:54:416
05	00155	154	2019-11-05 02:43:54:416
06	00139	150	2019-11-05 02:42:54:416
07	00151	146	2019-11-05 02:41:54:416
08	00151	151	2019-11-05 02:40:54:416
09	00166	139	2019-11-05 02:39:54:416
10	00143	147	2019-11-05 02:38:54:415

▼ Secondary NTP server

No.	Offset [us]	Delay [us]	Receive time
No sync-telegram from Secondary NTP server.			

[sc_invalid configuration, 2, en_US]

Figure 2-15 SNTP Diagnosis, No Secondary NTP Server Configured

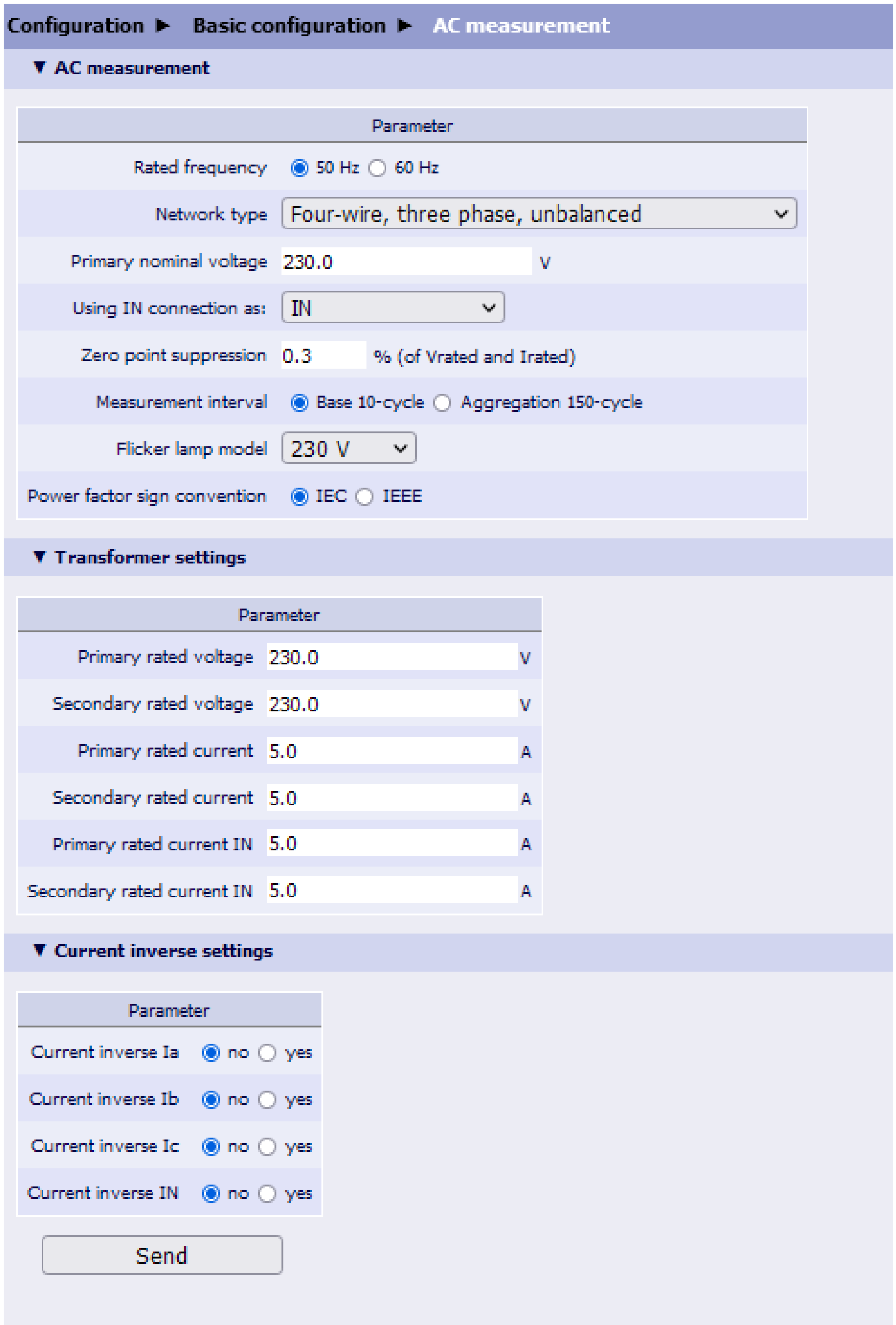
2.5 AC Measurement

2.5.1 Configuration via Web Pages

Configuration of the AC Measurement

To change the AC measurement settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **AC measurement**.



[sc_ac_measurement, 5, en_US]

Figure 2-16 Configuration Tab, AC Measurement

NOTE

If you have disabled the voltage transformer before upgrading to V2.60, the parameter **Voltage transformer** is visible on the HTML page.

Once you enable the voltage transformer, the parameter **Voltage transformer** is invisible on the HTML page. If you want to disable the voltage transformer, you can set the same value for **Primary rated voltage** and **Secondary rated voltage**.

- Configure the respective parameters according to the following table.

Table 2-6 Settings for AC Measurement

Parameter	Default Setting	Setting Range
AC measurement		
Rated frequency	50 Hz	50 Hz ± 15 % 60 Hz ± 15 %
Network type[3]	4-wire, 3-phase, unbalanced	1-phase network 3-wire, 3-phase balanced 3-wire, 3-phase, unbalanced (2 * I) 3-wire, 3-phase, unbalanced (3 * I) 4-wire, 3-phase, balanced 4-wire, 3-phase, unbalanced
Primary nominal voltage[4] (Phase-N/PE)	230.0 V	1.0 V to 1 000 000.0 V (depending on the setting of **Primary rated voltage**) IEC 61000-4-30 Class A: • Up to 230 V: 200 % overvoltage • > 230 V to 400 V: 200 % to 15 % overvoltage UL conditions: • Up to 170 V: 200 % overvoltage • > 170 V to 300 V: 200 % to 15 % overvoltage
Using IN connection as[5]	IN	Not connected IN[6] I4
Zero-point suppression[7]	0.3 % (of Vrated, Irated)	0.0 % to 10.0 %
Measurement interval	Base 10-cycle (at 50 Hz) or Base 12-cycle (at 60 Hz)	Base 10-cycle at 50 Hz or Base 12-cycle at 60 Hz Aggregation 150-cycle at 50 Hz or Aggregation 180-cycle at 60 Hz
Flicker lamp model	230.0 V	230.0 V 120.0 V
Power factor sign convention	IEC	IEC IEEE

3 In the case of contradictory parameter settings, **Primary nominal voltage** is indicated as faulty (red) and **Network type** as not adjustable (gray). Moreover, the **Send** button is disabled.
4 The value of this parameter must be within the range from 50 % to 200 % of the **Primary rated voltage**. Otherwise, after you click the **Send** button, the value of this parameter changes to be the same as the value of **Primary rated voltage**.
5 This parameter is not available when the connection type is **1-phase network**.
6 This option is only available when the connection type is **4-wire, 3-phase, unbalanced**.
7 Voltage and current values smaller than/equal to the setting referred to 100 % are not included in the calculation and display.

Parameter	Default Setting	Setting Range
Transformer settings		
Voltage transformer[8]	Yes	No Yes
Primary rated voltage	230.0 V	1.0 V to 1 000 000.0 V[9]
Secondary rated voltage	230.0 V	1.0 V to 690.0 V
Primary rated current	5.0 A	1.0 A to 100 000.0 A
Secondary rated current	5.0 A	1.0 A to 10.0 A
Depending on the configuration of the **Using IN connection as** parameter, the following parameters show **IN** or **I4**, or are not visible.		
Primary rated current IN/I4	5.0 A	1.0 A to 100 000.0 A
Secondary rated current IN/I4	5.0 A	1.0 A to 10.0 A
Current inverse setting		
Current inverse Ia[10]	no	no yes
Current inverse Ib[10]	no	no yes
Current inverse Ic[10]	no	no yes
Current inverse IN[10]	no	no yes

NOTE

For SICAM Q200, the reference voltage and current values for the zero-point suppression are as follows:

- V_{rated} = 400 V
- I_{rated} = 5 A

Both are secondary values.

For a zero-point suppression of 0.3 %, all voltages that are smaller than 1.2 V and all currents that are smaller than 15 mA are set to 0 to avoid energy counting without defined measurands.

NOTE

If you change one of the following parameters, the device restarts:

- Rated frequency
- Network type

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

8 Once you enable the voltage transformer, the parameter **Voltage transformer** is invisible on the HTML page. If you want to disable the voltage transformer, you can set the same value for **Primary rated voltage** and **Secondary rated voltage**.

9 If you upgrade your firmware to V02.60, and want to set this parameter to the value from 1.0 V to 99.9 V, you must get the default configuration firstly.

10 This parameter is to define whether the current direction is the same as the physical connection.

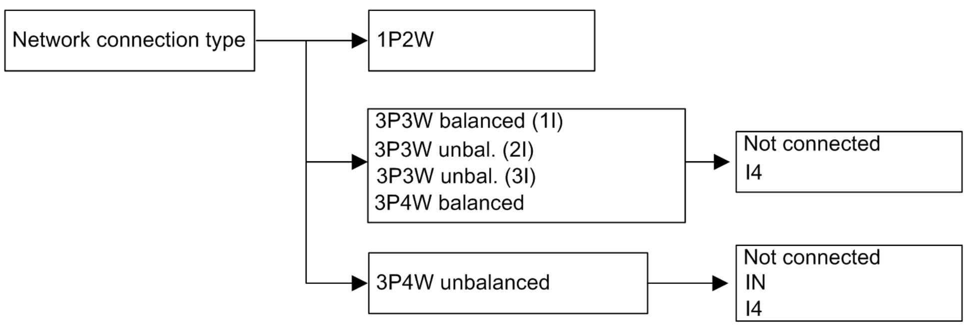
NOTE

If you change the **Network type** during ongoing operation, check settings, measured values, and limiting values for inconsistencies. Check also the ICD/IID file which is suitable for the network type. If there are any invalid measured values and limiting values or a wrong ICD file, restart the device.

Usage of I4 in Different Network Connections

The 4th physical current input is used as IN or as an independent current I4 in different network connections:

- The 4th physical current input is currently not supported in the 1P2W network connection.
- The 4th physical current input is used as an independent current I4 or is disconnected in all 3P3W network connections and the 3P4W balanced network connection.
- The 4th physical current input is used as IN by default in the 3P4W unbalanced network connection, but can be disconnected or used as an independent current I4.



[dw_settings_IN_input_usage, 1, en_US]

Figure 2-17 Setting Usage of IN Input

Current-Transformer Settings

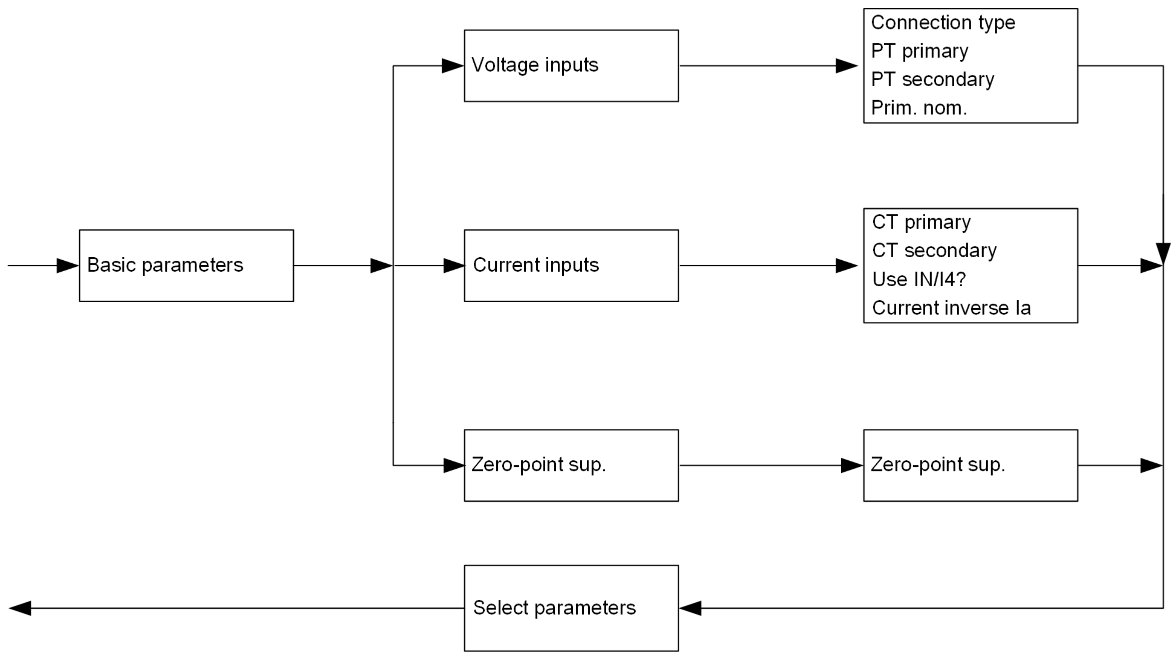
While using CTs, the settings of CTs for the 3 line currents are independent of the CT for the 4th physical current input.

Current-Inverse Settings

With the parameter **Current inverse**, you can define whether the current direction is the same as the physical connection for each phase.

2.5.2 Configuration via Display

Submenu Basic Parameters



[dw_submenu_basic_settings, 3, en_US]

Figure 2-18 Submenu, Basic Parameters

Table 2-7 Basic Parameter Settings

Parameter	Default Setting	Setting Range
Voltage Inputs		
Connection type	3P4W	1P2W (1-phase system) 3P3WB (3-wire, equal load) 3P3W_2I (3-wire, any load (2*I)) 3P3W_3I (3-wire, any load (3*I)) 3P4WB (4-wire, equal load) 3P4W (4-wire, any load)
PT primary	230.0 V	1.0 V to 1 000 000.0 V
PT secondary	230.0 V	1.0 V to 600.0 V
Prim. nom.	230.0 V	1.0 V to 1 000 000.0 V (depending on the setting of **PT primary**) IEC 61000-4-30 Class A: • Up to 230 V: 200 % overvoltage • > 230 V to 400 V: 200 % to 15 % overvoltage UL conditions: • Up to 170 V: 200 % overvoltage • > 170 V to 300 V: 200 % to 15 % overvoltage

Parameter	Default Setting	Setting Range
Current Inputs		
CT primary	5.0 A	1.0 A to 100 000.0 A
CT secondary	5.0 A	1.0 A to 10.00 A
Use IN/I4?	IN	None IN I4
IN/I4 primary	5.0 A	1.0 A to 100 000.0 A
IN/I4 secondary	5.0 A	1.0 A to 10.0 A
Current inverse Ia	no (no checkmark)	yes (checkmark) no (no checkmark)
Current inverse Ib	no (no checkmark)	yes (checkmark) no (no checkmark)
Current inverse Ic	no (no checkmark)	yes (checkmark) no (no checkmark)
Current inverse IN	no (no checkmark)	yes (checkmark) no (no checkmark)
Zero-Point Suppression		
Zero-point suppression (in % of Vrated and Irated)	0.3 %	0.0 % to 10.0 %

2.5.3 Measuring System

The device measures the power quality according to IEC 61000-4-30 Ed. 3 in 1-phase or polyphase energy supply systems.
The basic measuring interval for calculation of the following values is 10 cycles in 50-Hz systems or 12 cycles in 60-Hz systems:

- Voltage RMS values
- Harmonics and interharmonics of voltages
- Voltage unbalance
- Currents
- Harmonics and interharmonics of currents

NOTE

Depending on parameter settings, the browser displays the measured values with the corresponding unit or indications in a table that is updated every 10 s. Harmonics and interharmonics can be represented in a table or in a diagram.

The measuring functions are divided into the following parts:

- PQ measurements
- Operational measurements
- Energy management and counter functions

An overview of the measured quantities demanded according to IEC 61000-4-30 Ed.3, their measurement uncertainty and measuring ranges are represented in the following tables.

Measured Quantities and Operational Measurement Uncertainty acc. to IEC 62586-1 Product Standard Class A and Standards IEC 61000-4-30 Ed. 3, IEC 61000-4-7, and IEC 61000-4-15

Table 2-8 Measured Quantities and Their Operational Measurement Uncertainty

<table>
<tr><th>Measured Quantity</th><th>Unit</th><th>Measuring Range</th><th>Operational Measurement Uncertainty acc. to
IEC 62586 Class A,
IEC 61000-4-30 Ed. 3,
IEC 61000-4-7,
IEC 61000-4-15</th></tr>
<tr><td>Frequency f</td><td>Hz</td><td>50 Hz (±15 %):
42.5 Hz to 57.5 Hz
60 Hz (±15 %):
51.0 Hz to 69.0 Hz</td><td>±10 mHz
Power-system voltage > 2 V required</td></tr>
<tr><td rowspan="2">Voltage $V_{ph\text{-}N/PE}$ (star)</td><td rowspan="2">V</td><td>10 % to 150 % Udin</td><td>±0.1 % Udin</td></tr>
<tr><td colspan="2">AC 57.7 V to 400 V (autorange)
IEC 61000-4-30 Ed. 3 Class A:
• Up to AC 230 V: 200 % overvoltage
• > AC 230 V to 400 V: 200 % to 15 % overvoltage
UL conditions:
• Up to AC 170 V: 200 % overvoltage
• > AC 170 V to 300 V: 200 % to 15 % overvoltage</td></tr>
<tr><td rowspan="2">Voltage $V_{ph\text{-}ph}$ (delta)</td><td rowspan="2">V</td><td>10 % to 150 % Udin</td><td>±0.1 % Udin</td></tr>
<tr><td colspan="2">AC 100 V to 690 V (autorange)
IEC 61000-4-30 Ed. 3 Class A:
• Up to AC 400 V: 200 % overvoltage
• > AC 400 V to 690 V: 200 % to 15 % overvoltage
UL conditions:
• Up to AC 290 V: 200 % overvoltage
• > AC 290 V to 520 V: 200 % to 15 % overvoltage</td></tr>
<tr><td>Flicker Pst</td><td>–</td><td>Pst: 0.2 to 10</td><td>Acc. to IEC 61000-4-15:
Pst: ±5 %</td></tr>
<tr><td>Flicker Plt</td><td>–</td><td>Plt: 0.2 to 10</td><td>Acc. to IEC 61000-4-15:
Plt: ±5 %</td></tr>
<tr><td>Undervoltages (dips) and overvoltages (swells) of the power-system voltage</td><td>V, s</td><td>–</td><td>Amplitude: ±0.2 % of Udin
Duration: ±1 cycle</td></tr>
<tr><td>Voltage interruptions of the power-system voltage</td><td>V, s</td><td>–</td><td>Duration: ±1 cycle</td></tr>
<tr><td>Voltage unbalance</td><td>%</td><td>–</td><td>±0.15 %</td></tr>
<tr><td rowspan="2">Harmonics of voltage H_xV_{ph}</td><td rowspan="2">% or V</td><td rowspan="2">10 % to 200 % acc. to IEC 61000-2-4, class 3</td><td>IEC 61000-4-7, Class I:
Condition: Um ≥ 1 % of Udin
Maximum error: ±5 % of Um</td></tr>
<tr><td>Condition: Um < 1 % of Udin
Maximum error: ±0.05 % of Udin</td></tr>
</table>

Measured Quantity	Unit	Measuring Range	Operational Measurement Uncertainty acc. to IEC 62586 Class A, IEC 61000-4-30 Ed. 3, IEC 61000-4-7, IEC 61000-4-15
Mains signaling voltage MSV_{ph-N}(star) / MSV_{ph-ph}(delta)	V	0 % to 15 % Udin	Condition: 3 % to 15 % of Udin Maximum error: ±5 % of Um
			Condition: 1 % to 3 % of Udin Maximum error: ±0.15 % of Udin
Rapid voltage change (RVC)	See chapter *6.7.1 Function Description*		
Magnitude of current	%	10 % FS to 150 % FS	0.1 % Accuracy current: see next table
Emissions 2 kHz to 150 kHz	V	± 50 V	± 1 V
Udin: Primary nominal voltage, corresponding to the primary rated voltage Um: Measured value u2: Value of negative-sequence system component V u0: Value of zero-sequence system component V FS: Full scale			

NOTE

The frequency measurement is carried out as software frequency measurement (V_{a-N} , V_{b-N} , V_{c-N} > 2 V).

The frequency will be measured first at the measuring circuit V_{a-N}.

If the voltage V_{a-N} is < 2 V, the measurement is performed automatically at the measuring circuit V_{b-N}.

If the voltage V_{b-N} is < 2 V, the measurement is performed automatically at the measuring circuit V_{c-N}.

If none of the voltages is > 2 V, the frequency measurement is invalid.

Measured Quantities and Their Operational Measuring Accuracy

Table 2-9 Measured Quantities and Operational Measuring Accuracy according to IEC 61557-12:2018

Measured Quantity	Unit	Accuracy Class
Voltage	V	0.1
Current	A	0.1
Active power P	W	0.1
Reactive power Q	var	1
Apparent power S	VA	0.2
Power factor	–	0.5
Frequency	Hz	0.02
THD U/I	%	1
Harmonics U/I	V/A	1
Unbalance Unb	%	0.2
Active energy WP	Wh	0.1 Class 0.1S according to IEC 62053-22:2020
Reactive energy WQ	varh	2 Class 0.5S according to IEC 62053-24:2020
Apparent energy WS	VAh	0.2

2.5.4 Measurands

2.5.4.1 Operational Measured Quantities Depending on the Connection Types

Table 2-10 Operational Measured Quantities Depending on the Connection Types in Power Systems (10/12 cycles)

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Voltage							
Va	a-N	x	–	–	–	x	x
Vb	b-N	–	–	–	–	–	x
Vc	c-N	–	–	–	–	–	x
Vab	a-b	–	x	x	x	–	x
Vbc	b-c	–	x	x	x	–	x
Vca	c-a	–	x	x	x	–	x
V_N	N-PE	x	–	–	–	x	x
Vavg	a+b+c	–	x	x	x	–	$1/3\ \Sigma\ U_k$
Ratio of negative sequence and zero sequence to positive sequence: u2/u0	a+b+c	–	x[11]	x[11]	x[11]	–	x
Current							
Ia	a	x	x	x	x	x	x
Ib	b	–	–	x	x	–	x
Ic	c	–	–	x	x	–	x
I_N[12]	N	–	–	–	–	–	x
I_4[12]	N	–	x	x	x	x	x
Iavg	a+b+c	–	–	x	x	–	$1/3\ \Sigma\ I_k$
Ratio of negative sequence and zero sequence to positive sequence: i2/i0	a+b+c	–	–	x	x[13]	–	x
Fundamental Power Factor							
cos φ(a)	a	x	x	x	x	x	x
cos φ(b)	b	–	–	x	x	–	x
cos φ(c)	c	–	–	x	x	–	x
cos φ	a+b+c	x	x	x	x	x	$\cos(\varphi_{VI})$
Power Factor							
PFa	a	x	x	x	x	x	x
PFb	b	–	–	x	x	–	x
PFc	c	–	–	x	x	–	x

11 The value of u0 is invalid.

12 Depending on the configuration for **AC Measurement**, the 4th physical current input can be used as I_N, I_4, or can be selected as **not connected**.

13 The value of i0 is invalid.

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
PF	a+b+c	x	x	x	x	x	Σ P/Σ S[14]
Phase Angle							
φa	a	x	x	x	x	x	x
φb	b	–	–	x	x	–	x
φc	c	–	–	x	x	–	x
φVI	a+b+c	x	x	x	x	x	arctan (Σ Q1/ Σ P1)
φabV	a+b+c	–	–	–	–	–	x
φbcV	a+b+c	–	–	–	–	–	x
φcaV	a+b+c	–	–	–	–	–	x
φabI	a+b+c	–	–	x	x	–	x
φbcI	a+b+c	–	–	x	x	–	x
φcaI	a+b+c	–	–	x	x	–	x
Frequency							
System frequency	a	x	x	x	x	x	x
10-s frequency	a	x	x	x	x	x	x
Crest Factor							
CF Va	a-N	x	–	–	–	x	x
CF Vb	b-N	–	–	–	–	–	x
CF Vc	c-N	–	–	–	–	–	–
CF Vab	a-b	–	x	x	x	–	x
CF Vbc	b-c	–	x	x	x	–	x
CF Vca	c-a	–	x	x	x	–	x
CF Ia	a	x	x	x	x	x	x
CF Ib	b	–	–	x	x	–	x
CF Ic	c	–	–	x	x	–	x
CF IN[12]	N	–	–	–	–	–	x
CF I4[12]	N	–	x	x	x	x	x

2.5.4.2 Harmonics, Interharmonics, and Emissions Depending on the Connection Types

Table 2-11 Harmonics and Interharmonics Depending on the Connection Types in Power Systems

Measured Quantity (x = 1 to 63, y = 1 to 49) x = 1: Fundamental	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Magnitude of Voltage Harmonics							
H_Va-x	a-N	x	–	–	–	x	x
H_Vb-x	b-N	–	–	–	–	–	x
H_Vc-x	c-N	–	–	–	–	–	x

14 P = total active power; S = total apparent power

Measured Quantity (x = 1 to 63, y = 1 to 49) x = 1: Fundamental	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
H_Vab-x	a-b	–	x	x	x	–	x
H_Vbc-x	b-c	–	x	x	x	–	x
H_Vca-x	c-a	–	x	x	x	–	x
Magnitude of Voltage Interharmonics							
HI_Va-y	a-N	x	–	–	–	x	x
HI_Vb-y	b-N	–	–	–	–	–	x
HI_Vc-y	c-N	–	–	–	–	–	x
HI_Vab-y	a-b	–	x	x	x	–	x
HI_Vbc-y	b-c	–	x	x	x	–	x
HI_Vca-y	c-a	–	x	x	x	–	x
Magnitude of Harmonic Currents							
H_Ia-x	a	x	x	x	x	x	x
H_Ib-x	b	–	–	x	x	–	x
H_Ic-x	c	–	–	x	x	–	x
Magnitude of Interharmonic Currents							
HI_Ia-y	a	x	x	x	x	x	x
HI_Ib-y	b	–	–	x	x	–	x
HI_Icy	c	–	–	x	x	–	x
THDS, Voltage							
THDS_Va	a-N	x	–	–	–	x	x
THDS_Vb	b-N	–	–	–	–	–	x
THDS_Vc	c-N	–	–	–	–	–	x
THDS_Vab	a-b	–	x	x	x	–	x
THDS_Vbc	b-c	–	x	x	x	–	x
THDS_Vca	c-a	–	x	x	x	–	x
THDS, Current							
THDS_Ia	a	x	x	x	x	x	x
THDS_Ib	b	–	–	x	x	–	x
THDS_Ic	c	–	–	x	x	–	x
TDD, Current							
TDD_Ia	a	x	x	x	x	x	x
TDD_Ib	b	–	–	x	x	–	x
TDD_Ic	c	–	–	x	x	–	x
K-Factor, Voltage							
K-Factor_Va	a-N	x	–	–	–	x	x
K-Factor_Vb	b-N	–	–	–	–	–	x
K-Factor_Vc	c-N	–	–	–	–	–	x
K-Factor_Vab	a-b	–	x	x	x	–	x
K-Factor_Vbc	b-c	–	x	x	x	–	x
K-Factor_Vca	c-a	–	x	x	x	–	x
K-Factor, Current							
K-Factor_Ia	a	x	x	x	x	x	x

Measured Quantity (x = 1 to 63, y = 1 to 49) x = 1: Fundamental	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
K-Factor_Ib	b	–	–	x	x	–	x
K-Factor_Ic	c	–	–	x	x	–	x
THDR, Voltage							
THDR_Va	a-N	x	–	–	–	x	x
THDR_Vb	b-N	–	–	–	–	–	x
THDR_Vc	c-N	–	–	–	–	–	x
THDR_Vab	a-b	–	x	x	x	–	x
THDR_Vbc	b-c	–	x	x	x	–	x
THDR_Vca	c-a	–	x	x	x	–	x
THDR, Current							
THDR_Ia	a	x	x	x	x	x	x
THDR_Ib	b	–	–	x	x	–	x
THDR_Ic	c	–	–	x	x	–	x
THD-2650, Voltage							
THD-2650_Va	a-N	x	–	–	–	x	x
THD-2650_Vb	b-N	–	–	–	–	–	x
THD-2650_Vc	c-N	–	–	–	–	–	x
THD-2650_Vab	a-b	–	x	x	x	–	x
THD-2650_Vbc	b-c	–	x	x	x	–	x
THD-2650_Vca	c-a	–	x	x	x	–	x
THD-2650, Current							
THD-2650_Ia	a	x	x	x	x	x	x
THD-2650_Ib	b	–	–	x	x	–	x
THD-2650_Ic	c	–	–	x	x	–	x
THDI, Voltage							
THDI_Va	a-N	x	–	–	–	x	x
THDI_Vb	b-N	–	–	–	–	–	x
THDI_Vc	c-N	–	–	–	–	–	x
THDI_Vab	a-b	–	x	x	x	–	x
THDI_Vbc	b-c	–	x	x	x	–	x
THDI_Vca	c-a	–	x	x	x	–	x
THDI, Current							
THDI_Ia	a	x	x	x	x	x	x
THDI_Ib	b	–	–	x	x	–	x
THDI_Ic	c	–	–	x	x	–	x
Phase Angles (Angle), Prevailing Phase Angles (PreAngle), and Prevailing Ratio (PR) of Voltage Harmonics							
H_Angle/ PreAngle/ PR_Va-x	a-N	x	–	–	–	x	x
H_Angle/ PreAngle/ PR_Vb-x	b-N	–	–	–	–	–	x
H_Angle/ PreAngle/ PR_Vc-x	c-N	–	–	–	–	–	x

Measured Quantity (x = 1 to 63, y = 1 to 49) x = 1: Fundamental	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Phase Angles (Angle), Prevailing Phase Angles (PreAngle), and Prevailing Ratio (PR) of Harmonic Currents							
H_Angle/ PreAngle/ PR_Ia-x	a	x	–	–	–	x	x
H_Angle/ PreAngle/ PR_Ib-x	b	–	–	–	–	–	x
H_Angle/ PreAngle/ PR_Ic-x	c	–	–	–	–	–	x

Table 2-12 Emissions Depending on the Connection Types in Power Systems

Measured Quantity (x = 1 to 35, y = 1 to 71)	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Magnitude of Voltage Emissions 2 kHz to 9 kHz							
HF1_Va-x	a-N	x	–	–	–	x	x
HF1_Vb-x	b-N	–	–	–	–	–	x
HF1_Vc-x	c-N	–	–	–	–	–	x
HF1_Vab-x	a-b	–	–	–	–	–	x
HF1_Vbc-x	b-c	–	–	–	–	–	x
HF1_Vca-x	c-a	–	–	–	–	–	x
Magnitude of Voltage Emissions 9 kHz to 150 kHz							
HF1_Va-y	a-N	x	–	–	–	x	x
HF1_Vb-y	b-N	–	–	–	–	–	x
HF1_Vc-y	c-N	–	–	–	–	–	x
HF1_Vab-y	a-b	–	–	–	–	–	x
HF1_Vbc-y	b-c	–	–	–	–	–	x
HF1_Vca-y	c-a	–	–	–	–	–	x

2.5.4.3 Measured Quantities of Power Depending on the Connection Types

Table 2-13 Measured Quantities of Power Depending on the Connection Types in Power Systems

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Active Power							
Pa	a	x	x	x	x	x	x
Pb	b	–	–	x	x	–	x
Pc	c	–	–	x	x	–	x
P	a+b+c	x	x	x	x	x	x
Reactive Power							
Qa	a	x	x	x	x	x	x

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Qb	b	–	–	x	x	–	x
Qc	c	–	–	x	x	–	x
Q	a+b+c	x	x	x	x	x	x
Apparent Power							
Sa	a	x	x	x	x	x	x
Sb	b	–	–	x	x	–	x
Sc	c	–	–	x	x	–	x
S	a+b+c	x	x	x	x	x	x
Reactive Power (Fundamental)							
Q1a	a	x	x	x	x	x	x
Q1b	b	–	–	x	x	–	x
Q1c	c	–	–	x	x	–	x
Q1	a+b+c	x	x	x	x	x	x
Active Power of Harmonics							
H-Pa-x	a	x	–	–	–	x	x
H-Pb-x	b	–	–	–	–	–	x
H-Pc-x	c	–	–	–	–	–	x
SumPa	a	Σ H-Pa-x	–	–	–	–	x
SumPb	b	–	–	–	–	–	x
SumPc	c	–	–	–	–	–	x
Reactive Power of Harmonics							
H-Qa-x	a	x	–	–	–	x	x
H-Qb-x	b	–	–	–	–	–	x
H-Qc-x	c	–	–	–	–	–	x
SumQa	a	Σ H-Qa-x	–	–	–	–	x
SumQb	b	–	–	–	–	–	x
SumQc	c	–	–	–	–	–	x
Apparent Power of Harmonics							
H-Sa-x	a	x	–	–	–	x	x
H-Sb-x	b	–	–	–	–	–	x
H-Sc-x	c	–	–	–	–	–	x
SumSa	a	Σ H-Sa-x	–	–	–	–	x
SumSb	b	–	–	–	–	–	x
SumSc	c	–	–	–	–	–	x

2.5.4.4 Measured Quantities of Energy Depending on Connection Types

Table 2-14 Measured Quantities of Energy Depending on Connection Types in Power Systems (Intervals (Cycle): 10/12 Cycles)

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Active Energy/Export							
WPa_exp	A	x	x	x	x	x	x
WPb_exp	B	–	–	x	x	–	x
WPc_exp	C	–	–	x	x	–	x
WP_exp	A+B+C	x	x	x	x	x	Σ WP_{k_sup}
Active Energy/Import							
WPa_imp	A	x	x	x	x	x	x
WPb_imp	B	–	–	x	x	–	x
WPc_imp	C	–	–	x	x	–	x
WP_imp	A+B+C	x	x	x	x	x	Σ WP_{k_dmd}
Reactive Energy/Inductive							
WQa_ ind	A	x	x	x	x	x	x
WQb_ ind	B	–	–	x	x	–	x
WQc_ ind	C	–	–	x	x	–	x
WQ_ ind	A+B+C	x	x	x	x	x	Σ WQ_{k_ind}
Reactive Energy/Capacitive							
WQa_ cap	A	x	x	x	x	x	x
WQb_ cap	B	–	–	x	x	–	x
WQc_ cap	C	–	–	x	x	–	x
WQ_ cap	A+B+C	x	x	x	x	x	Σ WQ_{k_cap}
Apparent Energy							
WSa	A	x	x	x	x	x	x
WSb	B	–	–	x	x	–	x
WSc	C	–	–	x	x	–	x
WS	A+B+C	x	x	x	x	x	Σ WS_k
Frozen Active Energy/Export							
WPa_exp	A	x	x	x	x	x	x
WPb_exp	B	–	–	x	x	–	x
WPc_exp	C	–	–	x	x	–	x
WP_exp	A+B+C	x	x	x	x	x	Σ WP_{k_sup}
Frozen Active Energy/Import							
WPa_imp	A	x	x	x	x	x	x
WPb_imp	B	–	–	x	x	–	x
WPc_imp	C	–	–	x	x	–	x
WP_imp	A+B+C	x	x	x	x	x	Σ WP_{k_dmd}
Frozen Reactive Energy/Inductive							
WQa_ ind	A	x	x	x	x	x	x
WQb_ ind	B	–	–	x	x	–	x
WQc_ ind	C	–	–	x	x	–	x

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
WQ_ ind	A+B+C	x	x	x	x	x	Σ WQ_{k_ind}
Frozen Reactive Energy/Capacitive							
WQa_ cap	A	x	x	x	x	x	x
WQb_ cap	B	–	–	x	x	–	x
WQc_ cap	C	–	–	x	x	–	x
WQ_ cap	A+B+C	x	x	x	x	x	Σ WQ_{k_cap}
Frozen Apparent Energy							
WSa	A	x	x	x	x	x	x
WSb	B	–	–	x	x	–	x
WSc	C	–	–	x	x	–	x
WS	A+B+C	x	x	x	x	x	Σ WS_k

NOTE

All measurements with intervals: 10 or 12 cycles

2.5.4.5 Flicker and Main Signaling Voltage Depending on Connection Types

Table 2-15 Flicker and Main Signaling Voltage Depending on Connection Types in Power Systems

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Short-Term Flicker							
Pst (a-n)	a-N	x	–	–	–	x	x
Pst (b-n)	b-N	–	–	–	–	–	x
Pst (c-n)	c-N	–	–	–	–	–	x
Pst (a-b)	a-b	–	x	x	x	–	x
Pst (b-c)	b-c	–	x	x	x	–	x
Pst (c-a)	c-a	–	x	x	x	–	x
Long-Term Flicker							
Plt (a-n)	a-N	x	–	–	–	x	x
Plt (b-n)	b-N	–	–	–	–	–	x
Plt (c-n)	c-N	–	–	-	–	–	x
Plt (a-b)	a-b	–	x	x	x	–	x
Plt (b-c)	b-c	–	x	x	x	–	x
Plt (c-a)	c-a	–	x	x	x	–	x
Instantaneous Flicker Sensation							
Pinst (a-n)	a-N	x	–	–	–	x	x
Pinst (b-n)	b-N	–	–	–	–	–	x
Pinst (c-n)	c-N	–	–	–	–	–	x
Pinst (a-b)	a-b	–	x	x	x	–	x
Pinst (b-c)	b-c	–	x	x	x	–	x

Measured Quantity	Circuit	1-Phase System	3-Wire Network (Delta) (Balanced (1I)	3-Wire Network (Delta) Unbalanced (3I)	3-Wire Network (Delta) Unbalanced (2I)	4-Wire Network (Star) Balanced (1I)	4-Wire Network (Star) Unbalanced (3I)
Pinst (c-a)	c-a	–	x	x	x	–	x
Main Signaling Voltage (MSV)							
Msv_a-N	a-N	x	–	–	–	x	x
Msv_b-N	b-N	–	–	–	–	–	x
Msv_c-N	c-N	–	–	–	–	–	x
Msv_ab	a-b	–	x	x	x	–	x
Msv_bc	b-c	–	x	x	x	–	x
Msv_ca	c-a	–	x	x	x	–	x

2.5.5 AC Operational Values

2.5.5.1 Function Description

Basic AC operational values are gathered during measurement and shown both on the Web pages (see *Figure 2-19*) and numerically on the display.

Besides, AC operational values of the crest factors are gathered during measurement and shown on the web pages. The crest factor is the ratio of peak to TrueRMS values. It is available for both voltages and currents.

2.5.5.2 Value View of the Basic Values via Web Pages

To display the basic values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Basic values**.

Value view ► Operational values ► Basic values

▼ Basic values

▼ Frequency

Measurement	Unit	Value	Min value		Max value	
f	Hz	***	50.000	2022-11-23 16:44:14:205	50.001	2000-01-01 22:52:39:404

▼ Voltage and current

Measurement	Unit	Value	Min value		Max value	
Va	V	0.000	0.000	2000-01-01 02:02:21:296	230.013	2000-01-01 22:52:53:804
Vb	V	0.000	0.000	2000-01-01 02:02:21:296	230.006	2000-01-01 22:52:53:804
Vc	V	0.000	0.000	2000-01-01 02:02:21:296	230.034	2000-01-01 22:52:53:804
Vab	V	0.000	0.000	2000-01-01 02:02:21:296	398.396	2000-01-01 22:52:53:804
Vbc	V	0.000	0.000	2000-01-01 02:02:21:296	398.405	2000-01-01 22:52:53:804
Vca	V	0.000	0.000	2000-01-01 02:02:21:296	398.405	2000-01-01 22:52:53:804
VN	V	0.000	0.000	2000-01-01 02:02:21:296	2.279	2000-01-01 22:52:58:004
Vavg	V	0.000	0.000	2000-01-01 02:02:21:296	230.018	2000-01-01 22:52:53:804
Vavg ph-ph	V	0.000	-		-	
Ia	A	0.0000	0.0000	2000-01-01 02:02:21:296	4.9995	2022-11-23 13:50:13:407
Ib	A	0.0000	0.0000	2000-01-01 02:02:21:296	4.9998	2022-11-23 16:18:01:796
Ic	A	0.0000	0.0000	2000-01-01 02:02:21:296	4.9993	2022-11-23 11:23:29:607
IN	A	0.0000	0.0000	2000-01-01 02:02:21:296	0.0000	2000-01-01 02:02:21:296
Iavg	A	0.0000	0.0000	2000-01-01 02:02:21:296	4.9996	2022-11-23 13:50:13:407

▼ Angle

Measurement	Unit	Value	Min value		Max value	
φab V	°	***	0.000	2000-01-01 22:55:55:203	122.628	2000-01-05 21:57:44:603
φbc V	°	***	0.000	2000-01-01 22:55:55:203	121.142	2000-01-01 22:55:55:003
φca V	°	***	0.000	2000-01-01 22:55:55:203	120.364	2000-01-06 00:31:21:999
φab I	°	***	0.000	2000-01-01 22:55:55:203	179.073	2022-11-23 16:44:14:405
φbc I	°	***	0.000	2000-01-01 22:55:55:203	122.593	2000-01-01 22:55:55:003
φca I	°	***	0.000	2000-01-01 22:55:55:403	176.521	2000-01-01 22:55:55:203
φUIa	°	***	-0.015	2000-01-06 00:31:21:999	47.189	2000-01-01 22:55:55:003
φUIb	°	***	-0.028	2000-01-05 21:57:44:603	45.016	2022-11-23 11:12:17:801
φUIc	°	***	-0.025	2000-01-05 21:57:44:603	45.724	2000-01-01 22:52:38:804
φUI	°	***	-0.019	2000-01-05 21:57:44:603	45.019	2000-01-01 22:52:39:004

▼ Unbalance

Measurement	Unit	Value	Min value		Max value	
Neg. seq. comp. V	%	***	0.000	2000-01-01 22:55:55:203	2.537	2000-01-05 21:57:44:603
Neg. seq. comp. I	%	***	0.000	2000-01-01 22:55:55:203	2.531	2000-01-05 21:57:44:603
Zero seq. comp. V	%	***	0.000	2000-01-01 22:55:55:203	0.677	2000-01-01 22:55:55:003
Zero seq. comp. I	%	***	0.000	2000-01-01 22:55:55:203	0.675	2000-01-01 22:55:55:003

▼ Power factor

Measurement	Unit	Value	Min value		Max value	
cos φ (a)	-	***	0.680	2000-01-01 22:55:55:003	1.000	2000-01-05 21:57:44:603
cos φ (b)	-	***	0.707	2022-11-23 11:12:17:801	1.000	2000-01-05 21:57:45:003
cos φ (c)	-	***	0.698	2000-01-01 22:52:38:804	1.000	2000-01-05 21:57:46:003
cos φ	-	***	0.707	2000-01-01 22:52:39:004	1.000	2000-01-05 21:57:45:603
PFa	-	***	-0.710	2000-01-01 22:52:38:804	1.000	2000-01-05 23:54:24:005
PFb	-	***	-0.720	2000-01-01 22:55:55:003	1.000	2000-01-05 22:05:38:600
PFc	-	***	-0.711	2000-01-01 22:55:55:003	1.000	2000-01-05 22:01:16:402
PF	-	***	-0.709	2000-01-01 22:55:55:003	1.000	2000-01-05 22:27:43:401

▼ Crest factor

Measurement	Unit	Value	Min value		Max value	
CF Ua	-	***	0.000	2022-11-21 15:14:59:417	2.258	2000-01-05 21:57:44:603
CF Ub	-	***	0.000	2022-11-21 15:14:59:417	2.373	2000-01-05 21:57:44:603
CF Uc	-	***	0.000	2022-11-21 15:14:59:417	2.316	2000-01-05 21:57:44:603
CF Uab	-	***	0.000	2022-11-21 15:14:59:417	2.243	2000-01-05 21:57:44:603
CF Ubc	-	***	0.000	2022-11-21 15:14:59:417	2.565	2000-01-05 21:57:44:603
CF Uca	-	***	0.000	2022-11-21 15:14:59:417	2.276	2000-01-05 21:57:44:603
CF Ia	-	***	0.000	2022-11-21 15:14:59:417	2.257	2000-01-05 21:57:44:603
CF Ib	-	***	0.000	2022-11-21 15:14:59:417	90.510	2022-11-22 17:43:01:408
CF Ic	-	***	0.000	2022-11-21 15:14:59:417	2.309	2000-01-05 21:57:44:603
CF IN	-	***	***	***	***	***

▼ Deviation (GB/T 19862-2016)

Measurement	Unit	Value
f	Hz	***
Va	%	-100.000
Vb	%	-100.000
Vc	%	-100.000
Vab	%	-100.000
Vbc	%	-100.000
Vca	%	-100.000

[sc_value_view_basic_values_q200, 2, en_US]

Figure 2-19 Value View Tab, Basic Values

NOTE

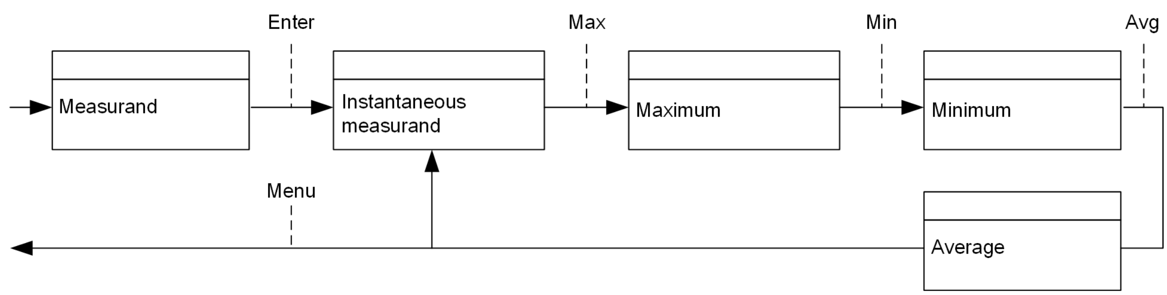
If *** is displayed instead of a value, this value is invalid.

If ^^^ is displayed instead of a value, this value overflows.

2.5.5.3 Value View via Display

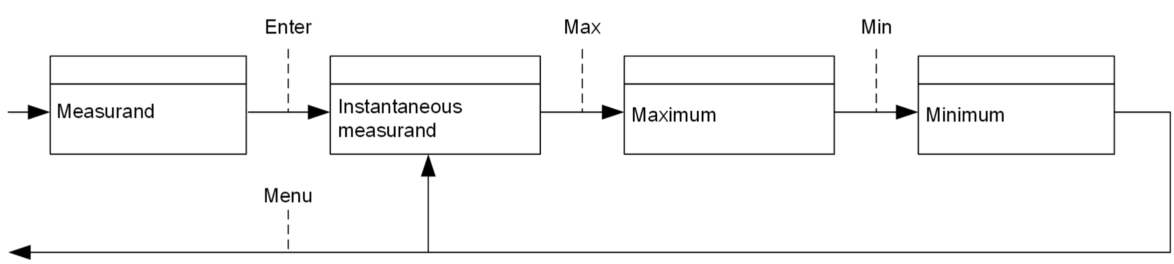
Submenu Various Measured Quantities

- Voltage Vph-n, Voltage Vph-ph
- Current I
- Power factor PF, Tot. Pwr.factor PF tot
- cos φ
- Frequency f



[dw_ac_power_2, 1, en_US]

Figure 2-20 Submenu Various Measured Quantities: Vph-n; Vph-ph; I



[dw_ac_power, 2, en_US]

Figure 2-21 Submenu Various Measured Quantities: PF, PF tot; cos φ; f

2.5.6 AC Power and Energy

2.5.6.1 Function Description

The following AC power and energy values are gathered during measurement and shown both on the Web pages and numerically on the display:

- Power values P, Q, Q1, S
- Energy values WP (imp, exp), WQ (imp, exp, ind, cap), WS
- Load profiles (for more information, refer to *5.1 Load Profile*)
- Tariffs (for more information, refer to *5.4 Tariffs*)
- Frozen energy (for more information, refer to *5.5 Energy Freeze and Reset*)

2.5.6.2 Value View of the AC Power and Energy via Web Pages

To display the AC-power and energy values in the **Value view** tab, proceed as follows:

- In the navigation window, click **AC power** or **Energy**.

Value view ► Operational values ► Power ► AC power

▼ Power

Measurement	Unit	Value	Min value		Max value	
Pa	W	0.00	0.00	2000-01-01 02:02:21:296	813.17	2022-11-23 16:18:06:996
Pb	W	0.00	0.00	2000-01-01 02:02:21:296	813.15	2022-11-23 16:18:07:596
Pc	W	0.00	0.00	2000-01-01 02:02:21:296	813.06	2022-11-23 16:18:07:596
P	W	0.00	0.00	2000-01-01 02:02:21:296	2 439.38	2022-11-23 16:18:07:596
Qa	var	0.00	-0.14	2000-01-05 21:57:44:603	813.29	2000-01-01 22:52:39:004
Qb	var	0.00	-0.35	2000-01-05 21:57:44:803	813.30	2022-11-23 11:12:17:801
Qc	var	0.00	-0.34	2000-01-05 21:57:44:803	813.38	2000-01-01 22:52:39:004
Q	var	0.00	-0.69	2000-01-05 21:57:44:803	2 439.97	2022-11-23 11:12:17:801
Q1a	var	0.00	-0.01	2000-01-05 23:51:32:006	813.28	2000-01-01 22:52:39:004
Q1b	var	0.00	-0.01	2000-01-05 23:53:07:805	813.27	2022-11-23 11:12:17:801
Q1c	var	0.00	-0.01	2000-01-05 23:47:16:998	813.38	2000-01-01 22:52:39:004
Q1	var	0.00	-0.03	2000-01-05 23:56:28:004	2 439.93	2022-11-23 11:12:17:801
Sa	VA	0.00	0.00	2000-01-01 02:02:21:296	1 149.94	2022-11-23 16:18:06:996
Sb	VA	0.00	0.00	2000-01-01 02:02:21:296	1 149.91	2022-11-23 16:18:07:596
Sc	VA	0.00	0.00	2000-01-01 02:02:21:296	1 149.96	2000-01-01 22:55:48:403
S	VA	0.00	0.00	2000-01-01 02:02:21:296	3 449.80	2022-11-23 16:18:07:596

[sc_evaluation_ac power, 3, en_US]

Figure 2-22 Value View of the AC Power

Value view ► Operational values ► Energy ► Energy

▼ Energy

Measurement	Energy				
	Unit	Total	A	B	C
WP_imp	Wh	13 878.07	4 626.10	4 626.13	4 625.77
WP_exp	Wh	0.00	0.00	0.00	0.00
WQ_imp	varh	13 630.07	4 543.10	4 542.97	4 543.90
WQ_exp	varh	0.00	0.00	0.00	0.00
WQ_ind	varh	13 630.10	4 543.10	4 542.97	4 543.90
WQ_cap	varh	0.00	0.00	0.00	0.00
WS	VAh	19 523.97	6 507.87	6 507.83	6 508.20

[sc_eva_energy, 3, en_US]

Figure 2-23 Value View of the Energy

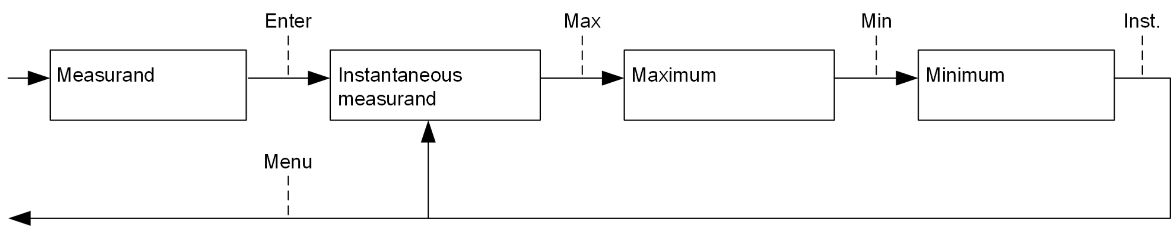
NOTE

If *** is displayed instead of a value, this value is invalid.
If ^^^ is displayed instead of a value, this value overflows.

2.5.6.3 Value View via Display

Submenu Various Measured Quantities

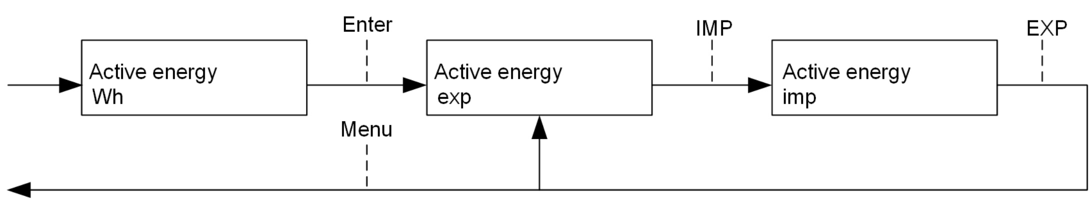
- Voltage Vph-n, Voltage Vph-ph
- Current I
- Active Power P, React. Power Q, App. Power S, Total Power P, Q, S
- Power factor PF, Tot. Pwr.factor PF tot
- cos φ
- Frequency f
- Phase unbal. Vnb, Inb



[dw_measured quantities, 2, en_US]

Figure 2-24 Submenu Various Measured Quantities

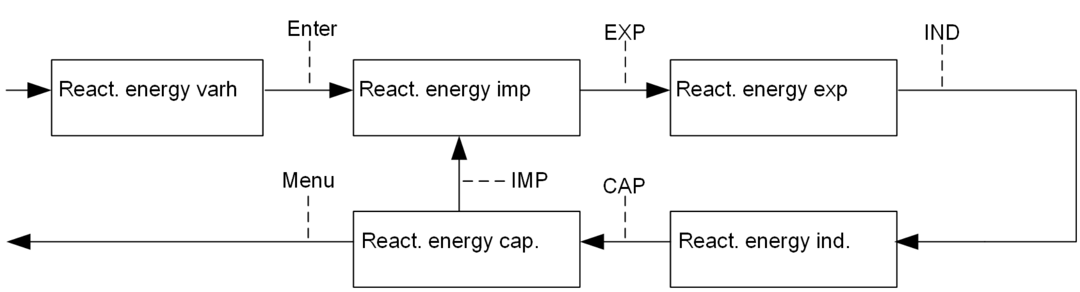
Submenu Active Energy



[dw_active_energy, 4, en_US]

Figure 2-25 Submenu Active Energy

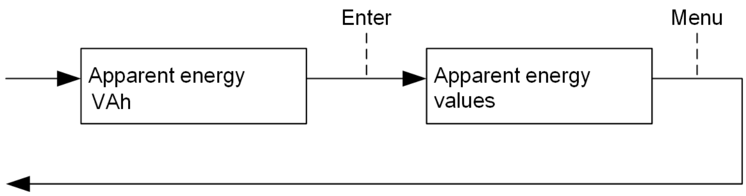
Submenu Reactive Energy



[dw_reactive_energy, 3, en_US]

Figure 2-26 Submenu Reactive Energy

Submenu Apparent Energy



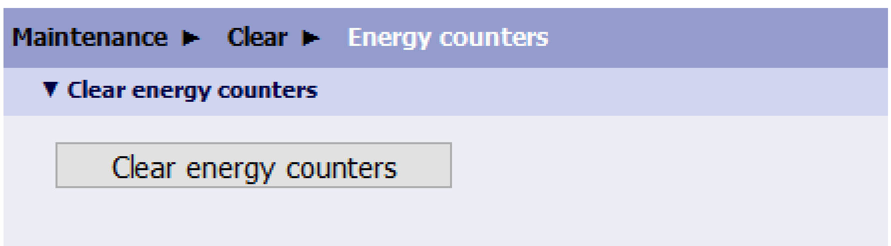
[dw_apparent_energy, 2, en_US]

Figure 2-27 Submenu Apparent Energy

2.5.6.4 Clearing of Energy Counters

To clear the energy counters in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Energy counters**.



[sc_Reset energy counters, 3, en_US]

Figure 2-28 Maintenance Tab, Clear Energy Counters

- Click **Clear energy counters**.
  The energy counters are cleared. The **Action was successful** indication is displayed on the status bar.

NOTE

The cleared energy counters include the following values:

- Energy values
- Frozen-energy values
- Tariff values
- CO_2-emission values

2.6 Email Notification

2.6.1 Function Description

With the function **Email notification**, the device sends you emails of warnings about the power-quality events and notifications about the indication changes that occur.

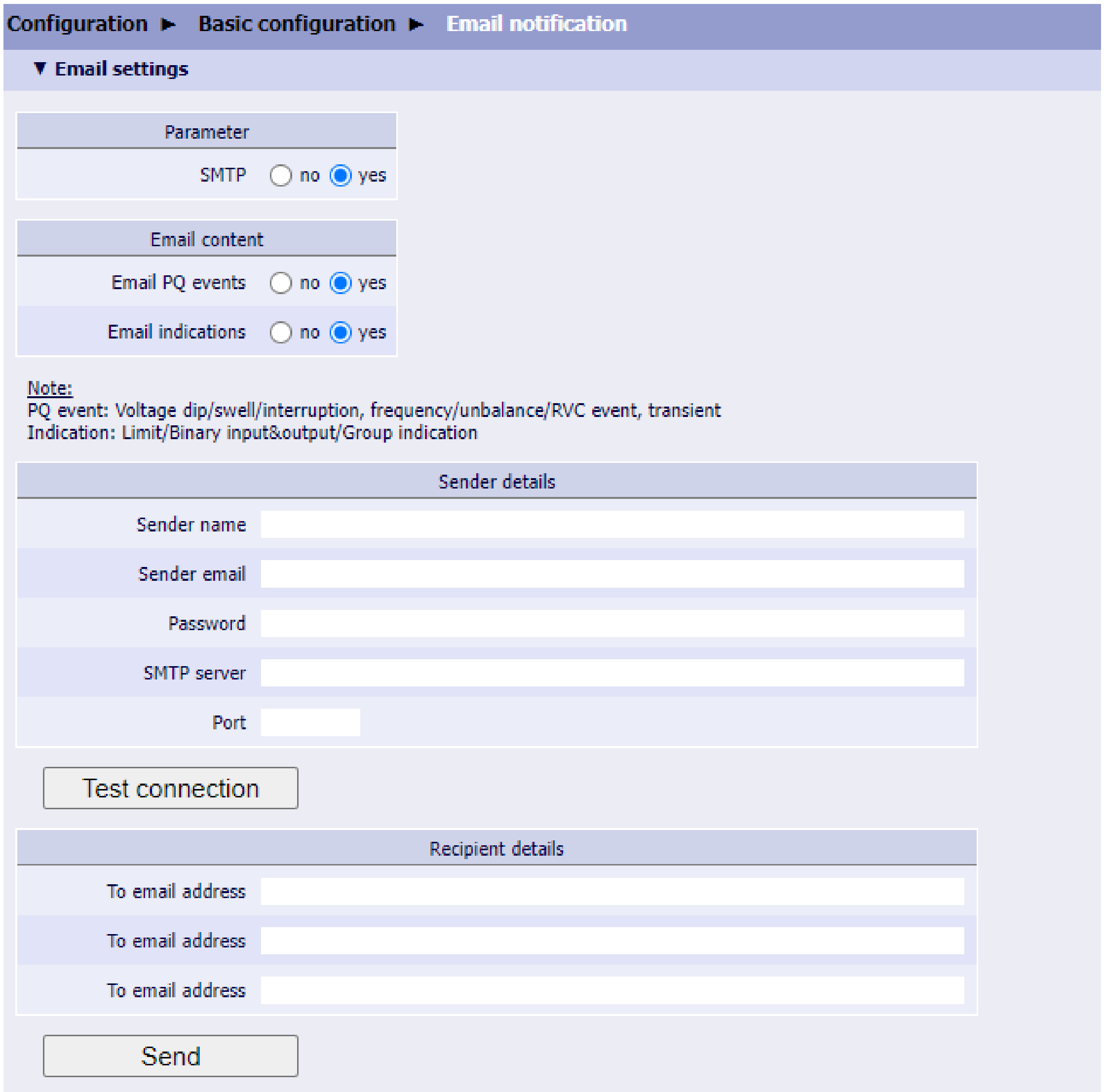
The emails fall into the following types:

- Warnings of the following power-quality events:
  - Voltage dips
  - Voltage swells
  - Voltage interruptions
  - Frequency events
  - Voltage-unbalance events
  - RVC events
  - Transients
- Notifications about changes of the following indications:
  - Limits
  - BI/BO indications
  - Group indications

2.6.2 Configuration via Web Pages

To enable the function **Email notification** in the tab **Configuration**, proceed as follows:

- In the navigation window, click **Basic configuration**.
- Set the parameter **SMTP** to ***yes***.
  The relevant parameters are available on the screen only when **SMTP** is set to ***yes***.



[sc_configuration_email, 1, en_US]

Figure 2-29 Configuration Tab, Email Notification

- Select which types of emails (PQ events, indications, or both) you want to receive.
- Configure the sender-related parameters according to *Table 2-16*.

- Click **Test connection**.
  If the parameters you entered are valid, the message "SMTP connection: Successful" shows up:

NOTE

The network connection is a prerequisite for successful test connection.

- Configure the recipient-related parameters according to *Table 2-16*.
- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Table 2-16 Settings for Email Notification

Parameter	Default Setting	Setting Range	Comment
SMTP	no	no yes	-
Email PQ events	yes	no yes	-
Email indications	yes	no yes	-
Sender Details			
Sender name	empty	Max. 63 characters	-
Sender email	empty	Max. 63 characters	These 4 parameters come from the vendor of the email server and must be configured to activate the function **Email notification**.
Password	empty	Max. 63 characters	
SMTP server	empty	Max. 63 characters IP address or domain name	
Port	empty	0 to 65 535	
Recipient Details			
To email address	empty	Max. 63 characters	• Up to 3 recipients can be configured. • To activate the function **Email notification**, you must configure at least 1 recipient.

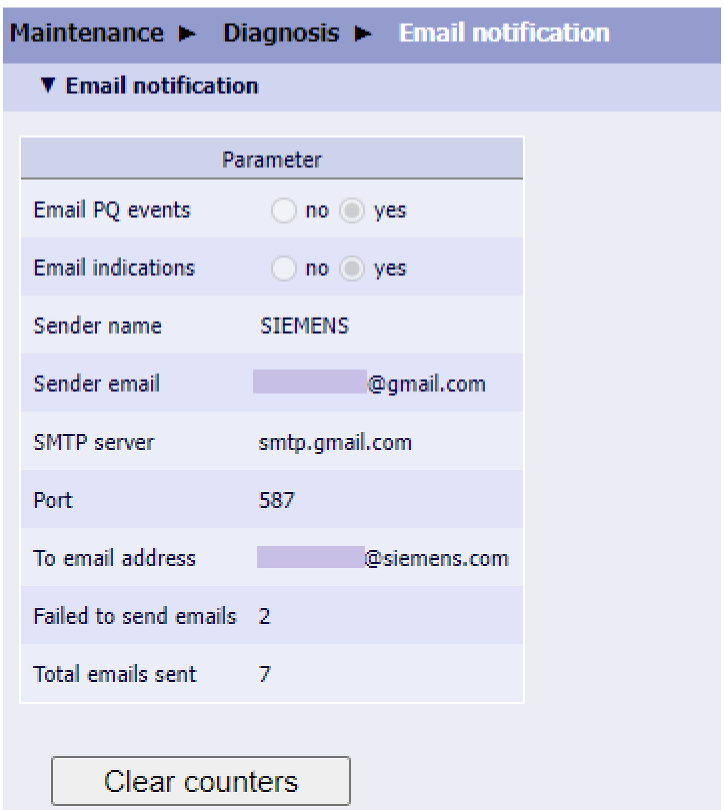
NOTE

- The SMTP server can be an IP address or a domain name. For the SMTP server to support a domain name, you must enable the DNS protocol (refer to *Configuration of the Communication Ethernet, Page 73*).
- The email addresses, IP address/domain name, and port number must be valid to ensure successful email delivery.

2.6.3 Diagnosis for Email Notification

The diagnosis for the function **Email notification** shows the configured settings as well as the counts of failed emails and total emails sent.

To view the diagnostic data in the tab **Maintenance**, click **Email notification** in the navigation window:



[sc_email_diagnosis, 1, en_US]

Figure 2-30 Maintenance Tab, Email Notification

To clear the counts of failed emails and total emails sent, click **Clear counters**.

2.7 Ethernet Communication

2.7.1 Ethernet

2.7.1.1 Function Description

The device has two 100Base-T Ethernet ports (RJ45 connectors) at the rear side of the device. These Ethernet ports can be configured either to be 2 switched ports of the same Ethernet network with 1 MAC and 1 IP address or to be assigned to 2 different Ethernet networks with 2 MAC and IP addresses, 1 for each of both of the Ethernet networks.

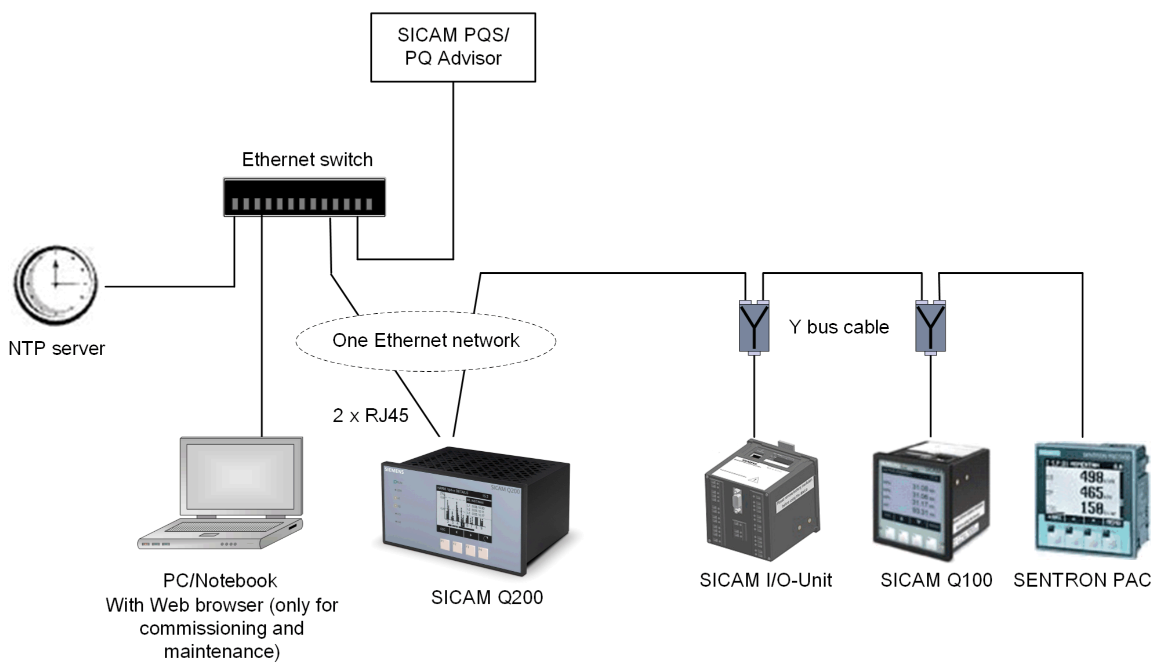
All Devices in 1 Ethernet Network

The 2 Ethernet ports of the device are configured as 2 switched ports of 1 Ethernet network using the built-in Ethernet switch of the device.

The following figure shows a local network of an installation with different field devices and a data evaluation and control system (SCADA system, for example SICAM PQS) as well as an NTP server for time synchronization via the Ethernet network.

The Ethernet communication protocol for data exchange between the field devices and the control system is IEC 61850 or Modbus TCP.

Devices with an integrated Ethernet switch (for example, SICAM I/O-Unit, SICAM Q100) can simplify the network cabling.



[dw_all_devices_in_one_Ethernet_network, 2, en_US]

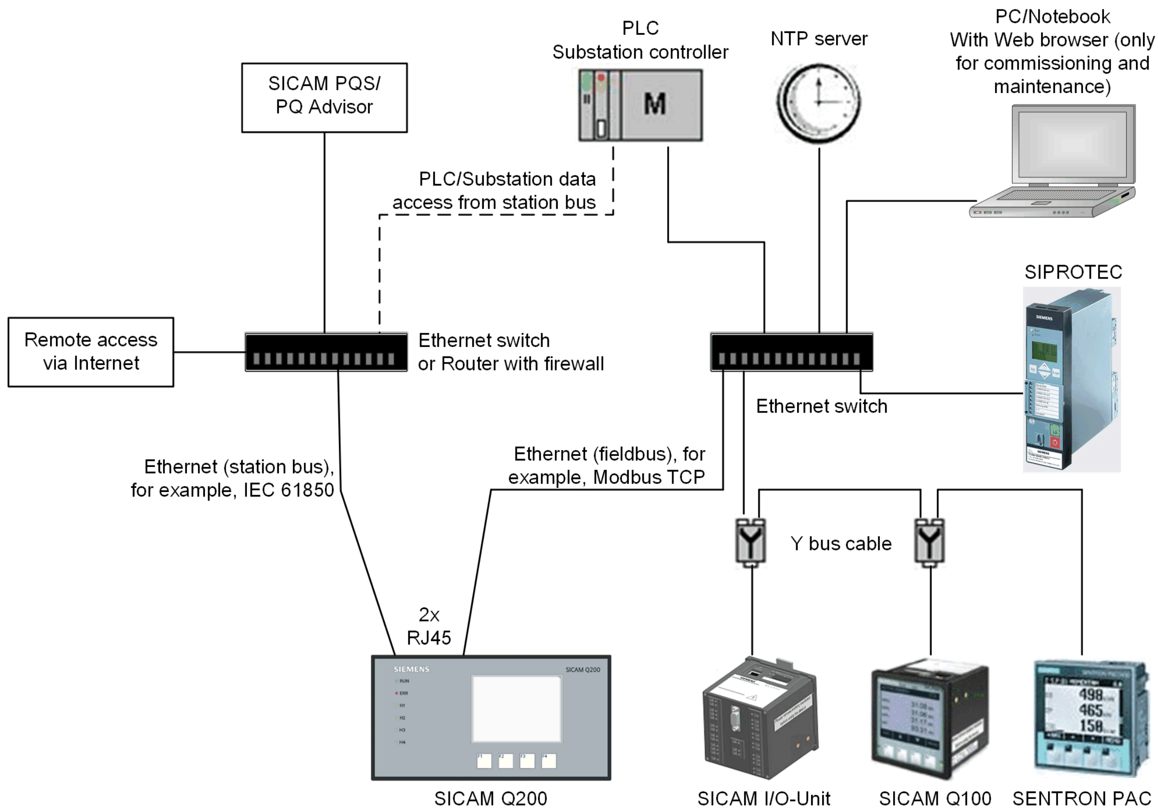
Figure 2-31 All Devices in 1 Ethernet Network

2 Networks – Station Bus and Field Bus

In this network topology the communication is split up in 2 separate networks (for example, field-bus network and station-bus network).

The device can be directly connected to 2 different Ethernet networks. So, it can be used as link between the 2 networks or can be additionally connected to the station bus in order to transmit larger amount of data (for example PQ records) more easily.

The used communication protocol in the device can differ for both of the networks, for example it can be protocol Modbus TCP on the field bus side and protocol IEC 61850 on the station bus side.



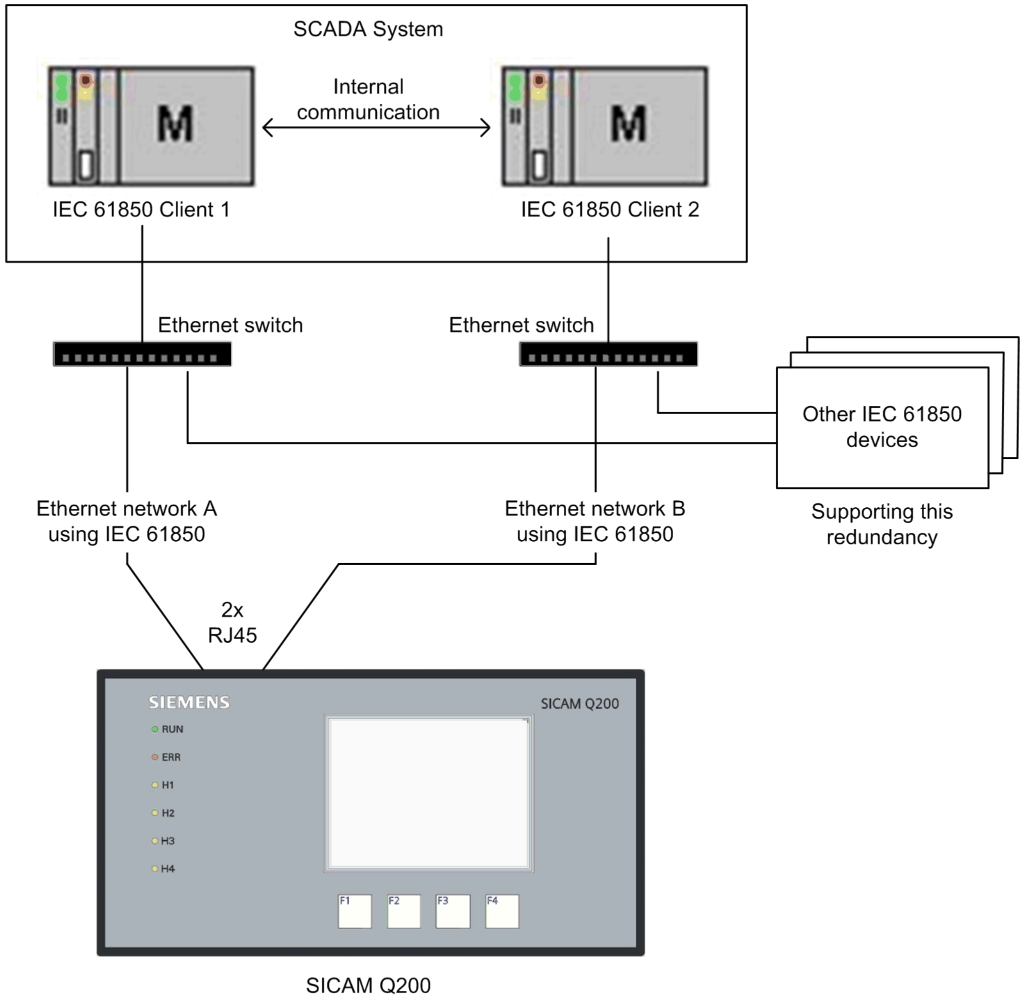
[dw_2-networks, 2, en_US]

Figure 2-32 Example for Installation: 2 Networks – Station Bus and Field Bus

IEC 61850 Redundancy Using 2 Networks

Via the 2 Ethernet ports, the device allows the setup of a redundant network using the IEC 61850 protocol.

The SCADA system is responsible to discard redundancy information. It will connect to the device on 2 networks with different IP addresses. Relevant services like reporting, control, and file transfer defined in PICS only allow 1 connection at a time, not multiple connections in parallel.



[dw_IEC61850_redundancy_with_2-networks, 1, en_US]

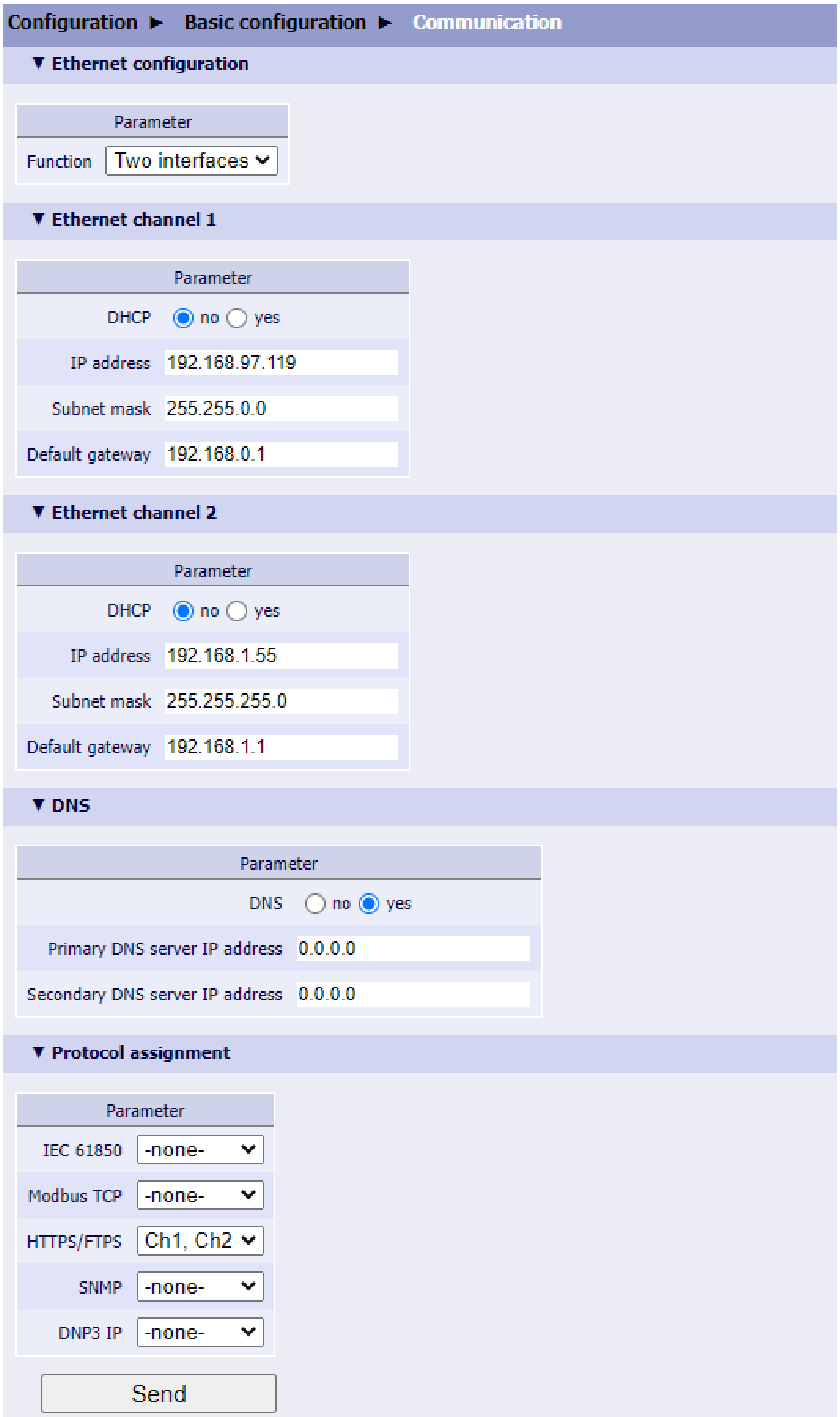
Figure 2-33 Example for Installation: IEC 61850 Redundancy Using 2 Networks

2.7.1.2 Configuration via Web Pages

Configuration of the Communication Ethernet

To change the Ethernet communication settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Communication Ethernet**.



[sc_ethernet_communication_example, 6, en_US]

Figure 2-34 Configuration Tab, Ethernet Settings

- Configure the respective parameters according to the following table.

Table 2-17 Settings for Communication Ethernet

Parameter	Default Setting	Setting Range	Description
Ethernet Configuration			
Function	Switch	Switch Two interfaces	Configuration of both Ethernet ports: Switch: 2 switched ports in 1 network 2 interfaces: 2 Ethernet interfaces in 2 networks
Ethernet Channel 1			
DHCP	no	no yes	Determines whether DHCP is used for automatic receiving of network parameters instead of fixed network configuration settings DHCP can only be used if IEC 61850 is disabled.
IP address	192.168.0.55	Any	Network configuration for Ethernet Channel 1 (only available for Channel 1 **DHCP** = ***no***)
Subnet mask	255.255.255.0		
Default gateway	192.168.0.1		
Ethernet Channel 2			
DHCP	no	no yes	Determines whether DHCP is used for automatic receiving of network parameters instead of fixed network configuration settings DHCP can only be used if IEC 61850 is disabled.
IP address	192.168.1.55	Any	Network configuration for Ethernet Channel 2 (only available for Channel 2 **DHCP** = ***no***)
Subnet mask	255.255.255.0		
Default gateway	192.168.1.1		
DNS			
DNS	no	no yes	Determines whether the DNS protocol is used for the SMTP server to support a domain name
Primary DNS server IP address	0.0.0.0	Any No polling of the DNS server if 0.0.0.0 is entered	
Secondary DNS server IP address	0.0.0.0		
Protocol Assignments			
IEC 61850	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the IEC 61850 communication protocol to the Ethernet channels (only available for SICAM Q200 devices with the IEC 61850 communication option according to the order number) The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***. IEC 61850 can only be used with fixed IP addresses (no DHCP).
Modbus TCP	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the Modbus TCP communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***.

Parameter	Default Setting	Setting Range	Description
HTTPS/FTPS	Ch1, Ch2	Ch1 Ch2 Ch1, Ch2	Activation and assignment of the HTTPS/FTPS communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***. The protocol cannot be completely deactivated in order to ensure access to the device.
SNMP	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the SNMP communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***.
DNP3 IP	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the DNP3 IP communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***.

NOTE

The protocols listed under the **Protocol Assignments** can work in parallel according to your configuration.

NOTE

After the parameter changes are enabled, the device will be reset.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

NOTE

If **Function** is changed from **Function** = ***Two interfaces*** to **Function** = ***Switch***, then the settings of protocol assignments with Channel 2 selected are changed as follows:

- Ch2 → none
- Ch1 → Ch1, Ch2

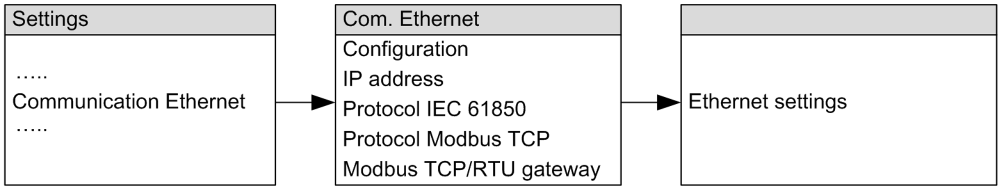
NOTE

If **Function** is set to ***Two interfaces***, use Ethernet channel 1 for cross-gateway communication.

2.7.1.3 Configuration via Display

Submenu Ethernet Settings

The operation is carried out with the softkeys F1 to F4.



[dw_display_communication_ethernet, 1, en_US]

Figure 2-35 Submenu Communication via Ethernet

NOTE

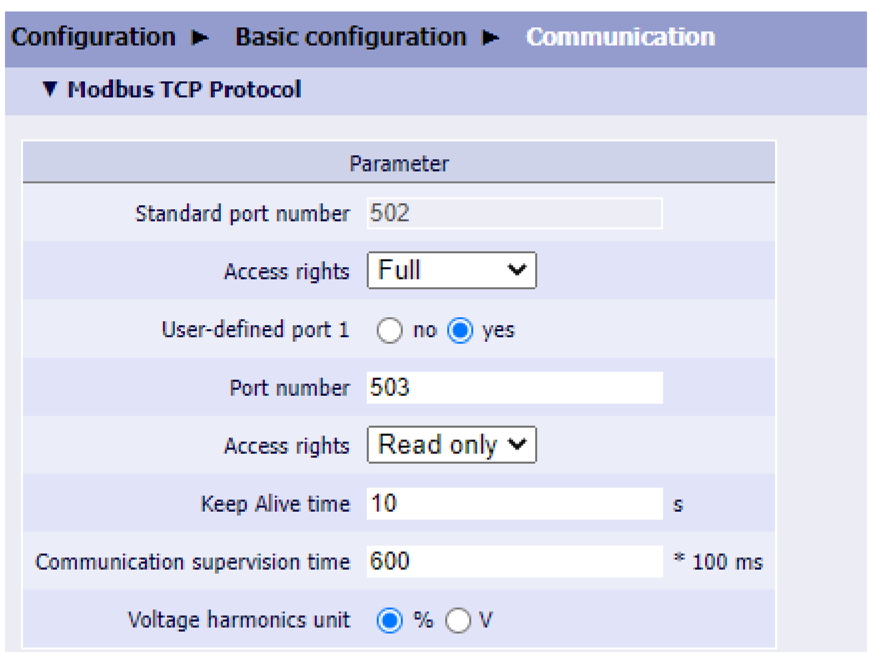
The MAC-Address is shown on the display but cannot be edited.
For this purpose, a prompt is displayed which you must acknowledge with **OK**.

2.7.2 Modbus TCP Server

2.7.2.1 Configuration via Web Pages

Precondition: The **Modbus TCP** protocol must be assigned to at least 1 Ethernet interface.
To change the Modbus TCP settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Modbus TCP protocol**.



[sc_Modbus_TCP_settings, 5, en_US]

Figure 2-36 Configuration Tab, Modbus TCP Settings

- Configure the respective parameters according to the following table.

Table 2-18 Settings for Modbus TCP

Parameter	Default Setting	Setting Range
Standard port number	502	502 Not settable
Access rights	Full	Full Read only

Parameter	Default Setting	Setting Range
User-defined port 1	no	no yes
Port number[15]	503	503 to 65 535
Access rights[15]	Read only	Full Read only
Keep alive time	10 s	0 s = switch off 1 s to 65 535 s
Communication supervision time	600 (* 100 ms)	0 s = none 100 ms to 6 553 400 ms
Voltage harmonics unit	%	% V

NOTE

The 2 port numbers must be different from each other.

NOTE

If the protocol is active on both Ethernet interfaces, the protocol settings are identical for the communication via both interfaces.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Number of Connections

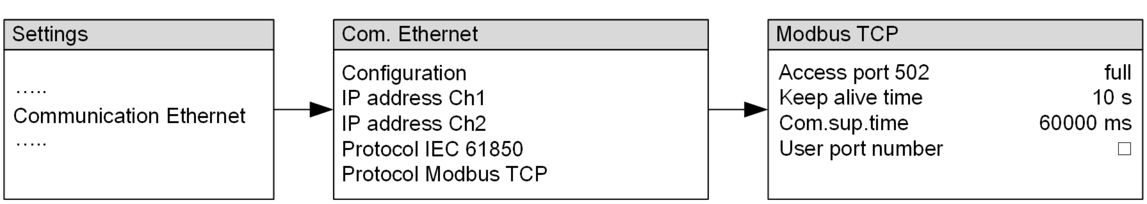
Up to 5 TCP connections are possible:

- Without user port number: 5 connections via the standard port 502
- With user port number: 3 connections via the standard port 502 and 2 connections via the user port

2.7.2.2 Configuration via Display

Submenu Modbus TCP Settings

The operation is carried out with the softkeys F1 to F4.



[dw_display_communication_Modbus_TCP, 2, en_US]

Figure 2-37 Submenu Communication via Modbus TCP

2.7.2.3 Diagnosis of the Modbus TCP

The diagnosis for the Modbus TCP allows analyzing parameters and communication as well as resetting the diagnostic counters.

15 This parameter is available only if **User-defined port 1** is set to **yes**.

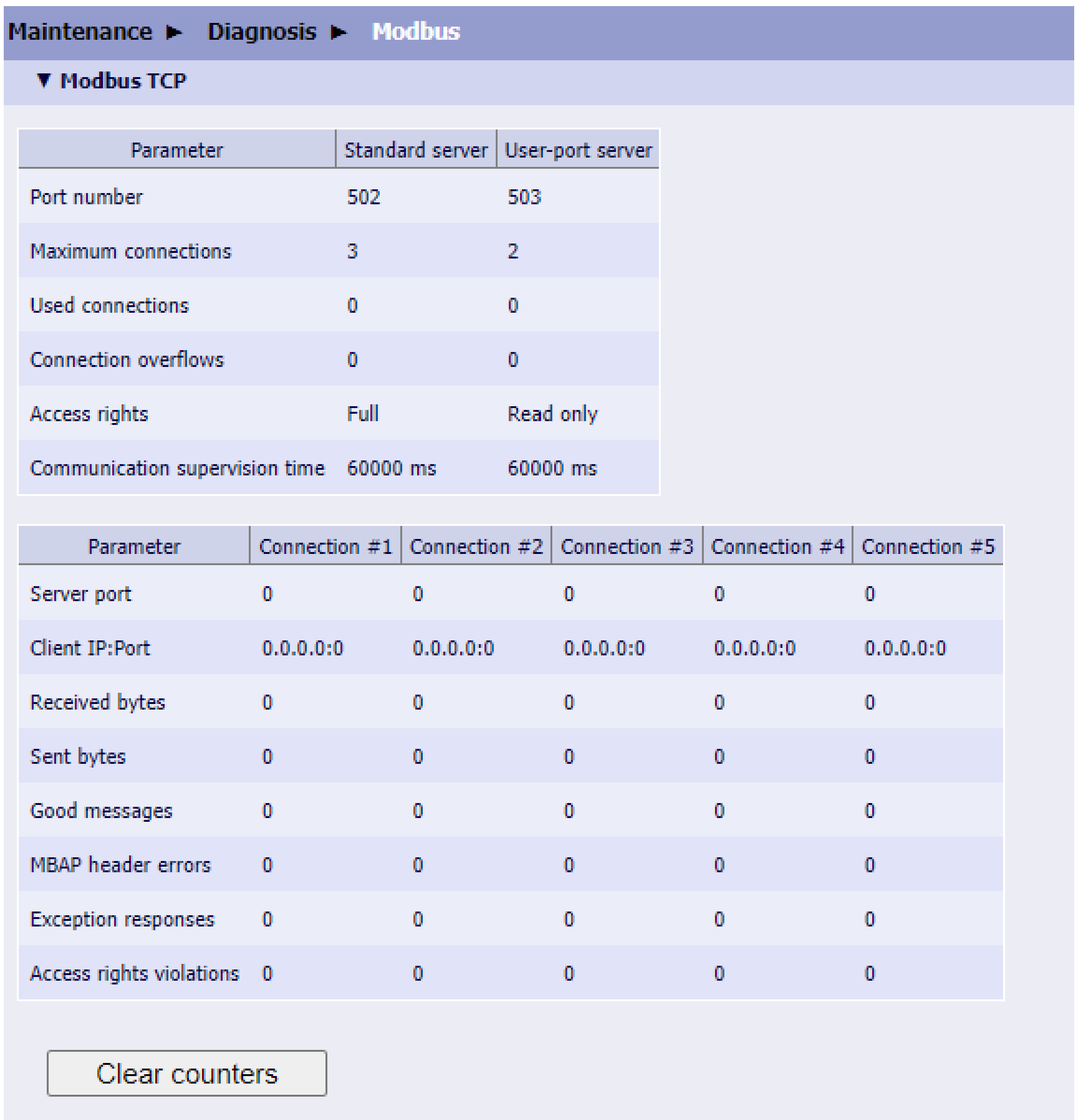
NOTE

The diagnostic data of **Modbus TCP** are displayed only if the bus protocol has been assigned to an Ethernet channel in the tab **Configuration** → **Basic configuration** → **Communication Ethernet**.

If the protocol has not been assigned to an Ethernet interface, the **Diagnosis Modbus TCP** window displays **-none-**.

For the diagnosis of the protocol Modbus TCP in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Modbus**.
  The **Modbus** window opens and the **Modbus TCP** protocol is displayed. For Modbus TCP the **Standard server**, the **User-port server** and the **Connection** data are analyzed.



Parameter	Standard server	User-port server
Port number	502	503
Maximum connections	3	2
Used connections	0	0
Connection overflows	0	0
Access rights	Full	Read only
Communication supervision time	60000 ms	60000 ms

Parameter	Connection #1	Connection #2	Connection #3	Connection #4	Connection #5
Server port	0	0	0	0	0
Client IP:Port	0.0.0.0:0	0.0.0.0:0	0.0.0.0:0	0.0.0.0:0	0.0.0.0:0
Received bytes	0	0	0	0	0
Sent bytes	0	0	0	0	0
Good messages	0	0	0	0	0
MBAP header errors	0	0	0	0	0
Exception responses	0	0	0	0	0
Access rights violations	0	0	0	0	0

[sc_Diagnosis_Modbus-TCP, 2, en_US]

Figure 2-38 Maintenance Tab, Diagnosis Modbus TCP

- To clear the counters for Modbus TCP, click **Clear counters**.
  All counters for Modbus TCP are reset to 0.

Diagnostic Information for Standard Server and User-Port Server

- Port number:
  Standard port 502 and configured user port
- Maximum connections:
  - Without user port number: 5 connections via the standard port 502
  - With user port number: 3 connections via the standard port 502 and 2 connections via the user port
- Used connections:
  Number of connections that are actually used
- Connection overflows:
  Counter of the attempts to establish more connections than allowed;
  Number of allowed connection attempts:
  For user port number 502: ≥ 5 connection attempts via the standard port 502
  For other user port numbers: ≥ 3 connection attempts via standard port 502 and/or ≥ 3 connection attempts via user port
- Access rights: as configured
- Communication supervision time: as configured

Diagnostic Information of Connections

- Server port:
  Server port number of the current connection in the respective column; if 0 is displayed, the connection is inactive or down
- Client IP:Port:
  Last or current IP address and port number of the client
- Received bytes:
  Total number of bytes received by the TCP port
- Sent bytes:
  Total number of bytes sent to the TCP port
- Good messages:
  Total number of messages received that were detected as valid Modbus messages
- MBAP header errors:
  Error in the MBAP header: incorrect protocol ID or implausible length of data
- Exception responses:
  Counters of the transmitted exception response messages
- Access rights violations:
  Total number of write accesses received if the parameter **Access rights for port xxx** is set to **Read only** of the associated TCP port (for example 502) in the **Communication Ethernet** input/output window. For more information, refer to chapter *2.7.1.2 Configuration via Web Pages*.

2.7.3 Modbus Gateway

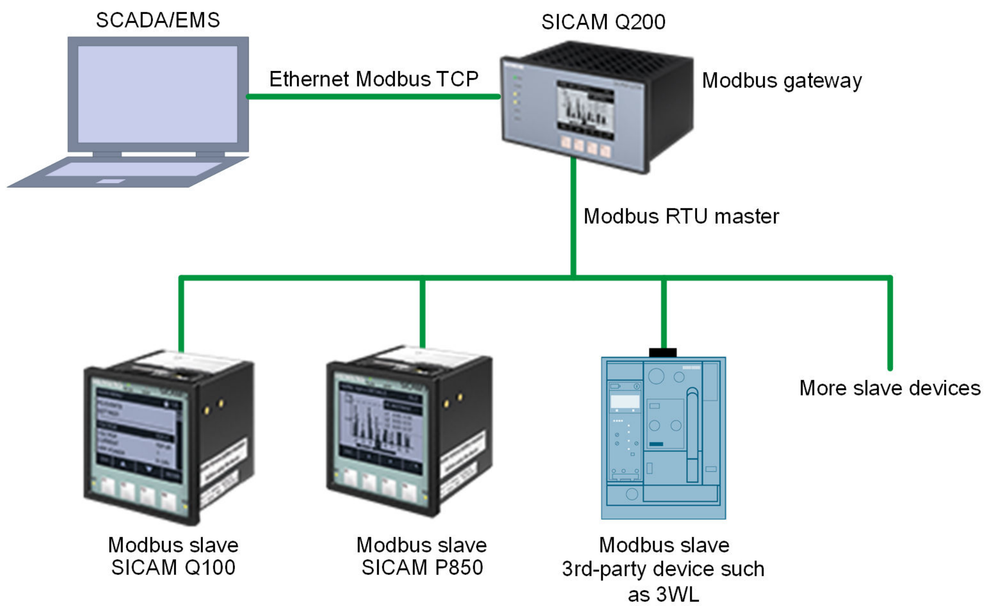
2.7.3.1 Function Description

The device can function as a Modbus gateway through which the control system communicates with a serial network of devices.

A Modbus master device can communicate through the gateway device with the serial network of devices connected to the serial ports of the gateway device. The gateway device receives Modbus TCP/IP data on the TCP port, translates it to Modbus RTU, and then forwards it to the addressed slave device.

The following figure shows how the device connects your personal computer to the slave devices. The maximum number of Modbus slaves that can be connected depends on the number of serial ports on the gateway device.

Schematic Overview of the Functioning of the Modbus Gateway



[dw_modbus_gateway_q200, 2, en_US]

Figure 2-39 Functioning of the Modbus Gateway

NOTE

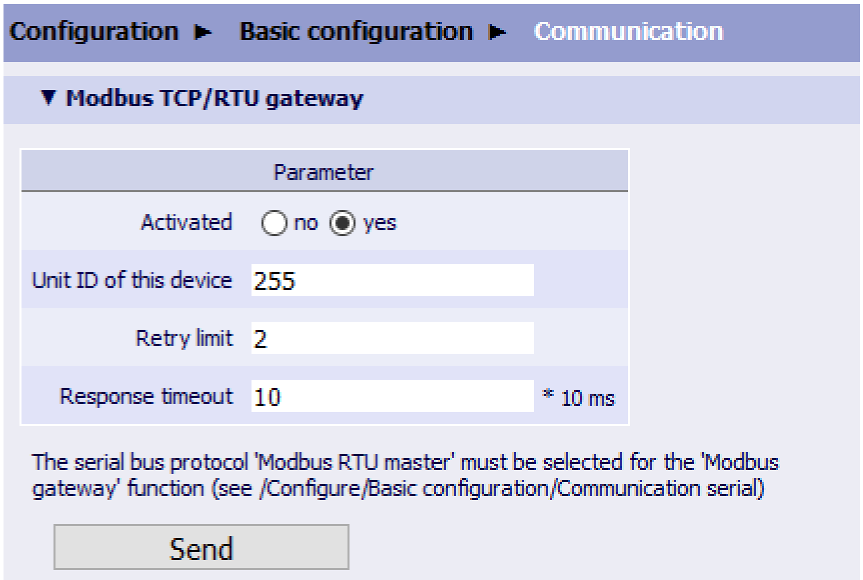
During a firmware update of the device, the Modbus gateway function is stopped.

2.7.3.2 Configuration of the Modbus Gateway via Web Pages

Precondition: The **Modbus TCP** protocol must be assigned to at least 1 Ethernet interface. The **Modbus RTU Master** protocol must have been selected under serial communication.

To change the settings of the **Modbus Gateway** in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Modbus TCP protocol**.



[sc_Communication_modbus_TCP_RTU_gateway, 3, en_US]

Figure 2-40 Configuration Tab, Modbus Gateway Settings

- Configure the respective parameters according to the following table.

Table 2-19 Settings for the Modbus Gateway

Parameter	Default Settings	Setting Range
Activated	no	no yes
Unit ID of this device	255	1 to 255
Retry limit[16]	2	0 to 10
Response timeout[16]	10 (* 10 ms)	(1 to 6000) * 10 ms = 10 ms to 60 s

NOTE

If the protocol is active on both Ethernet interfaces then the protocol settings are identical for the communication via both interfaces.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Number of Connections

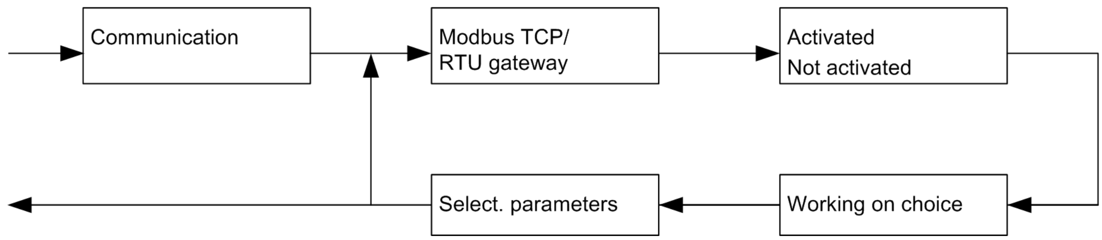
Refer to *Number of Connections, Page 78*.

2.7.3.3 Configuration and Value View via Display

Submenu Modbus Gateway Settings

The operation is carried out with the softkeys F1 to F4.

16 These values are necessary if the Modbus slave device has not been configured for the requested Unit ID. If a Modbus slave device was configured, its values are used.



[dw_submenu_modbus_gateway, 1, en_US]

Figure 2-41 Submenu, Communication via Modbus Gateway

2.7.3.4 Diagnosis of the Modbus Gateway

The diagnosis of the Modbus gateway provides the following information:

- Overview of the last 5 telegrams sent by the Modbus gateway (only available if the Modbus gateway function has been activated, see chapter *2.7.3.2 Configuration of the Modbus Gateway via Web Pages*)

Last Modbus Gateway Messages

This section is available only if the Modbus gateway function is activated.

Table 2-20 Description of the Parameters in Last Modbus Gateway Messages

Parameter	Description
Status	Status of the request messages • Good: correct response • No response: the bus device does not respond (for example, communication failure) • Exception responses (n): exception response sent with error code • CRC error: a CRC error was detected in the response
Name	Name of the Modbus slave device to which the request message was sent. The name is only available if the Modbus slave device was also parameterized in the Modbus RTU Master (active parameter set). Otherwise, **–** is entered.
Dev. addr.	Device address of the Modbus slave device to which the request message belongs
Fct. code	Modbus function code used in the request message
Start addr.	Start register address when reading data of this request message
Qty. of regs	Number of registers requested in this message
Last request	This value indicates how many ms ago the data were requested. It is a snapshot referring to the last update of the diagnostic page on the Web. It cannot be used to determine the sending time exactly.
Client IP: Port	IP address and TCP port number of the Modbus TCP client that sent the request

2.7.4 IEC 61850

2.7.4.1 Function Description

The IEC 61850 protocol is also used for communication via the Ethernet interface. The IEC 61850 specification with a detailed explanation of the protocol is given in the International Standard IEC 61850. The device supports IEC 61850, Edition 2.

The device supports 6 input configurations:

- 1-phase system
- 3-wire network – balanced (1I)
- 3-wire network – unbalanced (3I)

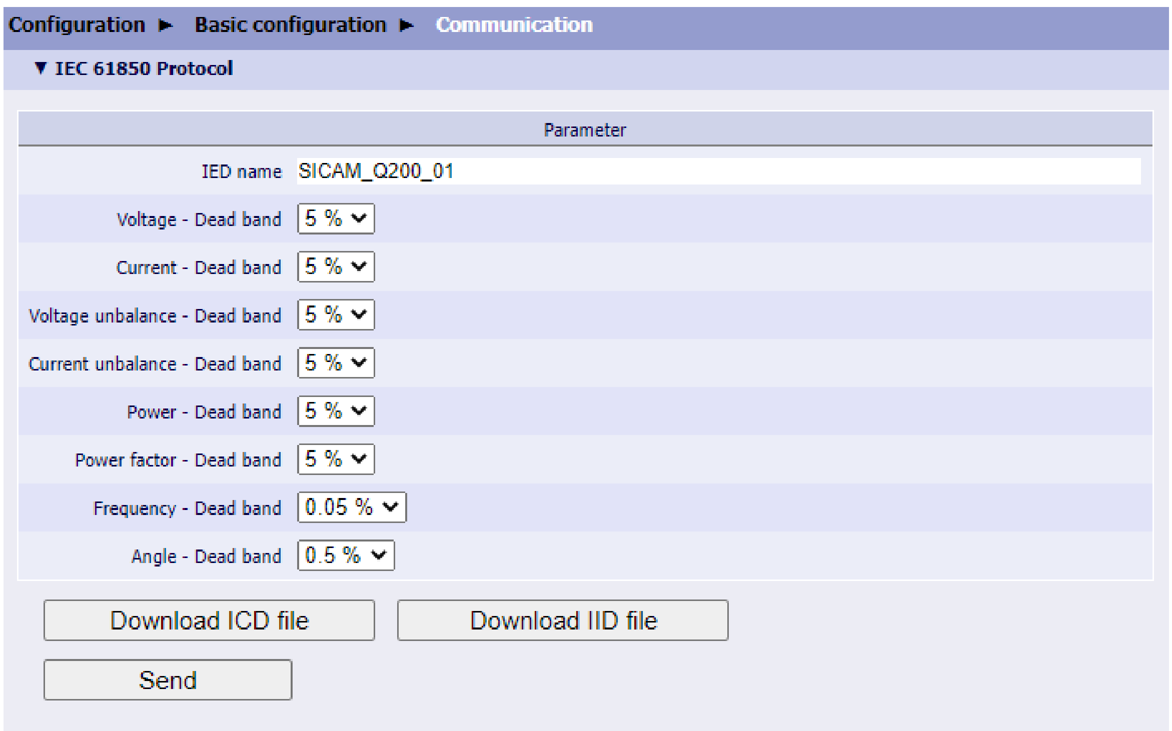
- 3-wire network – unbalanced (2I)
- 4-wire network – balanced (1I)
- 4-wire network – unbalanced (3I)

2.7.4.2 Configuration via Web Pages

Configuration of the IEC 61850 Protocol

Precondition: The **IEC 61850** protocol must be assigned to at least 1 Ethernet interface.
To change the IEC 61850 settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **IEC 61850 protocol**.



[sc_IEC61850_configuration, 6, en_US]

Figure 2-42 Configuration Tab, IEC 61850 Settings

- Configure the respective parameters according to the following table.

Table 2-21 Settings for IEC 61850

Parameter	Default Setting	Setting Range
IED Name	SICAM_Q200_01	Max. 60 characters Only a-z, A-Z, _, 0-9 are permitted. The first character must be an alpha character.
Voltage - Dead band	5 %	1 % to 5 %, in 1-% steps
Current - Dead band	5 %	1 % to 5 %, in 1-% steps
Voltage unbalance - Dead band	5 %	1 % to 5 %, in 1-% steps
Current unbalance - Dead band	5 %	1 % to 5 %, in 1-% steps
Power - Dead band	5 %	1 % to 5 %, in 1-% steps
Power factor - Dead band	5 %	2 % to 5 %, in 1-% steps

Parameter	Default Setting	Setting Range
Frequency - Dead band	0.05 %	0.02 % 0.05 % 0.2 %
Angle - Dead band	0.5 %	0.2 % 0.5 % 1 % 2 %

NOTE

If the protocol is active on both Ethernet interfaces then the protocol settings are identical for the communication via both interfaces.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Download IID File

The Instantiated IED Description (IID) file contains the data of the currently parameterized network type, for example: 4-wire, any load (3P4W), the currently parameterized IP address, the subnet mask, the default gateway, and the IED name.
This file is of the.iid format.

- Click **Download IID file**.
  The IID file is downloaded to a folder you selected.

Download ICD File

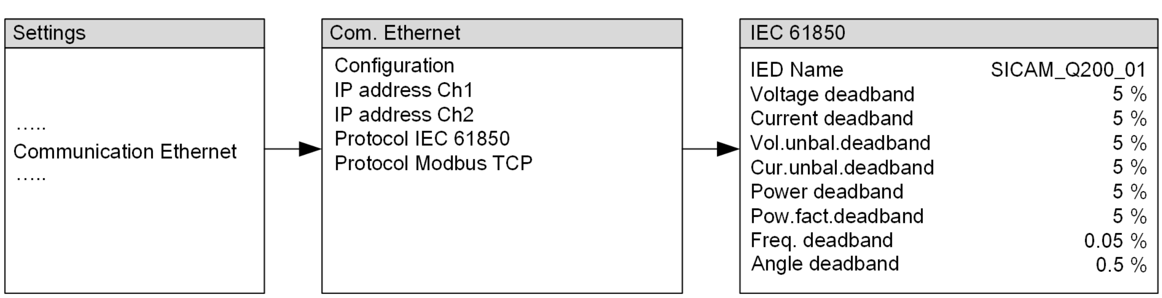
The IED Capability Description (ICD) file contains the data of the currently parameterized network type, the currently parameterized IP address, the subnet mask, and the default gateway. The IED name is always TEMPLATE.
This file is of the .icd format.

- Click **Download ICD file**.
  The ICD file is downloaded to a folder you selected.

2.7.4.3 Configuration via Display

Submenu IEC 61850 Settings

The operation is carried out with the softkeys F1 to F4.



[dw_display_communication_IEC61850, 3, en_US]

Figure 2-43 Submenu Communication via IEC 61850

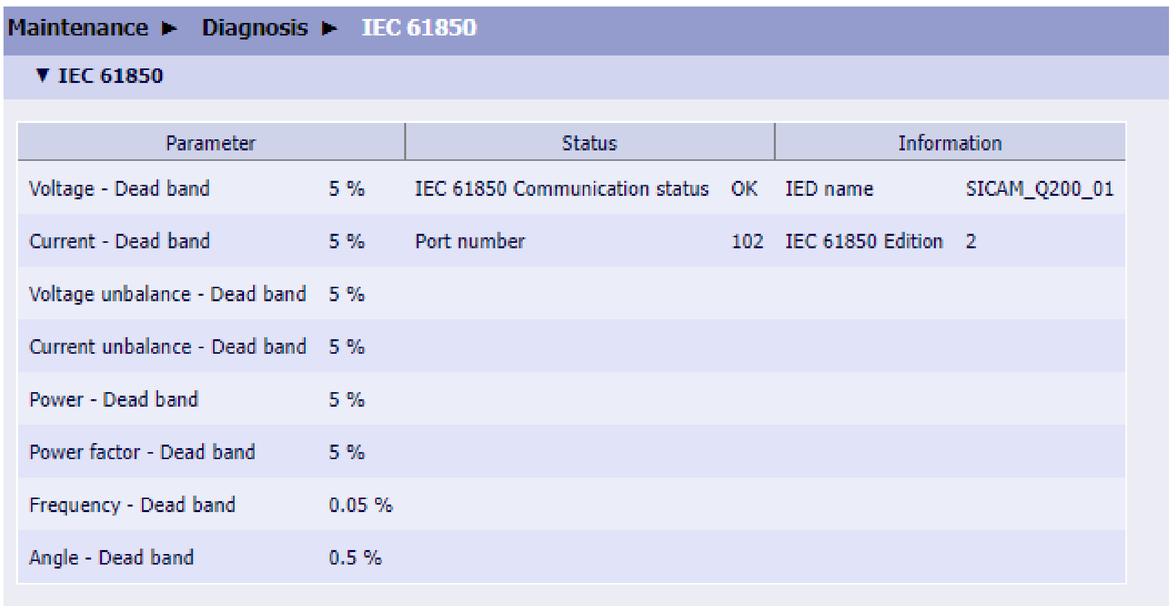
2.7.4.4 Diagnosis of IEC 61850

NOTE

The diagnosis of IEC 61850 is only available and displayed if the IEC 61850 protocol has been assigned to an Ethernet channel in **Configuration** > **Basic configuration** > **Communication Ethernet**.

For the diagnosis of the IEC 61850 protocol in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **IEC 61850 protocol**.



Maintenance ▶ Diagnosis ▶ IEC 61850

▼ IEC 61850

Parameter		Status		Information	
Voltage - Dead band	5 %	IEC 61850 Communication status	OK	IED name	SICAM_Q200_01
Current - Dead band	5 %	Port number	102	IEC 61850 Edition	2
Voltage unbalance - Dead band	5 %				
Current unbalance - Dead band	5 %				
Power - Dead band	5 %				
Power factor - Dead band	5 %				
Frequency - Dead band	0.05 %				
Angle - Dead band	0.5 %				

[sc_IEC61850_diagnosis, 5, en_US]

Figure 2-44 Maintenance Tab, Diagnosis IEC 61850

Parameter

With IEC 61850, the following parameters are displayed:

- Voltage – Dead band: 5 % by default
- Current – Dead band: 5 % by default
- Voltage unbalance – Dead band: 5 % by default
- Current unbalance – Dead band: 5 % by default
- Power – Dead band: 5 % by default
- Power factor – Dead band: 5 % by default
- Frequency – Dead band: 0.05 % by default
- Angle – Dead band: 0.5 % by default

Status

With IEC 61850, the following status is displayed:

- IEC 61850 Communication status: OK or Fail
- Port number: Set port number, for example 102

Information

With IEC 61850, the following information is displayed:

- IED Name: SICAM
- IEC 61850 Edition: 2

2.7.5 Ethernet Security

2.7.5.1 Function Description

HTTPS

The secure HTTPS protocol is used for access to Internet sites of the device. Internally, the device uses the open source library OpenSSL for the encrypted communication.

For certificate handling in your browser, follow the instructions from the Application Note. You can find this Application Note on the Internet site *http://www.siemens.com/gridsecurity* under **Downloads > Downloads Cyber Security General > Application Notes**.

FTPS

The implicit mode of FTPS (FTP Secure) is used for transferring files. For more information, refer to *2.7.7 File Transfer Protocol Secure (FTPS)*.

SNMPv3

You can find a detailed description of functions and conditions for SNMPv3 in chapter *2.7.5.2 Simple Network Management Protocol v3 (SNMPv3)*.

2.7.5.2 Simple Network Management Protocol v3 (SNMPv3)

The SNMPv3 security mechanism in the device is also responsible for the RFC3414 (Request for Comments: User-based Security Model (USM)).

The following functions and conditions are supported by SNMPv3:

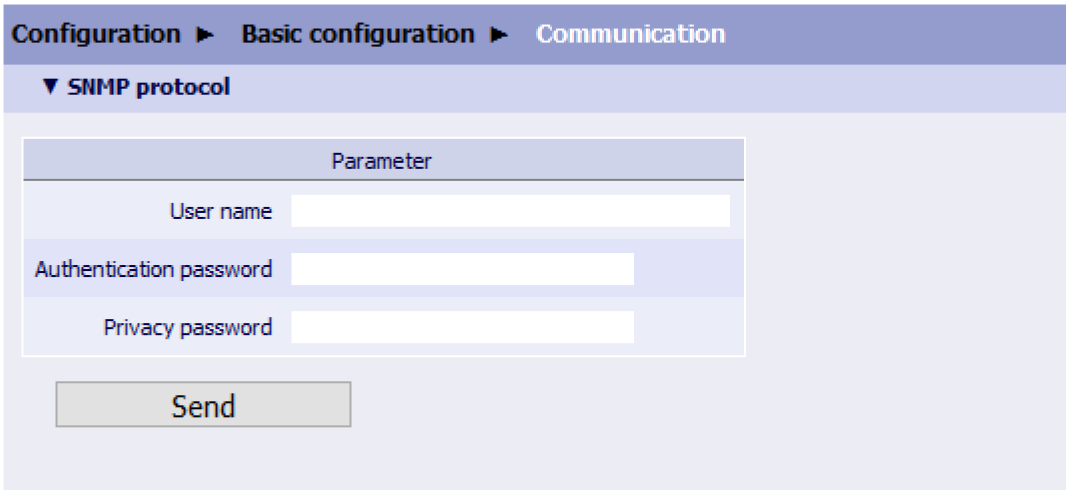
- Only 1 user is possible, adding or removing of extra users is not possible
- User name is set via parameterization
- User name and passwords must be entered before the first access
  Default settings for user name and passwords are empty.
- 2 passwords are necessary (can be configured via parameterization)
  - Authentication password
  - Privacy password
- The valid character range for user name and passwords is limited to:
  - Numbers (0-9)
  - Latin characters (A-Z, a-z)
  - Basic special characters in the ASCII-character code range (33 to 126)
- Maximum length of a user name is 32 characters.
- Maximum length of a SNMPv3 password is 24 characters.
  Passwords must be at least 8 characters long.
- Authentication with MD5 algorithm, encryption with DES algorithm
- SNMP must be enabled via parameterization.
- Only read access is allowed.
- Only RFC1213 MIB is supported.

2.7.5.3 Configuration via Web Pages

Parameterization of SNMP Protocol

Precondition: The SNMP protocol must be assigned to 1 Ethernet interface.
To change the SNMPv3 settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **SNMP protocol**.



[sc_Password_SNMP-v3, 4, en_US]

Figure 2-45 Configuration Tab, SNMPv3 Settings

- Configure the respective parameters according to the following table.

Table 2-22 Settings for SNMPv3

Settings	Default Setting	Setting Range
User name (User name for SNMPv3 access)	Empty, for example: not set	Up to 32 characters • Numbers 0 to 9 • Small and capital Latin letters • Basic special characters
Authentication password		8 to 24 characters • Numbers 0 to 9 • Small and capital Latin letters • Basic special characters
Privacy password		

- Click **Send**. The changed passwords are immediately valid.

In order to change the password, you have to be aware of the following:

- Changes of SNMPv3 settings are only possible via the Web browser, not via the device display.
- With the default values (all are empty), access via SNMPv3 is not possible. The parameters above must be set before accessing data via SNMP.
- Only one, multiple or all passwords can be changed at once. If a password should not be changed then the associated text box must remain empty.
  All 3 parameters must have correct values in order to enable access via SNMPv3. If not both of the passwords have been entered the access via SNMPv3 is not possible.

- If an empty user name is set the access via SNMPv3 is not possible furthermore. Passwords then also are set to their defaults (empty).
- If during user name or password change on the HTML page a password input remains empty and a valid SNMP configuration is already activated, the currently set password is not changed.

2.7.6 DNP3 IP

2.7.6.1 Function Description

The DNP3 IP protocol can be used for communication via the Ethernet interface.

The DNP3 IP specification with a detailed explanation of the protocol is given in the *IEEE Standard for Electric Power Systems Communications - Distributed Network Protocol (DNP3) IEEE Std 1815-2012*.

For details of the DNP3 IP protocol implemented in SICAM Q200, see the *DNP3 Device Profile*.

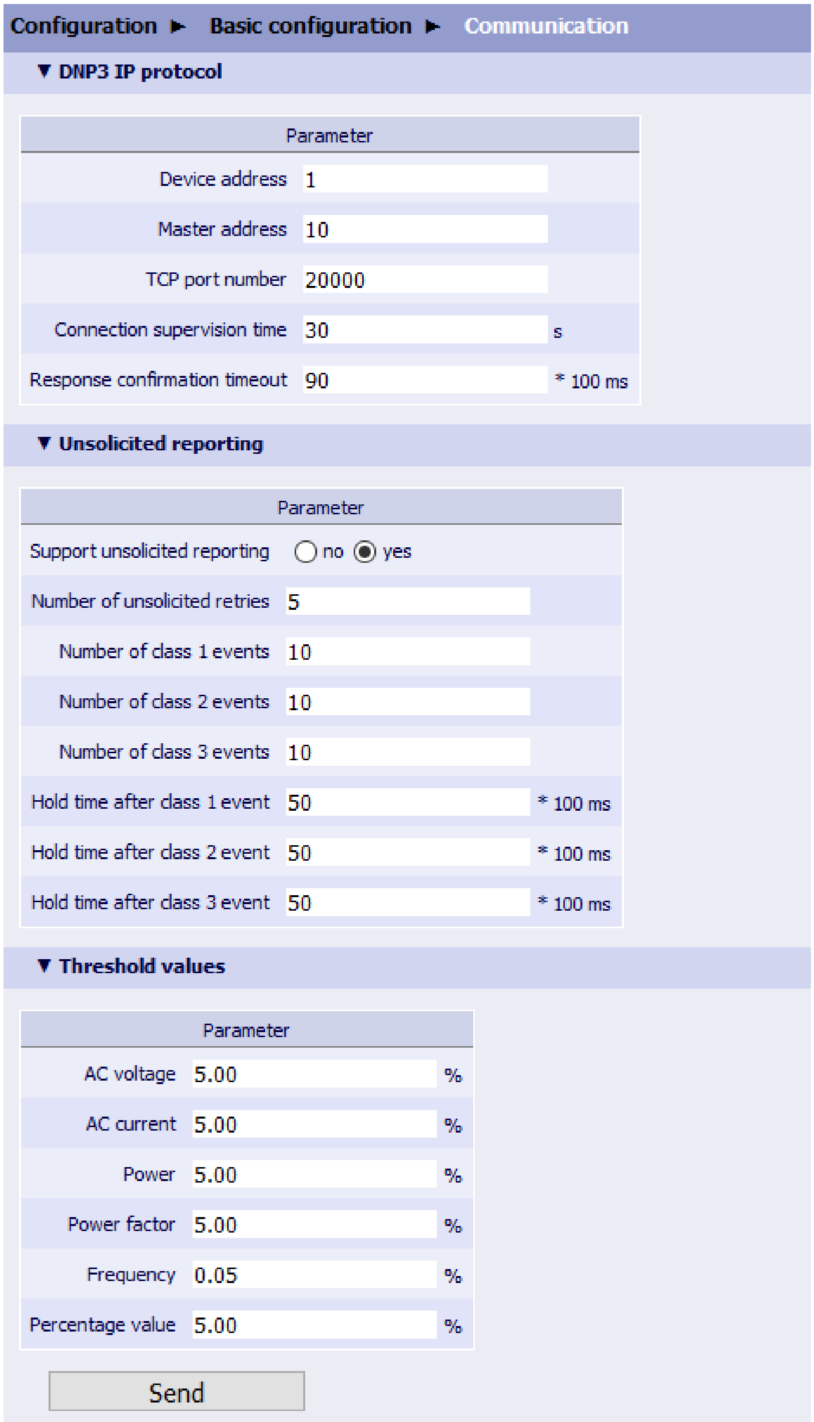
2.7.6.2 Configuration via Web Pages

Parameterization of DNP3 IP Protocol

Precondition: The DNP3 IP protocol must be assigned to at least 1 Ethernet interface.

To change the DNP3 IP settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **DNP3 IP protocol**.



[sc_configuration_DNP3_IP, 3, en_US]

Figure 2-46 Configuration Tab, DNP3 IP Protocol

- Configure the respective parameters according to the following table.

Table 2-23 Settings for DNP3 IP

Parameter	Default Setting	Setting Range	Chapters in DNP3 Device Profile[17]
DNP3 IP Protocol			
Device address	1	1 to 65 519	1.4.1
Master address	10	1 to 65 519	1.4.3 1.8.2
TCP port number	20 000	1 to 65 535	1.3.8
Connection supervision time	30 s	1 s to 3600 s	1.3.10
Response confirmation timeout	90 (9 s)	0.01 s to 3600.00 s, step: 100 ms	1.7.1 1.8.3
Unsolicited transmission			
Support unsolicited reporting	no	no yes	1.8.1
The following parameters are only available when **Support unsolicited reporting** is set to **yes**.			
Number of unsolicited retries	5	0 to 200	1.8.4
Number of class X events	10	1 to 100	1.9.1 1.9.2 1.9.3
Hold time after class X event	50 (5 s)	0 s to 3600 s, step: 100 ms	1.9.5 1.9.6 1.9.7
Threshold values			
AC voltage	5.00 %	0.00 % to 10.00 %	-
AC current	5.00 %	0.00 % to 10.00 %	-
Power	5.00 %	0.00 % to 10.00 %	-
Power factor	5.00 %	0.00 % to 10.00 %	-
Frequency	0.05 %	0.00 % to 10.00 %	-
Percentage value	5.00 %	0.00 % to 10.00 %	-

NOTE

Only one DNP3 master can be connected to the SICAM Q200 device. If you select **Two interfaces** for the parameter **Function**, the DNP communication can be established either via Ethernet connection Ch1 or via Ethernet connection Ch2 which depends on the configuration.

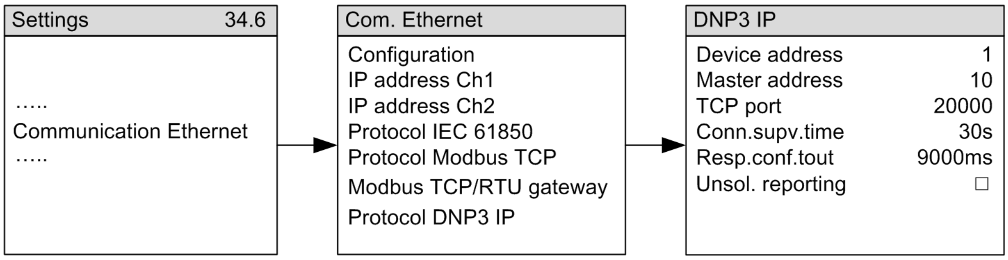
- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

17 Refer to the Siemens download area for *SICAM Q200*.

2.7.6.3 Configuration via Display

Submenu DNP3 IP Settings

The operation is carried out with the softkeys F1 to F4.



[dw_display_communication_DNP3_IP, 1, en_US]

Figure 2-47 Submenu Communication via DNP3 IP

2.7.7 File Transfer Protocol Secure (FTPS)

Function Description

The device supports the transfer of files via FTPS, an extension to FTP (File Transfer Protocol) which combines FTP with TLS (Transport Layer Security). FTPS is encrypted and more secure than FTP. The device adopts the implicit mode of FTPS, where both control and data transmission channels are encrypted.

The following files of the device can be transferred via FTPS:

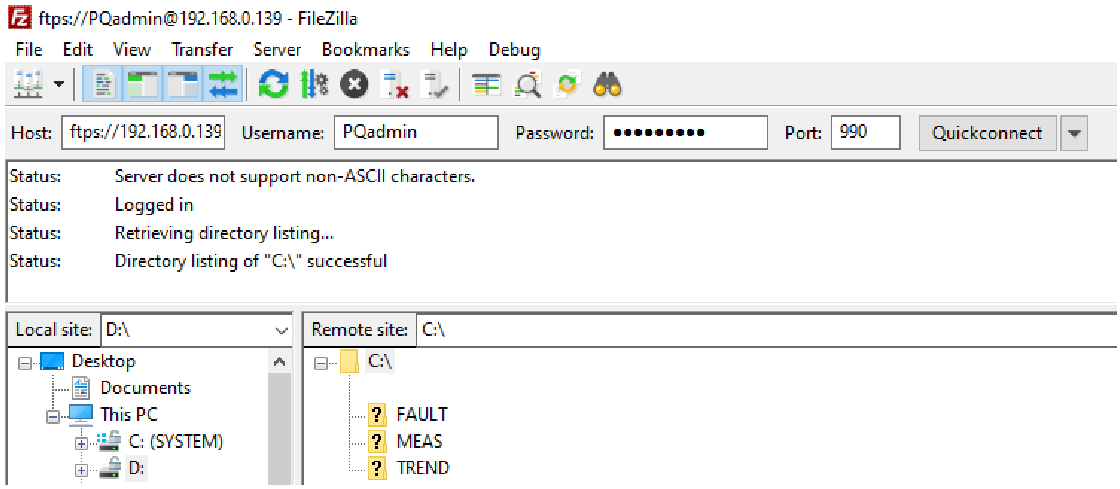
- Fault records: COMTRADE files
- Measurement records: PQDIF or CSV files
- Trend records: PQDIF files

2.7.7.1 File Download via FTPS

You can download files via the FTPS protocol. Use an FTP client application such as FileZilla or WinSCP to view and download files stored on the device. Take FileZilla for example. To download files via FTPS, proceed as follows:

- Start FileZilla.
- Enter the IP address in the **Host** input area (for example, the default IP address: 192.168.0.55).
- Enter your user name and password (same as the RBAC user name and password).
- Enter the port number 990.

- Click **Quickconnect**.



[sc_filezilla_overview, 1, en_US]

Figure 2-48 Files Shown on FileZilla

FAULT	Fault records
MEAS	Measurement records
TREND	Trend records

The downloadable files are shown in folders in the **Remote site** area.
For SICAM Q200, the first-layer folders are sorted by record type and the subfolders by year and date.

- You can download the files in the following ways:
  - Select the files that you want to download and then drag and drop them to your local disk.
  - Select and right-click the files that you want to download. Click **Download**.
  - To download a single file, double-click it.

NOTE

Only users with **configuration downloading** rights (refer to *Table 8-6*) can download files via FTPS.
The FTP server supports only 1 FTP client.

NOTE

For better performance, it is highly recommended that you enable TLS session resumption on the FTP client.

2.8 Serial Communication

2.8.1 Modbus RTU Slave

2.8.1.1 Function Description

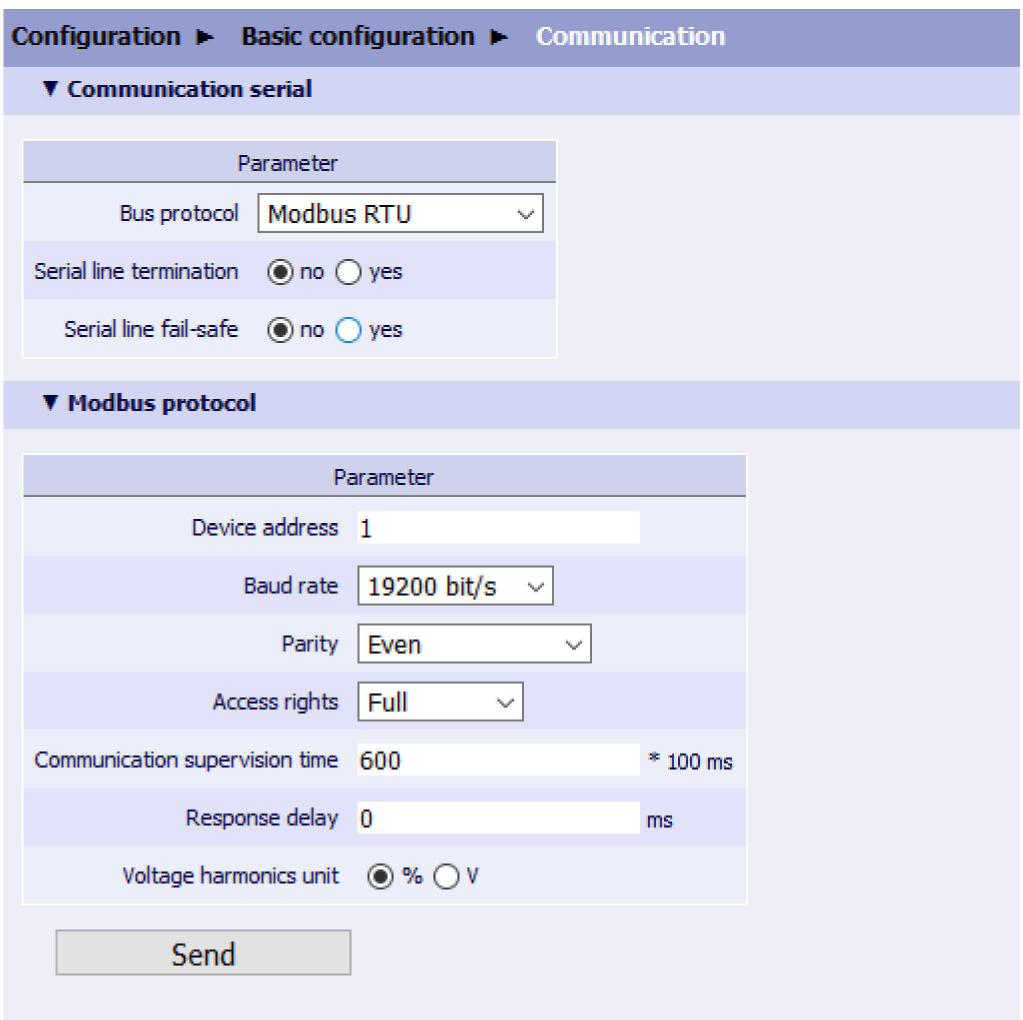
The serial communication using Modbus RTU (slave) with the device is executed via the RS485 interface.

2.8.1.2 Configuration via Web Pages

Configuration of the Serial Communication with Modbus RTU (Slave) via RS485 Interface

Precondition: The **Modbus RTU** protocol must have been activated for the RS485 interface.
To change the Modbus RTU (slave) settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Communication serial** and select **Modbus RTU** as the **Bus protocol**.



[sc_Modbus_RTU_slave_configuration, 4, en_US]

Figure 2-49 Configuration Tab, Modbus RTU (Slave)

- Configure the respective parameters according to the following table.

Table 2-24 Settings for Communication Serial, Modbus RTU (Slave)

Parameter	Default Setting	Setting Range
Bus protocol	None	None **Modbus RTU** *(slave)* Modbus RTU Master
Serial line termination	No	No Yes: connectable terminating resistors, 120 Ω between A and B
Serial line fail-safe	No	No Yes: connectable fail safe resistors, 680 Ω between B and VCC_RS485 as well as A and GND_RS485
Device address	1	1 to 247
Baud rate	19 200 bit/s	1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19 200 bit/s, 38 400 bit/s, 57 600 bit/s, 115 200 bit/s
Parity	Even	None, 1 stop bit Even Odd None, 2 spot bit
Access rights	Full	Full Read only
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms
Response delay	0 ms	0 ms to 1000 ms
Voltage harmonics unit	%	% V

NOTE

If you select **-none-** as the **Bus protocol**, no protocol will be available.

The Modbus RTU slave responds to a request of a Modbus RTU master after a silent time of 3.5 character times (depending on the baud rate). This minimal silent time on the bus is a requirement of the Modbus specification.

It can be necessary that the response delay must be increased. As an example, some RS485 converters need more time for direction switchover. In such cases, the **Response delay** parameter allows to add an additional delay from receiving the request to sending the response.

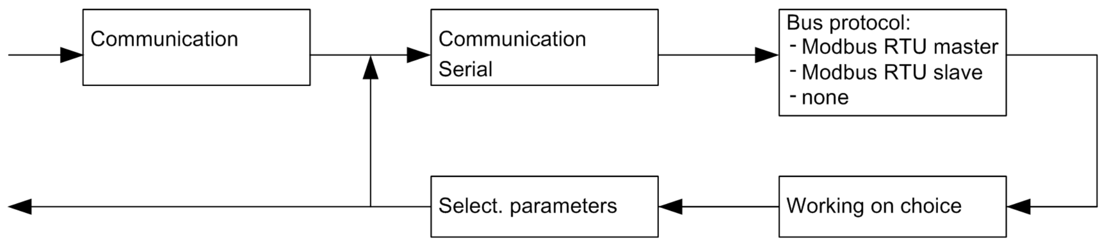
To avoid any abnormal communication, when the **Baud rate** is ≥ 38 400, the **response delay** must be ≥ 20 ms.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

2.8.1.3 Configuration via Display

Submenu Modbus RTU (Slave) Settings

The operation is carried out with the softkeys F1 to F4.



[dw_submenu_serial_communication, 1, en_US]

Figure 2-50 Submenu Communication via Modbus RTU Slave

2.8.1.4 Diagnosis of the Modbus RTU Slave

NOTE

The diagnostic data of Modbus RTU (slave) is displayed only if **Modbus RTU** has been selected as a bus protocol in **Configuration** > **Basic configuration** > **Communication serial**.

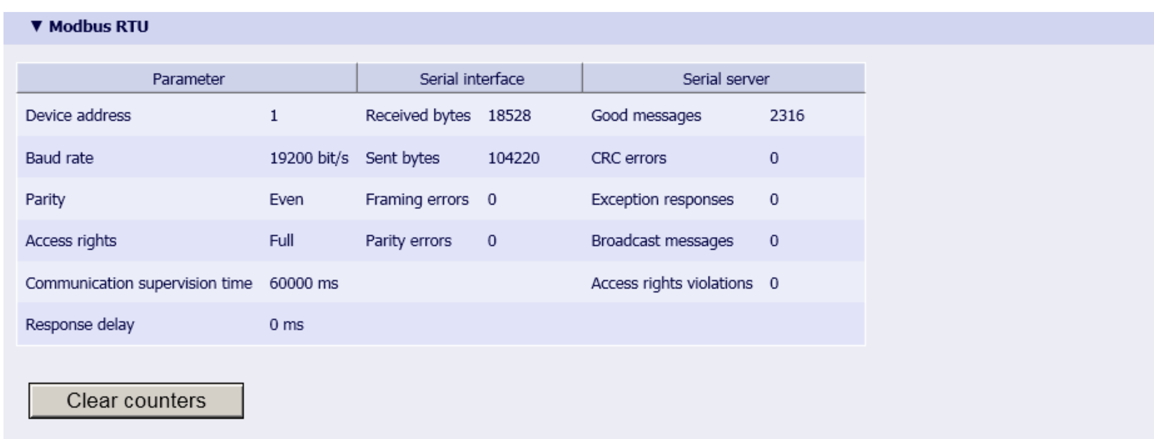
If the Modbus RTU (slave) has not been selected, the menu option for selecting the Modbus RTU diagnostic data is not available.

To view the diagnosis of the protocol Modbus RTU (slave) in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Modbus**.

The diagnosis of **Modbus RTU** (slave) provides the following information:

- Serial interface
- Serial server



▼ Modbus RTU

Parameter		Serial interface		Serial server	
Device address	1	Received bytes	18528	Good messages	2316
Baud rate	19200 bit/s	Sent bytes	104220	CRC errors	0
Parity	Even	Framing errors	0	Exception responses	0
Access rights	Full	Parity errors	0	Broadcast messages	0
Communication supervision time	60000 ms			Access rights violations	0
Response delay	0 ms				

Clear counters

[sc_Modbus_RTU_slave_diagnosis, 2, en_US]

Figure 2-51 Maintenance Tab, Diagnosis Modbus RTU (Slave)

- To clear the counters for Modbus RTU (slave), click **Clear counters**.
  All counters for Modbus RTU (slave) are reset to 0.

Serial Interface

Table 2-25 Description of the Parameters in the Serial Interface

Parameter	Description
Received bytes	Total number of bytes received by the RS485 interface
Sent bytes	Total number of bytes sent to the RS485 interface

Parameter	Description
Framing errors	Number of detected frame errors (invalid stop bit, for example if the baud rate is wrong)
Parity errors	Number of detected parity errors (wrong parity)

Serial Server

Table 2-26 Description of the Parameters in the Serial Server

Parameter	Description
Good messages	Total number of messages received that were detected as valid Modbus messages
CRC errors	Total number of messages received in which CRC errors were detected
Exception responses	Counters of the transmitted exception response messages
Broadcast messages	Total number of the broadcast messages received with the server address 0
Access rights violations	Total number of write accesses received if the parameter **Access rights** is set to **Read only** in the Communication serial window.

2.8.2 Modbus RTU Master

2.8.2.1 Function Description

A Modbus master device can communicate through the gateway device with the serial network of devices connected to the serial ports of the gateway device. For more information on the Modbus gateway function, refer to *2.7.3 Modbus Gateway* .

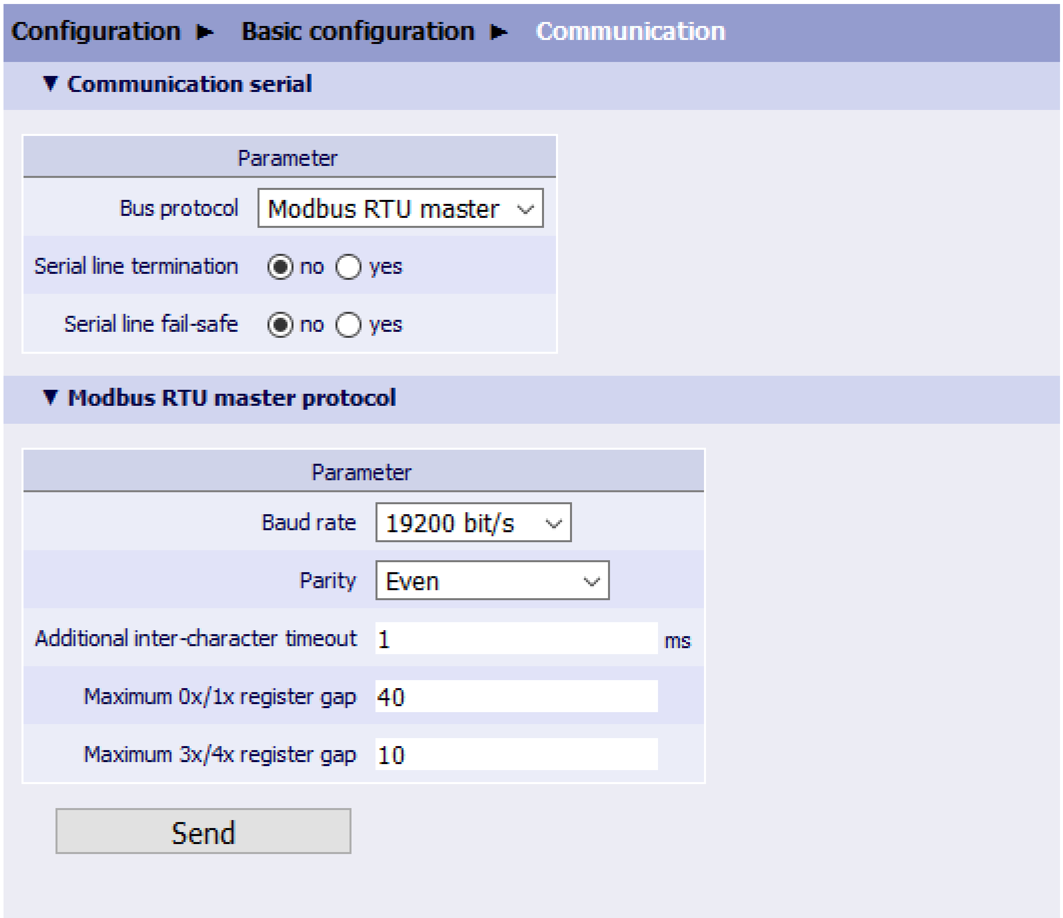
2.8.2.2 Configuration via Web Pages

Configuration of the Serial Communication with Modbus RTU Master via RS485 Interface

Precondition: The **Modbus RTU Master** protocol must have been activated for the RS485 interface.

To change the Modbus RTU Master settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Communication serial** and select **Modbus RTU master** as the **Bus protocol**.



[sc_Modbus_RTU_master_configuration, 4, en_US]

Figure 2-52 Configuration Tab, Modbus RTU Master

- Configure the respective parameters according to the following table.

Table 2-27 Settings for Communication Serial, Modbus RTU Master

Parameter	Default Settings	Setting Range
Bus protocol	-none-	-none- Modbus RTU *(slave)* **Modbus RTU master**
Serial line termination	No	No Yes: Connectable terminating resistors, 120 Ω between A and B
Serial line fail-safe	No	No Yes: Connectable fail safe resistors, 680 Ω between B and VCC_RS485 as well as A and GND_RS485
Baud rate	19 200 bit/s	1200 bit/s, 2400 bit/s 4800 bit/s, 9600 bit/s 19 200 bit/s, 38 400 bit/s 57 600 bit/s, 115 200 bit/s

Parameter	Default Settings	Setting Range
Parity	Even	None, 1 stop bit Even Odd None, 2 stop bit
Additional inter-character timeout	1 ms	0 ms to 100 ms The Modbus specification requires that the individual characters of a serial Modbus RTU telegram have to be transmitted successively with a maximum character gap of 1.5 character times (or max. 750 µs for Baud rates >19 200 bit/s). Longer silent intervals between the characters are interpreted as telegram end. A longer gap between the characters can be tolerated with this parameter. Note that this also causes longer cycle times. If at least one SICAM P50 device is connected to the bus, at least the following values have to be set for **Additional inter-character timeout**: 1200 bit/s, 2400 bit/s: 0 4800 bit/s, 9600 bit/s: 2 19 200 bit/s: 3 38 400 bit/s: 4 57 600 bit/s, 115 200 bit/s: 6
Maximum 0x/1x register gap	40	0 to 200 Maximum number of **not-mapped** registers which are being requested between mapped registers in one request telegram.
Maximum 3x/4x register gap	10	

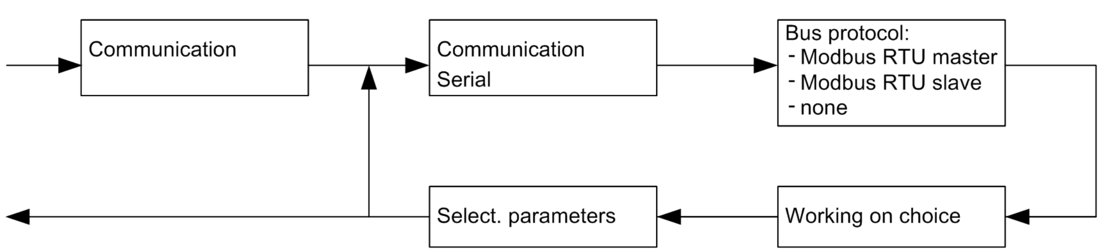
The Modbus RTU Master bus protocol must be selected both for serial settings and for the Modbus gateway function.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

2.8.2.3 Configuration via Display

Submenu Modbus RTU Master Settings

The operation is carried out with the softkeys F1 to F4.



[dw_submenu_serial_communication, 1, en_US]

Figure 2-53 Submenu, Communication via Modbus RTU Master

2.8.2.4 Diagnosis of the Modbus RTU Master

NOTE

The diagnostic data of Modbus RTU master is displayed only if this bus protocol has been selected in the tab **Configuration → Basic configuration → Communication serial → Modbus RTU master**.

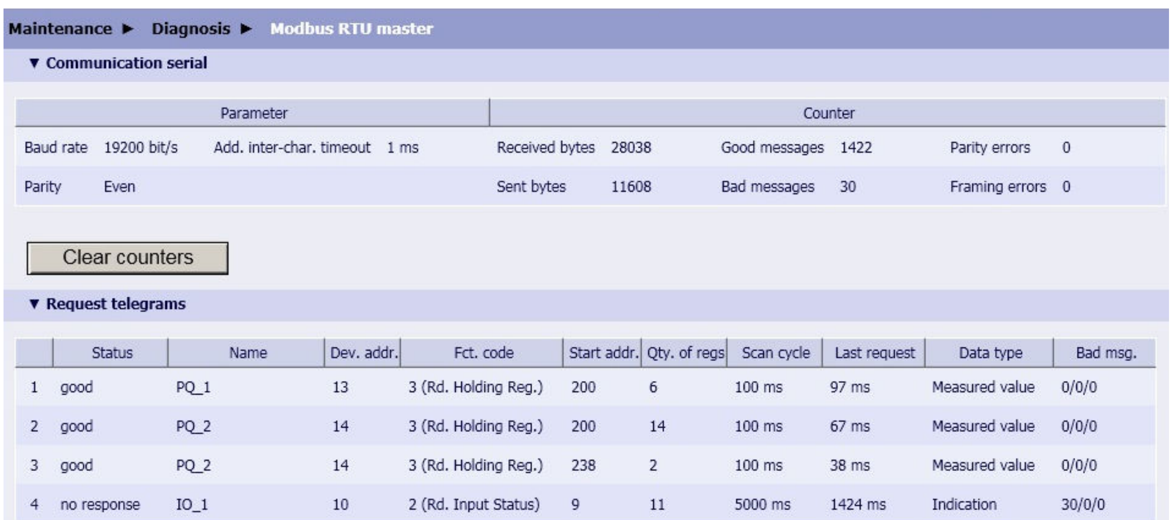
If the Modbus RTU master has not been selected, the menu option for selecting the Modbus RTU diagnostic data is not available.

To view the diagnosis of the protocol Modbus RTU master in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Modbus RTU master**.

The diagnosis of the **Modbus RTU master** provides the following information:

- Check of the state of the serial communication with telegram and error counters and an overview of the set serial interface parameters.
- Overview of request telegrams sent by the Modbus RTU master including request status for every telegram.



[sc_Diagnosis_Modbus-RTU-master, 1, en_US]

Figure 2-54 Maintenance Tab, Diagnosis of the Modbus RTU Master

- To clear the counters for the Modbus RTU master, click **Clear counters**.
  All counters for Modbus RTU master are reset to 0.

Counters

Table 2-28 Description of the Parameters in the Counters

Parameter	Description
Received bytes	Total number of bytes received from the RS485 interface since the last device restart or the last clearing of the counter.
Sent bytes	Total number of bytes sent to the RS485 interface since the last device restart or the last clearing of the counter.
Good messages	Number of valid response messages of Modbus slave devices (syntax of the message is valid and the message was received within the response time-out).

Parameter	Description
Bad messages	Total number of: • No responses (response time-out after sending a request) • Error feedback indications • Errors in message formats received
Parity errors	Number of detected parity errors (wrong parity).
Framing errors	Number of detected framing errors (invalid stop bit, for example, if the baud rate is wrong).

Request Telegrams

Table 2-29 Description of the Parameters in the Request Telegrams

Parameter	Description
Status	Status of the request messages • Good: correct response • Not requested: the request was not sent yet after changing the configuration • No response: the bus device does not respond (for example, communication failure) • Exception responses (n): exception response sent with error code • CRC error: a CRC error was detected in the response • PDU error: implausible response (for example, the requested number of registers was not output)
Name	Name of the Modbus slave device to which the request message belongs (as for the Modbus device configuration)
Dev.addr.	Device address of the Modbus slave device to which the request message belongs (as for the Modbus device configuration)
Fct.code	Modbus function code used in the request message.
Start addr.	Start register address when reading data of this request message (based on the register numbers of the Modbus mapping configuration)
Qty. of regs	Number of registers requested in this message. This value is calculated automatically based on the Modbus mapping configuration and the maximum register gap parameters in the serial interface configuration
Scan cycle:	Scan cycle (send cycle) currently used for this request message Either the configured scan cycle is used for the data type or the configured **Scan cycle on error**
Last request	This value indicates how many milliseconds ago the request message was sent last. Note that this value is only intended as a notification that this message is sent and when it was sent last. It is a snapshot referring to the last update of the diagnostic page on the Web. It cannot be used to determine the bus cycle time exactly. This value can be greater than the configured scan cycle. This means that there is a longer delay in the bus cycle, for example, due to devices that are not responding.

Parameter	Description
Data type	Data type requested with this request message (one or more data objects of this data type were requested; different data types are always requested with separate messages, because they have different scan cycles).
Bad meg.	Counter for errors of this request: • No responses • Exception responses • CRC errors

Commissioning

If a Modbus slave device is connected correctly, the serial parameters (baud rate and parity) are identical to the parameterization in the Modbus RTU master of the device, the device address was checked, and the errors **no responses** or **CRC errors** still occur (sporadically), proceed as follows:

- Try to increase the **Response timeouts**. Some devices may take longer to respond (in particular when reading a larger number of values with 1 message) or at low baud rates.
- Try to increase the **Additional inter-character timeout**. There may be larger message gaps during the transmission or a device needs a longer bus silent interval.

2.8.3 Modbus Slave Devices

2.8.3.1 Function Description

For the correct functioning of the Modbus RTU Master, the Modbus RTU Master must know all Modbus slave devices which are connected to the RS485 interface. The data the devices must read must also be defined.

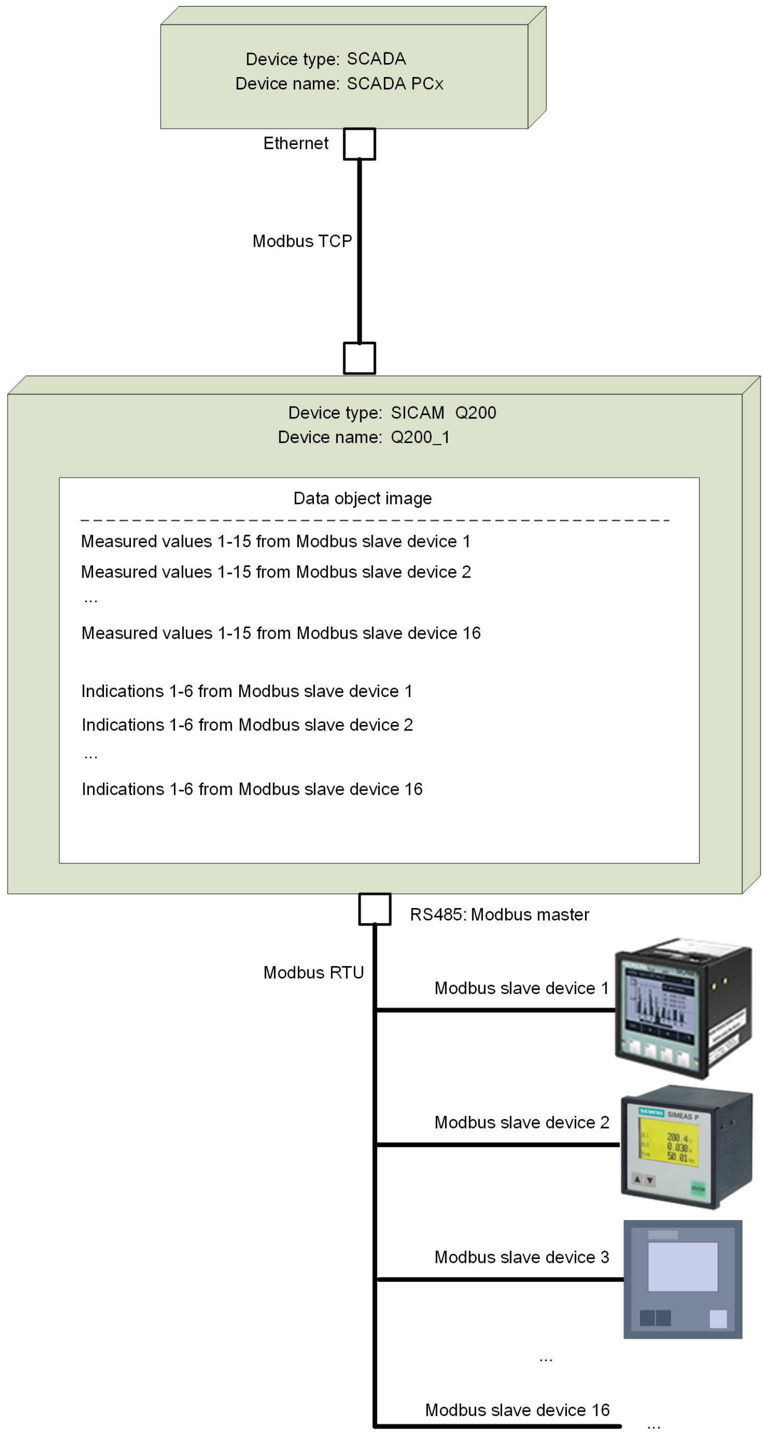
NOTE

Modbus slave devices can only be parameterized if you select the communication protocol Modbus RTU Master.

You can parameterize up to 16 Modbus slave devices. You can select the Modbus slave devices in the 4 groups **Modbus slave devices 1-4**, **Modbus slave devices 5-8**, **Modbus slave devices 9-12**, and **Modbus slave devices 13-16**.

The parameterization of the 16 Modbus slave devices is identical and described only for the Modbus slave device 1 in the following.

Functioning of Modbus Slave Devices



[dw_function-gateway-q200, 3, en_US]

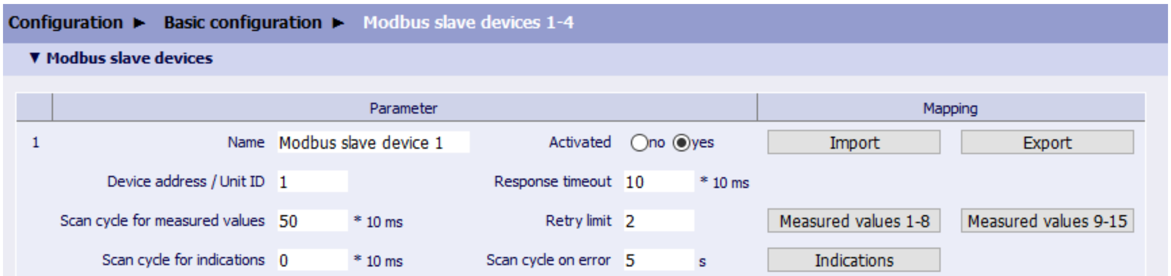
Figure 2-55 Functioning of Modbus Slave Devices

2.8.3.2 Configuration and Value View via Web Pages

Basic Settings

To change the basic settings for Modbus slave devices in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Modbus slave devices 1-4**.



[sc_Config Modbus slave devices, 2, en_US]

Figure 2-56 Configuration Tab, Modbus Slave Devices, Device 1 Activated

- Configure the respective parameters according to the following table.

Table 2-30 Settings for the Modbus Slave Devices

Parameter	Default Setting	Setting Range
Name	Modbus slave device x	Max. 31 characters
Activated	no	no yes (= Activation of the option field): The buttons for parameterization of the mapping data are also activated for the slave device here.
Device address / Unit ID (Modbus slave device address)	1	1 to 247 Address corresponds to the Unit ID in the Modbus TCP telegram with simultaneous use of the Modbus Gateway function
Scan cycle for measured values	50 (*10 ms)	0 to 36 0000 * 10 ms (10 ms to 1 h) 0 = Each interrogation cycle Minimum time difference between the measured-value requests
Scan cycle for indications	0 (*10 ms)	0 to 36 0000 * 10 ms (10 ms to 1 h) 0 = Each interrogation cycle Minimum time difference between the measured-value requests
Response timeout	10 (*10 ms)	1 to 6000 * 10 ms (10 ms to 60 s)
Retry limit	2	0 to 10 (0 = No request retries) Number of request retries after expiration of **Response timeout** before a communication error for the Modbus slave is identified.

Parameter	Default Setting	Setting Range
Scan cycle on error	5 s	1 to 3600 s (1 s to 1 h) Retry cycle for sending request telegrams if the retry limits are exceeded or in the case of error responses.
Buttons: Import Export Measured values 1-8 and 9-15 Indications	Inactive	The buttons in the **Mapping** columns are only activated if the option **Activated = yes** has been set. The functions of the buttons are described in the following chapters.

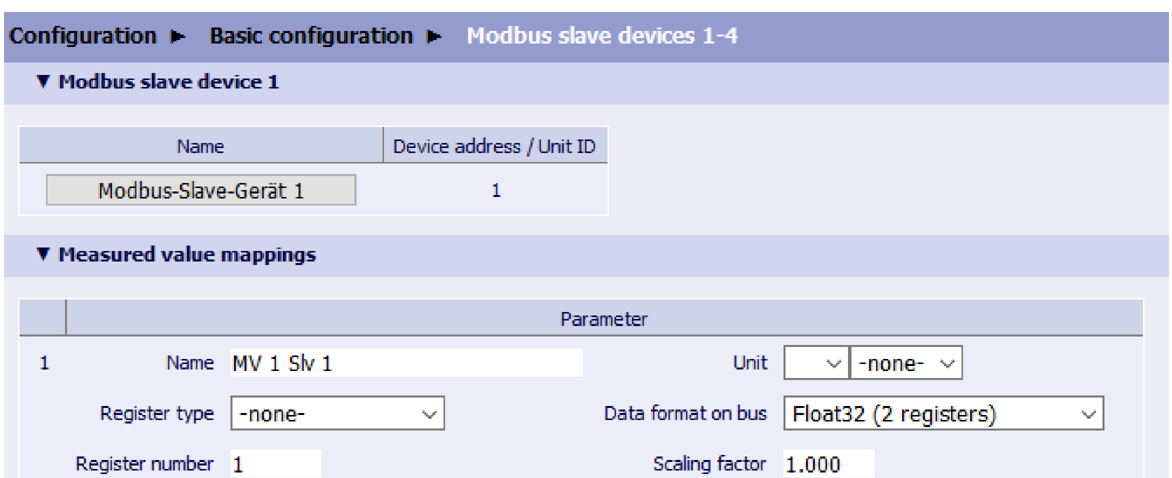
- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Mapping – Measured Values 1-15

At **Measured values 1-8** and **Measured values 9-15**, the measured values are defined which are read by a selected Modbus slave device.

To change the settings of the measured values for Modbus slave devices (for example Modbus slave device 1) in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Modbus slave devices 1-4**, activate the **Modbus slave device 1**, and click **Measured values 1-8**.



[sc_Modbus_slave devices_configuration, 3, en_US]

Figure 2-57 Configuration Tab, Modbus Slave Device 1, Measured Value Mapping

NOTE

If you click the button in the upper part of the window (**Q200_1** in the example), you get back to the corresponding **Modbus slave devices** configuration page.

- Configure the respective parameters according to the following table.

Table 2-31 Settings for Assignment of the Measured Values of the Modbus Slave Device 1

Parameter	Default Setting	Setting Range
Name	MV x Slv 1 (**M**easured **V**alue of connected **Sl**a**v**e device 1; x = 1 to 15)	Max. 31 characters Max. 10 characters if the name is also to be displayed on the device display.
Unit **Note on frequency measured values**: If a frequency measured value (unit: Hz) has been parameterized without a multiplier (multiplier: -), an additional check is made whether the resulting value is in the range of 15 Hz to 65 Hz. Measured values outside this range are marked as invalid. **Factors** Selecting a multiplier for the following units is not recommended and will be rejected: -none- ° °C °F %	Multiplier: –	m (milli) c (centi) d (deci) – h (hecto) k (kilo) M (Mega) G (Giga)
	Unit: -none-	-none- m kg s A °C V Hz W Pa m2 m3 VA var ° Wh VAh varh % °F
Register type	-none-	-none- Input registers Holding registers For **-none-**, the assignment is ignored and the corresponding measured value cannot be selected for other functions.
Data format on bus	Float32 (2 registers)	Float32 (2 registers) Int16 (1 register) Int16_Ung8000h (1 register) UInt16 (1 register) UInt32 (2 registers)
Register number	1	1 to 65 535
Scaling factor	1.000	Any float value 0.00: resulting measured value = 0.00

Table 2-32 Data Format on Bus for Measured Values

Data Format on Bus	Description	Setting Range	Invalid Recognition	Used by (Example)
Float32 (2 registers)	IEEE Float value	-10^{38} to $+10^{38}$	NaN = invalid INF = overflow	SENTRON PAC3x00, SICAM AI 7XV5674, SICAM T 7KG966, SICAM P50 7KG775
Int16 (1 register)	16 bit signed integer	- 32 768 to +32 768	-none-	SENTRON 3WL/3VL SICAM P50 7KG775
Int16_Ung8000 (1 register)	16 bit signed integer	-32 768 to +32 768	-32 768 (8000 h) = invalid	SIPROTEC 4
UInt16 (1 register)	16 bit integer, ≥ 0	0 to +65 535	-none-	SENTRON 3WL/3VL
UInt32 (2 registers)	32 bit integer, ≥ 0	0 to +4 294 967 295	-none-	SIPROTEC 4, SENTRON 3WL/3VL

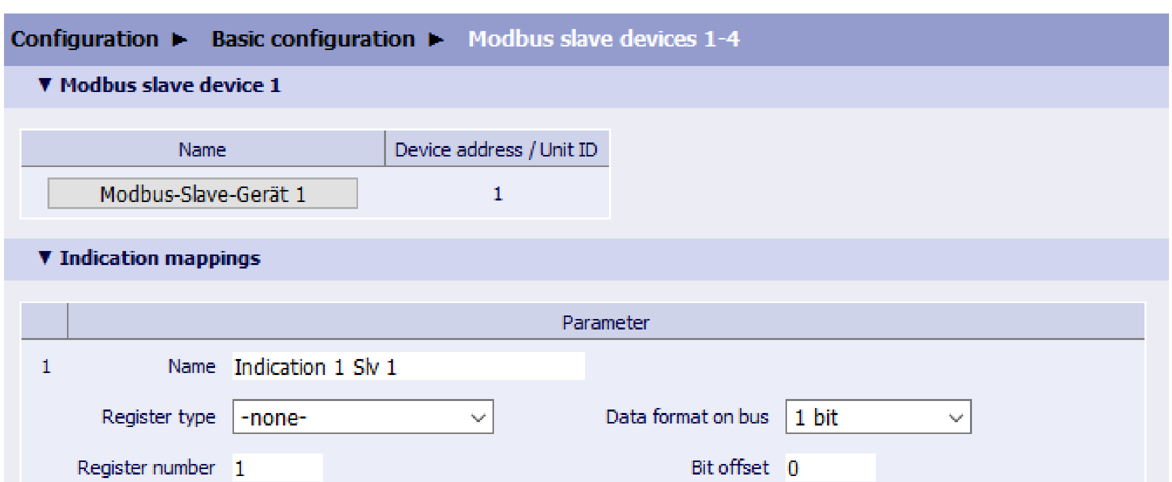
- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Mapping – Indications

At **Indications**, the indications are defined which are read by a selected Modbus slave device.

To change the settings of the indications for Modbus slave devices (for example Modbus slave device 1) in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Modbus slave devices 1-4**, activate the **Modbus slave device 1**, and click **Indications**.



[sc_Modbus_slave_devices_indication, 3, en_US]

Figure 2-58 Configuration Tab, Modbus Slave Device 1, Indication Mapping

NOTE

If you click the button in the upper part of the window (**Q200_1** in the example), you get back to the corresponding **Modbus slave devices** configuration page.

- Configure the respective parameters according to the following table.

Table 2-33 Settings for Assignment of the Indications of the Modbus Slave Device 1

Parameter	Default Setting	Setting Range
Name	Indication x Slv 1 (Indication of connected **Sl**ave device 1; x = 1 to 6)	Max. 31 characters
Register type	-none-	-none- Coil status registers Input status registers Input registers Holding registers For **-none-**, the assignment is ignored and the corresponding indication cannot be selected for other functions.
Data format on bus	1 bit	1 Bit 1 Bit in UInt32 Data format used to transmit the indication via Modbus
Register number	1	1 to 65 535
Bit offset (only relevant for register types Input register or Holding register)	0	0 to 15 (for data format 1 Bit) 0 to 31 (for data format 1 Bit in UInt32) (depending on selection for **Data format on bus**)

Table 2-34 Data format on Bus for Indications

Data Format on Bus	Description	Setting Range	Invalid Recognition	Used by (Example)
1 bit	1 bit (for all register types; additionally select **Bit offset** for the Input register and the Holding register)	0 = off 1 = on	None	SICAM P50 7KG775, SENTRON 3WL/3VL, SIPROTEC4
1 bit in UInt32	1 bit in 2 successive Input registers or Holding registers which have to be read together.	0 = off 1 = on	None	SENTRON PAC3x00

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Mapping – Export

Several Modbus slave devices of the same type can be connected to the device. This is the case, for example, if feeders that are configured identically exist in a substation. These devices frequently read the same data then.

You can use the export function of the device to export the configuration of a Modbus slave device (for example, Modbus slave device 1) which is parameterized in the device to the connected PC. After that, you can import this configuration from the PC either into this device (for example, Modbus slave device 3) or into other devices.

To change the settings of the export for Modbus slave devices (for example Modbus slave device 1) in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Modbus slave devices 1-4**, activate the **Modbus slave device 1**, and click **Export**.

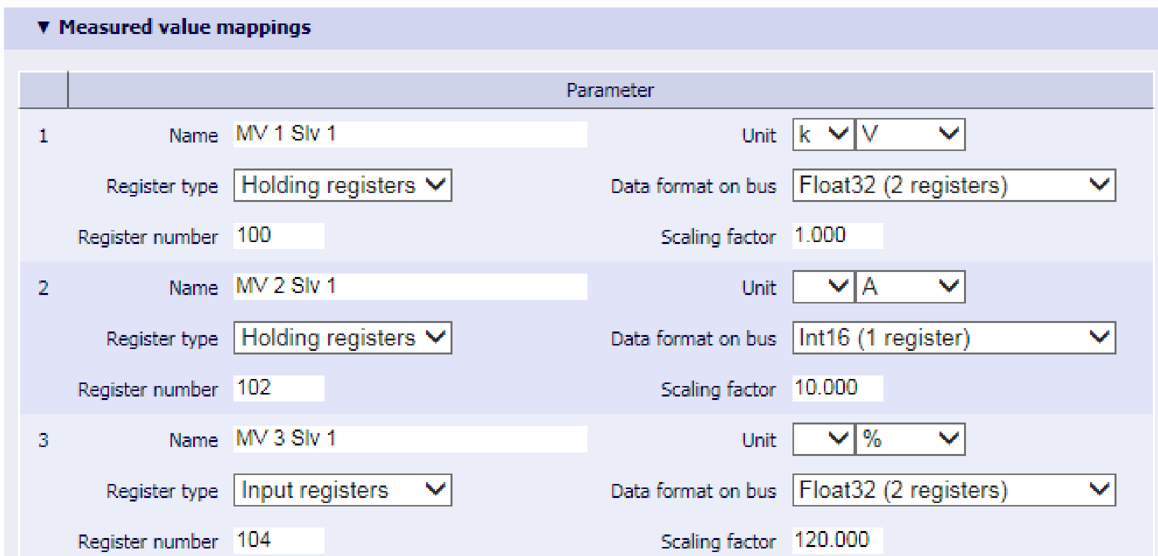
  The **File Download** dialog opens. You can save or open the downloaded file. For more information, refer to **File download → Save** and **File download → Open/Print** described in *7.3.3.1 Single File Download*.

NOTE

The file extension must be .txt.

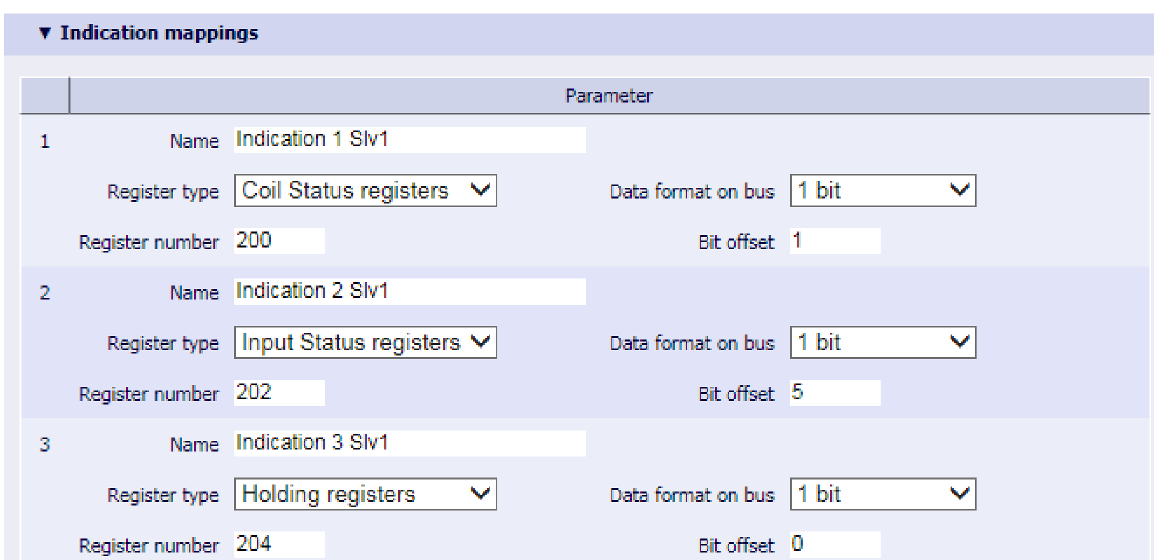
CLIENT MAPPING INFORMATION

The **CLIENT MAPPING INFORMATION** is created as a text file when the export function is triggered. The following example shows a configuration with 3 measured values and 3 indications.



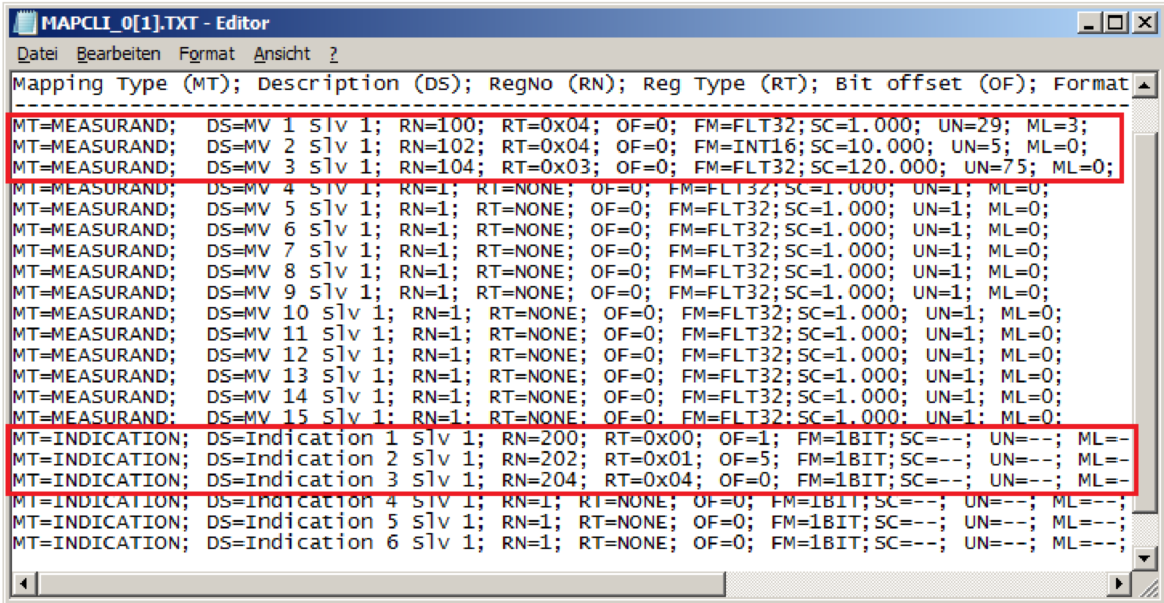
[sc_Modbus_RTU_master_measured_values, 4, en_US]

Figure 2-59 Configuration of 3 Measured Values (Example)



[sc_Modbus_slave_indication_mappig, 3, en_US]

Figure 2-60 Configuration of 3 indications (Example)



[sc_client-mapping-info, 1, en_US]

Figure 2-61 Resulting CLIENT MAPPING INFORMATION (Example)

Table 2-35 Description and Setting Ranges of the Parameters in the Text File

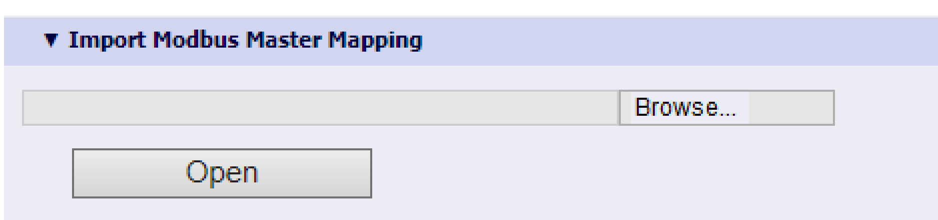
Label	Measurand (MV) Indication (I)	Description	Setting Range
MT	MV	**M**apping **T**ype (Data type)	MEASURAND INDICATION
DS	MV, I	**D**e**s**cription Name of the associated data object	String with max. 31 characters Longer strings are cut at 31 characters during import.
RN	MV, I	**R**egister **n**umber (within the selected register type RT)	1 to 65 535
RT	MV, I	**R**egister **t**ype	0x0 – Coil status register 0x1 – Input status register 0x3 – Input register 0x4 – Holding register
OF	I	Bit **of**fset (for INDICATION in Holding registers)	0 to 15 (for FT = 1BIT) 0 to 31 (for FM = 1BITI-NUINT32)
FM	MV, I	Data **f**or**m**at	For MEASURAND: FLT32, INT16, UINT16, UINT32, INT16INV7FFF and INT16INV8000 For INDICATION: 1BIT, 1BITINUINT32
SC	MV	**Sc**aling factor for MEASURAND	Arbitrary float value

Label	Measurand (MV) Indication (I)	Description	Setting Range
UN	MV	Unit-multiplier for MEASURAND	1: dimensionless 2: Meter 3: kg 4: s 5: A 23: °C 29: V 33: Hz 38: W 39: Pa 41: m^2 42: m^3 61: VA 63: var 64: ° 71: VAh 72: Wh 73: varh 75: % 76: °F
ML	MV	Unit multiplier for measure-ments	-3: milli (m) -2: centi (c) -1: deci (d) 0: no multiplier 2: hecto (h) 3: kilo (k) 6: Mega (M) 9: Giga (G)

Mapping – Import

To import the Modbus master mapping (for example Modbus slave device 1) in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Modbus slave devices 1-4**, activate the **Modbus slave device 1**, and click **Import**.



[sc_Modbus_RTU_master_import, 4, en_US]

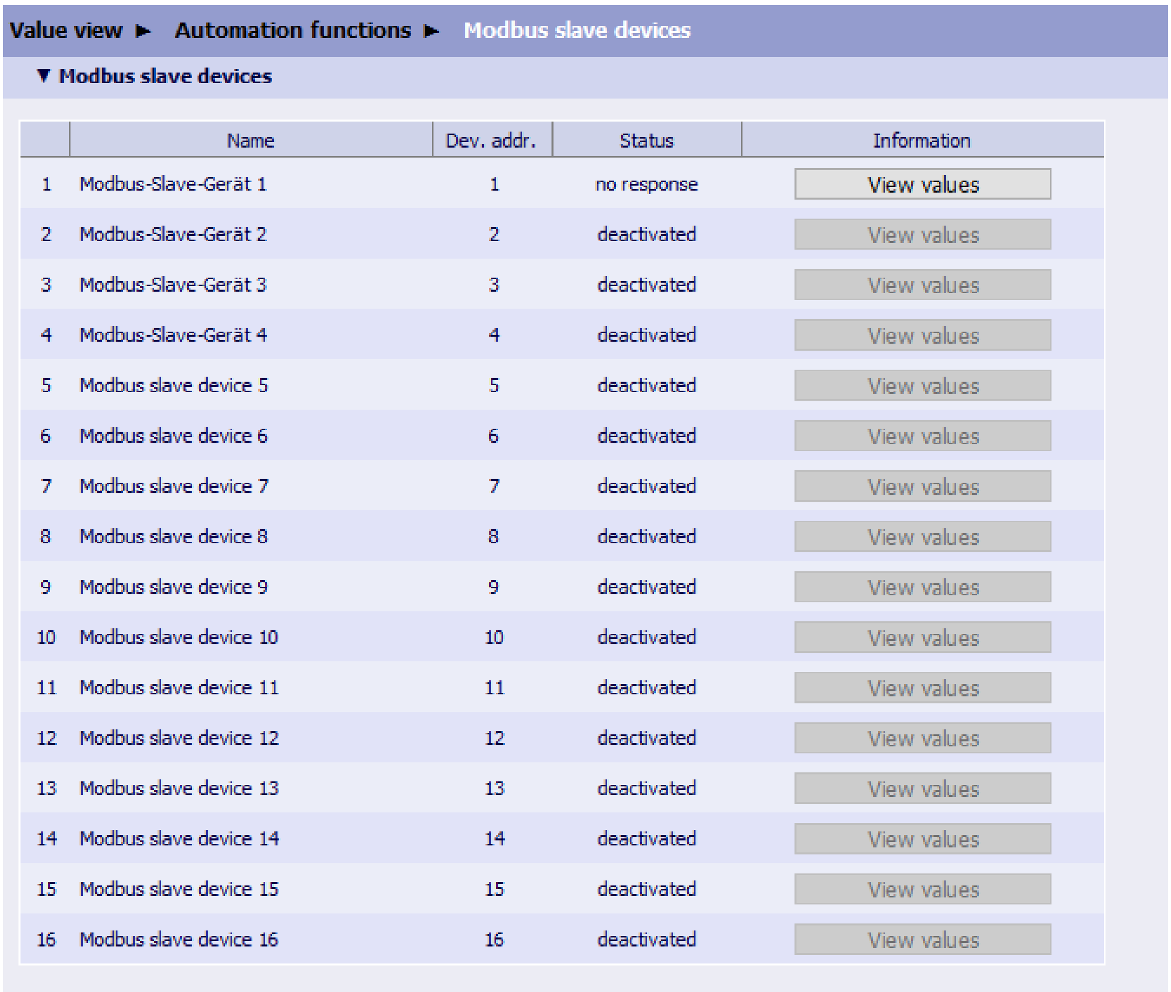
Figure 2-62 Configuration Tab, Modbus Slave Device, Import

- Click **Browse...**.
  The **File Download** dialog opens.
- Select the desired file (extension .txt) in the directory.

- In the tab, click **Open**.
  The information of the text file is applied by the device and interpreted in the passive parameter set. In the case of faulty data, an error message is entered in the error log.

Value View of Modbus Slave Devices

The connection status of the Modbus slave devices (maximum 16 devices) is checked and displayed as follows:



[sc_Process_connections, 3, en_US]

Figure 2-63 Value View Tab, Connection Status of Modbus Slave Devices

Connection Status

Table 2-36 Connection Status

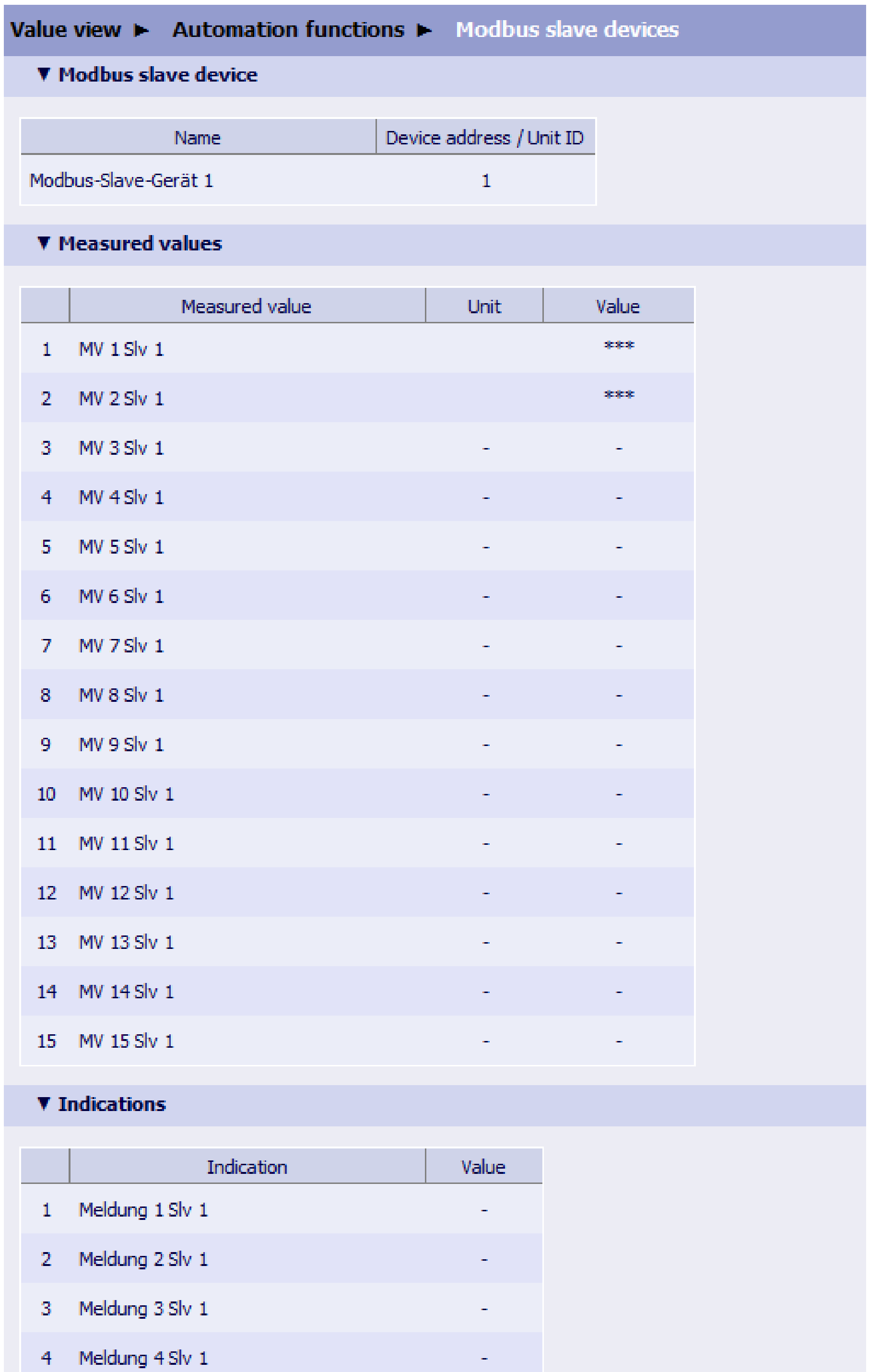
Status	Description
Good	The assigned information could be requested successfully.
No response	The Modbus slave device does not respond; communication failure or device switched off.
No mapping data	Data mapping was not configured for the device. Therefore, data are not requested.
Excp. response	At least one request was answered with a Modbus error feedback.
Msg. error	Errors in the evaluation of a response telegram (for example, CRC error)
Deactivated	The Modbus slave device was not configured.

Viewing Measured Values and Indications

- In the **Information** column (see figure *Figure 2-63*), click **View values**:

NOTE

The button is not enabled if the status shows **deactivated** and **no mapping data**.



[sc_M-S-values view, 2, en_US]

Figure 2-64 Value View Tab, Values and Indications

Measured values and indications are displayed for the respective Modbus slave device.

For measured values, *** is displayed and for indications, **invalid** is displayed if the value was received with an invalid identifier or the value could not be read (for example, interrupted connection to the Modbus slave device).

3 Process Connections

3.1 General

Before taking measurements, make sure to configure the settings in the **Configuration** tab according to the topology of your device. Select the favored process connections in the navigation window of the **Configuration** tab to see and change the set parameters.

The submenus contain the following connections:

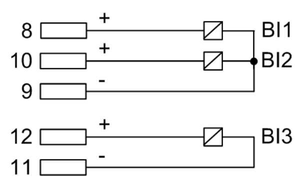
- Binary inputs
- Binary outputs
- LEDs

3.2 Binary Inputs

3.2.1 Function Description

The device has up to 2 x 3 binary inputs:

- 3 binary inputs on terminal block S
  2 are binary inputs with a common root and 1 binary input is not connected to common potential (electrically isolated)
- 3 binary inputs on terminal block R
  2 are binary inputs with a common root and 1 binary input is not connected to common potential (electrically isolated)



[dw_binary inputs, 1, en_US]

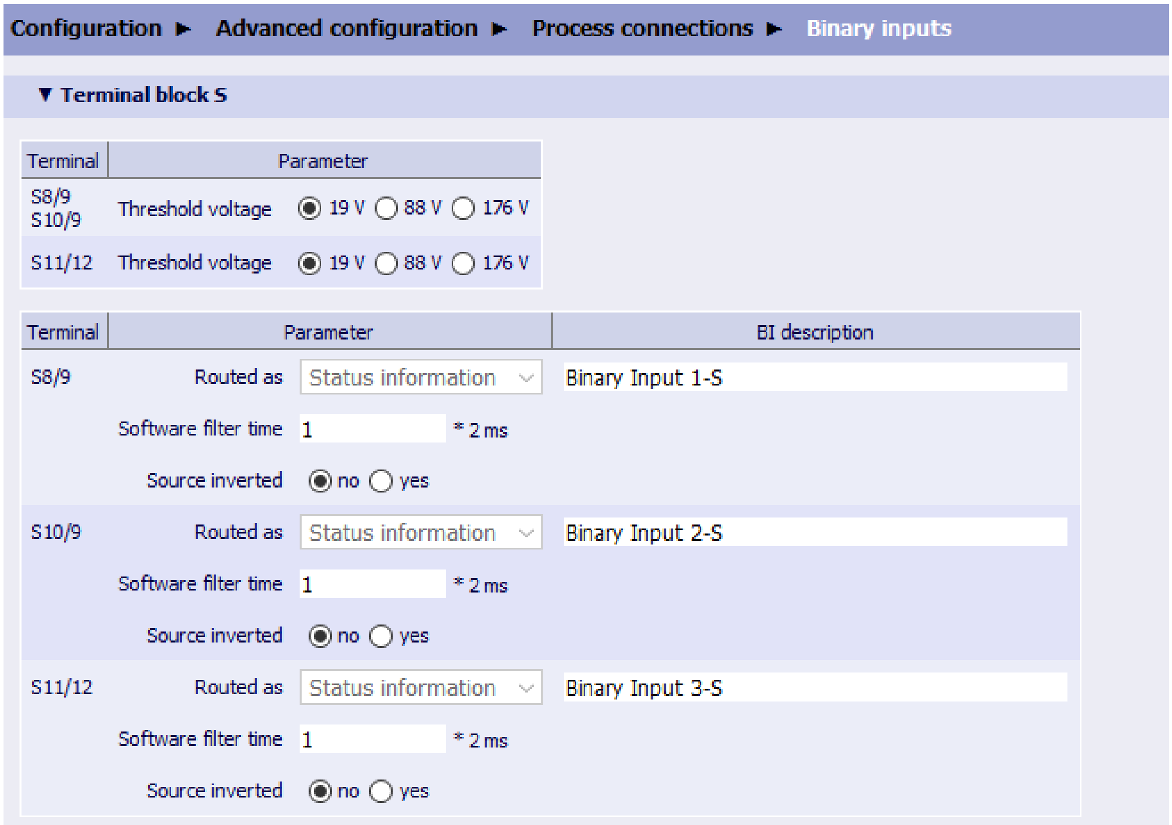
Figure 3-1 Function of the Binary Inputs

3.2.2 Configuration and Value View via Web Pages

Configuration of the Binary Inputs

To change the settings of binary inputs in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Binary inputs**.



[sc_BI_configuration_tab, 4, en_US]

Figure 3-2 Configuration Tab, Binary Inputs

- Configure the respective parameters according to the following table.

NOTE

The parameterization of the binary inputs is identical.

Table 3-1 Settings for Binary Inputs S and R

Parameter	Default Setting	Setting Range
Threshold voltage	19 V	19 V 88 V 176 V
Routed as:[18]	Status information	Status information Load profile source Tariff source
Software filter time (only settable if **Routed as:** is set to ***Status information***)	1 (* 2 ms)	2 ms to 120 000 ms (settable in 2-ms increments)

18 The parameter cannot be changed in this field. In the **Configuration** tab, **Energy management** menu, select **Load profile source** or **Tariff source**. If you did not select a source, **Status information** is automatically selected.

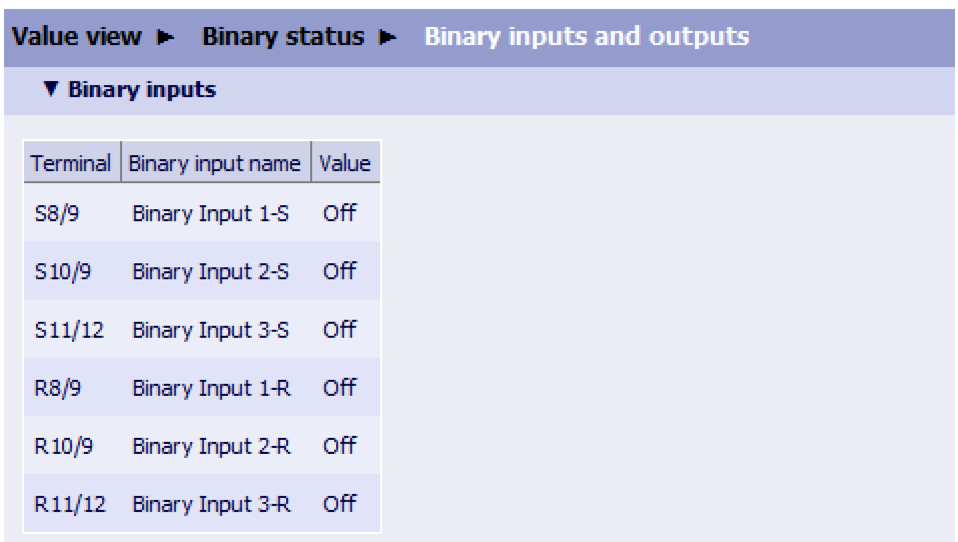
Parameter	Default Setting	Setting Range
Source inverted	no	no yes
BI description	For example for terminal S11/12: Binary input 3-S	Max. 31 characters

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of the Binary Inputs

To display the values of the binary inputs in the **Value view** tab, proceed as follows:

- In the navigation window, click **Binary inputs and outputs**.



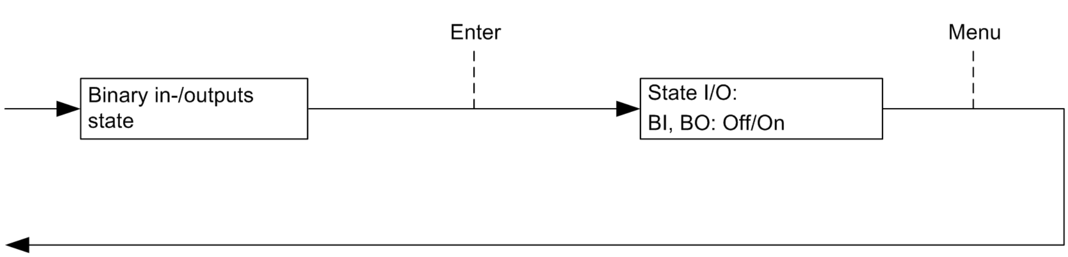
[sc_BI_evaluation, 4, en_US]

Figure 3-3 Value View Tab, Binary Status (Binary Inputs)

Depending on the parameterization, either the status information or the source is evaluated.

3.2.3 Value View via Display

Submenu Binary Inputs



[dw_submenu_binary_inputs_outputs, 1, en_US]

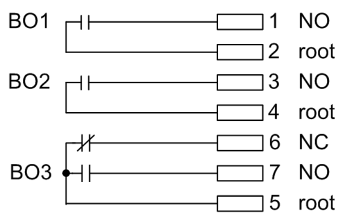
Figure 3-4 Submenu Binary Inputs

3.3 Binary Outputs

3.3.1 Function Description

The device has 2 x 3 binary outputs (relay contacts):

- 3 binary outputs on terminal block S
  2 of which are normally open (NO) contacts and 1 is a change over (NC) contact
- 3 binary inputs on terminal block R
  2 of which are normally open (NO) contacts and 1 is a change over (NC) contact



[dw_binary outputs, 1, en_US]

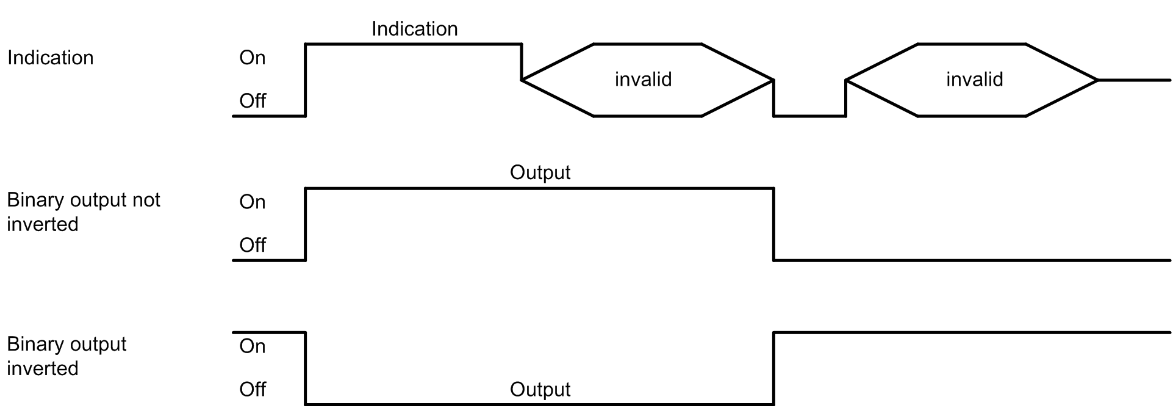
Figure 3-5 Function of the Binary Outputs

Binary outputs are issued as indications.
4 **Operating modes** are possible:

- Persistent
- Persistent with fail safe
- Pulse
- Pulse with retrigger

Persistent

The binary output has the status ON or OFF. If the indication becomes invalid, the binary output continues to maintain its current status.

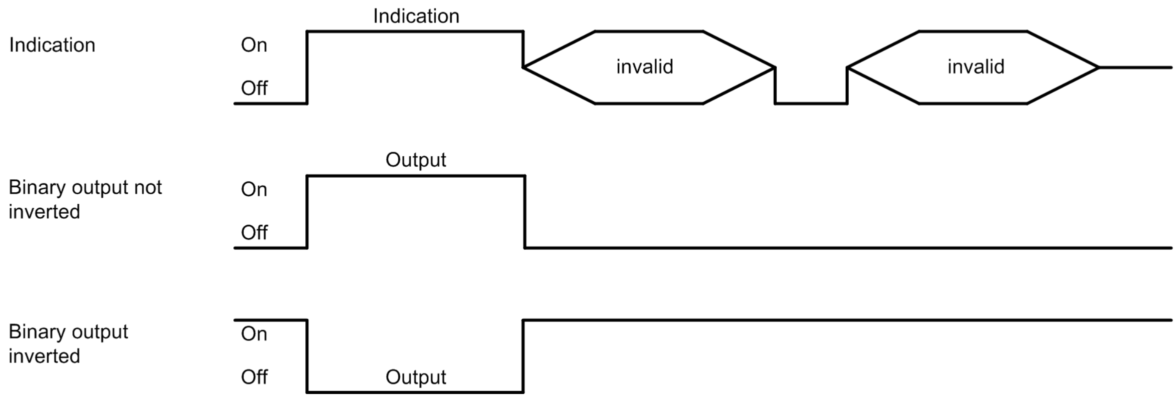


[dw_persistent, 1, en_US]

Figure 3-6 Persistent

Persistent with Fail Safe

If the indication becomes invalid, the binary output switches into the OFF state if **Source inverted = no**, or it switches into the ON state if **Source inverted = yes**.

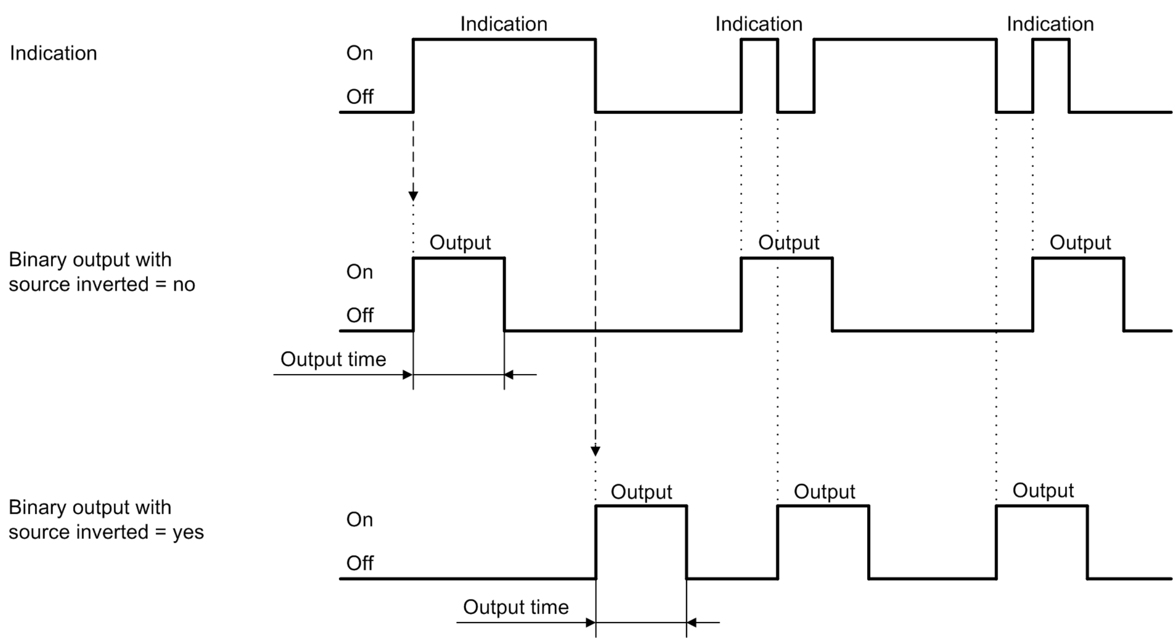


[dw_persistent-with-fail-save, 1, en_US]

Figure 3-7 Persistent with Fail Safe

Pulse

This indication is output as pulse. If the indication changes again while the output pulse is ON, the pulse output time is not restarted. This means that a change of the indication during the pulse output will be ignored.



[dw_pulse-without-retrigger, 1, en_US]

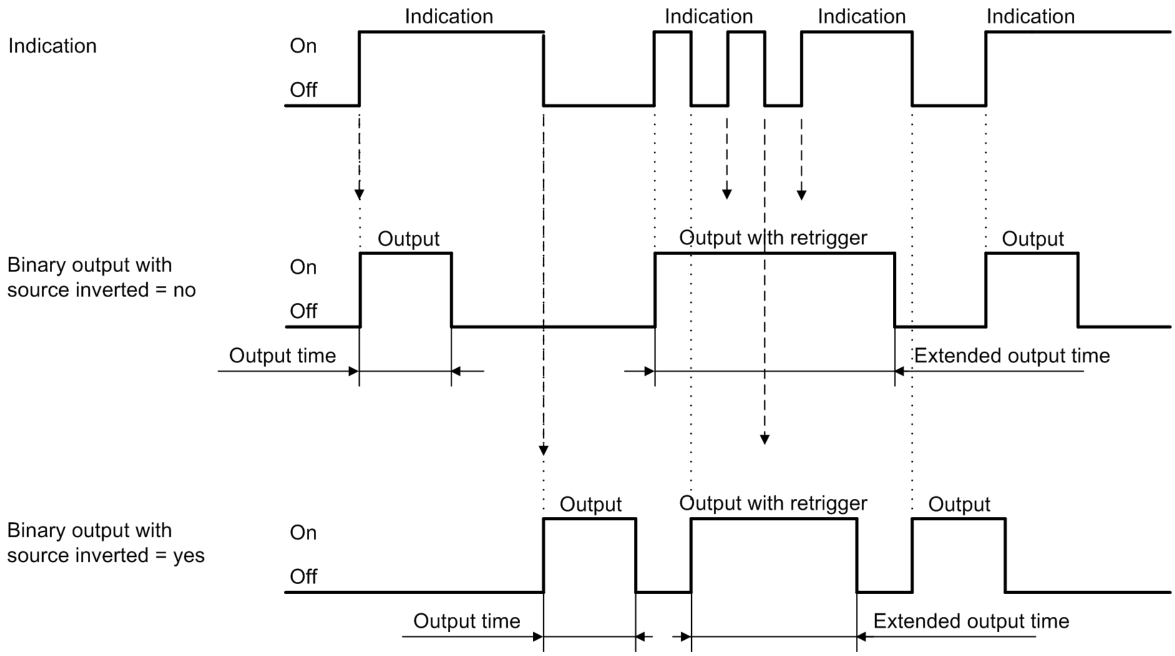
Figure 3-8 Pulse without Retrigger

NOTE

For the indications **Voltage Event Available**, **Voltage Unbalance Event Available**, **Frequency Event Available**, and **Transient Event Available** (refer to *14.1.1 Operational Indications*), if the operating mode is configured as **Persistent**, when an event occurs, the ON state starts and lasts until the start of the next event, and the OFF state is negligible. To automatically trigger the OFF state after configured duration, configure the operating mode as **Pulse**.

Pulse with Retrigger

This indication is output as pulse. The output pulse is retriggered if the indication is changed during the pulse output. This means that the pulse output is extended.



[dw_pulse-with-retrigger, 1, en_US]

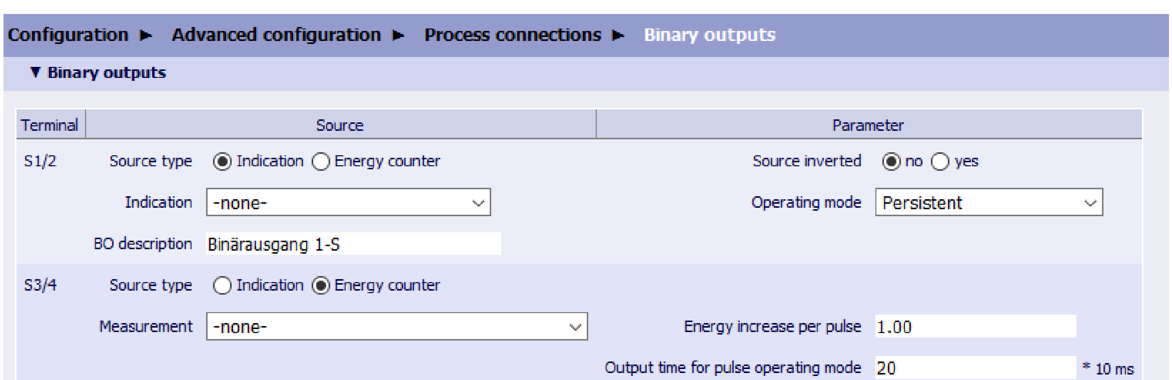
Figure 3-9 Pulse with Retrigger

3.3.2 Configuration and Value View via Web Pages

Configuration of the Binary Outputs

To change the settings of the binary outputs in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Binary outputs**.



[sc_BO_configuration, 4, en_US]

Figure 3-10 Configuration Tab, Binary Outputs

- Configure the respective parameters according to the following table.

Table 3-2 Settings for Binary Outputs

Parameter	Default Setting	Setting Range
Source type	Indication	Indication Energy counter
Source Type Indication		
Indication[19]	-none-	Acc. to list box
BO description (can be set for all binary outputs individually)	For example for terminal S1/2: Binary output 1-S	Max. 31 characters
Source inverted (can be set individually for all relay outputs)	no	no yes
Operating mode[20] (can be set individually for all relay outputs)	Persistent	Persistent Persistent with fail safe Pulse Pulse with retrigger
Output time for pulse operating mode (setting only possible for operating modes ***Pulse*** and ***Pulse with retrigger***)	20 (* 10 ms)	50 ms to 3 600 000 ms
Source Type Energy Counter		
Energy counter [19]	-none-	Acc. to list box
Energy increase per pulse	1.00 Wh	0.10 Wh/VAh/varh to 1 000 000.00 Wh/VAh/varh
Output time for pulse operating mode	20 * 10 ms = 200 ms	50 ms to 3 600 000 ms

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Behavior when Activating the Set of Parameters after the Set of Parameters was Changed

Persistent: The binary output is set to the new status (ON or OFF) as defined by the current indication.

Pulse: If the binary output is ON in **pulse** mode while activating the parameter set, the binary output is immediately switched to OFF after the parameter set has been activated. This happens even if the parameterized **Output time for pulse operating mode** has not yet elapsed.

Value View of the Binary Outputs

To display the values of the binary outputs in the **Value view** tab, proceed as follows:

- In the navigation window, click **Binary inputs and outputs**.

19 If you select **-none-** as the source of an **indication** or **energy counter**, the corresponding binary output is inactive.

20 If you have selected one of the 2 **Pulse** types in the **Operating mode** list box, enter an output time x (in x *10 ms) in the **Output time for pulse operating mode** field.

▼ **Binary outputs**

Terminal	Indication / counter	Value	Information	Value
S1/2	-none-			
S3/4	Battery Failure	Off	Binary Output 2-S	On
S5/6/7	Time Synchronization Error	Off	Binary Output 3-S	Off
R1/2	WPa_sup	9764864	Binary Output 1-R	Off
R3/4	WP_SUP_TARIFF_1	-982594617	Binary Output 2-R	Off
R5/6/7	WS_TARIFF_1	-1075679736	Binary Output 3-R	Off

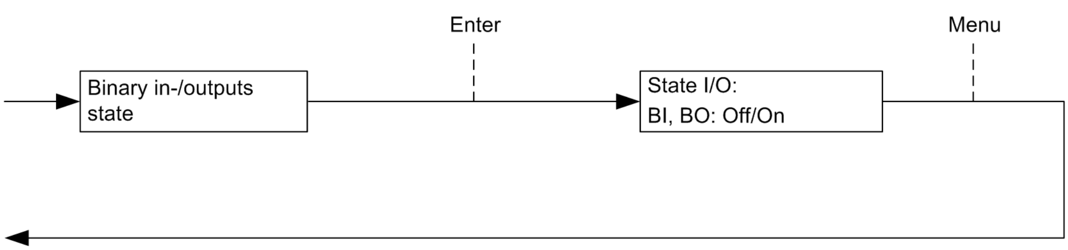
[sc_BO_evaluation, 1, en_US]

Figure 3-11 Value View Tab, Binary Status (Binary Outputs)

Depending on the parameterized source type, the indications routed to the binary outputs and energy counters are evaluated.

3.3.3 Value View via Display

Submenu Binary Outputs



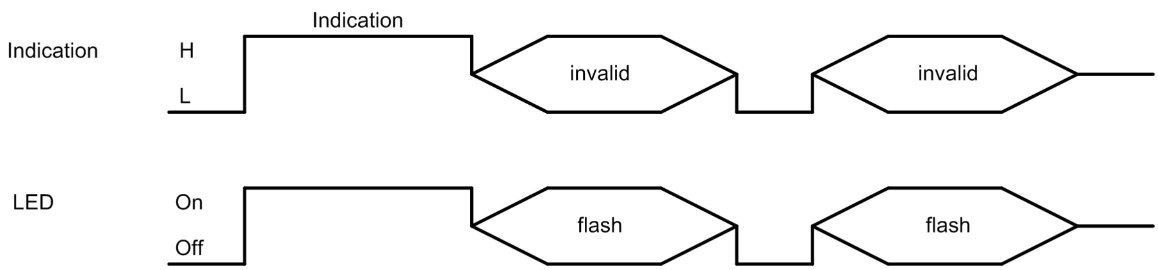
[dw_submenu_binary_inputs_outputs, 1, en_US]

Figure 3-12 Submenu Binary Outputs

3.4 LEDs

3.4.1 Function Description

Behavior of the LEDs



[dw_LED-output, 1, en_US]

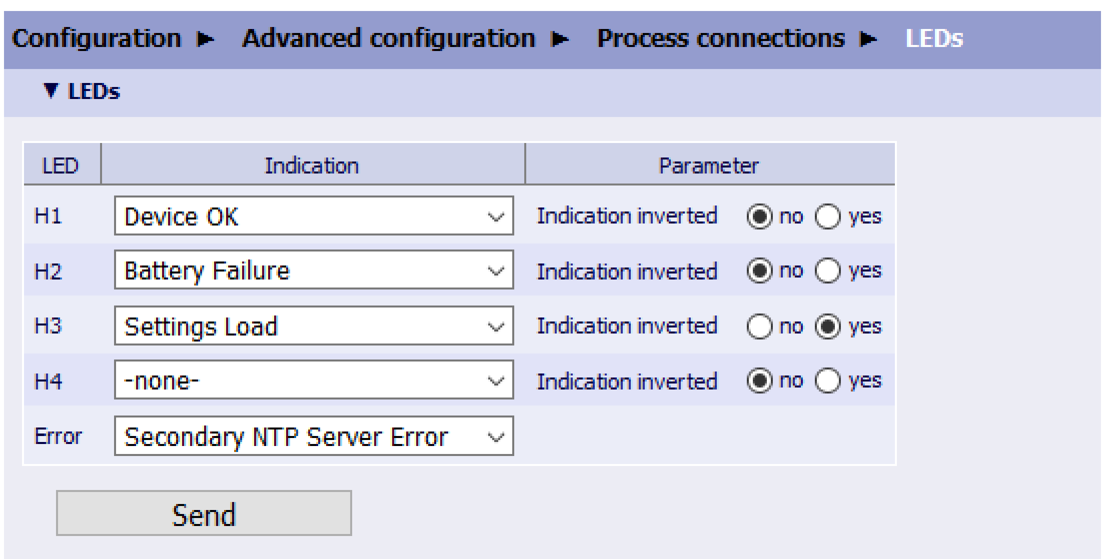
Figure 3-13 Behavior of the LEDs

3.4.2 Configuration via Web Pages

Configuration of the LEDs

To change the LED settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **LEDs**.



[sc_LED_config, 2, en_US]

Figure 3-14 Configuration Tab, LEDs

- Configure the respective parameters according to the following table.

Table 3-3 Settings for LEDs

Parameter	Default Setting	Setting Range
RUN	Device ready	Not settable
ERROR	-none-	Errors are signaled as parameterized (only error indications can be parameterized). -none- Battery failure Ethernet link error Time synchronization error Primary NTP server error Secondary NTP server SD card error
H1 H2 H3 H4 Only the indications for the parameterization of the binary outputs are displayed which can be used according to the current device settings. Indications which are read by Modbus slave devices are available in the list box if they are parameterized in Modbus Master Mapping.	-none-	Acc. to list box Limit Violation, Group Indication and Binary Inputs: Designation can be changed during the parameterization.
Indication inverted	no	no yes

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

NOTE

Select Indication **-none-** to disable the corresponding LED.

You can find explanations for the LED indications in chapter *11 Troubleshooting, Repair, and Fallback Mode*.

4 Automation Functions

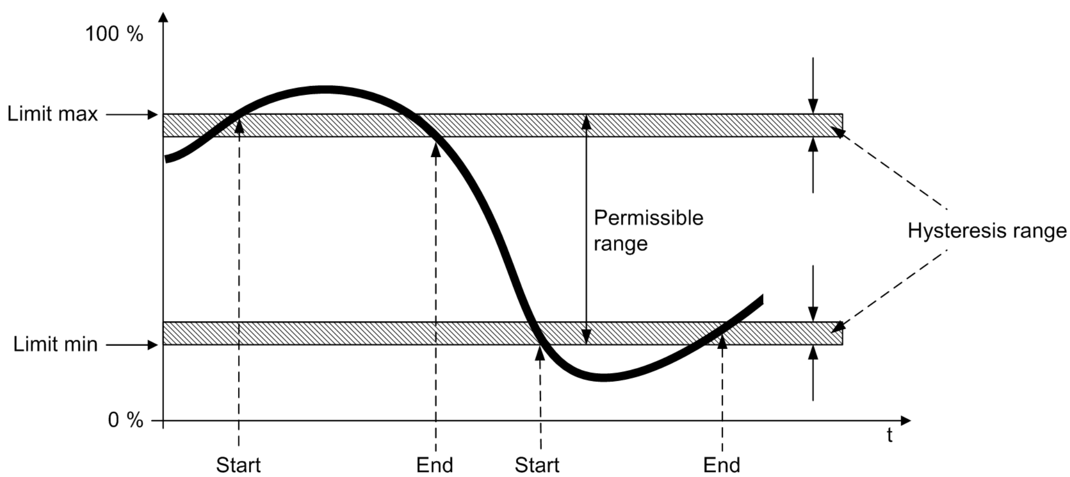
4.1 Limits

4.1.1 Function Description

In the **Select automation functions** menu, you can set upper or lower limits for up to 16 measured values. Limit violations of the upper or lower range of values can be output as indications. Limiting-value violations can be signaled to the device via 6 binary outputs and the LEDs H1 to H4. Furthermore, all 16 limit violations can be sent to peripheral devices via communication interfaces.

The programmable limits are divided into 2 groups: **Limits 1-8** and **Limits 9-16**. The parameterization is identical for all limits.

Hysteresis of the Limiting-Value Violation



[dw_hysteresis, 1, en_US]

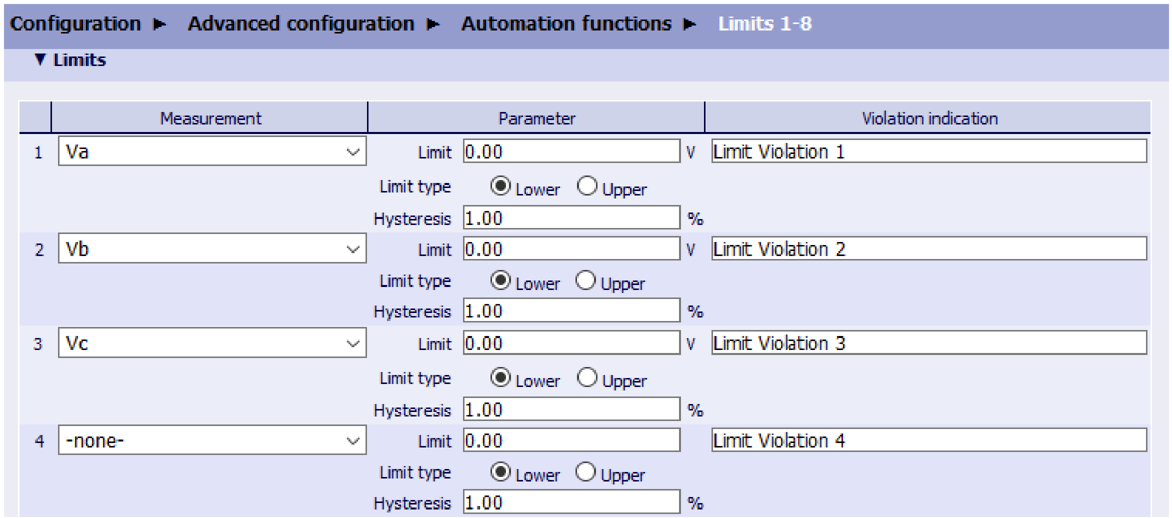
Figure 4-1 Hysteresis (General Representation)

4.1.2 Configuration and Value View via Web Pages

Configuration of the Limits

To change the limit settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Limits 1-8** or **Limits 9-16**.



[sc_q100_Limits_configuration, 2, en_US]

Figure 4-2 Configuration Tab, Limits (Example)

- Configure the respective parameters according to the following table.

Table 4-1 Settings for Limits

Parameter	Default Setting	Setting Range
Measurement	-none-	Measured value selection list depending on network type
Limit	0.00[21]	-1 000 000 000.00 to 1 000 000 000.00 (unit)
Limit type	Lower	Lower Upper
Hysteresis (%)	1.00	0.00 to 10.00
Violation indication	Limit Violation x (x = 1 to 16)	The name of the indication is customizable; max. 31 characters.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

NOTE

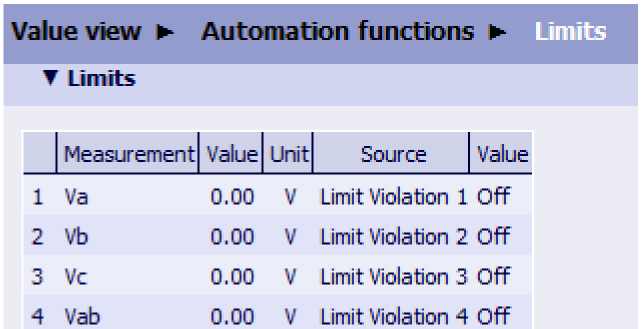
Select **-none-** for **Measurement** to disable the corresponding limit indication.
It depends on the configured network type which quantities are offered in the list box of the **Measurement**. The **Network type** is specified in the **Basic configuration** > **AC measurement**.

Value View of the Limits

To display the limits in the **Value view** tab, proceed as follows:

- In the navigation window, click **Limits**.

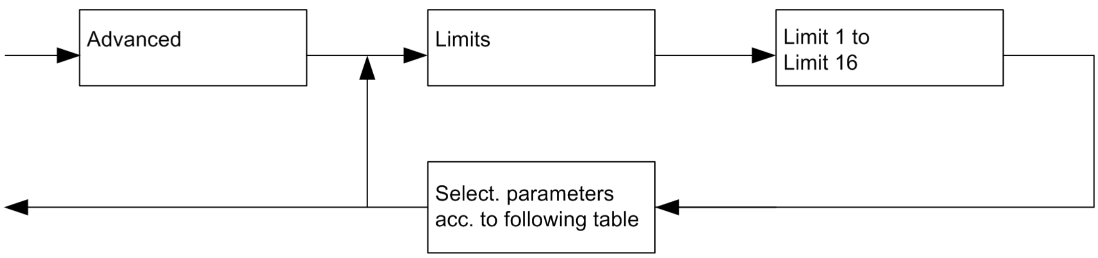
21 The limit value must be the primary value.



[sc_Limits_evaluation, 3, en_US]

Figure 4-3 Value View Tab, Limits

4.1.3 Configuration and Value View via Display



[dw_submenu_limits, 1, en_US]

Figure 4-4 Submenu Limits

Table 4-2 Settings for Advanced

Parameter	Default Setting	Setting Range
Source	-none-	Acc. to the list box
Mode	Smaller than	Greater than Smaller than
Value	0.00	-1 000 000 000.00 to +1 000 000 000.00 (unit)
Hysteresis	1.0 %	0.0 % to 10.0 %
State	ON	ON OFF (O) Acc. to the current configuration

4.2 Group Indications

4.2.1 Function Description

Up to 4 **Group indications** can be parameterized and each of them can be assigned to up to 4 logically linked single-point indications. The single-point indications can be inverted.

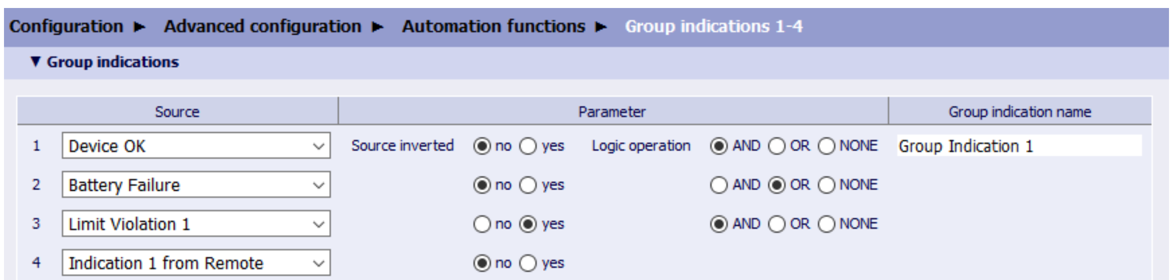
Rule for Linking Indications to a Group Indication

In a group indication, up to 4 indications can sequentially be linked logically. The indications 1 to 4 are always linked successively as follows:

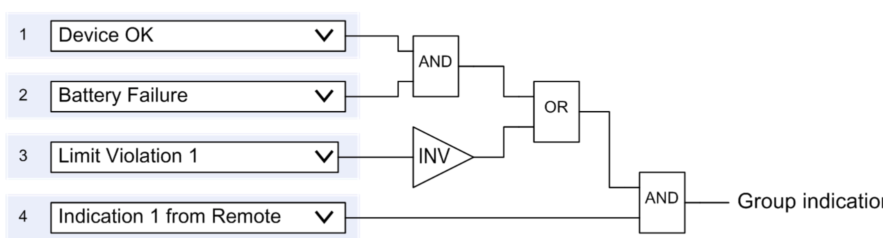
Indication 1 with Indication 2 = Indication 1/2

Indication 1/2 with Indication 3 = Indication 1/2/3

Indication 1/2/3 with Indication 4 = Group indication

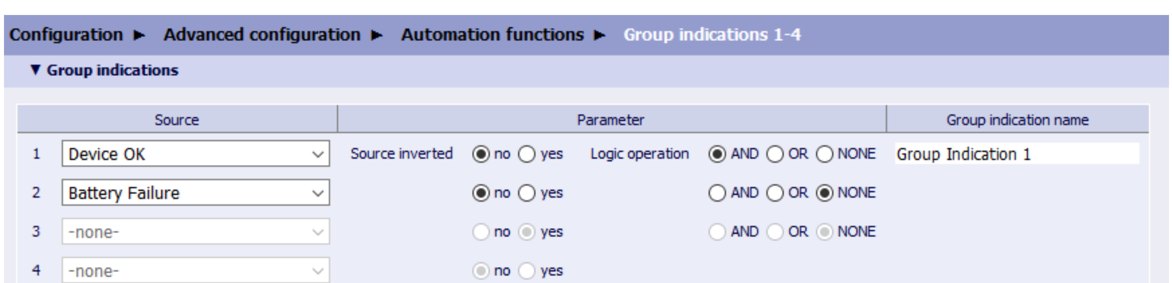


[sc_q200_regular_4x_1, 2, en_US]

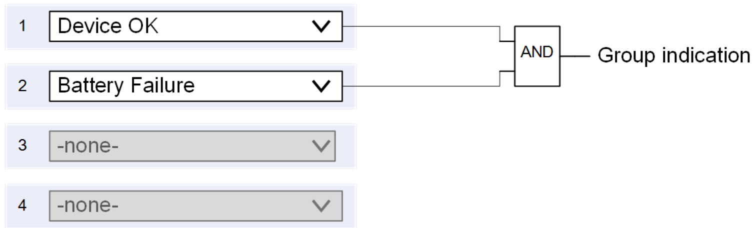


[dw_q200_regular_4x_1, 1, en_US]

Figure 4-5 Example: Linking 4 Indications to a Group Indication



[sc_q200_regular_2x_1, 2, en_US]

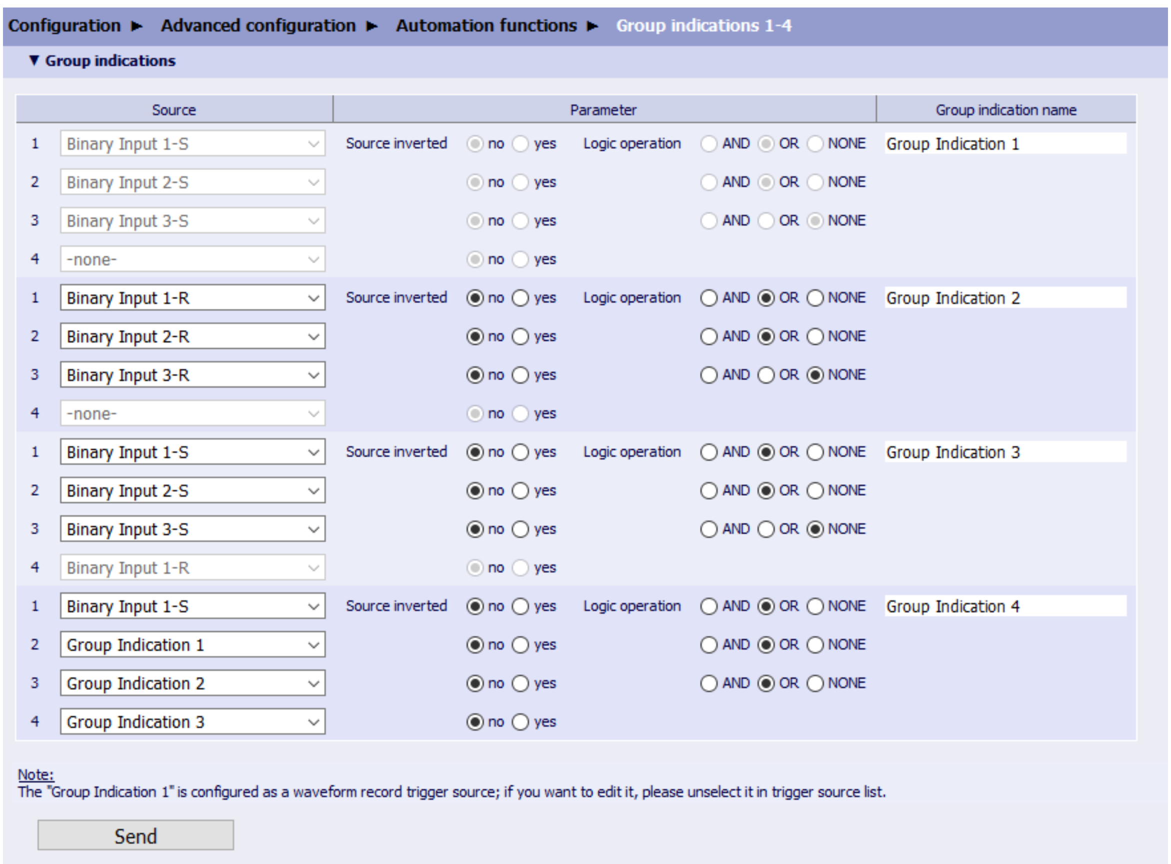


[dw_p85x_regular_2x_1, 1, en_US]

Figure 4-6 Example: Linking 2 Indications to a Group Indication

Rule for Linking Binary Inputs to a Group Indication

For a group indication that is used to trigger the waveform recorder, you must select binary inputs or indication groups which are linked by binary inputs as **Source** and set **Source inverted** to **no** for each source. The **Logic operation** of each source must be **OR**.



[sc_Notes to Show Why You Cannot Edit the Parameters, 2, en_US]

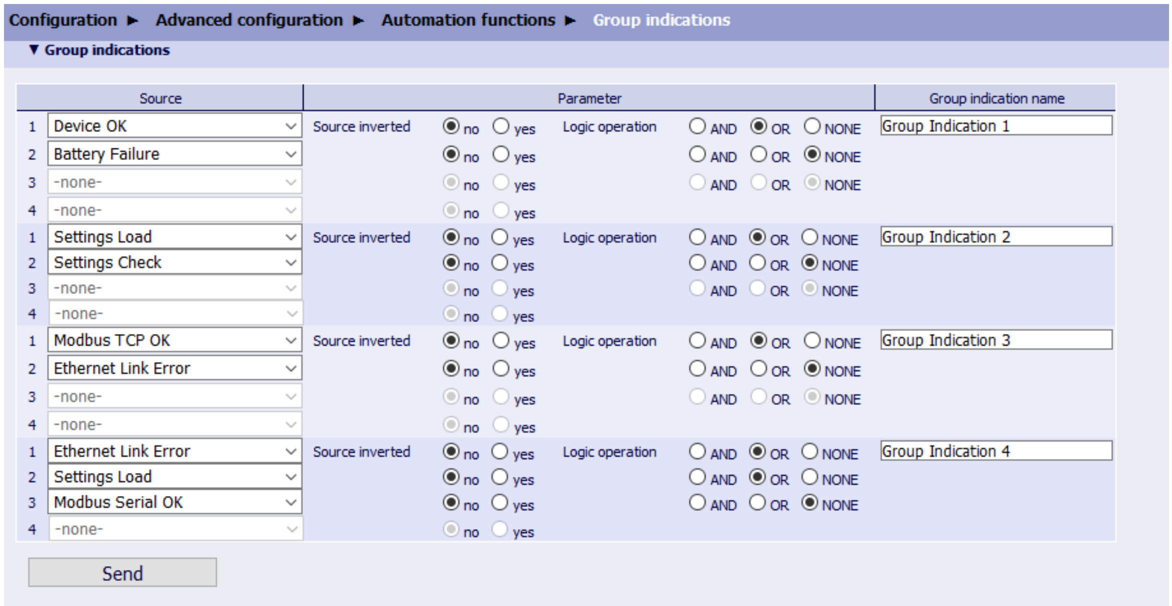
Figure 4-7 Example: Linking Binary Inputs to Group Indications

4.2.2 Configuration and Value View via Web Pages

Configuration of the Group Indications

To change the settings of the group indication in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Group indications 1-4**.



[sc_Group_indication_configuration, 5, en_US]

Figure 4-8 Configuration Tab, Group Indications

- Configure the respective parameters according to the following table.

Table 4-3 Settings for Group Indications

Parameter	Default Setting	Setting Range
Source Only the indications for the parameterization of the binary outputs are displayed which can be used according to the current device settings. Indications which are read by Modbus slave devices are available in the list box if they are parameterized in the Modbus Master Mapping.	-none-	Acc. to list box Limit violation, group indication and binary inputs: Designation can be changed during the parameterization.
Source inverted	no	no yes
Logic operation	NONE	NONE OR AND
Group indication name	Group Indication x (x = 1 to 4)	The name of the indication is customizable; max. 31 characters.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

NOTE

Sources are assigned inside a group indication sequentially from source 1 to source 4.

If you select **-none-** at the 1st source in a group indication, you cannot configure further sources in this group indication. In this case, the group indication is inactive.

You can also integrate group indications into subordinated group indications, for example group indication 1 into group indication 3.

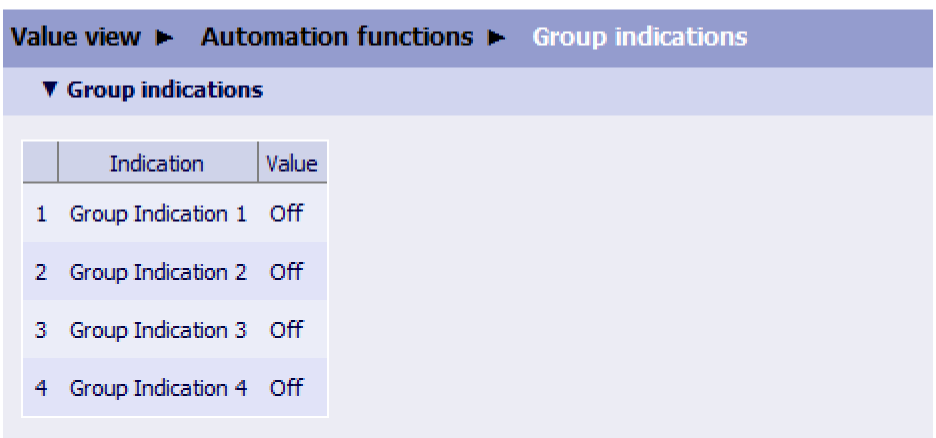
NOTE

If a group indication is selected as the trigger source, you cannot edit the parameters of the group indication except for the name. You can see the following note at the end of the HTML page: **The "Group Indication x" is configured as a waveform recorder trigger source; if you want to edit it, please unselect it in trigger source list**. See *4.2.1 Function Description*.

Value View of the Group Indications

To display the values of group indications in the **Value view** tab, proceed as follows:

- In the navigation window, click **Group indications**.



[sc_Group_indication_evaluation, 2, en_US]

Figure 4-9 Value View Tab, Group Indications

5 Energy Management

5.1 Load Profile

5.1.1 Function Description

General

The load profile reflects the history of the electric power and documents the distribution of power fluctuations and peaks. The load profile is determined on the basis of 10/12 cycles (50 Hz/60 Hz) and saved as average value at the end of a measuring period in the load-profile image.

The device supports 2 methods for the determination of the average power value:

- **Fixed block**
- **Rolling block**

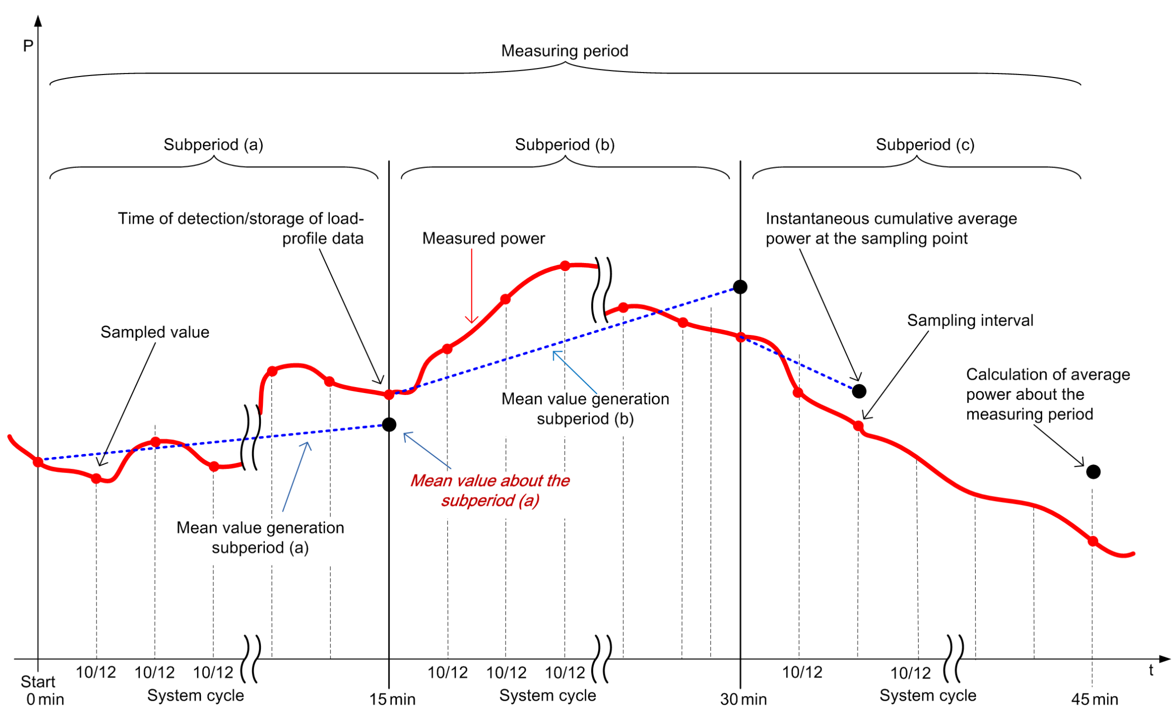
The load profile is stored in the non-volatile ring buffer of the device and provided at the communication interfaces (see Communication manual). In addition, it can be output as CSV file.

The load profile can be recorded in synchronized form (time, trigger) or in non-synchronized form. The synchronization is made by external or internal triggers.

The following diagram shows a 45-min measuring period which consists of 3 subperiods of 15 min each (Rolling block).

The measured and calculated load-profile data are stored in the ring buffer at the end of each subperiod. After 3 subperiods, the average power value of the measuring period is calculated from the 3 load-profile data of the subperiods. The values (cumulative values and averages) can be retrieved at any time within a subperiod via the communication. At the end of the 4th subperiod (d) the average power values are calculated from subperiods b, c, and d.

The preset measuring-period length of a subperiod is 15 minutes.



[dw_power-history-15-min, 1, en_US]

Figure 5-1 Power History of a Measuring Period Consisting of Three 15-min Subperiods

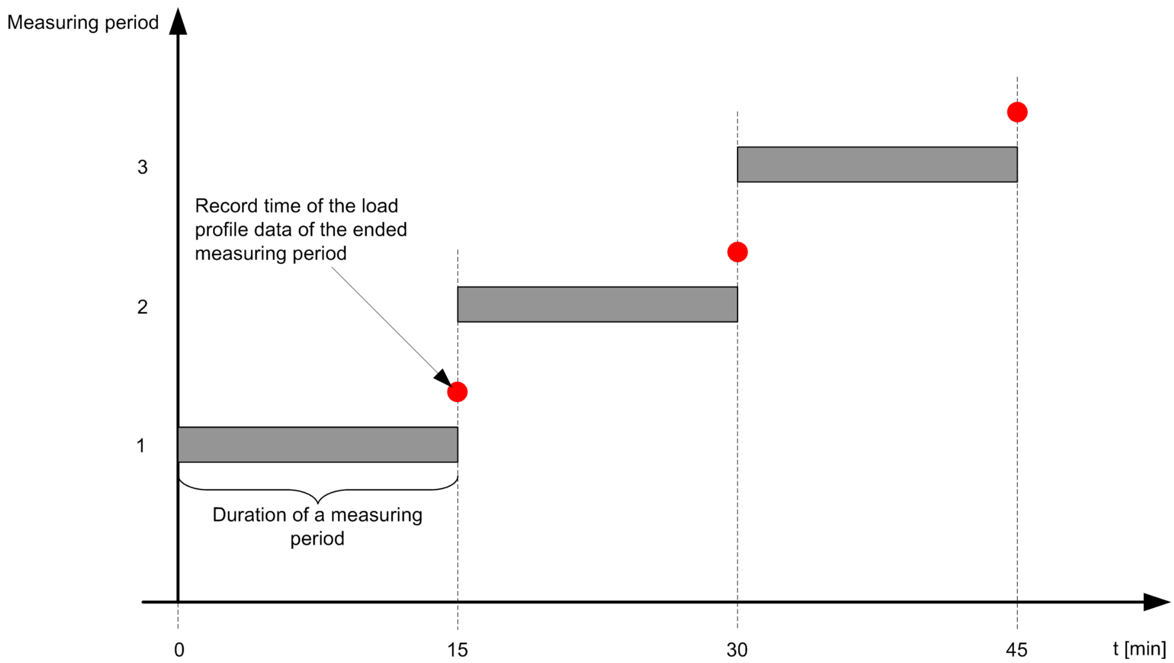
Methods of Load-Profile Determination

The device supports the following load-profile determination methods:

- Fixed block
- Rolling block

Fixed Block

The **Fixed-block** method is characterized by the **number of subperiods** per period that is set to **1**. It means the period length is equal to the length of the subperiod.



[dw_load-profile-fixed-block, 1, en_US]

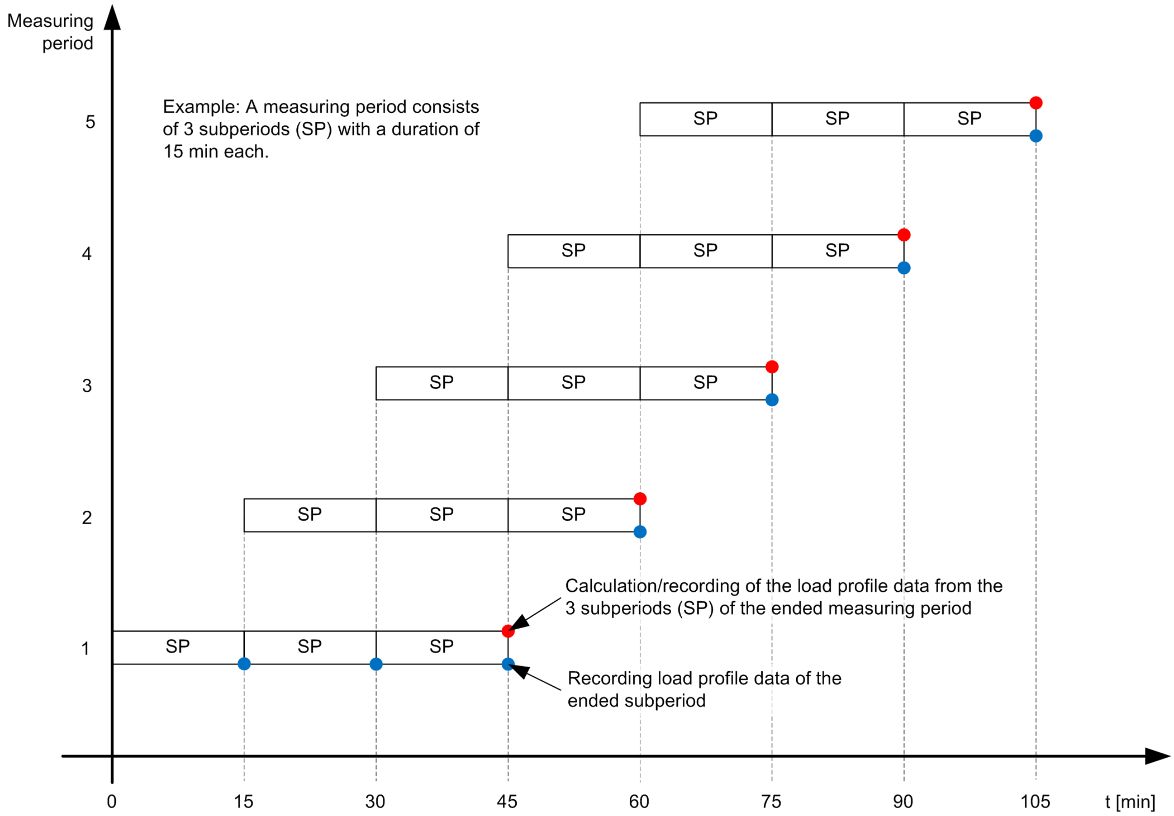
Figure 5-2 Determination of the Load Profile according to the Fixed-Block Method

Rolling Block

A **measuring period** of the **rolling-block** method consists of 2 to 5 **subperiods** depending on the parameterization.

The length of a measuring period is the product of the number of subperiods and the parameterized length of the subperiod. The average power values of the periods are calculated from the total of the average power values of the subperiods and its subperiod times as well as from the total period of time.

The following figure shows the history of the measuring periods during the load-profile determination:



[dw_load-profile-rolling-block, 1, en_US]

Figure 5-3 History of the Measuring Periods for Determination of the Load Profile according to the Rolling-Block Method

Load-Profile Data at the Communication Interface

The following load-profile data are available during a measuring period:

- Average power values for all power quantities during the measuring period, calculated from the average power values at the end of every subperiod (red dots in the figure)
- Average power values for all power quantities during the subperiods (blue dots in the figure)
- Maximum and minimum values for all power quantities within the subperiods
- Cumulated power values for all power quantities at every sampling point within the current subperiod

The arithmetic average power values and the extreme values per subperiod are stored in the ring buffer. The cumulated power values can be retrieved via communication or displayed on the Web pages.

Load-Profile Calculation – Arithmetic average power value:

The calculation of the arithmetic **average power value** of a measuring period refers to the actual duration of the measuring period.

Special case: With constant power consumption or constant power supply, the arithmetic average power value also remains constant in the current measuring period.

Load-Profile Calculation – Cumulated power value:

The **power values** are calculated cumulatively and the calculation refers to the (expected) length of the respective subperiod.

Special case: With constant power consumption or constant power supply, the cumulated power value rises **linearly** in the current measuring period.

Historical Load-Profile Data

The device records the following measurands:

Table 5-1 Historical Load-Profile Data

Measurement	Cumulated Power Values	Arithmetic Average Power Values	Maximum Values	Minimum Values
P_{Import}	x	x	±x	±x
P_{Export}	x	x		
Q_{Import}	x	x	±x	±x
Q_{Export}	x	x		
S	x	x	x	x

Storage of Load-Profile Data

The load-profile data are stored in a ring buffer with up to 4000 datasets. If the ring buffer is full every new dataset overwrites the oldest dataset. Every dataset contains the average power values, minimum/maximum values, a time stamp, and status information for a completed subperiod.

The traceability of the load profile depends on the length of the subperiod:

- Fixed-block method: length of the measuring period = 15 min
- Rolling-block method: length of the subperiod = 15 min

On the condition that all periods correspond to the configured period length, the recording period is longer than 40 days.

Current Load-Profile Data at the Communication Interfaces and on the Web Pages

The load-profile data of the current and last completed periods are output at the communication interfaces.

For information on the data transmission via the communication protocols Modbus TCP, Modbus RTU, and IEC 61850, refer to the Communication manual.

On the Web pages, the load-profile data are displayed in the tab **Value view**→ **Load profile**.

Types of Synchronization

At the beginning of every subperiod, the device expects a synchronization signal which can either be supplied externally or created internally.

External supply of the synchronization signal:

- Via one of the binary inputs
- Via the communication interfaces

Creation of the internal synchronization signal:

- Creation through the internal clock of the device

Synchronization with External Synchronization Pulses

Synchronization via binary inputs or communication interface

The device checks whether there is a deviation from the set time or whether there are no synchronization pulses. If a set tolerance is exceeded or if the value falls below this tolerance, the measuring period is shortened and marked accordingly.

If the time grid of the incoming pulses is shifted, the device adapts to the changed time grid automatically.

Particularities in the synchronization via communication interface

The synchronization telegram transmitted via Modbus TCP or Modbus RTU contains, among other things, the length of the subperiods in minutes.

If the set length of the subperiods in the device does not correspond to the length in the telegram, the synchronization pulse is ignored. Load-profile data are still recorded though based on the internal clock of the device.

Synchronization via the Internal Clock of the Device

If external synchronization is not possible, for instance, due to no synchronization pulse, the synchronization can be configured with the internal clock of the device. The length of measuring period and subperiod depends only on the internal clock of the device.

The starting time of the subperiod is the previous full hour plus a multiple of the configured length of the subperiod.

Updating the time within the current measuring period or beyond the measuring period causes shortened measuring periods and is given the information **resynchronized** in the time stamp.

Substitute values are not written for any gaps in the history.

Special Conditions and Effects on the Load Profile at Synchronization

Device Restart

If a functional battery is installed in the device, the existing load-profile records are kept unchanged.

Resetting the Device Clock

Resetting the device clock does not affect the load-profile recording. The historical load profiles with a date in the future do not prevent resetting the device clock.

Failure of the Measuring Voltage:

Failure of the measuring voltage does not affect the load profile.

Failure and Return of the Supply Voltage:

When the supply voltage returns after a temporary failure, the device records shortened measuring periods.

Interpolated values are not determined and written for load-profile data which were not recorded during the period.

Effect of Tariff Change

The low-to-high tariff change has an effect on the load profile since all values stored in the load profile have been assigned to the valid tariff in a unique way.

The current period keeps the old tariff up to the period end. The new tariff will be effective from the starting time of the subsequent period. The power meters of the device change to the other tariff after the current measuring period.

Additional Information on the Load-Profile Data

The device determines the following additional information for every period (see Communication manual, Load profile – Management):

- LOADPROFILE_FLAG_QUALITY_SYNC
  The device triggered the period end prematurely due to a synchronization irregularity. As long as the time has not been determined, the flag is set. The time can be undefined if the battery could not buffer the time, for example, due to discharged battery.
- LOADPROFILE_FLAG_QUALITY_AUXPOWER_FAIL
  The device triggered the period end prematurely due to supply-voltage failure.
- LOADPROFILE_FLAG_QUALITY_UNSECURE
  The load-profile data are unsafe. Reasons are:
  - Measuring current or measuring voltage are outside the specified range
  - Type of reactive power was changed

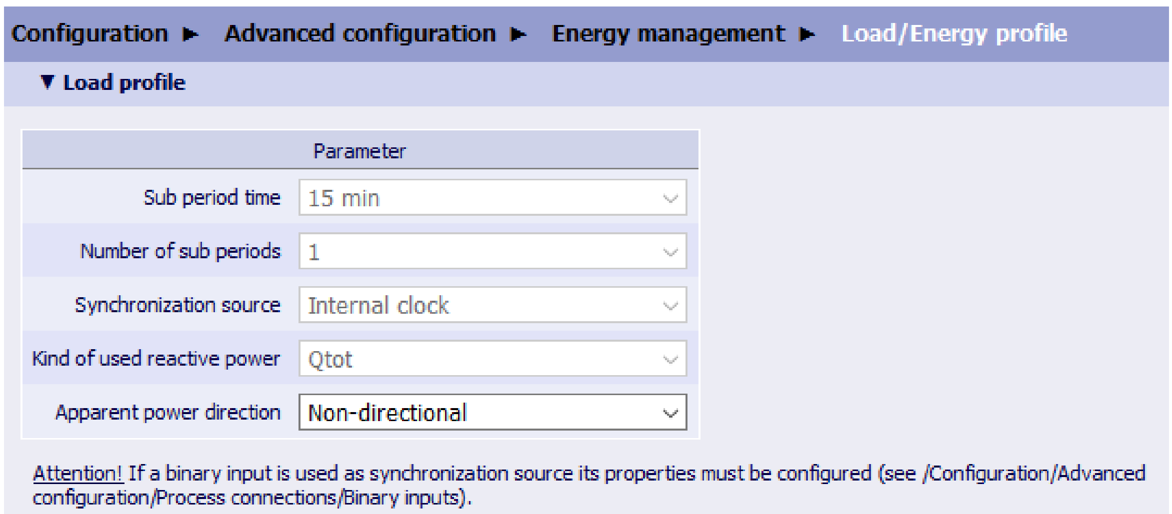
The additional information is stored with the other load-profile data and can be retrieved via the communication interfaces.

5.1.2 Configuration and Value View via Web Pages

Configuration of the Load Profile

To change the settings of the load profile in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Load/Energy profile**.



[sc_Configure_load-profile, 3, en_US]

Figure 5-4 Configuration Tab, Load Profile

- Configure the respective parameters according to the following table.

Table 5-2 Settings for Load Profile

Parameter	Default Setting	Setting Range
Subperiod time	15 min	1 min to 6 min in 1-min steps, 10 min, 12 min, 15 min, 20 min, 30 min, 60 min
Number of subperiods[22]	1	1 to 5
Synchronization source	Internal clock	None Protocol Binary input 1-S Binary input 1-R Binary input 2-S Binary input 2-R Binary input 3-S Binary input 3-R Internal clock

22 Number = 1: Fixed Block method: The lengths of the subperiod and of the measuring period are identical; Number = 2 to 5: Rolling Block method; Length of the subperiod: The length of the subperiod is an integer part of a full hour; Length of measuring period: The length of the measuring period cannot be configured directly. It is defined as the product of the length of the subperiod and the number of subperiods: Length of measuring period = n x length of subperiod; n = number of subperiods

Parameter	Default Setting	Setting Range
Kind of used reactive power	Q1	Q1 Qn Qtot
Apparent power direction	Non-directional	Non-directional Directional

NOTE

Changing the number and length of the subperiods deletes the load-profile buffer.

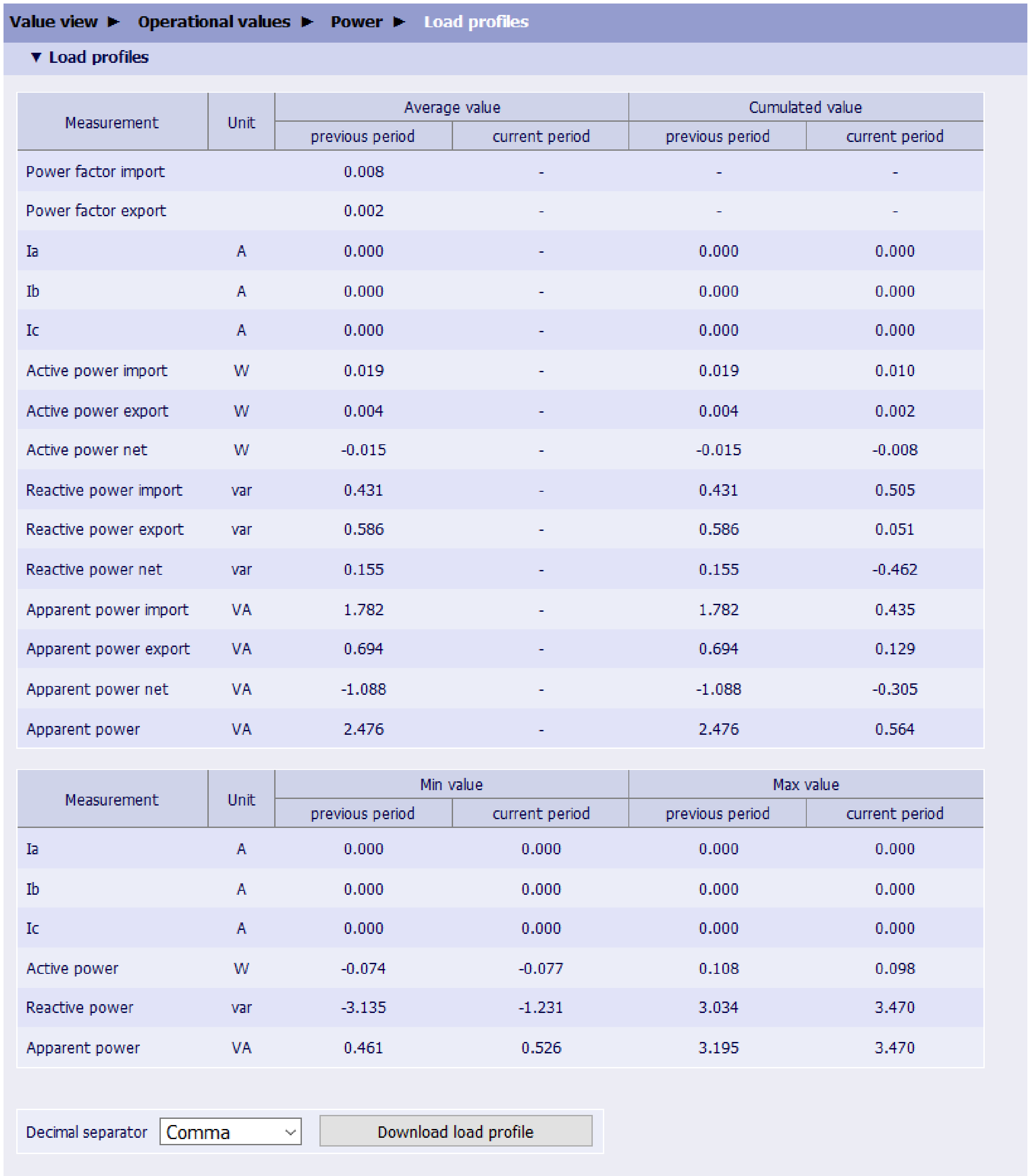
If a binary input is used as synchronization source, its properties must be configured (see chapter *3.2.2 Configuration and Value View via Web Pages*.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of the Load Profile

To display the values of the load profile in the **Value view** tab, proceed as follows:

- In the navigation window, click **Load profiles**.



Value view ► Operational values ► Power ► Load profiles

▼ Load profiles

Measurement	Unit	Average value		Cumulated value	
		previous period	current period	previous period	current period
Power factor import		0.008	-	-	-
Power factor export		0.002	-	-	-
Ia	A	0.000	-	0.000	0.000
Ib	A	0.000	-	0.000	0.000
Ic	A	0.000	-	0.000	0.000
Active power import	W	0.019	-	0.019	0.010
Active power export	W	0.004	-	0.004	0.002
Active power net	W	-0.015	-	-0.015	-0.008
Reactive power import	var	0.431	-	0.431	0.505
Reactive power export	var	0.586	-	0.586	0.051
Reactive power net	var	0.155	-	0.155	-0.462
Apparent power import	VA	1.782	-	1.782	0.435
Apparent power export	VA	0.694	-	0.694	0.129
Apparent power net	VA	-1.088	-	-1.088	-0.305
Apparent power	VA	2.476	-	2.476	0.564

Measurement	Unit	Min value		Max value	
		previous period	current period	previous period	current period
Ia	A	0.000	0.000	0.000	0.000
Ib	A	0.000	0.000	0.000	0.000
Ic	A	0.000	0.000	0.000	0.000
Active power	W	-0.074	-0.077	0.108	0.098
Reactive power	var	-3.135	-1.231	3.034	3.470
Apparent power	VA	0.461	0.526	3.195	3.470

Decimal separator Comma Download load profile

[sc_Load_profile_evaluation, 6, en_US]

Figure 5-5 Value View Tab, Load Profiles

In the **decimal separator**, you can select whether you want to display the load-profile data with **comma** or **decimal point** after the download.

To download the load profile, proceed as follows:

- Click **Download load profile**.
  The **File Download** dialog opens. You can save the CSV file. For more information, refer to *7.3.3.1 Single File Download*.

NOTE

The file extension must be .csv.

5.1.3 Configuration via Display

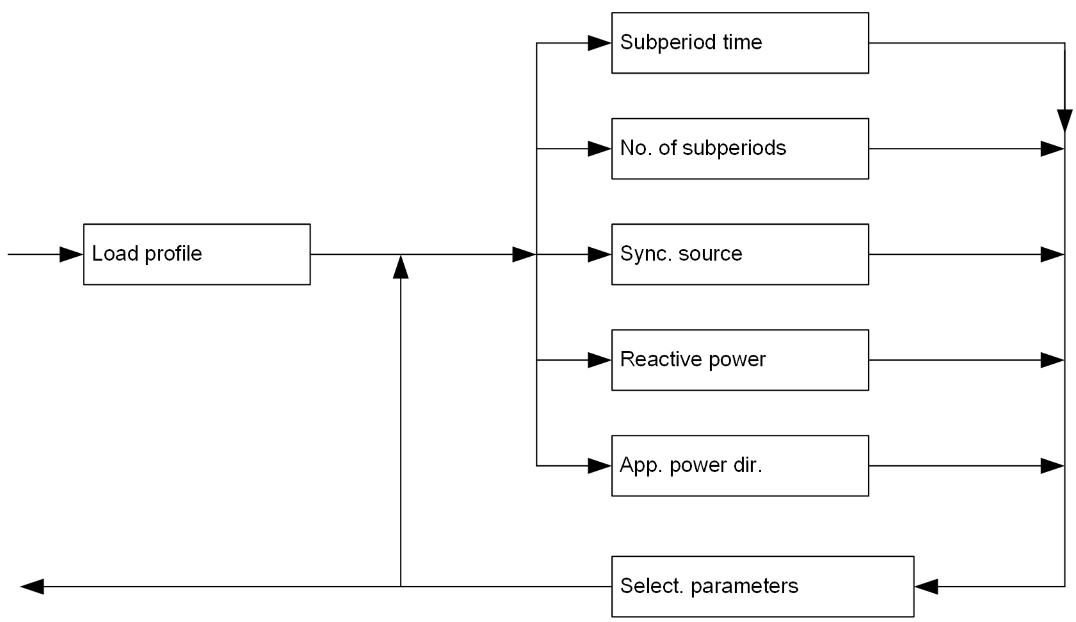
Submenu Load Profile

NOTE

If you select the **Load profile** parameter, the following message is displayed first:

Changing these parameters resets the load profile!

To confirm, press the softkey **F4 (Ok)**.



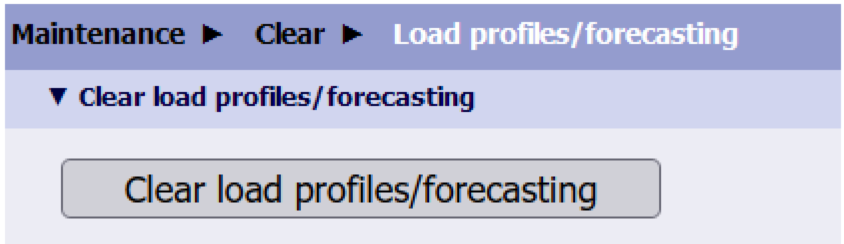
[dw_submenu_load_profile, 4, en_US]

Figure 5-6 Submenu Load Profile

5.1.4 Clearing of Load Profiles

To clear the load profiles in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Load profiles/forecasting**.



[sc_maintenance_load profile, 1, en_US]

Figure 5-7 Maintenance Tab, Clear Load Profiles/Forecasting

- Click **Clear load profiles/forecasting**.
  The load profiles and load-forecasting data are cleared. The indication **Action was successful** is displayed in the status bar.

5.2 Load Forecasting

5.2.1 Function Description

The function **Load forecasting** is used to predict the load demand in the upcoming hours or days based on the historical load values.

The device measures and forecasts the maximum, minimum, and average values of the following measurands:

- I_a: Current of phase A
- I_b: Current of phase B
- I_c: Current of phase C
- Active power net: Net active power

The device supports forecasting load values for the following time intervals:

- Hour: Forecast values for the next 4 hours
- Day: Forecast values for the next 4 days

5.2.2 Value View via Web Pages

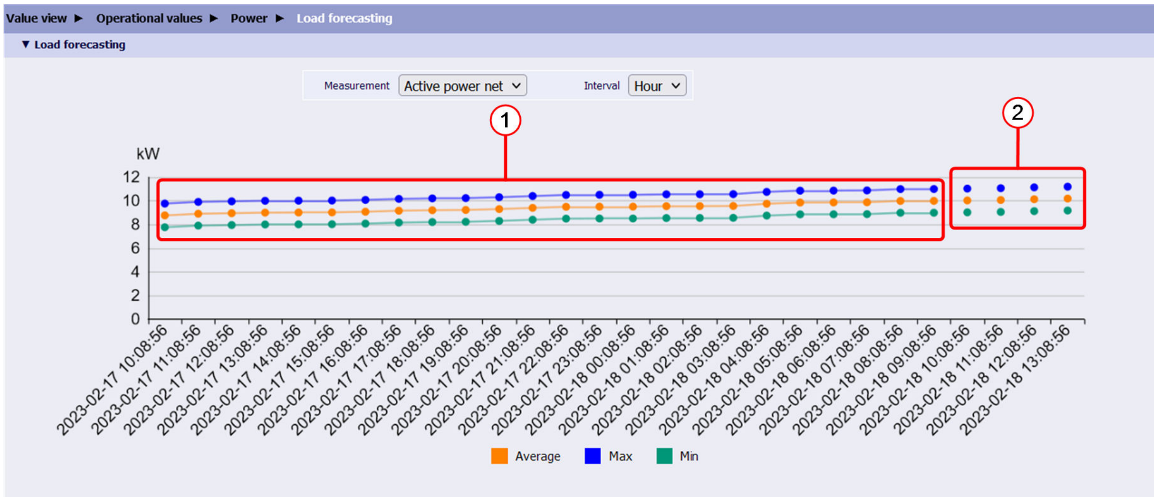
To view the load-forecasting data in the tab **Value View**, proceed as follows:

- In the navigation window, click **Load forecasting**.
- Configure the respective parameters according to the following table.

Table 5-3 Settings for Load Forecasting

Parameter	Default Setting	Setting Range
Measurement	Active power net	I_a I_b I_c Active power net
Interval	Hour	Hour Day

The historical and forecast load values are shown as follows:



[le_load_forecasting, 1, en_US]

Figure 5-8 Value View Tab, Load Forecasting

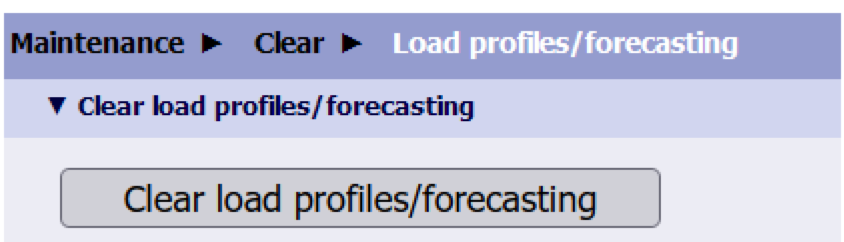
(1) Historical values: The connected dots form a trend curve.
If the **Interval** is set to ***Hour***, 24 historical values are provided; if the **Interval** is set to ***Day***, 31 historical values are provided.

(2) Forecast values: Each dot represents a value of 1 hour or 1 day.

5.2.3 Clearing of Load-Forecasting Data

To clear the load-forecasting data in the tab **Maintenance**, proceed as follows:

- In the navigation window, click **Load profiles/forecasting**.



[sc_maintenance_load profile, 1, en_US]

Figure 5-9 Maintenance Tab, Clear Load Profiles/Forecasting

- Click **Clear load profiles/forecasting**.
The load profiles and load-forecasting data are cleared. The indication **Action was successful** is displayed in the status bar.

5.3 Energy Profile

5.3.1 Function Description

The energy profile is calculated based on the stored load profile when a Modbus request comes. The calculated energy profiles are not stored in the device. You can configure the time interval and read the data of 288 energy profiles via the Modbus TCP protocol.

The following table shows an example of the expecting format of the energy profile:

Time Stamp of the Last Period	kWh[23] Export	kVARh[24] Export	kWh Import	kVARh Import	kVAh[25]
2019-03-15 00:00:00	14.04164982	2.154378414	0	6737.519043	6737.519043
2019-03-15 00:15:00	12.24571609	1.000230339	0	6674.347168	6674.347168
2019-03-15 00:30:00	11.24571609	3.000230339	0	6674.347168	6674.347168

If the energy profile is enabled, the load profile is set to a fixed configuration as follows:

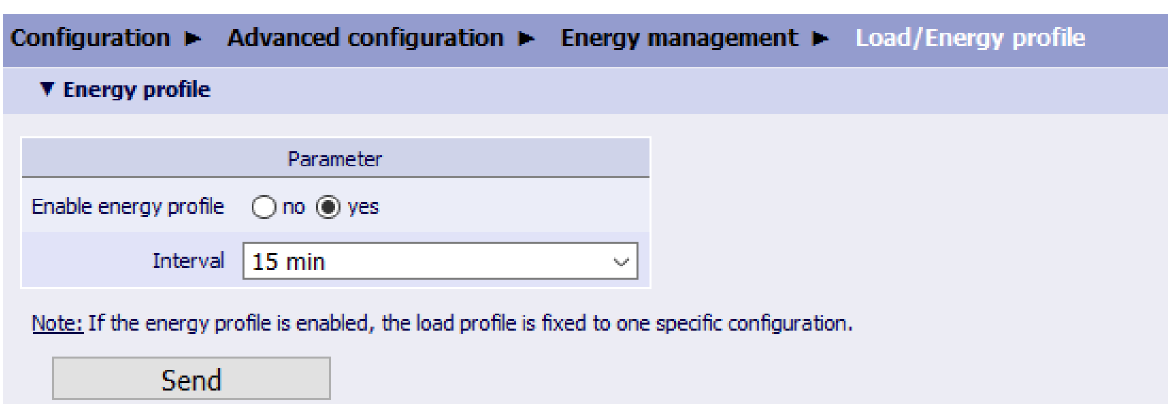
- Subperiod time: 15 min
- No. of subperiods: 1
- Sync. source: internal clock
- Reactive power: Qtot

5.3.2 Configuration and Value View via Web Pages

Configuration of the Energy Profile

To change the settings of the energy profile in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Load/Energy profile**.



[sc_configure_energy-profile, 3, en_US]

Figure 5-10 Configuration Tab, Energy Profile

- Configure the respective parameters according to the following table.

23 kWh = active energy
24 kVARh = reactive energy
25 kVAh = apparent energy

Table 5-4 Settings for Energy Profile

Parameter	Default Setting	Setting Range
Enable energy profile	no	no yes
Interval	15 min	15 min 30 min 45 min 1 h 24 h

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

You can read the data of the calculated energy profiles via the Modbus TCP registers.

5.4 Tariffs

5.4.1 Function Description

The device supports up to 8 tariffs for energy meters. The 8 tariffs include the supplied or consumed active energy, the reactive energy, and the apparent energy. If the tariff change is controlled via protocol, up to 8 tariffs can be set. If the tariff change is controlled via binary inputs, up to 2 tariffs can be set.

The tariffs are changed via the external interfaces. A time-related tariff changing is only possible by a superordinate system.

Tariff Change with Load-Profile Synchronization

The recorded load profile is always assigned to the current tariff.

If you change the tariff during a running measuring period, for example, from high to low tariff, it has initially no effect on the load-profile recording.

The new tariff becomes effective in the power meters of the device only with the start of the next measuring subperiod.

Tariff Change without Load-Profile Synchronization

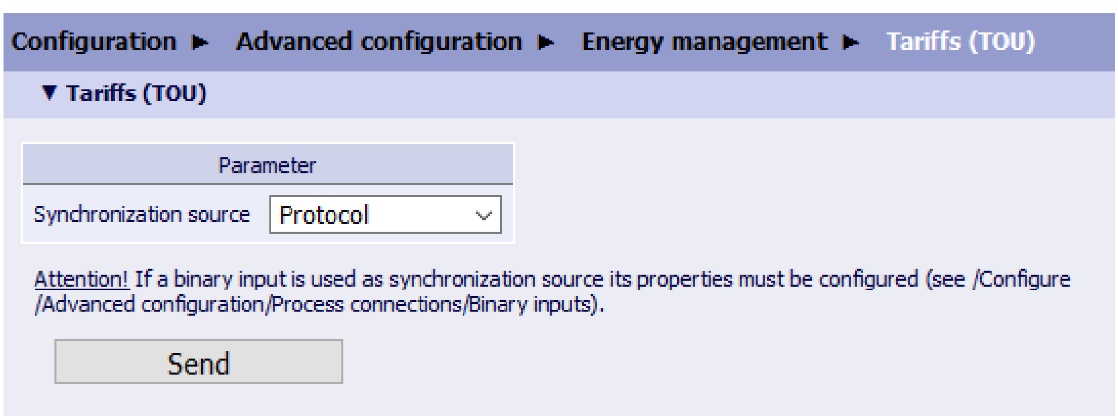
If **-none-** has been selected as synchronization source when parameterizing the load profile, the tariff change becomes effective immediately. For more detailed information, refer to **Default Setting** and **Setting Range** in chapter *5.1.2 Configuration and Value View via Web Pages*.

5.4.2 Configuration and Value View via Web Pages

Configuration of the Tariffs

To change the settings of the tariffs in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Tariffs (TOU)**.



[sc_tariffs_configure, 2, en_US]

Figure 5-11 Configuration Tab, Tariffs (TOU)

- Configure the respective parameters according to the following table.

Table 5-5 Settings for Tariffs (TOU)

Parameter	Default Setting	Setting Range
Synchronization source	Protocol	Protocol[26] Binary input 1-S Binary input 1-R Binary input 2-S Binary input 2-R Binary input 3-S Binary input 3-R Calendar
The following parameters are available only when **Synchronization source** is set to **Calendar**.		
Season 1 Start	01-01	01-01 to 12-31
Season 1 End	06-30	01-01 to 12-31
Season 2 Start	07-01	Not settable The rest days of the full year
Season 2 End	12-31	
Weekend Setting	Thursday and Friday	Sunday to Saturday, max. 2 days
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 1 Start	00:00	00:00 to 23:45
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 1 End	24:00	00:15 to 24:00
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 2 Start	00:00	00:15 to 23:45
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 2 End	24:00	00:30 to 24:00
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 1 Active	no[27]	yes no
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 2 Active	no	yes no
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Workday/ Weekend Selection	Every Day	Every Day Workday Weekend
Coverage Check		Pass Fail (with gap) Fail (with overlap)

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

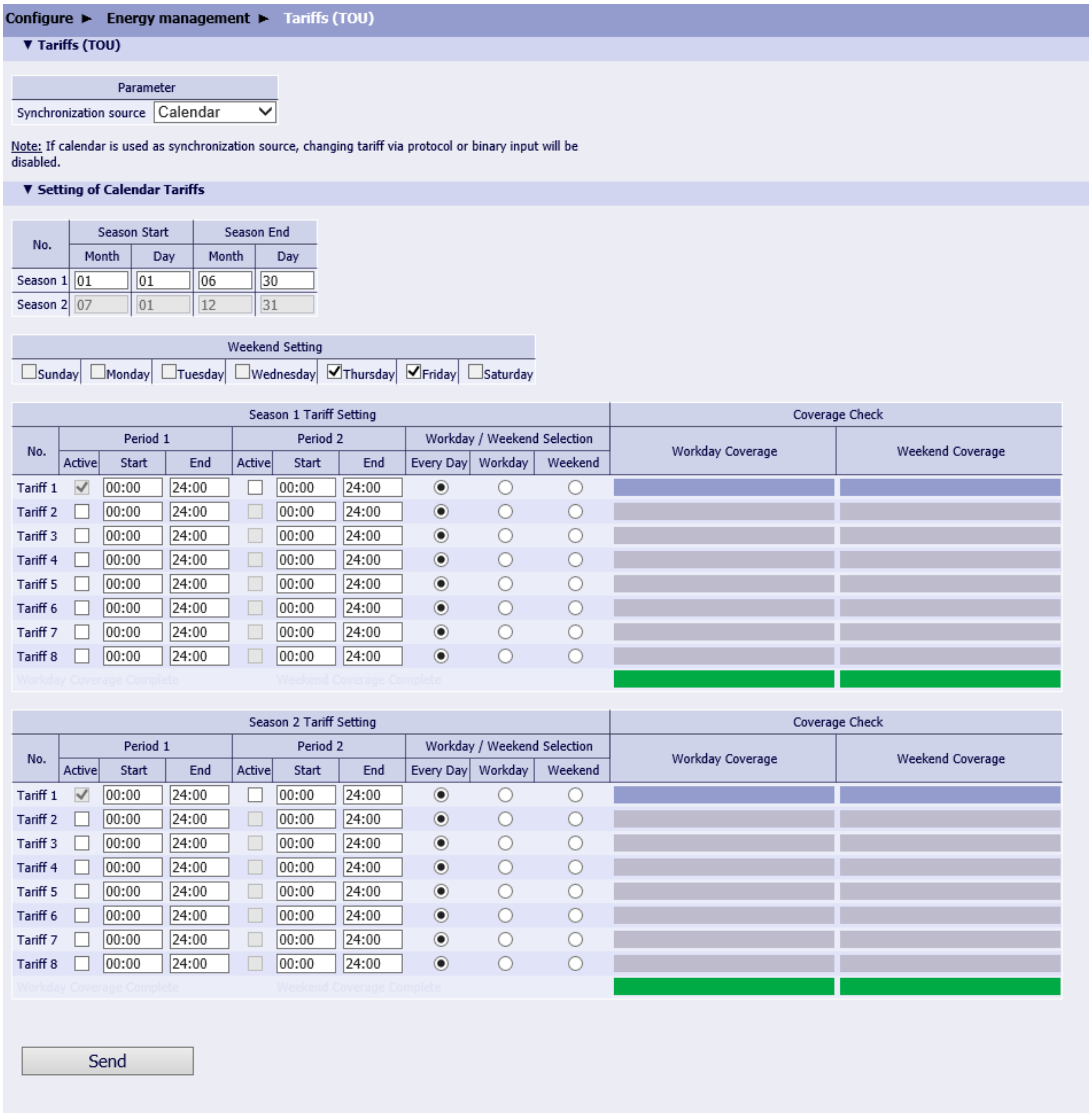
Synchronization Source = Calendar

When **`Synchronization source`** is set to ***`Calendar`***:

- If the coverage check passes, all the coverage check bars are show in green, see *Figure 5-12*.
- If the coverage check fails, the coverage check bars are show in other colors, see *Figure 5-13*. The button **Send** is disabled. You must reconfigure the parameters.

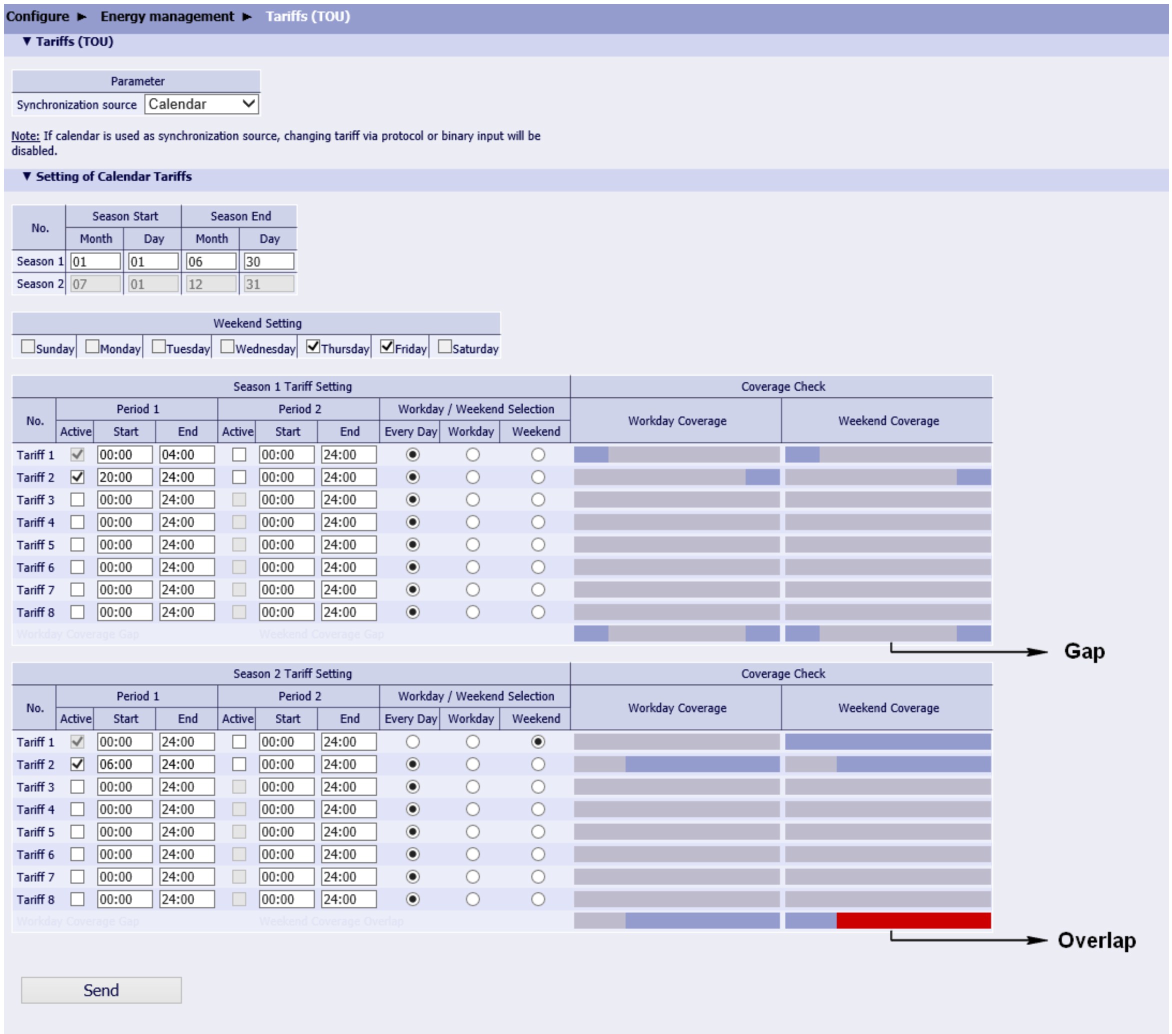
26 In this case, the protocol Modbus TCP can control tariff 1 to tariff 8.

27 The default settings of Tariff 1 Period 1 Active for 2 seasons are checked.



[sc_tariff_calendar, 1, en_US]

Figure 5-12 Configuration Tab, Synchronization Source: Calendar, Pass



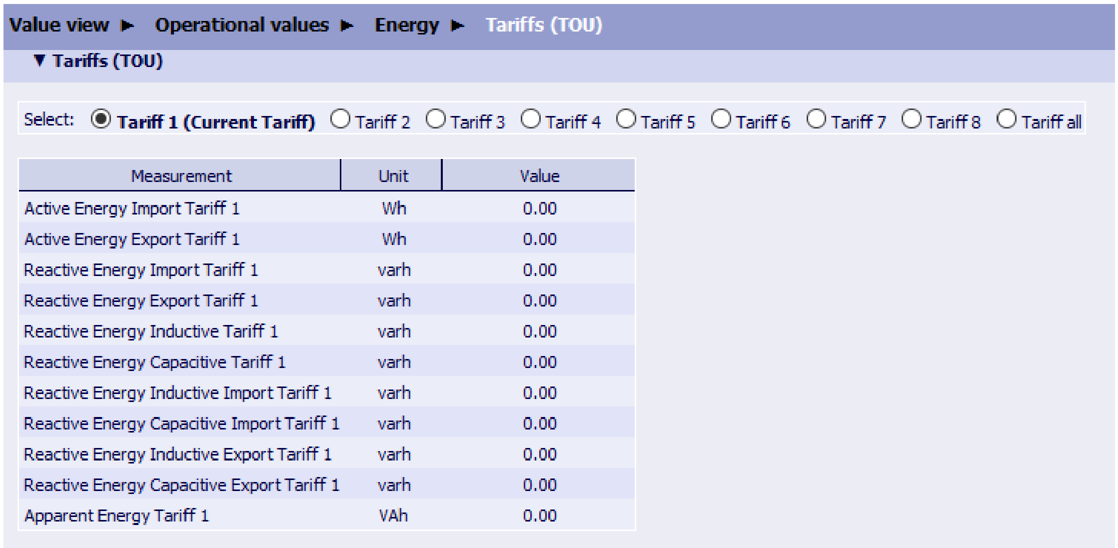
[sc_calendar fail with words, 1, en_US]

Figure 5-13 Configuration Tab, Synchronization Source: Calendar, Fail with Gap or Overlap

Value View of the Tariffs (TOU)

You can determine 4 tariffs for all energy types. To display the **Tariff** values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Tariffs (TOU)**.



Measurement	Unit	Value
Active Energy Import Tariff 1	Wh	0.00
Active Energy Export Tariff 1	Wh	0.00
Reactive Energy Import Tariff 1	varh	0.00
Reactive Energy Export Tariff 1	varh	0.00
Reactive Energy Inductive Tariff 1	varh	0.00
Reactive Energy Capacitive Tariff 1	varh	0.00
Reactive Energy Inductive Import Tariff 1	varh	0.00
Reactive Energy Capacitive Import Tariff 1	varh	0.00
Reactive Energy Inductive Export Tariff 1	varh	0.00
Reactive Energy Capacitive Export Tariff 1	varh	0.00
Apparent Energy Tariff 1	VAh	0.00

[sc_Q100_tariffs_evaluation, 2, en_US]

Figure 5-14 Value View Tab, Tariffs (TOU)

After data transmission, the values are further processed in the peripheral devices.

5.4.3 Clearing of Tariff Values

Refer to chapter *2.5.6.4 Clearing of Energy Counters*.

5.5 Energy Freeze and Reset

5.5.1 Function Description

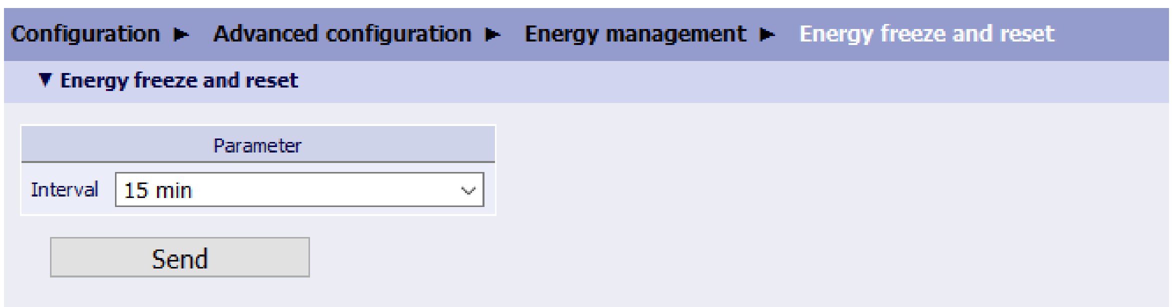
The function of **Energy Freeze and Reset** is used to configure the freezing interval for the energy values. After a time interval is configured, the energy values are frozen and not updated during the interval until the next interval starts. The frozen values are transmitted by the report function and the IEC 61850 protocol in the MMTN/MMTR logic node.

5.5.2 Configuration and Value View via Web Pages

Configuration of the Energy Freeze and Reset

To change the settings of the energy freeze and reset in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Energy freeze and reset**.



[sc_Configure_snapshot-energy, 3, en_US]

Figure 5-15 Configuration Tab, Energy Freeze and Reset

- Configure the respective parameters according to the following table.

Table 5-6 Settings for Energy Freeze and Reset

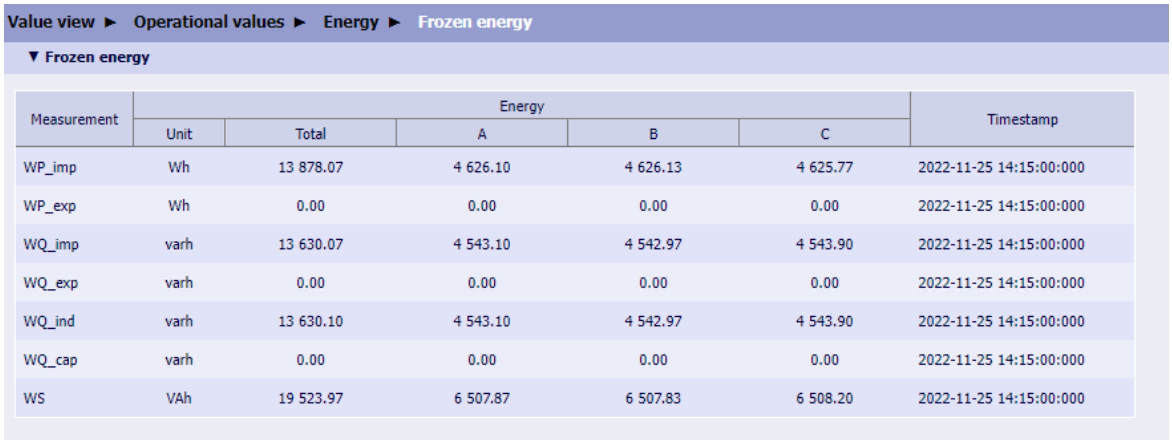
Parameter	Default Setting	Setting Range
Interval	15 min	1 min, 5 min, 10 min, 15 min, 30 min, 60 min

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of the Frozen Energy

To display the values of the frozen energy in the **Value view** tab, proceed as follows:

- In the navigation window, click **Frozen energy**.



Measurement	Energy					Timestamp
	Unit	Total	A	B	C	
WP_imp	Wh	13 878.07	4 626.10	4 626.13	4 625.77	2022-11-25 14:15:00:000
WP_exp	Wh	0.00	0.00	0.00	0.00	2022-11-25 14:15:00:000
WQ_imp	varh	13 630.07	4 543.10	4 542.97	4 543.90	2022-11-25 14:15:00:000
WQ_exp	varh	0.00	0.00	0.00	0.00	2022-11-25 14:15:00:000
WQ_ind	varh	13 630.10	4 543.10	4 542.97	4 543.90	2022-11-25 14:15:00:000
WQ_cap	varh	0.00	0.00	0.00	0.00	2022-11-25 14:15:00:000
WS	VAh	19 523.97	6 507.87	6 507.83	6 508.20	2022-11-25 14:15:00:000

[sc_q100_frozen energy, 3, en_US]

Figure 5-16 Value View Tab, Frozen Energy

5.5.3 Clearing of Frozen-Energy Values

Refer to chapter *2.5.6.4 Clearing of Energy Counters*.

5.6 CO2 Emissions

5.6.1 Function Description

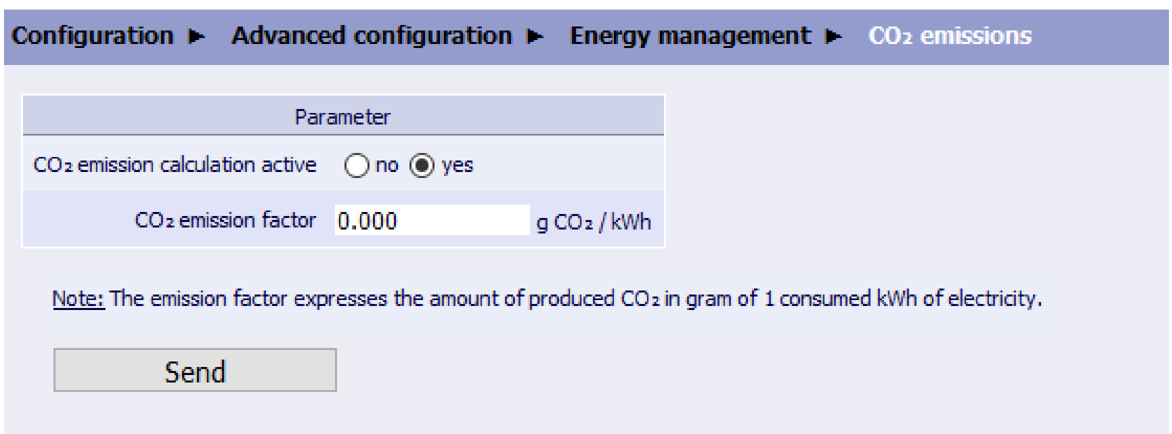
The device supports to calculate and show the CO_2 emissions. The calculation is based on the accumulated imported and exported active energy, and the configured CO_2 emission factor. The calculation interval is the same as the configured freeze energy interval. The calculated CO_2 emission values are transmitted by the Modbus registers. For the register number, refer to the Modbus mapping.
If you change the parameters of **Voltage transformer** or the parameters of **Current transformer** in **Configuration → Basic configuration → AC measurement**, the calculated CO_2 emission values are reset to 0.

5.6.2 Configuration and Value View via Web Pages

Parameterization of CO_2 Emission

To change the settings of the CO_2 emissions in the **Configuration** tab, proceed as follows:

- In the navigation window, click **CO_2 emissions**.



[sc_q100_CO2 emissions, 2, en_US]

Figure 5-17 Configuration Tab, CO_2 Emission

- Configure the respective parameters according to the following table.

Table 5-7 Settings for CO_2 Emissions

Parameter	Default Setting	Setting Range
CO_2 emission calculation active	no	no yes
CO_2 emission factor	0.000 g CO_2/kWh	0.000 g CO_2/kWh to 1 000 000.000 g CO_2/kWh

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of CO_2 Emission

To display the calculated CO_2-emission values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Frozen energy**.
  The unit and value of the calculation result are shown in the table. The CO_2-emission calculation is only for the accumulated imported and exported active energy. For the other energy types, the unit and value of the CO_2 emission are shown as **--**.

Value view ► Operational values ► Energy ► Frozen energy

▼ Frozen energy

Measurement	Energy					CO₂ emissions		Timestamp
	Unit	Total	A	B	C	Unit	Value	
WP_imp	Wh	13 878.07	4 626.10	4 626.13	4 625.77	t	0.000000	2022-11-25 14:15:00:000
WP_exp	Wh	0.00	0.00	0.00	0.00	t	0.000000	2022-11-25 14:15:00:000
WQ_imp	varh	13 630.07	4 543.10	4 542.97	4 543.90	--	--	2022-11-25 14:15:00:000
WQ_exp	varh	0.00	0.00	0.00	0.00	--	--	2022-11-25 14:15:00:000
WQ_ind	varh	13 630.10	4 543.10	4 542.97	4 543.90	--	--	2022-11-25 14:15:00:000
WQ_cap	varh	0.00	0.00	0.00	0.00	--	--	2022-11-25 14:15:00:000
WS	VAh	19 523.97	6 507.87	6 507.83	6 508.20	--	--	2022-11-25 14:15:00:000

[sc_frozen energy_CO2_emissions, 1, en_US]

Figure 5-18 Value View Tab, Frozen Energy

You can also view the CO_2-emission values in **Energy**.

Value view ► Operational values ► Energy ► Energy

▼ Energy

Measurement	Energy					CO₂ emissions	
	Unit	Total	A	B	C	Unit	Value
WP_imp	Wh	13 878.07	4 626.10	4 626.13	4 625.77	t	0.000000
WP_exp	Wh	0.00	0.00	0.00	0.00	t	0.000000
WQ_imp	varh	13 630.07	4 543.10	4 542.97	4 543.90	--	--
WQ_exp	varh	0.00	0.00	0.00	0.00	--	--
WQ_ind	varh	13 630.10	4 543.10	4 542.97	4 543.90	--	--
WQ_cap	varh	0.00	0.00	0.00	0.00	--	--
WS	VAh	19 523.97	6 507.87	6 507.83	6 508.20	--	--

[sc_eva_energy_CO2_emissions, 1, en_US]

Figure 5-19 Value View Tab, Energy

If the CO_2-emission calculation is deactivated, the columns for CO_2 emissions are not shown in the table of **Energy** or in the table of **Frozen Energy**.

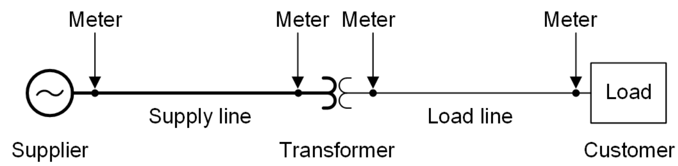
5.6.3 Clearing of CO_2-Emission Values

Refer to chapter *2.5.6.4 Clearing of Energy Counters*.

5.7 Loss Compensation

5.7.1 Function Description

The meter can be located at the one of the 4 points shown in the following figure:



[dw_loss compensation_application, 1, en_US]

Figure 5-20 Application Scenario

When the metering point and billing point are located separately, the measured values at the metering point differ from the values at the billing point. The function **Loss compensation** can calculate and compensate the loss. As a result, the measured values at the metering point are much closer to the values at the billing point.

Addition and Subtraction of Loss Compensation

In a basic system, there are 4 possible billing points and 4 possible metering points. The device adds or subtracts the loss based on the inputs and locations of the metering point and the billing point.

Table 5-8 Addition and Subtraction of Loss Compensation

Billing Point	Metering Point	Calculation of the Loss Compensation
1	1	No compensation
2		Supply-line loss subtracted
3		Supply-line loss and transformer loss subtracted
4		Transformer loss, supply-line loss, and load-line loss subtracted
1	2	Supply-line loss added
2		No compensation
3		Transformer loss subtracted
4		Transformer loss and load-line loss subtracted
1	3	Transformer loss and supply-line loss added
2		Transformer loss added
3		No compensation
4		Load-line loss subtracted
1	4	Transformer loss, supply-line loss, and load-line loss added
2		Load-line loss and transformer loss added
3		Load-line loss added
4		No compensation

Calculation of Line Loss Compensation

Table 5-9 Symbols in the Calculation Formulas

P_{loss}	Active power of line loss (LLW)
Q_{loss}	Reactive power of line loss (LLV)
x	Reactance
r	Resistance
l	Unit length

L	Total length in units
T	Power transformer ratio $T = V_{supply\ side}/V_{load\ side}$
R	Resistive component
Z	Impedance
X	Reactive component

The resistive component of the impedance contributes to the active-power loss, while the reactive component contributes to the reactive-power loss.

$$LLW = P_{loss} = I \cdot \left(I \cdot \frac{r}{l} \cdot L\right) = I^2 \cdot R$$

[fo_line_loss_P, 1, en_US]

$$LLV = Q_{loss} = I \cdot \left(I \cdot \frac{x}{l} \cdot L\right) = I^2 \cdot X$$

[fo_line_loss_Q, 1, en_US]

For a 3-phase system, the line loss for each phase is calculated separately according to the measured current:

$$P_{loss-tot} = P_{loss-a} + P_{loss-b} + P_{loss-c} = {I_a}^2 \cdot R_a + {I_b}^2 \cdot R_b + {I_c}^2 \cdot R_c$$

[fo_line_loss_P_3ph, 1, en_US]

$$Q_{loss-tot} = Q_{loss-a} + Q_{loss-b} + Q_{loss-c} = {I_a}^2 \cdot X_a + {I_b}^2 \cdot X_b + {I_c}^2 \cdot X_c$$

[fo_line_loss_Q_3ph, 1, en_US]

The current at the billing point (BP) is calculated with a reference of the current at the metering point (MP). The loss calculation is influenced by the following factors:

- The location of the MP
- The location of the BP
- The transformer ratio

If the MP is at the supply side, the loss calculation per phase is as follows (phx represents the phase A, B, or C):

$$LLW_{supply-phx} = {I_{phx}}^2 \cdot R_{supply}$$

[fo_line_loss_P_supply_supply, 1, en_US]

$$LLV_{supply-phx} = {I_{phx}}^2 \cdot X_{supply}$$

[fo_line_loss_Q_supply_supply, 1, en_US]

$$LLW_{load-phx} = T^2 \cdot {I_{phx}}^2 \cdot R_{load}$$

[fo_line_loss_P_supply_load, 1, en_US]

$$LLV_{load-phx} = T^2 \cdot {I_{phx}}^2 \cdot X_{load}$$

[fo_line_loss_Q_supply_load, 1, en_US]

If the MP is at the load side, the loss calculation per phase is as follows (phx represents the phase A, B, or C):

$$LLW_{supply-phx} = \frac{1}{T^2} \cdot {I_{phx}}^2 \cdot R_{supply}$$

[fo_line_loss_P_load_supply, 1, en_US]

$$LLV_{supply-phx} = \frac{1}{T^2} \cdot {I_{phx}}^2 \cdot X_{supply}$$

[fo_line_loss_Q_load_supply, 1, en_US]

$$LLW_{load-phx} = {I_{phx}}^2 \cdot R_{load}$$

[fo_line_loss_P_load_load, 1, en_US]

$$LLV_{load-phx} = {I_{phx}}^2 \cdot X_{load}$$

[fo_line_loss_Q_load_load, 1, en_US]

Calculation of Transformer Loss Compensation

Table 5-10 Symbols in the Calculation Formulas

S_{TRated}	Rated total apparent power of the power transformer
V_{TRated}	Rated voltage of the power transformer
%Excitation	Ratio of no-load current (at rated voltage) to full-load current
%Impedance	Ratio of full-load voltage (at rated current) to rated voltage
$LWFe_{Tr.rated}$	Active power of no-load loss The active power that is consumed by the core of the transformer at the rated voltage with no-load current
$LWCu_{Tr.rated}$	Active power of full-load loss The active power that is consumed by the windings of the transformer at the rated apparent power with full-load current
$LVFe_{Tr.rated}$	Reactive power of no-load loss The reactive power that is consumed by the core of the transformer at the rated voltage with no-load current
$LVCu_{Tr.rated}$	Reactive power of full-load loss The reactive power that is consumed by the windings of the transformer at the rated apparent power with full-load current
LWFe	Adjusted $LWFe_{Tr.rated}$ according to the actual voltage and current
LWCu	Adjusted $LWCu_{Tr.rated}$ according to the actual voltage and current
LVFe	Adjusted $LVFe_{Tr.rated}$ according to the actual voltage and current
LVCu	Adjusted $LVCu_{Tr.rated}$ according to the actual voltage and current

Transformer loss is a combination of the power consumed by the magnetizing inductance of the core (iron loss) and the impedance of the windings (copper loss).

The iron loss is a function of the applied voltage and is often referred to as **no-load loss**. The iron loss is induced even when there is no load current.

The copper loss is a function of the winding current and is often referred to as **load loss**. The copper loss is calculated for any operating condition.

The active power of no-load loss is calculated as follows:

$$LVFe_{Tr.rated} = \sqrt{\left(S_{Tr.rated} \cdot \frac{\%Excitation}{100}\right)^2 - (LWFe_{Tr.rated})^2}$$

[fo_transformer_loss_no-load, 1, en_US]

The reactive power of full-load loss is calculated as follows:

$$\mathrm{LVCu}_{\mathrm{Tr.rated}} = \sqrt{\left(\mathrm{S}_{\mathrm{Tr.rated}} \cdot \frac{\%\mathrm{Impedance}}{100}\right)^2 - \left(\mathrm{LWCu}_{\mathrm{Tr.rated}}\right)^2}$$

[fo_transformer_loss_full-load, 1, en_US]

The rated primary current at the metering point for the 3-phase system is calculated as follows:

$$\mathrm{I}_{\mathrm{Tr.rated}} = \frac{\mathrm{S}_{\mathrm{Tr.rated}}}{\sqrt{3} \cdot \mathrm{V}_{\mathrm{Tr.rated}}}$$

[fo_transformer_loss_rated_primary_current, 1, en_US]

To improve the accuracy of the loss calculation, it is necessary to adjust the calculated power loss according to the actual voltage and current:

$$\mathrm{LWFe} = \mathrm{LWFe}_{\mathrm{Tr.rated}} \cdot \left(\frac{\mathrm{V}_{\mathrm{actual}}}{\mathrm{V}_{\mathrm{Tr.rated}}}\right)^2$$

[fo_transformer_loss_no-load_watt, 1, en_US]

$$\mathrm{LVFe} = \mathrm{LVFe}_{\mathrm{Tr.rated}} \cdot \left(\frac{\mathrm{V}_{\mathrm{actual}}}{\mathrm{V}_{\mathrm{Tr.rated}}}\right)^4$$

[fo_transformer_loss_no-load_var, 1, en_US]

$$\mathrm{LWCu} = \mathrm{LWCu}_{\mathrm{Tr.rated}} \cdot \left(\frac{\mathrm{I}_{\mathrm{actual}}}{\mathrm{I}_{\mathrm{Tr.rated}}}\right)^2$$

[fo_transformer_loss_load_watt, 1, en_US]

$$\mathrm{LVCu} = \mathrm{LVCu}_{\mathrm{Tr.rated}} \cdot \left(\frac{\mathrm{I}_{\mathrm{actual}}}{\mathrm{I}_{\mathrm{Tr.rated}}}\right)^2$$

[fo_transformer_loss_load_var, 1, en_US]

Loss Compensation and Update Period

The device adds to or subtracts from the line- and transformer-loss compensation values to the measured power quantities. The device updates the compensated power quantities every 10/12 cycles or 150/180 cycles. The update period is determined by the configured measurement interval. For more information on the configuration of the measurement interval, refer to *Configuration of the AC Measurement, Page 44*.

The energy, frozen energy, and TOU calculations are based on the compensated power values. The energy quantities are refreshed every 10/12 cycles.

The total active-power loss and reactive-power loss are calculated with the following formulas. P and Q refer to measured power values. α, β, and γ are signs of the unit coefficients of the loss compensation at the supply side, the transformer, and the load side.

$$\Delta\mathrm{P} = \alpha \cdot \mathrm{LLW}_{\mathrm{supply}} + \beta \cdot \left(\mathrm{LWFe}_{\mathrm{tot}} + \mathrm{LWCu}_{\mathrm{tot}}\right) + \gamma \cdot \mathrm{LLW}_{\mathrm{load}}$$

[fo_total_loss_P, 1, en_US]

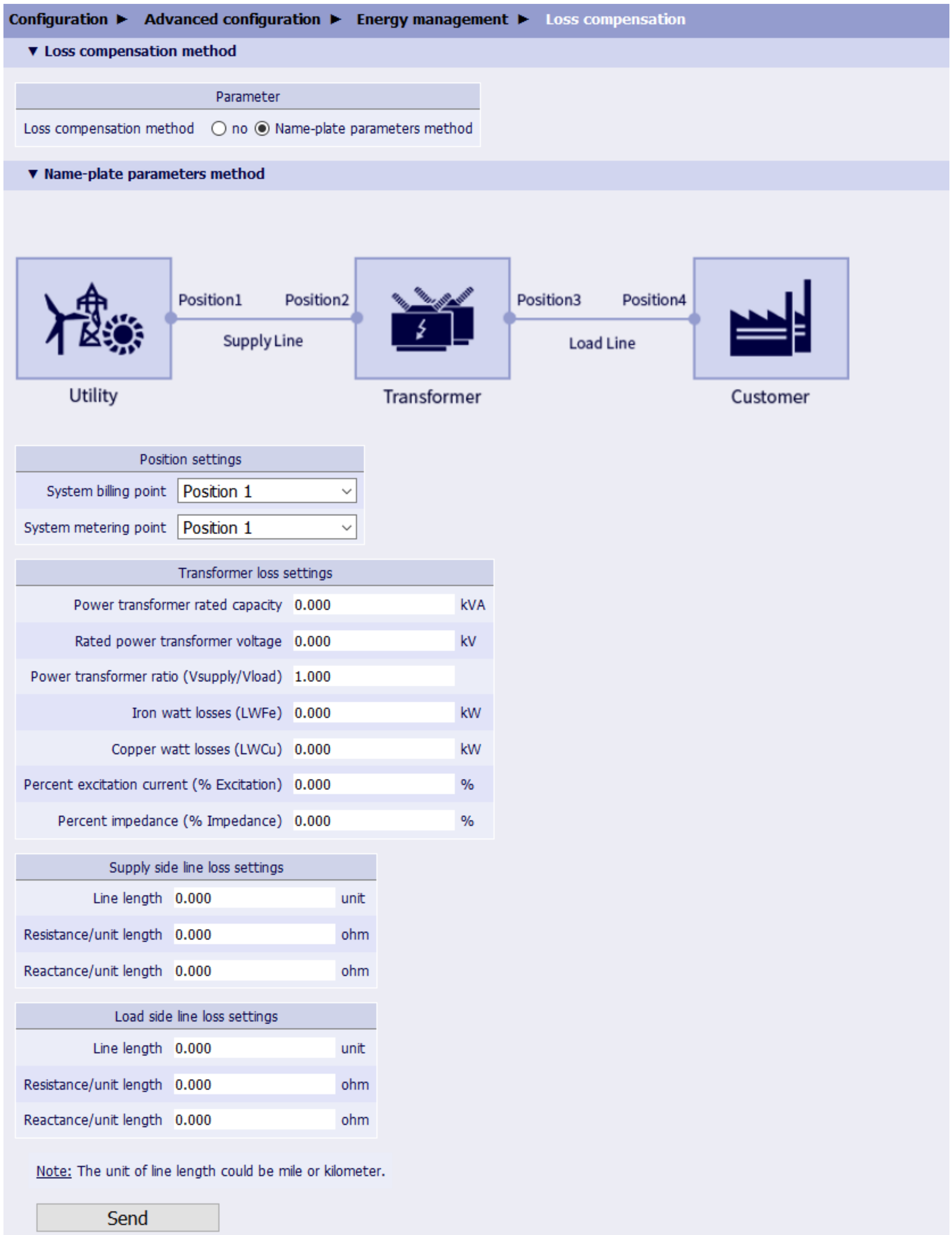
$$\Delta\mathrm{Q} = \alpha \cdot \mathrm{LLV}_{\mathrm{supply}} + \beta \cdot \left(\mathrm{LVFe}_{\mathrm{tot}} + \mathrm{LVCu}_{\mathrm{tot}}\right) + \gamma \cdot \mathrm{LLV}_{\mathrm{load}}$$

[fo_total_loss_Q, 1, en_US]

5.7.2 Configuration of the Loss Compensation

To change the settings of the loss compensation in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Loss compensation**.



[sc_loss compensation, 1, en_US]

Figure 5-21 Configuration Tab, Loss Compensation

- Configure the respective parameters according to the following table.

Table 5-11 Settings for the Loss Compensation

Parameter	Default Setting	Setting Range
Loss compensation method	No	No Name-plate parameters method
Position settings		
System billing point	Position 1	Position 1: Supply side, not transformer side Position 2: Supply side, transformer side Position 3: Load side, transformer side Position 4: Load side, not transformer side
System metering point	Position 1	Position 1: Supply side, not transformer side Position 2: Supply side, transformer side Position 3: Load side, transformer side Position 4: Load side, not transformer side
Transformer loss settings		
Power transformer rated capacity	0.000 kVA	0.000 kVA to 100 000 000.000 kVA If the network type is set to 1-phase, set a phase-to-neutral value for this parameter. If the network type is set to 3-phase, set a phase-to-phase value for this parameter.
Rated power transformer voltage	0.000 kV	0.000 kV to 1000.000 kV If the network type is set to 1-phase, set a phase-to-neutral value for this parameter. If the network type is set to 3-phase, set a phase-to-phase value for this parameter.
Power transformer ratio (V_{supply}/V_{load})	1.000	0.001 to 1000.000
Iron watt losses (LWFe)	0.000 kW	0.000 kW to 100 000.000 kW No load or iron watt loss of the transformer core
Copper watt losses (LWCu)	0.000 kW	0.000 kW to 100 000.000 kW Full load or copper watt loss of the transformer windings
Percent excitation current (%Excitation)	0.000 %	0.000 % to 100.000 %
Percent impedance (%Impedance)	0.000 %	0.000 % to 100.000 %
Supply side line loss settings		
Line length	0.000 unit	0.000 unit to 1000.000 unit The unit can be mile or kilometer, and must be consistent with the unit of the length of resistance and reactance.
Resistance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm
Reactance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm
Load side line loss settings		
Line length	0.000 unit	0.000 unit to 1000.000 unit The unit can be mile or kilometer, and must be consistent with the unit of the length of resistance and reactance.
Resistance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm
Reactance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

6 Power Quality

6.1 Harmonics, Interharmonics, Phase Angles of the Harmonics

6.1.1 Function Description

Harmonic Power and Harmonic Angles

Measurement of phase angles is helpful to analyze different phenomena. It can be used for the following purposes:

- Evaluation of harmonic flows throughout the system
- Identification of harmonic sources and harmonic sinks
- Calculation of active, reactive, and apparent powers of harmonics
- Assessment of harmonic current measurements in different points in the system
- Modeling of disturbing loads and evaluation of their disturbing effect
- Identification of measures to reduce the circuit feedback of the load

The device provides these measurements to support evaluation options that support the customer in minimizing the influence of harmonics in the network or load, for example, when selecting the devices to reduce the circuit feedback, filters, and reactive compensation.

Harmonic Directions

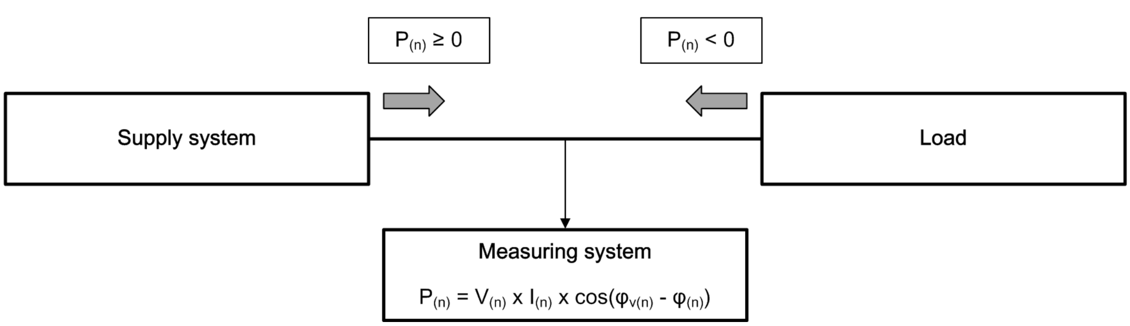
The device measures harmonics of voltages, currents, and powers up to the 63rd order according to the IEC 61000-4-7 standard.

The following values are given for each harmonic:

- RMS value (for power: RMS value and sign)
- Phase angle

The sign of the active power of the single harmonic can indicate the direction of the power flow of this harmonic in a supply system – seen from the installation point of the device. Thus, it is possible to identify demands that generate the harmonics and that are probably the cause of the harmonics.

For the voltage and current, the given phase angle of the harmonic refers to the voltage of the fundamental component in the respective phase. The phase angle between the current harmonic and the corresponding voltage harmonic is used to calculate the sign of the active harmonic power.



[dw_harmonic directions, 1, en_US]

Figure 6-1 Principle of Harmonic Directions

For measuring the RMS values and the phase angles, a 10-cycle interval is used for 50-Hz distribution systems. For 60-Hz distribution systems, a 12-cycle interval is used.

For the active power of the aggregated harmonics, the following factors are used to calculate the direction:

- The aggregated voltage harmonics (average only)
- The aggregated current harmonics (average only)
- The prevailing angles including the prevailing factors at the end of each aggregation interval

The sign of the active power of the aggregated harmonics shows the direction:

- Positive sign: demand side, shown in green on the HTML page
- Negative sign: supply side, shown in blue on the HTML page

The prevailing factors of the voltage and current harmonics are used to calculate the confidence of the harmonics power direction. The confidence determines whether the direction is stable or not. If the confidence is lower than 0.91, the direction of the aggregated harmonic power is not shown in the diagram.

The aggregated harmonics power values are shown on the HMTL page. The aggregated harmonics power values and the confidence values are stored in the SD card and the PQDIF file.

Measured Quantity	Measurement Records Aggregated Value PQDIF	Measurement Records Confidence Value PQDIF
Active Power		
Pa	x	x
Pb	x	x
Pc	x	x

Interfaces: protocols IEC 61850 (PQDIF depending on the measuring interval)

Analysis of Harmonic Phase Angles

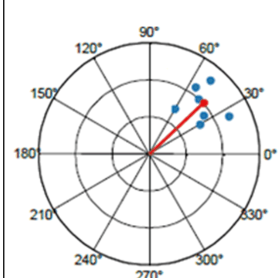
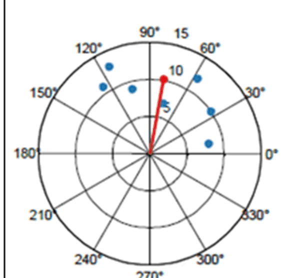
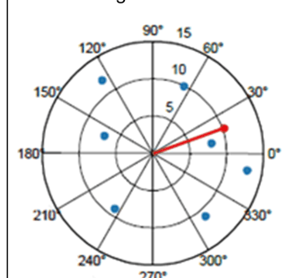
For the voltage and current harmonics, the following values are given additionally:

- Prevailing phase angle (Prev°)
- Prevailing ratio (PR)

The **Prevailing phase angle** represents harmonic emissions for intervals (such as the 10-min aggregation interval). **Prev°** indicates the phase angle of a certain load. The prevailing phase angle is calculated via the aggregation time from the phase angles of the 10-cycle or 12-cycle intervals. In the figures in the following table, the prevailing phase angle is displayed as a red line.

The **Prevailing ratio** indicates load fluctuations during aggregation and indicates the degree of the variation of a phase angle. For a prevailing-ratio value of 1, the phase angle of the corresponding harmonic is constant (PR = 1: no fluctuation). The phase angles of the large variation (see following table), which have a prevailing ratio of < 0.8, are high dispersal and the prevailing phasor has no useful meaning.

3 examples for the relation between prevailing ratio and prevailing phase angle:

Phase-angle variation	Low variation	Medium variation	Large variation
			
Prevailing phase angle	43 °	79 °	19 °
Prevailing ratio	0.988	0.88	0.2

[dw_phase-variation, 1, en_US]

Figure 6-2 Examples for Phase-Angle Variations

However, the prevailing phasor only makes sense if the harmonic phase angles have a low variation (the measurements are not highly dispersed in the complex plane). The prevailing ratio is proposed to indicate how much the harmonic measurements vary in the complex plane.

NOTE

You can find further information about this feature in the Application Note Harmonic Phase Angles Direction located at *https://www.siemens.com/download?DLA03_1781*.

Total Demand Distortion (TDD)

TDD in the device is the ratio of the harmonic currents to the maximum of the load current in the last measuring interval.

$$\mathrm{TDD} = \frac{\sqrt{\sum_{h=2}^{50} (I_h)^2}}{I_{max}} \cdot 100\ \%$$

[fo_tdd, 2, en_US]

NOTE

For the calculations in the device, the value H = 50 is used.

I_{max} is the maximum current of the last aggregation interval.

Recording and Evaluation

Table 6-1 Recording and Evaluation of the Harmonics/Interharmonics

Measured Quantity (x = 1 to 50, y = 1 to 49) x = 1: Fundamental	Measurement Records AVG PQDIF, CSV[28]	Measurement Records Max. Value PQDIF, CSV[28]	Measurement Records Min. Value PQDIF, CSV[28]
Magnitude of Voltage Harmonics			
H_Va-x	x	x	–
H_Vb-x	x	x	–
H_Vc-x	x	x	–
H_Vab-x	x	x	–
H_Vbc-x	x	x	–
H_Vca-x	x	x	–
Magnitude of Voltage Interharmonics			
HI_Va-y	x	x	–
HI_Vb-y	x	x	–
HI_Vc-y	x	x	–
HI_Vab-y	x	x	–
HI_Vbc-y	x	x	–
HI_Vca-y	x	x	–
Magnitude of Current Harmonics			
H_Ia-x	x	x	–
H_Ib-x	x	x	–
H_Ic-x	x	x	–
Magnitude of Current Interharmonics			
HI_Ia-y	x	x	–
HI_Ib-y	x	x	–
HI_Ic-y	x	x	–

28 The device only supports CSV query, no CSV file in device.

Measured Quantity (x = 1 to 50, y = 1 to 49) x = 1: Fundamental	Measurement Records AVG PQDIF, CSV[28]	Measurement Records Max. Value PQDIF, CSV[28]	Measurement Records Min. Value PQDIF, CSV[28]
THDS, Voltage			
THDS_Va	x	x	x
THDS_Vb	x	x	x
THDS_Vc	x	x	x
THDS_Vab	x	x	x
THDS_Vbc	x	x	x
THDS_Vca	x	x	x
THDS, Current			
THDS_Ia	x	x	x
THDS_Ib	x	x	x
THDS_Ic	x	x	x

Table 6-2 Recording and Evaluation of the Emissions 2 kHz to 150 kHz

Measured Quantity (x = 1 to 35, y = 1 to 71)	Measurement Records AVG PQDIF, CSV[28]	Measurement Records Max. Value PQDIF, CSV[28]	Measurement Records Min. Value PQDIF, CSV[28]
Magnitude of Voltage Emissions 2 kHz to 9 kHz			
H_Va-x H_Va-y (max. values)	x	x	–
H_Vb-x H_Vb-y (max. values)	x	x	–
H_Vc-x H_Vc-y (max. values)	x	x	–
H_Vab-x	x	x	–
H_Vbc-x	x	x	–
H_Vca-x	x	x	–
Magnitude of Voltage Emissions 9 kHz to 150 kHz			
H_Va-y H_Va-y (max. values)	x	x	–
H_Vb-y H_Vb-y (max. values)	x	x	–
H_Vc-y H_Vc-y (max. values)	x	x	–
H_Vab-y	x	x	–
H_Vbc-y	x	x	–
H_Vca-y	x	x	–

Interfaces: protocols IEC 61850 (PQDIF depending on the measuring interval) and Modbus

28 The device only supports CSV query, no CSV file in device.

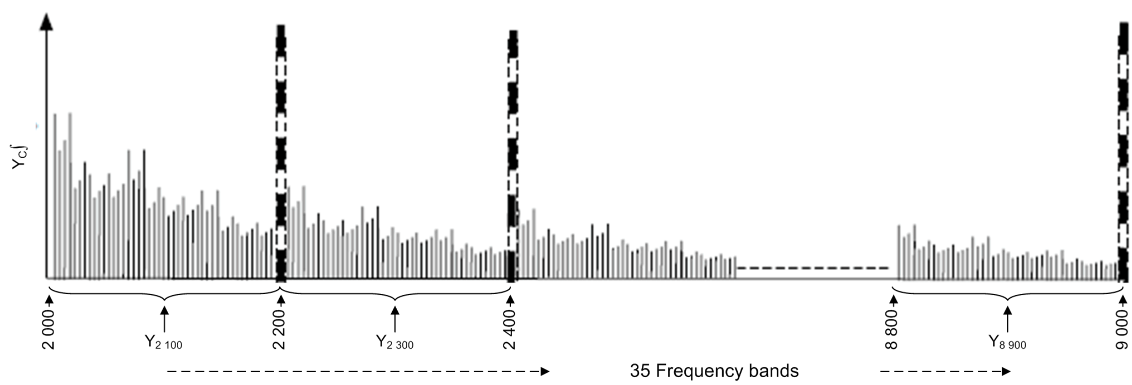
6.1.2 Function Description Emissions

Emissions in the Frequency Range 2 kHz to 150 kHz

The measurements of emissions in the range from 2 kHz to 150 kHz become more important. These measurement methods are part of the IEC 61000-4-7 and IEC 61000-4-30: Edition 3. Several phenomena can influence and generate such high frequencies on the network.

The measurement recorder of the device can record high-frequency emissions from 2 kHz to 9 kHz and 9 kHz to 150 kHz. The emissions are represented graphically and/or quantitatively in the following ranges:

- Complete 2 kHz to 150 kHz emission range
- 2 kHz to 9 kHz frequency range; 35 frequency bands for 50 Hz, 33 frequency bands for 60 Hz; resolution 200 Hz
- 9 kHz to 150 kHz frequency range; 71 frequency bands; resolution 2 kHz



[dw_high-freq-sign_2-to-9kHz, 1, en_US]

Figure 6-3 For example: Frequency Bands for Measurements in the Range above the 40th Harmonic Order for 50-Hz Power System from 2 kHz to 9 kHz

NOTE

For further information see standard IEC 61000-4-7, annex B.

The following representations of the harmonics of the voltage are possible:

- Harmonics from 2 kHz to 9 kHz
  - Tabular in % (see *Figure 6-11* and *Figure 6-12*)
  - Diagram, instantaneous values and maximum values in % (see *Figure 6-10*)
- 9 kHz to 150 kHz
  - Tabular in % (see *Figure 6-14* and *Figure 6-15*)
  - Diagram, instantaneous values and maximum values in % (see *Figure 6-13*)
- 1-day heat map
  - 1-day record of the emission in the frequency range from 2 kHz to 9 kHz with color scaling and numerical representation of the emission level, maximum emission levels per phase
  - 1-day record of the emission in the frequency range from 9 kHz to 150 kHz with color scaling and numerical representation of the emission level, maximum emission levels per phase

6.1.3 Configuration and Value View via Web Pages

Configuration of the Harmonics

The required settings for gathering the harmonics, interharmonics, and THDS are set in the main settings (see chapter *2.5.1 Configuration via Web Pages*) and in the recorder settings (see chapter *6.11.2 Configuration and Value View via Web Pages*).

Value View of the Voltage Harmonics

To display the measured values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Voltage harmonics**.
  You can select to view the phase-to-phase voltages (ph-ph) or the phase-to-neutral voltages (ph-N) when the connection type is **4-wire, 3-phase, unbalanced**.

Value view ▶ Power quality ▶ Harmonics ▶ Voltage harmonics

▼ Voltage harmonics

Voltage ◉ ph-N ◯ ph-ph

Measurement	Unit	Value	Max value	
Fundamental Va	V	0.000	471.603	2020-12-21 17:44:08:608
Fundamental Vb	V	0.000	***	***
Fundamental Vc	V	0.000	***	***
THDR Va	%	0.000	18.946	2020-12-21 17:44:08:608
THDR Vb	%	0.000	0.000	2020-12-10 14:31:57:737
THDR Vc	%	0.000	0.000	2020-12-10 14:31:57:737
THDR Vab	%	0.000	0.000	2020-12-10 14:31:57:737
THDR Vbc	%	0.000	0.000	2020-12-10 14:31:57:737
THDR Vca	%	0.000	0.000	2020-12-10 14:31:57:737
THDS Va	%	0.000	742.053	2020-12-22 14:33:01:606

[sc_Harmonic_voltage, 3, en_US]

Figure 6-4 Value View Tab, Voltage Harmonics

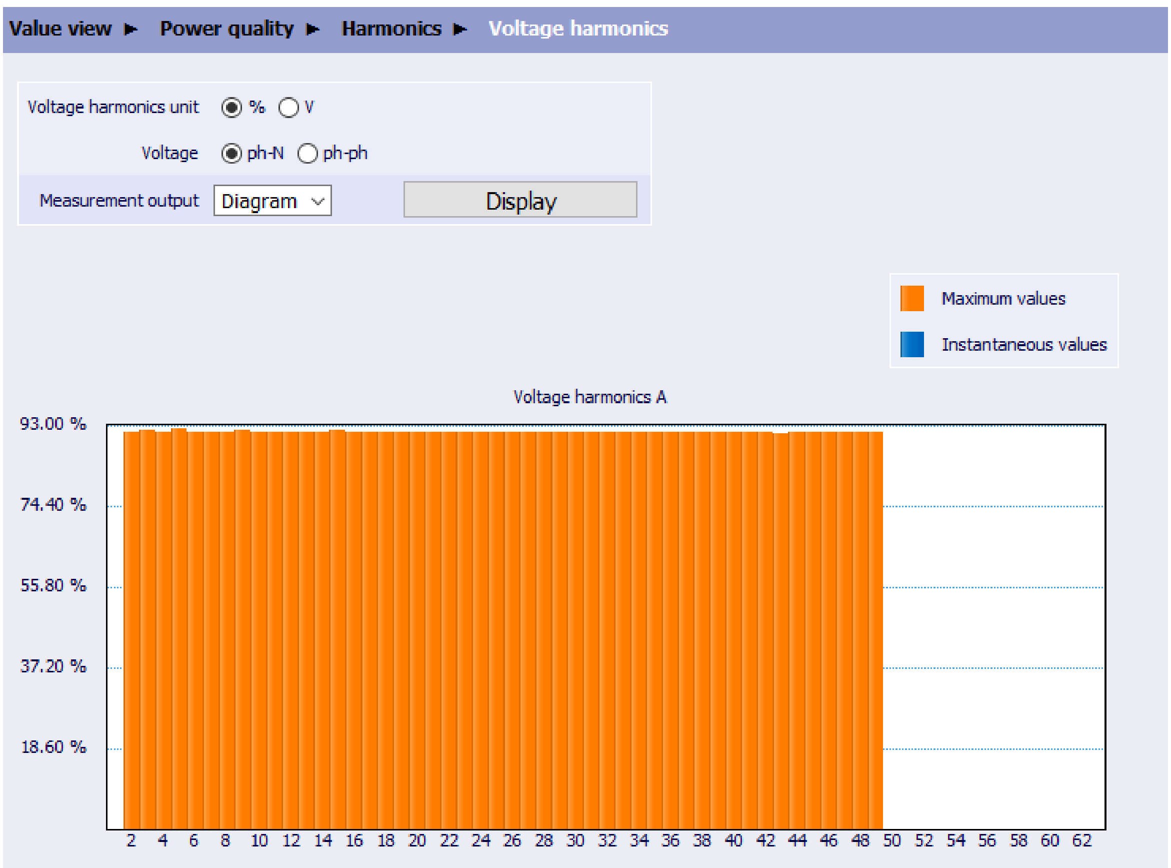
- Configure the respective parameters according to the following table.

Table 6-3 Settings for the Value View of Voltage Harmonics

Parameter	Default Setting	Setting Options
Voltage harmonics unit	%	% V
Voltage[29]	ph-N	ph-N ph-ph
Measurement output	Diagram	Table Diagram

- Click **Display**.
  The detailed results are displayed in tables or in diagrams. The instantaneous values and the maximum values are both presented.

View in Diagrams:

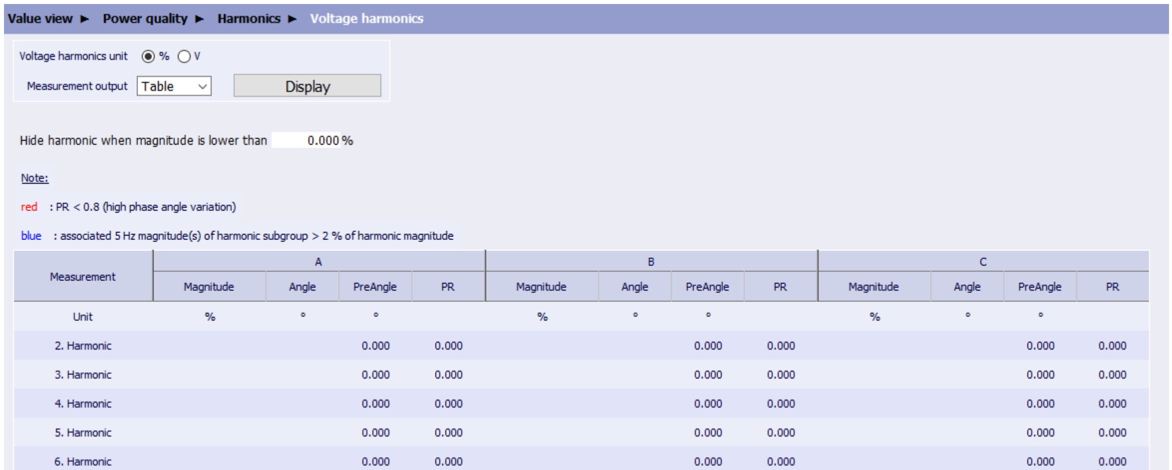


[sc_Harmonic_voltage_diagram, 3, en_US]

Figure 6-5 Value View Tab, Voltage Harmonics, Diagram

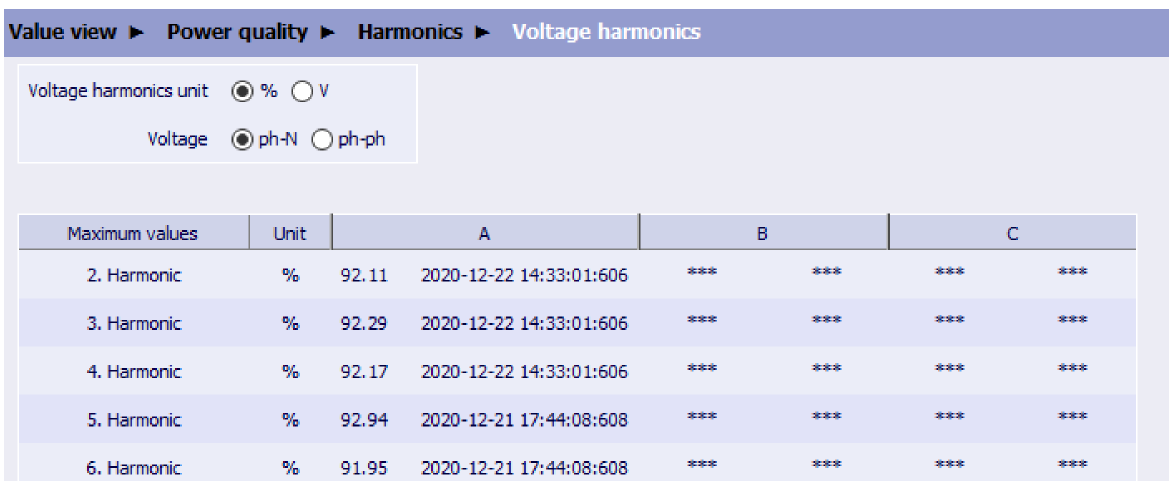
29 This parameter is only available when the connection type is **4-wire, 3-phase, unbalanced** and the measurement output is diagram.

View in Tables:



[sc_Harmonic_voltage_output_table, 3, en_US]

Figure 6-6 Value View Tab, Voltage Harmonics, Instantaneous Values, Table



[sc_Harmonic_voltage_values_max, 2, en_US]

Figure 6-7 Value View Tab, Voltage Harmonics, Maximum Values, Table

Value View of the Voltage Interharmonics

The operation to view the voltage interharmonics is similar to the voltage harmonics. For more information, refer to *Value View of the Voltage Harmonics, Page 173*.

Value View of the Harmonic Currents

The operation to view the harmonic currents is similar to the voltage harmonics. For more information, refer to *Value View of the Voltage Harmonics, Page 173*.

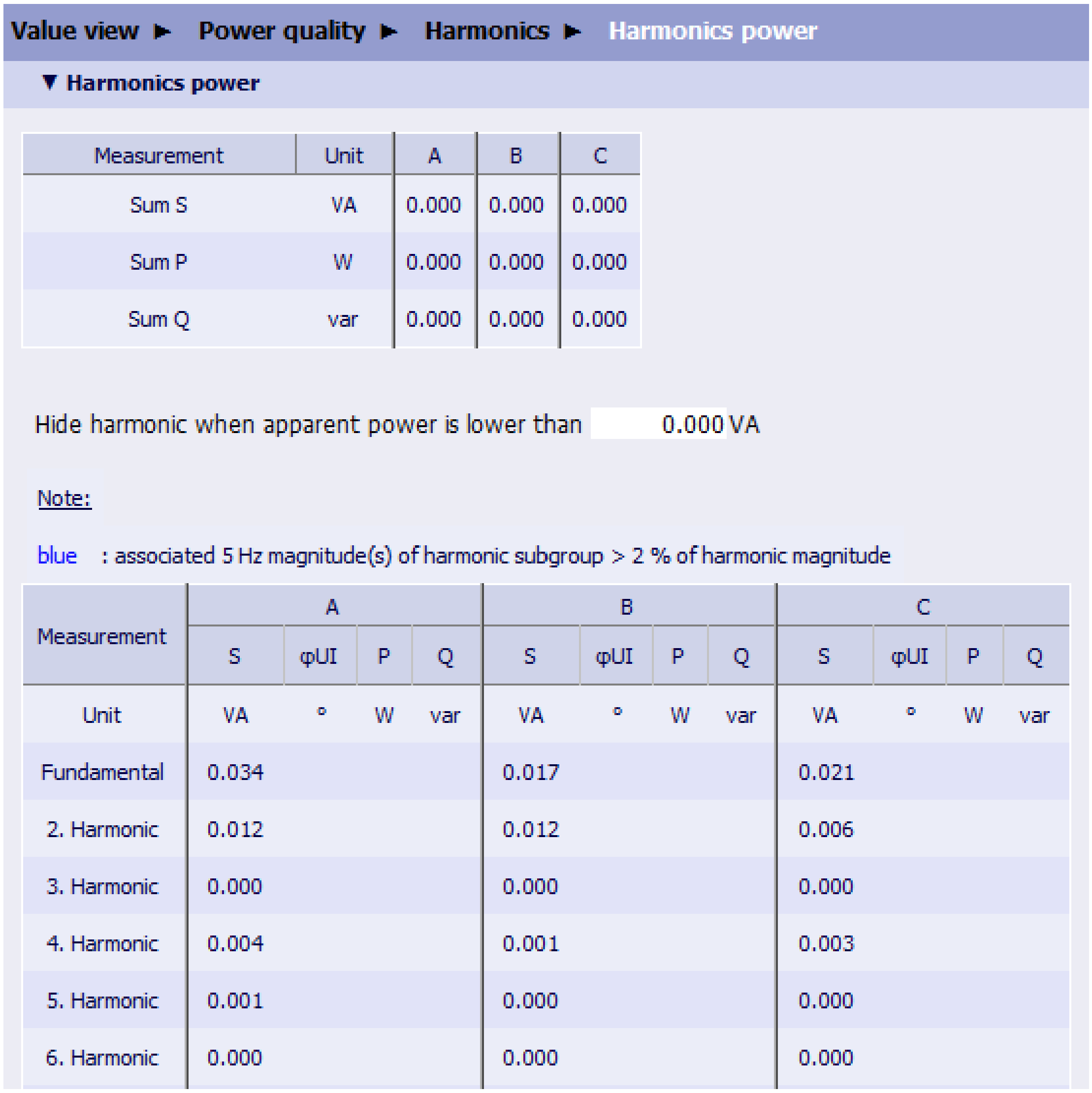
Value View of the Interharmonic Currents

The operation to view the interharmonic currents is similar to the voltage harmonics. For more information, refer to *Value View of the Voltage Harmonics, Page 173*.

Value View of the Harmonics Power

To display the measured values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Harmonics power**.
  The harmonics power values are displayed in tables.


Value view ▶ Power quality ▶ Harmonics ▶ Harmonics power

▼ Harmonics power

Measurement	Unit	A	B	C
Sum S	VA	0.000	0.000	0.000
Sum P	W	0.000	0.000	0.000
Sum Q	var	0.000	0.000	0.000

Hide harmonic when apparent power is lower than 0.000 VA

Note:

blue : associated 5 Hz magnitude(s) of harmonic subgroup > 2 % of harmonic magnitude

Measurement	A				B				C			
	S	φUI	P	Q	S	φUI	P	Q	S	φUI	P	Q
Unit	VA	°	W	var	VA	°	W	var	VA	°	W	var
Fundamental	0.034				0.017				0.021			
2. Harmonic	0.012				0.012				0.006			
3. Harmonic	0.000				0.000				0.000			
4. Harmonic	0.004				0.001				0.003			
5. Harmonic	0.001				0.000				0.000			
6. Harmonic	0.000				0.000				0.000			

[sc_harmonic power, instantaneous, 2, en_US]

Figure 6-8 Value View Tab, Harmonic Power, Instantaneous Value

The harmonics power function supports to hide harmonics that you are not interested in from the display table. You can set the value from which amount of the harmonics power is hidden on the display via the parameter **Hide Harmonic when apparent power is lower than x.xxx VA** displayed above the measurement table. If you press the **ENTER** key, the value set for this parameter is active. It is not necessary to activate the parameter.

If one of the spectral lines ±5 Hz of the harmonic frequency is greater than 2 % of the RMS value of the harmonic, the corresponding value is displayed in blue as an indication.

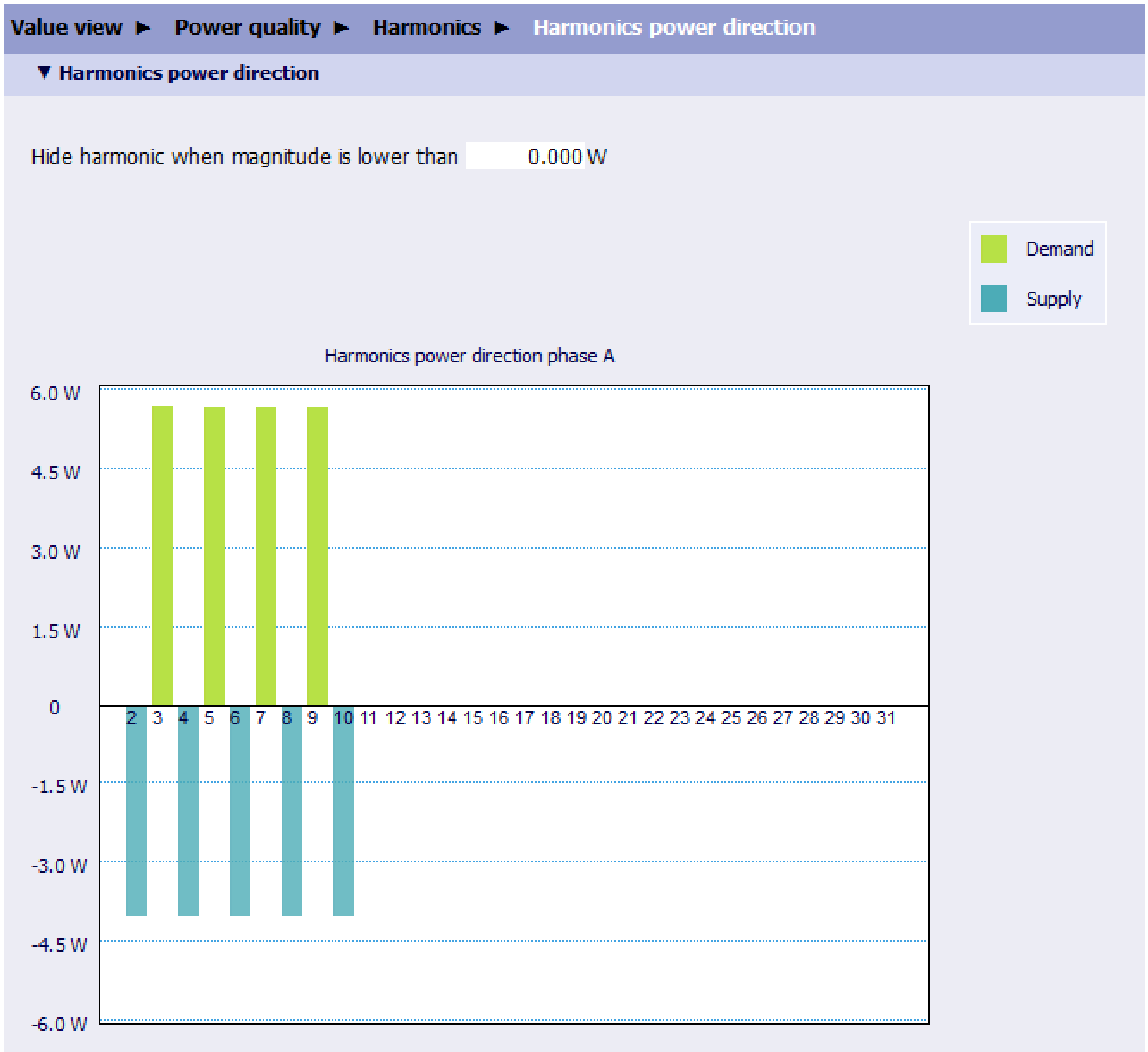
The sign of the active power of the single harmonic determines the power-flow direction:

- Positive sign: from the supply system to the demand
- Negative sign: from the demand to the supply system

Value View of the Harmonics Power Direction

To display the measured values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Harmonics power direction**.
  The aggregated values are displayed in a diagram.



[sc_harmonics power direction, 2, en_US]

Figure 6-9 Value View Tab, Harmonics Power Direction, Aggregated Value

The harmonics power function supports to hide harmonics that you are not interested in from the display table. You can set the value from which amount of the harmonics power is hidden on the display via the parameter **Hide harmonic when magnitude is lower than x.xxx W** displayed above the measurement table. If you press the **ENTER** key, the value set for this parameter is active. It is not necessary to activate the parameter.
The sign of the active power of the aggregated harmonics shows the direction:

- Positive sign: demand side, shown in green on the HTML page
- Negative sign: supply side, shown in blue on the HTML page

Evaluation of Voltage Emissions 2 kHz to 9 kHz

To display the measured values in the **Value view** tab, proceed as follows:

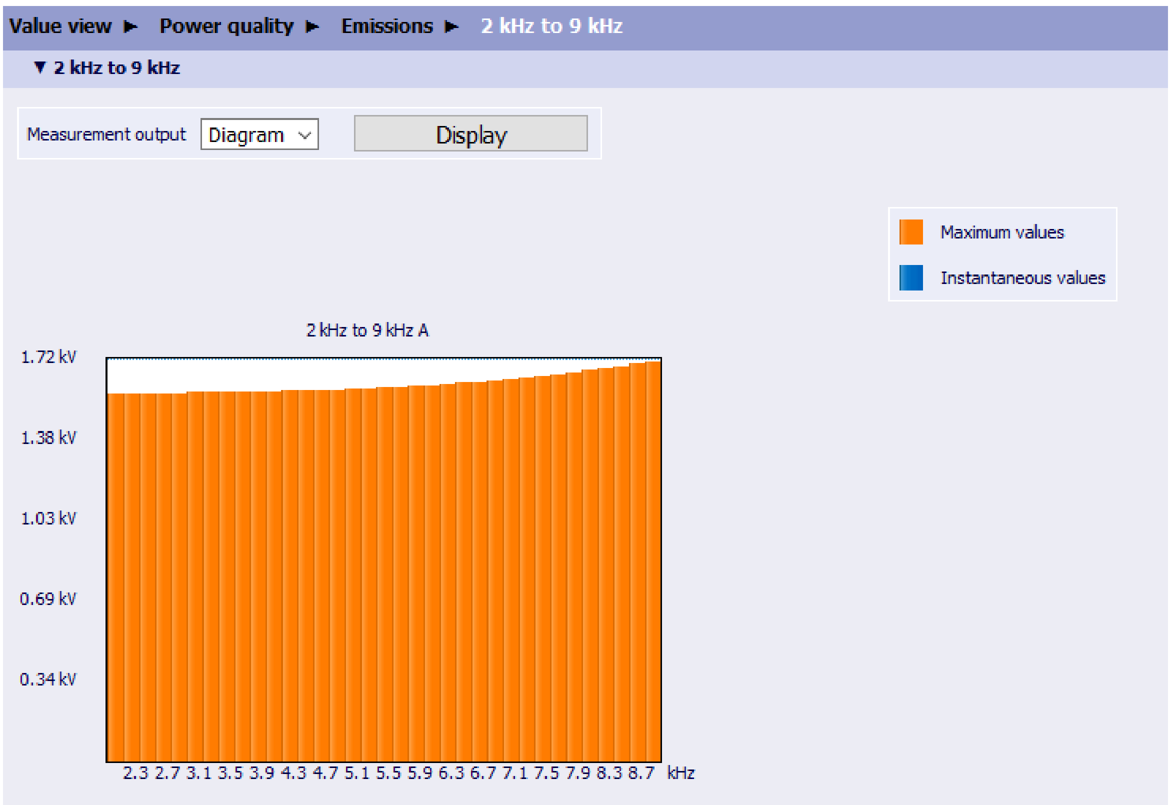
- In the navigation window, click **2 kHz to 9 kHz**.
- Configure the parameter in the list box according to the following table:

Table 6-4 Settings for Evaluation of Emissions 2 kHz to 9 kHz

Parameter	Default Setting	Setting Options
Measurement output	Diagram	Table Diagram

- Click **Display**.
  The detailed results are displayed in tables or in diagrams. The instantaneous values and the maximum values are both presented.

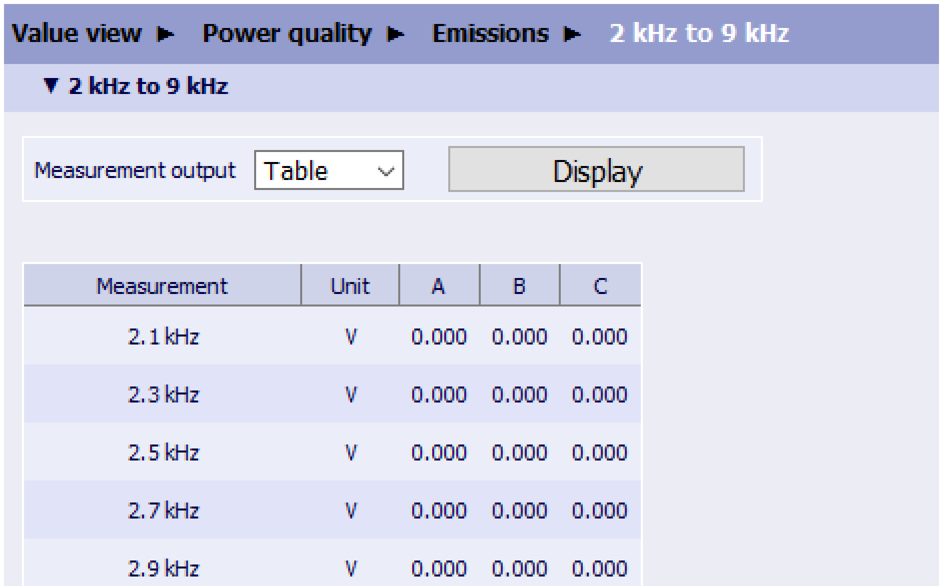
View in Diagrams:



[sc_Harmonic_voltage_2-9 kHz_diagram, 3, en_US]

Figure 6-10 Value View Tab, Voltage Emissions 2 kHz to 9 kHz, Diagram

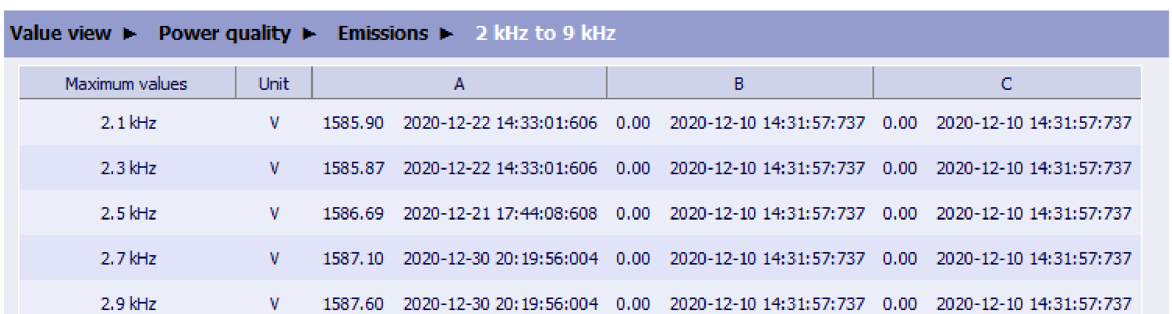
View in Tables:



Measurement	Unit	A	B	C
2.1 kHz	V	0.000	0.000	0.000
2.3 kHz	V	0.000	0.000	0.000
2.5 kHz	V	0.000	0.000	0.000
2.7 kHz	V	0.000	0.000	0.000
2.9 kHz	V	0.000	0.000	0.000

[sc_Harmonic_voltage_2-9 kHz_table, 3, en_US]

Figure 6-11 Value View Tab, Voltage Emissions 2 kHz to 9 kHz, Instantaneous Values, Table



Maximum values	Unit	A		B		C	
2.1 kHz	V	1585.90	2020-12-22 14:33:01:606	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
2.3 kHz	V	1585.87	2020-12-22 14:33:01:606	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
2.5 kHz	V	1586.69	2020-12-21 17:44:08:608	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
2.7 kHz	V	1587.10	2020-12-30 20:19:56:004	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
2.9 kHz	V	1587.60	2020-12-30 20:19:56:004	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737

[sc_new_harmonics_voltage_2-9_kHz_max, 2, en_US]

Figure 6-12 Value View Tab, Voltage Emissions 2 kHz to 9 kHz, Maximum Values, Table

Evaluation of Voltage Emissions 9 kHz to 150 kHz

To display the measured values in the **Value view** tab, proceed as follows:

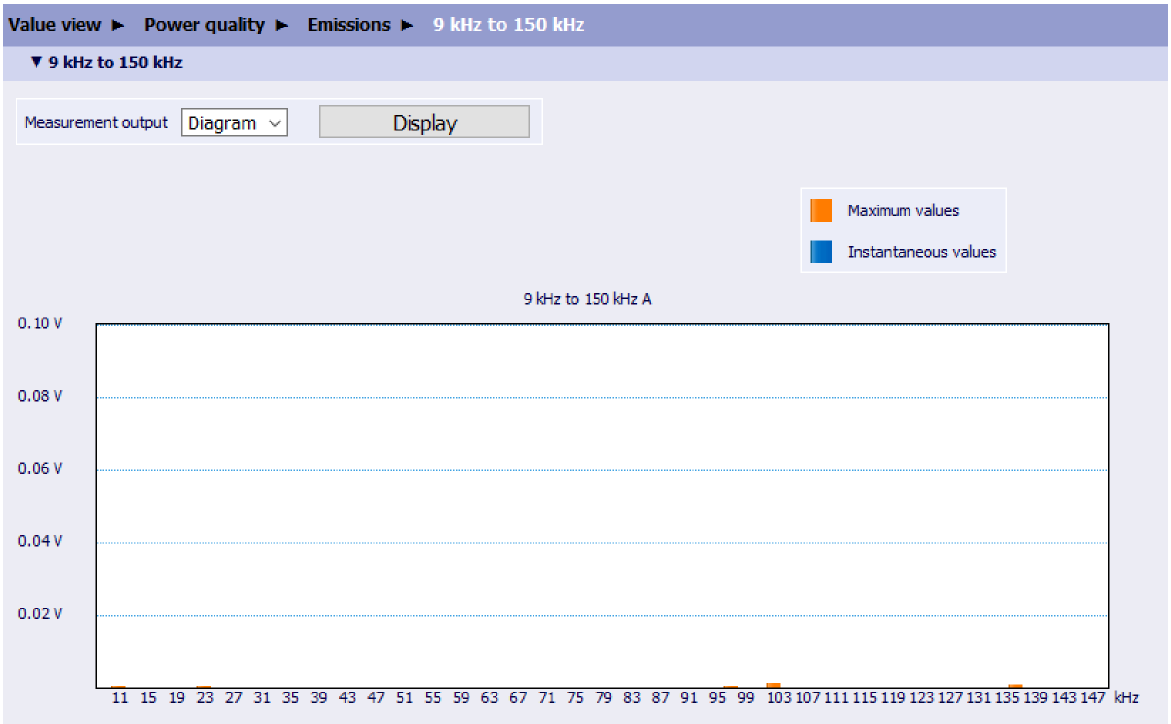
- In the navigation window, click**9 kHz to 150 kHz**
- Configure the parameter in the list box according to the following table:

Table 6-5 Setting for Evaluation of Emissions 9 kHz to 150 kHz

Parameter	Default Setting	Setting Options
Measurement output	Diagram	Table Diagram

- Click **Display**.
  The detailed results are displayed in tables or in diagrams. The instantaneous values and the maximum values are both presented.

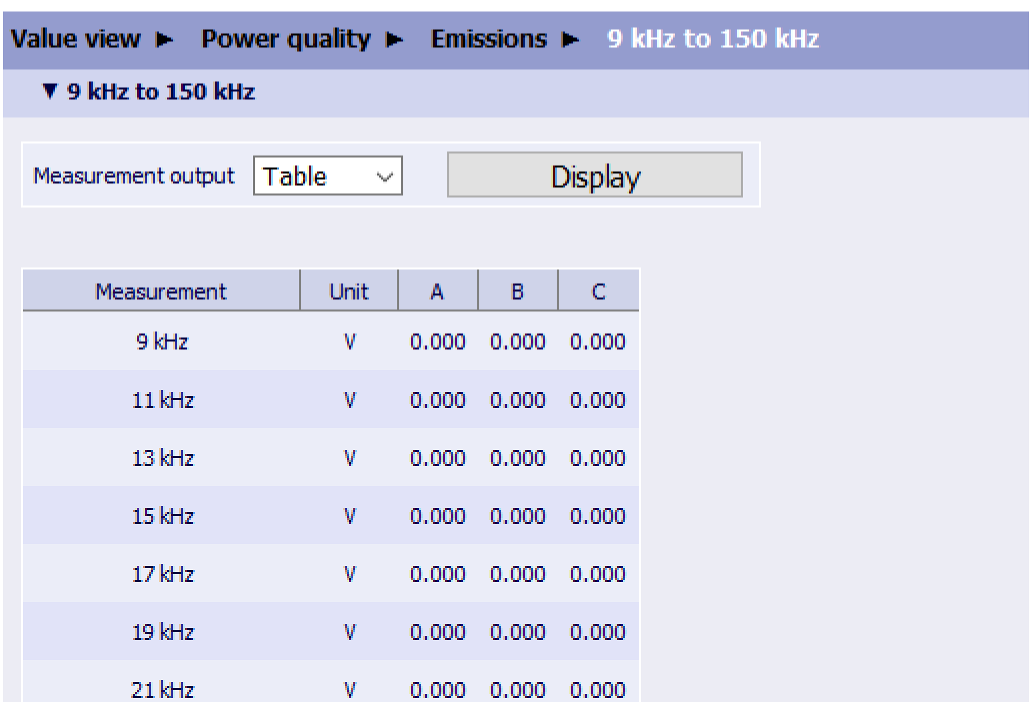
View in Diagrams:



[sc_Harmonic_voltage_9-150_kHz_diagram, 3, en_US]

Figure 6-13 Value View Tab, Voltage Emissions 9 kHz to 150 kHz, Diagram

View in Tables:



Measurement	Unit	A	B	C
9 kHz	V	0.000	0.000	0.000
11 kHz	V	0.000	0.000	0.000
13 kHz	V	0.000	0.000	0.000
15 kHz	V	0.000	0.000	0.000
17 kHz	V	0.000	0.000	0.000
19 kHz	V	0.000	0.000	0.000
21 kHz	V	0.000	0.000	0.000

[sc_Harmonics_voltage_9-150_kHz_table_inst_value, 2, en_US]

Figure 6-14 Value View Tab, Voltage Emissions 9 kHz to 150 kHz, Instantaneous Values, Table

Value view ▶ Power quality ▶ Emissions ▶ 9 kHz to 150 kHz

Maximum values	Unit	A		B		C	
9 kHz	V	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
11 kHz	V	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
13 kHz	V	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
15 kHz	V	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
17 kHz	V	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
19 kHz	V	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737
21 kHz	V	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737	0.00	2020-12-10 14:31:57:737

[sc_Harmonics_voltage_9-150_kHz_table_max_value, 2, en_US]

Figure 6-15 Value View Tab, Voltage Emissions 9 kHz to 150 kHz, Maximum Values, Table

2 kHz to 150 kHz Heatmap

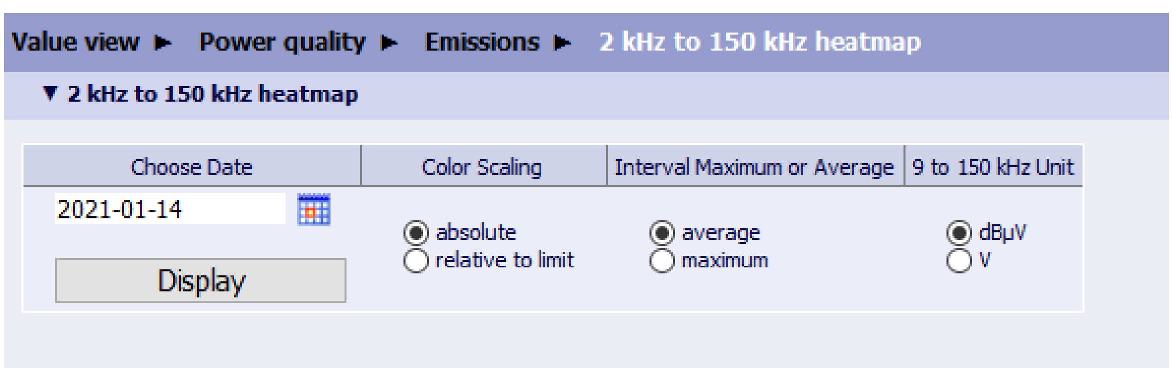
Visualization of the 1-Day Record

With SICAM Q200, it is possible to visualize the 1-day records of the voltage emissions.
You can display the following 1-day records for harmonics from 2 kHz to 9 kHz with a resolution of 200 Hz and harmonics from 9 kHz to 150 kHz with a resolution of 2 kHz:

- Absolute values of the harmonic
- Relative values of the harmonic to the limiting value
- Heatmap with representation of the magnitude of the harmonic in dBµV for 9kHz to 150 kHz
- Heatmap with representation of the magnitude of the harmonic in V for 9kHz to 150 kHz

To display the measured values in the **Value view** tab, proceed as follows:

- In the navigation window, click **2 kHz to 150 kHz heatmap**.



[sc_Calender, 3, en_US]

- Configure the date and options for emissions 2 kHz to 150 kHz according to the following table.

Table 6-6 Settings for Evaluation of Emissions 2 kHz to 150 kHz Heatmap

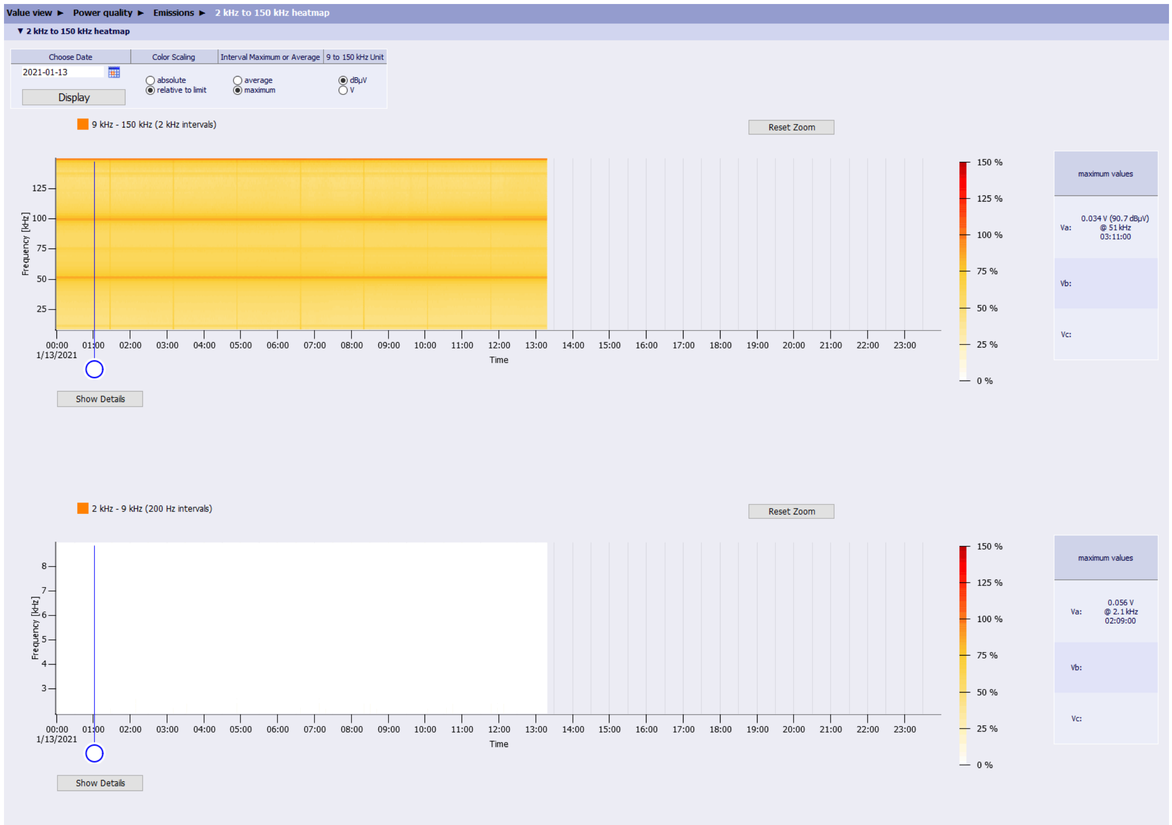
Parameter	Default Setting	Setting Options
Choose Date	Current date	Any
Color Scaling	absolute	absolute relative to limit

Parameter	Default Setting	Setting Options
Interval Maximum or Average	average	average maximum
9 to 150 kHz unit	dBµV	dBµV V

- Click **Display**.
  The color scaling corresponds to the range of the magnitude of the harmonic (bar on the right). Only the phase with the highest magnitude is considered.

[sc_Heatmap_absolut_values, 3, en_US]

Figure 6-16 1-Day Record of the Emissions from 2 kHz to 9 kHz and from 9 kHz to 150 kHz; Average Values of the Magnitude



[sc_Heatmap_rated_voltage, 3, en_US]

Figure 6-17 1-Day Record of the Emissions from 2 kHz to 9 kHz and from 9 kHz to 150 kHz; Relative to Limit Values of the Magnitude

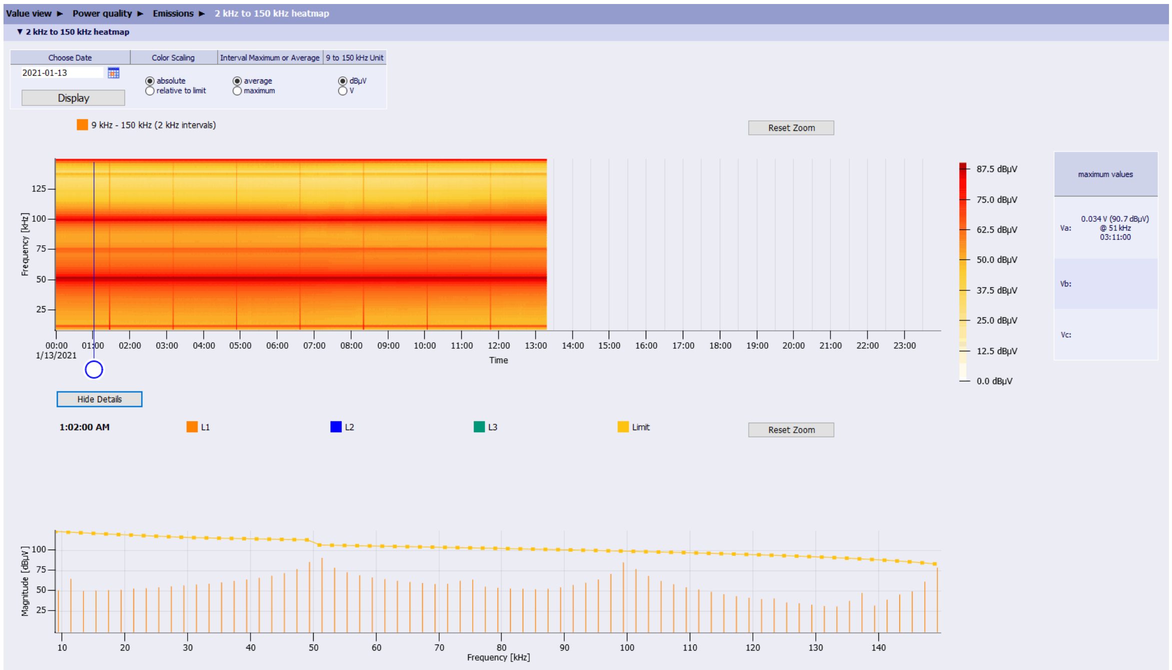
Diagram Functions

The heatmap diagram provides the following functions:

- Zoom function over time range:
  You can mark a range in the diagram and thus activate the zoom function. To exit the zoom function then, click the **Reset Zoom** button.
- Show harmonic bar chart:
  - To show the bar chart, click **Show Details**.
  - Move the blue marker in the heatmap to select the time which you want to show in the bar chart.
  - To hide the bar chart, click **Hide Details**.

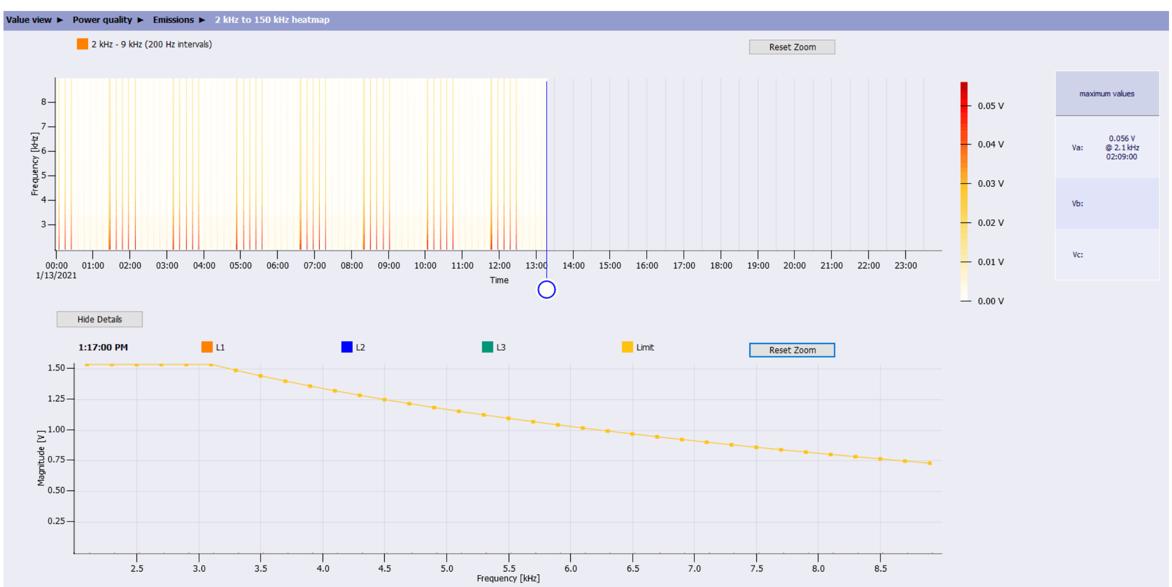
The following display option is available:

- Frequency range from 9 kHz to 150 kHz:
  The value can be displayed in V or in dBµV.



[sc_Heatmap_logarithm_scaling, 3, en_US]

Figure 6-18 Average Values of the Emissions in dBµV, Example: Emissions from 9 kHz to 150 kHz at 01:02

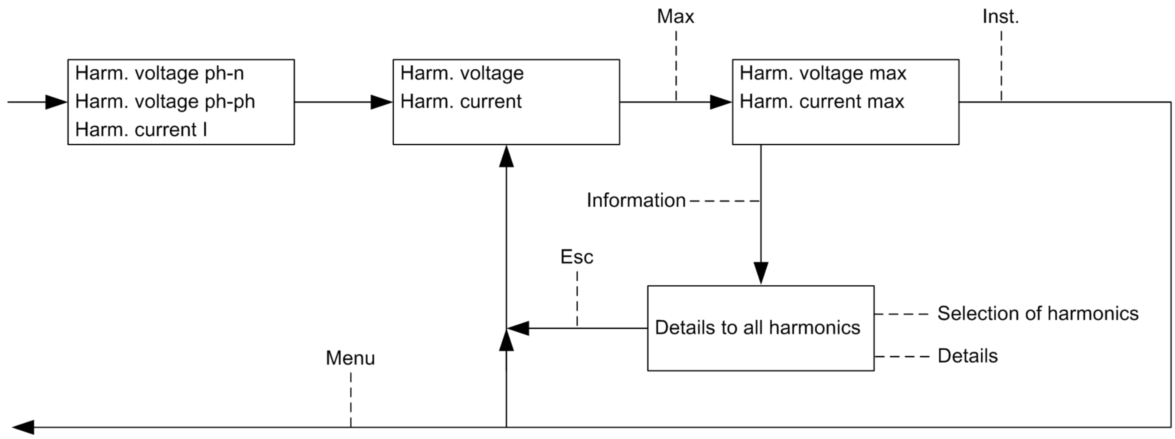


[sc_Heatmap_max_values, 3, en_US]

Figure 6-19 Maximum Values of the Emissions, Example: Emissions from 2 kHz to 9 kHz at 13:17

6.1.4 Value View via Display

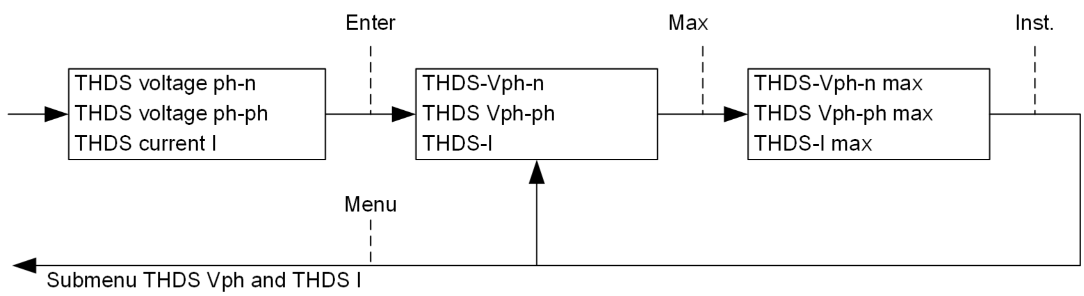
Submenu Voltage Harmonics V and Current Harmonics I (Bar Charts)



[dw_submenu_evaluation_harmonics, 1, en_US]

Figure 6-20 Submenu Harmonic Voltage and Harmonic Current

Submenu THDS



[dw_submenu_THDS2, 2, en_US]

Figure 6-21 Submenu THDS V and THDS I

6.2 Flicker

6.2.1 Function Description

The flicker is measured according to IEC 61000-4-15.

The short-term flicker value (Pst) and the long-term flicker value (Plt) are determined for phase-to-ground voltages and delta voltages. The flicker is measured on all 3 voltage channels.

Flickers appear with a frequency from 0.005 Hz to 35 Hz.

The device measures the following flicker types:

- Short-term flicker values (Pst)
  Determined by 10 min (short-term flicker), fixed
- Long-term flicker values (Plt)
  Over 2 h (12 Pst values), fixed

Table 6-7 Recording of the Flicker

Measured Quantities	Measurement Records PQDIF
Short-Term Flicker	
P_{st} (a-n)	x
P_{st} (b-n)	x
P_{st} (c-n)	x
P_{st} (a-b)	x
P_{st} (b-c)	x
P_{st} (c-a)	x
Long-Term Flicker	
P_{lt} (a-n)	x
P_{lt} (b-n)	x
P_{lt} (c-n)	x
P_{lt} (a-b)	x
P_{lt} (b-c)	x
P_{lt} (c-a)	x

Interfaces: protocols IEC 61850 (PQDIF depending on the measuring interval) and Modbus TCP

The measurement range and accuracy are specified according to the standard IEC 61000-4-15.

Table 6-8 Test Specifications for the Flickermeter Classifier

Rectangular Changes per Minute (CPM)	Voltage Fluctuation %			
	120-V Lamp 50-Hz System	120-V Lamp 60-Hz System	230-V Lamp 50-Hz System	230-V Lamp 60-Hz System
1	3.178	3.181	2.715	2.719
2	2.561	2.564	2.191	2.194
7	1.694	1.694	1.450	1.450
39	1.045	1.040	0.894	0.895
110	0.844	0.844	0.722	0.723
1620	0.545	0.548	0.407	0.409
4000	3.426	Test not required	2.343	Test not required

Rectangular Changes per Minute (CPM)	Voltage Fluctuation %			
	120-V Lamp 50-Hz System	120-V Lamp 60-Hz System	230-V Lamp 50-Hz System	230-V Lamp 60-Hz System
4800	Test not required	4.837	Test not required	3.263
Note 1: If the CPM is 1620, the modulation frequency of the rectangular square wave is 13.5 Hz. Note 2: For tests according to this table, the first voltage change is applied within 5 s after the P_{st} evaluation is started. Flickermeters having a pretest time to charge the filters, indicate when the P_{st} evaluation starts. With the indication, the testing authority can determine when to start the rectangular modulation pattern.				

All the voltage fluctuation values in *Table 6-8* are multiplied with a fixed factor k. P_{st} is determined by the factor k. Siemens specifies the working range of the classifier as 0.2 ≤ k ≤ 10. The corresponding value P_{stk} is within ± 5 % or ± 0.05 of the factor k, depending on which value is greater.

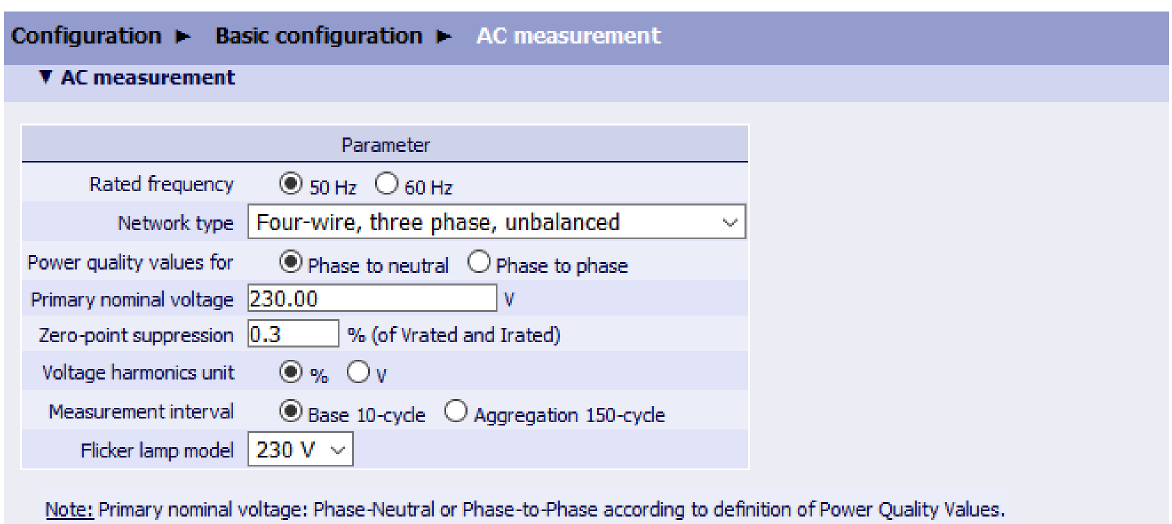
The rectangular modulation must be applied with a duty cycle of 50 % ± 2 %, and the transition time from one voltage level to the next must be less than 0.5 ms.

6.2.2 Configuration and Value View via Web Pages

Configuration of the Flicker

To configure the **Flicker lamp model** in the **Configuration** tab, proceed as follows:

- In the navigation window, click **AC measurement**.



[sc_Q100_flicker lamp model, 3, en_US]

Figure 6-22 Configuration Tab, Flicker

- Select a **Flicker lamp model** according to the following table.

  The **Flicker lamp model** selection depends on the **Primary nominal voltage**, because flicker is a visual phenomenon created by voltage variations, and the voltage variations are caused by changing in luminance of lighting systems.

Table 6-9 Settings for Flicker

Parameter	Default Setting	Setting Options
Flicker lamp model	230 V	230 V 120 V

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Configuration of the Aggregation Interval for the Flicker

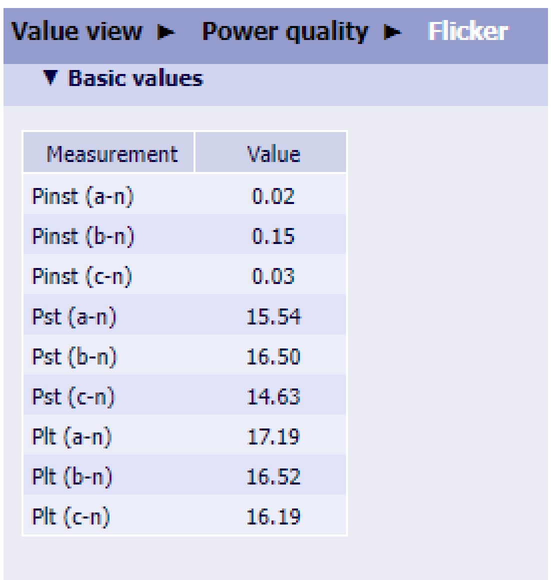
To configure the aggregation interval for the flicker in the **Configuration** tab, click **Measurement records**.

The aggregation interval for flicker is not configurable. The short-term flicker is fixed to 10 min, and the long-term flicker is fixed to 2 h.

Value View of the Flicker

To display the flicker values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Flicker**.



Measurement	Value
Pinst (a-n)	0.02
Pinst (b-n)	0.15
Pinst (c-n)	0.03
Pst (a-n)	15.54
Pst (b-n)	16.50
Pst (c-n)	14.63
Plt (a-n)	17.19
Plt (b-n)	16.52
Plt (c-n)	16.19

[sc_value_view_flicker, 1, en_US]

Figure 6-23 Value View Tab, Flicker

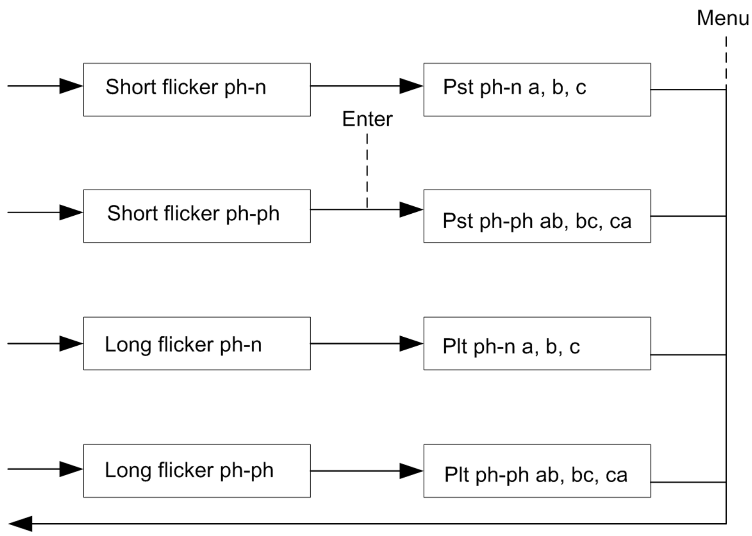
To display the aggregation values of the flicker in the **Value view** tab, proceed as follows:

- In the navigation window, click **Measurement records**.
- Configure the respective parameters according to *Table 6-29* (see chapter *6.11.2 Configuration and Value View via Web Pages*).
- Select **Long term flicker** or **Short term flicker** as the **Aggregation data**.

6.2.3 Value View via Display

Submenu Flicker

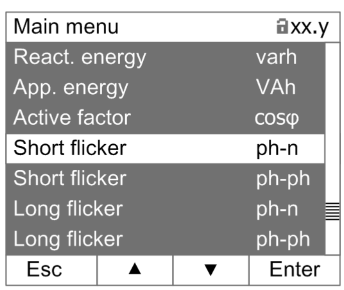
In the main menu, click **Short flicker ph-n**, **Short flicker ph-ph**, **Long flicker ph-n**, or **Long flicker ph-ph**.



[dw_submenu_flicker_display, 1, en_US]

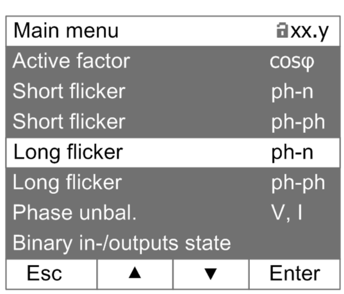
Figure 6-24 Submenu Flicker

The following interface displays are available:



[dw_display_short_flicker, 1, en_US]

Figure 6-25 Short Flicker



[dw_display_long_flicker, 1, en_US]

Figure 6-26 Long Flicker

6.3 Measured-Value Recording

The device provides different recording options for the load profile and for monitoring and analyzing the power quality.

Table 6-10 Recording Measured Values

Recording	Measurands	Storage Interval/Storage Method	Application
Measured values (measurement records)	Power frequency	10 s (fixed)	Long-time monitoring of the power quality, for example according to EN 50160
	Magnitude of supply voltage	10 min (1 min, 10 min)	
	Supply-voltage unbalanced		
	Harmonics and interharmonics of the voltage		
	Flicker	• P_{st} determined over 10 min • P_{lt} determined over 2 h (12 P_{st} values)	Monitoring of the flicker severity according to IEC 61000-4-15
	Magnitude of current	10 min (1 min, 10 min)	Long-time monitoring of current- and power-related values
	Current harmonics and inter-harmonics		
	Current unbalanced		
	Additional data (for example, power values, phase angles, min/max/AVG values)		
	2 to 9 kHz Harmonics		
	9 to 150 kHz Harmonics		
Voltage events (event records)	• Voltage dips • Voltage interruptions	Residual voltage V_{rms} (1/2-cycle) and time stamps (duration)	Long-time monitoring of the power quality according to EN 50160, classification of voltage events, for example ITIC curve
	Voltage swells	Maximum voltage magnitude V_{rms} (1/2-cycle) and time stamps (duration)	
	RVC	–	–
Long-term recording and monitoring (trend records)	V_{rms} (1/2-cycle)	2 h (2 h, 24 h)	Subsequent analysis of the power quality with any grid codes
Fault records (waveform records)	• Voltages • Currents • Binary inputs (depending on the Hardware) • Frequency	• Voltage and current variations • Binary input and remote indication changes • Storage of sampled values (default 2 s, max. 10 s) and indication values	Analyzing the causes of power-quality problems
Mains signaling voltage	Mains signaling voltages on the supply voltage	Mains signaling voltage triggers, start time, aquisition of 10/12 cycle voltages (max. 2 min)	Monitoring of the mains signaling voltage according to EN 50160

Recording	Measurands	Storage Interval/Storage Method	Application
Load-profile records	Load profile	Method **Fixed Block** or method **Rolling Block**	Determining the load profile for supply and consumption of electric power
Transients (transient logs)	Transient waveform	• Recording when detected • Recording duration depending on configuration settings • Sample rate 1 MS/s	Analyzing the causes of power-quality problems

The respective measuring interval of the recording is time-stamped to enable a correct time evaluation.

6.4 Voltage Events

6.4.1 Function Description

The device detects voltage events (dips, swells, interruptions) based on 1/2-cycle RMS values according to IEC 61000-4-30 Edition 3.0.

The device detects the direction of the voltage events under the following network types:

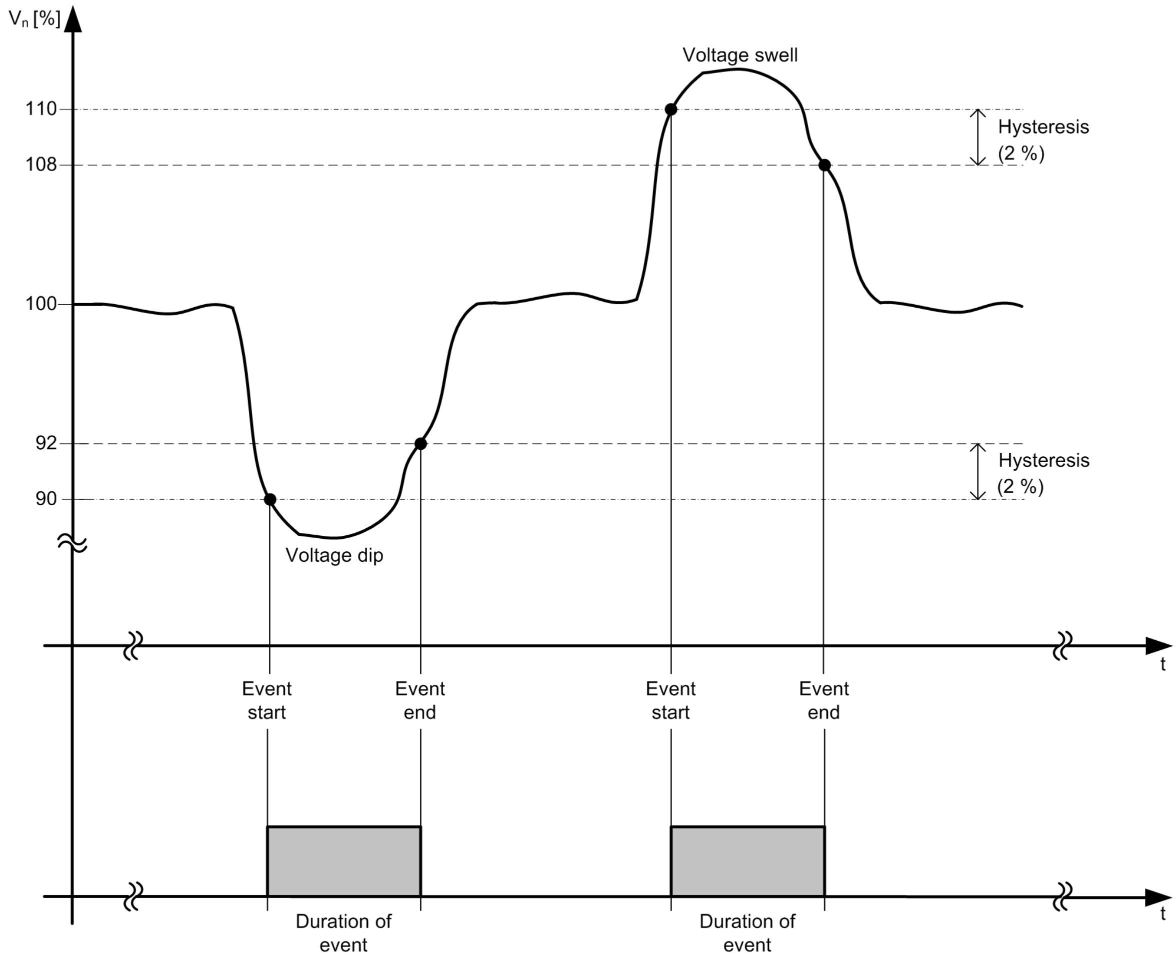
- 1-phase network
- 4-wire, 3-phase, unbalanced (The event-detection mode is ph-N.)
- 3-wire, 3-phase, unbalanced (2 * I)
- 3-wire, 3-phase, unbalanced (3 * I)

There are 2 types of reference voltage:

- Primary nominal voltage (V_n)
- Sliding reference voltage (V_{sr})

Using $\mathbf{V_n}$ as reference in all voltage ranges, the device works as follows:

- It determines the start of events with the threshold value.
  All thresholds are related to the primary nominal voltage.
- It determines the end of voltage events with the voltage considering the hysteresis of the preset threshold.



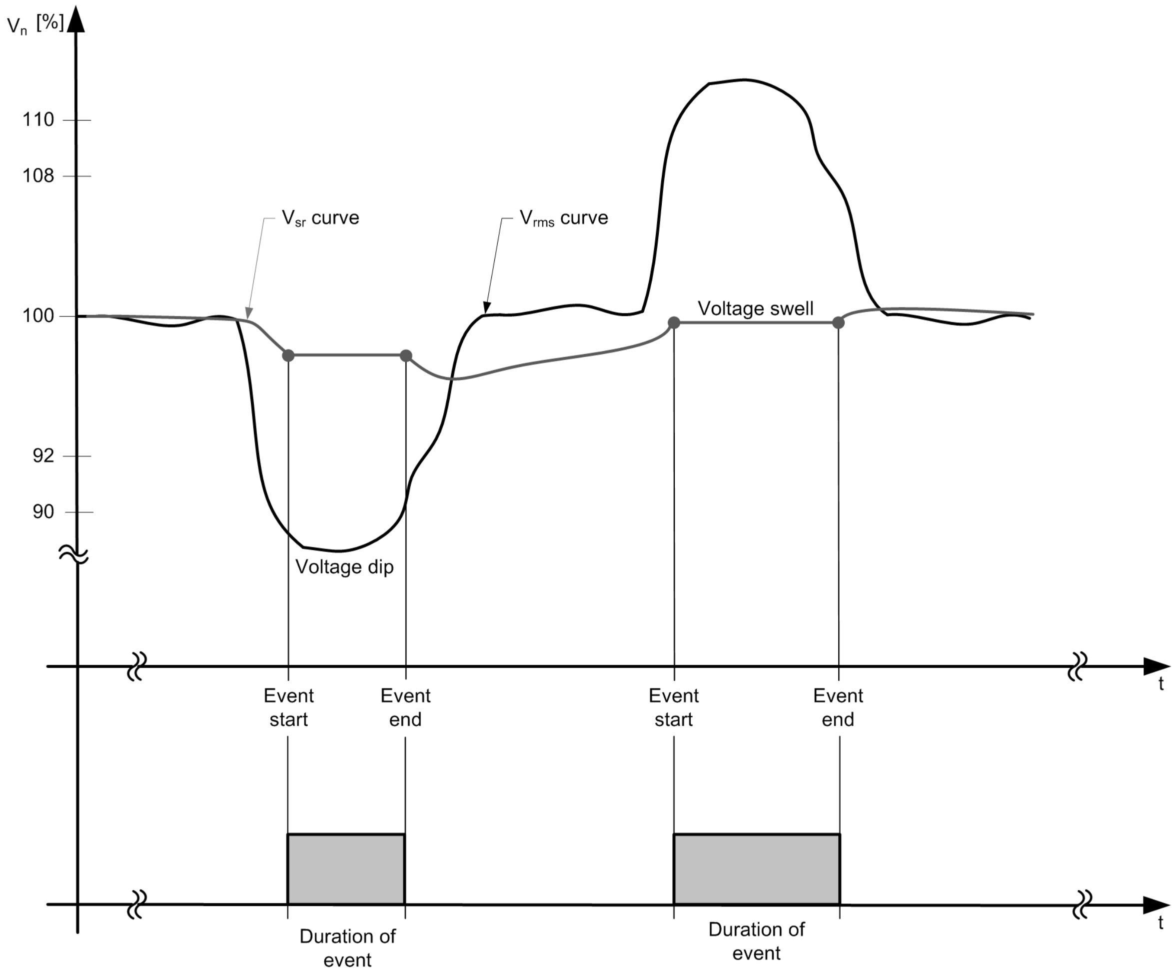
[dw_event_recorder_detection, 1, en_US]

Figure 6-27 Example of Voltage Event Detection with Primary Nominal Voltage as Reference Voltage

The settings are as follows on the Web page:

- Swell threshold: 110 %
- Dip threshold: 90 %
- Hysteresis: 2 %

Using **V_{sr}** as reference voltage in high- or medium-voltage power systems[30], dips and swells are detected based on a voltage relative to the actual RMS voltage. Interruptions and hysteresis are detected based on the sliding **Primary nominal voltage**.



[dw_sliding_reference_voltage, 1, en_US]

Figure 6-28 Example of Voltage Event Detection with Sliding Reference Voltage as Reference Voltage

The settings are as follows on the web page:

- Swell threshold: 110 %
- Dip threshold: 90 %
- Hysteresis: 2 %

NOTE

The **Sliding reference voltage** is updated every 10 cycles/12 cycles. If a swell or dip happens, the **Sliding reference voltage** is not updated and the previous value is used.

NOTE

For multi-phase power systems, a separated sliding reference voltage for each phase is used. If a 1-phase voltage event occurs, it will freeze all phase V_{sr}.

30 In the IEC 61000-4-30 Edition 3.0, the sliding voltage reference V_{sr} is not used in low-voltage systems.

The voltage event logs are saved in a PQDIF file according to the international PQDIF standard *IEEE P1159.3*. The following table presents the recommended channel definitions for a simple RMS variation event list of voltage dips, voltage swells, and voltage interruptions.

Table 6-11 Example Channel Definitions for RMS Variation Event List Using ID_QT_MAGDURTIME

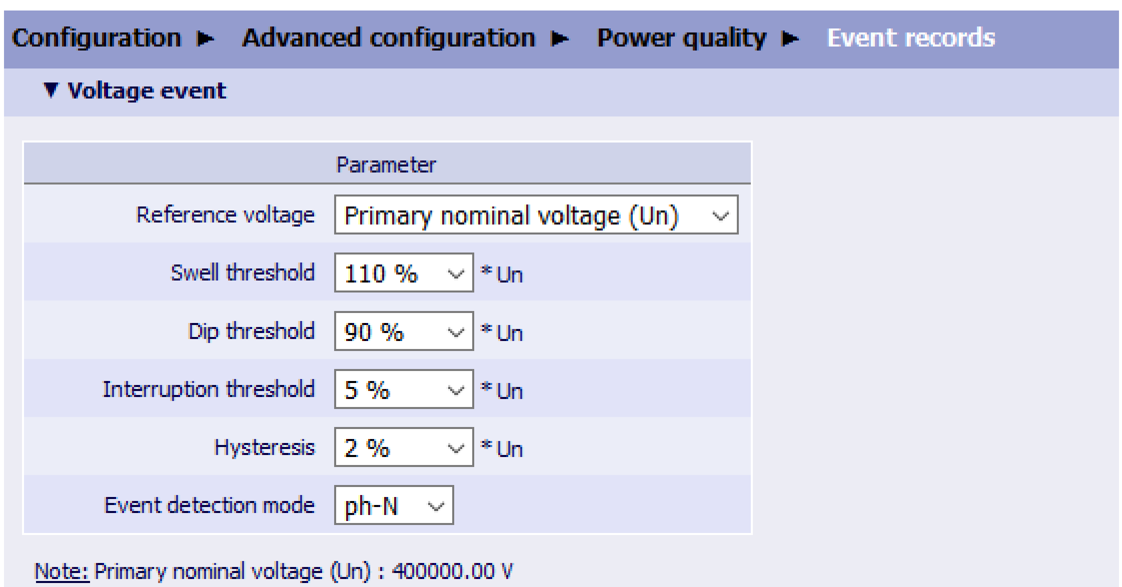
Channel Instance	Series Instance	Value Type ID	Quantity Measured ID	Phase ID[31]	Quantity Units ID	Quantity Characteristic ID
0	0	TIME	VOLTAGE	TOTAL	SECONDS	TIME_OFFSET
0	1	VAL	VOLTAGE	TOTAL	VOLTS	RMS
0	2	DURATION	VOLTAGE	TOTAL	SECONDS	DURATION
0	3	VAL	VOLTAGE	TOTAL	NONE	NONE
0	4	VAL	VOLTAGE	TOTAL	NONE	NONE
0	5	PROB	VOLTAGE	TOTAL	NONE	NONE

6.4.2 Configuration and Value View via Web Pages

Configuration of the Voltage Event

To configure the settings of the voltage event in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Event records**.



[sc_config_voltage event, 1, en_US]

Figure 6-29 Configuration Tab, Event Records, Voltage Event

- Configure the respective parameters according to the following table.

31 The Phase ID can be AN, BN, CN, AB, BC, CA, and TOTAL. The voltage event direction is only shown in the event with the Phase ID TOTAL.

Table 6-12 Settings for Voltage Events

Parameter	Default Setting	Setting Range
Voltage Event		
Reference voltage	Primary nominal voltage (V_n)	Primary nominal voltage (V_n) Sliding reference voltage (V_{sr})
Swell threshold[32]	110 %	105 % to 140 %, increments of 5 %
Dip threshold[32]	90 %	75 % to 95 %, increments of 5 %
Interruption threshold	5 %	1 %, 2 %, 3 %, 5 %, 8 %, 10 %
Hysteresis	2 %	1 % to 6 %, increments of 1 %
Event detection mode[33]	ph-N	ph-N ph-ph

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

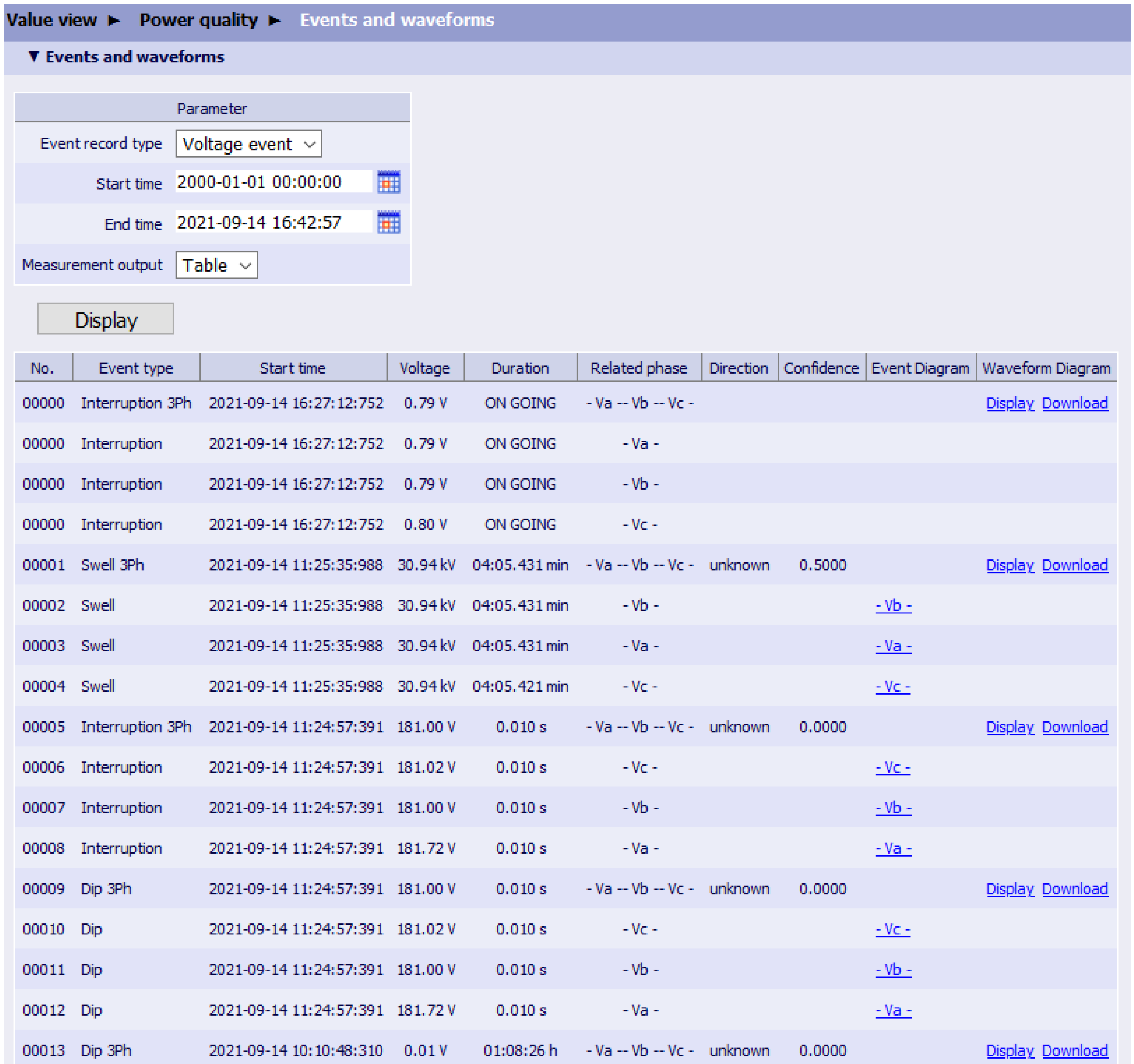
Value View of the Voltage Events

To display the values of the voltage events in the **Value view** tab, proceed as follows:

- In the navigation window, click **Events and waveforms**.
  The information of the latest 20 voltage events is shown without query.

32 According to the EN 50160 standard in the PQ report, the default setting of dip and swell (90 % and 110 %) is recommended.

33 Only for the **3P4W (3-phase/4-wire) unbalanced** network type, you can select the **ph-N** or **ph-ph** option as event detection mode.



No.	Event type	Start time	Voltage	Duration	Related phase	Direction	Confidence	Event Diagram	Waveform Diagram
00000	Interruption 3Ph	2021-09-14 16:27:12:752	0.79 V	ON GOING	- Va -- Vb -- Vc -				Display Download
00000	Interruption	2021-09-14 16:27:12:752	0.79 V	ON GOING	- Va -				
00000	Interruption	2021-09-14 16:27:12:752	0.79 V	ON GOING	- Vb -				
00000	Interruption	2021-09-14 16:27:12:752	0.80 V	ON GOING	- Vc -				
00001	Swell 3Ph	2021-09-14 11:25:35:988	30.94 kV	04:05.431 min	- Va -- Vb -- Vc -	unknown	0.5000		Display Download
00002	Swell	2021-09-14 11:25:35:988	30.94 kV	04:05.431 min	- Vb -			- Vb -	
00003	Swell	2021-09-14 11:25:35:988	30.94 kV	04:05.431 min	- Va -			- Va -	
00004	Swell	2021-09-14 11:25:35:988	30.94 kV	04:05.421 min	- Vc -			- Vc -	
00005	Interruption 3Ph	2021-09-14 11:24:57:391	181.00 V	0.010 s	- Va -- Vb -- Vc -	unknown	0.0000		Display Download
00006	Interruption	2021-09-14 11:24:57:391	181.02 V	0.010 s	- Vc -			- Vc -	
00007	Interruption	2021-09-14 11:24:57:391	181.00 V	0.010 s	- Vb -			- Vb -	
00008	Interruption	2021-09-14 11:24:57:391	181.72 V	0.010 s	- Va -			- Va -	
00009	Dip 3Ph	2021-09-14 11:24:57:391	181.00 V	0.010 s	- Va -- Vb -- Vc -	unknown	0.0000		Display Download
00010	Dip	2021-09-14 11:24:57:391	181.02 V	0.010 s	- Vc -			- Vc -	
00011	Dip	2021-09-14 11:24:57:391	181.00 V	0.010 s	- Vb -			- Vb -	
00012	Dip	2021-09-14 11:24:57:391	181.72 V	0.010 s	- Va -			- Va -	
00013	Dip 3Ph	2021-09-14 10:10:48:310	0.01 V	01:08:26 h	- Va -- Vb -- Vc -	unknown	0.0000		Display Download

[sc_voltage event direction, 3, en_US]

Figure 6-30 Value View Tab, Voltage Events

- Configure the respective parameters according to the following table.

Table 6-13 Settings for Value View of the Voltage Events

Parameter	Default Setting	Setting Range
Event record type	Voltage event	Voltage event Frequency event Voltage unbalance event RVC event
Start time	2000-01-01 00:00:00	You can edit the text box directly or select the start time from the calendar.
End time	Current date/time	You can edit the text box directly or select the end time from the calendar.
Measurement output	Table	Table CSV

- Select one of the following **Measurement output** options:
  - **Table**
    If you select **Table**, click **Display**.
    The determined results are displayed in a table. In the multi-page tables, you can show the forward and backward pages with the **>>** and **<<** buttons. If you want to view a certain page, enter the page number at the bottom and click **show**.
  - **CSV**
    If you select **CSV**, click **Download**.
    The measured values are downloaded as a CSV file and are exported to the storage location you selected.

Direction

This column indicates the direction of the voltage event:

- Forward: The event happens on the demand side.
- Backward: The event happens on the supply side.
- Both: The event comes from both the demand and supply sides.
- Unknown: The event comes from an unknown direction.

Confidence

This column indicates the correctness of the calculated direction based on the algorithm.
If the confidence factor is too low, the **Direction** is shown as **unknown**.

NOTE

The columns about the voltage-event direction are shown only if the **Network type** is set to one of the following options:

- 1-phase network
- 4-wire, 3-phase, unbalanced (The event-detection mode is ph-N.)
- 3-wire, 3-phase, unbalanced (2 * I)
- 3-wire, 3-phase, unbalanced (3 * I)

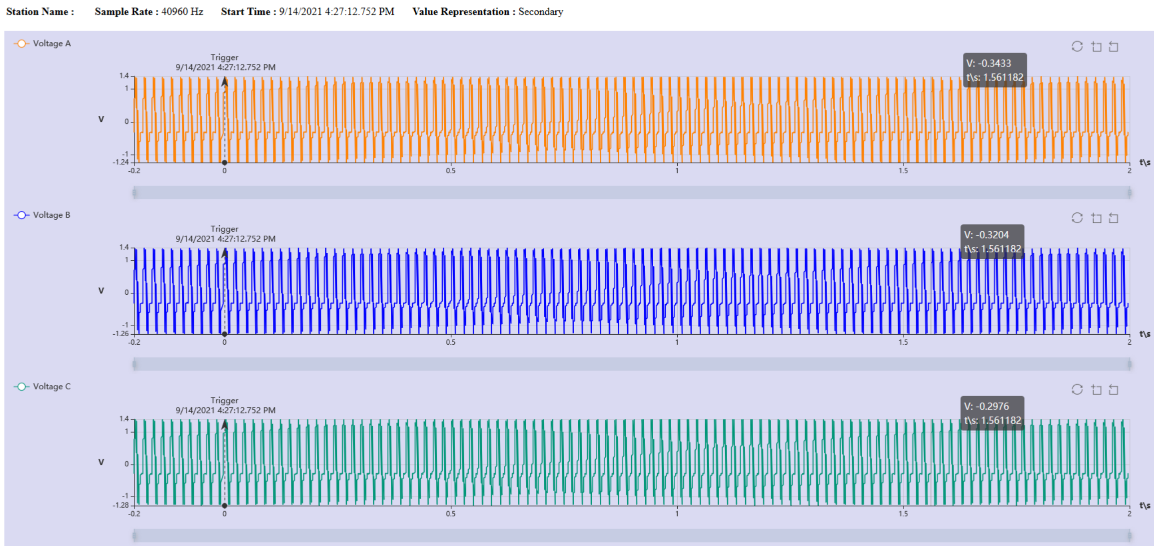
For the configuration of the **Network type**, refer to chapter *2.5.1 Configuration via Web Pages*.

Event Diagram

You can view the voltage-event diagram via the Web browser.

Waveform Diagram

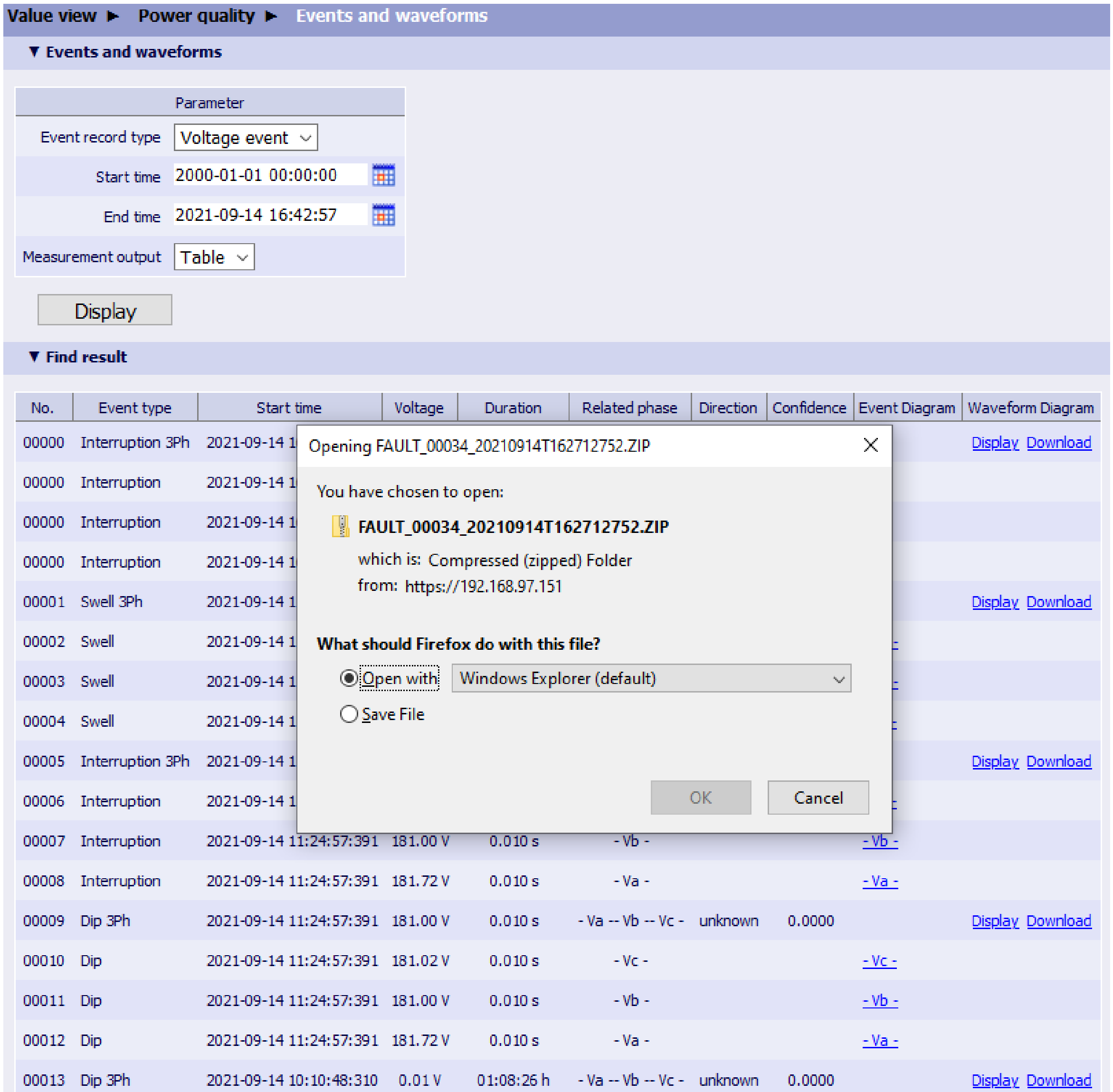
If you select **voltage event** as the voltage trigger, you can view the diagram of the triggered waveform record via the Web browser by clicking **Display**.



[sc_waveform diagram display, 1, --_--]

Figure 6-31 Displaying Waveform Diagram

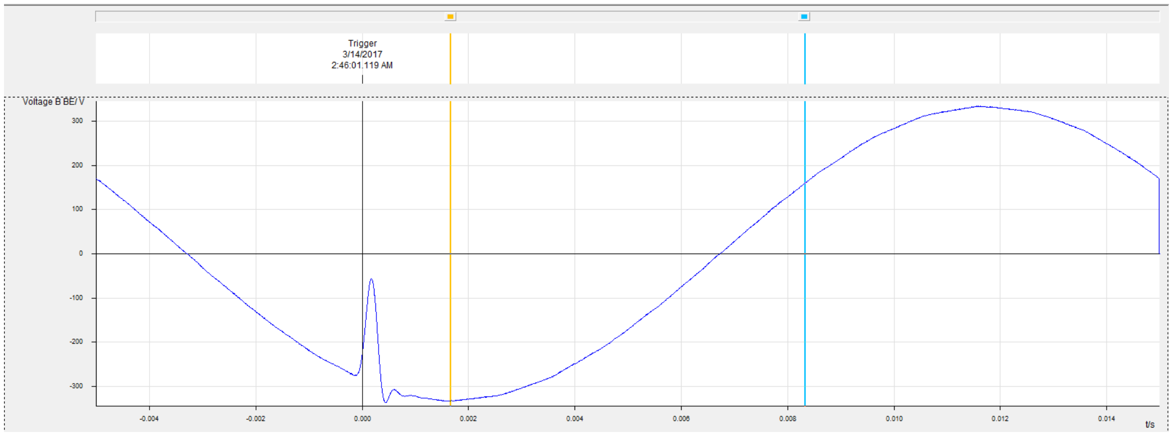
You can also save the waveform diagram by clicking **Download**.



[sc_waveform diagram download, 1, en_US]

Figure 6-32 Downloading Waveform Diagram

To view the downloaded COMTRADE file, open the file with the **ComtradeViewer** or with **SIGRA**



[sc_COMTRADE_waveform, 1, en_US]

Figure 6-33 Channel Waveform

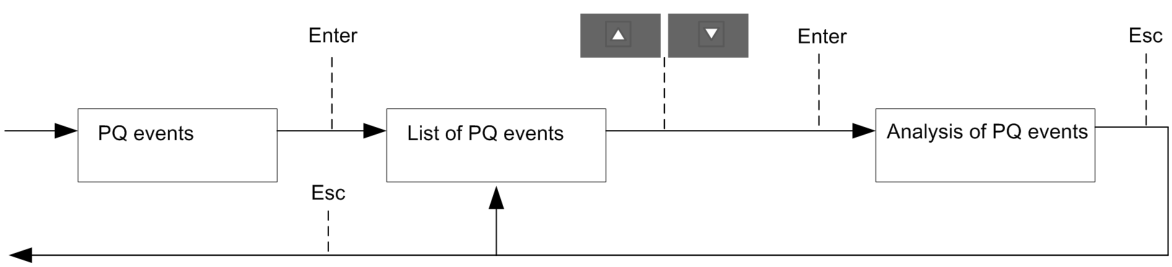
6.4.3 Value View via Display

Submenu Power Quality (PQ) events

In the main menu, select **PQ events**.

NOTE

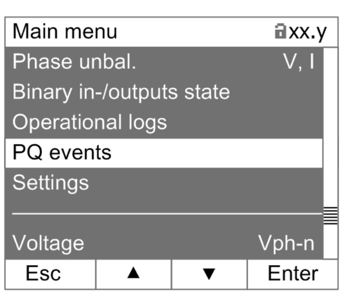
You can query the latest 10 events via HMI screen.



[dw_submenu_voltage_events, 2, en_US]

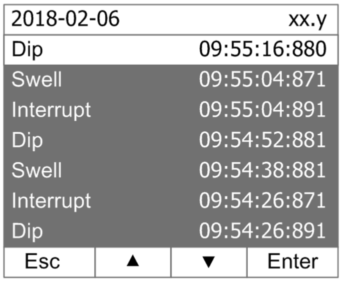
Figure 6-34 Submenu PQ Events

The following interface displays are available:



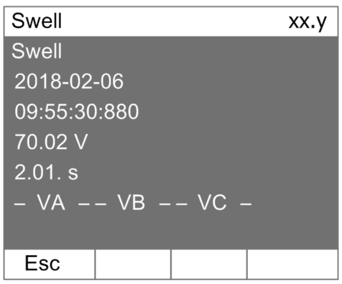
[dw_display_PQ_events, 1, en_US]

Figure 6-35 PQ Events



[dw_display_dip, 1, en_US]

Figure 6-36 List of PQ Events



[dw_display_swell, 1, en_US]

Figure 6-37 Analysis of PQ Events

6.4.4 Clearing of Events

You can clear the following PQ events respectively:

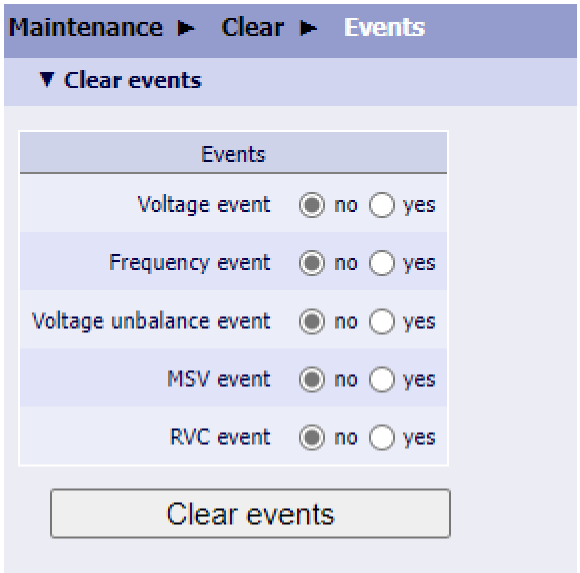
- Voltage event
- Frequency event
- Voltage unbalance event
- MSV event[34]
- RVC event

Clearing the Events

To clear the PQ events in the **Maintenance** tab proceed as follows:

- In the navigation window, click **Events**.

[34] The reset of MSV event is used when the **New MSV event mode** is selected for the source type **indication** in **Binary outputs** (see chapter *Configuration of the Binary Outputs, Page 122*) or in **Group indications** (see chapter *Configuration of the Group Indications, Page 132*.



[sc_Reset PQ events, 5, en_US]

Figure 6-38 Maintenance Tab, Clear Events

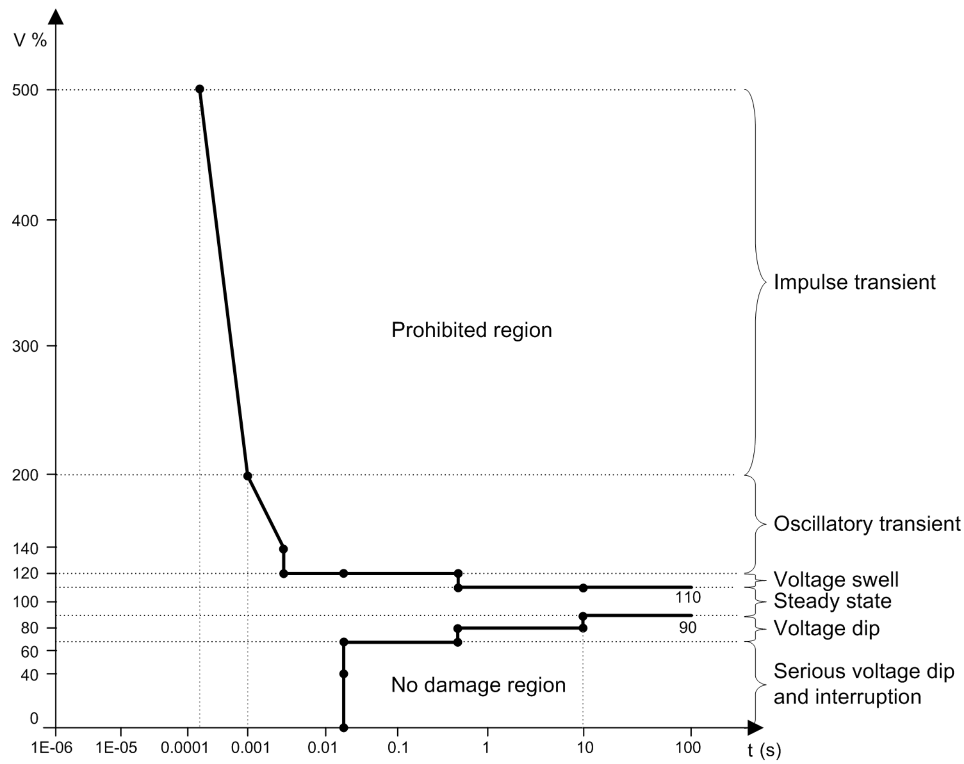
- Select the event type that you want to clear.
- Click **Clear events**.
  The selected events are deleted. The **Action was successful** indication is displayed on the status bar.

6.5 ITI (CBEMA) Curve

6.5.1 Introduction to ITI (CBEMA) Curve

The ITI (CBEMA) curve[35] is published by Technical Committee 3 (TC3) of the Information Technology Industry Council. It is available at *https://www.itic.org*.

The ITI curve (see following figure) describes an AC input voltage envelope. The curve describes steady state and transitory conditions. You find detailed information about ITIC under *https://www.itic.org*.



[dw_ITIC curve, 1, en_US]

Figure 6-39 ITI Curve

6.5.2 Alarm of ITI (CBEMA) Curve Violation

If the detected voltage violates the selected sensitivity curve, an alarm can be triggered and reported. The device first classifies the detected voltage, and then sends the following information and report to a third–party system, such as Desigo CC:

- Alarm information via the Modbus protocol or IEC 61850 protocol
- An alarm file (HTML 5) via the IEC 61850 file transfer

There are 2 Modbus registers and 1 IEC 61850 logical node for the alarm.

You can configure the alarm as a source of the binary output and the LED. For more information of the configuration, refer to *3.3.2 Configuration and Value View via Web Pages* and *3.4.2 Configuration via Web Pages*.

The device supports to evaluate the violation of the **ITI (CBEMA)[36] curve** (Information Technology Industry curve).

For more information on the ITI (CBEMA) curve, refer to *6.5.1 Introduction to ITI (CBEMA) Curve*.

35 ITIC: Information Technology Industry; CBEMA: Computer and Business Equipment Manufacture Association Council

36 ITI, formerly known as the Computer & Business Equipment Manufacturer's Association

6.5.3 Value View via Web Pages

Value View of the ITI (CBEMA) Curve Violation

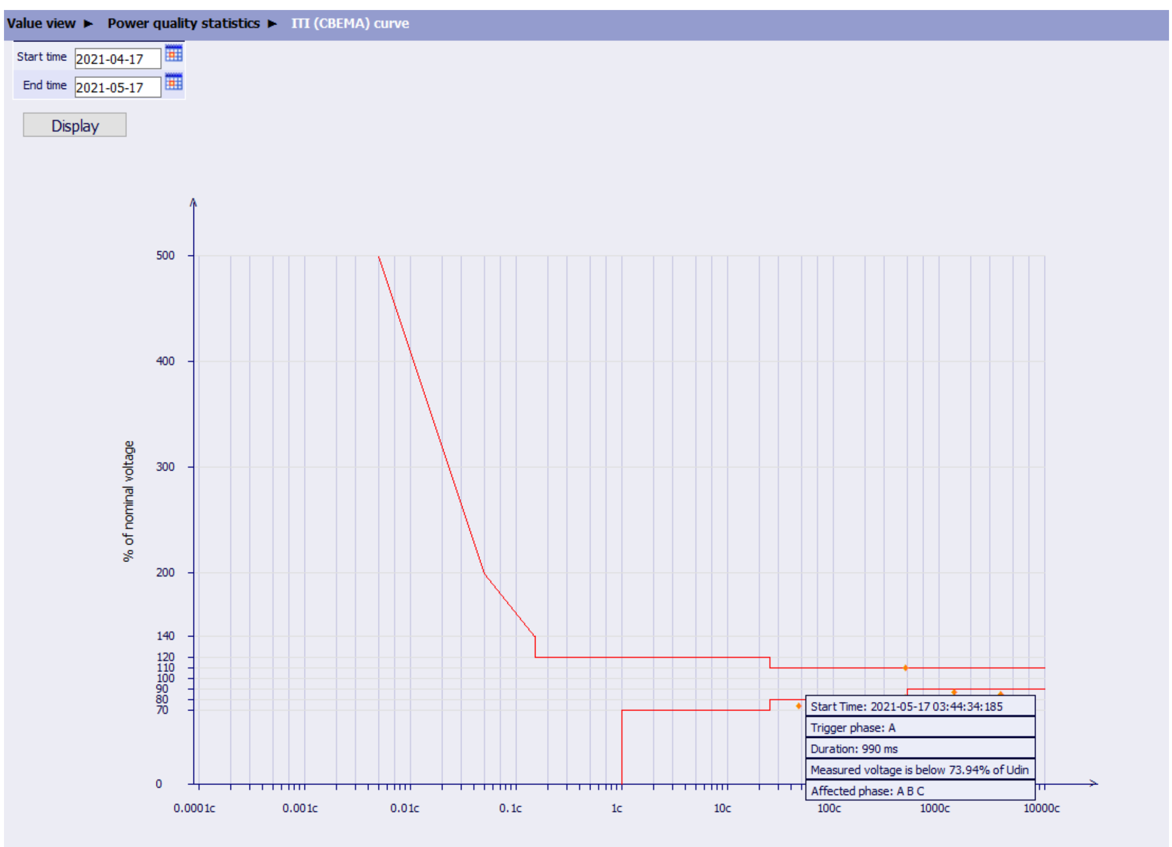
To show the sensitivity curve and the classification of the detected event in the **Value view** tab, proceed as follows:

- In the navigation window, click **ITI (CBEMA) curve**.
- Configure the respective parameters according to the following table.

Table 6-14 Settings for Viewing the ITI (CBEMA) Curve Violation

Parameter	Default Setting	Setting Range
Start time	Current date	You can edit the text box directly or select the start time from the calendar.
End time	Current date	You can edit the text box directly or select the end time from the calendar.

- Click **Display**.
  The blue point refers to the detected event within the curve. The orange point refers to the detected event out of the range of the curve.
  If you move your mouse over the orange point, you can see the detailed information of the event.



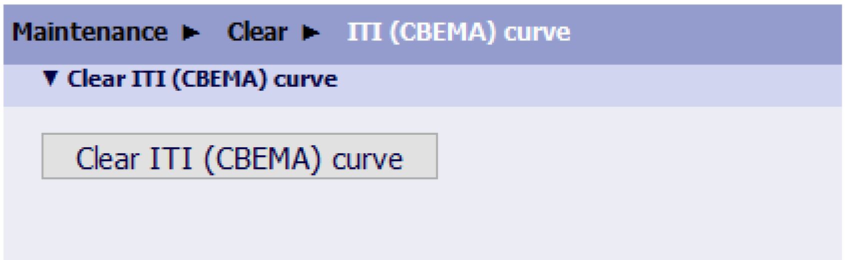
[sc_value_view_ITI(CBEMA) Curve, 1, en_US]

Figure 6-40 Value View Tab, ITI (CBEMA) Curve

6.5.4 Clearing of the ITI (CBEMA) Curve

To clear the ITI (CBEMA) curves in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **ITI (CBEMA) curve**.



[sc_clear ITI (CBEMA)curve, 1, en_US]

Figure 6-41 Maintenance Tab, Clear ITI (CBEMA) Curve

- Click **Clear ITI (CBEMA) curve**.
  The ITI (CBEMA) curves are cleared. The **Action was successful** indication is displayed on the status bar.

6.6 SEMI F47 Curve

6.6.1 Overview

SEMI F47 Specification

SEMI F47 is the specification for the voltage sag immunity of semiconductor processing equipment. The specification sets the minimum voltage sag immunity requirements for equipment used in the semiconductor industry. The immunity is specified in terms of voltage sag depth (in percent of the nominal voltage remaining during the sag) and voltage sag duration (in cycles or seconds). The SEMI F47 specification is available at: *https://www.semi.org/*.

SEMI F47 Curve

The SEMI F47 curve and the 4 zones around it (refer to *Figure 6-42*) indicate the following:

- How many violations of the SEMI F47 curve happened in the past.
- Which violation of the ride-through curve impacts the semiconductor equipment.

The device supports to detect and display the violations of the SEMI F47 curve (dip and interruption events).

6.6.2 Value View via Web Pages

Value View of the SEMI F47 Curve

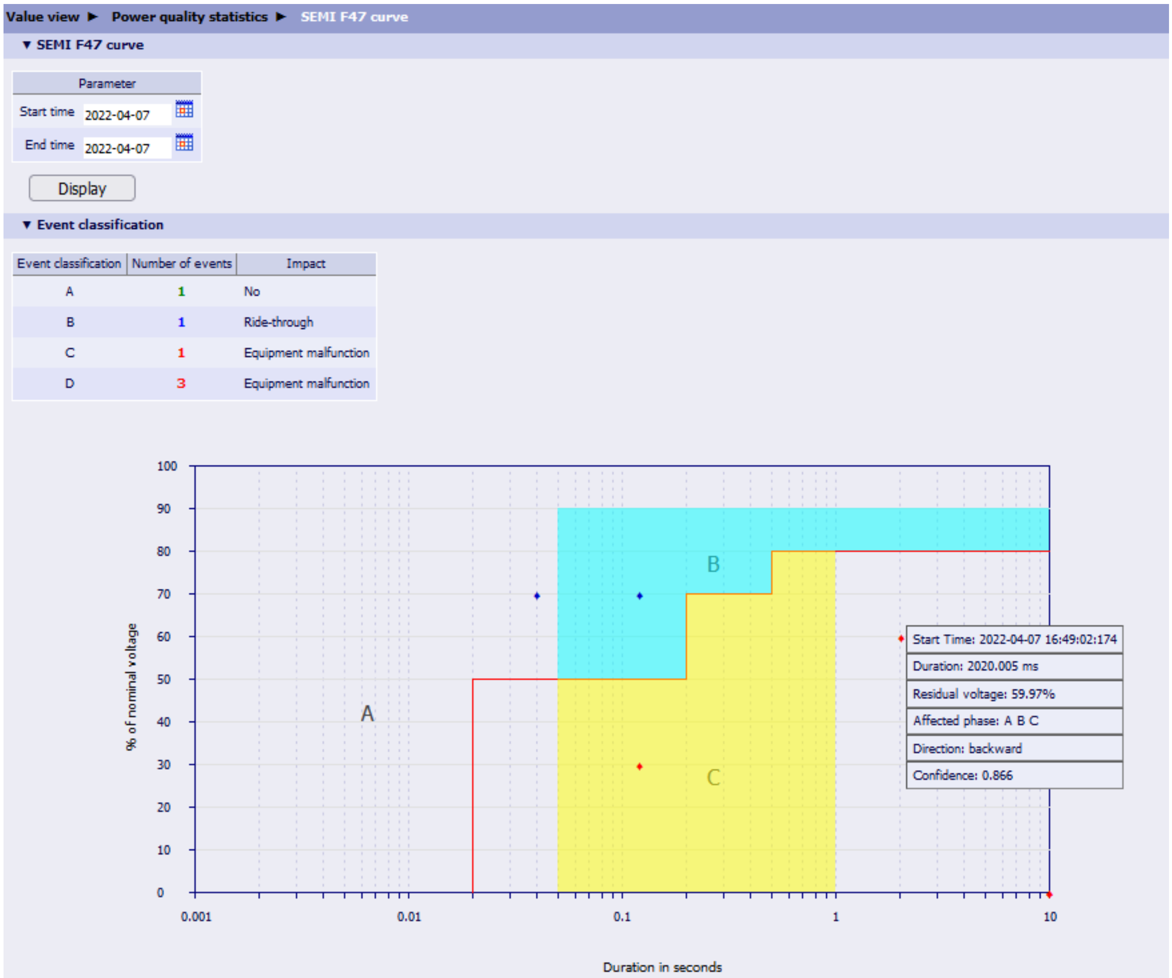
To show the SEMI F47 curve and the 4 zones A, B, C, and D in the **Value view** tab, proceed as follows:

- In the navigation window, click **Power quality statistics** > **SEMI F47 curve**.
- Configure the respective parameters according to the following table.

Table 6-15 Settings for Viewing the Violations of the SEMI F47 Curve

Parameter	Default Setting	Setting Range
Start time	Current date	You can edit the text box directly or select the start time from the calendar.
End time	Current date	You can edit the text box directly or select the end time from the calendar.

- Click **Display**.



[sc_SEMI_F47_curve, 2, en_US]

Figure 6-42 Value View Tab, SEMI F47 Curve

Definitions of the zones A, B, C, and D:

Zone A	Voltage-dip amplitude ≥ 10 % and duration < 0.05 s
Zone B	Voltage-dip amplitude ≥ 10 %, but above the SEMI F47 curve, and duration > 0.05 s
Zone C	Voltage-dip amplitude is below the SEMI F47 curve and the duration is between 0.05 s and 1 s.
Zone D	Voltage-dip amplitude ≥ 20 % and duration > 1 s

The blue points above the SEMI F47 curve refer to the events which are within the SEMI F47 tolerance.
The red points below the SEMI F47 curve refer to the events which are beyond the SEMI F47 tolerance.
If you move your mouse over an event point, you can see the following detailed information of the event:

- Start time
- Duration
- Residual voltage
- Affected phase
- Direction (only for 1P2W, 3P3W_2I, 3P3W_3I, and 3P4W network types)
- Confidence (only for 1P2W, 3P3W_2I, 3P3W_3I, and 3P4W network types)

NOTE

For both 50-Hz and 60-Hz systems, the SEMI F47 curve is the same.

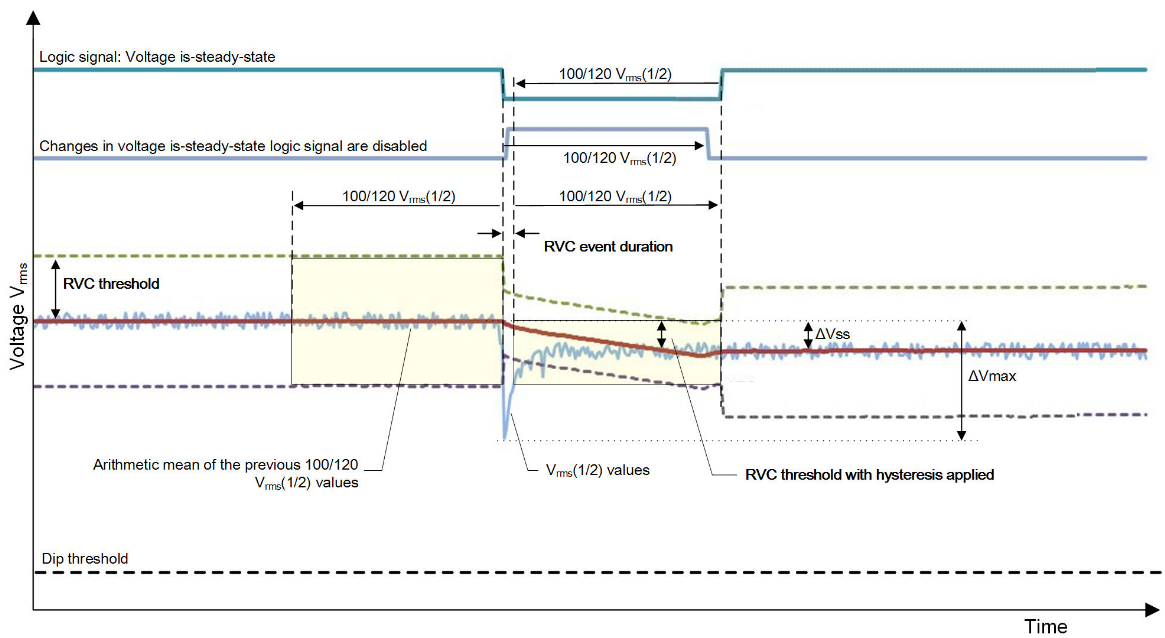
6.7 RVC Events

6.7.1 Function Description

Rapid voltage change (RVC) is a quick transition in RMS voltage occurring between 2 steady-state conditions, and during which the RMS voltage does not exceed the dip/swell threshold. The threshold of RVC detection is from 1 % up to 6 % of Udin.

The following data and values are determined during the evaluation of the rapid voltage change in the device and listed in the dialog **Rapid Voltage Change**:

- RVC event start time
- RVC event duration
- ΔVmax
- ΔVss
- Affected phase (a, b, c, ab, bc, ca)



[dw_RVC function, 2, en_US]

Figure 6-43 Rapid Voltage Change (Dip Threshold)

NOTE

$V_{rms}(1/2)$:

RMS voltage refreshed every half-cycle according to IEC 61000-4-30 Ed. 3.

100/120 $V_{rms}(1/2)$ values:

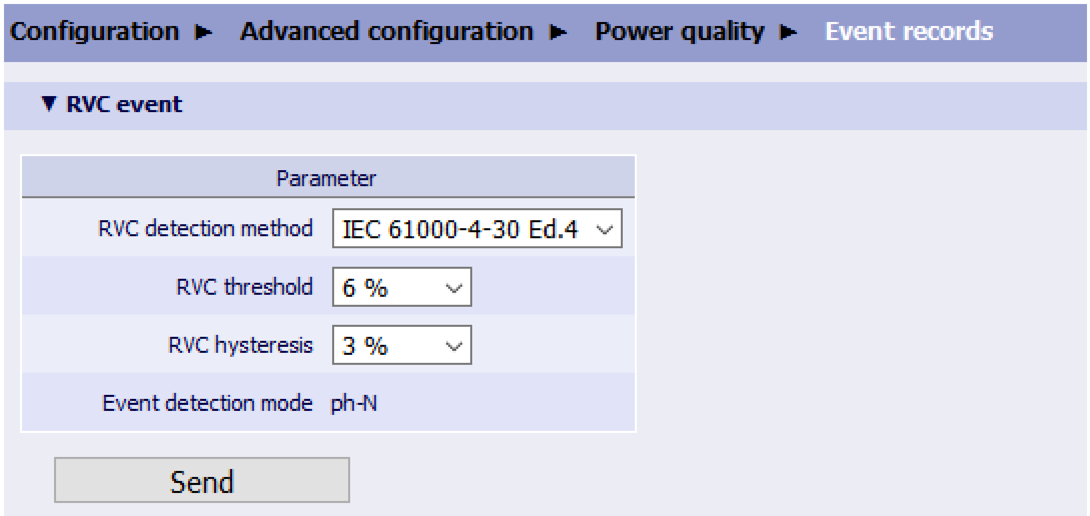
100 values for 50 Hz rated, or 120 values for 60 Hz rated.

6.7.2 Configuration and Value View via Web Pages

Configuration of the Rapid Voltage Change (RVC)

To change the RVC settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Event records**.



[sc_Config RVC, 3, en_US]

Figure 6-44 Configuration Tab, RVC Event

- Configure the respective parameters according to the following table.

Table 6-16 Settings for RVC Events

Parameter	Default Settings	Setting Range
RVC detection method	IEC 61000-4-30 Ed.4	IEC 61000-4-30 Ed.3 IEC 61000-4-30 Ed.4
RVC threshold	6 %	1 %, 2 %, 3 %, 4 %, 5 %, 6 %
RVC hysteresis[37]	3 %	0.5 %, 1 %, 1.5 %, 2 %, 2.5 %, 3 %
Event detection mode	ph-N	Not settable RVC event detection mode will always be synchronized with the setting **Event detection mode**.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of the RVC Events

To display the values of the RVC events in the **Value view** tab, proceed as follows:

- In the navigation window, click **Events**.
- Configure the respective parameters in the list boxes according to the following table:

37 According to IEC 61000-4-30 Ed.3, RVC hysteresis is recommended to be half of the threshold.

Table 6-17 Settings for Viewing the RVC Events

Parameter	Default Setting	Setting Options
Event record type	RVC event	Voltage event **RVC event** Frequency event Voltage unbalance event
Start time	2000-01-01 00:00:00	You can edit the text box directly or select the start time from the calendar.
End time	Current date/time	You can edit the text box directly or select the start time from the calendar.
Measurement output	Table	Table CSV

- Select one of the following **Measurement output** options:
  - **Table**
    If you select **Table**, click **Display**.
    The determined results are displayed in a table. In the multi-page tables, you can show the forward and backward pages with the **>>** and **<<** buttons. If you want to view a certain page, enter the page number at the bottom and click **show**.
  - **CSV**
    If you select **CSV**, click **Download**.
    The measured values are downloaded as a CSV file and are exported to the storage location you selected.

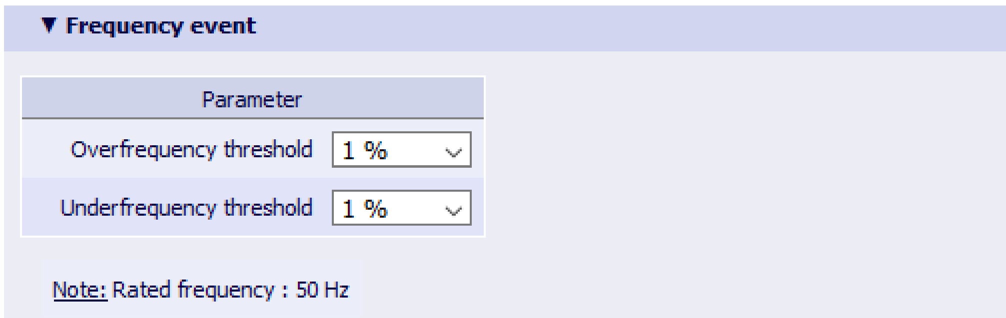
6.7.3 Clearing of RVC Events

Refer to chapter *6.4.4 Clearing of Events*.

6.8 Frequency Events

6.8.1 Configuration and Value View via Web Pages

Configuring the Frequency Events



[sc_Param frequency events, 2, en_US]

Figure 6-45 Configuration Tab, Frequency Events

To change the frequency event settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Event records**
- Configure the respective parameters according to the following table.

Table 6-18 Settings for Frequency Events

Parameter	Default Setting	Setting Range
Underfrequency threshold	1 %	0.1 % to 1.0 %, increments of 0.1 % 1.0 % to 5.0 %, increments of 1.0 %
Overfrequency threshold	1 %	0.1 % to 1.0 %, increments of 0.1 % 1.0 % to 5.0 %, increments of 1.0 %

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value view of the Frequency Events

To display the frequency event values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Events**.
- Configure the respective parameters according to the following table.

Table 6-19 Settings for Viewing the Frequency Events

Parameter	Default Setting	Setting Range
Event record type	Frequency event	Voltage event RVC event **Frequency event** Voltage unbalance event
Start time	2000-01-01 00:00:00	You can edit the text box directly or select the start time from the calendar.

Parameter	Default Setting	Setting Range
End time	Current date/time	You can edit the text box directly or select the end time from the calendar.
Measurement output	Table	Table CSV

- Select one of the following **Measurement output** options:
  - **Table**

    If you select **Table**, click **Display**.

    The determined results are displayed in a table. In the multi-page tables, you can show the forward and backward pages with the **>>** and **<<** buttons. If you want to view a certain page, enter the page number at the bottom and click **show**.
  - **CSV**

    If you select **CSV**, click **Download**.

    The measured values are downloaded as a CSV file and are exported to the storage location you selected.

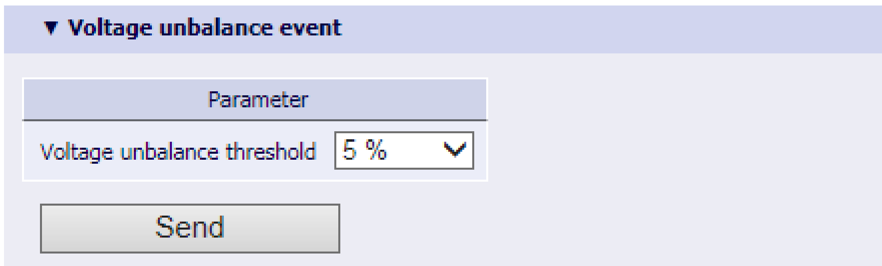
6.8.2 Clearing of Frequency Events

Refer to chapter *6.4.4 Clearing of Events*.

6.9 Voltage-Unbalance Events

6.9.1 Configuration and Value View via Web Pages

Configuring the Voltage-Unbalance Events



[sc_Param unbal events, 1, en_US]

Figure 6-46 Configuration Tab, Voltage Unbalance Events

To change the voltage unbalance event setting in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Event records**.

Table 6-20 Settings for Voltage-Unbalance Events

Parameter	Default Setting	Setting Range
Voltage unbalance threshold	5 %	1 % to 5 %, increments of 1 %

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of the Voltage-Unbalance Events

To display the voltage-unbalance events in the **Value view** tab, proceed as follows:

- In the navigation window, click **Events**.
- Configure the respective parameters in the list boxes according to the following table.

Table 6-21 Settings for Viewing the Voltage-Unbalance Events

Parameter	Default Setting	Setting Range
Event record type	Voltage unbalance event	Voltage event Frequency event **Voltage unbalance event** RVC event
Start time	2000-01-01 00:00:00	Any with calendar function Time format: depends on date/time format config.
End time	Current date/time	
Measurement output	Table	Table CSV

- Click **Display**.

  The detailed results are displayed in a **Find result** table. In multi-paged tables, you can navigate forward and back in the pages using the **>>** and **<<** buttons.

6.9.2 Clearing of Voltage-Unbalance Events

Refer to chapter *6.4.4 Clearing of Events*.

6.10 Waveform Records

6.10.1 Function Description

When a trigger function is activated, a waveform recorder records the following values:

- Voltages
- Currents
- Binary inputs

The following table shows all trigger sources of the waveform recorder, as well as the corresponding measurement time base and trigger conditions.

Table 6-22 Triggers of the Waveform Recorder

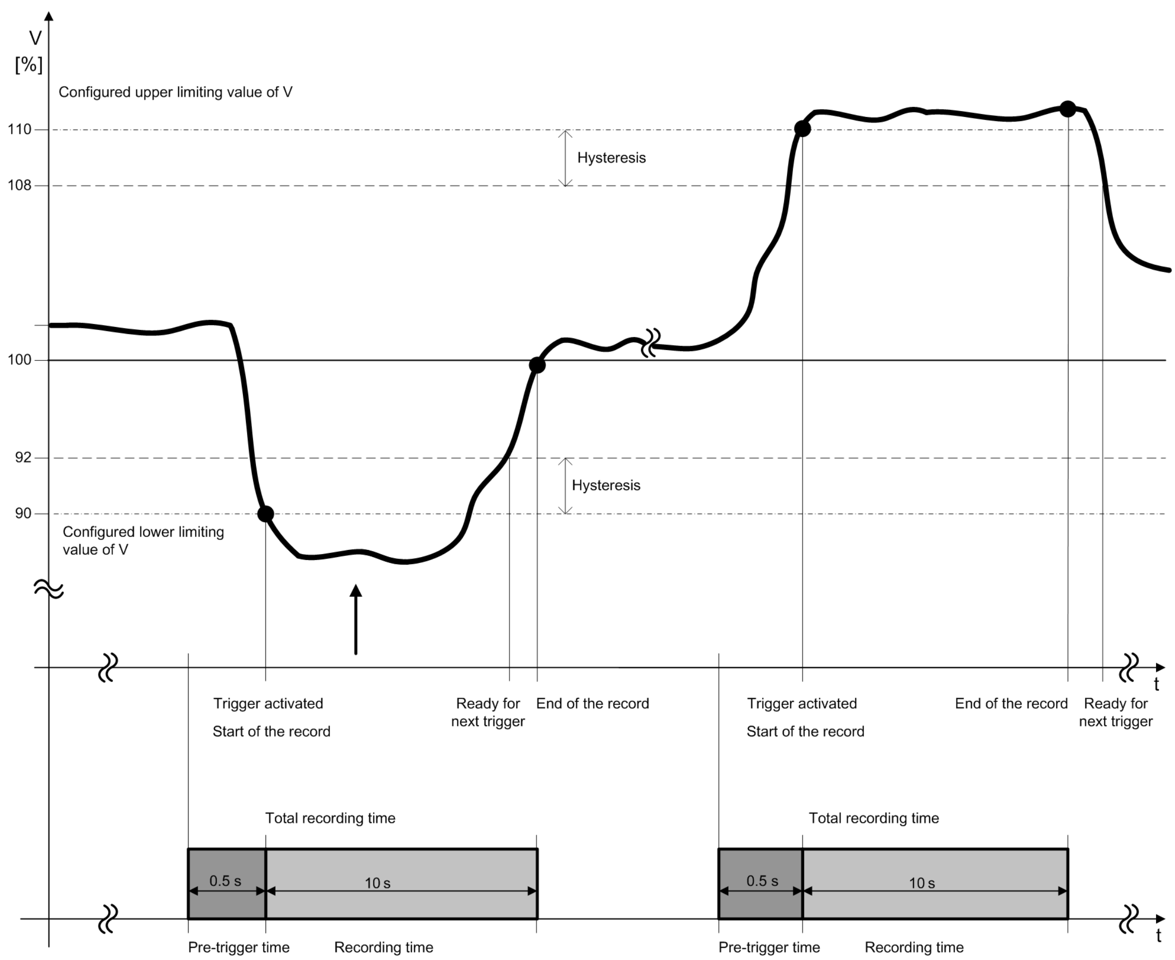
<table>
<tr><th>Trigger Source</th><th>Measurement Time Base</th><th>Trigger Conditions</th></tr>
<tr><td>Voltage trigger</td><td>1/2 cycle</td><td>The trigger starts if one of the following conditions is met:
• The measured value > the upper threshold
• The measured value < the lower threshold
• A voltage event occurs.</td></tr>
<tr><td>Current trigger</td><td>1/2 cycle</td><td>The trigger starts if one of the following conditions is met:
• The measured value > the upper threshold
• The measured value < the lower threshold</td></tr>
<tr><td>Binary trigger
• Binary input
• Remote indication
• Group indication</td><td>2 ms</td><td>The status of the selected trigger source changes to the set trigger value.</td></tr>
<tr><td>Transient cross trigger</td><td>Samples with sampling rate 1.024 MHz</td><td>The transient measurement and the cross trigger are both activated at the menu Transient recorder (see chapter 6.14.2 Configuration and Value View via Web Pages).</td></tr>
<tr><td>Zero-sequence component voltage trigger</td><td rowspan="3">10 cycles (at 50 Hz)
12 cycles (at 60 Hz)</td><td rowspan="2">The measured value > the threshold</td></tr>
<tr><td>Zero-sequence component current trigger</td></tr>
<tr><td>Frequency trigger</td><td>• Frequency > the upper threshold or
• Frequency < the lower threshold</td></tr>
<tr><td>Manual trigger</td><td>N/A</td><td>Click the button Trigger manually.</td></tr>
<tr><td>Cyclic trigger</td><td>N/A</td><td>If you set a trigger time, the waveform recorder is triggered at that time every day.</td></tr>
</table>

A group indication must consist of binary inputs with the logic **OR** and the source must not be inverted. If the **Trigger value** parameter is set to **ON**, the status change of any binary input from **OFF** to **ON** can activate the trigger. In this case, the status of the group indication only changes at the first time and keeps **ON** after that until all binary inputs change to **OFF**. A group indication is not available at **Trigger source** parameter by default. It is only available in the setting options after you configure the group indication under the menu **Select automation functions** (see chapter *4.2.1 Function Description*).

You can parameterize the trigger sources and switch them on/off separately. If the trigger is switched off, recording cannot be initiated.

Finishing of the waveform recording depends on the configured recording duration. The waveform record is written to the SD card for subsequent evaluation.

The nominal sampling rate for the waveform recorder is 40 960 samples per second, that is approximately 819 samples per cycle for the 50-Hz system.



[dw_Waveform_example, 3, en_US]

Figure 6-47 Example of Waveform Recording

Total recording time = Pretrigger time + Recording time

The following table shows which measured quantities can be recorded in COMTRADE files when a corresponding trigger function is activated.

Table 6-23 Recording and Evaluation

Recorder Routing	Measured Quantities	COMTRADE
Voltage[38]	Va	x
	Vb	x
	Vc	x
	Vab	x
	Vbc	x
	Vca	x
	V_N	x
Current[39]	Ia	x
	Ib	x
	Ic	x
	I_N/I_4	x
Binary input[40]	Binary Input 1-S	x
	Binary Input 2-S	x
	Binary Input 3-S	x
	Binary Input 1-R	x
	Binary Input 2-R	x
	Binary Input 3-R	x
Frequency	10/12 cycle frequency RMS value	x

The frequency channel records the RMS value, the binary-input channel records the status value, and other analog channels record sampled values.

For more information on the **Configuration**, refer to the chapter *6.10.2 Configuration and Value View via Web Pages*.

NOTE

The BI record available in COMTRADE files only when the device has a binary input, which depends on the MLFB selected.

6.10.2 Configuration and Value View via Web Pages

Configuration of the Waveform Records

To configure the settings of the waveform records in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Waveform records**.

38 For the 4-wire, 3-phase network type, the phase-to-phase or phase-to-neutral voltage channels are recorded depending on the selection of power quality values (Udin) in AC measurement configuration.

39 Current channels can be recorded when the current trigger is activated.

40 It is mandatorily recorded in COMTRADE files.

[sc_Waveform_configuration, 4, en_US]

Figure 6-48 Configuration Tab, Waveform Records, Part 1

[sc_Waveform_configuration_part2, 2, en_US]

Figure 6-49 Configuration Tab, Waveform Records, Part 2

- Configure the respective parameters according to the following table.

Table 6-24 Settings for Waveform Records

Parameter	Default Setting	Setting Range
Voltage trigger[41]		
Trigger active	voltage event	no user-defined voltage event
The following parameters are available when **Trigger active** is set to **User-defined**.		
Tolerance unit	Percentage	Percentage Numerical

41 You must follow the setting rules as below: Upper threshold > lower threshold and (upper threshold - lower threshold) > 2 * hysteresis

Parameter	Default Setting	Setting Range
Trigger by ph-N[42]	yes	no yes
Upper threshold	110.00 % of the primary nominal voltage	100.00 % to 200.00 % of the primary nominal voltage 1 to 2 times the primary nominal voltage[43]
Lower threshold	90.00 % of the primary nominal voltage	0.00 % to 99.99 % of the primary nominal voltage 0.00 V to the primary nominal voltage[43]
Hysteresis	2.00 % of the primary nominal voltage	0.00 % to 50.00 % of the primary nominal voltage
Trigger by ph-ph[42]	yes	no yes
Upper threshold[44]	110.00 % of the primary voltage	100.00 % to 200.00 % of the primary voltage 1 to 2 times the primary voltage[43]
Lower threshold[44]	90.00 % of the primary voltage	0.00 % to 99.99 % of the primary voltage 0.00 V to the primary voltage[43]
Hysteresis[44]	2.00 % of the primary voltage	0.00 % to 50.00 % of the primary voltage
Current trigger limits[41]		
Trigger active	no	no yes
Tolerance unit	Percentage	Percentage Numerical
Upper threshold	120.00 % of the rated current In	5.00 % to 200.00 % of the rated current In (0.05 × In) A[45] to 1 000 000.00 A[43]
Lower threshold	0.00 % of the rated current In	0.00 % to 100.00 % of the rated current In 0.00 A to 1 000 000.00 A[43]
Hysteresis	2.00 % of the rated current In	0.00 % to 50.00 % of the rated current In 0.00 A to 500 000.00 A
Configuration binary trigger		
Trigger active	no	no yes

42 This parameter is only available when the connection type is **4-wire, 3-phase, unbalanced**.

43 When **Tolerance unit** is selected as **numerical**, the threshold is in number.

44 This parameter is only available when the connection type is **4-wire, 3-phase, unbalanced**, and the **Trigger by ph-ph** is activated.

45 **In** is equal to 5 A in case of no CT; otherwise, **In** is the primary rated CT current.

Parameter	Default Setting	Setting Range
Trigger source	Binary input 1-S	Indication 1 from Remote Indication 2 from Remote Binary Input 1-S Binary Input 2-S Binary Input 3-S Binary Input 1-R Binary Input 2-R Binary Input 3-R Group Indication 1 Group Indication 2 Group Indication 3 Group Indication 4
Note: By default the option for group indications is not available for the parameter **Trigger source**. It is only available in the list after you configure the group indication in the menu **Select automation functions**. For more information, see *4.2.1 Function Description*. For the configuration of group indications used to trigger the waveform recorder, see *Rule for Linking Binary Inputs to a Group Indication, Page 132*.		
Trigger value	Off	Off On
Zero-sequence component voltage trigger limits		
Trigger active	no	no yes
Threshold	5 %	0.5 % to 10 %
Zero-sequence component current trigger limits		
Trigger active	no	no yes
Threshold	5 %	0.5 % to 10 %
Frequency trigger limits		
Trigger active	no	no yes
Upper threshold	50.50 Hz[46]	50 Hz to 55 Hz[46]
	60.60 Hz[47]	60 Hz to 66 Hz[47]
Lower threshold	49.50 Hz[46]	45 Hz to 50 Hz[46]
	59.40 Hz[47]	54 Hz to 60 Hz[47]
Note: The default setting and setting options of the frequency trigger limits automatically adapt to the network rated frequency range which is configured at **AC measurement**.		
Manual trigger		
Trigger active	no	no yes
Action	Trigger	If you set the **Trigger active** parameter to **yes**, the button **Trigger** is enabled.
Cyclic trigger		
Trigger active	no	no yes
Trigger time	00:00:00	You can edit the text box directly or select the trigger time from the calendar.

46 The rated frequency of the network set under the menu **AC measurement** is 50 Hz.

47 The rated frequency of the network set under the menu **AC measurement** is 60 Hz.

Parameter	Default Setting	Setting Range
Recorder routing		
Voltage	yes	Not settable The channels of voltage are mandatorily recorded in COMTRADE files.
Current	yes	no yes
Binary inputs	yes	no yes
Frequency	no	no yes
Waveform capture setting		
Pretrigger time	0.2 s	0.1 s to 0.5 s Increments of 0.1 s
Recording time	2.0 s	0.5 s to 10.0 s Increments of 0.5 s

The total recording time is the sum of the Pretrigger time and the Recording time, and cannot be changed.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Error Information

If the set value is out of the range, a red error message **Note: Please consider the setting ranges!** appears and the value changes back to the default setting.

If the set values do not follow the setting rules, a red error message **Note: Consider setting rules: 'upper threshold > lower threshold' and (upper threshold - lower threshold) > 2 * hysteresis** appears and the value changes back to the previous setting.

Value View of the Waveform Records

To view and download the waveform records triggered by the voltage event, refer to *Waveform Diagram, Page 198*.

You cannot view the waveform records triggered by the other sources via the Web browser, but you can download them. For more information, refer to chapter *7.3 File Download*.

During the download progress, the selected files are stored by the browser. You can use the software SIGRA to display the transmitted record data. For more information on SIGRA, contact the Siemens Hotline.

6.10.3 Clearing of Waveform Records

To clear waveform records, refer to chapter *7.2 Clearing of Data*.

You cannot clear MSV records alone.

6.11 Measurement Records

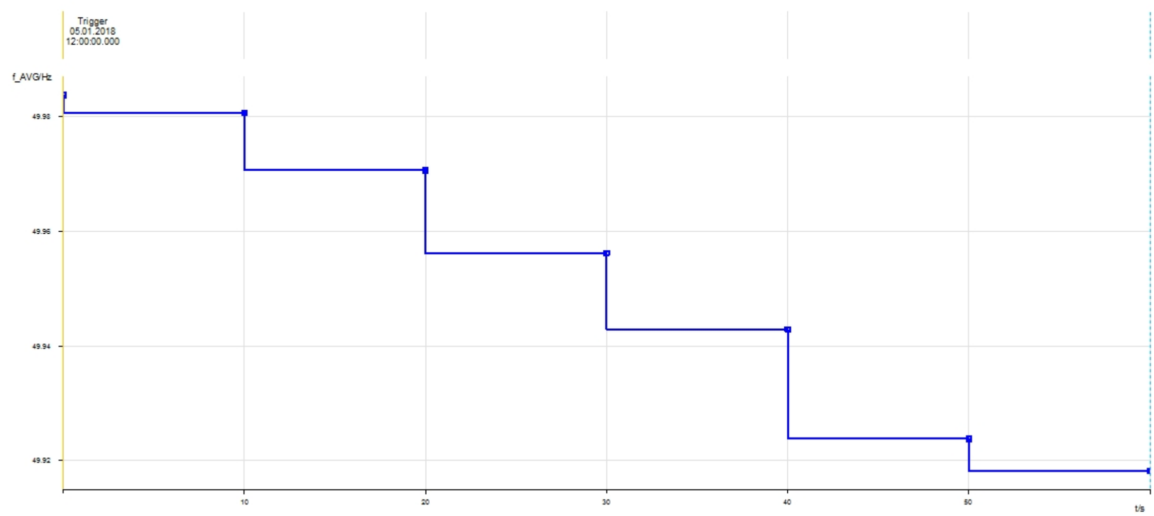
6.11.1 Function Description

The measurement recorder continuously records average values and for some parameters also minimum and maximum values over parameterized periods. The average values are calculated according to IEC 61000-4-30 Edition 3.0. The power quality evaluation is according to EN 50160 (for examples voltage magnitude, 10 second frequency).

Additionally, non-power quality data are recorded, for example:

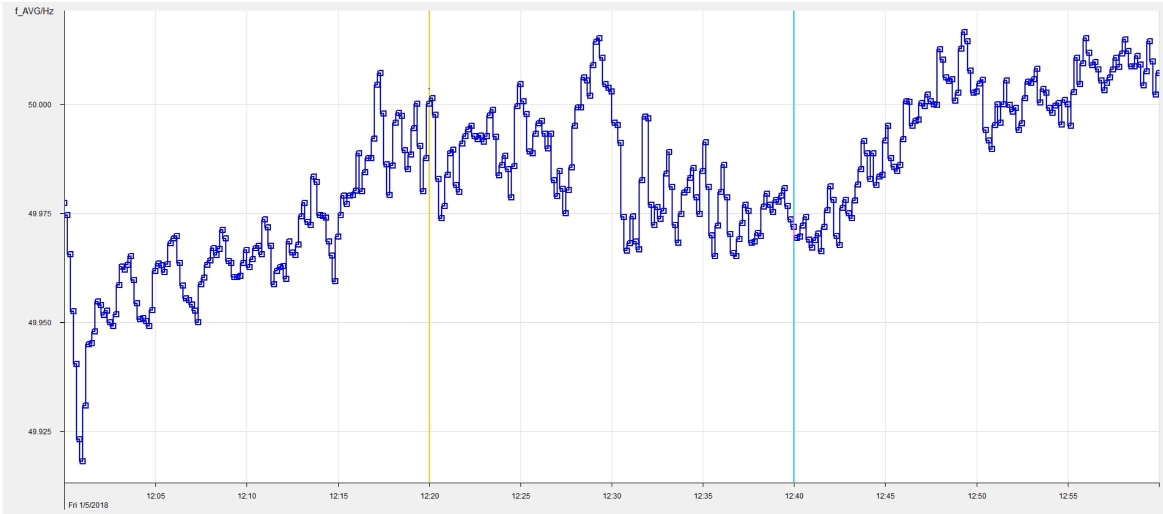
- Power
- Power factor
- Angles
- Energy

In the configuration, you can select the aggregation interval and the file-generation interval. The files are recorded in the device and are available for download as PQDIF for transmission via IEC 61850.



[sc_freq_meas_2min, 1, en_US]

Figure 6-50 Example 1 for Measurement Records, Frequency Measurement of 10 Seconds, and Record Duration of 1 Minute



[sc_freq_meas_20min, 1, en_US]

Figure 6-51 Example 2 for Measurement Records, Frequency Measurement of 10 Seconds, and Record Duration of 1 Hour

Recording and Evaluation of the Measured Quantities

NOTE

The voltage is recorded in the following network types:

- 1-phase network
- 3P4W (3 phases/4 wires): phase-to-phase voltage or phase-to-neutral voltage
- 3P3W (3 phases/3 wires): only phase-to-phase voltage

Table 6-25 Recording and Evaluation of the Measured Quantities

Measured Quantities	AVG	Max. Value	Min. Value
	PQDIF, CSV[48]		
Frequency			
10 s freq (fixed 10 s freq.)	x[49]	–	–
f (system frequency based on 10/12 cycles)	x	x	x
f (system frequency based on 10 s)	x	x	x
Voltage (measurement intervals 1 min, 10 min)			
Va	x	x	x
Vb	x	x	x
Vc	x	x	x
V_N	x	x	x
Vavg	x	–	–
Vab	x	x	x
Vbc	x	x	x

48 CSV files can be generated on HTML pages only after a request from the user.

49 According to IEC 61000-4-30, the frequency is permanently defined with 10 s mean-value recording.

Measured Quantities	AVG	Max. Value	Min. Value
	PQDIF, CSV[48]		
Vca	x	x	x
Current			
Ia	x	x	x
Ib	x	x	x
Ic	x	x	x
I_N[50]	x	x	x
I_4[50]	x	x	x
Iavg	x	–	–
Active Power			
Pa	x	x	x
Pb	x	x	x
Pc	x	x	x
P	x	x	x
Reactive Power			
Qa	x	x	x
Qb	x	x	x
Qc	x	x	x
Q	x	x	x
Apparent Power			
Sa	x	x	x
Sb	x	x	x
Sc	x	x	x
S	x	x	x
Active Power Factor			
cos φ(a)	x	x	x
cos φ(b)	x	x	x
cos φ(c)	x	x	x
cos φ	x	x	x
Power Factor			
PFa	x	x	x
PFb	x	x	x
PFc	x	x	x
PF	x	x	x
Phase Angle			
φUIa	x	x	x
φUIb	x	x	x
φUIc	x	x	x
φUI	x	x	x
φab V	x	–	–
φbc V	x	–	–
φca V	x	–	–
φab I	x	–	–

48 CSV files can be generated on HTML pages only after a request from the user.

50 Depending on the configuration for **AC Measurement**, the 4th physical current input can be used as I_N, I_4, or can be selected as **not connected**.

Measured Quantities	AVG	Max. Value	Min. Value
	PQDIF, CSV[48]		
φbc I	x	–	–
φca I	x	–	–
Unbalance			
Neg.seq.comp.V	x	x	x
Zero seq.comp.V	x	x	x
Neg.seq.comp.I	x	x	x
Zero seq.comp.I	x	x	x
Power Reactive Fundamental			
Q1a	x	x	x
Q1b	x	x	x
Q1c	x	x	x
Q1	x	x	x
Further Measured Quantities			
Flicker	See chapter *6.2 Flicker*		
Energy[51]	See chapter *5 Energy Management*		
Harmonics	See chapter *6.1 Harmonics, Interharmonics, Phase Angles of the Harmonics*		
Emissions	See chapter *6.1.2 Function Description Emissions*		
Mains signaling voltage	See chapter *6.13 Mains Signaling Voltage (MSV)*		

- Interfaces: protocols IEC 61850 (PQDIF depending on the measuring interval) and Modbus TCP

Intervals of Aggregation Data and PQDIF Files

The intervals of aggregation data are defined according to the parameter **Aggregation interval**. The intervals of PQDIF files are defined according to the parameter **File generation interval**.

Table 6-26 PQDIF File Interval (Measurement Records)

Aggregation Interval	File Generation Interval	Start Time of Recording of a Complete PQDIF File
1 min	2 h	00:00 h 02:00 h 04.00 h .... 20:00 h 22:00 h
10 min	2 h, 24 h	None

6.11.2 Configuration and Value View via Web Pages

Parameterization of Measurement Records

To change the parameters of the measurement recorder in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Measurement records**.

48 CSV files can be generated on HTML pages only after a request from the user.

51 The energy values in the following 5 channels are recorded: active energy demand, active energy supply, reactive energy import, reactive energy export, and apparent energy.

[sc_measurement_configuration, 6, en_US]

Figure 6-52 Configuration Tab, Measurement Records

- Select a template

  The **Measurement records** provides 2 templates:

  – **IEC 61000-4-30 Ed. 3**

    In this template, fixed aggregation data are selected.

  – **All measurement**

    In this template, all aggregation data are selected.

- Configure the respective parameters according to the following table.

Table 6-27 Settings for Measurement Records

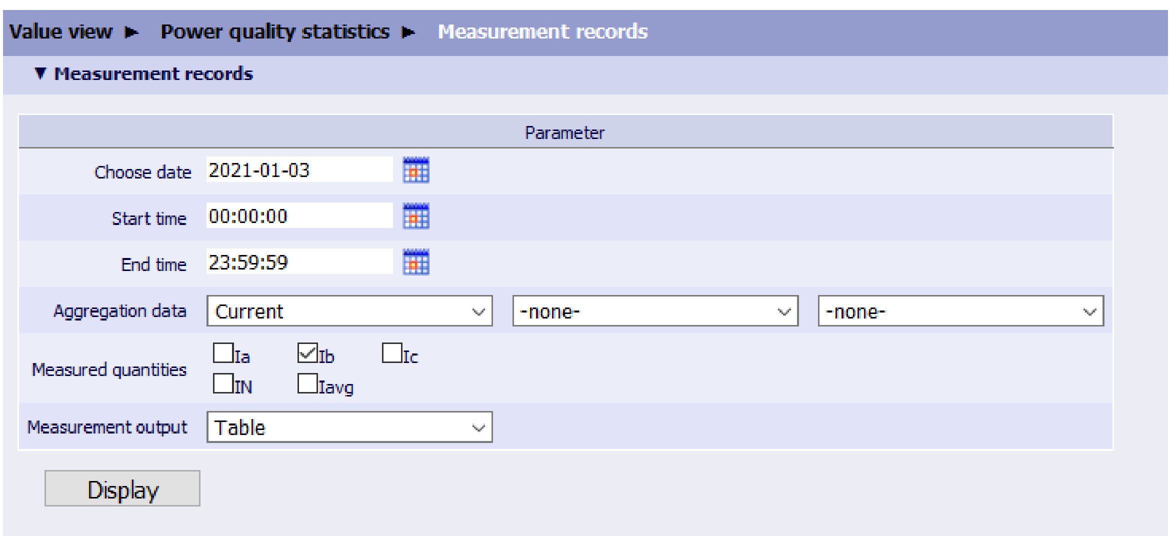
Parameter	Default Setting	Setting Range
Template	IEC 61000-4-30	IEC 61000-4-30 Ed. 3 All measurement
Aggregation interval[52]	10 min	1 min, 10 min
Energy recorder active	no	no, yes[53]
File generation interval[54]	24 h	2 h, 24 h

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Evaluation of Measurement Records

To display the **Measurement records** values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Measurement records**.
- Configure the respective parameters in the list boxes according to the following tables.



[sc_measurement_evalu, 2, en_US]

Figure 6-53 Value View Tab, Measurement Records: **Measurement Output** with **Table**, **CSV**, or **Diagram (1 day)**

52 For short-term flicker, the aggregation interval is fixed to 10 min; for long-term flicker, the aggregation interval is fixed to 2 h; for **10-s frequency**, the aggregation interval is fixed to 10 s.

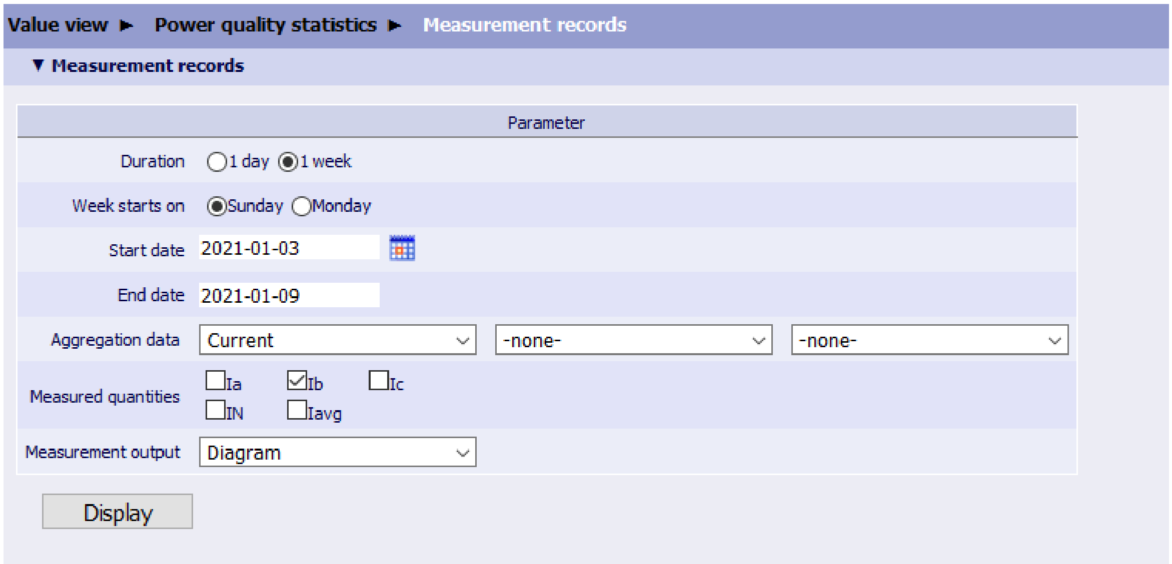
53 After you select **yes**, the energy value interval will show on the underside. The energy value interval is the same as the configured interval of **Energy freeze and reset**.

54 For 1-min aggregation, the file generate interval is fixed to 2 h; for other aggregations, the file generate interval is optional.

Table 6-28 Settings for Value View of the Measurement Records: Measurement Output with Table or CSV

Parameter	Default Setting	Setting Options
Choose date	Current date	You can edit the text box directly or select the date from the calendar.
Start time	00:00:00	You can edit the text box directly or select the start time from the calendar.
End time	23:59:59	You can edit the text box directly or select the end time from the calendar.
Aggregation data	10 second frequency	10 second frequency Short-term flicker Long-term flicker Frequency Voltage Current Power Power factor Phase angles Unbalance THDS Voltage harmonic odd Voltage harmonic even Harmonic current odd Harmonic current even Voltage Interharmonics Interharmonic currents Power Reactive Fundamental Emissions (2-9)kHz Emissions (9-150)kHz
Measured quantities	None	The selectable **Measured quantities** depend on the selected **Aggregation data**. You can select at most 3 channels from the **Measured quantities**.
Measurement output	Table	Table Diagram[55] CSV

55 The diagram displays the primary value only.



[sc_measurement config_diagram 1 week, 2, en_US]

Figure 6-54 Value View Tab, Measurement Records: **Measurement Output** with **Diagram (1 week)**

Table 6-29 Settings for Value View of the Measurement Records: Measurement Output with Diagram

Parameter	Default Setting	Setting Options
Duration	1 day[56]	1 day 1 week
Week starts on	Sunday	Sunday Monday
Start date	Sunday of the device local week	You can select the date from the calendar. **Start date** automatically changes to the first day of the week. If you select **Sunday** at **Week starts on**, the **Start date** is Sunday of the selected week. If you select **Monday** at **Week starts on**, the **Start date** is Monday of the selected week.
End date	Monday of the device local week	You cannot set this parameter. It is automatically calculated based on the set **Start date**. If you select **Sunday** at **Week starts on**, the **End date** is Saturday of the selected week. If you select **Monday** at **Week starts on**, the **End date** is Sunday of the selected week.

56 For settings of other parameters, refer to *Table 6-28*.

Parameter	Default Setting	Setting Options
Aggregation data	10 second frequency	10 second frequency Short-term flicker Long-term flicker Frequency Voltage Current Power Power factor Phase angles Unbalance THDS Voltage harmonic odd Voltage harmonic even Harmonic current odd Harmonic current even Voltage Interharmonics Interharmonic currents Power Reactive Fundamental Emissions (2-9)kHz Emissions (9-150)kHz
Measured quantities	None	The selectable **Measured quantities** depend on the selected **Aggregation data**. You can select at most 3 channels from the **Measured quantities**.
Measurement output	Table	Table Diagram[57] CSV

- Select one of the following **Measurement output** options:
  - **Table**

    If you select **Table**, click **Display**.

    The determined results are displayed in a table. In the multi-page tables, you can show the forward and backward pages with the **>>** and **<<** buttons. If you want to view a certain page, enter the page number at the bottom and click **show**.
  - **Diagram**

    If you select **Diagram**, click **Display**.

    You can view 1-day or 1-week records with a diagram.
  - **CSV**

    If you select **CSV**, click **Download**.

    The measured values are downloaded as a CSV file and are exported to the storage location you selected.

6.11.3 Clearing of Min/Max Values

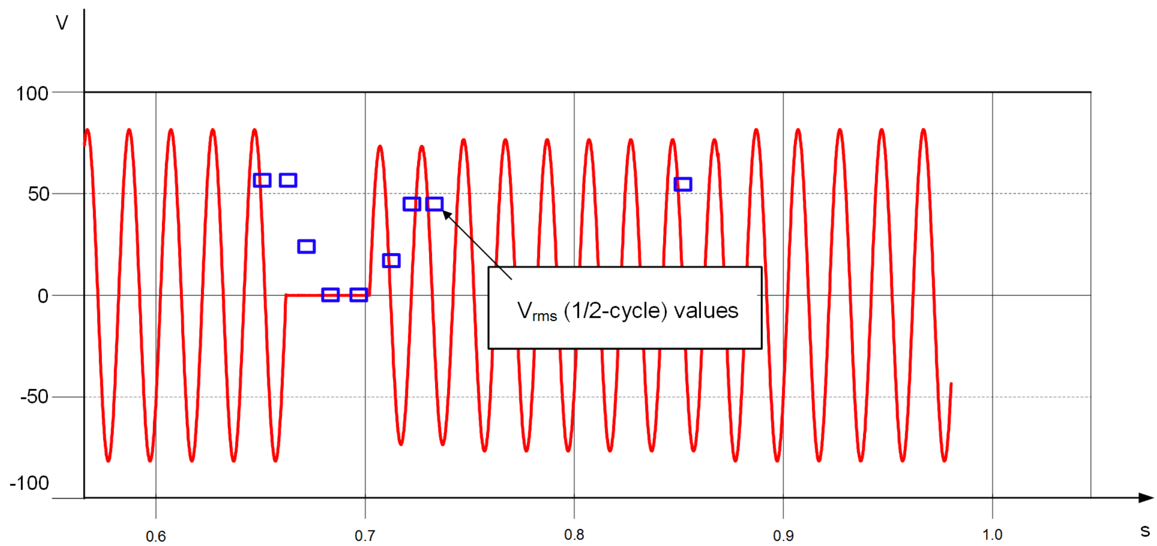
To clear the min/max values, refer to *7.2 Clearing of Data*.

57 The diagram displays the primary value only.

6.12 Trend Records

6.12.1 Function Description

The function **Trend records** ensures the acquisition and long-term monitoring of the voltage V_{rms} (1/2-cycle) values during voltage changes. The function **Trend records** compares the 1/2-cycle RMS value calculated from measured value with last recorded 1/2-cycle RMS value in every 1/2 cycle. If the difference exceeds or falls below the **Tolerance number**, the new 1/2-cycle RMS value is recorded.



[dw_trend_rec_Vrms, 2, en_US]

Figure 6-55 Example for Voltage Changes

Once the measuring interval ends, the next measuring interval starts automatically. You can set the following parameters via the Web pages:

- Tolerance number
- Maximum recording interval

Table 6-30 Recording and Evaluation

Measured Quantities	PQDIF
Va	x
Vb	x
Vc	x
Vab	x
Vbc	x
Vca	x

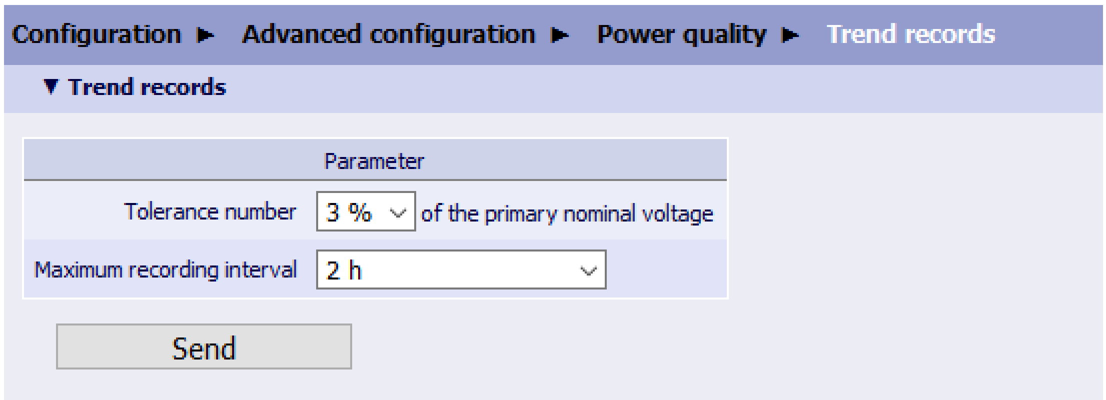
- Interfaces: protocols IEC61850, HTML
- Conditions: 1/2 cycle, RMS values

6.12.2 Configuration and Value View via Web Pages

Configuration of the Trend Records

To change the settings of the **Trend records** in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Trend records**.



[sc_trend-recorder_config, 2, en_US]

Figure 6-56 Configuration Tab, Trend Records

- Configure the respective parameters according to the following table.

Table 6-31 Settings for Trend Records

Parameter	Default Setting	Setting Range
Tolerance number	Percentage: 3 % of the primary nominal voltage	1 % to 5 %, increments of 1 %
Maximum recording interval	2 h	2 h 24 h

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

File Generation of the Trend Records

The trend records can be displayed via the Web pages or saved as PQDIF files. The PQDIF files of the trend records can be sent to the PQS and the Analyzer for the event evaluation via the IEC 61850 protocol.

The trend values are recorded when they exceed or fall below the configured **Tolerance number**. The associated generation of a PQDIF file starts after the configured **Maximum recording interval** reaches, for example, 24 h.

Table 6-32 PQDIF File Interval of a Trend Record

Maximum Recording Interval	PQDIF File Interval	Comments
2 h	00:00 h 02:00 h ... 20:00 h 22:00 h	The maximum points are 86 400 in a PQDIF file of a trend record. If the voltage exceeds or falls below the tolerance limit frequently[58], another recording file will be generated.
24 h	00:00 h	

Value View of the Trend Records

To display the trend records in the **Value view** tab, proceed as follows:

- In the navigation window, click **Trend records**.
- Configure the respective parameters according to the following table.

Table 6-33 Settings for Viewing the Trend Records

Parameter	Default Setting	Setting Range
Choose date	Current date	You can edit the text box directly or select the date from the calendar.
Start time	00:00:00	You can edit the text box directly or select the start time from the calendar.
End Time	23:59:59	You can edit the text box directly or select the end time from the calendar.
Measured quantities	Va	Va, Vb, Vc, Vab, Vbc, Vca
Measurement output	Table	Table Diagram[59] CSV

- Select one of the following **Measurement output** options:
  - **Table**
    If you select **Table**, click **Display**.
    The determined results are displayed in a table. In the multi-page tables, you can show the forward and backward pages with the **>>** and **<<** buttons. If you want to view a certain page, enter the page number at the bottom and click **show**.
  - **Diagram**
    If you select **Diagram**, click **Display**.
    You can view 1-day or 1-week records with a diagram.
  - **CSV**
    If you select **CSV**, click **Download**.
    The measured values are downloaded as a CSV file and are exported to the storage location you selected.

58 The device runs under a terrible grid, and all V_{rms} (1/2-cycle) values are recorded.

59 Diagram only displays the primary value.

6.13 Mains Signaling Voltage (MSV)

6.13.1 Function Description

Mains signaling voltage (MSV) measurement is performed according to IEC 61000-4-30.

The device detects mains signaling frequencies from 100 Hz to 3 kHz. The threshold for detection and capture is from 1 % up to 15 % of Un.

NOTE

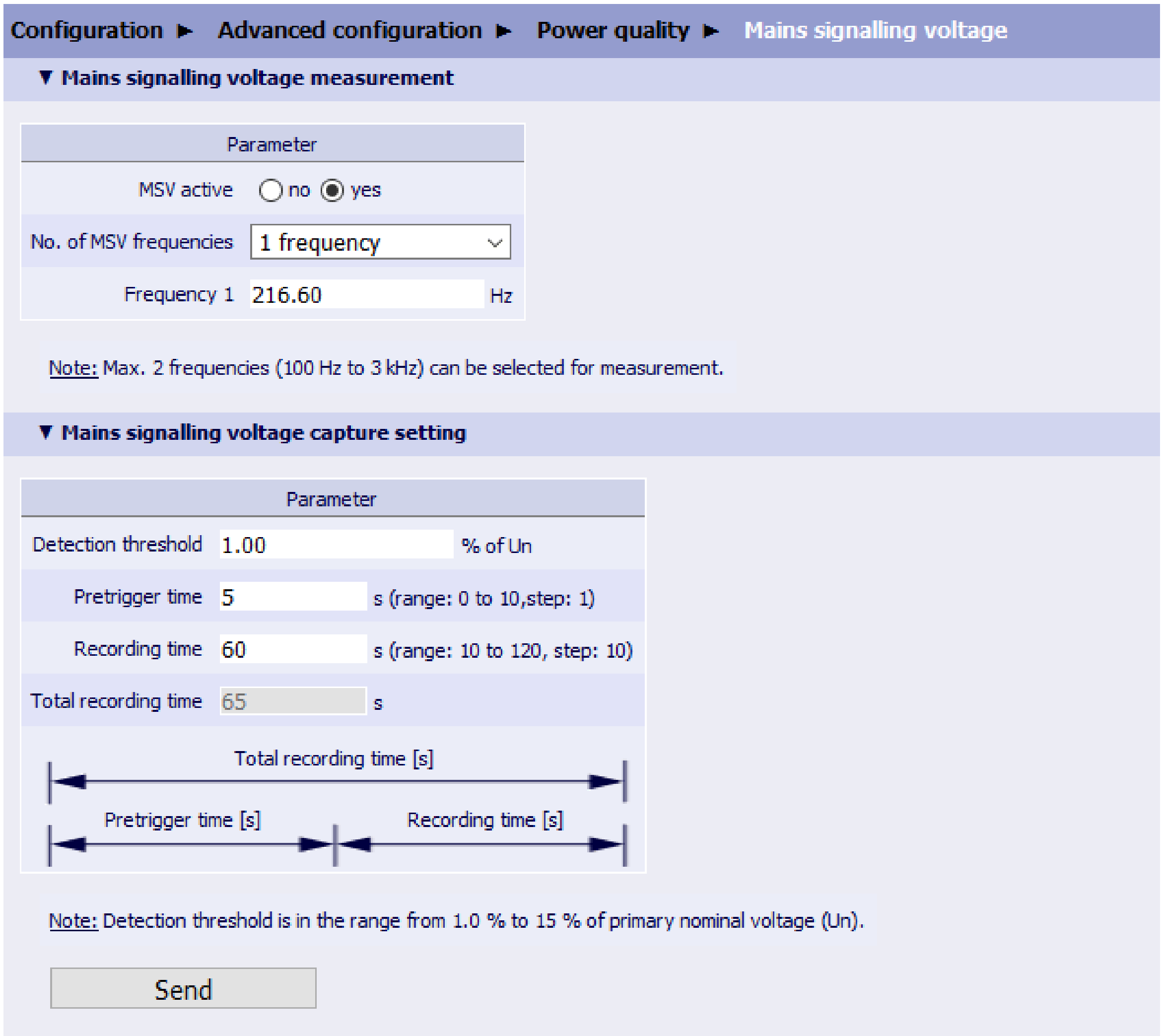
The MSV function is deactivated in default factory settings.

6.13.2 Configuration and Value View via Web Pages

Configuration of the Mains Signaling Voltage (MSV)

To change the settings of the MSV in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Mains signaling voltage**.



[sc_mains_signaling_voltage_configuration, 3, en_US]

Figure 6-57 Configuration Tab, Mains Signaling Voltage

- Configure the respective parameters according to the following table.

Table 6-34 Settings for Mains Signaling Voltage

Parameter	Default Setting	Setting Range
Mains Signaling Voltage Measurement		
MSV active	no	no yes
No. of MSV frequencies	1 frequency	1 frequency 2 frequencies
Frequency 1	216.60 Hz	100.00 Hz to 3000.00 Hz
Frequency 2	1060.00 Hz	100.00 Hz to 3000.00 Hz
Mains Signaling Voltage Capture Setting		
Detection threshold	1.00 % of Un	1.00 % to 15.00 % of Un
Pretrigger time	5 s	0 s to 10 s, step: 1 s
Recording time	60 s	10 s to 120 s, step: 10 s

The Total recording time is the sum of the Pretrigger time and the Recording time, and cannot be changed.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of the MSV

To display the MSV values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Mains signaling voltage**.
- Configure the respective parameters according to the following table.

Table 6-35 Settings for Viewing the Mains Signaling Voltage

Parameter	Default Setting	Setting Range
Start time	Current date 00:00:00	You can edit the text box directly or select the start time from the calendar.
End time	Current date 23:59:59	You can edit the text box directly or select the end time from the calendar.
Record list	none	File list fulfilled the preceding parameters
Measurement output	Table	Table Diagram

- Select one of the following **Measurement output** options:
  - **Table**
    If you select **Table**, click **Display**.
    The determined results are displayed in a table. In the multi-page tables, you can show the forward and backward pages with the **>>** and **<<** buttons. If you want to view a certain page, enter the page number at the bottom and click **show**.
  - **Diagram**
    If you select **Diagram**, click **Display**.
    You can view 1-day or 1-week records with a diagram.

6.13.3 Clearing of MSV Events and Records

To clear MSV events, refer to chapter *6.4.4 Clearing of Events*.
To clear MSV records, refer to chapter *7.2 Clearing of Data*. You cannot clear MSV records alone.

6.14 Transient Records

6.14.1 Function Description

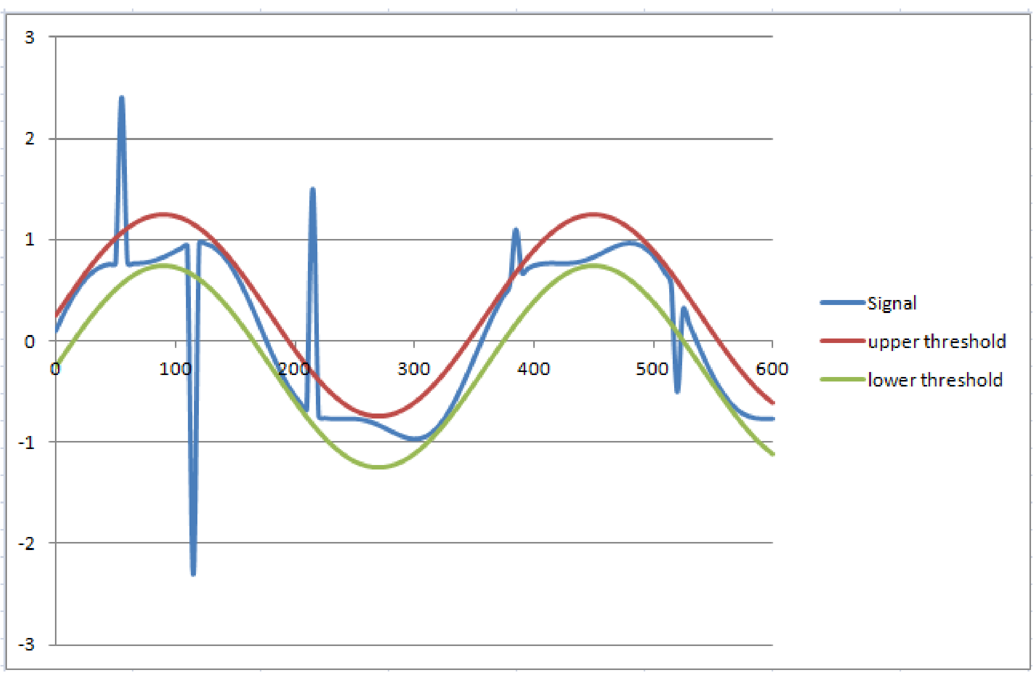
If the instantaneous value of the primary nominal voltage exceeds the threshold at one or several sampling points, SICAM Q200 detects temporary overvoltage as transients. The sampling rate for the transients detection is 1.024 MHz. Thus, transients can be resolved with an accuracy of appox. 1 µs. This results in 20 480 samples per cycle for 50 Hz and in 17 067 samples per cycle for 60 Hz.

SICAM Q200 uses envelope method, and detects transient with upper and lower sine waveform threshold. It provides logs and COMTRADE files containing related waveforms to store the transient information.

The following data and values are determined during the evaluation as transient logs in SICAM Q200 and listed on HTML page:

- Index number of the event
- Start time (time stamp with date and time)
- Trigger Phase
- Affected Phases
- Peak Voltage
- Peak Phase

When a transient is triggered and detected on the device, the operational indication **Transient Event Available** is turned ON and the record is saved as a COMTRADE file to the SD card. Additionally, the transient can trigger the waveform recorder when the cross trigger is activated.



[sc_enve_method, 1, en_US]

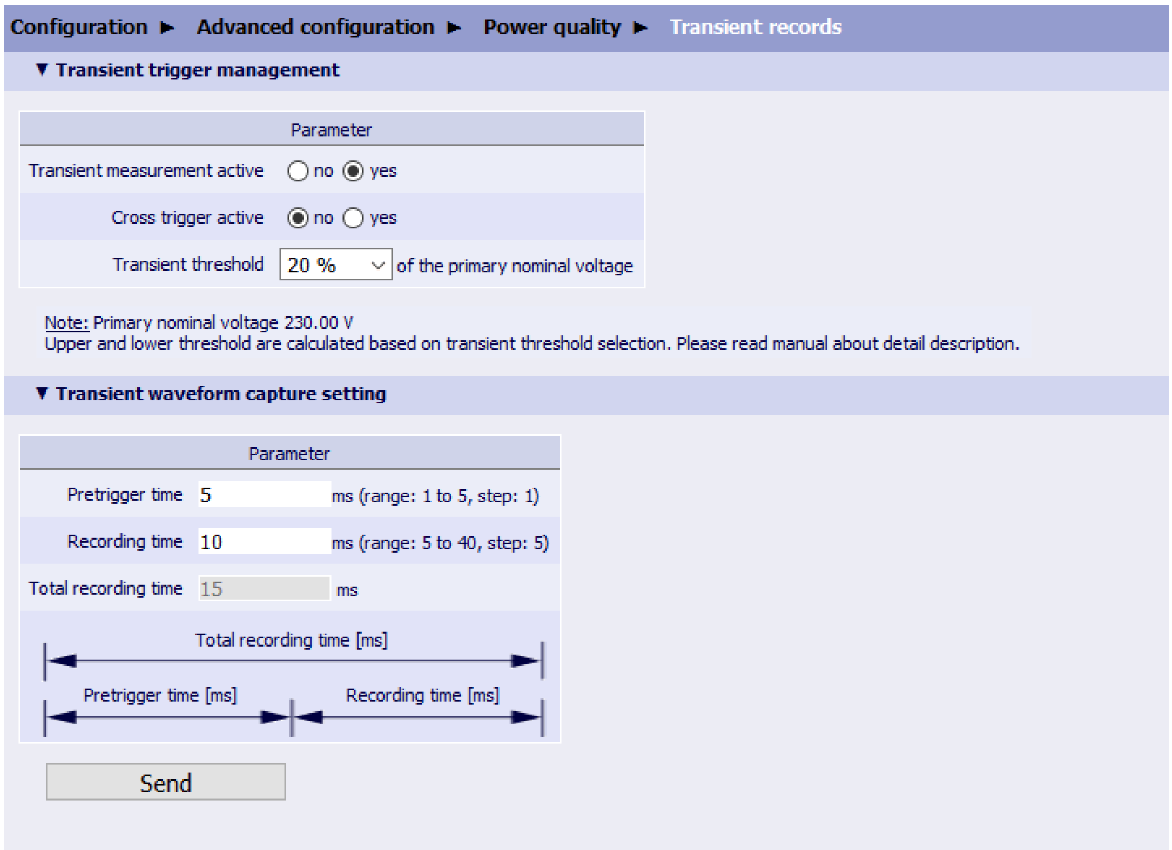
Figure 6-58 Transient Detection with Envelope Method

6.14.2 Configuration and Value View via Web Pages

Configuration of the Transient Records

To change the settings of the **Transient records** in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Transient records**.



[sc_transient_recorder_configuration, 3, en_US]

Figure 6-59 Configuration Tab, Transient Records

- Configure the respective parameters according to the following table.

Table 6-36 Setting for Transients

Parameter	Default Setting	Setting Range
Transient active	no	no yes If you set the **Transient active** parameter to **no**, the transient configuration items are hidden, the transient record is disabled, and no data is recorded. When the transient is active again, the last selected values are used.
Cross trigger active	no	no yes If you set the **Cross trigger active** to **yes**, the detected transient can trigger the waveform recorder (see chapter *6.10.1 Function Description*).

Parameter	Default Setting	Setting Range
If you set the **Transient active** parameter to **yes**, the following parameters are visible:		
Transient threshold	20 % of the primary nominal voltage	10 %, 15 %, 20 %, 25 %
Pretrigger time	5 ms	1 ms to 5 ms, increments of 1 ms
Recording time	10 ms	5 ms to 40 ms, increments of 5 ms

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Value View of the Transient Records

To display the transient-record values in the **Value view** tab, proceed as follows:

- In the navigation window, click **Transient logs**.

No.	Start time	Trigger Phase	Affected Phases	Peak Voltage	Peak Phase	Waveform Diagram
00001	2021-09-15 10:09:52:084	- Vc -	- Va -- Vb -- Vc -- Vab -- Vbc -- Vca -	245.0 V	- Vbc -	Display Download
00002	2021-09-15 10:09:50:071	- Vb -	- Vb -- Vab -- Vbc -	56.0 V	- Vab -	Display Download
00003	2021-09-15 10:09:46:065	- Vb -	- Vb -- Vab -- Vbc -	77.0 V	- Vab -	Display Download
00004	2021-09-15 10:09:42:059	- Vb -	- Vb -- Vab -- Vbc -	92.0 V	- Vb -	Display Download
00005	2021-09-15 10:09:38:054	- Vb -	- Vb -	41.0 V	- Vb -	Display Download
00006	2021-09-15 10:09:34:048	- Vb -	- Vb -- Vab -- Vbc -	107.0 V	- Vab -	Display Download
00007	2021-09-15 10:09:26:036	- Vb -	- Vb -- Vab -- Vbc -	94.0 V	- Vb -	Display Download
00008	2021-09-15 10:09:22:030	- Vb -	- Vb -- Vab -- Vbc -	70.0 V	- Vab -	Display Download
00009	2021-09-15 10:09:18:025	- Vb -	- Vb -- Vab -- Vbc -	68.0 V	- Vab -	Display Download
00010	2021-09-15 10:09:14:019	- Vb -	- Vb -- Vab -- Vbc -	100.0 V	- Vb -	Display Download
00011	2021-09-15 10:09:06:007	- Vb -	- Vb -- Vab -- Vbc -	107.0 V	- Vab -	Display Download
00012	2021-09-15 10:09:02:001	- Vb -	- Vb -	43.0 V	- Vb -	Display Download
00013	2021-09-15 10:08:57:996	- Vb -	- Vb -- Vab -- Vbc -	83.0 V	- Vb -	Display Download
00014	2021-09-15 10:08:53:990	- Vb -	- Vb -- Vab -- Vbc -	85.0 V	- Vab -	Display Download
00015	2021-09-15 10:08:49:984	- Vb -	- Vb -- Vab -- Vbc -	53.0 V	- Vab -	Display Download

[sc_transient_recorder_evaluation, 4, en_US]

Figure 6-60 Value View Tab, Transient Records

- Select the **Start time** and **End time**.
- Click **Display**.

Dependent on the selection, the determined results will be displayed under **Find result**. In the multipaged tables, you can show the forward and backward pages with the **>>** and **<<** buttons. If you want to view a certain page, enter the page number at the bottom and click **show**.

The column **Start time** indicates the moment when a transient event is triggered.

The column **Trigger phase** refers to the voltage channel of the first detection.

The column **Affected Phases** refers to the affected voltage channels during the whole recording duration.

The column **Peak voltage** shows the peak voltage that is selected during the record duration. The biggest magnitude of voltage (maximum or minimum) of each available phase according to the network-type selection during the transient recording time is selected as the peak value.

The peak-value selection is only among PP voltage or PN voltage. It can be detected up to 6000 V.

For displaying and downloading the transient logs via the Web browser, refer to *Waveform Diagram, Page 198*.

Table 6-37 Settings for Viewing the Transient Records

Parameter	Default Setting	Setting Options
Start time	One hour before the current date/time	You can edit the text box directly or select the start time from the calendar.
End time	Current date/time	You can edit the text box directly or select the end time from the calendar.

NOTE

During the record duration, retriggering of a transient is not possible.

After the transient recording is done, the transient recorder needs a short time range for an automatic internal resynchronization process. During this time, no transient can be detected and recorded. The resynchronization time lasts approx. 600 ms.

When the storage is full, the oldest record is replaced by the newest one.

NOTE

The sampling frequency of a transient-signal detection channel is 1.024 MS/s.

For a maximum total recording time of 45 ms (5 ms + 40 ms), 46 081 samples are recorded for each voltage channel.

Only the VxPE channels (x = {a,b,c,N}) will be recorded. For more detailed analysis, the channels must be calculated with the PC tools.

Record-File Size

The size of the transient record file is related to the total duration and to the channel number:

Network Type	Voltage Channels in COMTRADE File	Number of Voltage Channels	COMTRADE File Size (45 ms Recording Time)
Single-Phase network Four-wire, 3 phase, balanced	VaPE, NPE	2	(2 · 2 + 4+4) Bytes · 1 MS/s · 0.045 s = 540 kB
Three-wire, 3 phase modes	VaPE, VbPE, VcPE	3	(3 · 2 + 4+4) Bytes · 1 MS/s · 0.045 s = 630 kB
Four-wire, 3 phase, unbalanced	VaPE, VbPE, VcPE, NPE	4	(4 · 2 + 4+4) Bytes · 1 MS/s · 0.045 s = 720 kB

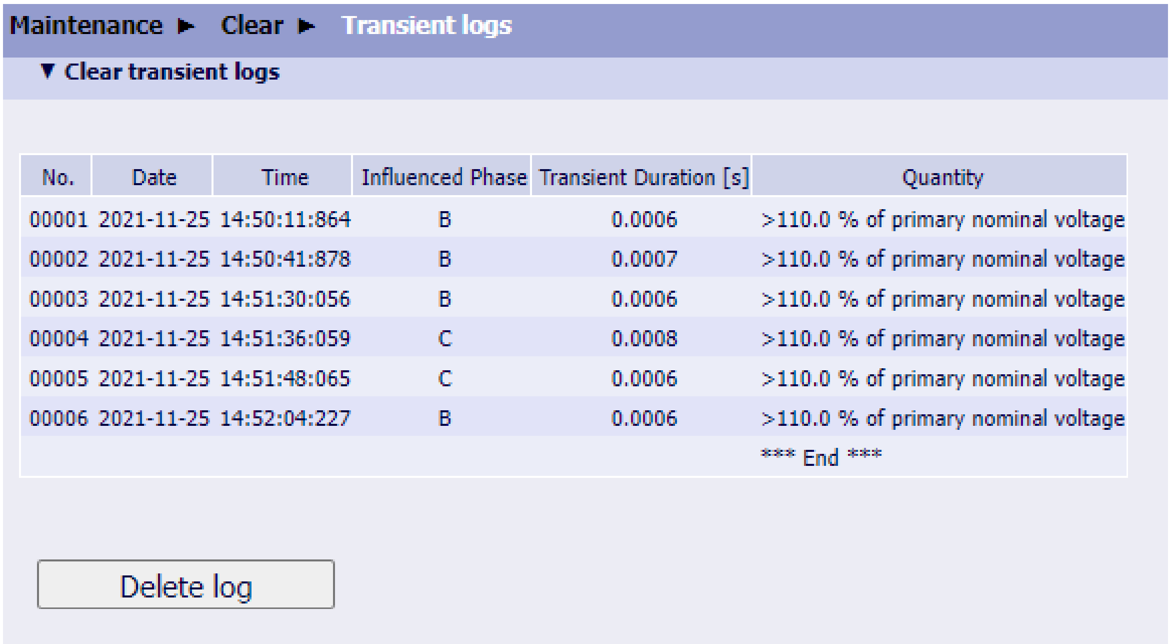
If you select **Pretrigger time** = **5 ms**, **Transient duration** = **40 ms**, the file size is calculated according to the following equation:

(4 · 2 + 4 + 4) Bytes · 1 MS/s · 0.045 = 720 kB

6.14.3 Delete Transient Logs

To delete the transient logs in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Transient logs**.



[sc_Delete transient log, 3, en_US]

Figure 6-61 Maintenance Tab, Delete Transient Logs

- Click **Delete log**.
  The transient logs are deleted. The **Action was successful** indication is displayed on the status bar.

6.15 EN 50160 Report

6.15.1 Function Description

The device generates an **EN 50160 report** automatically or manually. According to the standard EN 50160, the device generates the report by analyzing the measurand including power frequency, supply voltage magnitude, flicker, voltage unbalance, harmonics, and events.

The **EN 50160 report** provides 3 templates and 1 user-defined mode:

- **EN 50160 LV**, **EN 50160 MV** and **EN 50160 HV**
  For the 3 templates, the limiting values are fixed, and the threshold values are referred to the standard EN 50160.
- **User-defined**
  In this mode, you can configure the limiting values.

When the events happen, the data is flagged in red in the measurement records.

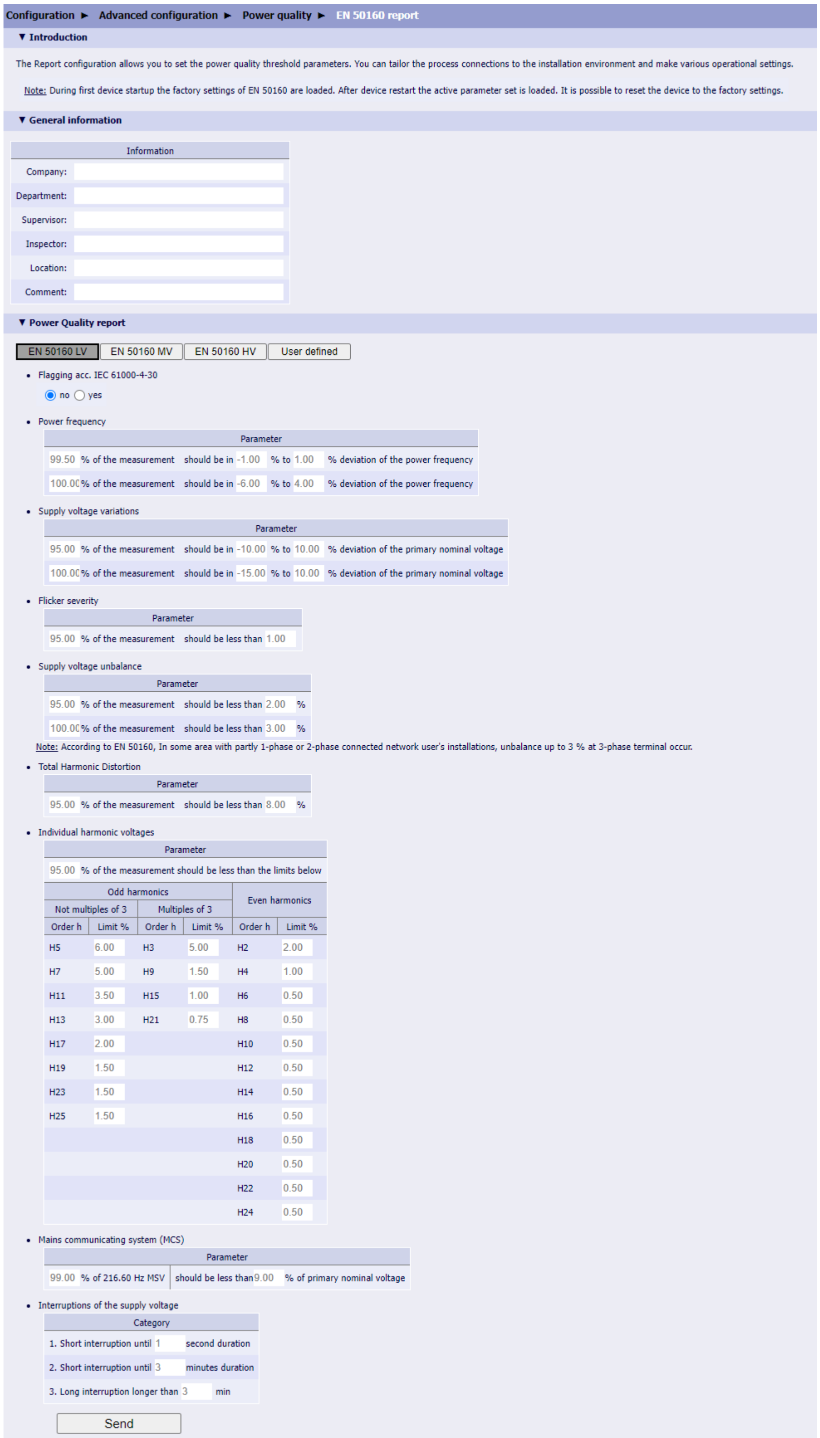
If the **Flagging acc. IEC 61000-4-30** is set as *yes*, the device hides flagged data in the EN 50160 report.

6.15.2 Configuration and Value View via Web Pages

Configuration of the EN 50160 Report

To configure the settings of the **EN 50160 report** in the **Configuration** tab, proceed as follows:

- In the navigation window, click **EN 50160 report**.



[sc_PQ_report_configuration, 4, en_US]

Figure 6-62 Configuration Tab, EN 50160 Report

- Configure the respective parameters according to the following table.
  For the **General information**, you can edit the text box directly.

Table 6-38 Settings for EN 50160 Report

<table>
<tr><th colspan="2">Parameter</th><th>Default Setting</th><th>Setting Options</th></tr>
<tr><td colspan="4">General Information</td></tr>
<tr><td colspan="2">Company:
Department:
Supervisor:
Inspector:
Location:
Comment:</td><td>–</td><td>Any text displayed in the printout of the power-quality report
Max. 32 characters</td></tr>
<tr><td colspan="4">Power Quality Report</td></tr>
<tr><td colspan="2">Evaluation mode according to</td><td>EN 50160 LV</td><td>• EN 50160 LV
• EN 50160 MV
• EN 50160 HV
• User-defined</td></tr>
<tr><td colspan="2">Flagging acc. to IEC 61000-4-30</td><td>no</td><td>no
yes</td></tr>
<tr><td colspan="2" rowspan="2">Power frequency</td><td>99.5 % of the measurement should be within a deviation of -1.0 % to 1.0 %</td><td rowspan="14">The settings are fixed for the template of EN 50160 LV, EN 50160 MV and EN 50160 HV.
You can edit the limiting values in the text box directly under the user-defined evaluation mode.</td></tr>
<tr><td>100 % of the measurement should be within a deviation of -6.0 % to 4.0 %</td></tr>
<tr><td colspan="2" rowspan="2">Supply voltage variations for the template of EN 50160 LV</td><td>95 % of the measurement should be within a deviation of -10.0 % to 10.0 %</td></tr>
<tr><td>100 % of the measurement should be within a deviation of -15.0 % to 10.0 %</td></tr>
<tr><td colspan="2" rowspan="2">Supply voltage variations for the template of EN 50160 MV & HV</td><td>99 % of the measurement should be within a deviation of -10.0 % to 10.0 %</td></tr>
<tr><td>100 % of the measurement should be within a deviation of -15.0 % to 15.0 %</td></tr>
<tr><td colspan="2">Flicker severity</td><td>95 % of the measurement should be less than 1.0 %</td></tr>
<tr><td colspan="2" rowspan="2">Supply voltage unbalance[60]</td><td>95 % of the measurement should be less than 2.0 %</td></tr>
<tr><td>100 % of the measurement should be less than 3.0 %</td></tr>
<tr><td colspan="2">Total harmonic distortion</td><td>95 % of the measurement should be less than 8.0 %</td></tr>
<tr><td rowspan="2">Harmonic voltages for the template of EN 50160 LV</td><td>Odd harmonics</td><td>H3: 5.0, H5: 6.0, H7: 5.0, H9: 1.5, H11: 3.5, H13: 3.0, H15: 1.0, H17: 2.0, H19: 1.5, H21: 0.75, H23: 1.5, H25: 1.5</td></tr>
<tr><td>Even harmonics</td><td>H2: 2.0, H4: 1.0, H6: 0.5, H8: 0.5, H10: 0.5, H12: 0.5, H14: 0.5, H16: 0.5, H18: 0.5, H20: 0.5, H22: 0.5, H24: 0.5</td></tr>
<tr><td rowspan="2">Harmonic voltages for the template of EN 50160 MV</td><td>Odd harmonics</td><td>H3: 5.0, H5: 6.0, H7: 5.0, H9: 1.5, H11: 3.5, H13: 3.0, H15: 0.5, H17: 2.0, H19: 1.5, H21: 0.5, H23: 1.5, H25: 1.5</td></tr>
<tr><td>Even harmonics</td><td>H2: 2.0, H4: 1.0, H6: 0.5, H8: 0.5, H10: 0.5, H12: 0.5, H14: 0.5, H16: 0.5, H18: 0.5, H20: 0.5, H22: 0.5, H24: 0.5</td></tr>
</table>

60 According to the EN 50160, up to 3 % unbalance can occur in 3-wire networks in areas with many 1-wire and 2-wire connections.

Parameter		Default Setting	Setting Options
Harmonic voltages for the template of EN 50160 HV	Odd harmonics	H3: 3.0, H5: 5.0, H7: 4.0, H9: 1.3, H11: 3.0, H13: 2.5, H15: 0.5, H17: u.c.[61], H19: u.c., H21: 0.5, H23: u.c., H25: u.c.	
	Even harmonics	H2: 1.9, H4: 1.0, H6: 0.5, H8: 0.5, H10: 0.5, H12: 0.5, H14: 0.5, H16: 0.5, H18: 0.5, H20: 0.5, H22: 0.5, H24: 0.5	
Mains communicating system for the template of EN 50160 LV & MV		99.0 % of 216.60 Hz MSV should be less than 9.0 % of primary nominal voltage. 99.0 % of "YYY" Hz MSV should be less than "xxx" % of the primary nominal voltage.[62]	
Interruptions of the supply voltage		Short interruption until 1-second duration	
		Short interruption until 3-minute duration	
		Long interruption longer than 3-minute duration	

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

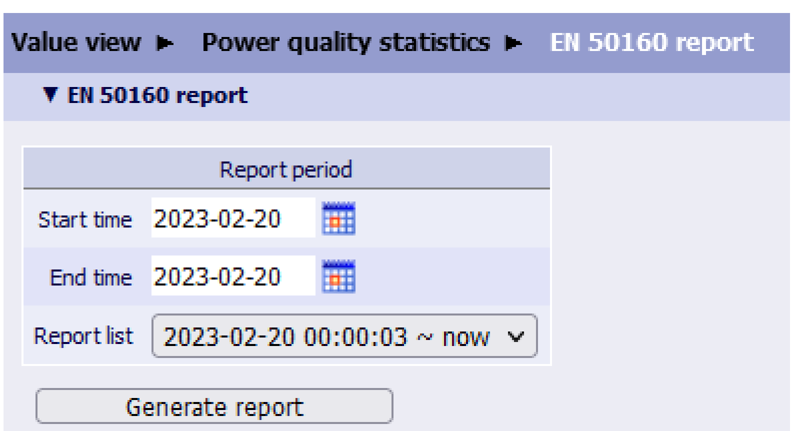
NOTE

The factory settings are based on EN 50160. If you have changed the settings, the set parameters are applied after a device restart. It is possible to reset to the factory settings.

Value View of the EN 50160 Report

To display the EN 50160 report in the **Value view** tab, proceed as follows:

- In the navigation window, click **EN 50160 report**.



[sc_q200_PQ_Report_evalu, 4, en_US]

Figure 6-63 Value View Tab, EN 50160 Report

- Edit the text box directly or select the **Start time** and **End time** from the calendar.
- Select a report from the **Report list**.
- Click **Generate report**.

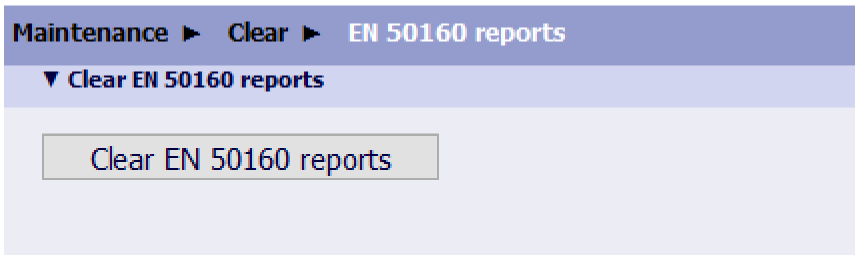
61 Short for "under consideration"
62 The frequency "YYY" and the limit "xxx" are based on the configured frequency.

The report is displayed in a separate window and can be printed out or saved.

6.15.3 Clearing of EN 50160 Reports

To clear the EN 50160 reports in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **EN 50160 Reports**.



[sc_clear en 50160 reports, 1, en_US]

Figure 6-64 Maintenance Tab, Clear EN 50160 Reports

- Click **Clear EN 50160 reports**.
  The EN 50160 reports are cleared. The **Action was successful** indication is displayed on the status bar.

6.16 IEEE 519 Report for Harmonics

6.16.1 Function Description

IEEE 519 is a standard that focuses on harmonic control in the electrical system. For more information, refer to *https://standards.ieee.org/standard/519-2014.html*. An IEEE 519 report is a kind of power quality report that focuses on harmonic values and conforms to the IEEE 519 standard.

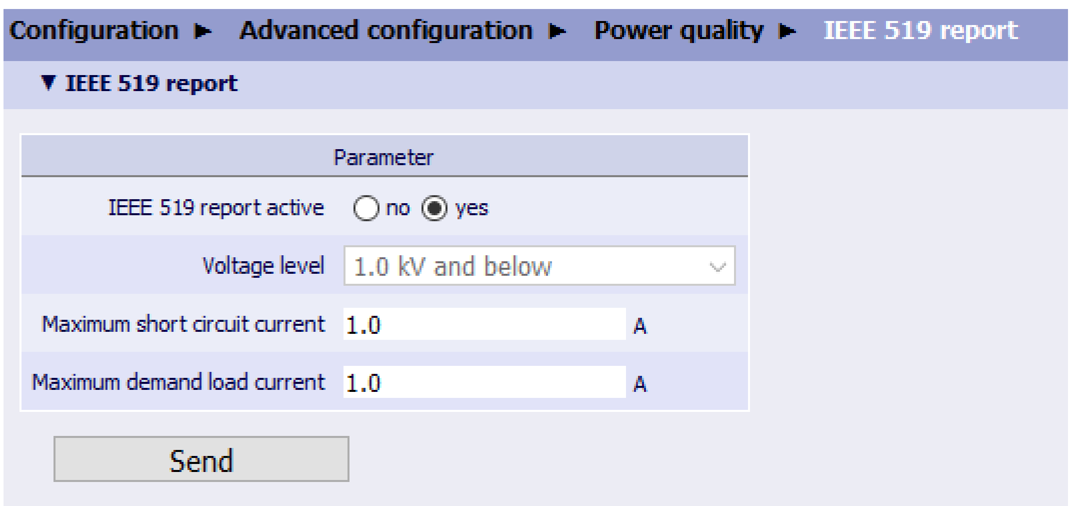
According to the IEEE 519 report, you can limit the harmonic-current emission to a reasonable value. Meanwhile, the supplier can take measures to decrease the voltage-distortion level by modifying the supply-system impedance characteristics as necessary.

6.16.2 Configuration and Value View via Web Pages

Configuration of the IEEE 519 Report

To configure the settings of the IEEE 519 report in the **Configuration** tab, proceed as follows:

- In the navigation window, click **IEEE 519 report**.



[sc_configure_IEEE 519, 2, en_US]

Figure 6-65 Configuration Tab, IEEE 519 Report

- Configure the respective parameters according to the following table.

Table 6-39 Settings for the IEEE 519 Report

Parameter	Default Setting	Setting Range
IEEE 519 report active[63]	no	no yes
Voltage level	1.0 kV and below	1.0 kV and below Above 1.0 kV up to 69.0 kV Above 69.0 kV up to 161.0 kV Above 161.0 kV Not settable, depending on the value of the primary nominal voltage set in **AC measurement**, see *Table 2-6*
Maximum short-circuit current	1.0 A	1.0 A to 1 000 000.0 A
Maximum demand load current	1.0 A	1.0 A to 1 000 000.0 A

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

NOTE

If you activate the parameter change when the IEEE 519 report is being generated, the report of today or this week is reset.

Value View of the IEEE 519 Report

To display the IEEE 519 report in the **Value view** tab, proceed as follows:

- In the navigation window, click **IEEE 519 report**.

63 If you select to activate this function, Siemens recommends selecting 10 min as the aggregation interval in the **Measurement records**, see *Table 6-27*.

Value view ▶ Power quality statistics ▶ IEEE 519 report

▼ Daily report

Measurement	Exceed 99th percentile limits	
	Yesterday	Today
Va harmonic	N.A.	N.A.
Vb harmonic	N.A.	N.A.
Vc harmonic	N.A.	N.A.
THDS Va	N.A.	Pass
THDS Vb	N.A.	Pass
THDS Vc	N.A.	Pass
Ia harmonic	N.A.	N.A.
Ib harmonic	N.A.	N.A.
Ic harmonic	N.A.	N.A.
TDD Ia	N.A.	Pass
TDD Ib	N.A.	Pass
TDD Ic	N.A.	Pass

▼ Weekly report

Measurement	Exceed 95th percentile limits		Exceed 99th percentile limits	
	Last week	This week	Last week	This week
Va harmonic	Failed	N.A.	-	-
Vb harmonic	Failed	N.A.	-	-
Vc harmonic	Failed	N.A.	-	-
THDS Va	Pass	Pass	-	-
THDS Vb	Pass	Pass	-	-
THDS Vc	Pass	Pass	-	-
Ia harmonic	Pass	N.A.	Pass	N.A.
Ib harmonic	Pass	N.A.	Pass	N.A.
Ic harmonic	Pass	N.A.	Pass	N.A.
TDD Ia	Pass	N.A.	Pass	N.A.
TDD Ib	Pass	N.A.	Pass	N.A.
TDD Ic	Pass	N.A.	Pass	N.A.

[sc_value view_IEEE 519, 1, en_US]

Figure 6-66 Value View Tab, IEEE 519 Report

In the daily report, the statistical values are harmonics of 3 s:

- If the 99th-percentile value of the measured quantity exceeds the limits defined in the IEEE 519 standard, the indication **Failed** is shown.
- If the 99th-percentile value of the measured quantity does not exceed the limits defined in the IEEE 519 standard, the indication **Pass** is shown.
- If there is no valid 99th-percentile value of the measured quantity, the indication **N.A.** is shown.

In the weekly report, the statistical values are aggregation harmonics of 1 min and 10 min:

- If the 95th-percentile value or the 99th-percentile value of the measured quantity exceeds the limits defined in the IEEE 519 standard, the indication **Failed** is shown.
- If the 95th-percentile value or the 99th-percentile value of the measured quantity does not exceed the limits defined in the IEEE 519 standard, the indication **Pass** is shown.
- If there is no valid 95th-percentile value or 99th-percentile value of the measured quantity, the indication **N.A.** is shown.
- If the measured quantity is not evaluated by the IEEE 519 standard, the indication **-** is shown.

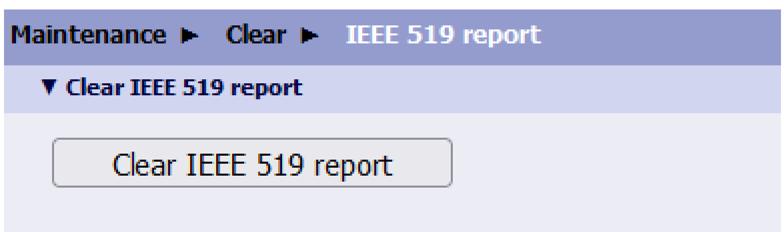
NOTE

If the battery runs out and the device is powered off, the storage of IEEE 519 reports is lost.

6.16.3 Clearing of the IEEE 519 Report

To clear the IEEE 519 report in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **IEEE 519 report**.



[sc_maint._IEEE 519, 2, en_US]

Figure 6-67 Maintenance Tab, Clear IEEE 519 report

- Click **Clear IEEE 519 report**.
  The IEEE 519 reports are cleared. The **Action was successful** indication is displayed on the status bar. The clearing is recorded in the audit log and in the operational log.

7 Display and Other Functions

7.1 Display and Display Settings

7.1.1 Function Description

In the **Configuration** tab, you can view and edit the display settings under the HMI menu. The menu includes 2 parts:

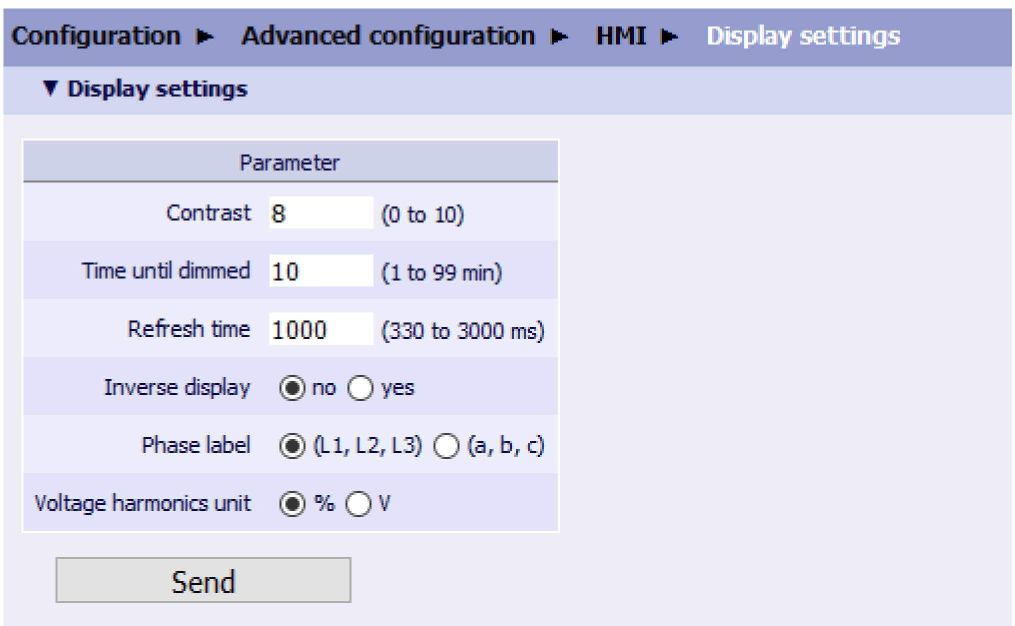
- Display settings
- User-defined screen

7.1.2 Configuration via Web Pages

Configuration of Display Settings

To configure the display settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Display settings**.



[sc_display_settings_configuration, 4, en_US]

Figure 7-1 Configuration Tab, Display Settings

- Configure the respective parameters according to the following table.

Table 7-1 Settings for Display

Parameter	Default Setting	Setting Range
Contrast	8	0 to 10
Time until dimmed	10	1 min to 99 min
Refresh time	1000	330 ms to 3000 ms
Inverse display	no	no yes

Parameter	Default Setting	Setting Range
Phase label	(L1, L2, L3)	(L1, L2, L3) (a, b, c)
Voltage harmonics unit	%	% V

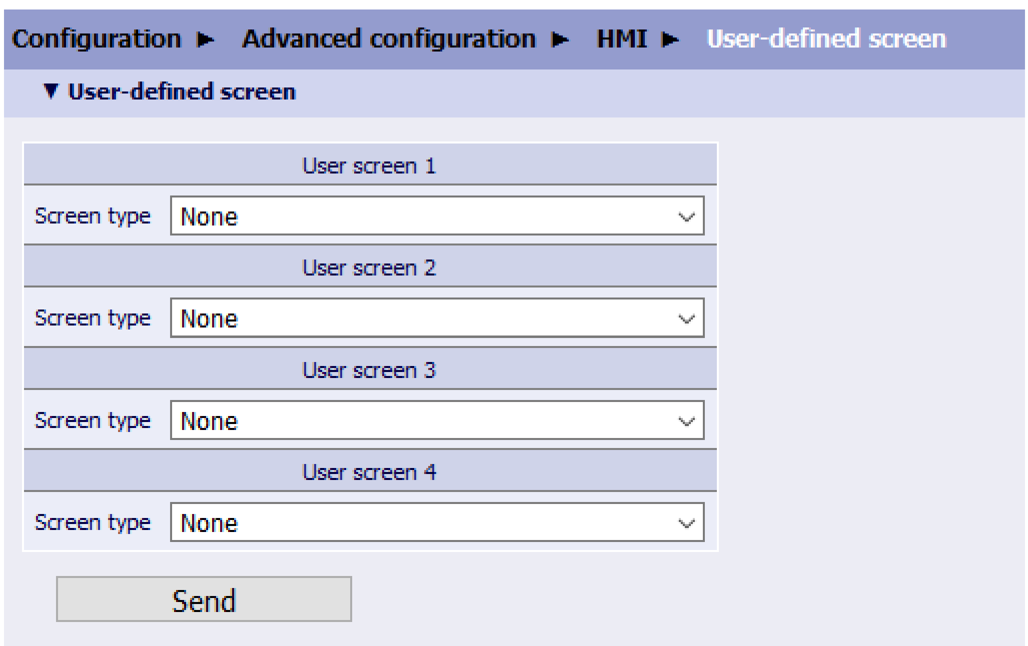
- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

Configuration of the User-Defined Screen

In the **User-defined screen** dialog, you can parameterize up to 4 different **User screens**. Each screen type allows you to select whether to display the measured values numerically (2 or 4 measured values) or graphically and numerically (2 or 3 measured values). To select which of the 4 screens are presently displayed on the device, use the device softkeys and the Web browser.

To configure the **User-defined screen** values in the **Configuration** tab, proceed as follows:

- In the navigation window, click **User-defined screen**.



[sc_user-defined_configuration, 2, en_US]

Figure 7-2 Configuration Tab, User-Defined Screen

- Configure the respective parameters according to the following table.

Table 7-2 Settings for User-Defined Screen

Parameter	Default Setting	Setting Range
Screen type	None[64]	None 2 measured values, numerical 4 measured values, numerical 2 measured values, graphical + numerical 3 measured values, graphical + numerical
Screen name	USER_SCREEN_x (x = 1 to 4)	You can update and edit it directly. Max. 18 characters Only English and German letters, numbers, and special characters are permitted.
2 measured values, numerical: • Display 1, numerical • Display 2, numerical	-not assigned-	The selection of measured values depends on the network type. Designation can be changed during the parameterization.
4 measured values, numerical: • Display 1, numerical • Display 2, numerical • Display 3, numerical • Display 4, numerical	-not assigned-	
2 measured values, graphical, and numerical: • Display 1, graph./num. • Display 2, graph./num.	-not assigned-	
3 measured values, graphical, and numerical: • Display 1, graph./num. • Display 2, graph./num. • Display 3, graph./num.	-not assigned-	
Display x, graph./num. (x = 1 to 3) • Min value • Max value	Unit according to measured value 1.0 10.0	The selected parameters are used to define the minimum and maximum values.

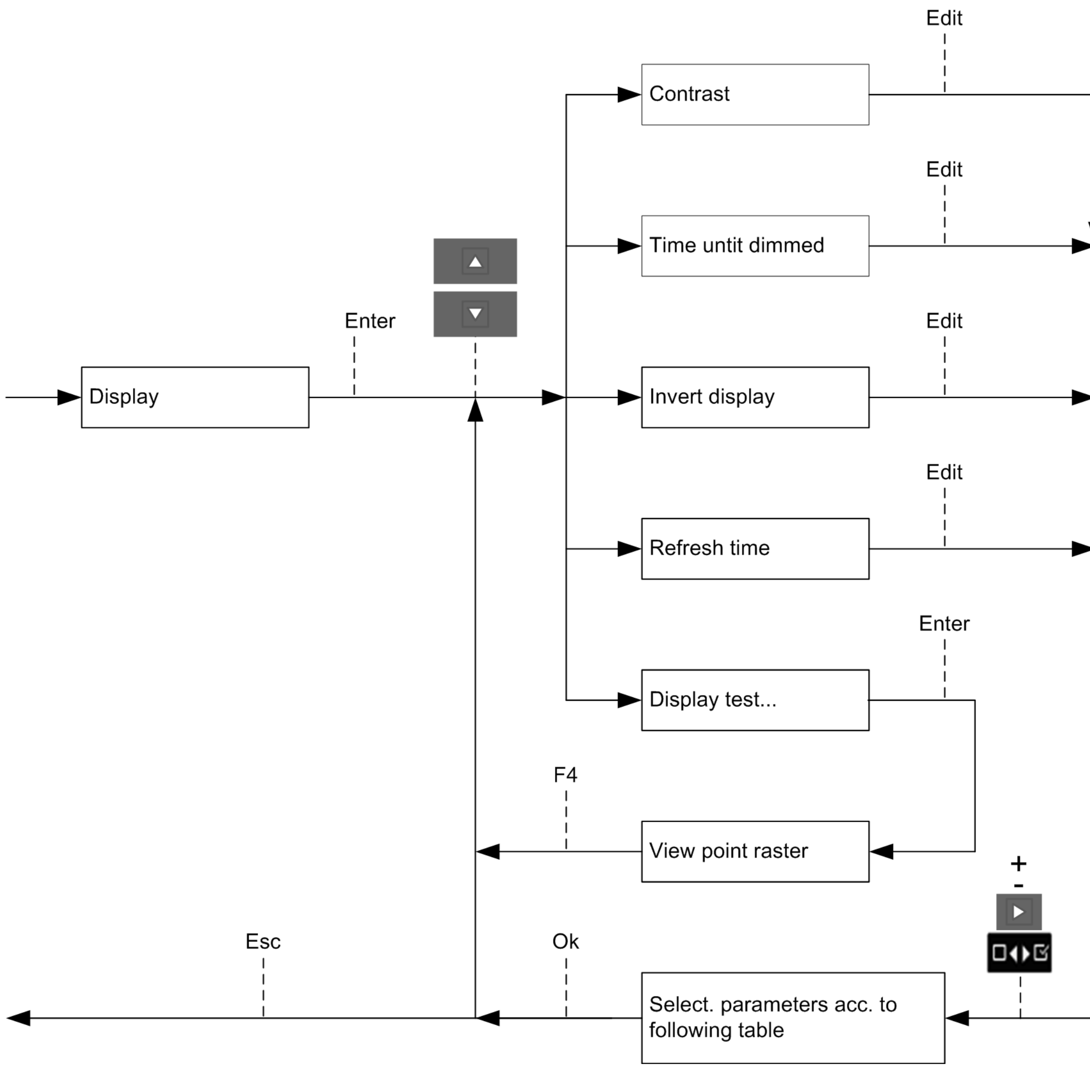
- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

64 If you have not made any selection, the displays explained in the following do not exist.

7.1.3 Configuration via Display

Submenu Display

In the main menu, select **Settings** → **Display**.



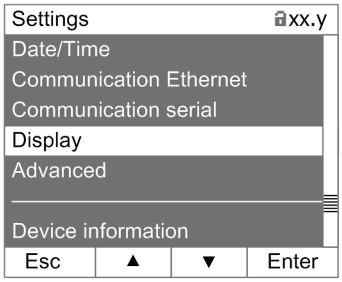
[dw_submenu_display, 1, en_US]

Figure 7-3 Submenu Display

Table 7-3 Settings for Display

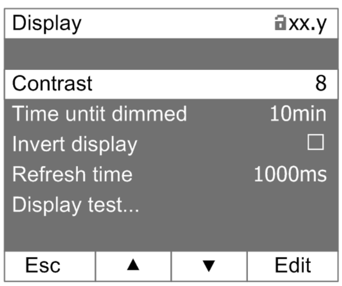
Parameter	Default Setting	Setting Range
Contrast	8	0 to 10
Time until dimmed	10	1 min to 99 min
Invert display	no	no yes
Refresh time	1000	330 ms to 3000 ms
Display test	View point raster	No setting range

The following interface displays are available:



[dw_display_settings, 1, en_US]

Figure 7-4 Display Settings

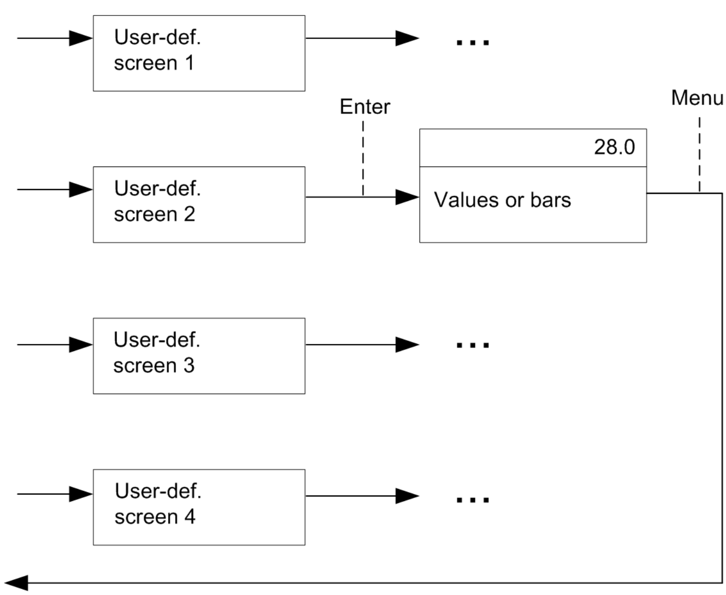


[dw_display_contrast, 1, en_US]

Figure 7-5 Display Content

User-Defined Screens

The user-defined screens are visible on the display only if they were activated via the Web pages (see *Configuration of the User-Defined Screen, Page 257*).



[dw_user-defined_screen, 1, en_US]

Figure 7-6 User-Defined Screens

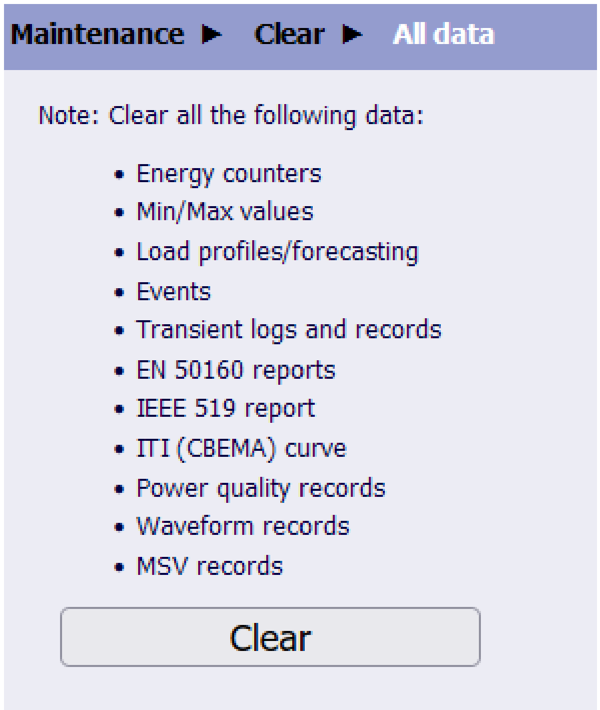
NOTE

Depending on the display type selected, the measured values are displayed numerically or as bars.

7.2 Clearing of Data

If you want to clear all data in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Clear data**.



[sc_clear_data, 2, en_US]

Figure 7-7 Maintenance Tab, Clear Data

- Click **Clear data**.

7.3 File Download

7.3.1 Function Description

The device provides the file download function. You can download the data in a standard format from the **File download** window. The following data formats are available:

- Trend records: PQDIF files
- Measurement records: PQDIF files
- Waveform records: COMTRADE files
- MSV records: COMTRADE files
- Transient records: COMTRADE files

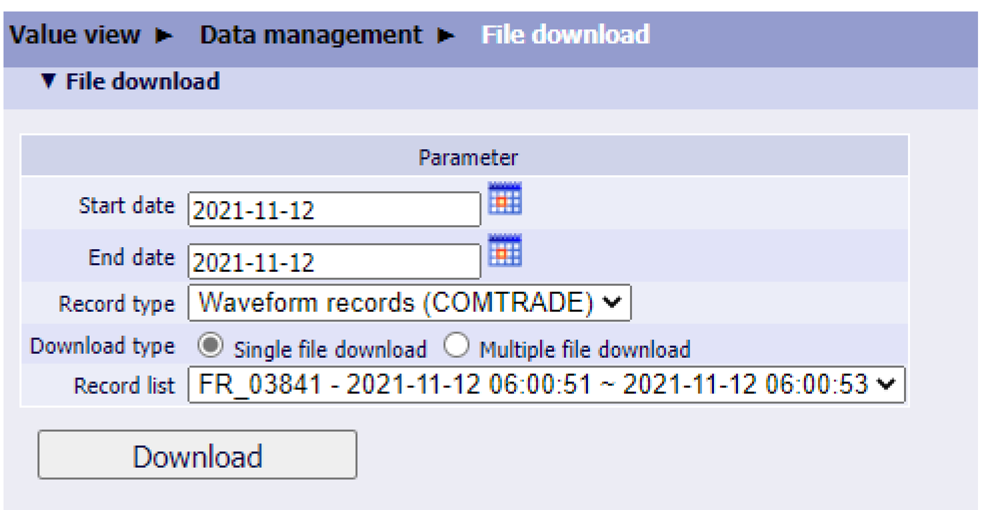
7.3.2 File Download via FTPS

Refer to *2.7.7 File Transfer Protocol Secure (FTPS)*.

7.3.3 File Download via Web Pages

To change the settings of the file download in the **Value view** tab, proceed as follows:

- In the navigation window, click **File download**.



[sc_single_file_download, 1, en_US]

Figure 7-8 Value View Tab, File Download

- Configure the respective parameters according to the following table.

Table 7-4 Settings for File Download

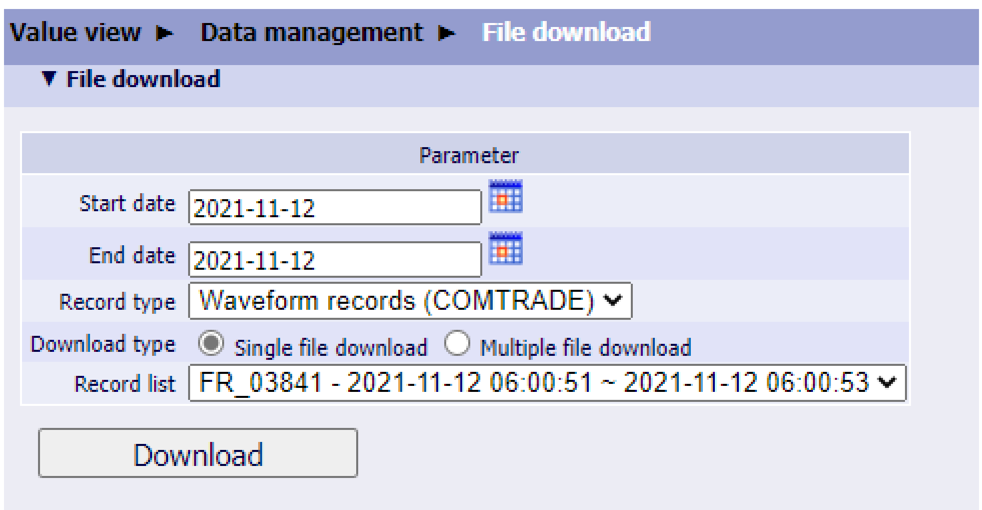
Parameter	Default Setting	Setting Options
Start date	Current date	You can edit the text box directly or select the start date from the calendar.
End date	Current date	You can edit the text box directly or select the end date from the calendar.

Parameter	Default Setting	Setting Options
Record type	Waveform records (COMTRADE)	• Trend records (PQDIF) • Measurement records (PQDIF) • Waveform records (COMTRADE) • MSV records (COMTRADE) • Transient records (COMTRADE)
Download type	Single file download	• Single file download • Multiple file download
Record list	None	File list fulfilled the preceding parameters

7.3.3.1 Single File Download

For a **Single file download**, proceed as follows:

- Select the **Single file download** as the **Download type**.
  All the records during this interval are displayed in the **Record list**.
- Select a record in the **Record list**.



[sc_single_file_download, 1, en_US]

Figure 7-9 Record List – Single File Download

- Click **Download**.
  During the download progress, the selected files are stored in the specified directory. You can use the **SIGRA** software to display the transmitted data of records. Contact the Siemens Hotline for more information, see the chapter *Preface*.
  The **File Download** dialog opens. You can save or open the downloaded file.

NOTE

The button **Download** is displayed only when the **Record list** is available.

File Download > Save

- In the dialog **File download**, click **Save**.
  The **Save As** dialog opens.
- Select the file path in the **Save in** list box.
- Use the file name suggested in the **File name** list box or enter a new file name.

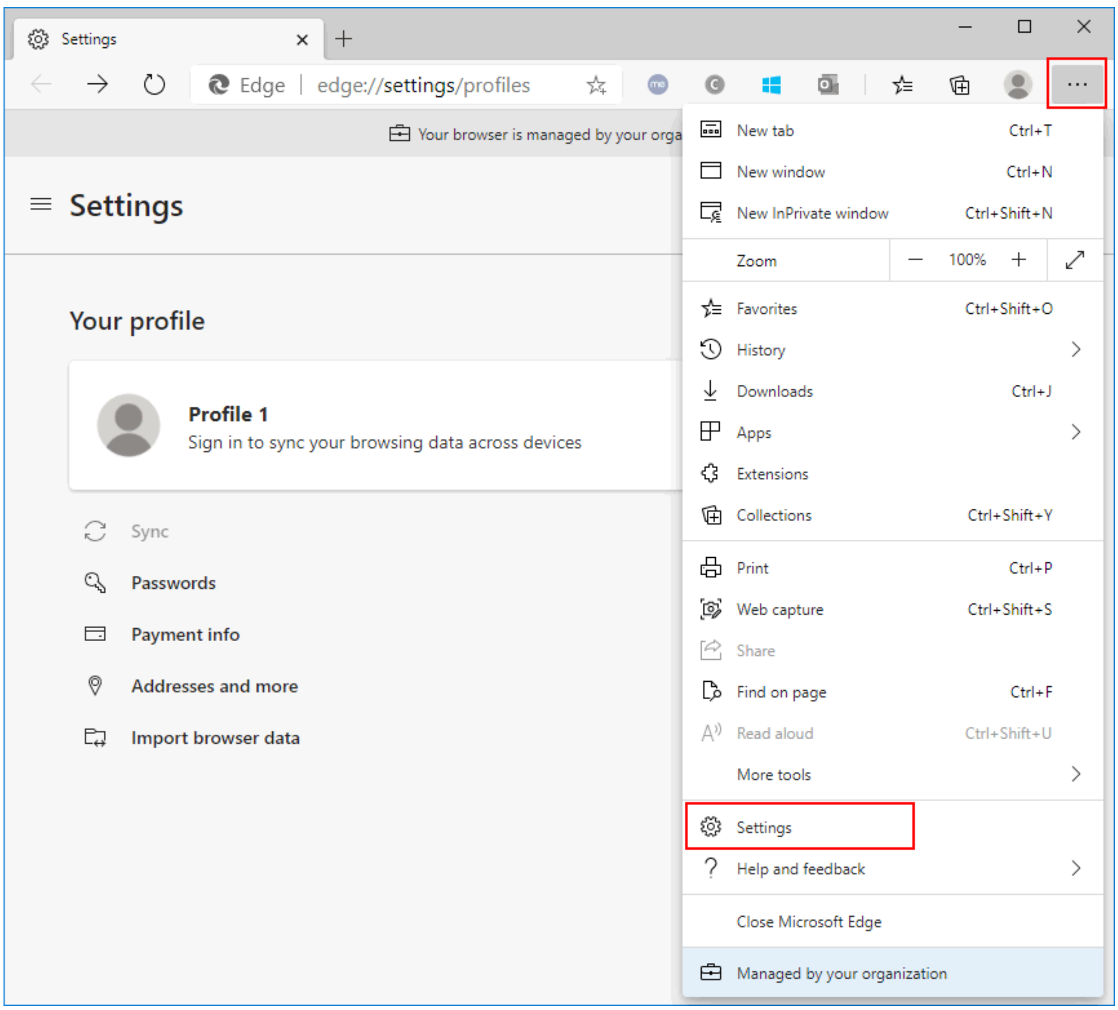
- Click **Save**.
  The **Download complete** dialog opens.
- In the dialog **Download complete**, click **Close**.

7.3.3.2 Multiple File Download via Microsoft Edge

The screenshots related with Microsoft Edge in this chapter are taken from Microsoft Edge version 87.0.664.75 (Official build) (64-bit).

Selecting Path via Microsoft Edge

- Start Microsoft Edge.
- Click **Settings and more** → **Settings**.

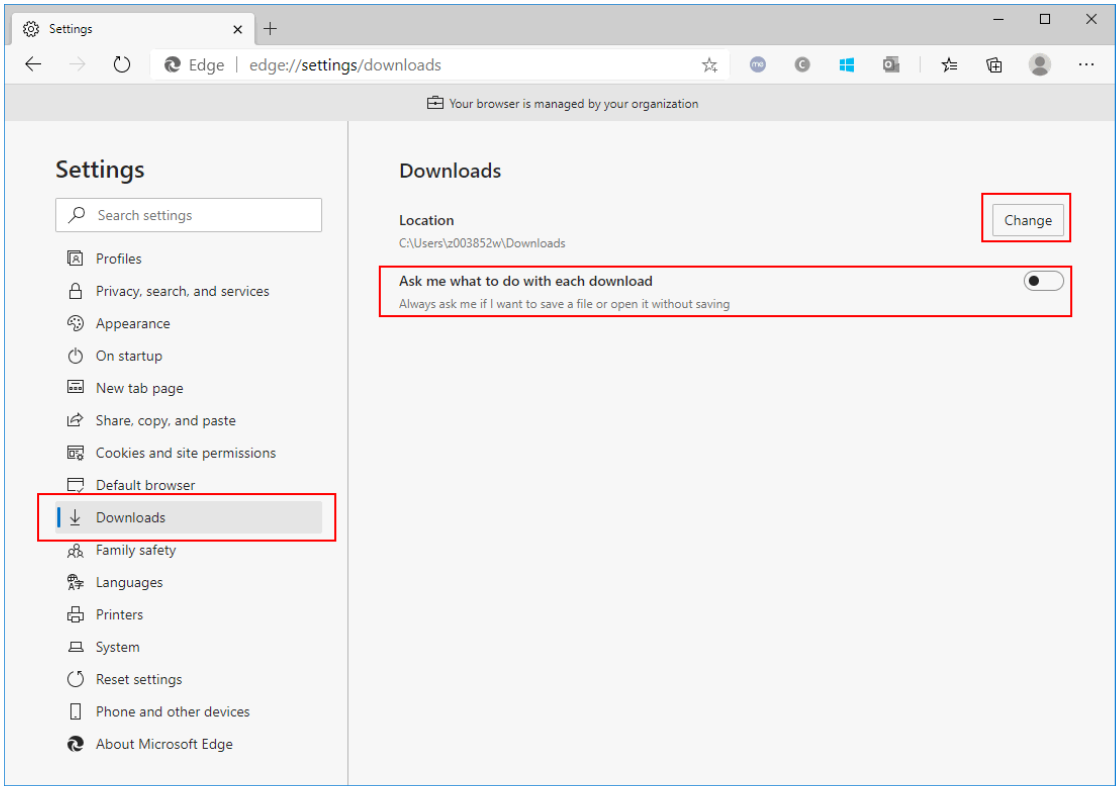


[sc_edge settings, 1, en_US]

Figure 7-10 Microsoft Edge Settings

- Click **Download**.

- Click **Change** to select the path for saving the download file.
  Do not select the **Ask where to save each file before downloading**.



[sc_edge download, 1, en_US]

Figure 7-11 Change Path for Download Files

- Click **Select folder**.

Downloading Multiple Files

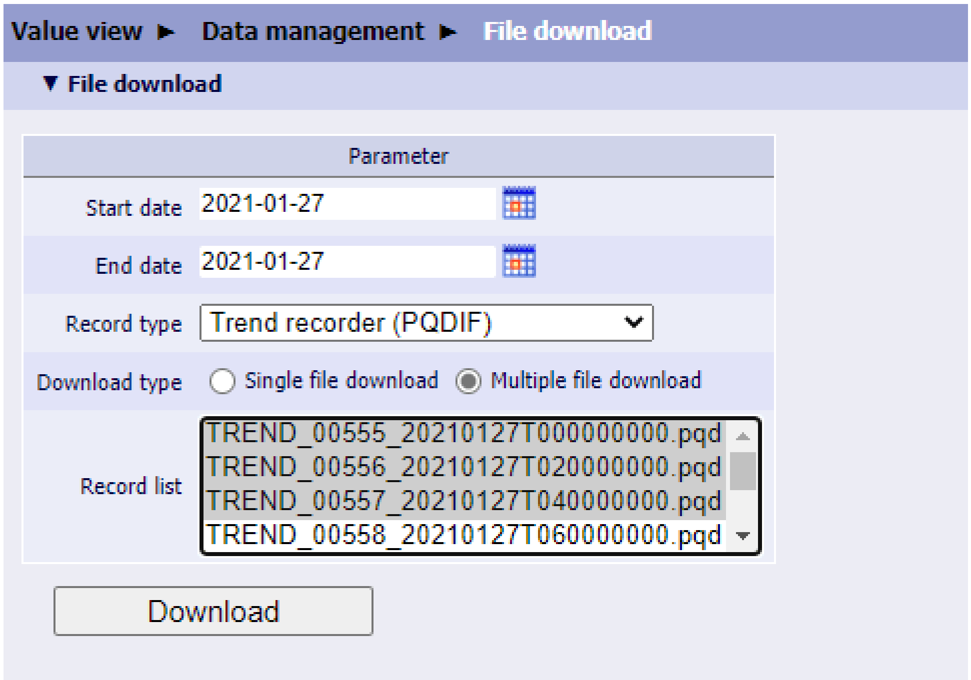
NOTE

The **Record List** of **Multiple File Download** is identical for trend records, measurement records and waveform records.

To do a multiple file download, proceed further as follows:

- Select the **Start date**, the **End date**, and the **Record type**.
- Select **Multiple file download** for the **Download type**.

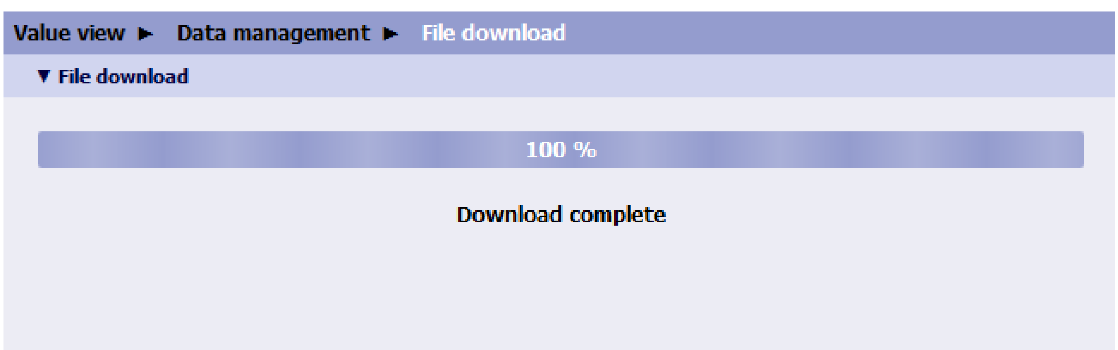
- Select the multiple files in the **Record list**.



[sc_save_directory, 2, en_US]

Figure 7-12 Value View Tab, Multiple File Download

- Click **Download**.
  The download progress is indicated and the selected files are stored in the specified directory.



[sc_download_progress, 2, en_US]

Figure 7-13 Status of the Download Progress

- Once the download is finished, check the files.

Visualizing Downloaded Files

You can display the transmitted data of records with the following programs:

- **SIGRA**: COMTRADE files
- **ComtradeViewer**: COMTRADE files
- **PQDIFCheck**: PQDIF files
- **PQDiffractor**: PQDIF files

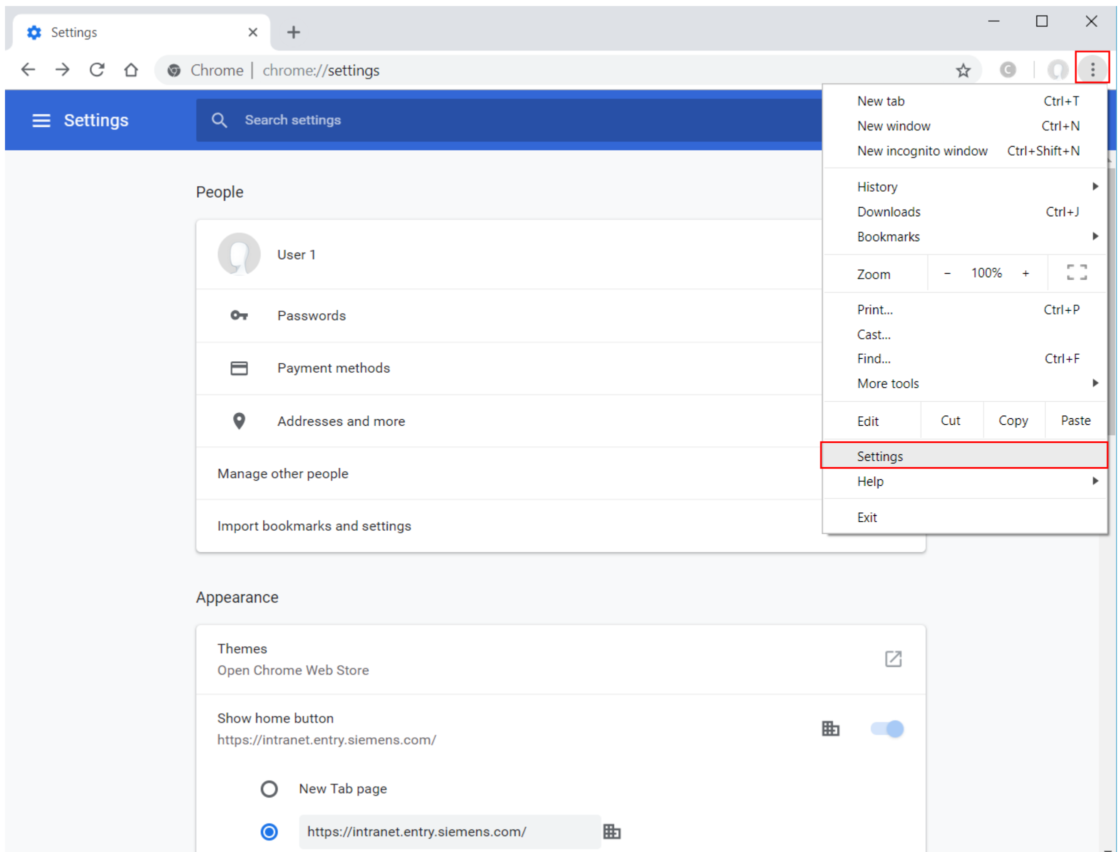
For more information on the programs, contact the Siemens Hotline.

7.3.3.3 Multiple File Download via Google Chrome

The screenshots related with Google Chrome in this chapter are taken from Google Chrome V71.0.3578.98 (Official Build) (64-bit).

Selecting Path via Google Chrome

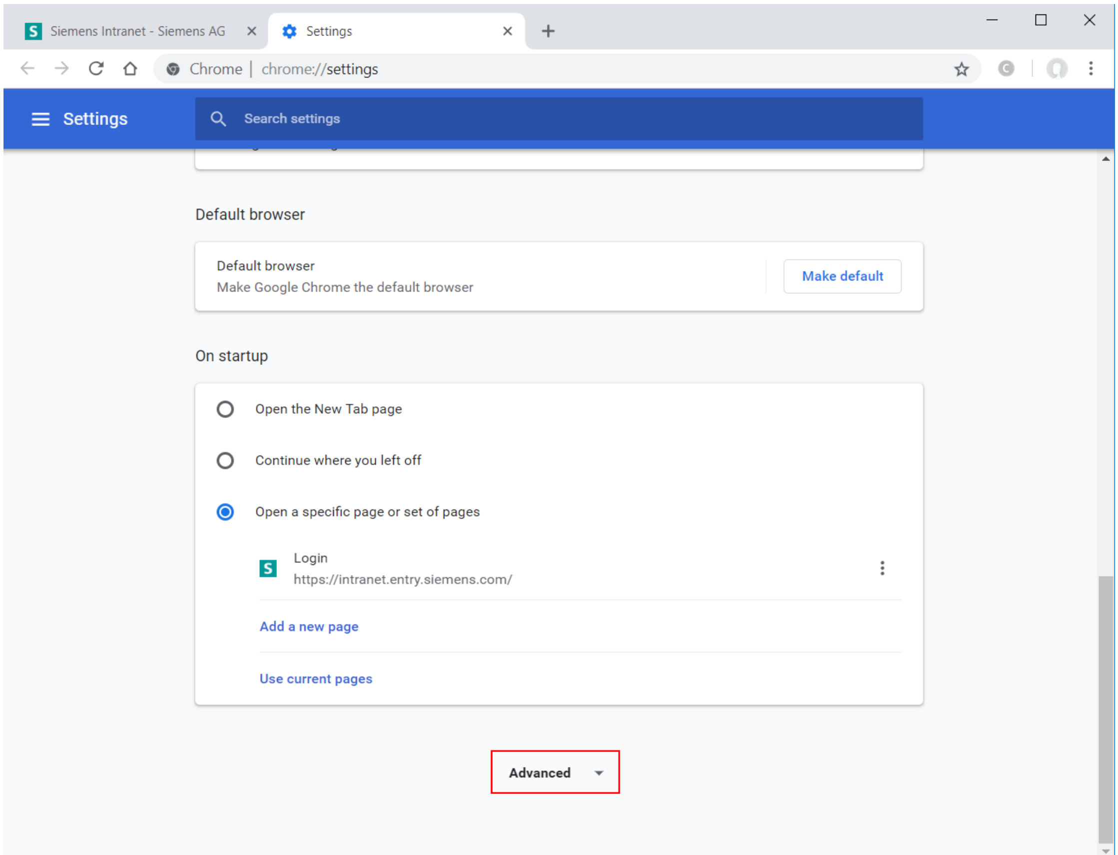
- Start Google Chrome.
- Click **Customize and control Google Chrome** → **Settings**.



[sc_Chrome_settings, 3, en_US]

Figure 7-14 Chrome Settings

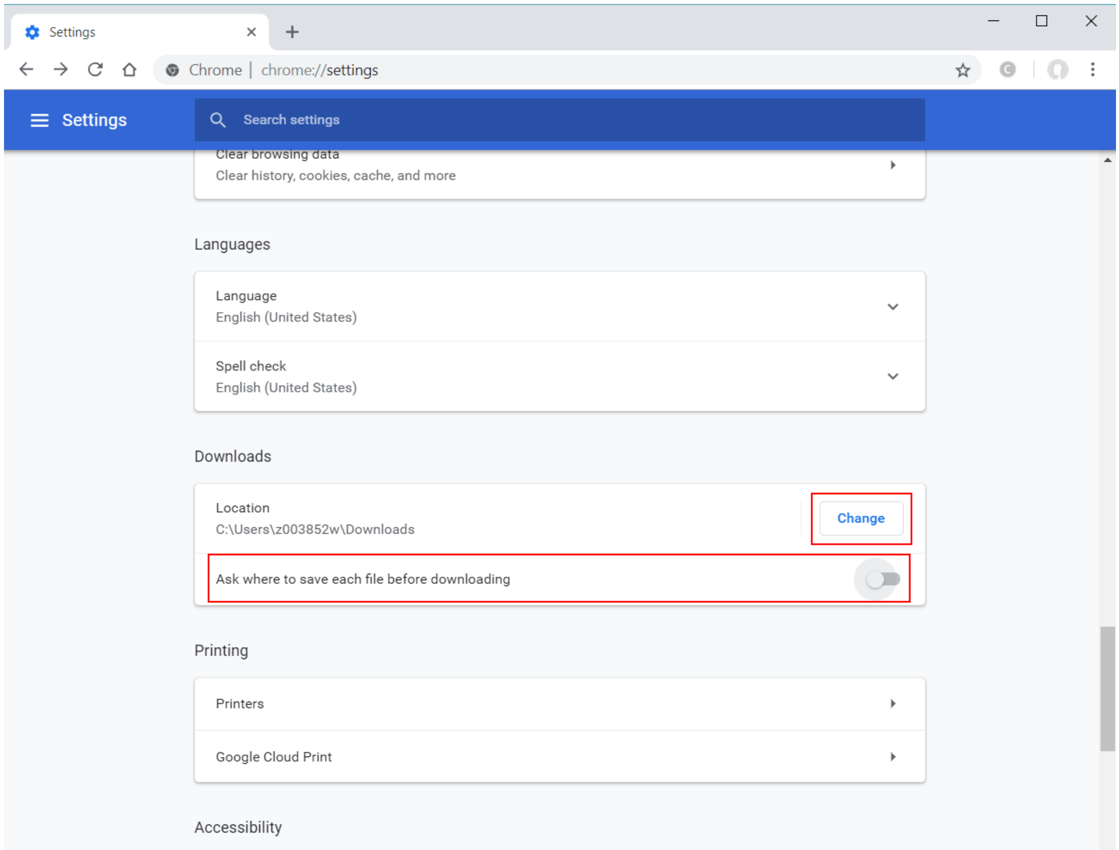
- Click **Show advanced settings...**.



[sc_Chrome_settings_advanced, 3, en_US]

Figure 7-15 Advanced Settings

- Click **Change...** to select the path for saving the download file.
  Do not select the **Ask where to save each file before downloading**.



[sc_Chrome_settings_downloads, 3, en_US]

Figure 7-16 Change Path for Download Files

- Click **OK**.

Downloading Multiple Files

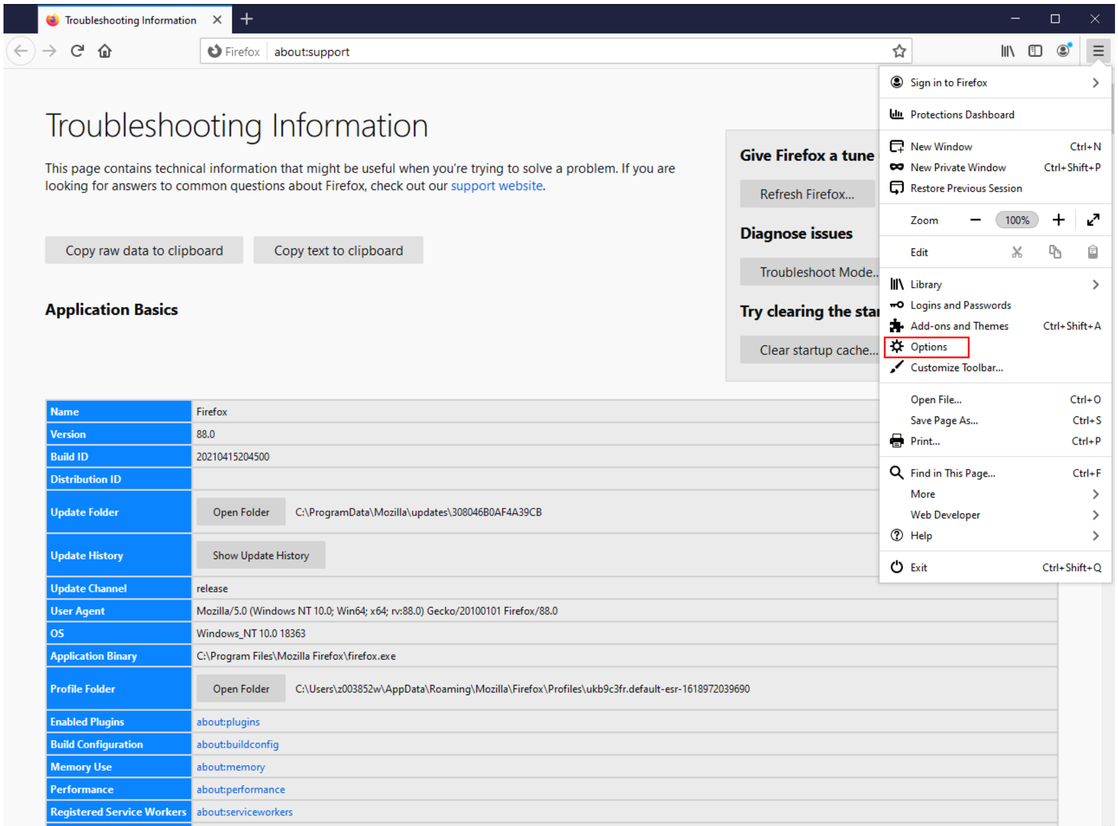
Refer to *Downloading Multiple Files, Page 265*.

7.3.3.4 Multiple File Download via Mozilla Firefox

The screenshots related with Mozilla Firefox in this chapter are taken from Mozilla Firefox V88.0 (64-bit).

Selecting Path via Mozilla Firefox

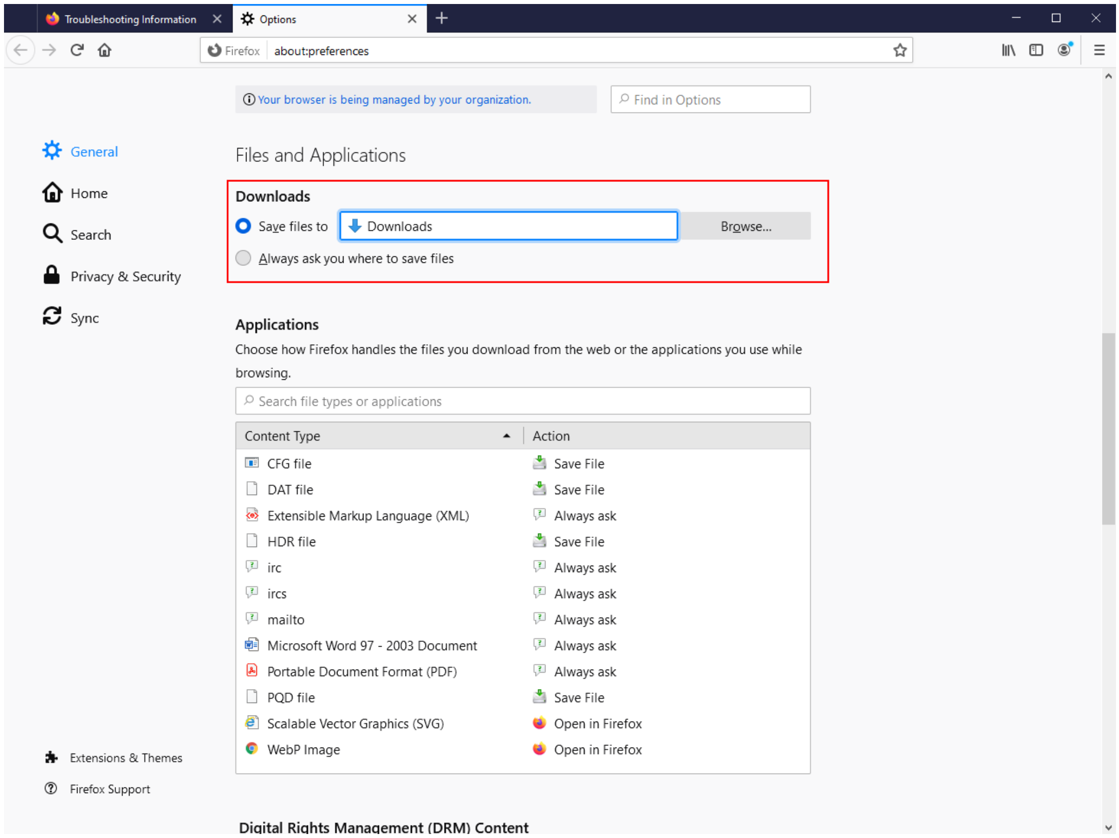
- Start the Mozilla Firefox.
- Click **Application Menu** > **Options**.



[sc_options_Firefox, 3, en_US]

Figure 7-17 Select Options

- Click **Browse...** to select the path for saving the download file.



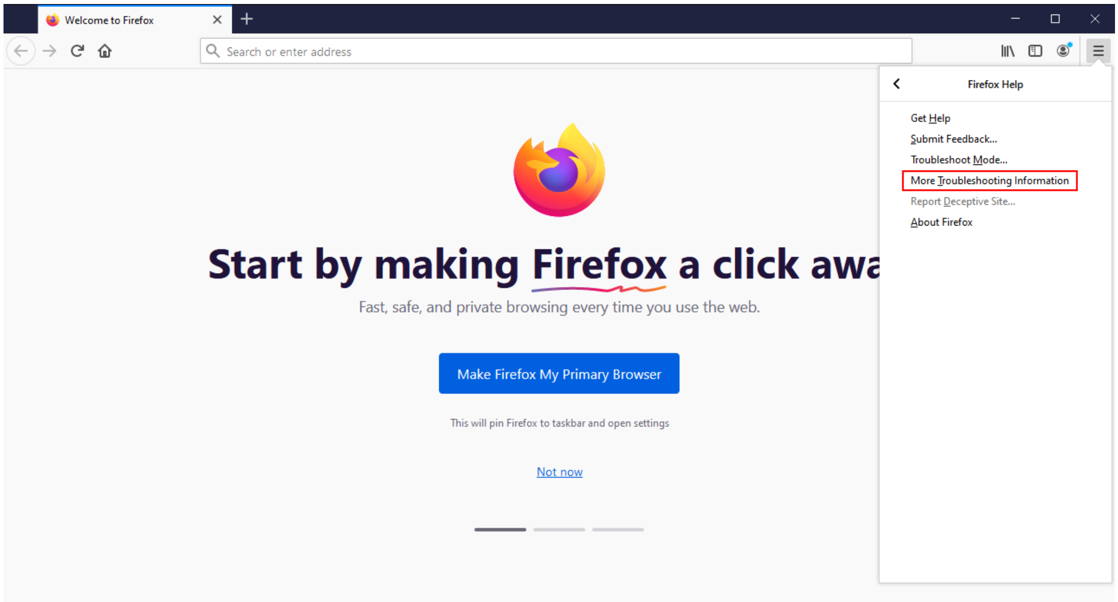
[sc_Firefox_select_path, 3, en_US]

Figure 7-18 Select Path

- Click **Select Folder**.

Setting the Mozilla Firefox

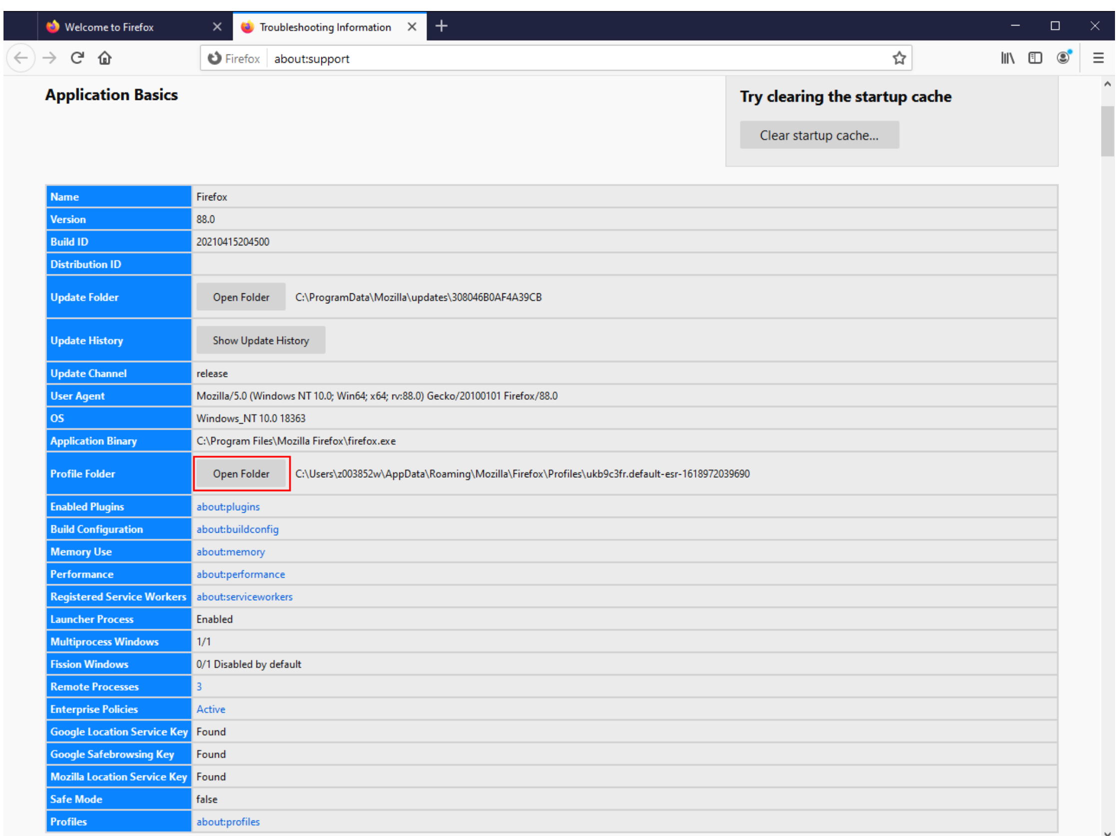
- Click **Application Menu** > **Help** > **More Troubleshooting Information**.



[sc_Troubleshooting, 3, en_US]

Figure 7-19 More Troubleshooting Information

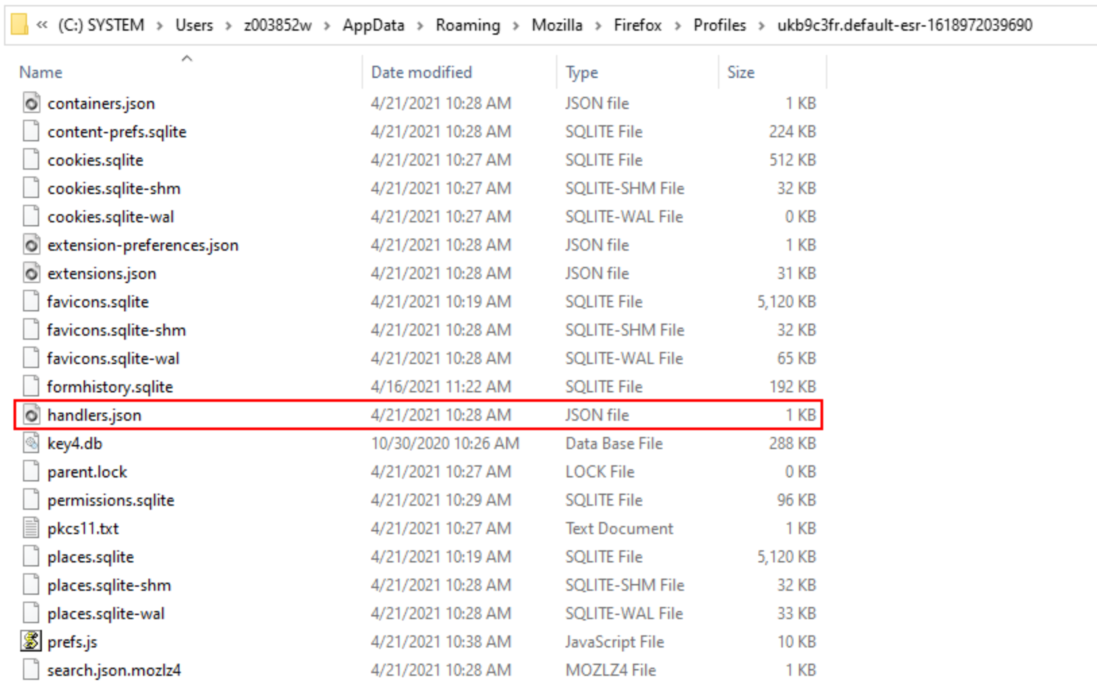
- Click **Open Folder**.



[sc_Show_folder, 3, en_US]

Figure 7-20 Open Folder

- Open the **handler.json** file with the **Text Editor** in the opened folder.

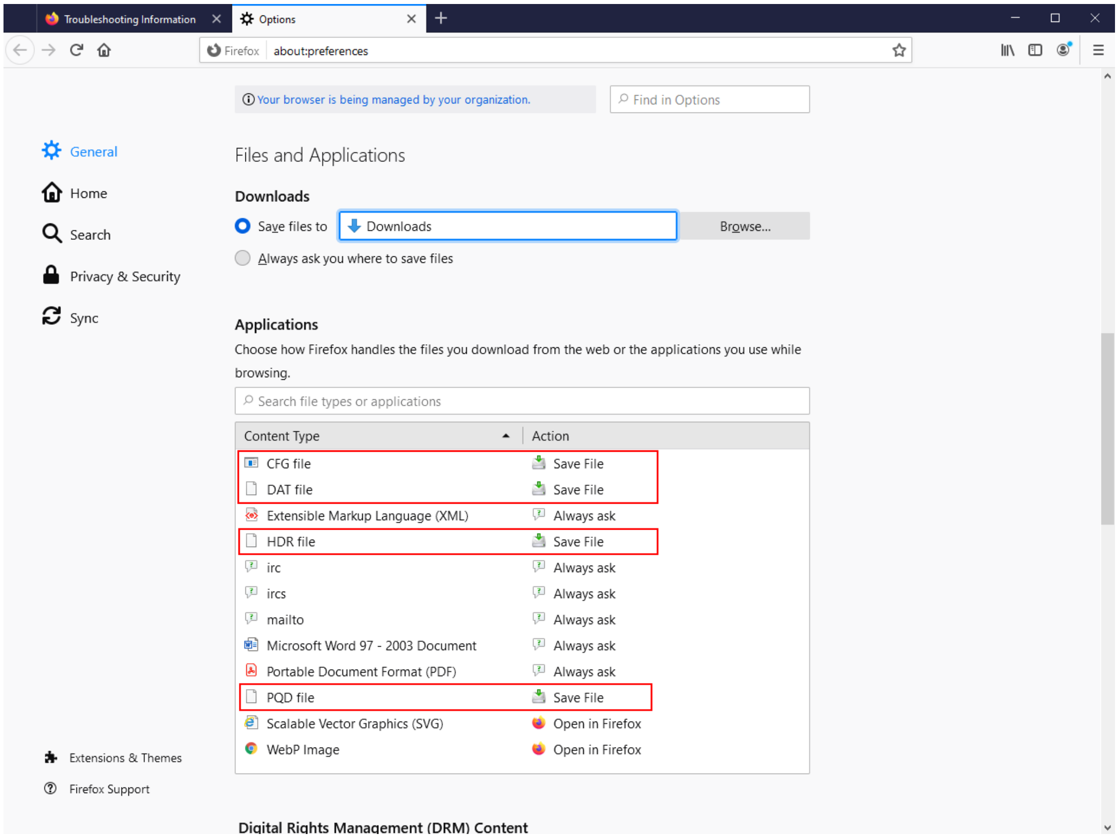


[sc_handler.json, 1, --_--]

- Replace the content with the following text and save it.

{"defaultHandlersVersion":{"en-US":4,"zh-CN":4,"en-GB":4},"mimeTypes":{"application/pdf":{"action":2,"extensions":["pdf"],"ask":true},"application/pqd":{"action":0,"extensions":["pqd"]},"application/hdr":{"action":0,"extensions":["hdr"]},"application/dat":{"action":0,"extensions":["dat"]},"application/cfg":{"action":0,"extensions":["cfg"]},"text/xml":{"action":2,"extensions":["xml","xsl","xbl"],"ask":true},"image/svg+xml":{"action":3,"extensions":["svg"]},"image/webp":{"action":3,"extensions":["webp"]},"application/msword":{"action":0,"ask":true,"extensions":["doc"]}},"schemes":{"irc":{"stubEntry":true,"handlers":[null,{"name":"Mibbit","uriTemplate":"https://www.mibbit.com/?url=%s"}]},"ircs":{"stubEntry":true,"handlers":[null,{"name":"Mibbit","uriTemplate":"https://www.mibbit.com/?url=%s"}]},"mailto":{"handlers":[null,{"name":"Yahoo! Mail","uriTemplate":"https://compose.mail.yahoo.com/?To=%s"},{"name":"Gmail","uriTemplate":"https://mail.google.com/mail/?extsrc=mailto&url=%s"}],"action":2,"ask":true}}}

- Restart the Mozilla Firefox.
- Check the 4 files with the red rectangles in the following figure in the **Application Menu** > **Options**.



[sc_check_files, 1, --_--]

Downloading Multiple Files

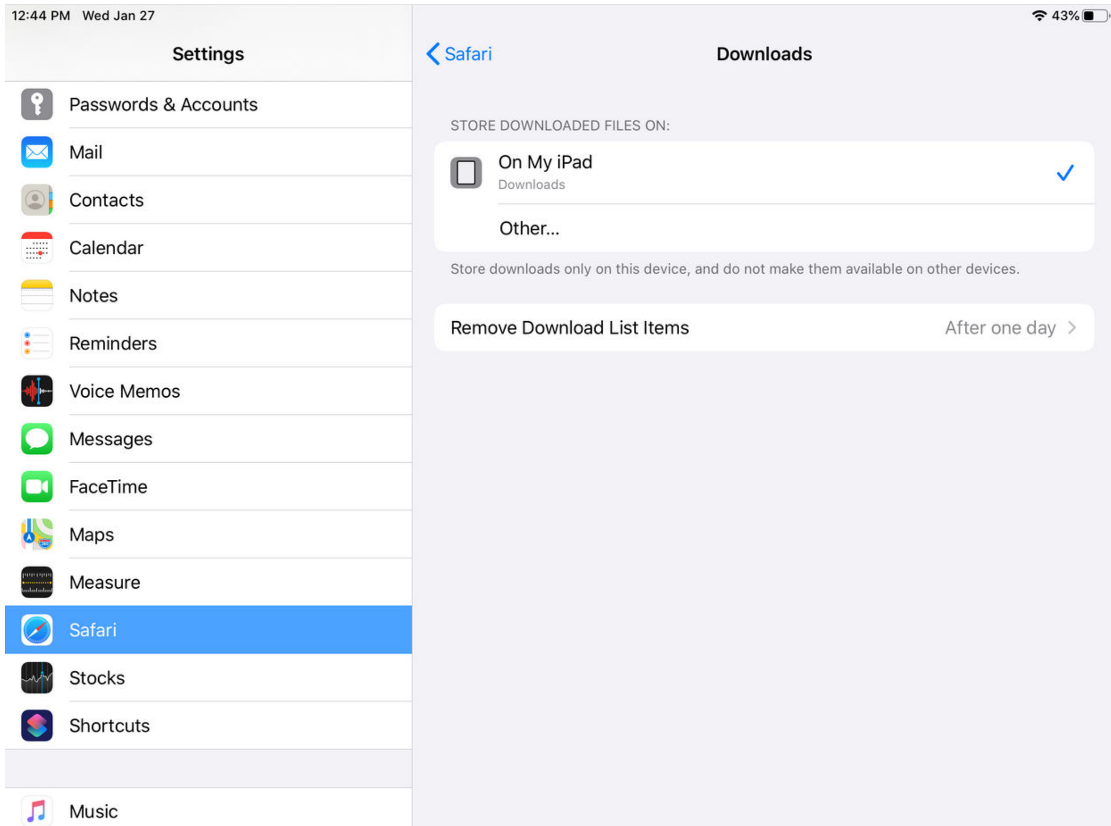
Refer to *Downloading Multiple Files, Page 265*.

7.3.3.5 Multiple File Download via Apple Safari

The screenshots related with Apple Safari in this chapter are taken from iPad 6 iOS 13.1.2.

Selecting Path via Apple Products

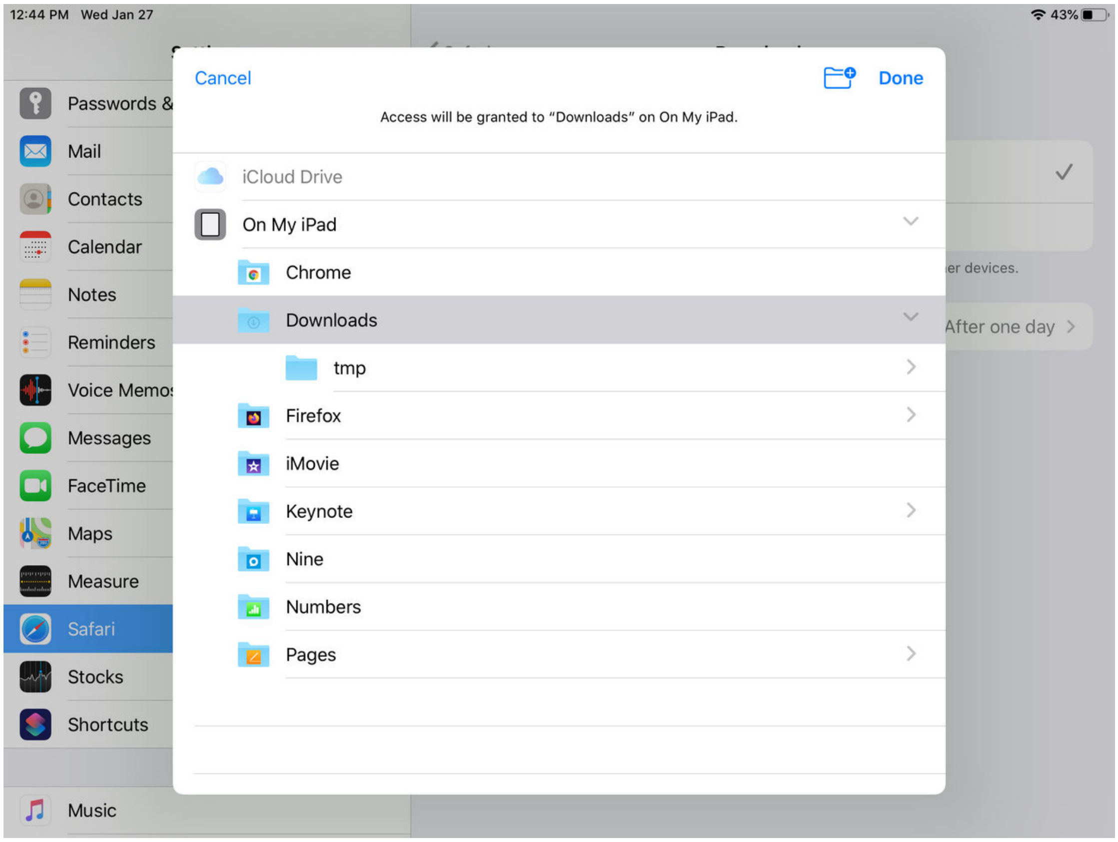
- Go to **Settings**.
- Click **Safari** → **Downloads**.



[sc_safari_downloads, 1, en_US]

Figure 7-21 Download Settings for Safari

- Click **Other...** to select a path for saving the downloaded files.



[sc_safari_seleting path, 1, en_US]

Downloading Multiple Files

Refer to *Downloading Multiple Files, Page 265*.

NOTE

When the download-progress dialog opens, you must go back to the file-download page and click **Download** for each record.

---

8 Cybersecurity

8.1 Overview

The following table contains an overview of the security features. Individual topics are explained in the following chapters.

Table 8-1 Overview

Topic	Description
HTTPS	The device supports the following HTTPS features: • For access to the Web UI of the device, the secure HTTPS communication protocol is used. Unencrypted HTTP access is not supported. • The free software OpenSSL is used for the TLS implementation. • The integrated Web server supports connection requests with the cryptographic protocol versions TLS1.2. Older versions are rejected due to security reasons. • Only high-strength Cipher Suites (key length ≥ 128 bit) are supported. • The device generates a self-signed TLS-certificate and is therefore not signed and confirmed by a certification authority. When using the user interface, all browsers will show a message regarding an unknown certificate warning about an untrusted connection. Due to the authentication scheme used by browsers, Siemens cannot provide certificates (for example, during assembly) to be used for HTTPS with browsers. This is because either the DNS name or the IP address of the device has to be part of the signed certificate, both of which are ultimately determined after installation at the site of the customer. That is why the products generate a self-signed certificate after the IP address has been set. This self-signed certificate has to be trusted in a secure way on all clients used to access this device. You can find the recommended way of trusting self-signed certificates in the document **Certificate trusting in web browsers**. You can find this document at *http://www.siemens.com/gridsecurity*, **Downloads** > **Downloads Cyber Security General** > **Application Notes**. • As the certificate is linked to the IP address of the device, it is generated anew with each change of the IP address. • The device contains a crypto chip which safely stores the private and public keys for TLS communication, required for the HTTPS protected Web UI. Both keys are stored into the crypto chip in the factory. The public key is read by the firmware in order to generate the TLS certificate, while the private key cannot be read out from the crypto chip. Therefore the main cipher operation happens in a trusted, dedicated hardware.
Role-Based Access Control (RBAC)	The device provides a role-based access control (RBAC) mechanism for the account management. With the RBAC mechanism, the permissions to perform certain actions on the device are assigned to specific roles. The device supports the centralized user-credentials management with a RADIUS server. For more information, refer to *8.2.2 Configuration via Web Pages*.
Automatic logout after a timeout of no action	If there are no actions via the Web browser for a timeout session (10 min by default), you log off automatically. For further actions, you must log on to the Web page again. For more information, refer to *8.3.2 Security Settings*
Audit log	The device provides an audit log to track security-relevant events. Only a user with auditor rights can access the messages in the audit log. For more information, refer to *8.8 Audit Log*.

Topic	Description
Syslog	The device supports transmitting the audit logs to a central log server using Syslog. For more information, refer to *8.5.1 Function Description*.
Firmware with digital signature	The integrity and authenticity of the firmware package is protected by a digital signature. Only a firmware package with a valid digital signature can be uploaded into the device.
SNMPv3	The SNMP service is provided with an SNMPv3 security mechanism. The device offers read-only access via SNMP only. For more information, refer to *2.7.5.2 Simple Network Management Protocol v3 (SNMPv3)*.
FTPS	The device supports the following FTPS features: • The FTP server supports connection requests with the cryptographic protocol versions TLS1.2. Older versions are rejected due to security reasons. • The device generates a self-signed TLS-certificate and is therefore not signed and confirmed by a certification authority. The FTP client will show a message regarding an unknown certificate warning about an untrusted connection.
Disable ports	All UDP or TCP ports except port 443 are closed at delivery of the device and must be activated explicitly (for example SNMP port). For more information, refer to *8.6 TCP/UDP Ports Used*.
Modbus TCP read only	When communicating via Modbus TCP, the read-only access is configurable. For more information, refer to *2.7.2.1 Configuration via Web Pages*.

- Deploy in a secured environment only:
  Siemens recommends protecting network access to its energy automation products with appropriate mechanisms (for example, firewalls, segmentation, VPN). It is advised to configure the environment according to the operational guidelines in order to run the devices in a protected IT environment.
  You can find the recommended security guidelines to Secure Substations at *http://www.siemens.com/gridsecurity*, **Cyber Security General Downloads** > **Manuals**.

8.2 Account Management

8.2.1 Function Description

The device provides a role-based access control (RBAC) mechanism for the account management. This function is a policy-neutral mechanism for access control to define the roles and privileges. With the RBAC mechanism, the permissions to perform certain actions on the device are assigned to specific roles. Besides the local account management, the device supports the centralized user-credentials management with a RADIUS server.

Creating Local User Accounts

There is no default user account or default password provided for a newly delivered device. After the newly delivered device boots up, you are required to create an initial local user account with an administrator role or a user account manager role on the Web UI. The device does not support to create any user account on a RADIUS server.

Afterwards, you can log on with the created role and get access to **Account management** to create, change, or delete the user accounts for the following roles:

Table 8-2 Roles and Role IDs

Role	Role ID	Role Definition
IEC 62351-8 Defined Roles		
Viewer	0	IEC 62351-8
Operator	1	IEC 62351-8
Engineer	2	IEC 62351-8
Installer	3	IEC 62351-8
Security administrator (SECADM)	4	IEC 62351-8
Security auditor (SECAUD)	5	IEC 62351-8
User account manager (RBACMNT)	6	IEC 62351-8
Siemens-Defined Roles		
Administrator (ADMIN)	-31648	SiemensGridSecurity
Backup operator (BACKUP_OP)	-101	SiemensGridSecurity
Guest	-20537	SiemensGridSecurity

The following table contains the access rights to different roles in the device:

Table 8-3 Access Rights Assigned to Different Roles

<table>
<tr><th rowspan="2">Role</th><th colspan="4">Access to the Web UI Tabs</th></tr>
<tr><th>Information</th><th>Configuration</th><th>Value View</th><th>Maintenance</th></tr>
<tr><td>Guest</td><td rowspan="10">View all pages</td><td>Password management</td><td>–</td><td>–</td></tr>
<tr><td>Viewer</td><td>View all operational settings
Password management</td><td rowspan="5">View all pages</td><td>View operational log, error logs, and diagnosis data</td></tr>
<tr><td>Operator</td><td>View all operational settings
Password management</td><td>Clear data
Reset energy counters, date/time, and min/max values
Delete load profile buffer
View/delete error logs, transient logs, and diagnosis data</td></tr>
<tr><td>Backup operator</td><td>View all operational settings
Password management
Save configuration to files</td><td>View operational log, error logs, and diagnosis data</td></tr>
<tr><td>Engineer</td><td>Modify all operational settings
Password management</td><td>View operational log, error logs, and diagnosis data
Enable/disable the customer support functions</td></tr>
<tr><td>Installer</td><td>Get default configuration
Open configuration from file
Save configuration to file</td><td>Firmware upload
View operational log, error logs, and diagnosis data
Enable/disable the customer support functions</td></tr>
<tr><td>User account manager</td><td>Account management
Password management</td><td>–</td><td>–</td></tr>
<tr><td>Security administrator</td><td>Account management
Security settings
Password management
Syslog
Activation/Cancel</td><td>–</td><td>–</td></tr>
<tr><td>Security auditor</td><td>Password management</td><td>–</td><td>View audit logs</td></tr>
<tr><td>Administrator</td><td>Full access to all pages</td><td>View all pages</td><td>Full access to all pages</td></tr>
</table>

NOTE

Only a user with the role of administrator, security administrator, or user account manager has the permission to access the **Account management**.

HMI Password

The device provides an option to use an HMI password. It determines whether the password for actions at the device display is activated or deactivated. The HMI password is deactivated by default.

- If the HMI password is deactivated, all actions at the device display can be executed without entering a password.
- If the HMI password is activated, you must enter a configured password to start actions at the device display.

8.2.2 Configuration via Web Pages

Creating an Initial Local User Account

To create an initial local user account, proceed as follows:

- In the **Log on** tab, select **Administrator** or **User Account Manager** from **Account Type**.

[sc_initial_account_creation, 4, en_US]

Figure 8-1 Creating an Initial Local User Account

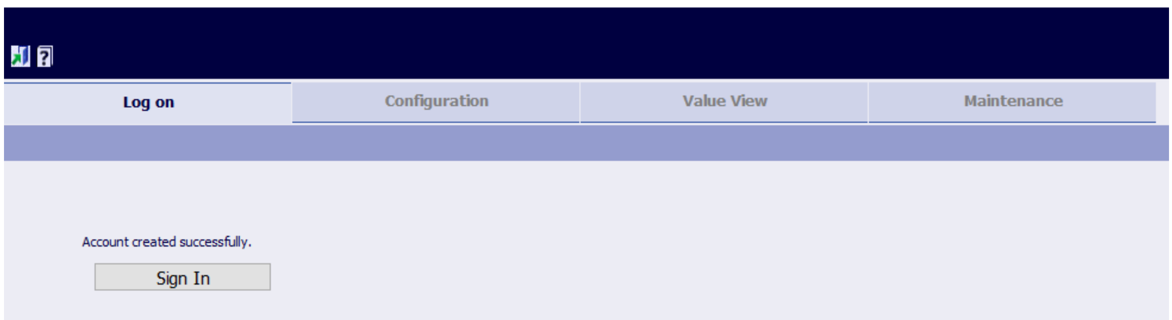
- Enter a new user name and password according to the following table.

Table 8-4 Settings for Creating an Initial Local Account

Parameter	Default Setting	Setting Range
Account type	Administrator	User Account Manager Administrator
User name	Empty	Up to 64 characters

Parameter	Default Setting	Setting Range
New password	Empty	8 to 24 characters Contains at least: • 1 capital Latin letter (A to Z) • 1 small Latin letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?
Repeat new password		

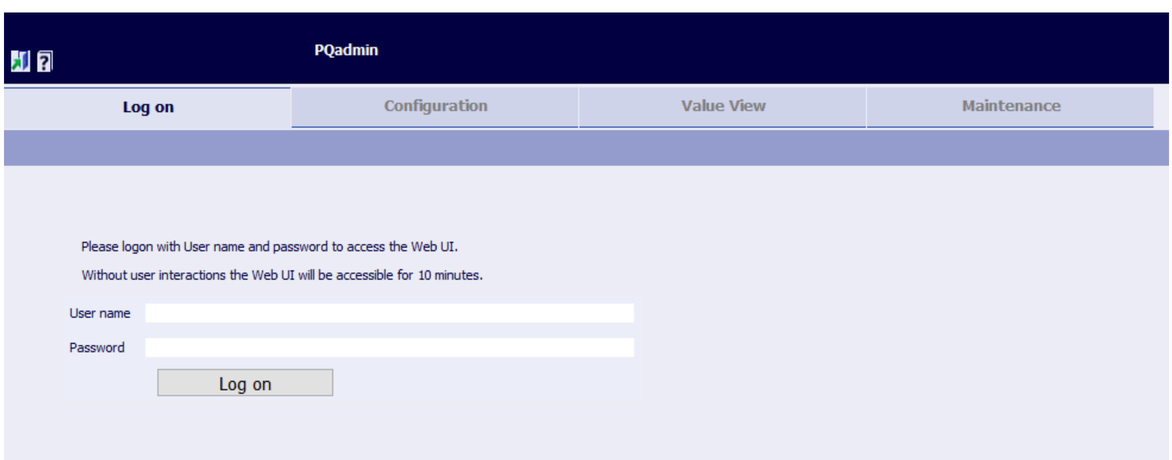
- Click **Confirm**. An initial local user account is created.
- Click **Sign in**.



[sc_sign in, 3, en_US]

Figure 8-2 Sign in, Account Management

- Enter the created user name and password in the **Log on** tab.



[sc_logon_RBAC, 3, en_US]

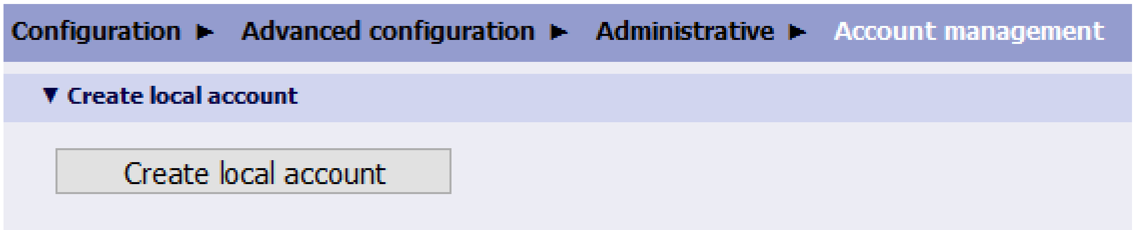
Figure 8-3 Log on Tab, Account Management

- Click **Log on**. The **Information** tab appears if the entered user name and password are correct.

Creating Local User Accounts with Different Roles

To create local user accounts with different roles in the **Configuration** tab, proceed as follows:

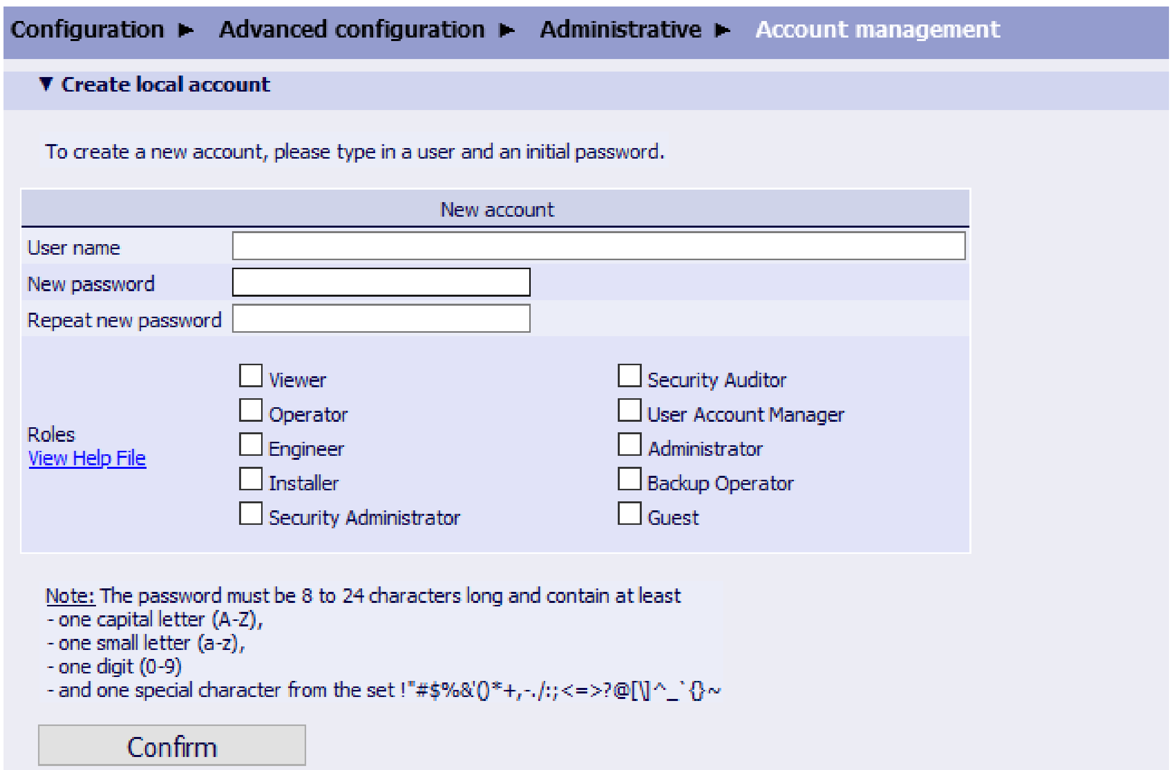
- In the navigation window, click **Account management**.



[sc_Create_accounts, 4, en_US]

Figure 8-4 Configuration Tab, Account Management

- Click **Create local account**.



[sc_q100_create_accounts, 2, en_US]

Figure 8-5 Configuration Tab, Creating Local Accounts

- Create local user accounts according to the following tables.

Table 8-5 Settings for Creating Local Accounts

Parameter	Default Setting	Setting Range
User name	Empty	Up to 64 characters
New password Repeat new password	Empty	8 to 24 characters Contains at least: • 1 capital letter (A to Z) • 1 small letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?
Roles	Empty	Click one or several option buttons to select a role or several roles for a user account according to *Table 8-6*.

Table 8-6 Overview of the Access Rights Assigned to Each Role

Description of the Access Rights	Role									
	Guest	Viewer	Operator	Backup Operator	Engineer	Installer	Security Administrator	Security Auditor	User Account Manager	Administrator
General information viewing	x[65]	x	x	x	x	x	x	x	x	x
Operational data viewing	–	x	x	x	x	x	–	–	–	x
Configuration settings viewing	–	x	x	x	x	x	–	–	–	x
Force values	–	–	x	–	–	–	–	–	–	x
Configuration downloading	–	–	–	x	x	x	–	–	–	x
Configuration change and uploading	–	–	–	–	x	x	–	–	–	x
Firmware change	–	–	–	–	–	x	–	–	–	x
User account management	–	–	–	–	–	–	x	–	x	x
Security management	–	–	–	–	–	–	x	–	–	x
Audit trail	–	–	–	–	–	–	-	x	–	x

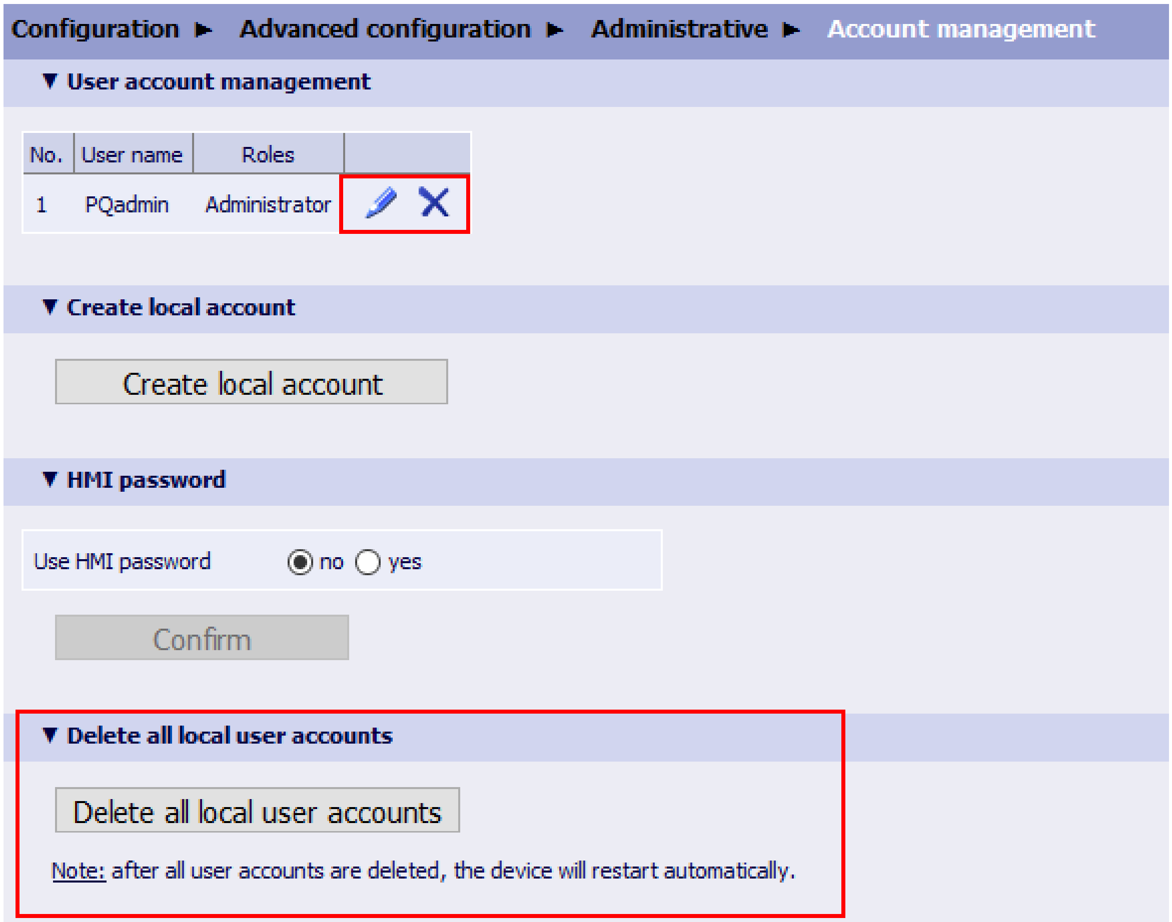
- Enter the user name, the password, and select a role or several roles for a user account.
- Click **Confirm**. A local user account is created.

Editing or Deleting an Existing Local User Account

To edit an existing user account, proceed as follows:

- In the navigation window, click **Account management**.

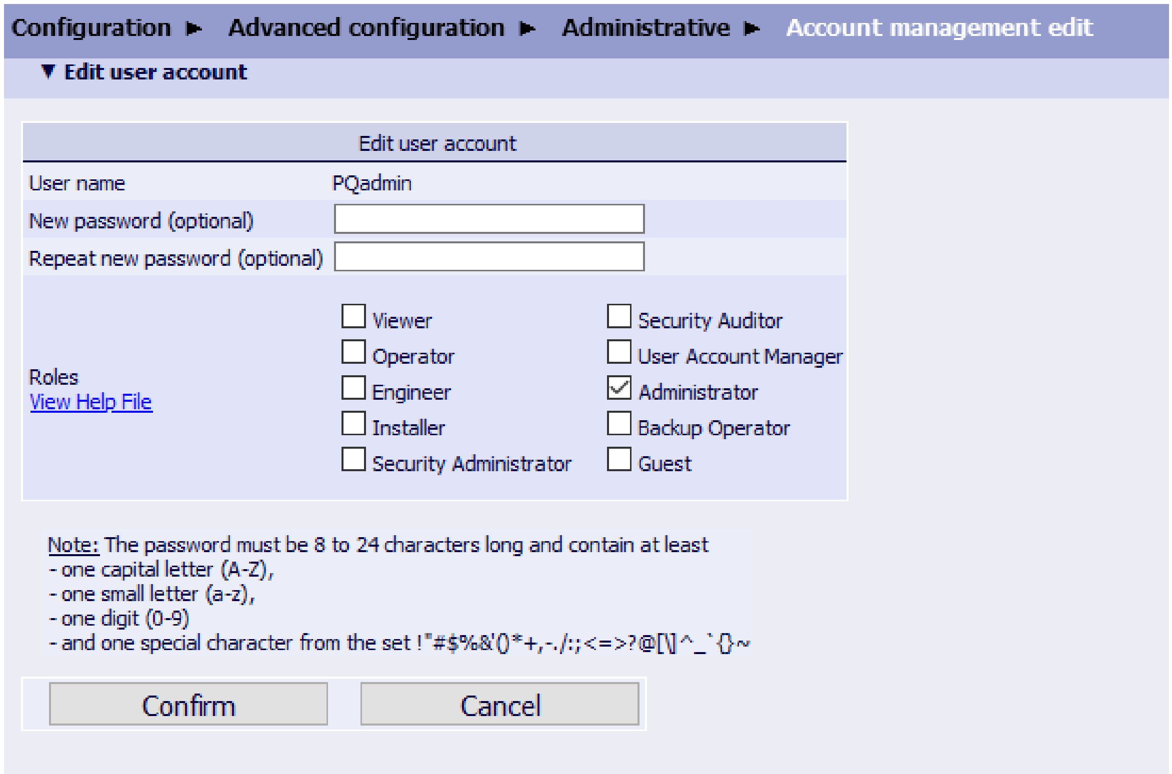
65 X represents that the user with this role is assigned with related rights.



[sc_account change_delete, 4, en_US]

Figure 8-6 Editing or Deleting a Local User Account

- Click the icon to edit the password or edit the role of an existing local user account.



[sc_q100_edit_accounts, 2, en_US]

Figure 8-7 Editing a Local User Account

- Edit the local user account according to the following table.

Table 8-7 Settings for Editing a Local User Account

Parameters	Default Setting	Setting Range
User name	Fixed, not configurable	The user name depends on the settings made by the account management.
New password (optional) Repeat new password (optional)	Empty	8 to 24 characters Contains at least: • 1 capital letter (A to Z) • 1 small letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?
Roles	Fixed	Click one or several option buttons according to the table *Table 8-6* to reselect the roles.

- Click **Confirm**, the local user account is edited successfully.

To delete an existing local user account, proceed as follows:

- In the navigation window, click **Account management**.
- Click the icon to delete an existing local user account.

- If you want to delete all the local user accounts, click the button **Delete all local user accounts** shown in *Figure 8-6*.

  As a result, the device restarts automatically. The **Log on** tab with creating an initial local user account opens after the device restarts, shown in *Figure 8-1*.

NOTE

If the roles for the users who have the permission to access **Account management** are changed, the users must log off and log on again to make sure that the roles are updated.

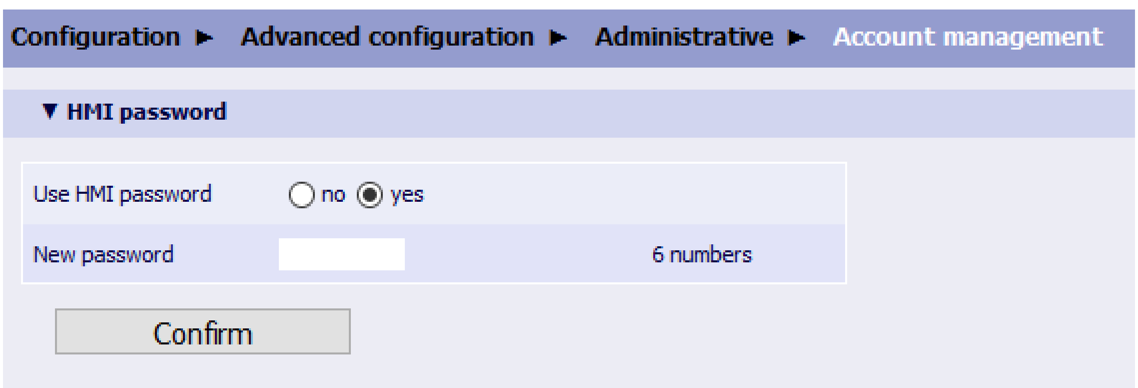
NOTE

To edit a local user account, you can choose to edit the password, the roles or both of the password and roles.

Parameterization of HMI Password

To set the HMI password in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Account management**.



[sc_HMI_password, 4, en_US]

Figure 8-8 Configuration Tab, HMI Password

- Set the HMI password according to the following table.

Table 8-8 Settings for HMI Password

Parameter	Default Setting	Setting Range
Use HMI password	no	no yes
New password	Empty	6 digital numbers (0 to 9)

- Click **Confirm**, the HMI password is set successfully.

Remote Authentication Dial-in User Service (RADIUS Server)

The device supports the centralized user-credentials management with a RADIUS server. Only users with the access right of **User Account Management** can configure the RADIUS server via the Web pages.

The RADIUS protocol is deactivated by default. The parameters for the RADIUS server are available and can be configured only after you activate the RADIUS protocol.

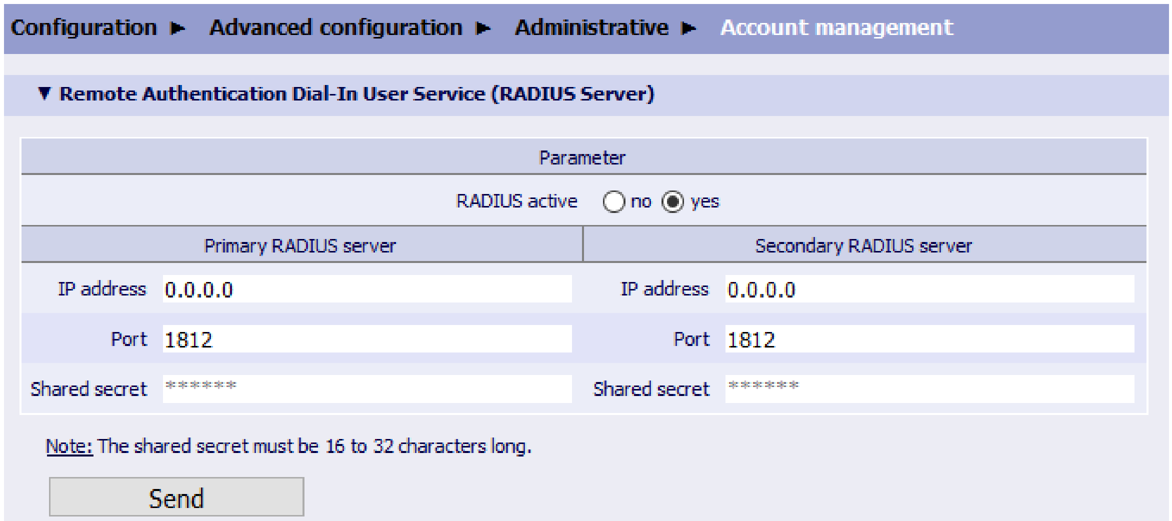
The device supports 2 RADIUS servers:

- Primary RADIUS server
- Secondary RADIUS server

If both RADIUS servers are configured, the device sends the authentication request to the primary RADIUS server first. The device sends the request to the secondary RADIUS server only if the primary RADIUS server is not reachable.

To set the RADIUS server in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Account management**.



[sc_RADIUS server, 3, en_US]

Figure 8-9 Configuration Tab, Remote Authentication

- Set the RADIUS server according to the following table.

Table 8-9 Settings for the RADIUS Server

Parameter	Default Setting	Setting Range
RADIUS active	no	no yes
Primary RADIUS server		
IP address	0.0.0.0	Any
Port	1812	0 to 65 535
Secret	Empty	Any (16 to 32 characters)
Secondary RADIUS server		
IP address	0.0.0.0	Any
Port	1812	0 to 65 535
Secret	Empty	Any (16 to 32 characters)

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

8.3 Security Settings

8.3.1 Function Description

The device provides the security settings to configure the login settings.

NOTE

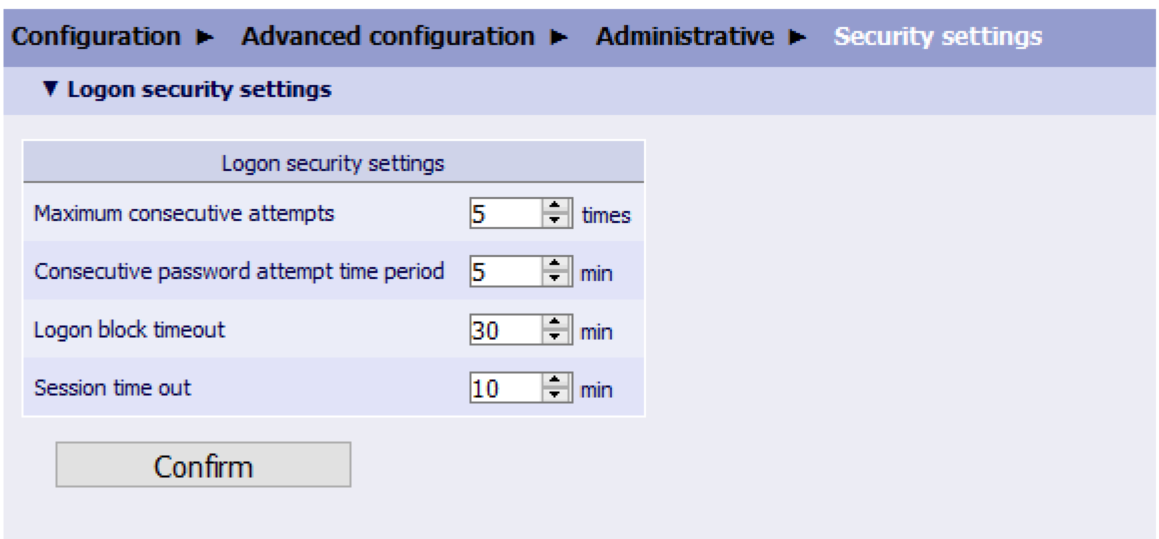
Only a user with the role of administrator or security administrator has the permission to access **Security Settings**.

8.3.2 Security Settings

The user with the account created with a role of administrator or security administrator has the permission to configure the logon security settings.

To configure the security settings in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Security settings**.



[sc_security_settings, 2, en_US]

Figure 8-10 Security Settings, RBAC

- Configure the respective parameters according to the following table.

Table 8-10 Settings for Security Settings

Parameter	Default Setting	Setting Range
Maximum consecutive attempts	5	5 times to 12 times
Consecutive password attempt time period	5	1 min to 10 min
Logon block timeout	30	30 min to 360 min
Session timeout	10	0 min (no timeout) to 1440 min (1 day) If the device restarts, you must log on again.

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

8.4 Password Management

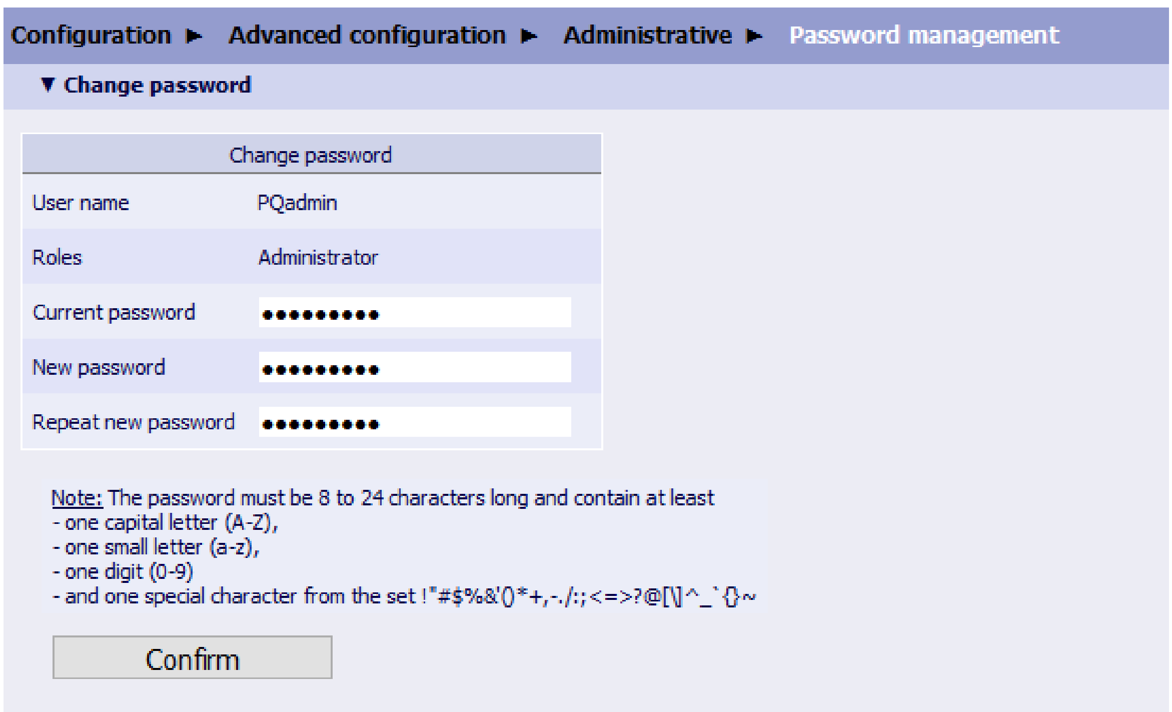
8.4.1 Function Description

To change the Web-UI login password, the device provides the access to **Password Management**.

8.4.2 Configuration via Web Pages

To change the password in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Password Management**.



[sc_change password_user_profile, 3, en_US]

Figure 8-11 Changing Passwords, Password Management

- Change the password according to the following table.

Table 8-11 Settings for Password Management

Parameter	Default Setting	Setting Range
User name	Fixed, not configurable	The user name and roles depend on the settings made by the account management.
Roles		
Current password	Empty	8 to 24 characters Contains at least: • 1 capital letter (A to Z) • 1 small letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?
New password		
Repeat new password		

- Enter the new password.
- Click **Confirm**. The password is changed.

8.5 Syslog

8.5.1 Function Description

In addition to showing audit logs in the **Maintenance** tab via the Web pages, the device supports transmitting the audit logs to a central log server using Syslog.

Syslog is a well-established internationally implemented standard for message logging. The Syslog standard is specified in the following documents:

- *Syslog Protocol*
- *Transmission of Syslog Messages over UDP*

Syslog allows the separation of the following:

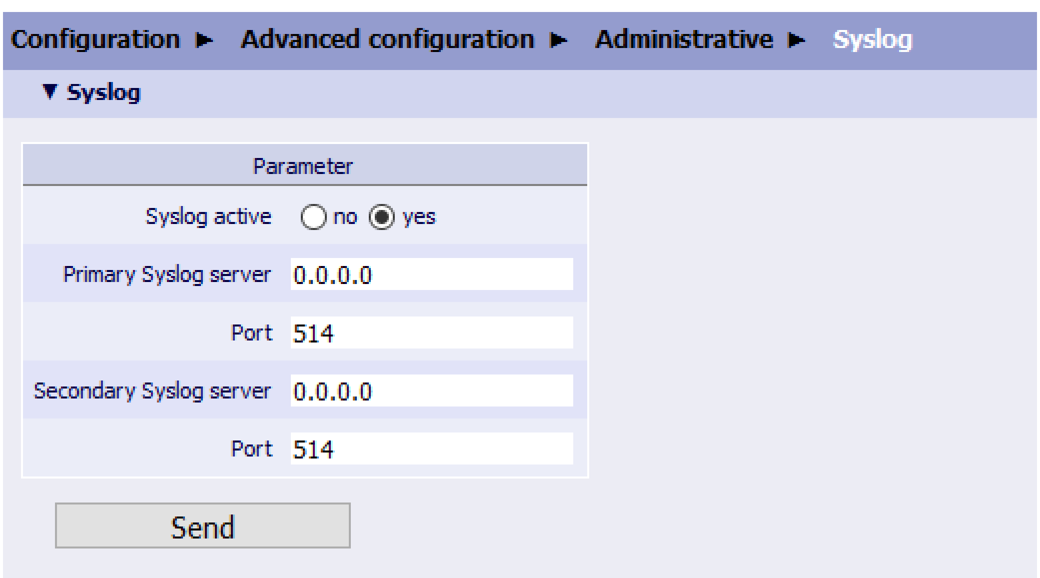
- The software that generates messages
- The system that stores messages
- The software that reports and analyzes messages

Computer system designers can use Syslog for system management and security auditing as well as general informational, analysis, and debugging messages. Various devices, such as printers, routers, and message receivers across many platforms use the Syslog standard. For example, a power quality device works as a device and a Kiwi Syslog service manager works as a receiver.

8.5.2 Configuration via Web Pages

To configure the **Syslog** function in the **Configuration** tab, proceed as follows:

- In the navigation window, click **Syslog**.



[sc_Syslog configure, 3, en_US]

Figure 8-12 Configuration Tab, Syslog

- Configure the respective parameters according to the following table.

Table 8-12 Settings for Syslog

Parameter	Default Setting	Setting Options
Syslog active	no	no yes
If you set the **Syslog active** parameter to **yes**, the following parameters are visible:		
Primary Syslog server	0.0.0.0	Any
Port	514	0 to 65 535
Secondary Syslog server	0.0.0.0	Any
Port	514	0 to 65 535

- After the parameterization, click **Send**.
- In the navigation window, click **Activation and cancel**.
- Click **Activate**.

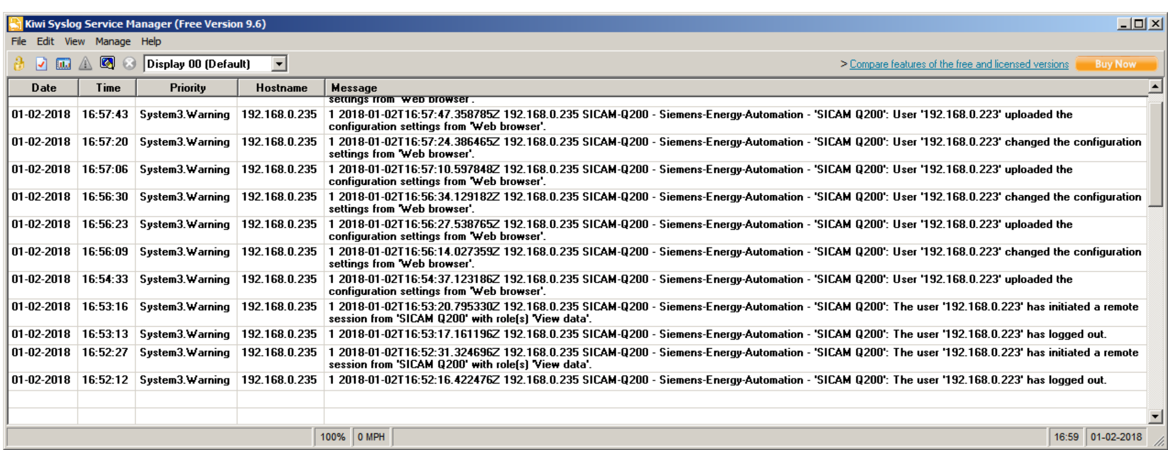
NOTE

Only a user with the role of administrator or security administrator has access to configure **Syslog**.

8.5.3 View via Syslog Server

If the Syslog function in the device is activated and the Syslog server is running, you can read the audit logs from the Syslog server. The audit logs are sent to the configured Syslog server using the UDP protocol when the logs are recorded in the device.

You can see the audit logs from the **Kiwi Syslog Service Manager**, see the following figure.



[sc_syslog server, 1, en_US]

Figure 8-13 Audit Logs on the Kiwi Syslog Service Manager

The following security messages are listed:

- **Date** of receiving the security message
- **Time** of receiving the security message
- **Priority** of the message, which is defined by the Syslog server
- **Hostname** of the device which generates the security message
- **Message** description

8.6 TCP/UDP Ports Used

Communication Protocol	Server/ Client	TCP/UDP	Port	Activated by Default	Description
HTTPS	Server	TCP	443	Yes	TLS connection to a Web browser for device configuration and value view
FTPS	Server	TCP	990	Yes	TLS connection to an FTP server for secure file transfer
SNTP	Client	UDP	123	No	Time synchronization
Modbus TCP	Server	TCP	502	No	Communication with a station controller using Modbus TCP and Modbus default TCP port
Modbus TCP	Server	TCP	503 to 65 535	No	Port number is configurable in the given range. Communication with a station controller using Modbus TCP and a user-defined TCP port.
IEC 61850	Server	TCP	102	No	Communication with a station controller using IEC 61850
DNP3 IP	Server	TCP	1 to 65 535 (20 000 by default)	No	SCADA Distributed Network Protocol 3.0 Communication based on Ethernet TCP/IP Port number is configurable in the given range.
SNMPv3	Server (Agent)	UDP	161	No	Network management
DHCP	Client	UDP	68	No	Dynamic Host Configuration Protocol
SMTP	Client	TCP	587 465 25 [66]	No	Simple Mail Transfer Protocol TLS connection to an SMTP server for sending emails
DNS	Client	UDP	53	No	Communication with a DNS server to translate domain names into IP addresses
Syslog	Client	UDP	514	No	Syslog protocol
RADIUS	Client	UDP	0 to 65 535 (1812 by default)	No	–

NOTE

Activate the ports only when you need to use the corresponding communication protocols.

66 Unlike Ports 587 and 465, which are encrypted, Port 25 is not encrypted, neither are other user-defined ports.

8.7 Message Logs

8.7.1 Function Description

Operational Log

The **Operational log** is shown in the **Information** tab (see chapter *10.11.2.4 Starting the Web Page during Operation*) and in the **Maintenance** tab. It can be deleted in the **Maintenance** tab (see chapter *8.7.2 Viewing and Clearing of Message Logs*).

NOTE

The last 128 operational indications are displayed, older indications are automatically deleted.

Error Log

The **Error log** is located in the **Maintenance** tab. The Error log entries can also be deleted here.

NOTE

The last 128 error messages are displayed, older messages are automatically deleted.
Error messages are service information that you provide upon request to the service department in case of an error.

8.7.2 Viewing and Clearing of Message Logs

Viewing and Clearing of Operational Logs

To clear the operational logs in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Operational log**.
- Click **Delete log**.
  All operational indications are deleted without backup. The indication no. 00001 appears in the log list: **Clear Operational Log**.

NOTE

If you need the operational indications, for example for subsequent analysis, save or print them out.

Viewing and Clearing of Error Logs

To clear the error logs in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Error log**.
- Click **Delete log**.
  All error logs are deleted without backup. The indication no. 00001 appears in the log list: *****Error Log Cleared*****.

The following error messages are listed:

- Serial **No.**
- **Date** of registration
- **Time** of registration
- **Relative time** (referring to the start of operation, output in milliseconds)

- **Task**, **Code** and **Location** are service information for the manufacturer
- **Description** of the error

NOTE

If you need the error messages, for example for subsequent analysis, save or print them out.

8.8 Audit Log

8.8.1 Function Description

The device provides an audit log to track the security-relevant events. The audit log can only be viewed by a user with the role **Security Auditor** or **Administrator**.

The **Audit log** is located in the **Maintenance** tab.

NOTE

The audit log is only available via HTML pages, not via device display.

The audit log stores the latest 4096 security messages. The older messages are automatically overwritten. You cannot delete the security messages manually.

8.8.2 Event Types

The following table shows examples of events logged in the audit log of the device.

Table 8-13 Event Types of the Audit Log

Event Type	Description
Login succeeded	The correct user name and password are entered.
Login failed	The number of consecutively incorrect user name and password has reached the configured maximum consecutive attempts. For the configuration, refer to chapter *8.3.2 Security Settings*.
Logout	• Session timeout: interactive session terminates due to timeout • The user manually logs off.
RBAC change	Change settings of: • Account management • Password management • HMI password
Audit-log access	Access the audit log
Value forcing	• Delete the following data: – Error log, operational log, and transient log – Load profile • Reset the following data: – Min/max values – Energy counters – Events like voltage event, MSV event, and RVC event • Clear data
Configuration access	• Upload a configuration file • Download a configuration file – Active configuration – Passive configuration
Activation of the configuration change	Activate the configuration change

Event Type	Description
Configuration of the CO_2 emissions	• Activate/deactivate the CO_2-emission calculation • Change the value of the CO_2-emission factor
Device restart	Restart the device due to: • Configuration change – IP address – Subnet mask – Default gateway – Ethernet configuration – IEC 61850 disable – SNMP disable – DHCP enable/disable – Measurement interval – Network type – IED name – User language – Rated frequency • Application – Enable/abort firmware upload – Clear data – Set default IP • Fallback mode – Firmware upgrade – Restart with factory settings
Modification of security-relevant parameterization	Modify settings of: • Modbus TCP/RTU read-only access • SNMP • IP address • Device name • Customer support functions
Firmware update	Upload new firmware to device
Time/date change	Change the time or the date
SD card plugged	Plug in an SD card
SD card unplugged	Unplug the SD card
Warning of audit-log capacity	The audit-log capacity is lower than 20 %.

8.8.3 Value View via Web Pages

To view the audit logs in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Audit log**.
  Security messages are displayed on the Web page.

Maintenance ► Message logs ► Audit log

▼ Audit log

No.	Date	Time	Processing firmware failed. Please check the firmware file.
00446	2020-11-02	16:47:09:012	'SICAM Q200': User 'PQadmin' viewed audit log from 'Browser'.
00445	2020-11-02	16:41:11:347	'Local Account': The user 'PQadmin' has logged in successfully to 'SICAM Q200' with role(s) 'Administrator '.
00444	2020-11-02	16:09:03:156	'SICAM Q200': The interactive session with the user 'PQadmin' has been terminated due to timeout ('10' minutes).
00443	2020-11-02	15:32:44:120	'Local Account': The user 'PQadmin' has logged in successfully to 'SICAM Q200' with role(s) 'Administrator '.
00442	2020-11-02	15:25:56:740	'Local Account': The user 'PQadmin' has logged in successfully to 'SICAM Q200' with role(s) 'Administrator '.
00441	2020-11-02	15?25?15?450	'SICAM Q200': User 'Fallback Mode' initiated restart from [with action: 'Firmware Upgrade'].
00440	2020-11-02	15?25?15?450	'SICAM Q200': User 'Fallback Mode' uploaded firmware version from 'V02.60.00.07' to 'V02.60.00.09'.
00439	2020-11-02	15:21:25:228	'SICAM Q200': User 'PQadmin' initiated restart from 'Browser' [with action: 'Enable Upload'].
00438	2020-11-02	15:20:59:841	'Local Account': The user 'PQadmin' has logged in successfully to 'SICAM Q200' with role(s) 'Administrator '.
00437	2020-11-02	15:20:11:262	'SICAM Q200': User 'PQadmin' initiated restart from 'Browser' [with action: 'User Language Changed'].
00436	2020-11-02	15:20:01:552	'SICAM Q200': User 'PQadmin' changed the configuration settings from 'Browser'.
00435	2020-11-02	15:18:26:428	'Local Account': The user 'PQadmin' has logged in successfully to 'SICAM Q200' with role(s) 'Administrator '.
00434	2020-11-02	15:13:34:734	'Local Account': The user 'PQadmin' has logged in successfully to 'SICAM Q200' with role(s) 'Administrator '.
00433	2020-11-02	15?10?38?852	'SICAM Q200': User 'Fallback Mode' initiated restart from [with action: 'Firmware Upgrade'].
00432	2020-11-02	15?10?38?852	'SICAM Q200': User 'Fallback Mode' uploaded firmware version from 'V02.60.00.09' to 'V02.60.00.07_z00'.
00431	2020-11-02	15:07:45:556	'SICAM Q200': User 'PQadmin' initiated restart from 'Browser' [with action: 'Enable Upload'].
00430	2020-11-02	15:07:42:455	'Local Account': The user 'PQadmin' has logged in successfully to 'SICAM Q200' with role(s) 'Administrator '.
00429	2020-11-02	15?06?12?804	'SICAM Q200': User 'Fallback Mode' initiated restart from [with action: 'Firmware Upgrade'].
00428	2020-11-02	15?06?12?804	'SICAM Q200': User 'Fallback Mode' uploaded firmware version from 'V02.60.00.07' to 'V02.60.00.09'.
00427	2020-11-02	15:03:09:487	'SICAM Q200': User 'PQadmin' initiated restart from 'Browser' [with action: 'Enable Upload'].
			*** End ***

[sc_Audit_log_maintenance, 5, en_US]

Figure 8-14 Maintenance Tab, Audit Log

To update the display of the audit logs, click **show** or press **F5** on your keyboard.

9 System Functions

9.1 Connection with SICAM PAS/PQS (V8.08 and Higher)

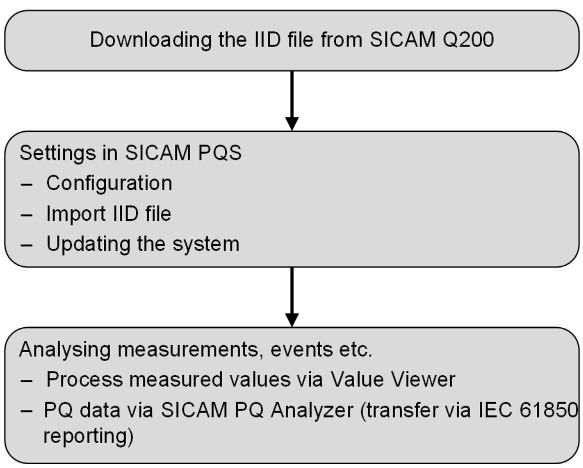
9.1.1 General

The data acquired by the device are stored on the SD card. The data of the measured-value recorder, for example mean values, and of the trend recorder are available in the PQDIF data format. The data of the waveform recorder are saved in the COMTRADE data format. This data can be transferred to the SICAM PAS/PQS using the IEC 61850 Ed.2 protocol.

The **SICAM PAS/PQS software, version V8.08** (available as of October 2016) and higher allows importing the data into the SICAM PAS/PQS archive. Once the data has been transferred into the SICAM PAS/PQS archive, it can be used for the further evaluation and reporting, export, etc.

The SICAM PQ Analyzer allows visualizing of the archived data as well as the result of the evaluation and reporting. For example, evaluations of the records and reports can be performed according to the EN 50160 standard or other grid codes.

The following diagram shows the sequence of the configuration and the analysis:



[dw_workflow-q200-settings-for-SICAM_PQS, 2, en_US]

Figure 9-1 Workflow

NOTE

You can find more information about SICAM PAS/PQS in the manual SICAM PAS, Overview, order number E50417-X8976-C431-B3 and under *http://w3.siemens.com/smartgrid/global/en/products-systems-solutions/substation-automation/substation-automation/pages/sicam-pas.aspx*.

9.2 Connection with PQ Advisor

9.2.1 Connection with PQ Advisor

PQ Advisor Compact

The PQ Advisor Compact is a Web-browser-based application and can be accessed with a URL. It is an application to monitor the power quality in the power system by visualizing the PQ data of all the connected devices. The PQ devices, for example, SICAM Q100, SICAM Q200, and SICAM P855, are automatically scanned and the power quality data are visualized using the PQ Advisor Compact. The functions of the PQ Advisor Compact are available via the dashboard view and the configuration view.

For more information, refer to *https://support.industry.siemens.com/cs/products?search=PQ%20Advisor%20Compact&mfn=ps&o=DefaultRankingDesc&lc=en-WW*.

9.3 Firmware Upload

9.3.1 Function Description

During a firmware update, the device firmware, the default set of parameters, text libraries, HTML files, or parts thereof are updated.

NOTE

Siemens recommends that you update the firmware to the version that contains the latest security patches.

NOTE

Before updating the firmware, Siemens recommends saving the current parameters set as described in *Activating the Set of Parameters, Page 28*.

NOTE

If you have activated the option in your Web browser to transfer the local directory name together with the file name when uploading files, then the total number of characters in the directory and file names may not exceed 126 characters. Otherwise, the firmware in your device will not be updated.

9.3.2 Firmware Upload via Web Pages

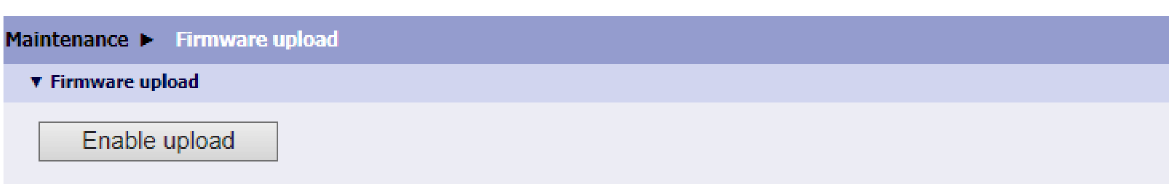
Firmware Upload

NOTE

Do not switch off the supply voltage during the firmware upload process.
If you want to carry out a firmware update, you must stop the recording before manually.

To update the firmware in the **Maintenance** tab, proceed as follows:

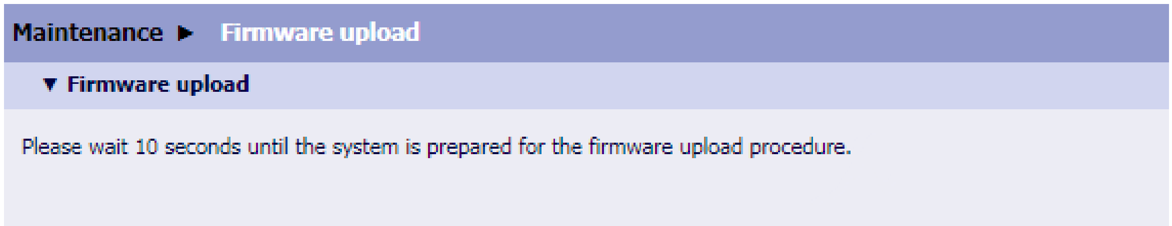
- Select **Firmware upload** in the navigation window.



[sc_enable_Firmware_upload, 2, en_US]

Figure 9-2 Enable Firmware Upload

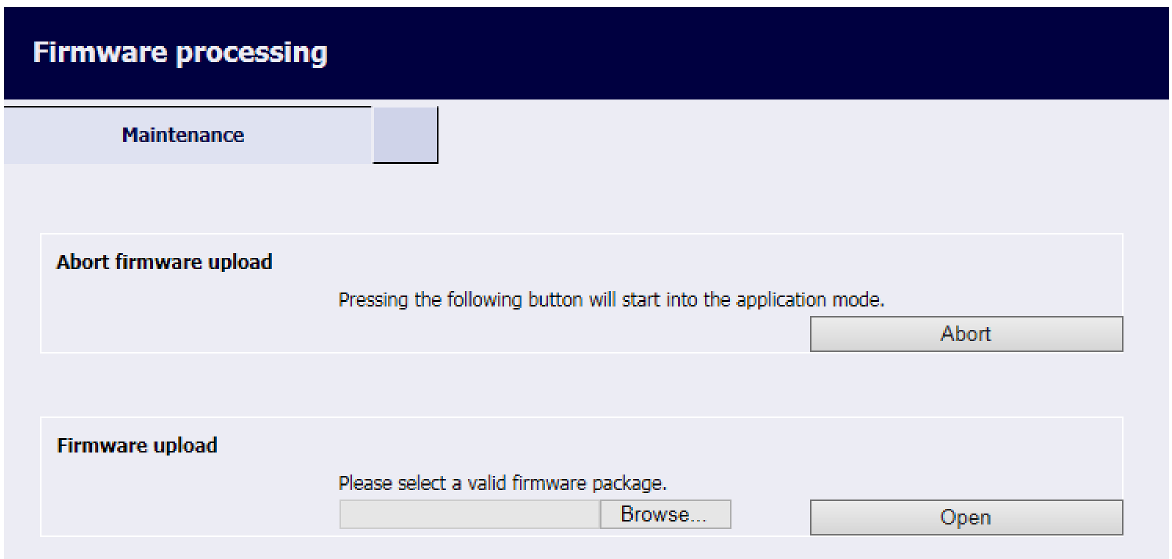
- Click **Enable upload**.
- Follow the notes in the following indication:



[sc_Firmware_upload_10s, 1, en_US]

Figure 9-3 Firmware-Upload Indication

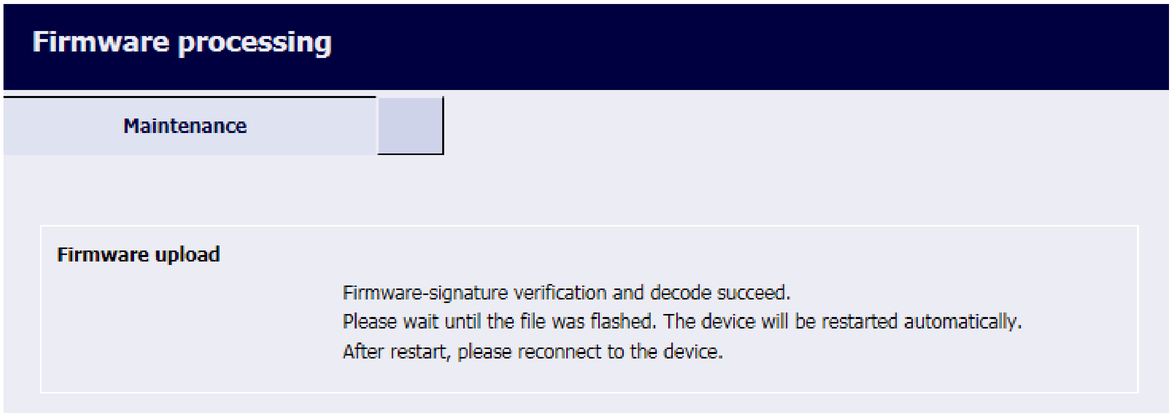
The **Firmware processing** dialog opens.



[sc_Firmware_processing, 2, en_US]

Figure 9-4 Firmware Processing, Firmware Upload

- Click **Browse...** in the section **Firmware upload**.
  The **Choose file** dialog opens.
- Select the desired upload file (extension .pck or .cms depending on the current firmware version) in the directory.
- Click **Open**.
  The selected path is inserted in the **Browse...** field.
- Click **Open**.
  Follow the notes in the following indication:



[sc_Firmware_processing_upload_successful, 2, en_US]

Figure 9-5 Firmware-Upload Indication When Loading a .cms File

After approximately 2 min, the device restarts automatically and the **Log on** tab appears for reconnection with the device.

Device firmware, default set of parameters, text libraries, HTML files, or parts thereof are uploaded.

NOTE

If the firmware update is from version earlier than V2.10 to V2.10 or later version, the LEDs **H1** and **Error** flashes for 2 min upon device restart. During this period, accessing the device via HTTPS is not possible.

You can find the upload file in the download area in the Siemens Internet under: *https://support.industry.siemens.com/cs/document/109743592/?en-US*. To update the firmware to the latest version, select the following upload file:

- File with extension .cms for update from version V2.10 or later version to the latest version
- File with extension .pck for update from version earlier than V2.10 to the latest version

NOTE

A file with extension .cms includes a digital signature that protects the integrity and authenticity of the firmware package.

After an update to the latest version, only .cms files can be used for a firmware upgrade or downgrade.

A firmware downgrade from V2.10 or a later version to a version earlier than V2.10 is impossible. Only signed firmware versions (*.cms) will be supported.

If the firmware upload fails, an error message is shown on the Web page. Following are some causes of failure:

- Invalid file extension
- Invalid digital signature
- Decoding failure

Abort Firmware Upload

If you do not want to update the firmware, then click **Abort** in the section **Abort firmware upload**.

The device will be restarted after 20 s in application mode.

10 Commissioning and First Steps

10.1 Safety Notes and Access Rights

Safety Notes

DANGER

Hazard due to high voltage

Non-observance will lead to death or serious injury.

Work may only be carried out by trained personnel who are familiar with and observe the safety requirements and precautions.

- Work may **never** be carried out if there is any hazardous voltage present.
- De-energize the device.
- **Isolating device**: Connect a suitable isolating device upstream to de-energize the device. The isolating device must be installed near the device, it must be easily accessible to the user and it must be marked as an isolating device for the device.
- Secure the supply voltage with an approved (UL/IEC) fuse: 1.6 A, type C.
- If a melting fuse is used, a suitable approved (UL/IEC) fuse holder has to be used.

NOTE

For electrical installations you have to observe and comply with the national and international provisions concerning the installation of electric power installation and the low-voltage directive 2014/35/EU.

Access Rights

NOTE

Operator control actions are password-protected (see *8 Cybersecurity*). This ensures that only operational crew members with access rights can use the device during operation.

10.2 Unpacking, Inspecting the Delivery, Installing, and Changing the Battery

Unpacking

The device has been safely packed for transport in the factory. Unpack the device with care and do not use force. Use an appropriate tool if necessary. After unpacking, inspect the device visually for any mechanical defects.

NOTE

If the device has been damaged during transport, do not connect and operate it.

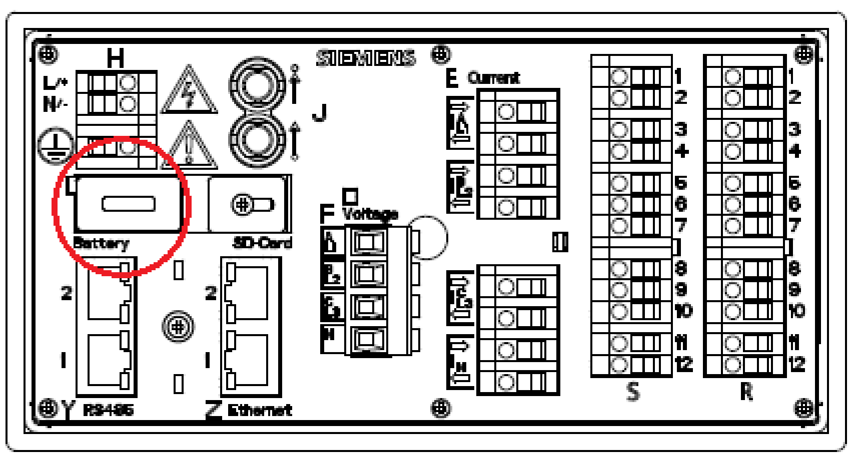
Observe any additional notes enclosed with the packaging.

Keep the transport packaging for future transport.

Inspecting the Delivery

After unpacking, first compare the packing list against your original purchase order to check that the delivered device has the desired rated data and functions and that all necessary and ordered accessories are enclosed.

Installing the Battery



[sc_battery_cover, 1, en_US]

Figure 10-1 Battery Compartment

If you want to operate the device immediately after the delivery, first insert the battery before beginning the installation. Upon delivery the battery is insulated in the battery compartment of the device.

If you want to operate the device later, insert the battery only before you intend to use the device.

NOTE

The battery powers the battery-buffered memory (SRAM) and the real-time clock (RTC). But the device can still be operated when no battery is inserted or when the battery is discharged. If, however, the supply voltage is lost, all metered energy values and error reports in the SRAM are deleted (and the real-time clock is reset (2000-01-01 00:00:00:000).

Customer-specific parameters are permanently stored in the Flash-EPROM even without a battery.

To insert the battery, observe the notes in the supplied Product Information and proceed as follows:

- Pull out the battery compartment.
- Take the battery out of the battery compartment.

- Remove the plastic foil.
- Insert the battery into the battery compartment.
- Push the battery compartment back in again.

Replacing a Used Battery

WARNING

Warning of incorrect treatment of the lithium battery (type PANASONIC CR2032 or VARTA 6032 101 501) or the use of an incorrect battery type. In the case of incorrect treatment or the wrong battery type, the battery may burn, explode or trigger a chemical reaction.

See product information for type of battery to be used.

Non-observance may lead to death or serious injury.

- ✧ Installing the battery or replacing it may only be carried out by trained personnel (see Preface) who are familiar with and observe the safety requirements and precautions.
- ✧ Do not reverse the polarity of the battery.
- ✧ Do not short-circuit the contacts. Use non-conducting tools for removing and installing the battery.
- ✧ Do not attempt to open the battery.
- ✧ The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100 °C (212 °F) or incinerate.
- ✧ Dispose of used battery promptly. Keep away from children.

Replace the batteries if the battery charge is too low (avoid full discharge). In this case, the **Battery Failure** operation indication is generated. This message can also be parameterized on one of the LEDs H1 to H4/ERROR or switched to one of the binary outputs (see chapter *3.3.2 Configuration and Value View via Web Pages*).

When the **Battery Failure** indication is displayed, replace the battery as follows:

- Pull out the battery compartment.
- Remove the new battery type PANASONIC CR2032 or VARTA 6032 101 501 from the packaging (check the expiry date on the packaging).
- Insert the battery carefully into the battery compartment with the polarity indicated above the battery compartment.
- Push the battery compartment back again.

NOTE

The internal battery test in the device is executed once within 24 hours as well as at the startup of the device. After replacing an empty battery the indication **Battery Failure** is reset only with the next regular internal battery test.

NOTE

Battery Disposal

The battery used in this device contains lithium. It may only be replaced by qualified personnel and disposed of by authorized recycling companies.

Do not dispose of the battery in the regular household waste.

The national and international regulations must be observed when disposing of the battery.

You can find information on the battery life in chapter *13.1.5 General Data*.

10.3 Assembly

General Assembly Notes

The device is designed for panel flush-mounting.

WARNING

Do not touch any live parts.

Non-observance may lead to death or serious injury.

✧ After installation of the device and wiring, close the control cabinet.

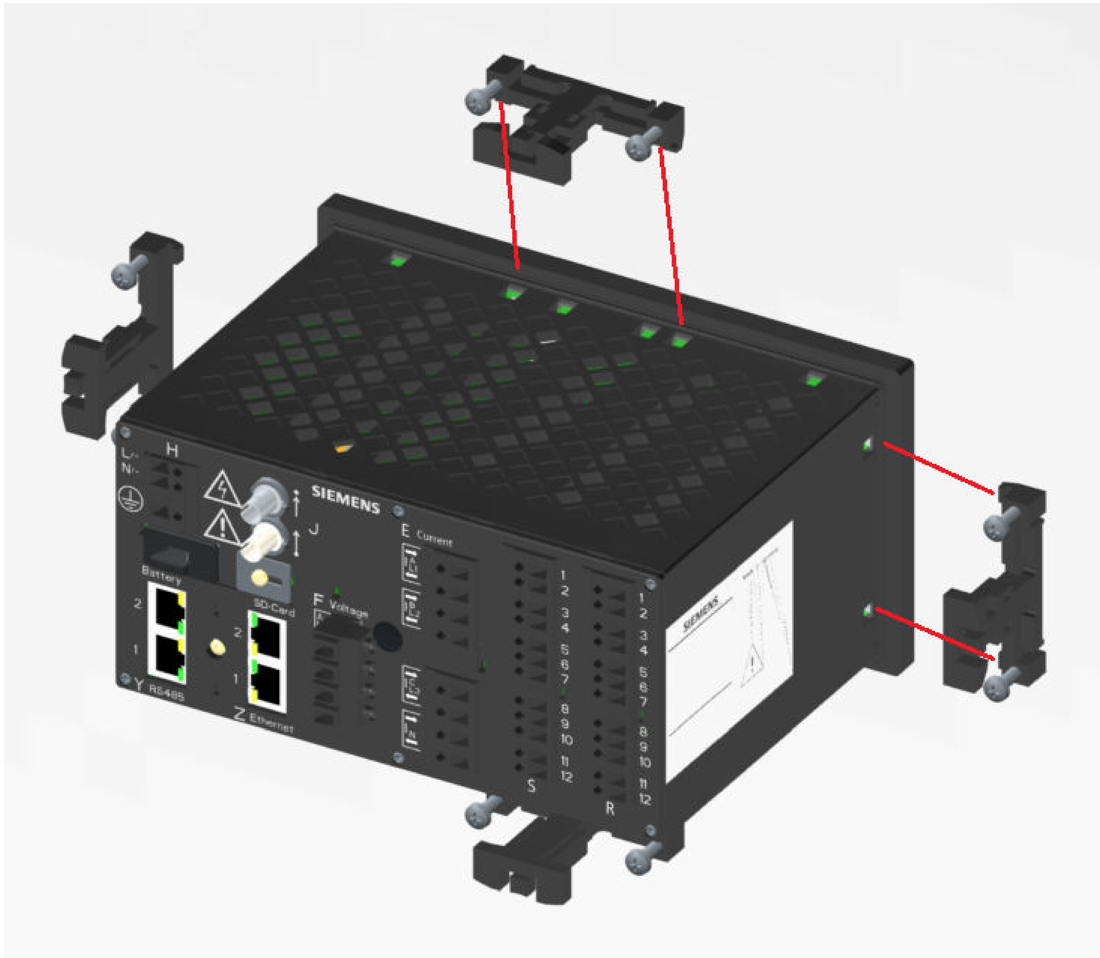
- The installation site must be vibration-proof. The permitted ambient temperature must be observed (see also chapter *13 Technical Data*).
- Operating the device outside the permitted operating temperature range can lead to measuring errors and device failure.
- Keep the following distances to adjacent devices:
  - On the side: ≥ 20 mm (0.79 inch)
  - Below and above: 15 cm (5.91 inch)
- The device must not be exposed to condensation during operation.
- Install the device in a location where it is not exposed to direct sunlight and strong temperature variations.

Assembly: Devices according to Degree of Protection IP54

To install the device into a switch panel, proceed as follows:

- Take out both clips and the gasket from the service kit IP54, order number 7KG9798-0PK54.
- Mount the gasket at the frame of the front panel, while pulling the gasket from the rear of the device.
- Insert the device into the assembly opening until it hits the limit and keep holding it tightly.

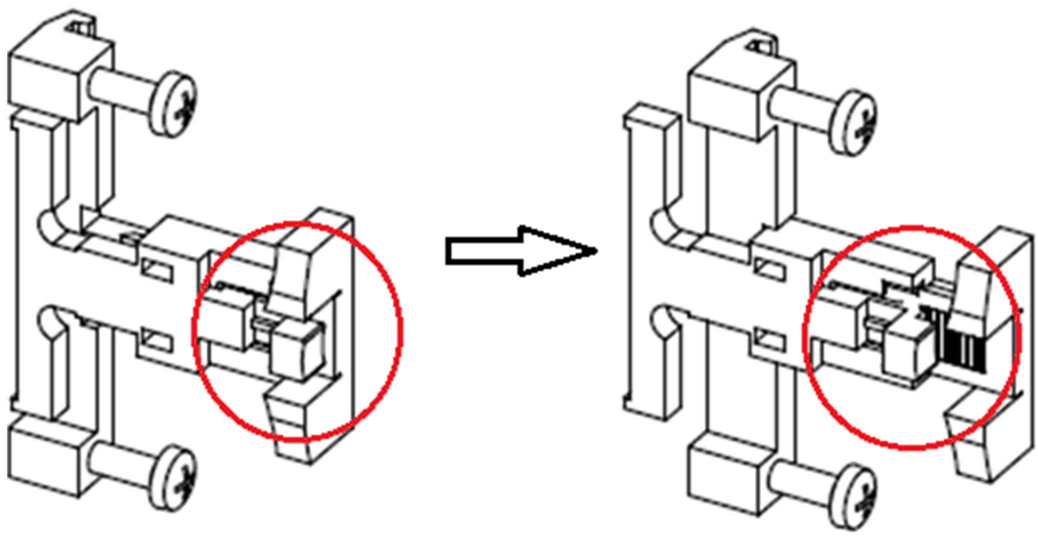
- Attach the 4 clips (2 clips are included with the device and 2 included in the service kit) into the given holes on the outside of the case. You have the possibility to attach the clips as follows:



[sc_inserting_clips, 1, en_US]

Figure 10-2 Inserting the Clips

- Inserting the Clips
  - A clip on the upper side and one on the bottom side, in the middle, on the right, and on the left (see figure) or
  - 2 clips on the upper side and 2 on the bottom side
- Fix the clips on the housing using the slide.



[dw_fixing_clips, 1, --_--]

Figure 10-3 Fixing the Clips

- Fix the screws on the clips carefully using a Phillips screwdriver (size PZ2) until the device is safely fixed to the switch panel.
- Fix the device finally to the switch panel using the slides.
- Remove the protective film from the display.

NOTE

The seal between the switch panel and the housing is effective only if the device is fixed correctly.

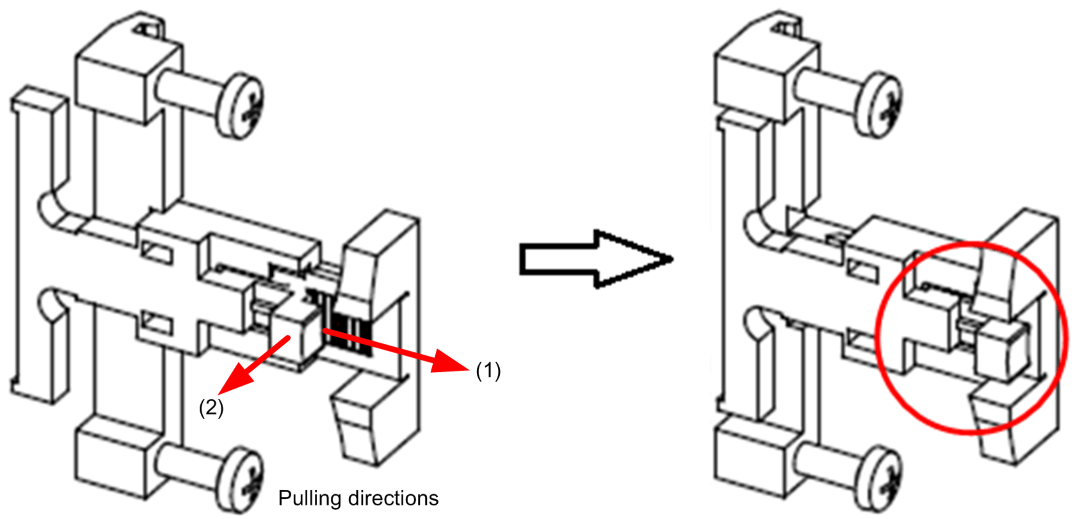
Assembly: Devices according to Degree of Protection IP40

The device is mounted into a switch panel with 2 clips in the same way as for devices according to the degree of protection IP54. In this case, the seal is not used.

- Insert the 2 delivered clips in the cut-outs of the housing. You have the following options for inserting the clips:
  - A clip in the middle of the upper side and one in the middle of the bottom side
  - A clip on the right side and one on the left side

Removing the Device

- Disconnect the lines from the device.
- Loosen the Phillips screws at the clips.
- Lever the slides at all clips carefully from the snap (2, see figure below) and draw the slide back (1).



[dw_loosening_clips, 1, en_US]

Figure 10-4 Loosening the Clips

(1) Pulling direction: Draw back the slide
(2) Pulling direction: Lever the slide from the snap

- Remove all clips.
- Remove the device from the switch panel by drawing it to the front and set it aside.

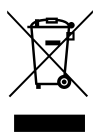
UL-Certification Conditions

Field wires of control circuits can be separated from other circuits with respect to the end-use requirements.

10.4 Environmental Protection Hints

Disposal of Old Equipment and Batteries (Applicable only for European Union and Countries with a Recycling System)

The disposal of our products and possible recycling of their components after decommissioning has to be carried out by an accredited recycling company, or the products/components must be taken to applicable collection points. Such disposal activities must comply with all local laws, guidelines and environmental specifications of the country in which the disposal is done. For the European Union the sustainable disposal of electronic scrap is defined in the respective regulation for "waste electrical and electronic equipment" (WEEE).



The crossed-out wheelie bin on the products, packaging and/or accompanying documents means that used electrical and electronic products and batteries must not be mixed with normal household waste.

According to national legislation, penalties may be charged for incorrect disposal of such waste.

By disposing of these products correctly you will help to save valuable resources and prevent any potential negative effects on human health and the environment.

NOTE

Our products and batteries must not be disposed of as household waste. For disposing batteries it is necessary to observe the local national/international directives.

Disposal of Mobile Storage Devices (e.g. USB Sticks and Memory Cards)

When disposing of/transferring mobile storage devices, using the **format** or **delete** functions only changes the file management information and does not completely delete the data from your mobile storage device. When disposing of or transferring a mobile storage device, Siemens strongly recommends physically destroying it or completely deleting data from the mobile storage device by using a commercially available computer data erasing software.

REACH/RoHS Declaration

You can find our current **REACH/RoHS** declarations at:

https://www.siemens.com/global/en/home/products/energy/ecotransparency/ecotransparency-downloads.html

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NOTE

You can find more information about activities and programs to protect the climate at the EcoTransparency website:

https://www.siemens.com/global/en/home/products/energy/ecotransparency.html

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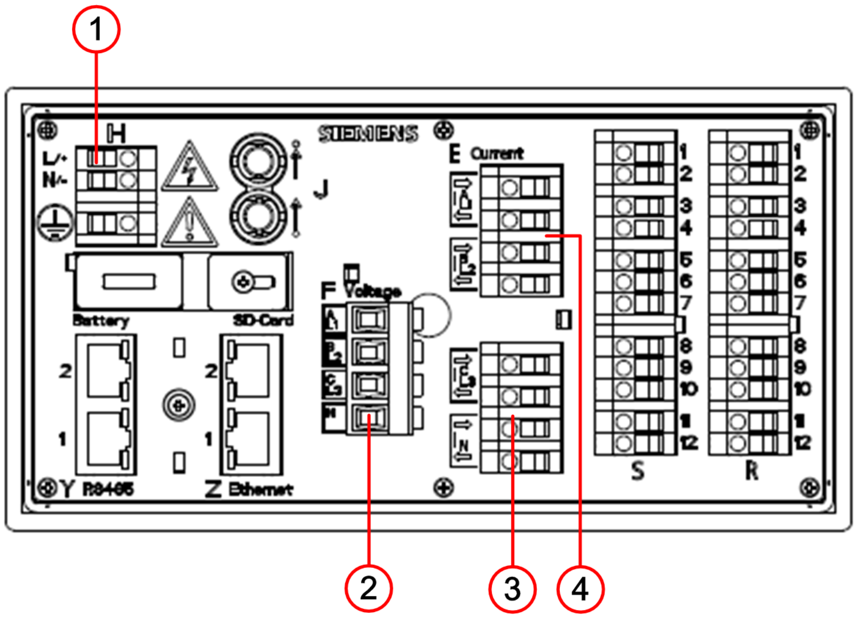
10.5 Electrical Connection



[le_Electical connection_01, 1, --_--]

Figure 10-5 Electrical Connection

(1) Terminal block H for power supply
(2) Terminal block F for voltage measurement
(3) Terminal block E for current measurement (phase c and neutral phase N)
(4) Terminal block E for current measurement (phase a and b)

NOTE

Be aware of the safety instruction in chapter *Safety Notes, Page 310*.

Power Supply

Connect the cables of the supply voltage on the terminal side of the device at terminal block H as follows:

Supply from the Alternating Voltage System

Terminal N/-: Neutral phase of the supply voltage
Terminal L/+: Phase of the supply voltage
Terminal Earthing: Protective grounding terminal

Supply from a Direct Voltage Source

Terminal N/-: Negative supply voltage
Terminal L/+: Positive supply voltage
Terminal Earthing: Protective grounding terminal

NOTE

Always connect the grounding at the device to the terminal for the protective phase grounding (terminal block H).

Terminals and Conductors

The device has the following terminal blocks:

Terminal Block	Description
E	4 inputs for alternating current measurement
F	4 inputs for alternating voltage measurement
H	Supply voltage

Terminals for supply voltage (H), inputs for current measurement (E), inputs for voltage measurement (F):

- Conductor cross-section, rigid max.: 2.5 mm^2 (AWG 14)
- Conductor cross-section (conductor with ferrule): 1.5 mm^2 (AWG 16)
- Conductor cross-section (conductor with ferrule, terminal F): 2.5 mm^2 (AWG 14)
- Tightening torque: 0.4 Nm to 0.5 Nm (3.5 in-lb to 4.5 in-lb)

Functions of the Terminals

Terminal	Assigned Function, Measured Value or Indication	Description
E: $I^{A}_{L1}\Rightarrow$	Ia	Phase a, input, current measurement
E: $I^{A}_{L1}\Leftarrow$	Ia	Phase a, output, current measurement
E: $I^{B}_{L2}\Rightarrow$	Ib	Phase b, input, current measurement
E: $I^{B}_{L2}\Leftarrow$	Ib	Phase b, output, current measurement
E: $I^{C}_{L3}\Rightarrow$	Ic	Phase c, input, current measurement
E: $I^{C}_{L3}\Leftarrow$	Ic	Phase c, output, current measurement
E: $I_N\Rightarrow$	N	Neutral phase, input current measurement
E: $I_N\Leftarrow$	N	Neutral phase, output current measurement
F: ${}^{A}_{L1}$	Van	Phase a, voltage measurement
F: ${}^{B}_{L2}$	Vbn	Phase b, voltage measurement
F: ${}^{C}_{L3}$	Vcn	Phase c, voltage measurement
F: N	N	Neutral phase, voltage measurement
H (Earth)	Protective phase	–
H: N / -	N/-	Neutral phase of the mains voltage or negative supply voltage
H: N / +	ph/+	Phase of the mains voltage or positive supply voltage

Voltage measuring inputs: In the case of a **direct connection** and **transformer connection**, the device has to be safeguarded with a **listed 10-A backup fuse** or a listed 10-A miniature circuit breaker.

NOTE

When using voltage transformers, the secondary connections must never be short-circuited!

10.6 Connection Principle

10.6.1 Using the Device in the Power Systems TT and TN

When using the device in the power systemsTT and TN, no special operating conditions must be observed.

10.6.2 Standard Application, Examples

The following input wiring diagrams are examples. Up to the maximum allowable current and voltage values the device can also be connected without interconnected current and voltage transformers.

Required voltage transformers can be operated in star connection or delta connection.

All input and output terminals that are not needed for measurements remain unwired.

NOTE

The illustration of the consistent ground connection of the instrument transformers is simplified in the following connection examples. The secondary windings of the current transformers installed in a high-voltage power system must be grounded on one side.

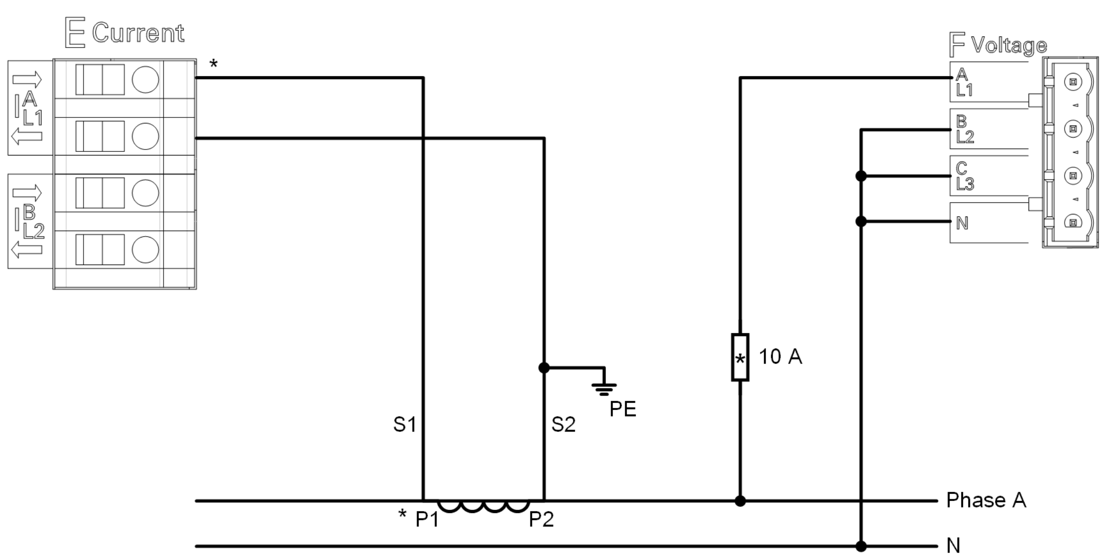
DANGER

Hazard due to high voltages in the event of a breakdown of the winding insulation

Non-observance will lead to death or serious injury.

✧ Ground the secondary windings of the current transformers on one side. They are installed in a high-voltage power system.

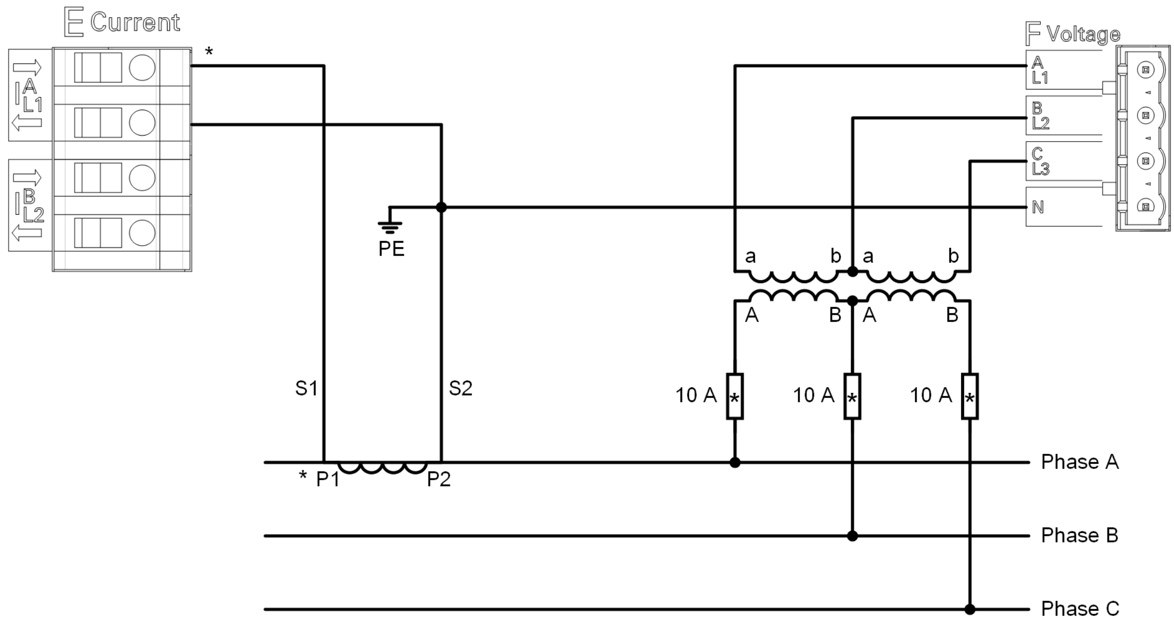
Example: 1-Phase System, No Voltage Transformer



[dw_1-phase-system, 2, en_US]

Figure 10-6 Example: 1-Phase System, No Voltage Transformer

Example: 3-Wire Network, 2 Voltage Transformers and 1 Current Transformer, Balanced



[dw_3-wire-network-balanced, 2, en_US]

Figure 10-7 Example: 3-Wire Network, 2 Voltage Transformers and 1 Current Transformer, Balanced

NOTICE

The secondary voltage on terminal F (voltage) must not exceed AC 600 V (AC 347 V for UL).

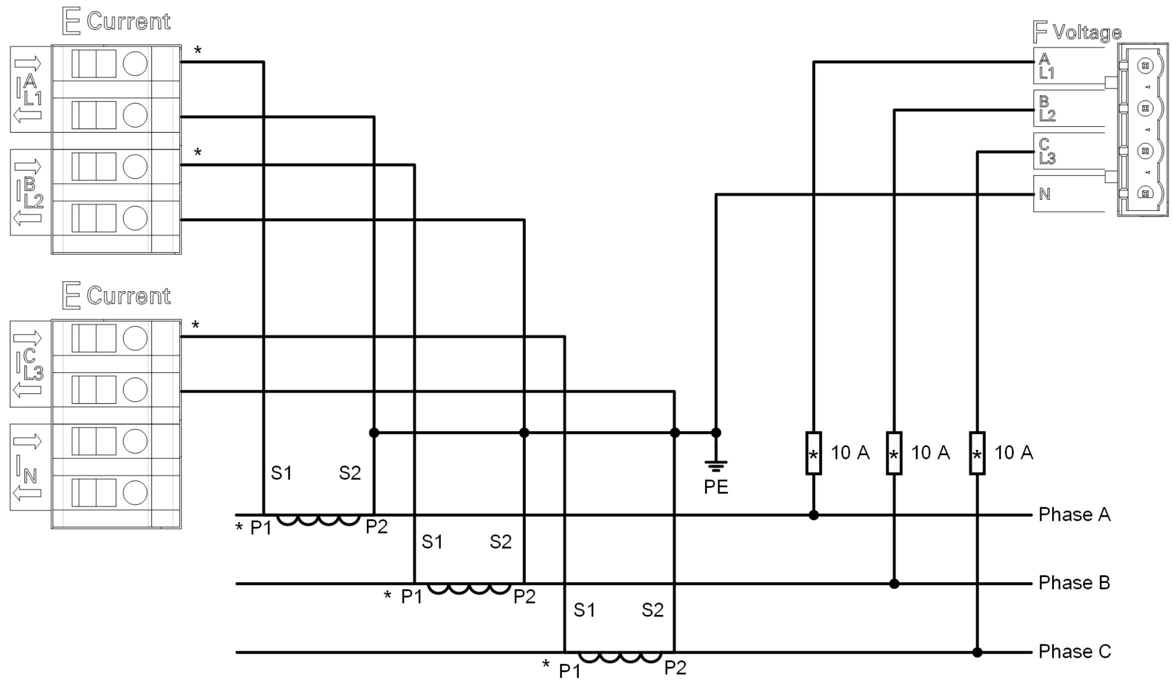
Non-observance can cause material damage.

✧ Make sure that the maximum permissible phase-to-ground voltage (PE) is not exceeded.

NOTE

The electrical connection PE-N is not mandatory.

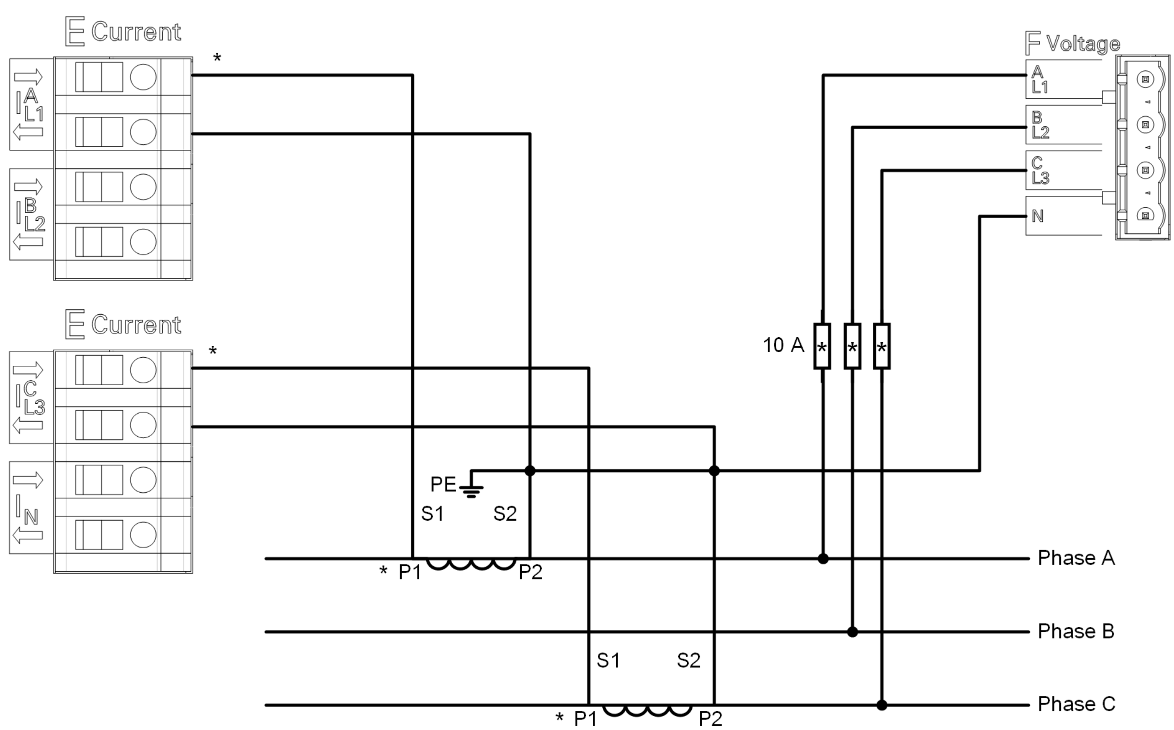
Example: 3-Wire Network, Direct Contact at Low-Voltage Power System, 3 Current Transformers, Unbalanced



[dw_3-wire-network-without-N, 2, en_US]

Figure 10-8 Example: 3-Wire Network, No Voltage Transformer, 3 Current Transformers, Unbalanced

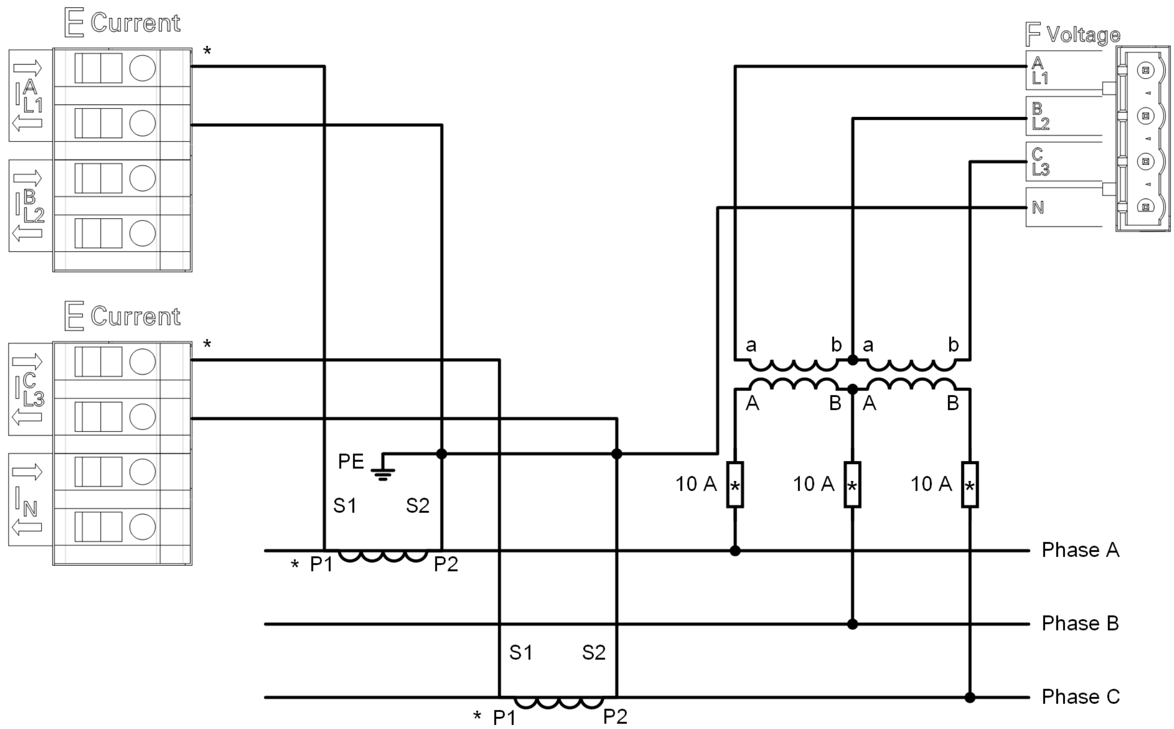
Example: 3-Wire Network, No Voltage Transformer, 2 Current Transformers, Unbalanced



[dw_3-wire-network-2I-3U, 2, en_US]

Figure 10-9 Example: 3-Wire Network, No Voltage Transformer, 2 Current Transformers, Unbalanced

Example: 3-Wire Network, 2 Voltage Transformers and 2 Current Transformers, Unbalanced



[dw_3-wire-network-2x-current, 2, en_US]

Figure 10-10 Example: 3-Wire Network, 2 Voltage Transformers and 2 Current Transformers, Unbalanced

NOTICE

The secondary voltage on terminal F (voltage) must not exceed AC 600 V (AC 347 V for UL).

Non-observance can cause material damage.

✧ Make sure that the maximum permissible phase-to-ground voltage (PE) is not exceeded.

Example: 3-Wire Network, 2 Voltage Transformers and 3 Current Transformers, Unbalanced

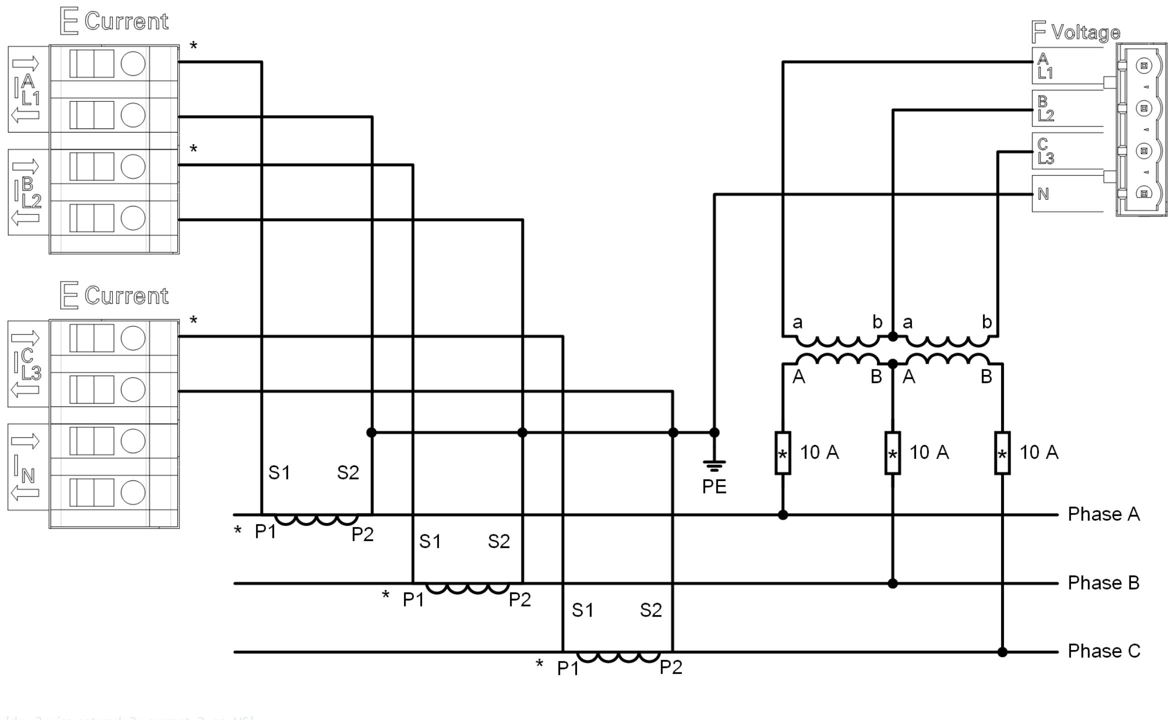


Figure 10-11 Example: 3-Wire Network, 2 Voltage Transformers and 3 Current Transformers, Unbalanced

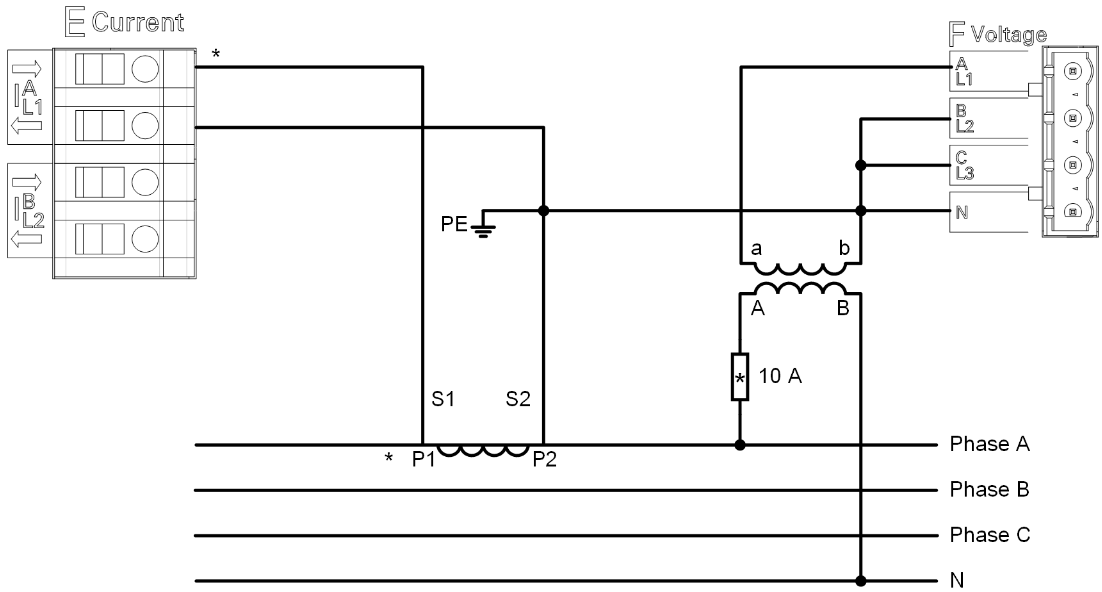
NOTICE

The secondary voltage on terminal F (voltage) must not exceed AC 600 V (AC 347 V for UL).

Non-observance can cause material damage.

✧ Make sure that the maximum permissible phase-to-ground voltage (PE) is not exceeded.

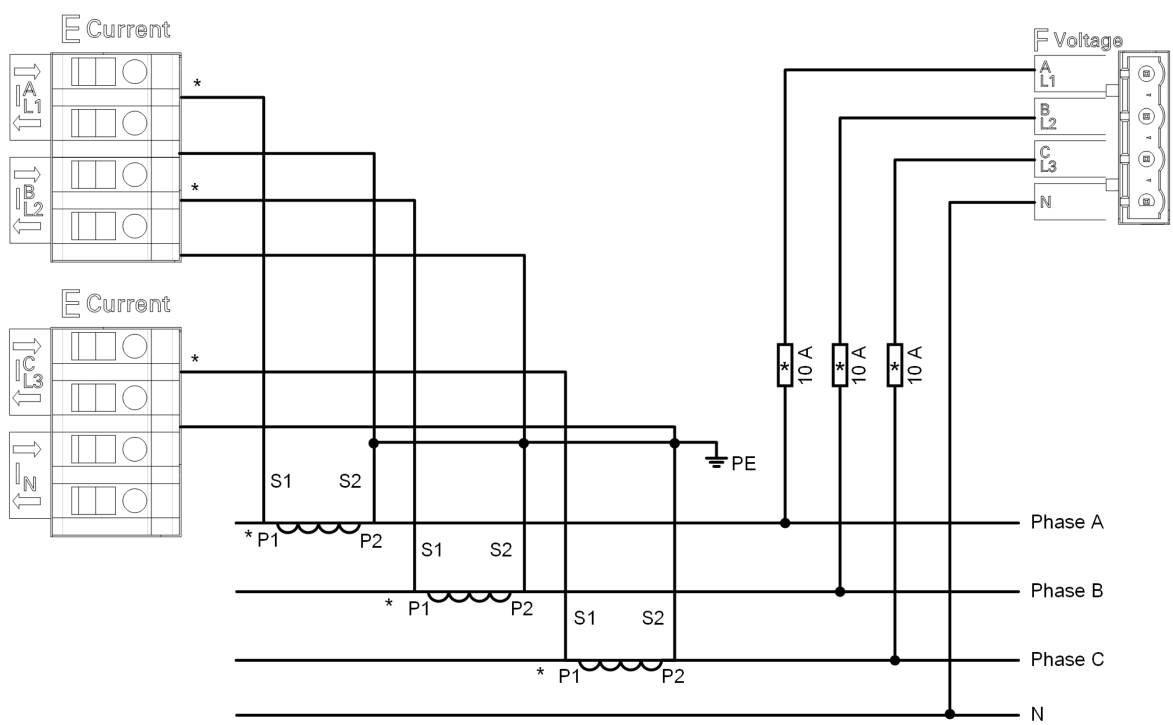
Example: 4-Wire Network, 1 Voltage Transformer and 1 Current Transformer, Balanced



[dw_4-wire-balance, 2, en_US]

Figure 10-12 Example: 4-Wire Network, 1 Voltage Transformer and 1 Current Transformer, Balanced

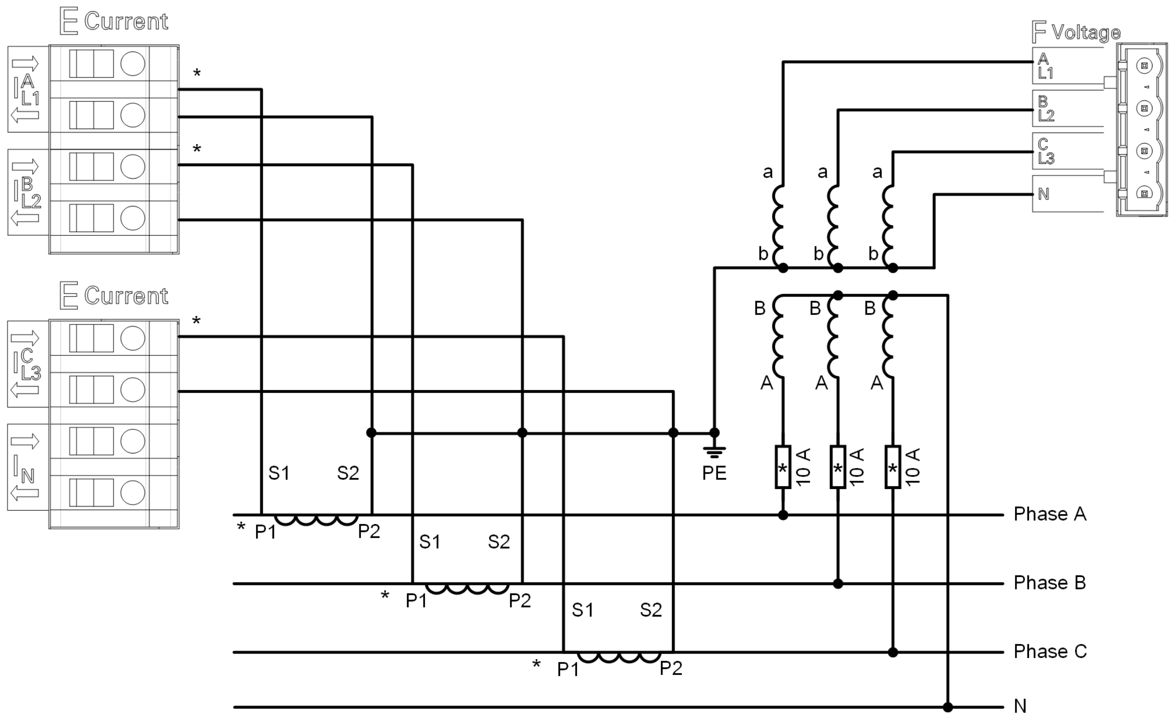
Example: 4-Wire Network, No Voltage Transformer, 3 Current Transformers, Unbalanced



[dw_4-wire-unbal-lowvoltage, 2, en_US]

Figure 10-13 Example: 4-Wire Network, No Voltage Transformer, 3 Current Transformers, Unbalanced

Example: 4-Wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced



[dw_4-wire-unbal-highvoltage, 2, en_US]

Figure 10-14 Example: 4-Wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced

Example: 4-Wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced, Current Transformer at the Neutral Phase

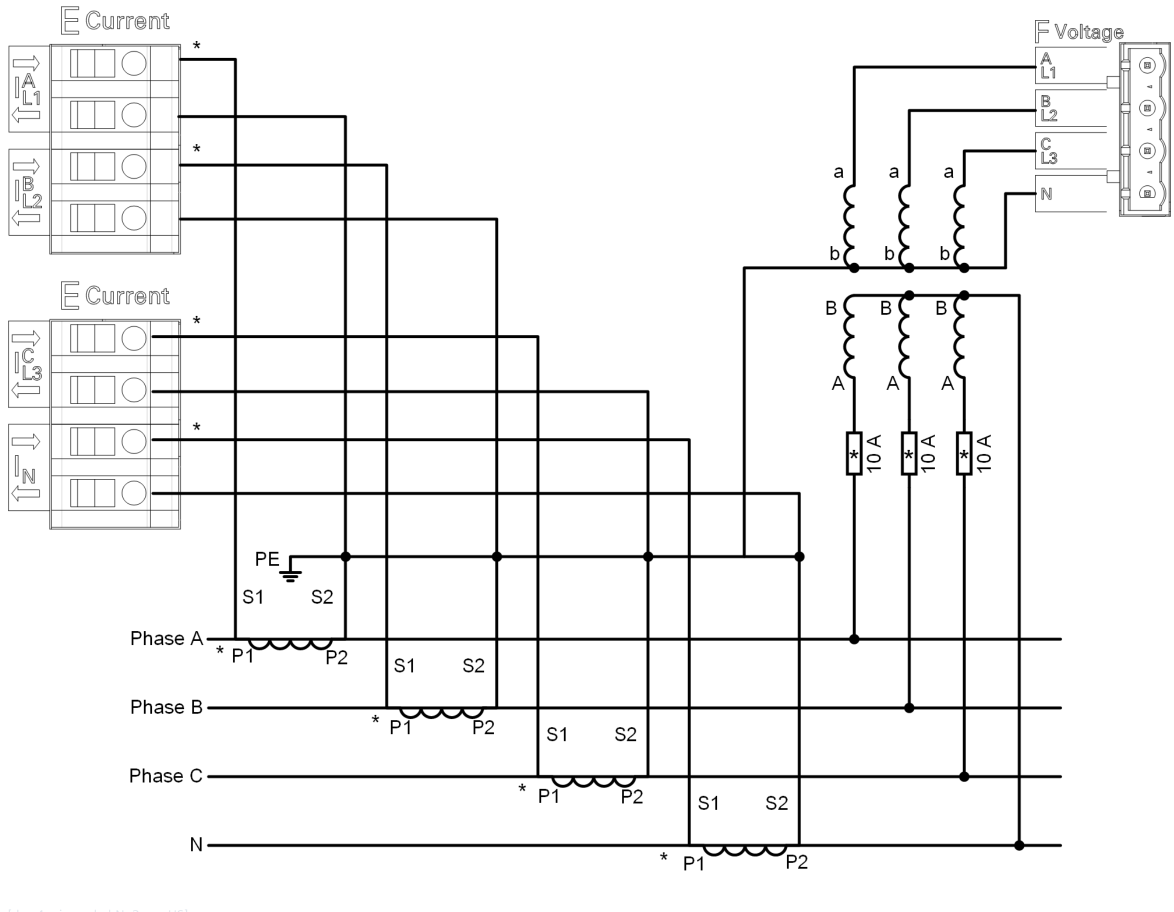


Figure 10-15 Example: 4-Wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced, Current Transformer at the Neutral Phase

NOTE

If you need to change the direction of the current connection, you can configure the current inverse for each phase in **Configuration** > **Basic configuration** > **AC measurement**.

10.6.3 Special Application, Example

Example 3-Wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced

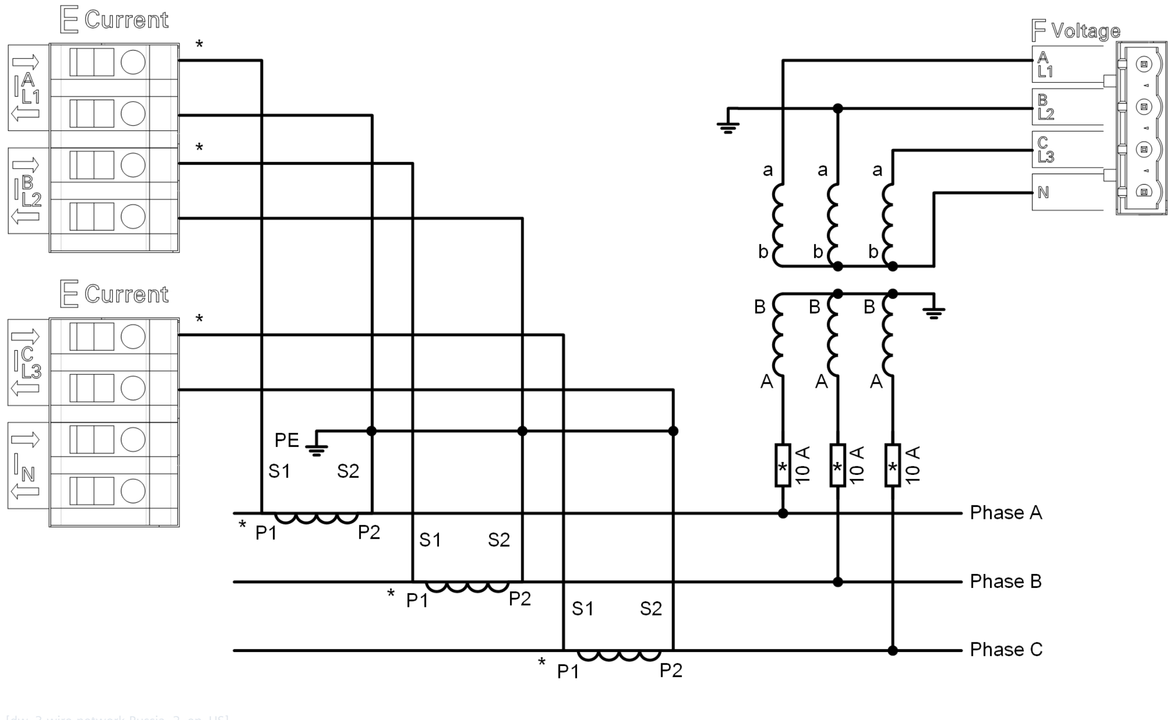
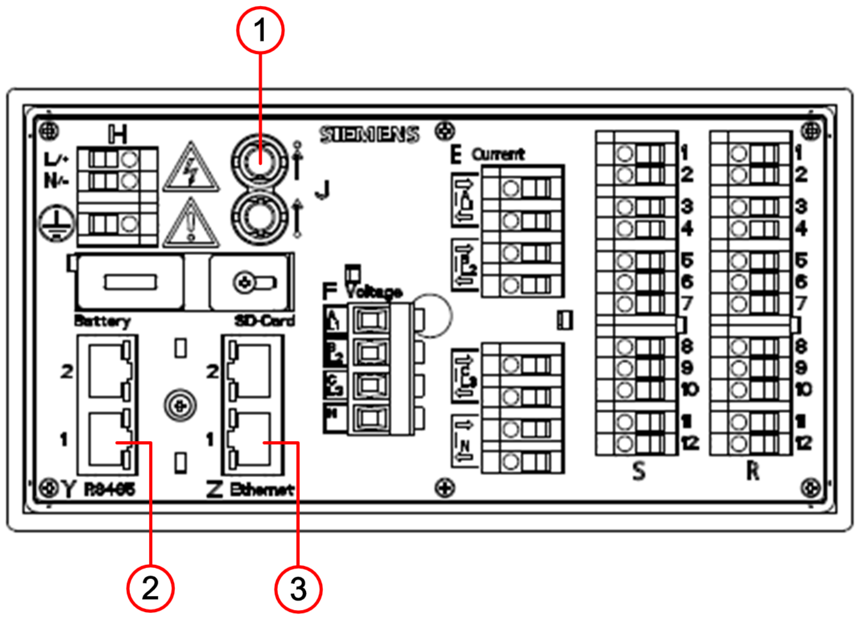


Figure 10-16 Example 3-Wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced

10.7 Communication Connections



[le_communication_connections, 1, --_--]

Figure 10-17 Communication Interfaces

(1) Optical interfaces J
(2) Serial interface Y1 und Y2
(3) Ethernet interfaces Z1 and Z2

NOTE

Be aware of the safety instruction in chapter *Safety Notes, Page 310*.

If you do not connect cables to the communication connectors, Siemens recommends covering the connectors with a cap or dummy plug (not included in the delivery) to prevent the contacts from becoming dirty.

Ethernet Interface

The device is equipped with 2 Ethernet interfaces. The data are exchanged via the 2 RJ45 plug connectors.
Further Technical data see chapter *13.1.3 Communication Interfaces*.
You can configure both Ethernet interfaces as follows:

- Function **Two interfaces**: 2 Ethernet interfaces in 2 networks
- Function **Switch**: 2 switched ports in 1 network

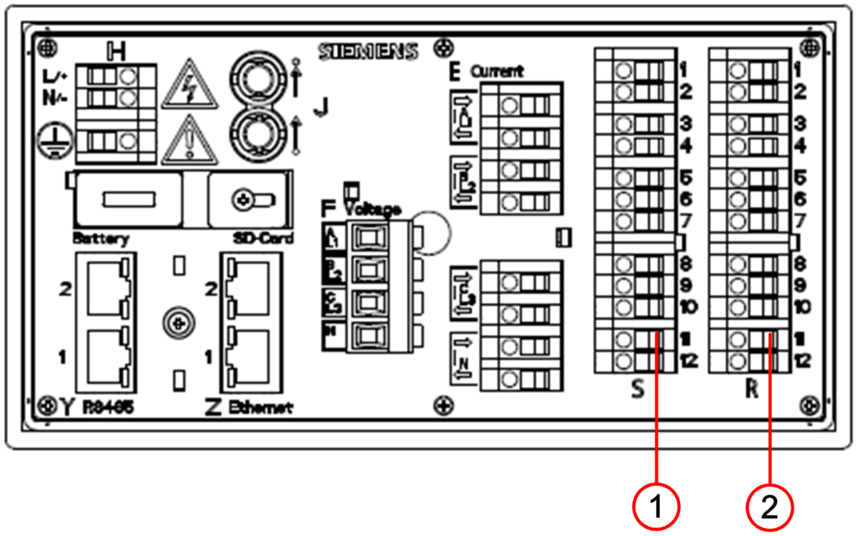
Serial Interface (RS485)

The device includes a serial interface, which communicates via 2 parallel switched RJ45 plug connectors.
Further Technical data see chapter *13.1.3 Communication Interfaces*.

Optical Interface

The optical interface (input and output) is in preparation for further applications.

10.8 Binary Connections



[le_binary_connections, 1, --_--]

Figure 10-18 Binary Connections

(1) Binary inputs/outputs S

(2) Binary inputs/outputs R

Terminals and Conductors

The device has the following terminal blocks:

Terminal Block	Description
S	3 binary inputs and 3 binary outputs
R	3 binary inputs and 3 binary outputs

Terminals for binary inputs/outputs

- Conductor cross-section, rigid max.: 2.5 mm^2 (AWG 14)
- Conductor cross-section (conductor with ferrule): 1.5 mm^2 (AWG 16)
- Tightening torque: 0.4 Nm to 0.5 Nm (3.5 in-lb to 4.5 in-lb)

Functions of the Terminals S and R

Terminals S and R	Description
1	Binary output 1, NO
2	Binary output 1, root
3	Binary output 2, NO
4	Binary output 2, root
5	Common root for both binary output 3
6	Binary output 3, NC
7	Binary output 3, NO
8	Binary input 1
9	Common root for both binary inputs 1 and 2
10	Binary input 2

Terminals S and R	Description
11	Binary input 3
12	Binary input 3

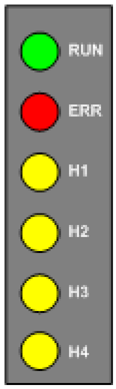
Interference suppression capacitors at the relay contacts: ceramic, 4.7 nF, 250 V

10.9 Meaning of LEDs

LEDs on the Front Side

The device automatically monitors the functions of hardware and software components. The LEDs on the front side of the housing (see *1.3 Device Design*) indicate the current device status.

Table 10-1 Designation of the LEDs on the Front Side

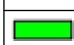
LEDs	Meaning
	RUN: Device active ERROR: Indicates an error according to parameterization H1 to H4: According to parameterization

Depending on the status, the LEDs can be permanently on, flashing, or off. The states are described in chapter *11 Troubleshooting, Repair, and Fallback Mode*.

LED at the Ethernet Socket

Depending on the status, the LEDs at the Ethernet socket can be permanently on, flashing, or off. The meaning of the LEDs is explained in the following table:

Table 10-2 LEDs at the Ethernet Socket

LED	Meaning
	LED Speed: • On: 100 Mbit/s • Off: 10 Mbit/s
	LED Link/Activity: • LED on: Ethernet link is up. • LED flashing: Ethernet link is up and data is transferred. • LED off: no Ethernet partners is connected.

NOTE

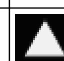
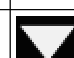
The LEDs at the RS485 sockets on the rear side do not have a meaning.

10.10 Operation via Display

10.10.1 General Operating Instructions

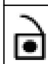
A restricted operation via the display of the device is possible with the softkeys.
The front softkeys F1 to F4 are used to set parameters, select measurands, and enter various settings.
The following table lists the icons which appear on the display when the softkeys are pressed.

Table 10-3 Control Functions of the Softkeys

Softkey Functions	F1	F2	F3	F4
General Softkey Functions				
Displaying the RMS value	RMS			
Canceling an action and returning to the action displayed previously	ESC			
Displaying the maximum value	MAX			
Displaying the minimum value	MIN			
Scrolling up				
Scrolling down				
Menu selection				MENU
Acknowledging the selection				ENTER
Special Softkey Functions				
Displaying the table of the value	Tab			
Displaying the graph	GRAPH			
Displaying additional information		INFO		
Active energy supply	SUP			
Active energy consumption	DMD			
Inductive reactive energy	IND			
Capacitive reactive energy	CAP			
Scrolling left				
Scrolling right				
Displaying the next additional information				
Switching to edit mode				EDIT

Softkey Functions	F1	F2	F3	F4
Exiting edit mode				OK
Increasing the displayed value or switching forward in the parameter list in edit mode		+		
Reducing the displayed value or switching backward in the parameter list in edit mode			-	
Switchover the sign		+/-		
Switching between selected and non-selected state (for example, password protection on → password protection off)				

Table 10-4 Icons in the Title Bar of the Display

Icon	Definition
	The device is password-protected.
	The device password was entered correctly and the device is unlocked.

10.10.2 Starting Operation

Before starting the device, the following preconditions must be met:

- Mount the device as described in chapter *10.3 Assembly*.
- Connect the lines for measurement, communication and supply voltage as described in the chapters *10.5 Electrical Connection*, *10.7 Communication Connections*, *10.8 Binary Connections* and observe the safety notes.
- Switch on the devices needed for the measurement.
- Switch on the supply voltage of the device.
- Check whether the LEDs indicate that the device is ready (see chapter *11.1.3 LED Indications*).

Once the device is initialized, the currently selected screen with the measured values is displayed.

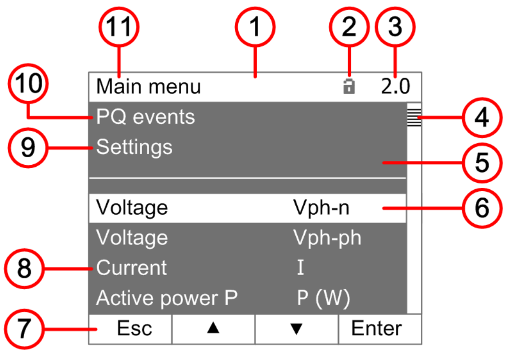
NOTE

The following figures only show the display without the front view of the device.

10.10.3 Display Content

Display of the Menus

In the main menu, all submenus are listed on the display:



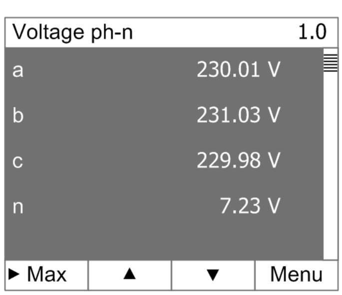
[dw_display_main-menu, 1, en_US]

Figure 10-19 Display Content

(1)	Title
(2)	Password icon
(3)	Display number
(4)	Scroll bar
(5)	Start/end of the list
(6)	Selected display
(7)	Current functions of the softkeys
(8)	Selectable measurements
(9)	Submenu settings
(10)	Diagnostics
(11)	Menu/submenu

The display can be switched between inverse mode and non-inverse mode (see chapter *7.1.2 Configuration via Web Pages*).

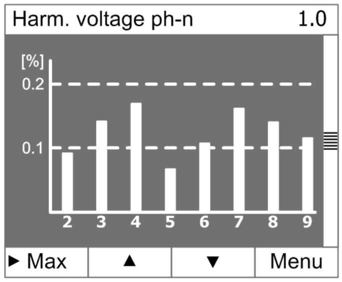
Display of Measured Values



[dw_display_measuremets, 1, en_US]

Figure 10-20 Display of Measured Values

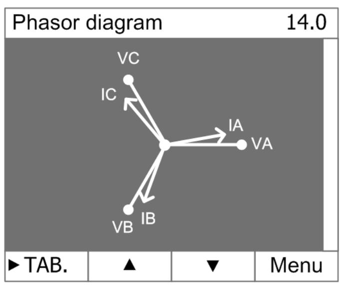
Display of Bar Charts



[dw_display-bar-chart, 1, en_US]

Figure 10-21 Display of Bar Charts

Display of Phasor Diagrams



[dw_display_phasor-diagram, 1, en_US]

Figure 10-22 Display of Phasor Diagrams

10.11 Operation via PC

10.11.1 General Usage Notes

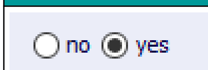
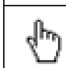
The device can be operated with HTML pages via the connected PC. Additionally, limited operation of the device is possible with softkeys on the display side in connection with the display.

The graphical user interface is stored in the device. To display the user interface, start the Web browser and enter the IP address of the device.

You can navigate via the Web browser using the icons on the toolbar, for example back, forward, print. The user interface itself does not contain any navigation icons.

Operating actions are performed with the mouse. Parameters and text are entered using the keyboard.

Table 10-5 Control Functions

Control Element	Control Function
	Option button: selects one option
	List box: selects an item from a list
Send	Button: Executing an action by clicking the button, that is the current settings on the Web page are transmitted to the device.
Configuration	Active tab (light blue)
Configuration	Inactive tab (dark blue)
	Selects and opens the item to be activated, for example a tab

NOTE

At the beginning of the parameterization, first set the **Network type** according to chapter *2.5.1 Configuration via Web Pages*. If you change the **Network type** during operation, check all settings, measured values, and limiting values for inconsistencies after activating the device. Check also the **ICD/IID file** which is suitable for the network type. If there are invalid values or a wrong **ICD/IID file**, restart the device.

NOTE

If you change settings in tabs, click **Send** on each tab to confirm the new setting. The settings have to be activated after the entire parameterization has been completed.

10.11.2 Start and Design of the User Interface

10.11.2.1 Initial Start of the Operation

Before starting the user interface, the following preconditions must be met:

- Assemble the device as described in chapter *10.3 Assembly*.
- Connect the lines for measurement, communication, and supply voltage as described in the chapters *10.5 Electrical Connection*, *10.7 Communication Connections*, and *10.8 Binary Connections*.
- Observe the safety notes.
- Switch on the devices needed for the measurement.

- Switch on the supply voltage of the device.
- Check whether the LEDs indicate that the device is ready (see chapter *11.1.3 LED Indications*).
- Match the IP address and the subnet mask of the network interface card of your computer to the device settings.
- Check on the computer screen whether the LAN connection is active. Activate the LAN connection if it is not activated (see the Windows manual or the Windows online help for more information).
- Start the Web browser.
- Enter the IP address in the Web browser (for example default IP address: https://192.168.0.55) of the device and press **ENTER**.
- Add the self-signed certificates to the certificate trust store of the Web browser. For more information, refer to the document in the download area of *http://www.siemens.com/gridsecurity*, **Downloads** > **Brochures and catalogs - previous download area** > **Content Type** > **Application Notes**.
- Create or enter the correct user name and password. For more information, refer to chapter *8.2.1 Function Description*.
- Click **Log on**.
  The user interface opens with the **Information** tab → **Show device information**.

NOTE

The device supports the following Web browsers:

- Microsoft Edge V41 and above
- Google Chrome V61 and above
- Mozilla Firefox V58 and above
- Apple Safari in iPad with iOS 13.1.2 and above

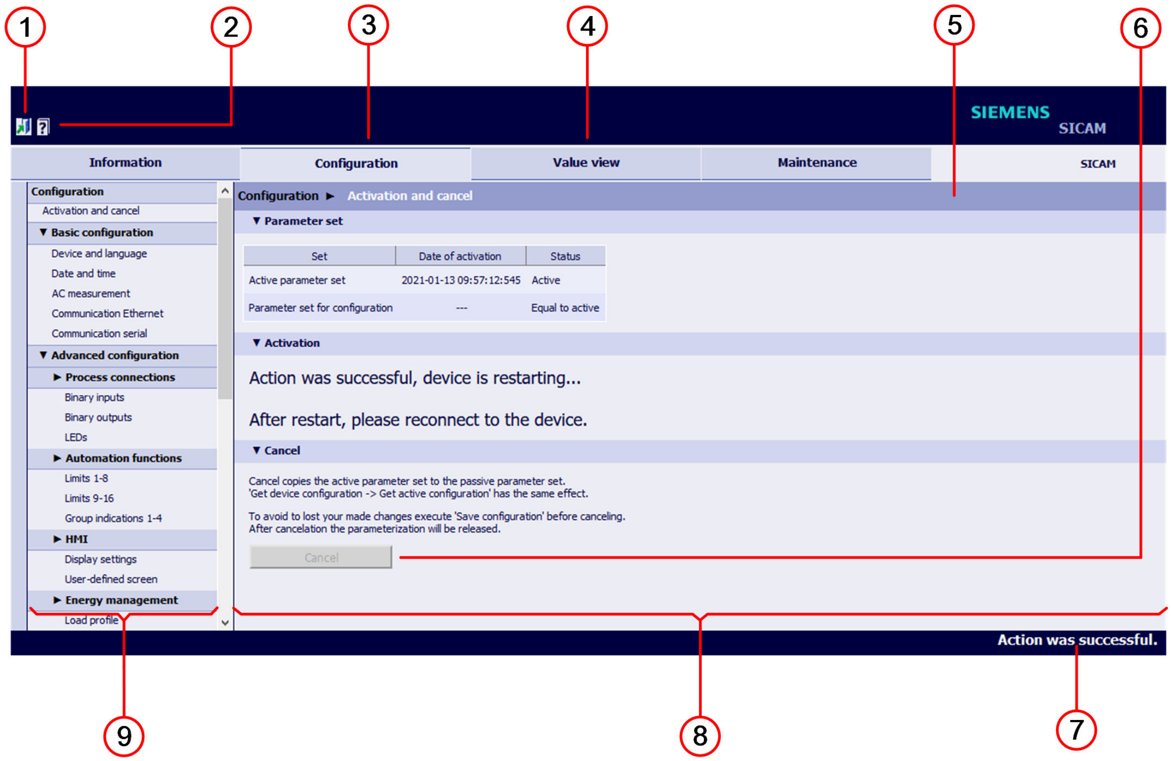
NOTE

When starting the device for the first time, a set of parameters with factory settings is loaded. You can modify these settings during the parameterization.
To set a different user language for the Web pages, open the **Configuration** tab → **Basic configuration** → **Device and language** and change the language.

10.11.2.2 Number of Connections via HTML

A maximum of 2 connections is possible via HTML.

10.11.2.3 Layout of the Web Page



[le_layout_user_interface, 2, en_US]

Figure 10-23 Layout of the Web Page

(1)	Logout icon
(2)	Online help
(3)	Active tab (light blue)
(4)	Inactive tab (dark blue)
(5)	Navigation bar
(6)	Button
(7)	Status bar
(8)	Dialog window
(9)	Navigation window

10.11.2.4 Starting the Web Page during Operation

To start the Web page, proceed as follows:

- Start the Web browser.
- Enter the IP address in the Web browser (for example the default IP address: 192.168.0.55) and press **ENTER**.
  The Web page opens with the **Log on** tab.
- Enter the **User name** and **Password**, and click **Log on**.
  The Web page opens with the **Information** tab.

You can click the logout icon (see red marking in *Figure 10-23*) to log off, and the login page will appear.

NOTE

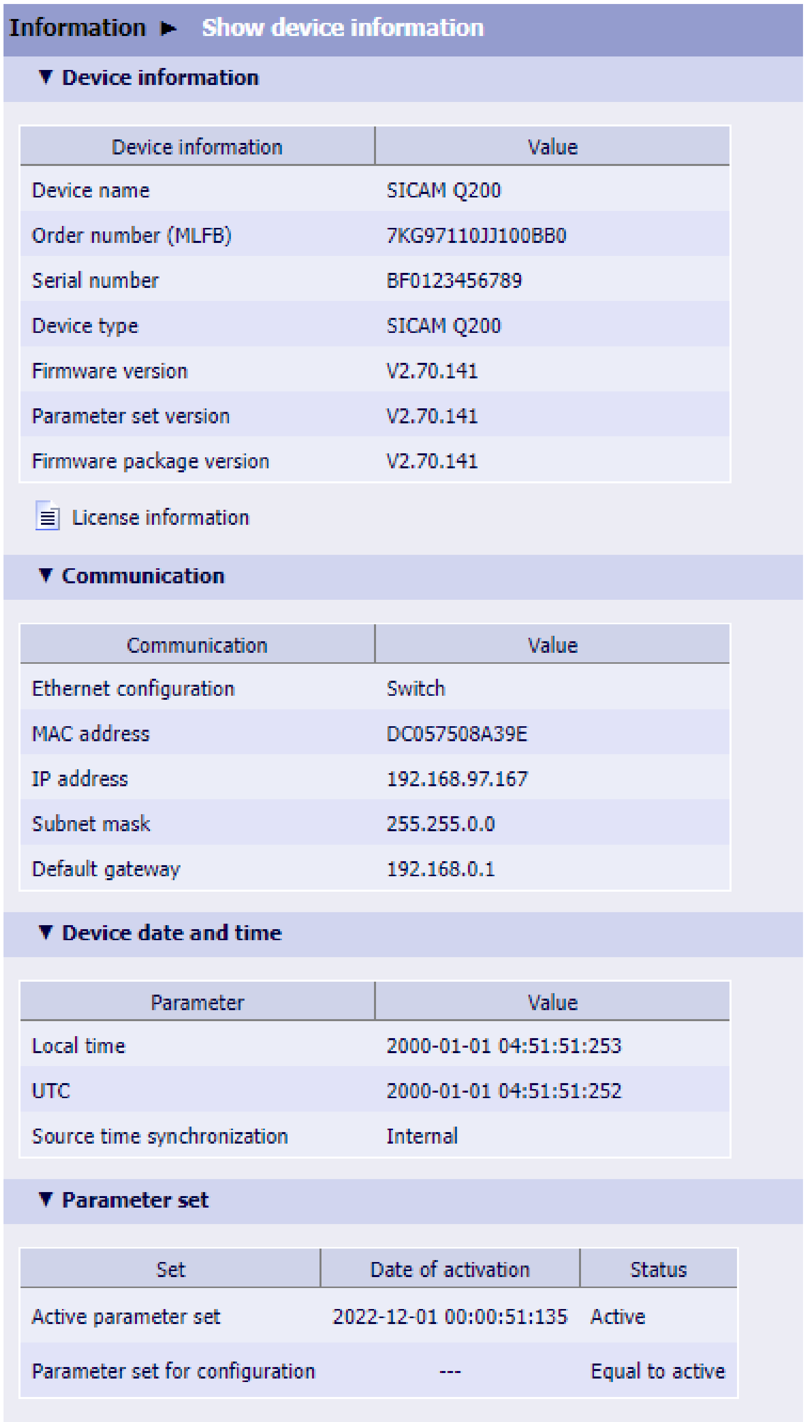
Without user interactions the Web UI will be accessible for 10 minutes (default). You can configure this timeout.

The navigation window of the **Information** tab contains:

- Show device information
- Operational log

Show Device Information

- Click **Show device information** in the navigation window.



Device information	Value
Device name	SICAM Q200
Order number (MLFB)	7KG97110JJ100BB0
Serial number	BF0123456789
Device type	SICAM Q200
Firmware version	V2.70.141
Parameter set version	V2.70.141
Firmware package version	V2.70.141

Communication	Value
Ethernet configuration	Switch
MAC address	DC057508A39E
IP address	192.168.97.167
Subnet mask	255.255.0.0
Default gateway	192.168.0.1

Parameter	Value
Local time	2000-01-01 04:51:51:253
UTC	2000-01-01 04:51:51:252
Source time synchronization	Internal

Set	Date of activation	Status
Active parameter set	2022-12-01 00:00:51:135	Active
Parameter set for configuration	---	Equal to active

[sc_Device_information, 3, en_US]

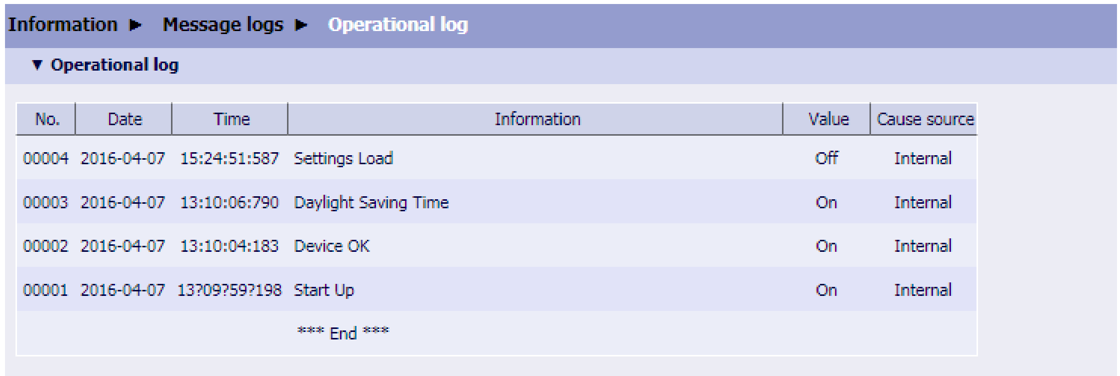
Figure 10-24 Information Tab, Show Device Information

Message Logs Menu – Operational Log

The **Message Logs** menu contains operational indications registered and saved by the device during operation. The device can save up to 128 operational indications. When the storage capacity is exceeded, the oldest indications will be overwritten successively.

To show the operational indications, proceed as follows:

- In the navigation window, click **Operational log**:



[sc_Operational_log, 2, en_US]

Figure 10-25 Information Tab, Operational Log

NOTE

The chapter *8.7.2 Viewing and Clearing of Message Logs* explains how to delete the operational indications manually.

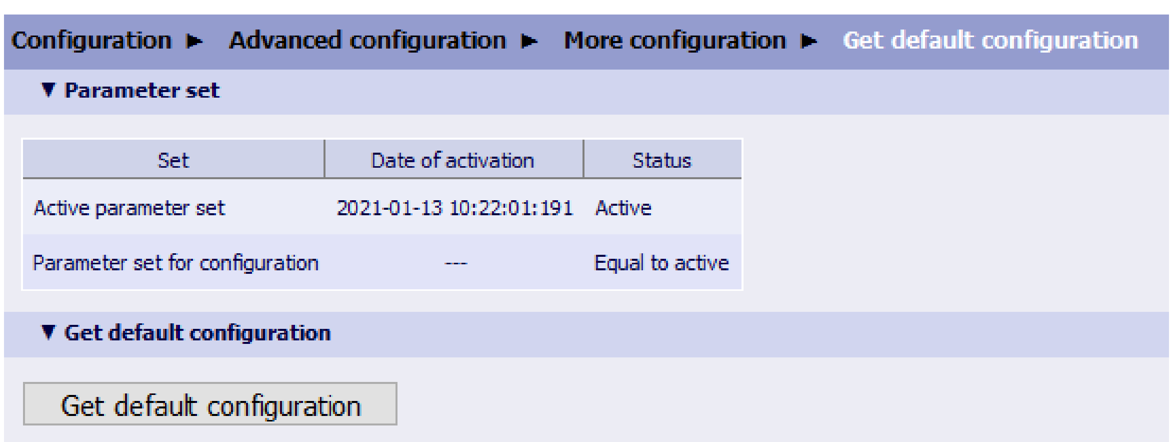
10.11.2.5 Get Default Configuration

NOTE

The device contains 2 sets of parameters. The set of parameters currently used for device operations is the **active set of parameters**. The inactive set of parameters is called the **passive set of parameters**.

If you have not changed the settings of the parameters since the first start of the device, you use the default settings.
If you have changed the settings of the parameters, and need to get the default configuration that is set at the factory, proceed as follows:

- In the navigation window of the **Configuration** tab, click **Get default configuration**.



[sc_Get_device_configuration, 2, en_US]

Figure 10-26 Configuration Tab, Get Default Configuration

A **copy** of the factory settings (= passive set of parameters) of the device is opened. In the meantime, the active parameter set in the device continues to operate.

- Edit the displayed factory settings, activate and use them as active set of parameters.

> **NOTE**
>
> The original factory settings are not overwritten and can be used at any time.

10.11.2.6 Access to the Passive Set of Parameters by Multiple Users

Reading the Passive Set of Parameters

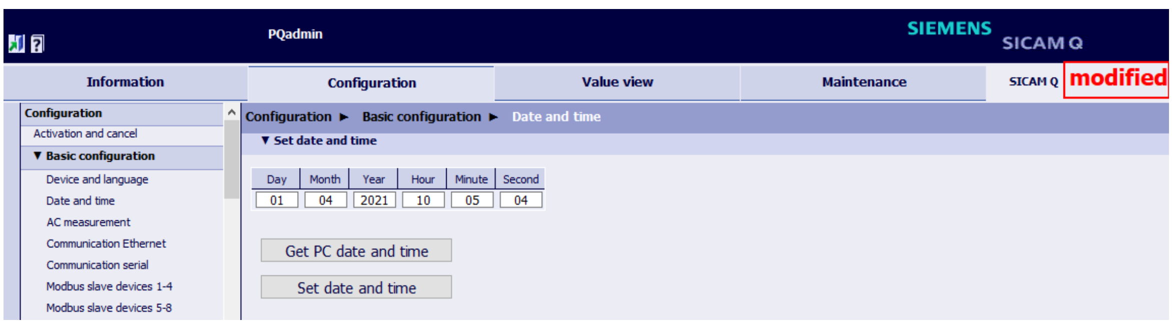
The user interface allows the simultaneous read access of up to 2 users to the passive set of parameters.

Editing the Passive Set of Parameters

The passive set of parameters can only be edited by one user even though multiple users have simultaneous read access.

Once a user changes a parameter on the Web page, the write access is denied for all other users.

If the write access is blocked, **modified** in brackets will be displayed in the upper right corner of the Web page. The user performing the changes will see **modified** without brackets.



[sc_access_blocked_modified, 3, en_US]

If a user performs changes, the server starts a 20-minute timer. If no further changes to the set of parameters are entered by the time the timer has counted down, write access is released again for all users. In this case, the modified data are discarded and the passive set of parameters is overwritten with the content of the active set of parameters.

If new changes to the passive parameter set are made during the 20-minute countdown, the timer is restarted by each action.

If the user has completed the changes to the passive set of parameters or finished the parameterization by clicking **Cancel**, write access for all users is also released.

10.12 Commissioning

10.12.1 Electrical Commissioning

Before commissioning the device, check that all connections are made properly.

- Connect the protective grounding terminal H (protective-conductor terminal) to the protective conductor of the switch panel or of the control cabinet.
- The secondary connections of interconnected current transformers must be short-circuited before you disconnect the power supply that leads to the device.
- **Voltage measuring inputs**: In the case of a **direct connection** and **transformer connection**, the device has to be safeguarded with a listed 10 A backup fuse or a listed 10 A miniature circuit breaker. When using voltage transformers, their secondary connections must never be short-circuited!
- Check the polarity and the phase assignment at the instrument transformers.

Siemens recommends leaving the device for a minimum of 2 hours in the operating room, before using it to allow temperature equalization and to avoid dimness and condensation.

Initial Commissioning

After you have inserted the battery, assembled the device and connected the supply voltage lines, you can start the device for the first time. Proceed as follows:

- Check that the operational data match the rated data on the label and the technical data of the device (see chapter *13.1.1 Power Supply*). This applies in particular to the supply voltage and to the maximum values of alternating current and alternating voltage.

NOTE

The wiring of the terminals described in the following depends on the type of measurement and analysis of the measuring result. You only have to wire the terminals needed for this purpose.

- Connect the measuring lines that are connected to the measuring objects to the terminal blocks E (Current) and F (Voltage).
- Connect the process connections required for the measurements.
- Connect a cable, for example, for the systems control, to one of the 2 RJ45 sockets Y (RS485 interface).
- Connect a LAN cable for the PC or for other devices in the system to one or to both RJ45 sockets Z (Ethernet).
- Close the door of the control cabinet to prevent touching live parts.
- Switch on the connected peripheral devices (PC, measuring device or modules) for measurand analysis.
- Switch on the supply voltage of the device.

NOTE

A connection cable for the RS485 interface is not component of the delivery. This cable is available in the specialized trade. The terminal connection of the RJ45 socket see chapter *13.1.3 Communication Interfaces*.

NOTE

The device does not have a power on/off switch. Switch the supply voltage on or off directly at the respective supply cable.

After an operating time of approximately 15 min, the device will stay within the tolerances specified in *13 Technical Data*.

NOTE

The starting time for the display is 15 s, the starting time for the Modbus TCP transfer is up to 30 s.

- Switch the alternating voltages and alternating currents to be measured at the measurement object on the measuring lines.
- Enter the IP address (default: 192.168.0.55) in the Web browser.
- Enter **User name** and **Password** for the **Web Login**.
- Carry out the measurements.

NOTE

If you change the measurement setup, de-energize the power lines and all measuring lines before opening the control cabinet.

10.12.2 New Device at Initial Commissioning

First Login

For the first login to a new device, you must create a local user account. For more information, refer to *8.2.1 Function Description*.

Basic Configuration

After logging on to the Web page of the device, you must configure the basic functions. For more information, refer to *2 Basic Functions*.

10.12.3 Firmware Update at Initial Commissioning

NOTE

Check the Siemens Internet site whether a new firmware version is available and update your firmware if necessary.
You can find the manuals and the firmware via the download area in the Siemens Internet under:

http://www.siemens.com/sicam-q200

You can find more detailed information on the firmware update in chapter *9.3.2 Firmware Upload via Web Pages*.

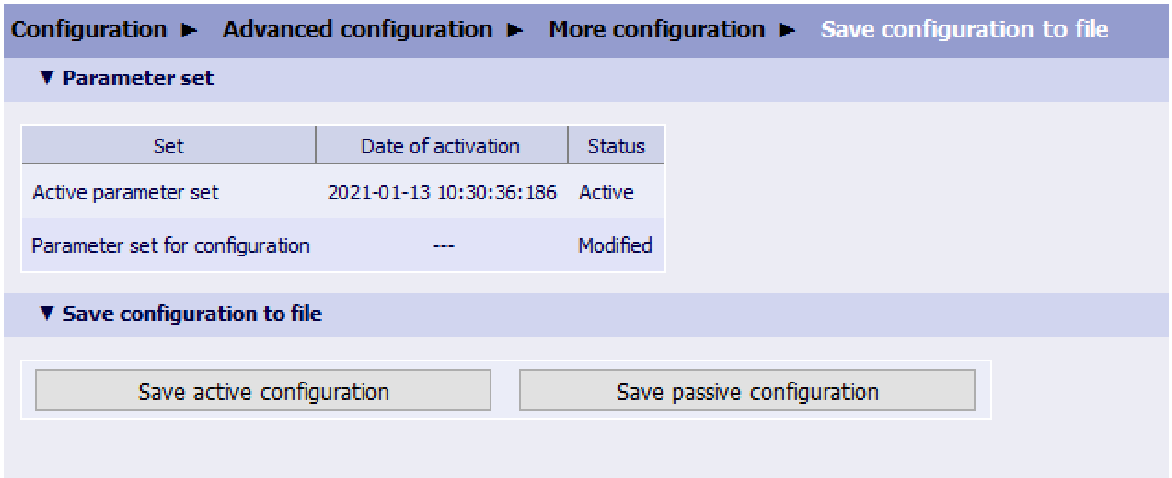
10.12.4 Import and Export of the Configuration File

When configuring many devices, you can export the configuration from 1 device and import it into the other devices.

Export of the Configuration

You can save both the active and the passive configuration to a file in the **Configuration** tab. Proceed as follows:

- In the navigation window, click **Save Configuration to File**.



[sc_Save config to file, 2, en_US]

Figure 10-27 Configuration Tab, Save Configuration to File

- Click either **Save active configuration** or **Save passive configuration**.
  The **File Download** dialog opens. You can save the downloaded configuration. For more information, refer to **File download** > **Save** described in *7.3.3.1 Single File Download*.

NOTE

The file extension must be .cfg.

NOTE

The file name has the following restrictions:

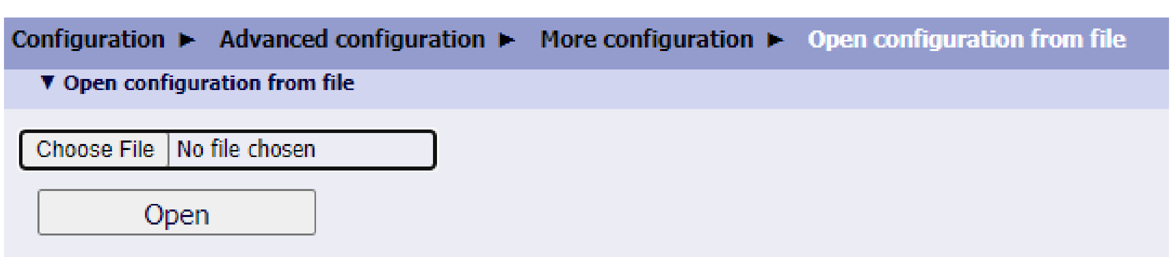
- Maximum 8 characters
- Only containing:
  – Letters: a to z, A to Z
  – Numbers: 0 to 9
  – Hyphen (-) and underline (_)

Import of the Configuration

To import the configuration to the target devices, proceed as follows:

- In the navigation window of the **Configuration** tab, click **Open configuration from file**.

Proceed as follows:



[sc_Open-configuration-from-file, 3, en_US]

Figure 10-28 Configuration Tab, Open Configuration from File

- Click **Choose file**.
- Select the desired file (extension .cfg) in the directory.
- Click **Open**.
  The selected path is inserted in the **Browse** field.
- Click **Open**.
  The device configuration from the CFG file is loaded.

10.12.5 Decommissioning

For security's sake, Siemens recommends that you take the following steps before decommissioning and removing the device (refer to *Removing the Device, Page 316*):

- Clear all data in the tab **Maintenance**.
- Reset the device to the default factory settings (refer to *Maintenance, Page 357*).

11 Troubleshooting, Repair, and Fallback Mode

11.1 Failures and LED Displays

11.1.1 General Inspection

Visual Inspection

If function failures occur, first check the device visually. Observe the following points when inspecting the device visually:

- Correct installation of the device at the intended location as described in chapter *10.3 Assembly*
- Compliance with the environmental conditions specified in chapter *13.1.4 Environmental Conditions and Climatic Stress Tests*
- Correct connection of supply voltage and grounding conductors according to chapter *10.5 Electrical Connection*
- Correct connection of measuring and communication lines according to chapters *10.5 Electrical Connection*, *10.7 Communication Connections* and *10.8 Binary Connections*

Function Checks

Additionally, check the following aspects:

- Functioning of the display according to chapter *10.10 Operation via Display* and good visibility of the display
- Correct functioning of peripheral devices (for example connected PC, series-connected current transformers)
- Compliance with the access rights according to chapter *10.1 Safety Notes and Access Rights*
- Compliance with the commissioning sequence of the device according to chapter *10.12 Commissioning*
- Evaluation of the LED failure indications, see chapter *11.1 Failures and LED Displays*

11.1.2 Troubleshooting and Repair

General Troubleshooting

You are not authorized to do troubleshooting for the defective device beyond the measures described in chapter *11.1.1 General Inspection* and make repairs on your own. Special electronic modules are inserted in SICAM Q200 which can only be replaced by the manufacturer according to the guidelines for Electrostatic sensitive devices (ESD).

If you suspect any damage on the device, Siemens recommends sending the entire device to the manufacturer. For this purpose, it is best to use the original transport packaging or similar packaging.

Troubleshooting Based on Error Messages

NOTE

Error messages are service information that you provide upon request to the service department in case of an error.

The error messages can be saved as described in chapter *7.3.3.1 Single File Download*, section **File download → Save**.

The error messages can be printed as described in chapter *7.3.3.1 Single File Download*, section **File download → Open**.

For more information, refer to *Viewing and Clearing of Error Logs, Page 297*.

11.1.3 LED Indications

Table 11-1 Meaning of LEDs

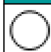
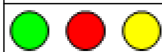
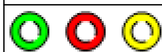
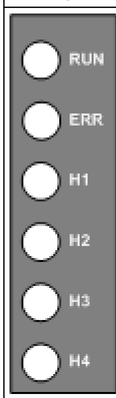
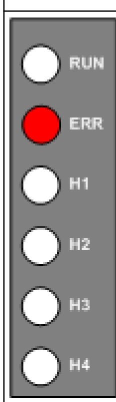
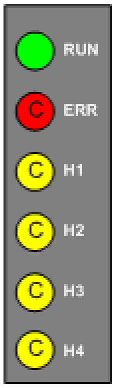
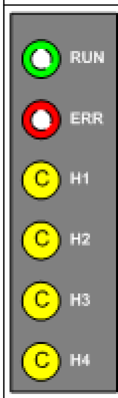
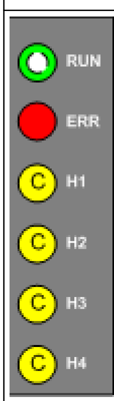
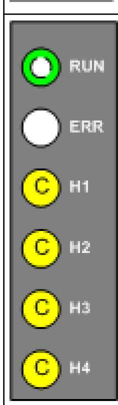
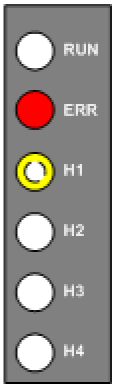
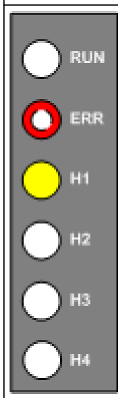
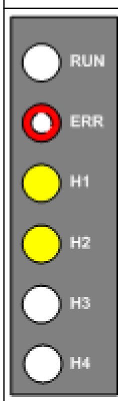
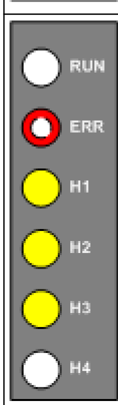
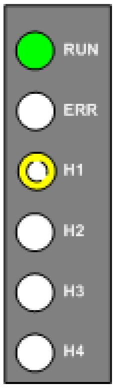
LED	Description
	LED is off.
	LED is on.
	LED is flashing (0.2 s on, 0.2 s off).
	LEDs according to configuration If an indication is assigned to an LED (see chapter *14.3.1.3 LEDs*): • Indication off → LED off • Indication on → LED on • Indication invalid → LED is flashing (0.5 s on and 0.5 s off)

Table 11-2 Indication of LEDs

LED Combination	Description
No Operation	
	Device is switched off.
	Device is switched on, but firmware is not loaded or Device is in startup phase.

LED Combination	Description
Normal Operation	
	The device uses the IP address configured by the user or received via DHCP. **ERR** and **H1** to **H4** LEDs are according to configuration. Indication Device OK = off: This always causes switching to the LED **ERR**.
	Normal operation with default IP address Default IP address is requested by pressing the **F4** softkey during normal operation.
	Double IP address has been detected in the network. The device is in operation but cannot be reached via Ethernet. Solve this network configuration issue and restart the device. Each device must have a unique IP address.
	An IP address request via DHCP is in progress. **ERR** = off and **H1** to **H4** LEDs according to configuration **RUN** LED stops flashing when IP address is received.

LED Combination	Description
Fallback Mode	
	The device uses the IP address configured by the user or received via DHCP. The device runs into the Fallback mode after an unresolvable error in normal operation occurs or by pressing the **F4** softkey during device startup.
	Fallback mode with default IP address Default IP address is requested by pressing the **F4** softkey during fallback mode.
	Double IP address in the network has been detected. The device is in fallback mode but cannot be reached via Ethernet. Solve this network configuration issue and restart the device. Each device must have a unique IP address.
	An IP address request via DHCP is in progress. **ERR** LED stops flashing when IP address is received.

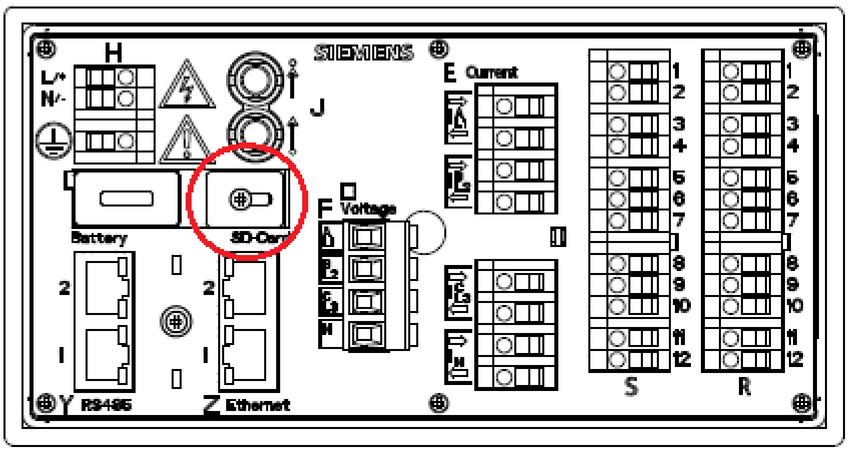
LED Combination	Description
Special Operating Mode	
	LEDs **RUN** and **ERROR**: An action is executed that needs a longer time. Firmware loading (during normal operation or in fallback mode) LEDs H1 to H4: Successively one LED **H1** to **H4** is on and then reverse from **H4** to **H1**.

11.2 Replacing the SD Card

In the as-delivered condition of the SICAM Q200 device, the 2-GB SD card is already mounted in the device. If you want to replace the SD card, proceed as follows:

NOTE

De-energize the device. Do not change the SD card, when the device is running.
Siemens recommends the following SD-card types: ATP Electronics AF2GUDI-SIA001 or SWISSBIT AG SFSD2048N1BW1MT-I-ME111-STD.



[sc_SD card change, 1, en_US]

Figure 11-1 Cover SD Card

- Loosen the screw with a Phillips screwdriver (size PZ1) at the SD-card slot. It is not necessary to remove the screw.
- Move the cover of the SD-card slot to the left.
- Press the SD card carefully to the inside with a suitable screwdriver until the SD card is unlocked.
- Remove the SD card.
- Make sure that the new SD card is properly aligned and insert it in the SD-card slot. Insert the SD card with a screwdriver until the SD card is noticeably locked.
- Move the cover of the SD-card slot to the right so that the slot is covered.
- Fix the screw with the Phillips screwdriver.

11.3 Fallback Mode

11.3.1 Function Description

The firmware of the device contains a complete application for the operation of the device and runs in 2 modifications, depending on the operating state:

- Normal operation: complete functional scope
- Fallback mode: minimum functional scope

The fallback mode is started automatically in case of severe system errors during the device start. Once the fallback mode is started, the indication **FALLBACK** appears on the device display.

The user interface **Fallback mode** opens in the browser. You can see and save different device information for fault analysis in the tabs. Furthermore, you can start different maintenance functions.

Fallback Mode during Device Restart

If a severe system error occurs during a manual restart of the device, the device automatically switches to the fallback mode.

Fallback Mode in Normal Operation

In case of an unexpected restart of the device during normal operation, the fallback mode starts only if a severe system error occurs during the restart. Otherwise, the device switches to normal operation immediately.

Manual Start of the Fallback Mode

If necessary, you can start the fallback mode manually using the softkey F4.

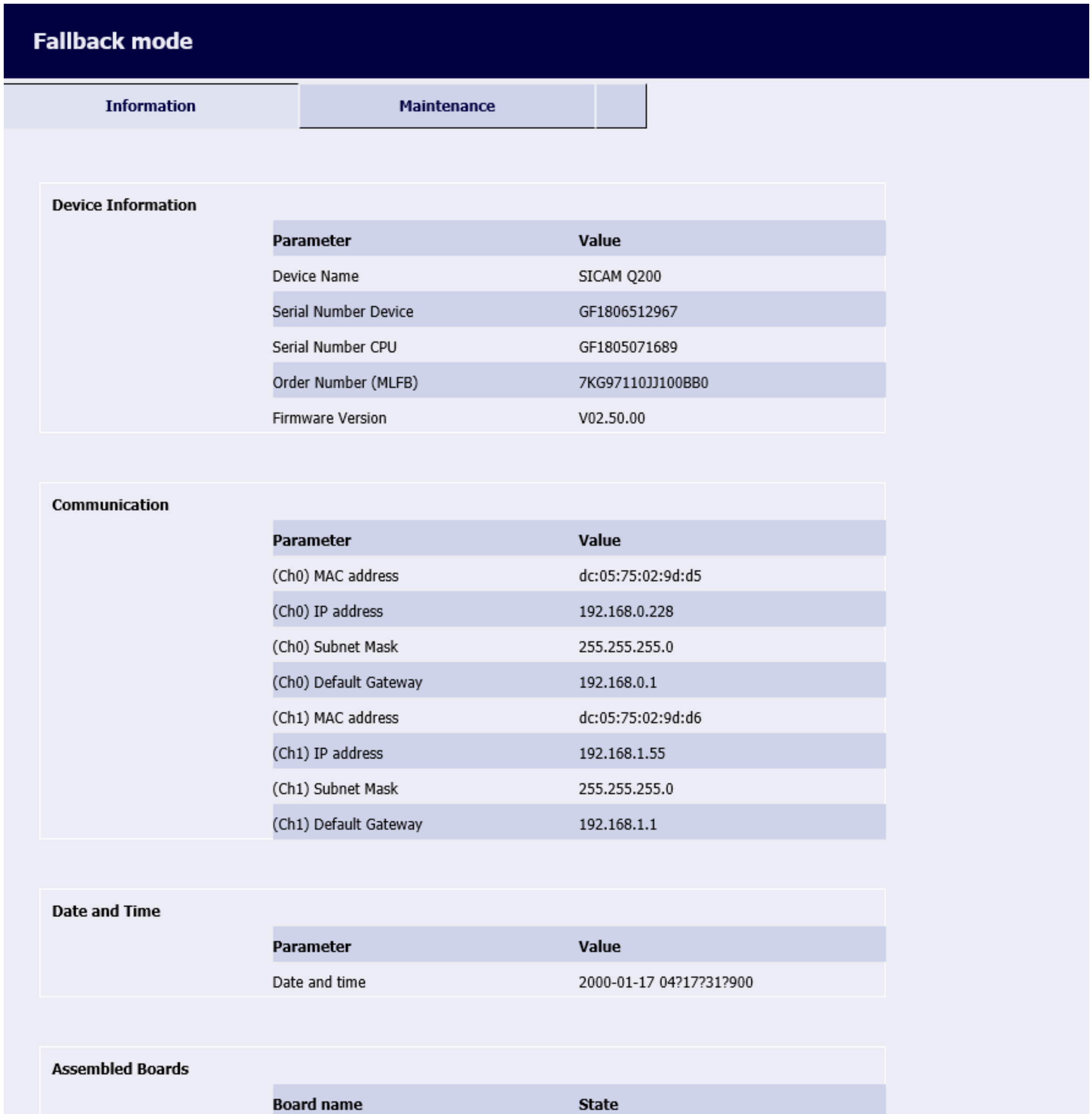
11.3.2 Start and Maintenance of the Fallback Mode

Start of the Fallback Mode

The **Fallback Mode** is started automatically in case of severe system errors during the device start. In this case, the user interface fallback mode with the **Information** and **Maintenance** tabs appears in the open browser once you have entered the IP address. The **Information** tab is opened.

To start the fallback mode manually, proceed as follows:

- Switch off the power supply.
- Press the softkey F4 on the device and switch on the power supply while keeping the softkey F4 pressed.
- Keep the softkey F4 pressed (approx. 10 s) until the display shows **FALLBACK**.
- Release the softkey F4.
  The device starts the fallback mode.
- Refresh the Web page in the browser.
  The user interface **Fallback mode** with the **Information** and **Maintenance** tabs opens in the open browser.
  The **Information** tab is opened with the information on different device properties and available or not available modules.

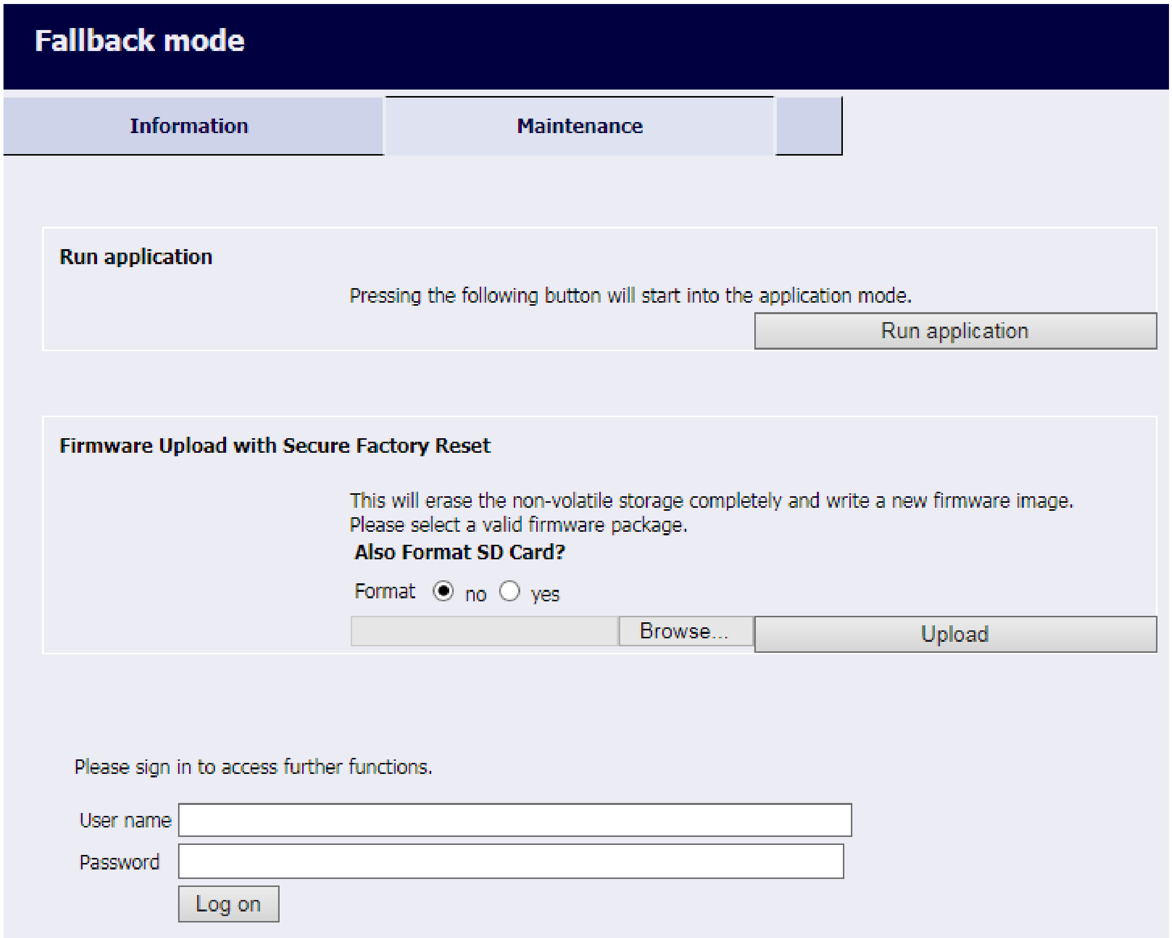


[sc_Fallback-mode_information, 2, en_US]

Figure 11-2 Fallback Mode, Information Tab (Detail)

Maintenance

In the **Maintenance** tab, you can start the application or set the device in the default factory settings state. It is possible to set the device in the default factory settings state without a user account.



[sc_fallback-mode_maintenance_overview, 2, en_US]

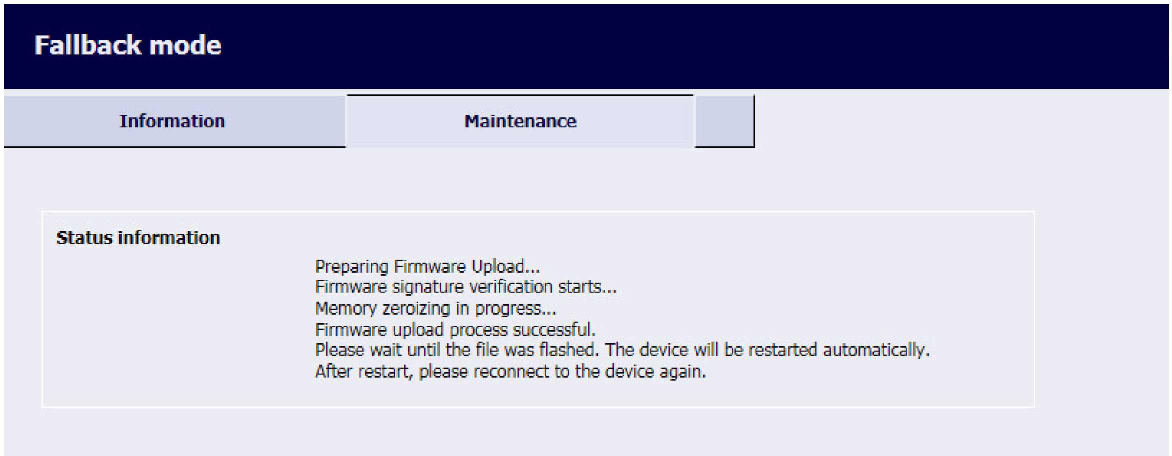
Figure 11-3 Fallback Mode, Maintenance Tab

Firmware Upload with Secure Factory Reset

If you select a valid firmware package and click **Upload**, the entire internal non-volatile memory is cleared. As a result, all the user settings and sensitive data including audit logs are deleted. After the firmware is uploaded, the device starts with factory default settings. The IP address is changed to the default setting 192.168.0.55.

You can also select to format the SD card meanwhile.

The progress is shown in the **Status information**, see the following picture.



[sc_FB_upload_status information, 1, en_US]

Figure 11-4 Fallback Mode, Status Information

NOTE

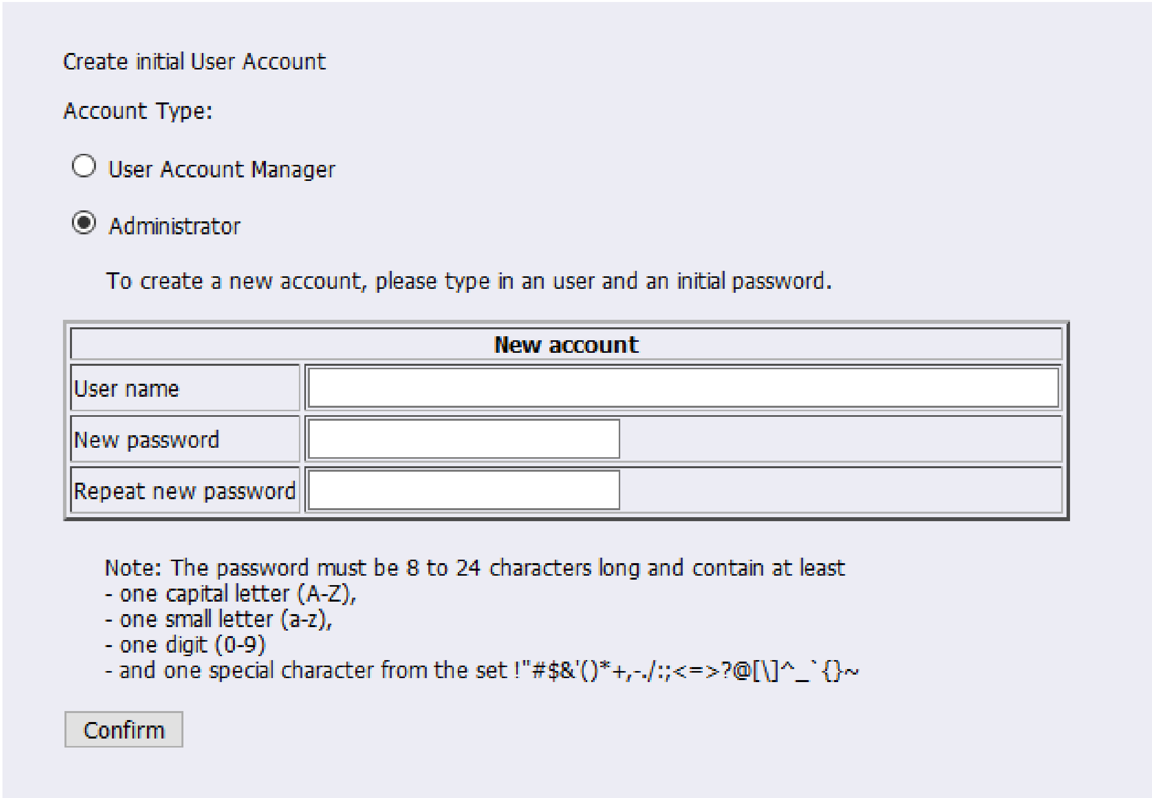
The whole operation takes more than 3 min, and must not be interrupted, for example by a power loss; otherwise, the device cannot recover and must be sent back to the factory.

NOTE

If you forget the user credentials, it is the only way to set the device in the factory state to create a new admin or User Account Manager.

To access to other functions, log on with the right user name and password.

If you have no user account, create the initial user account firstly.

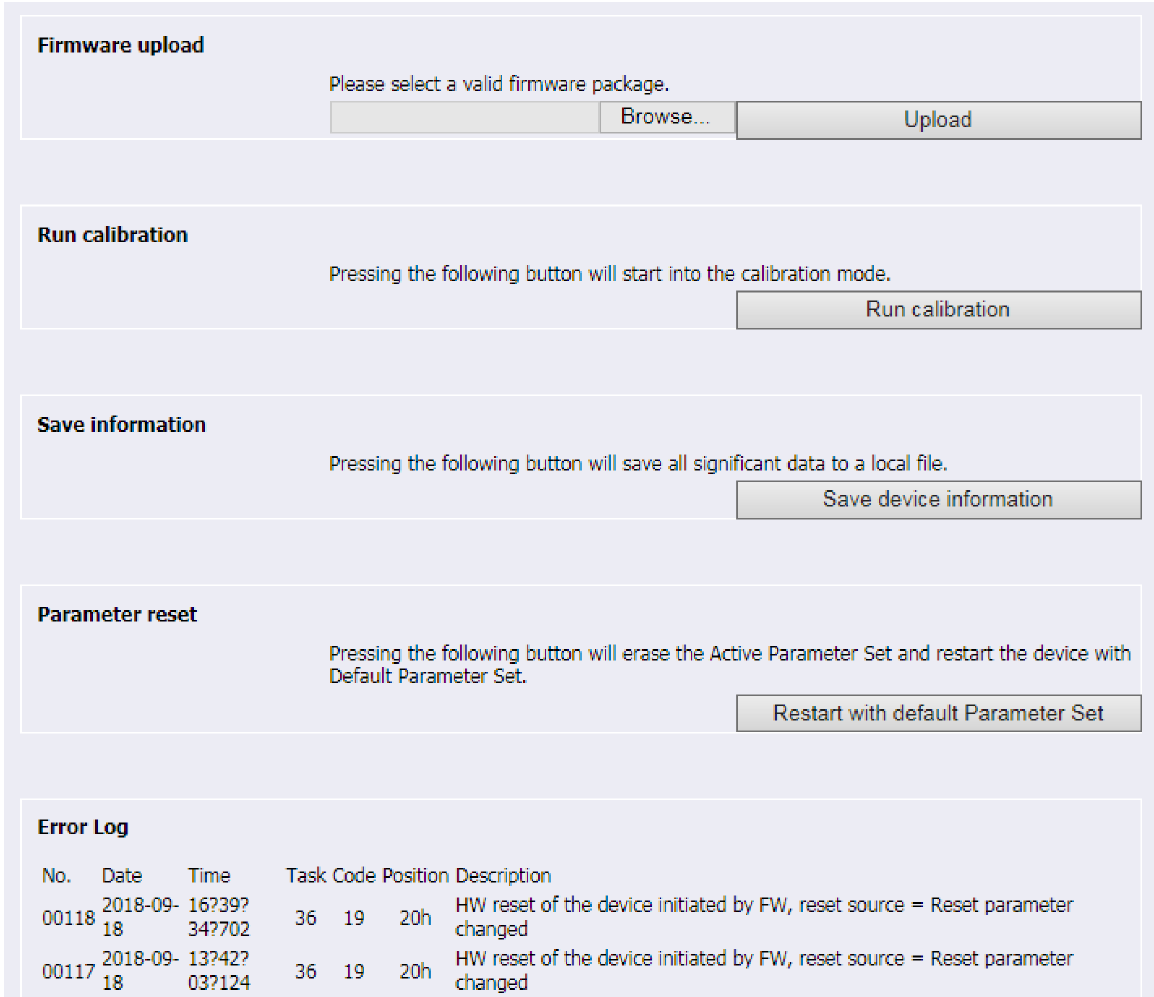


[sc_initial account in fallback, 1, en_US]

Figure 11-5 Fallback Mode, Create the Initial User Account

After you log on successfully, the **Maintenance** tab will be added with the following sections depending on the user roles:

- **Firmware upload**
- **Run calibration**
- **Save customer care support file**
- **Parameter reset**
- **Error log**



[sc_Fallback_upload, 4, en_US]

Figure 11-6 Fallback Mode, Firmware

Firmware upload

This session is available for the user with a role of installer or administrator. You can find more information on uploading the firmware in chapter *9.3.2 Firmware Upload via Web Pages*.

Save customer care support file

In this section, you can click **Save** to save the ZIP file of the customer care support to a local file folder. It is available for the user with a role of viewer, operator, installer, engineer, backup operator, or administrator.

Parameter reset

In this section, you can restart the device with the default parameter set. It is available for the user with a role of engineer, installer, or administrator.

Error log

In this section, you can delete the error messages in the file of error logs. It is available for the user with a role of operator or administrator.

NOTE

The section **Run calibration** is a service function. This function exclusively is used at the factory.

11.4 Customer Support Functions

11.4.1 Function Description

The firmware is able to execute and provide certain diagnostic and test functions. These functions are deactivated by default. It is only necessary to activate these functions via the diagnostic function if you assume the device is not working as expected and you contacted the Siemens Customer Support Center to get additional diagnostic information on the device status (see chapter *11.4.2 Configuration via Web Pages*).

Activate Diagnostic Function 1 – Diagnosis HTML Server on Port 8080

NOTE

For the analysis of a potential problem or malfunction, contact the Siemens Customer Support Center.

The following table contains URL addresses that can be used if the Siemens Customer Support Center needs to execute a diagnostic analysis.

HTML Page (URL)	Description
/printf	Diagnosis log is shown.
/fehler	Error log is shown.
/memstatistic	Table with runtime and stack usage of all tasks TCP/IP stack dynamic memory statistics, for example, are shown.
/sntp	SNTP diagnosis is shown, for example, responses of NTP servers.
/ethst	Ethernet statistics (Ethernet switch registers, Ethernet MAC registers, and statistics) is shown.
/sdcardstatistic	SD card information as well as speed and access statistics
/exbuf	Additional information if a fatal error occurred in the device

Activate Diagnostic Function 2 – Test Functions via Modbus TCP

It is possible to use Modbus TCP to access various test functions via the holding register. With the default settings, these test functions are deactivated. Read/write access to the Modbus register is not allowed. If access to the associated Modbus register is requested, the error exception code 02 returns, stating: **ILLEGAL_DATA_ADDRESS**.

11.4.2 Configuration via Web Pages

Diagnosis

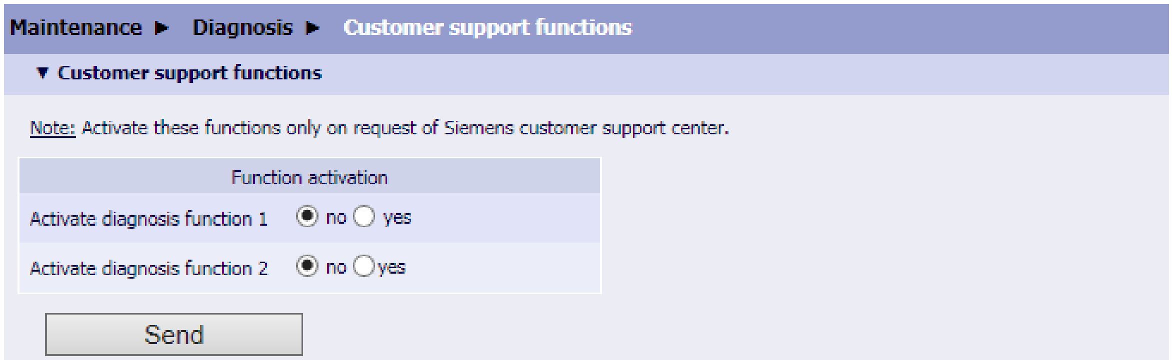
The device is able to execute and provide certain diagnostic and test functions. These functions are deactivated by default. It is only necessary to activate these functions via the diagnostic function if you assume the device is not working as expected and you contacted the Siemens Customer Support Center to get additional diagnostic information on the device status.

NOTE

Activate the following functions only on request of the Siemens Customer Support Center.

To change the **Function activation** settings in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Customer support functions**.



[sc_Diagnosis_customer-support, 3, en_US]

Figure 11-7 Maintenance Tab, Customer Support Functions

Table 11-3 Settings for Customer Support Functions

Parameter	Default Settings	Setting Range	Description
Activate diagnosis function 1	no	no yes	Activate the HTTP diagnosis server on port 8080 with additional diagnosis pages.
Activate diagnosis function 2	no	no yes	Activate the access to the device test functions for factory internal tests.

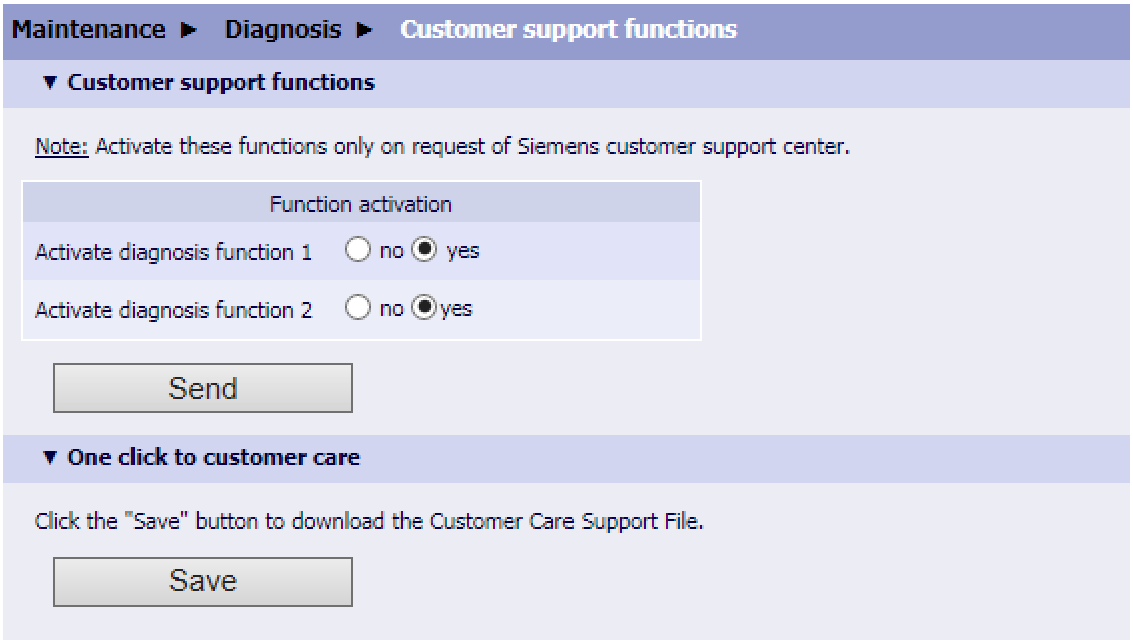
- Select **yes** for the **Activate diagnosis function 1** or **2**.
- Click **Send**.
- Read the data via the internal diagnosis server or use the device test functions via Modbus and inform the Siemens Customer Support Center.
- Select **no** for the **Activate diagnosis function 1** and **2**.

One Click to Customer Care

The device provides a fast way to get support from Siemens. To reduce the efforts for getting fast and comprehensive support, you can collect the relevant data to generate a file by a click and send it to Siemens Customer Support Center via the Secure File Exchange for customer support.

To collect and send the relevant data in the **Maintenance** tab, proceed as follows:

- In the navigation window, click **Customer support functions**.



[sc_Diagnosis_1 click to support, 1, en_US]

Figure 11-8 Maintenance Tab, One Click to Customer Care

- Click **Save** under **One click to customer care**.
- Save the file into a destination folder.
- Send the file to Siemens Customer Support Center via the Secure File Exchange.

The file saved from **One click to customer care** contains 4 subfiles inside. They are respectively the device information, Ethernet statistics, the configuration file, and the runtime statistics.

Name	Size	Packed Size	Modified	Created	Accessed	Attributes
DEVINFO.TXT	37 790	6 742	2018-09-19 05:13			A
ETHSTAT.TXT	10 653	3 065	2018-09-19 05:13			A
PS.CFG	157 936	34 496	2018-09-19 05:13			A
RUNSTAT.TXT	3 652	1 293	2018-09-19 05:13			A

[sc_file from one click to customer care, 1, en_US]

Figure 11-9 Files Saved from One Click to Customer Care

12 Maintenance, Storage, Transport

12.1 Maintenance, Storage, and Transport

Maintenance

Except for a battery replacement, the device is maintenance-free.

Wipe the device using a clean, dry and soft cloth if necessary. Do not use solvents.

The battery change is described in chapter *10.2 Unpacking, Inspecting the Delivery, Installing, and Changing the Battery*.

Storage

Store the device in a dry and clean location. Store the device within a temperature range from -40 °C to +70 °C (-40 °F to +158 °F).

The relative humidity must not lead to condensation or ice formation.

To avoid premature aging of the electrolytic capacitors, store the device within the recommended temperature range of +10 °C to +35 °C (+50 °F to +95 °F).

Siemens furthermore recommends connecting the device to supply voltage once a year for 1 to 2 days in order to form the inserted electrolytic capacitors. This procedure should also be carried out before operating the device.

NOTE

In this context, follow the commissioning notes in chapter *10 Commissioning and First Steps*.

Transport

If devices are to be shipped elsewhere, you can reuse the transport packaging. When using different packaging, you must ensure that the transport requirements according to ISO 2248 are adhered to. The storage packing of the individual devices is not adequate for transport purposes.

The Lithium batteries used in Siemens devices are subject to the Special Provision 188 of the UN Recommendations on the Transport of Dangerous Goods Model Regulations and Special Provision A45 of the IATA Dangerous Goods Regulation and the ICAO Technical Instructions. This is only valid for the original battery or original spare batteries.

13 Technical Data

13.1 Technical Data

13.1.1 Power Supply

Direct Voltage Terminal Block H

Rated input voltages	110 V to 250 V
Admissible input voltage tolerance	±20 %
Permitted ripple of the input voltage	15 %
Maximum inrush current	
At 110 V to 250 V	≤ 22 A; after 250 µs: < 5 A
Maximum power consumption	15 W

Alternating Voltage Terminal Block H

Rated input voltages	110 V to 230 V
System frequency at AC	50 Hz/60 Hz
Admissible input voltage tolerance	±20 %
Permitted harmonics	2 kHz
Maximum inrush current	
At 230 V	≤ 22 A; after 250 µs: < 5 A
Maximum power consumption	30 VA

13.1.2 Inputs and Outputs

Inputs for Alternating Voltage Measurements, Connector Block F

Rated input alternating voltage range	
Phase-N/PE	AC 57.73 V to 400 V (autorange) IEC 61000-4-30 Ed. 3 Class A: • Up to AC 230 V: 200 % overvoltage • > AC 230 V to 400 V: 200 % to 15 % overvoltage UL conditions: • Up to AC 170 V: 200 % overvoltage • > AC 170 V to 300 V: 200 % to 15 % overvoltage
Phase-phase	AC 100 V to 690 V (autorange) IEC 61000-4-30 Ed. 3 Class A: • Up to AC 400 V: 200 % overvoltage • > AC 400 V to 690 V: 200 % to 15 % overvoltage UL conditions: • Up to AC 290 V: 200 % overvoltage • > AC 290 V to 520 V: 200 % to 15 % overvoltage
Maximum input alternating voltage	
Phase-N/PE	460 V (347 V for UL)
Phase-phase	796 V (600 V for UL)
Input impedances	
a, b, c to N	3.0 MΩ
a-b, b-c, c-a	3.0 MΩ

a, b, c, N to PE	1.5 MΩ
Further information about the voltage measuring inputs	
Power consumption per input for V_{max} 460 V	70 mW
Permissible power frequency	42.5 Hz to 69.0 Hz
Measuring error under environmental influences	Acc. to IEC 61000-4-30 Ed. 3 Class A
Sampling rate	40.96 kHz @ 50 Hz

Inputs for Alternating Current Measurements, Connector Block E

Input alternating currents	
Rated input current range	AC 1 A to 5 A (autorange)
Max. input current	AC 10 A (sinusoidal only) Max. ±14.2 A peak
Power consumption per input	
At 5 A	2.5 mVA at $_{in}$ = 100 μΩ
Further information about the current measuring inputs	
Max. rated input voltage	150 V
Measuring error under environmental influences	Acc. to IEC 61000-4-30 Ed. 3 Class A
Thermal stability	10 A continuous 100 A for max. 1 s
Sampling rate	40.96 kHz

Binary Inputs, Connector Blocks R and S

Number	6
Rated input voltage range	24 V to 250 V
Maximum input voltage	DC 300 V
Static input current	1.34 mA ± 20 %
Threshold voltages (adjustable)	
Threshold voltage 19 V (at rated voltage 24 V)	U high ≥ 19 V U low ≤ 10 V
Threshold voltage 88 V (at rated voltage 110 V)	U high ≥ 88 V U low ≤ 44 V
Threshold voltage 176 V (at rated voltage 220 V)	U high ≥ 176 V U low ≤ 88 V
Propagation delay low to high	2.8 ms ± 0.3 ms

Binary Outputs (Relay Outputs), Connector Blocks R and S

Type of relay: NO relay CO relay	Number acc. to order number: Max. 4 Max. 2
Output values	
Switching capacity	On: 1000 W/VA Off: 30 VA; 40 W ohmic 25 W/VA at L/R ≤ 40 ms
Contact voltage AC and DC	250 V
Permissible current per contact	Continuous: 5 A Switching on and holding: 30 A for 500 ms (make contact)

Total permissible current for contacts connected to common potential	5 A
Switching time (OOT)	≤ 5 ms; (OOT = Output Operating Time) additional delay of the output medium used
Anti-interference capacitor across the contacts	4.7 nF
Contact life	
Expected contact life	> 10^7, mechanical, at 300 switching cycles/min
Expected contact life (resistive load)	> 10^5, electric (AC), at 20 switching cycles/min

13.1.3 Communication Interfaces

Ethernet Interface

Connection	RJ45 connector socket 100Base-T acc. to IEEE802.3 LED yellow: • On: Ethernet Link exists • Flashing: Ethernet activity • Off: no connection LED green: • On: 100 Mbit/s • Off: no connection
Protocols	Refer to *14.2.5.1 Communication Ethernet*
Voltage strength	DC 2200 V, AC 1500 V
Transmission rate	100 Mbit/s
Cable for 10/100 Base-T	100 Ω to 150 Ω STP, CAT5
Maximum cable length 10/100 Base-T	100 m, if correctly installed

Serial Interface RS485

Connection	RJ45 connector socket
Protocol	Refer to *14.2.6.1 Communication Serial*
Baud rate (adjustable)	Min. 1200 bit/s Max. 115 200 bit/s
Maximum distance of transmission	Max. 1 km (depending on transmission rate)
Transmission level	Low: -5 V to -1.5 V High: +1.5 V to +5 V
Reception level	Low: ≤ -0.2 V High: ≥ +0.2 V
Bus termination	Integrated, connectable terminating resistors, 120 Ω between A and B
Fail safe for idle bus	Integrated, connectable fail safe resistors, 680 Ω between B and VCC_RS485 as well as A and GND_RS485.
Dielectric strength	DC 700 V

Pin No.	Assignment
Pin assignment acc. to Modbus via Serial Line specification	
1	Not assigned
2	Not assigned
3	Not assigned
4	B RS485 connection pin B
5	A RS485 connection pin A
6	Not assigned
7	Not assigned
8	GND

13.1.4 Environmental Conditions and Climatic Stress Tests

Environmental Conditions

Temperature data	Operating temperature Devices with display: the legibility of the display is impaired at temperatures < 0 °C (+32 °F)	-25 °C to +55 °C -13 °F to +131 °F
	Temperature during transport	-40 °C to +70 °C -40 °F to +158 °F
	Temperature during storage	-40 °C to +70 °C -40 °F to +158 °F
	Maximum temperature gradient	20 K/h
Air humidity data	Mean relative humidity per year	≤ 75 %
	Maximum relative humidity	95 % 30 days a year
	Condensation during operation	Not permitted
	Condensation during transport and storage	Permitted
Altitude and operation site	Max. altitude above sea level	2000 m
	Operating condition	Indoors use
Pollution degree	2	

Climatic Stress Tests

Standards: IEC 60068
Dry cold: IEC 60068-2-1 test Ad
Dry heat during operation, storage, and transport: IEC 60068-2-2 test Bd
Damp heat: IEC 60068-2-78 test Ca
Change of temperature: IEC 60068-2-14 test Na and Nb

13.1.5 General Data

Battery	Type	PANASONIC CR2032 or VARTA 6032 101 501
	Voltage	3 V
	Capacity	230 mAh
	Typical life	For operation with permanently applied supply voltage: 10 years
		For operation with sporadically interrupted supply voltage: A total of 2 months over a 10-year period
Internal memory	Capacity	2 GB
Degree of protection		
Housing	IP20	
Front	IP40	
Front (with separate seal between housing and switch panel; seal is part of the IP54 kit of SICAM Q200 accessories)	IP54, dust-tight type 12 NEMA 12	

13.2 Test Data

13.2.1 Reference Conditions according to IEC 62586-1 for Determining Test Data

Ambient temperature	23 °C ± 2 °C
Relative humidity	40 % to 60 % RH
Supply voltage	V_{PS} ± 1 %
Phases (3-wire network)	3
External continuous magnetic fields	DC field: ≤ 40 A/m
	AC field: ≤ 3 A/m
DC components V/I	None
Signal waveform	Sinus
Frequency	50 Hz ± 0.5 Hz
	60 Hz ± 0.5 Hz
Voltage magnitude	Udin ± 1 %
Flicker	Pst < 0.1 %
Unbalance (all channels)	100 % ± 0.5 % of Udin
Harmonic	0 % to 3 % of Udin
Interharmonic	0 % to 0.5 % of Udin

13.2.2 Electrical Tests

Standards

Standards	IEC EN 61000-6-5, Ed. 1 IEC EN 61010-1 IEC EN 61010-2-030

Insulation Test according to IEC EN 61010-1 and IEC EN 61010-2-030

Inputs/Outputs	Insulation	Rated Voltage	ISO Test Voltage	Category
Current measurement inputs	Reinforced	150 V	AC 1400 V	Cat. III
Voltage measurement inputs	Reinforced	600 V	Surge voltage 4700 V	Cat. III
		300 V		Cat. IV
Supply voltage	Reinforced	300 V	DC 3100 V	Cat. III
Binary outputs	Reinforced	300 V	AC 2200 V	Cat. III
Binary inputs	Reinforced	300 V	AC 2200 V	Cat. III
Ethernet interface	SELV	< 24 V	DC 2200 V	–
RS485 interface	SELV	< 24 V	DC 700 V	–

EMC Tests for Immunity (Type Tests)

Standards	IEC EN 61000-6-5 For more standards see also individual functions
Electrostatic discharge, Class III, IEC 61000-4-2	6 kV contact discharge 8 kV air discharge 150 pF, Ri = 330 Ω with connected Ethernet cable

Fast transient bursts IEC 61000-4-4, Class IV	4 kV; 5 ns/50 ns 5 kHz Burst length = 15 ms Repetition rate 300 ms Ri = 50 Ω Test duration 1 min
High energy surge voltages (SURGE), Installation class III IEC 61000-4-5	Impulse: 1.2 µs/50 µs
Auxiliary voltage	Common mode: 2 kV; 12 Ω; 9 µF Diff. mode:1 kV; 2 Ω; 18 µF
Measuring inputs, binary inputs, and relay outputs	Common mode: 2 kV; 42 Ω; 0.5 µF Diff. mode: 1 kV; 42 Ω; 0,5 µF
Line-conducted high frequencies, amplitude-modulated, Class III , IEC 61000-4-6	10 V (150 kHz to 80 MHz); 80 % AM (1 kHz)
Damped oscillatory wave IEC 61000-4-18	1 kV (common mode, 1 MHz) 0.5 kV (differential mode, 1 MHz) 0.5 kV (common mode, 10 MHz)
Conducted common mode disturbances IEC 61000-4-16	10 V to 1 V (15 Hz to 150 Hz) 1 V (150 Hz to 1,5 kHz) 1 V to 10 V (1,5 kHz to 15 kHz) 10 V (15 kHz to 150 kHz)
Main frequency voltage IEC 61000-4-16	10 V continuous 100 V for 1 s
Ripple on d.c. power supply IEC 61000-4-17	10 % Un
Voltage dip (applicable only to a.c. power supply ports) IEC 61000-4-11	0 % during 5 cycles 0 % during 50 cycles 70 % during 1 cycles 40 % during 50 cycles Note: With 0 % and 40 % during 50 cycles, the device restarts. With 0 % and 40 % during 30 cycles the device functions are not influenced.
Voltage dips and interruptions (applicable only to d.c. power supply ports) IEC 61000-4-29	0 % during 0,05 s 40 % during 0,1 s 70 % during 0,1 s
High-frequency electromagnetic field, amplitude-modulated, Class III IEC 61000-4-3	10 V/m; 80 MHz to 3 GHz; 80 % AM (1 kHz) 3 V/m; 1 GHz to 2.7 GHz; 80 % AM (1 kHz) 1 V/m; 2.7 GHz to 6 GHz, 80 % AM (1 kHz)
Power system frequency magnetic field IEC 61000-4-8, Class IV	100 A/m continuous; 1 kA/m for 1 s

EMC Test for Noise Emission (Type Test)

Standard	CISPR 22, class A
Emission (conducted)	150 kHz to 30 MHz
Emission (radiated)	30 MHz to 1 GHz

13.2.3 Mechanical Stress Tests

Vibration and Shock Stress during Stationary Operation

Standards	IEC 60068
Vibration IEC 60068-2-6 test Fc	Sinusoidal 10 Hz to 60 Hz: ±0.075 mm amplitude; 60 Hz to 150 Hz: 1 g acceleration Frequency sweep 1 octave/min 20 cycles in 3 orthogonal axes
Shock IEC 60068-2-27 test Ea	Half-sine resistance 5 g acceleration, duration 11 ms, every 3 shocks in both directions of the 3 axes
Seismic Vibration IEC 60068-3-3 test Fc	Sinusoidal 1 Hz to 8 Hz: ±7.5 mm amplitude (horizontal axis) 1 Hz to 8 Hz: ±3.5 mm amplitude (vertical axis) 8 Hz to 35 Hz: 2 g acceleration (horizontal axis) 8 Hz to 35 Hz: 1 g acceleration (vertical axis) Frequency sweep 1 octave/min 1 cycle in 3 orthogonal axes

Vibration and Shock Stress during Transport

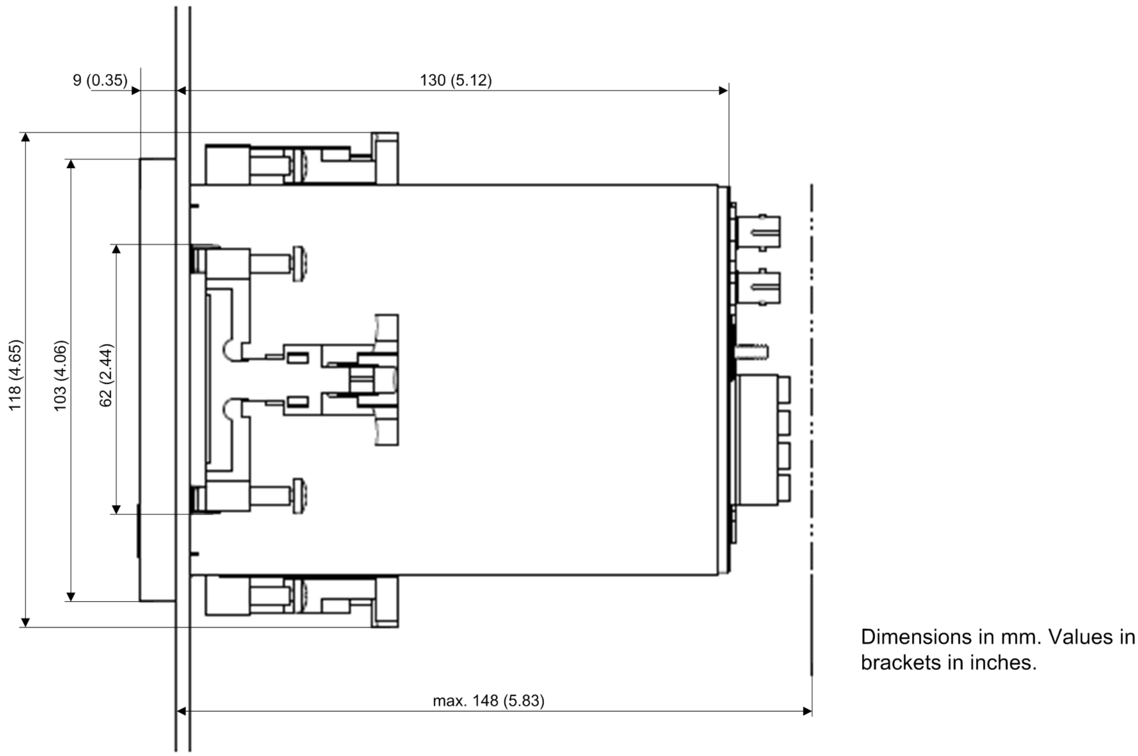
Standards	IEC 60068
Vibration IEC 60068-2-6 test Fc	Sinusoidal 5 Hz to 8 Hz: ±7.5 mm amplitude; 8 Hz to 150 Hz: 2 g acceleration Frequency sweep 1 octave/min 20 cycles in 3 orthogonal axes
Shock IEC 60068-2-27 test Ea	Semi-sinusoidal 15 g acceleration, duration 11 ms, every 3 shocks (in both directions of the 3 axes)
Continuous Shock IEC 60068-2-29 test Eb	Half-sine resistance 10 g acceleration, duration 16 ms, every 1000 shocks (in both directions of the 3 axes)
Free fall IEC 60068-2-32 test Ed	0.5 m

13.2.4 Safety Standards

Standards: EN 61010
IEC EN 61010-1, IEC EN 61010-2-30

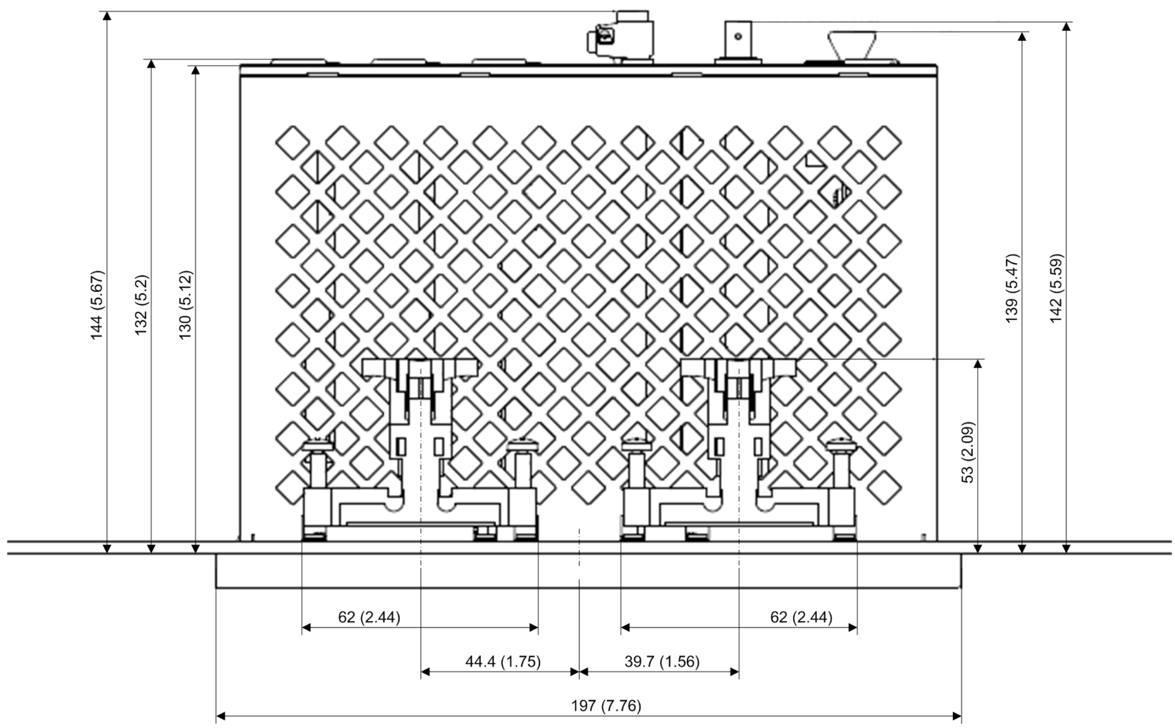
13.3 Dimensions

Mass	Approx. 1.2 kg
Dimensions (W x H x D), without clips	192 mm x 96 mm x 134.6 mm 7.56 inch x 3.78 inch x 5.3 inch
Distances to adjacent devices	On the side: ≥ 20 mm (0.79 inch) Below and above: 15 cm (5.91 inch)



[dw_dim-q200_side-view, 1, en_US]

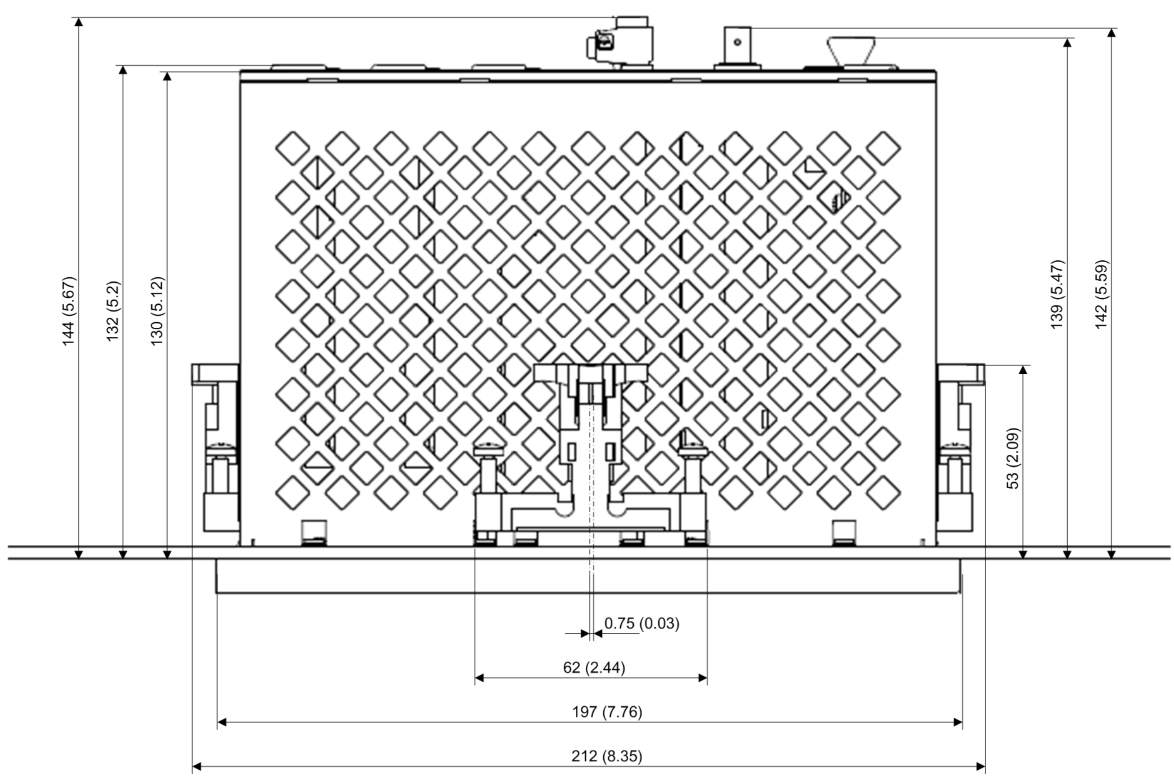
Figure 13-1 Side View SICAM Q200



Dimensions in mm. Values in brackets in inches.

[dw_dim-q200_top-view_Variant-1, 1, en_US]

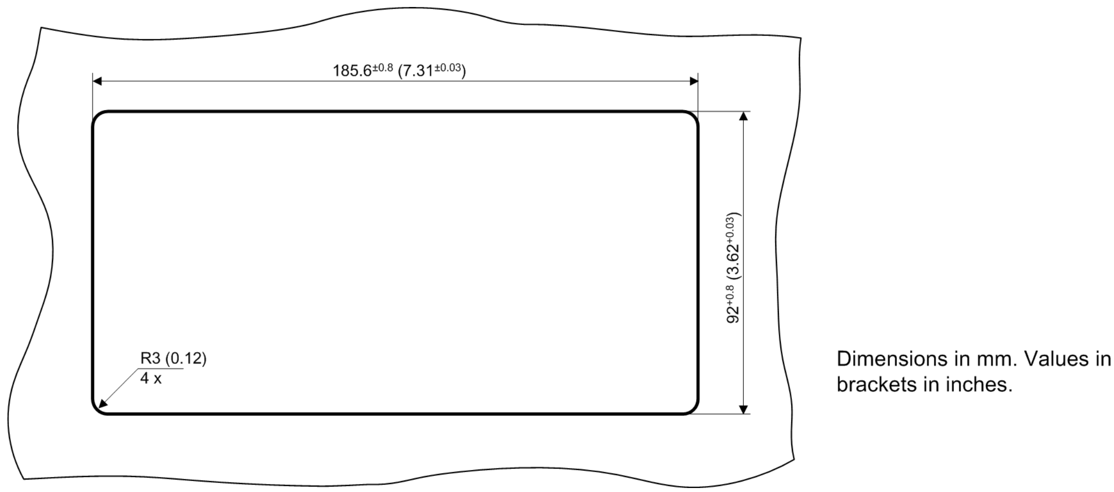
Figure 13-2 Top View SICAM Q200, Variant 1



Dimensions in mm. Values in brackets in inches.

[dw_dim-q200_top-view_Variant-2, 1, en_US]

Figure 13-3 Top View SICAM Q200, Variant 2



[dw_cut-out_in_switch_panel, 1, en_US]

Figure 13-4 Cut-Out in Switch Panel

14 Operational Indications and Operating Parameters

14.1 Operational Indications

14.1.1 Operational Indications

Indication	Description	Notes
Device OK	The device startup was successful.	Indication ON: Device ready Indication OFF: Device startup not successful or I/O boards detection failed
Battery Failure	Battery voltage < 2.7 V or no battery inserted	Indication ON: Battery failure The battery is checked during each device startup and once a day during operation. A possible battery failure is indicated only after the corresponding check.
Settings Load	Starting to change the parameters of the passive set of parameters.	Indication ON: Start of changes Indication OFF: Changes complete
Settings Check	The passive set of parameters is to be activated; the internal parameter check is running.	Indication ON: Check started Indication OFF: Check complete
Settings Activate	The passive set of parameters is enabled and the device works with these parameters.	Indication ON: Activation started Indication OFF: Activation complete
Modbus TCP OK (Modbus TCP Server)	At least 1 Modbus TCP server connection has received Modbus messages.	Indication ON: At least 1 Modbus message was received during the set communication supervision time. The time stamp is set when the first valid message is received. Indication OFF: No Modbus message was received during the set communication supervision time
Ethernet Link Error	For Ethernet function = Switch: No Ethernet connection on Ch1 and Ch2 For Ethernet function = Two interfaces: No Ethernet connection on Ch1	Indication ON: Error Indication OFF: Ethernet link recognized
Modbus Serial OK (Modbus RTU (Slave))	The Modbus serial communication has received a valid Modbus message.	Indication ON: At least 1 serial message was received during the set communication supervision time. The time stamp is set when the first valid message is received. Indication OFF: No serial message was received during the set communication supervision time.
Time Synchronization Error	Error during the time synchronization from the NTP server or fieldbus	Indication OFF: At least 1 time message was received during the set timer (**Error indication after**). The time stamp is set when the first valid time information or time synchronization is received. Indication ON: No time message was received during the set timer (**Error indication after**). The time stamp is set after the **Error indication after** timer has expired and no synchronization message was received. Parameter range: see chapter *14.2.2 Date and Time*.
	Error during internal time synchronization	Indication ON: RTC time invalid (during device start in case of battery failure) Indication OFF: After setting the clock via HTML
Primary NTP Server Error	Faulty or no response from the primary NTP server	Indication ON: Error Indication OFF: Valid time messages have been received for a configured period. Only for time synchronization via Ethernet NTP

Indication	Description	Notes
Secondary NTP Server Error	Faulty or no response from the secondary NTP server	Indication ON: Error Indication OFF: Valid time messages have been received for a configured period. Only for time synchronization via Ethernet NTP
Daylight Saving Time	Switching between daylight saving time/standard time	Indication ON: Daylight saving time Indication OFF: Standard time
Ethernet Link 2 Error	For Ethernet Function = Switch: Irrelevant For Ethernet Function = Two interfaces: No Ethernet connection on Ch2	Indication ON: Error Indication OFF: Ethernet link recognized
Default IP Address	The device has started with a default IP address after pressing the F4 button for more than 3 s during operation.	Indication ON: F4 was pressed and default IP is set in the device.
Limit Violation x	Indication that a parameterized limiting value has been violated	Indication ON: The limit of the monitored measured value has been violated or no measured value is parameterized as input of the limiting value. Indication OFF: The limit of the monitored measured value is not violated. Message invalid: The monitored measured value is invalid (for example, frequency at V < 15 % of V_{rated}). x = 1 to 16
Indication 1 from Remote	Status of the indications that can be set to control the LEDs and the binary outputs via the communication.	Indication ON: ON Indication OFF: OFF Message invalid: Not yet updated via the communication or again invalid via the communication
Indication 2 from Remote		
Rotating Field Clockwise	Indication of rotation voltage	Indication ON: Phase sequence Va-Vb-Vc, rotation clockwise Indication OFF: Phase sequence Va-Vc-Vb, (2 phases interchanged); rotation counter-clockwise Indication invalid: Direction of rotation cannot be calculated (for example, no voltage applied)
IEC 61850 Communication OK	IEC 61850 server is ready/not ready to accept IEC 61850 client connections.	Indication ON: IEC 61850 server is ready to accept IEC 61850 client connections. Indication OFF: IEC 61850 server is not ready to accept IEC 61850 client connections.
Voltage Dip Start	Start of a voltage dip	Indication ON: Voltage dip starts Indication OFF: Voltage dip ends
Voltage Swell Start	Start of a voltage swell	Indication ON: Voltage swell starts Indication OFF: Voltage swell ends
Voltage Interruption Start	Start of a voltage interruption	Indication ON: Voltage interruption starts Indication OFF: Voltage interruption ends
SD Card Error	Indication of an SD card error	SD card defective or read/write error
Voltage Event Available	Indication of a voltage event	Indication ON: There is a voltage dip, voltage swell, or voltage interruption
Frequency Event Available	Indication of a frequency event	Indication ON: There is an overfrequency or underfrequency event
Voltage Unbalance Event Available	Indication of a voltage unbalance event	Indication ON: There is a voltage unbalance event

Indication	Description	Notes
Indication x from Remote	Status of any indications which can be set for control via communication.	Indication ON Indication OFF Message invalid: Not yet updated via the communication or again invalid via the communication. x = 3 to 14
Load Profile Period Closed	Indication that a period has been closed	Only **Indication on** is logged.
Load Profile Synchr. Period	Indication that a synchronization signal was received	Only **Indication on** is logged.
Tariff x	Indication that the tariff x has been set	Only **Indication on** is logged. x = 1 to 8
Modbus RTU Master OK	All configured Modbus slave devices respond to request telegrams.	Indication ON: If all configured Modbus slave devices respond successfully to request telegrams. Indication OFF: If at least one Modbus slave device does not respond to a request telegram or if at least one Modbus slave device responds with a Modbus exception code.
New MSV event made	Indication of a new mains signaling voltage event	Indication ON: A new MSV event occurred
RVC event available	Indication of a rapid voltage change event	Indication ON: There is an RVC event
DNP3 IP communication OK	Communication via protocol DNP3 IP is correct.	Indication ON: DNP3 IP server is ready to accept DNP3 IP client connections. Indication OFF: DNP3 IP server is not ready to accept DNP3 IP client connections.
Violation of ITIC	Indication of an ITIC (CBEMA) curve violation	Indication ON: There is an ITIC (CBEMA) curve violation
Frequency Event Start	Start of a frequency event	Indication ON: Overfrequency or underfrequency event starts Indication OFF: Overfrequency or underfrequency event ends
Voltage Unbalance Event Start	Start of a voltage unbalance event	Indication ON: Voltage unbalance event starts Indication OFF: Voltage unbalance event ends
Transient Event Available	Indication of a transient event	Indication ON: There is a voltage transient
Binary Input x-S Binary Input x-R	Indication of the logic state of the binary input (ON/OFF)	Indication invalid: in startup not updated Binary input high: ON (OFF if inverted) Binary input low: OFF (ON if inverted) If the binary input has not been set to a function (load profile, tariff TOU), a change is logged as an operational indication. x = 1 to 3
Group indication x	Up to 4 single-point indications can be linked logically and combined to a group indication.	A total of 4 group indications can be parameterized. x = 1 to 4
Power Supply Failure	The power supply of the device dropped below the lower limit.	Indication only is logged in the **Operational log**; cannot be routed as input for automation functions or to communication.

14.2 Basic Functions

14.2.1 Device and Language

Table 14-1 Settings for Device and Language

Parameter	Default Setting	Setting Range
Device name	DEVICE	Max. 31 ASCII characters Max. 16 non-ASCII characters
Language	English (US)	ENGLISH (US) User language according to **User language preselection**: DEUTSCH (DE) or CHINESE (CN)

Table 14-2 Settings for User Language Preselection

Parameter	Default Setting	Setting Range
User language preselection	DEUTSCH (DE)	**Option User language preselection**: *CHINESE (CN)* You can select the following **Languages**: • ENGLISH (US) or • CHINESE (CN) **Option User language preselection**: *DEUTSCH (DE)* You can select the following **Languages**: • ENGLISH (US) or • DEUTSCH (DE)

14.2.2 Date and Time

Table 14-3 Settings for Time Synchronization

Parameter	Default Setting	Setting Range
Source time synchronization	Internal	Internal Ethernet NTP Fieldbus
Time zone offset to UTC	+00:00	-12:00 to +13:00 (hours) (in increments of 0.5 h)
Daylight Saving Time switchover	yes	no yes
DST offset	+01:00	0:00 to +2:00 (hours) (in increments of 0.5 h)

Parameter	Default Setting	Setting Range
Start of DST	March Last week	January to December First week Second week Third week Fourth week Last week
	Sunday 2:00 AM	Sunday to Saturday 12:00 AM to 11:00 PM (in increments of 1 h)
End of DST	October Last week	January to December First week Second week Third week Fourth week Last week
	Sunday 3:00 AM	Sunday to Saturday 12:00 AM to 11:00 PM (in increments of 1 h)
Additional Parameters if the Source is Ethernet NTP (Communication Ethernet bus protocol is set to Modbus TCP or IEC 61850)		
Primary NTP server IP Address	0.0.0.0	Any No polling of the NTP server if 0.0.0.0 is entered
Secondary NTP server IP Address	0.0.0.0	Any No polling of the NTP server if 0.0.0.0 is entered
Error indication after	10 min	2 min to 120 min
Additional Parameters if Source is Fieldbus		
Error indication after	10 min	2 min to 120 min

14.2.3 AC Measurement

Table 14-4 Settings for AC Measurement

Parameter	Default Setting	Setting Range
AC measurement		
Rated frequency	50 Hz	50 Hz ± 15 % 60 Hz ± 15 %
Network type[67]	4-wire, 3-phase, unbalanced	1-phase network 3-wire, 3-phase balanced 3-wire, 3-phase, unbalanced (2 * I) 3-wire, 3-phase, unbalanced (3 * I) 4-wire, 3-phase, balanced 4-wire, 3-phase, unbalanced

67 In the case of contradictory parameter settings, **Primary nominal voltage** is indicated as faulty (red) and **Network type** as not adjustable (gray). Moreover, the **Send** button is disabled.

Parameter	Default Setting	Setting Range
Primary nominal voltage[68] (Phase-N/PE)	230.0 V	1.0 V to 1 000 000.0 V (depending on the setting of **Primary rated voltage**) IEC 61000-4-30 Class A: • Up to 230 V: 200 % overvoltage • > 230 V to 400 V: 200 % to 15 % overvoltage UL conditions: • Up to 170 V: 200 % overvoltage • > 170 V to 300 V: 200 % to 15 % overvoltage
Using IN connection as[69]	IN	Not connected IN[70] I4
Zero-point suppression[71]	0.3 % (of Vrated, Irated)	0.0 % to 10.0 %
Measurement interval	Base 10-cycle (at 50 Hz) or Base 12-cycle (at 60 Hz)	Base 10-cycle at 50 Hz or Base 12-cycle at 60 Hz Aggregation 150-cycle at 50 Hz or Aggregation 180-cycle at 60 Hz
Flicker lamp model	230.0 V	230.0 V 120.0 V
Power factor sign convention	IEC	IEC IEEE
Transformer settings		
Voltage transformer[72]	Yes	No Yes
Primary rated voltage	230.0 V	1.0 V to 1 000 000.0 V[73]
Secondary rated voltage	230.0 V	1.0 V to 690.0 V
Primary rated current	5.0 A	1.0 A to 100 000.0 A
Secondary rated current	5.0 A	1.0 A to 10.0 A
Depending on the configuration of the **Using IN connection as** parameter, the following parameters show **IN** or **I4**, or are not visible.		
Primary rated current IN/I4	5.0 A	1.0 A to 100 000.0 A
Secondary rated current IN/I4	5.0 A	1.0 A to 10.0 A

68 The value of this parameter must be within the range from 50 % to 200 % of the **Primary rated voltage**. Otherwise, after you click the **Send** button, the value of this parameter changes to be the same as the value of **Primary rated voltage**.

69 This parameter is not available when the connection type is **1-phase network**.

70 This option is only available when the connection type is **4-wire, 3-phase, unbalanced**.

71 Voltage and current values smaller than/equal to the setting referred to 100 % are not included in the calculation and display.

72 Once you enable the voltage transformer, the parameter **Voltage transformer** is invisible on the HTML page. If you want to disable the voltage transformer, you can set the same value for **Primary rated voltage** and **Secondary rated voltage**.

73 If you upgrade your firmware to V02.60, and want to set this parameter to the value from 1.0 V to 99.9 V, you must get the default configuration firstly.

Parameter	Default Setting	Setting Range
Current inverse setting		
Current inverse Ia[74]	no	no yes
Current inverse Ib[74]	no	no yes
Current inverse Ic[74]	no	no yes
Current inverse IN[74]	no	no yes

14.2.4 Email

Table 14-5 Settings for Email Notification

Parameter	Default Setting	Setting Range	Comment
SMTP	no	no yes	-
Email PQ events	yes	no yes	-
Email indications	yes	no yes	-
Sender Details			
Sender name	empty	Max. 63 characters	-
Sender email	empty	Max. 63 characters	These 4 parameters come from the vendor of the email server and must be configured to activate the function **Email notification**.
Password	empty	Max. 63 characters	
SMTP server	empty	Max. 63 characters IP address or domain name	
Port	empty	0 to 65 535	
Recipient Details			
To email address	empty	Max. 63 characters	• Up to 3 recipients can be configured. • To activate the function **Email notification**, you must configure at least 1 recipient.

74 This parameter is to define whether the current direction is the same as the physical connection.

14.2.5 Ethernet Communication

14.2.5.1 Communication Ethernet

Table 14-6 Settings for Communication Ethernet

Parameter	Default Setting	Setting Range	Description
Ethernet Configuration			
Function	Switch	Switch Two interfaces	Configuration of both Ethernet ports: Switch: 2 switched ports in 1 network 2 interfaces: 2 Ethernet interfaces in 2 networks
Ethernet Channel 1			
DHCP	no	no yes	Determines whether DHCP is used for automatic receiving of network parameters instead of fixed network configuration settings DHCP can only be used if IEC 61850 is disabled.
IP address	192.168.0.55	Any	Network configuration for Ethernet Channel 1 (only available for Channel 1 **DHCP** = ***no***)
Subnet mask	255.255.255.0		
Default gateway	192.168.0.1		
Ethernet Channel 2			
DHCP	no	no yes	Determines whether DHCP is used for automatic receiving of network parameters instead of fixed network configuration settings DHCP can only be used if IEC 61850 is disabled.
IP address	192.168.1.55	Any	Network configuration for Ethernet Channel 2 (only available for Channel 2 **DHCP** = ***no***)
Subnet mask	255.255.255.0		
Default gateway	192.168.1.1		
DNS			
DNS	no	no yes	Determines whether the DNS protocol is used for the SMTP server to support a domain name
Primary DNS server IP address	0.0.0.0	Any No polling of the DNS server if 0.0.0.0 is entered	
Secondary DNS server IP address	0.0.0.0		
Protocol Assignments			
IEC 61850	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the IEC 61850 communication protocol to the Ethernet channels (only available for SICAM Q200 devices with the IEC 61850 communication option according to the order number) The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***. IEC 61850 can only be used with fixed IP addresses (no DHCP).

Parameter	Default Setting	Setting Range	Description
Modbus TCP	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the Modbus TCP communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***.
HTTPS/FTPS	Ch1, Ch2	Ch1 Ch2 Ch1, Ch2	Activation and assignment of the HTTPS/FTPS communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***. The protocol cannot be completely deactivated in order to ensure access to the device.
SNMP	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the SNMP communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***.
DNP3 IP	-none-	-none- Ch1 Ch2 Ch1, Ch2	Activation and assignment of the DNP3 IP communication protocol to the Ethernet channels The option ***Ch1*** and the option ***Ch2*** are only available for **Function** = ***Two interfaces***.

NOTE

The protocols listed under the **Protocol Assignments** can work in parallel according to your configuration.

NOTE

After the parameter changes are enabled, the device will be reset.

14.2.5.2 Protocol Modbus TCP and Modbus TCP/RTU Gateway

Table 14-7 Settings for Modbus TCP

Parameter	Default Setting	Setting Range
Standard port number	502	502 Not settable
Access rights	Full	Full Read only
User-defined port 1	no	no yes
Port number[75]	503	503 to 65 535

[75] This parameter is available only if **User-defined port 1** is set to **yes**.

Parameter	Default Setting	Setting Range
Access rights[75]	Read only	Full Read only
Keep alive time	10 s	0 s = switch off 1 s to 65 535 s
Communication supervision time	600 (* 100 ms)	0 s = none 100 ms to 6 553 400 ms
Voltage harmonics unit	%	% V

NOTE

The 2 port numbers must be different from each other.

Table 14-8 Settings for the Modbus Gateway

Parameter	Default Settings	Setting Range
Activated	no	no yes
Unit ID of this device	255	1 to 255
Retry limit[76]	2	0 to 10
Response timeout[76]	10 (* 10 ms)	(1 to 6000) * 10 ms = 10 ms to 60 s

14.2.5.3 Protocol IEC 61850

Table 14-9 Settings for IEC 61850

Parameter	Default Setting	Setting Range
IED Name	SICAM_Q200_01	Max. 60 characters Only a-z, A-Z, _, 0-9 are permitted. The first character must be an alpha character.
Voltage - Dead band	5 %	1 % to 5 %, in 1-% steps
Current - Dead band	5 %	1 % to 5 %, in 1-% steps
Voltage unbalance - Dead band	5 %	1 % to 5 %, in 1-% steps
Current unbalance - Dead band	5 %	1 % to 5 %, in 1-% steps
Power - Dead band	5 %	1 % to 5 %, in 1-% steps
Power factor - Dead band	5 %	2 % to 5 %, in 1-% steps
Frequency - Dead band	0.05 %	0.02 % 0.05 % 0.2 %
Angle - Dead band	0.5 %	0.2 % 0.5 % 1 % 2 %

76 These values are necessary if the Modbus slave device has not been configured for the requested Unit ID. If a Modbus slave device was configured, its values are used.

14.2.5.4 Protocol SNMP

Table 14-10 Settings for SNMPv3

Settings	Default Setting	Setting Range
User name (User name for SNMPv3 access)	Empty, for example: not set	Up to 32 characters • Numbers 0 to 9 • Small and capital Latin letters • Basic special characters
Authentication password		8 to 24 characters • Numbers 0 to 9 • Small and capital Latin letters • Basic special characters
Privacy password		

14.2.5.5 Protocol DNP3 IP

Table 14-11 Settings for DNP3 IP

Parameter	Default Setting	Setting Range	Chapters in DNP3 Device Profile[77]
DNP3 IP Protocol			
Device address	1	1 to 65 519	1.4.1
Master address	10	1 to 65 519	1.4.3 1.8.2
TCP port number	20 000	1 to 65 535	1.3.8
Connection supervision time	30 s	1 s to 3600 s	1.3.10
Response confirmation timeout	90 (9 s)	0.01 s to 3600.00 s, step: 100 ms	1.7.1 1.8.3
Unsolicited transmission			
Support unsolicited reporting	no	no yes	1.8.1
The following parameters are only available when **Support unsolicited reporting** is set to **yes**.			
Number of unsolicited retries	5	0 to 200	1.8.4
Number of class X events	10	1 to 100	1.9.1 1.9.2 1.9.3
Hold time after class X event	50 (5 s)	0 s to 3600 s, step: 100 ms	1.9.5 1.9.6 1.9.7
Threshold values			
AC voltage	5.00 %	0.00 % to 10.00 %	-
AC current	5.00 %	0.00 % to 10.00 %	-
Power	5.00 %	0.00 % to 10.00 %	-
Power factor	5.00 %	0.00 % to 10.00 %	-
Frequency	0.05 %	0.00 % to 10.00 %	-
Percentage value	5.00 %	0.00 % to 10.00 %	-

77 Refer to the Siemens download area for *SICAM Q200*.

14.2.6 Serial Communication

14.2.6.1 Communication Serial

Table 14-12 Settings for Communication Serial, Modbus RTU (Slave)

Parameter	Default Setting	Setting Range
Bus protocol	None	None **Modbus RTU** *(slave)* Modbus RTU Master
Serial line termination	No	No Yes: connectable terminating resistors, 120 Ω between A and B
Serial line fail-safe	No	No Yes: connectable fail safe resistors, 680 Ω between B and VCC_RS485 as well as A and GND_RS485
Device address	1	1 to 247
Baud rate	19 200 bit/s	1200 bit/s, 2400 bit/s, 4800 bit/s, 9600 bit/s, 19 200 bit/s, 38 400 bit/s, 57 600 bit/s, 115 200 bit/s
Parity	Even	None, 1 stop bit Even Odd None, 2 spot bit
Access rights	Full	Full Read only
Communication supervision time	600 * 100 ms	0 s = none 100 ms to 6 553 400 ms
Response delay	0 ms	0 ms to 1000 ms
Voltage harmonics unit	%	% V

Table 14-13 Settings for Communication Serial, Modbus RTU Master

Parameter	Default Settings	Setting Range
Bus protocol	-none-	-none- Modbus RTU *(slave)* **Modbus RTU master**
Serial line termination	No	No Yes: Connectable terminating resistors, 120 Ω between A and B
Serial line fail-safe	No	No Yes: Connectable fail safe resistors, 680 Ω between B and VCC_RS485 as well as A and GND_RS485

Parameter	Default Settings	Setting Range
Baud rate	19 200 bit/s	1200 bit/s, 2400 bit/s 4800 bit/s, 9600 bit/s 19 200 bit/s, 38 400 bit/s 57 600 bit/s, 115 200 bit/s
Parity	Even	None, 1 stop bit Even Odd None, 2 stop bit
Additional inter-character timeout	1 ms	0 ms to 100 ms The Modbus specification requires that the individual characters of a serial Modbus RTU telegram have to be transmitted successively with a maximum character gap of 1.5 character times (or max. 750 µs for Baud rates >19 200 bit/s). Longer silent intervals between the characters are interpreted as telegram end. A longer gap between the characters can be tolerated with this parameter. Note that this also causes longer cycle times. If at least one SICAM P50 device is connected to the bus, at least the following values have to be set for **Additional inter-character timeout**: 1200 bit/s, 2400 bit/s: 0 4800 bit/s, 9600 bit/s: 2 19 200 bit/s: 3 38 400 bit/s: 4 57 600 bit/s, 115 200 bit/s: 6
Maximum 0x/1x register gap	40	0 to 200
Maximum 3x/4x register gap	10	Maximum number of **not-mapped** registers which are being requested between mapped registers in one request telegram.

14.2.6.2 Modbus Slave Devices

Table 14-14 Settings for the Modbus Slave Devices

Parameter	Default Setting	Setting Range
Name	Modbus slave device x	Max. 31 characters
Activated	no	no yes (= Activation of the option field): The buttons for parameterization of the mapping data are also activated for the slave device here.
Device address / Unit ID (Modbus slave device address)	1	1 to 247 Address corresponds to the Unit ID in the Modbus TCP telegram with simultaneous use of the Modbus Gateway function
Scan cycle for measured values	50 (*10 ms)	0 to 36 0000 * 10 ms (10 ms to 1 h) 0 = Each interrogation cycle Minimum time difference between the measured-value requests

Parameter	Default Setting	Setting Range
Scan cycle for indications	0 (*10 ms)	0 to 36 0000 * 10 ms (10 ms to 1 h) 0 = Each interrogation cycle Minimum time difference between the measured-value requests
Response timeout	10 (*10 ms)	1 to 6000 * 10 ms (10 ms to 60 s)
Retry limit	2	0 to 10 (0 = No request retries) Number of request retries after expiration of **Response timeout** before a communication error for the Modbus slave is identified.
Scan cycle on error	5 s	1 to 3600 s (1 s to 1 h) Retry cycle for sending request telegrams if the retry limits are exceeded or in the case of error responses.
Buttons: Import Export Measured values 1-8 and 9-15 Indications	Inactive	The buttons in the **Mapping** columns are only activated if the option **Activated = yes** has been set. The functions of the buttons are described in the following chapters.

Table 14-15 Settings for Assignment of the Measured Values of the Modbus Slave Device 1

Parameter	Default Setting	Setting Range
Name	MV x Slv 1 (**M**easured **V**alue of connected **Sl**ave device 1; x = 1 to 15)	Max. 31 characters Max. 10 characters if the name is also to be displayed on the device display.
Unit **Note on frequency measured values**: If a frequency measured value (unit: Hz) has been parameterized without a multiplier (multiplier: -), an additional check is made whether the resulting value is in the range of 15 Hz to 65 Hz. Measured values outside this range are marked as invalid. **Factors** Selecting a multiplier for the following units is not recommended and will be rejected: -none- ° °C °F %	Multiplier: –	m (milli) c (centi) d (deci) – h (hecto) k (kilo) M (Mega) G (Giga)
	Unit: -none-	-none- m kg s A °C V Hz W Pa m2 m3 VA var ° Wh VAh varh % °F
Register type	-none-	-none- Input registers Holding registers For **-none-**, the assignment is ignored and the corresponding measured value cannot be selected for other functions.
Data format on bus	Float32 (2 registers)	Float32 (2 registers) Int16 (1 register) Int16_Ung8000h (1 register) UInt16 (1 register) UInt32 (2 registers)
Register number	1	1 to 65 535
Scaling factor	1.000	Any float value 0.00: resulting measured value = 0.00

Table 14-16 Data Format on Bus for Measured Values

Data Format on Bus	Description	Setting Range	Invalid Recognition	Used by (Example)
Float32 (2 registers)	IEEE Float value	-10^{38} to $+10^{38}$	NaN = invalid INF = overflow	SENTRON PAC3x00, SICAM AI 7XV5674, SICAM T 7KG966, SICAM P50 7KG775
Int16 (1 register)	16 bit signed integer	- 32 768 to +32 768	-none-	SENTRON 3WL/3VL SICAM P50 7KG775
Int16_Ung8000 (1 register)	16 bit signed integer	-32 768 to +32 768	-32 768 (8000 h) = invalid	SIPROTEC 4
UInt16 (1 register)	16 bit integer, ≥ 0	0 to +65 535	-none-	SENTRON 3WL/3VL
UInt32 (2 registers)	32 bit integer, ≥ 0	0 to +4 294 967 295	-none-	SIPROTEC 4, SENTRON 3WL/3VL

Table 14-17 Settings for the Modbus Slave Devices

Parameter	Default Setting	Setting Range
Name	Modbus slave device x	Max. 31 characters
Activated	no	no yes (= Activation of the option field): The buttons for parameterization of the mapping data are also activated for the slave device here.
Device address / Unit ID (Modbus slave device address)	1	1 to 247 Address corresponds to the Unit ID in the Modbus TCP telegram with simultaneous use of the Modbus Gateway function
Scan cycle for measured values	50 (*10 ms)	0 to 36 0000 * 10 ms (10 ms to 1 h) 0 = Each interrogation cycle Minimum time difference between the meas-ured-value requests
Scan cycle for indications	0 (*10 ms)	0 to 36 0000 * 10 ms (10 ms to 1 h) 0 = Each interrogation cycle Minimum time difference between the meas-ured-value requests
Response timeout	10 (*10 ms)	1 to 6000 * 10 ms (10 ms to 60 s)
Retry limit	2	0 to 10 (0 = No request retries) Number of request retries after expiration of **Response timeout** before a communication error for the Modbus slave is identified.

Parameter	Default Setting	Setting Range
Scan cycle on error	5 s	1 to 3600 s (1 s to 1 h) Retry cycle for sending request telegrams if the retry limits are exceeded or in the case of error responses.
Buttons: Import Export Measured values 1-8 and 9-15 Indications	Inactive	The buttons in the **Mapping** columns are only activated if the option **Activated = yes** has been set. The functions of the buttons are described in the following chapters.

Table 14-18 Data format on Bus for Indications

Data Format on Bus	Description	Setting Range	Invalid Recognition	Used by (Example)
1 bit	1 bit (for all register types; additionally select **Bit offset** for the Input register and the Holding register)	0 = off 1 = on	None	SICAM P50 7KG775, SENTRON 3WL/3VL, SIPROTEC4
1 bit in UInt32	1 bit in 2 successive Input registers or Holding registers which have to be read together.	0 = off 1 = on	None	SENTRON PAC3x00

14.3 Advanced Functions

14.3.1 Process Connections

14.3.1.1 Binary Inputs

Table 14-19 Settings for Binary Inputs S and R

Parameter	Default Setting	Setting Range
Threshold voltage	19 V	19 V 88 V 176 V
Routed as:[78]	Status information	Status information Load profile source Tariff source
Software filter time (only settable if **`Routed as:`** is set to ***`Status information`***)	1 (* 2 ms)	2 ms to 120 000 ms (settable in 2-ms increments)
Source inverted	no	no yes
BI description	For example for terminal S11/12: Binary input 3-S	Max. 31 characters

14.3.1.2 Binary Outputs

Table 14-20 Settings for Binary Outputs

Parameter	Default Setting	Setting Range
Source type	Indication	Indication Energy counter
Source Type Indication		
Indication[79]	-none-	Acc. to list box
BO description (can be set for all binary outputs individually)	For example for terminal S1/2: Binary output 1-S	Max. 31 characters
Source inverted (can be set individually for all relay outputs)	no	no yes
Operating mode[80] (can be set individually for all relay outputs)	Persistent	Persistent Persistent with fail safe Pulse Pulse with retrigger

78 The parameter cannot be changed in this field. In the **Configuration** tab, **Energy management** menu, select **Load profile source** or **Tariff source**. If you did not select a source, **Status information** is automatically selected.

79 If you select **-none-** as the source of an **indication** or **energy counter**, the corresponding binary output is inactive.

80 If you have selected one of the 2 **Pulse** types in the **Operating mode** list box, enter an output time x (in x *10 ms) in the **Output time for pulse operating mode** field.

Parameter	Default Setting	Setting Range
Output time for pulse operating mode (setting only possible for operating modes ***Pulse*** and ***Pulse with retrigger***)	20 (* 10 ms)	50 ms to 3 600 000 ms
Source Type Energy Counter		
Energy counter [79]	-none-	Acc. to list box
Energy increase per pulse	1.00 Wh	0.10 Wh/VAh/varh to 1 000 000.00 Wh/VAh/varh
Output time for pulse operating mode	20 * 10 ms = 200 ms	50 ms to 3 600 000 ms

14.3.1.3 LEDs

Table 14-21 Settings for LEDs

Parameter	Default Setting	Setting Range
RUN	Device ready	Not settable
ERROR	-none-	Errors are signaled as parameterized (only error indications can be parameterized). -none- Battery failure Ethernet link error Time synchronization error Primary NTP server error Secondary NTP server SD card error
H1 H2 H3 H4 Only the indications for the parameterization of the binary outputs are displayed which can be used according to the current device settings. Indications which are read by Modbus slave devices are available in the list box if they are parameterized in Modbus Master Mapping.	-none-	Acc. to list box Limit Violation, Group Indication and Binary Inputs: Designation can be changed during the parameterization.
Indication inverted	no	no yes

14.3.2 Automation Functions

14.3.2.1 Limit Violation 1-8 and 9-16

Table 14-22 Settings for Limits

Parameter	Default Setting	Setting Range
Measurement	-none-	Measured value selection list depending on network type
Limit	0.00[81]	-1 000 000 000.00 to 1 000 000 000.00 (unit)
Limit type	Lower	Lower Upper
Hysteresis (%)	1.00	0.00 to 10.00
Violation indication	Limit Violation x (x = 1 to 16)	The name of the indication is customizable; max. 31 characters.

14.3.2.2 Group Indications 1-4

Table 14-23 Settings for Group Indications

Parameter	Default Setting	Setting Range
Source Only the indications for the parameterization of the binary outputs are displayed which can be used according to the current device settings. Indications which are read by Modbus slave devices are available in the list box if they are parameterized in the Modbus Master Mapping.	-none-	Acc. to list box Limit violation, group indication and binary inputs: Designation can be changed during the parameterization.
Source inverted	no	no yes
Logic operation	NONE	NONE OR AND
Group indication name	Group Indication x (x = 1 to 4)	The name of the indication is customizable; max. 31 characters.

14.3.3 Display

14.3.3.1 Display Settings

Table 14-24 Settings for Display

Parameter	Default Setting	Setting Range
Contrast	8	0 to 10
Time until dimmed	10	1 min to 99 min
Refresh time	1000	330 ms to 3000 ms

81 The limit value must be the primary value.

Parameter	Default Setting	Setting Range
Inverse display	no	no yes
Phase label	(L1, L2, L3)	(L1, L2, L3) (a, b, c)
Voltage harmonics unit	%	% V

14.3.3.2 User-Defined Screen

Table 14-25 Settings for User-Defined Screen

Parameter	Default Setting	Setting Range
Screen type	None[82]	None 2 measured values, numerical 4 measured values, numerical 2 measured values, graphical + numerical 3 measured values, graphical + numerical
Screen name	USER_SCREEN_x (x = 1 to 4)	You can update and edit it directly. Max. 18 characters Only English and German letters, numbers, and special characters are permitted.
2 measured values, numerical: • Display 1, numerical • Display 2, numerical	-not assigned-	The selection of measured values depends on the network type. Designation can be changed during the parameterization.
4 measured values, numerical: • Display 1, numerical • Display 2, numerical • Display 3, numerical • Display 4, numerical	-not assigned-	
2 measured values, graphical, and numerical: • Display 1, graph./num. • Display 2, graph./num.	-not assigned-	
3 measured values, graphical, and numerical: • Display 1, graph./num. • Display 2, graph./num. • Display 3, graph./num.	-not assigned-	
Display x, graph./num. (x = 1 to 3) • Min value • Max value	Unit according to measured value 1.0 10.0	The selected parameters are used to define the minimum and maximum values.

82 If you have not made any selection, the displays explained in the following do not exist.

14.3.4 Energy Management

14.3.4.1 Load Profile

Table 14-26 Settings for Load Profile

Parameter	Default Setting	Setting Range
Subperiod time	15 min	1 min to 6 min in 1-min steps, 10 min, 12 min, 15 min, 20 min, 30 min, 60 min
Number of subperiods[83]	1	1 to 5
Synchronization source	Internal clock	None Protocol Binary input 1-S Binary input 1-R Binary input 2-S Binary input 2-R Binary input 3-S Binary input 3-R Internal clock
Kind of used reactive power	Q1	Q1 Qn Qtot
Apparent power direction	Non-directional	Non-directional Directional

14.3.4.2 Load Forecasting

Table 14-27 Settings for Load Forecasting

Parameter	Default Setting	Setting Range
Measurement	Active power net	I_a I_b I_c Active power net
Interval	Hour	Hour Day

83 Number = 1: Fixed Block method: The lengths of the subperiod and of the measuring period are identical; Number = 2 to 5: Rolling Block method; Length of the subperiod: The length of the subperiod is an integer part of a full hour; Length of measuring period: The length of the measuring period cannot be configured directly. It is defined as the product of the length of the subperiod and the number of subperiods: Length of measuring period = n x length of subperiod; n = number of subperiods

14.3.4.3 Energy Profile

Table 14-28 Settings for Energy Profile

Parameter	Default Setting	Setting Range
Enable energy profile	no	no yes
Interval	15 min	15 min 30 min 45 min 1 h 24 h

14.3.4.4 Tariffs

Table 14-29 Settings for Tariffs (TOU)

Parameter	Default Setting	Setting Range
Synchronization source	Protocol	Protocol[84] Binary input 1-S Binary input 1-R Binary input 2-S Binary input 2-R Binary input 3-S Binary input 3-R Calendar
The following parameters are available only when **Synchronization source** is set to **Calendar**.		
Season 1 Start	01-01	01-01 to 12-31
Season 1 End	06-30	01-01 to 12-31
Season 2 Start	07-01	Not settable The rest days of the full year
Season 2 End	12-31	
Weekend Setting	Thursday and Friday	Sunday to Saturday, max. 2 days
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 1 Start	00:00	00:00 to 23:45
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 1 End	24:00	00:15 to 24:00
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 2 Start	00:00	00:15 to 23:45
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 2 End	24:00	00:30 to 24:00
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 1 Active	no[85]	yes no
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Period 2 Active	no	yes no

84 In this case, the protocol Modbus TCP can control tariff 1 to tariff 8.
85 The default settings of Tariff 1 Period 1 Active for 2 seasons are checked.

Parameter	Default Setting	Setting Range
Season x (x = 1 or 2) Tariff y (y = 1 to 8) Workday/ Weekend Selection	Every Day	Every Day Workday Weekend
Coverage Check		Pass Fail (with gap) Fail (with overlap)

14.3.4.5 Energy Freeze and Reset

Table 14-30 Settings for Energy Freeze and Reset

Parameter	Default Setting	Setting Range
Interval	15 min	1 min, 5 min, 10 min, 15 min, 30 min, 60 min

14.3.4.6 CO2 Emissions

Table 14-31 Settings for CO_2 Emissions

Parameter	Default Setting	Setting Range
CO_2 emission calculation active	no	no yes
CO_2 emission factor	0.000 g CO_2/kWh	0.000 g CO_2/kWh to 1 000 000.000 g CO_2/kWh

14.3.4.7 Loss Compensation

Table 14-32 Settings for the Loss Compensation

Parameter	Default Setting	Setting Range
Loss compensation method	No	No Name-plate parameters method
Position settings		
System billing point	Position 1	Position 1: Supply side, not transformer side Position 2: Supply side, transformer side Position 3: Load side, transformer side Position 4: Load side, not transformer side
System metering point	Position 1	Position 1: Supply side, not transformer side Position 2: Supply side, transformer side Position 3: Load side, transformer side Position 4: Load side, not transformer side
Transformer loss settings		
Power transformer rated capacity	0.000 kVA	0.000 kVA to 100 000 000.000 kVA If the network type is set to 1-phase, set a phase-to-neutral value for this parameter. If the network type is set to 3-phase, set a phase-to-phase value for this parameter.
Rated power transformer voltage	0.000 kV	0.000 kV to 1000.000 kV If the network type is set to 1-phase, set a phase-to-neutral value for this parameter. If the network type is set to 3-phase, set a phase-to-phase value for this parameter.

Parameter	Default Setting	Setting Range
Power transformer ratio (V_{supply}/ V_{load})	1.000	0.001 to 1000.000
Iron watt losses (LWFe)	0.000 kW	0.000 kW to 100 000.000 kW No load or iron watt loss of the transformer core
Copper watt losses (LWCu)	0.000 kW	0.000 kW to 100 000.000 kW Full load or copper watt loss of the transformer windings
Percent excitation current (%Excitation)	0.000 %	0.000 % to 100.000 %
Percent impedance (%Impedance)	0.000 %	0.000 % to 100.000 %
Supply side line loss settings		
Line length	0.000 unit	0.000 unit to 1000.000 unit The unit can be mile or kilometer, and must be consistent with the unit of the length of resistance and reactance.
Resistance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm
Reactance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm
Load side line loss settings		
Line length	0.000 unit	0.000 unit to 1000.000 unit The unit can be mile or kilometer, and must be consistent with the unit of the length of resistance and reactance.
Resistance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm
Reactance/unit length	0.000 ohm	0.000 ohm to 1000.000 ohm

14.3.5 Power Quality Functions

14.3.5.1 Event Records

Table 14-33 Settings for Event Records

Parameter	Default Setting	Setting Range
Voltage event		
Reference voltage	Primary nominal voltage (V_n)	Primary nominal voltage (V_n) Sliding reference voltage (V_{sr})
Swell threshold[86]	110 %	105 % to 140 %, increments of 5 %
Dip threshold[86]	90 %	75 % to 95 %, increments of 5 %
Interruption threshold	5 %	1 %, 2 %, 3 %, 5 %, 8 %, 10 %
Hysteresis	2 %	1 % to 6 %, increments of 1 %
Event detection mode[87]	ph-N	ph-N ph-ph
RVC event		
RVC detection method	IEC 61000-4-30 Ed.4	IEC 61000-4-30 Ed.3 IEC 61000-4-30 Ed.4
RVC threshold	6 %	1 %, 2 %, 3 %, 4 %, 5 %, 6 %

86 According to EN 50160 standard in the PQ report, the default settings of dip and swell (90 % and 110 %) are recommended.

87 Only for **3P4W (3-phase/4-wire) unbalanced** network types, you can select the **ph-N** or **ph-ph** option as event detection mode.

Parameter	Default Setting	Setting Range
RVC hysteresis[88]	3 %	0.5 %, 1 %, 1.5 %, 2 %, 2.5 %, 3 %
Event detection mode[89]	ph-N	ph-N ph-ph
Frequency event		
Underfrequency threshold	1 %	0.1 % to 0.9 %, increments of 0.1 % 1.0 % to 5.0 %, increments of 1.0 %
Overfrequency threshold	1 %	0.1 % to 0.9 %, increments of 0.1 % 1.0 % to 5.0 %, increments of 1.0 %
Voltage-unbalance event		
Voltage-unbalance threshold	5 %	1 % to 5 %, increments of 1 %

14.3.5.2 Waveform Records

Table 14-34 Settings for Waveform Records

Parameter	Default Setting	Setting Range
Voltage trigger[90]		
Trigger active	voltage event	no user-defined voltage event
The following parameters are available when **Trigger active** is set to **User-defined**.		
Tolerance unit	Percentage	Percentage Numerical
Trigger by ph-N[91]	yes	no yes
Upper threshold	110.00 % of the primary nominal voltage	100.00 % to 200.00 % of the primary nominal voltage 1 to 2 times the primary nominal voltage[92]
Lower threshold	90.00 % of the primary nominal voltage	0.00 % to 99.99 % of the primary nominal voltage 0.00 V to the primary nominal voltage[92]
Hysteresis	2.00 % of the primary nominal voltage	0.00 % to 50.00 % of the primary nominal voltage
Trigger by ph-ph[91]	yes	no yes
Upper threshold[93]	110.00 % of the primary voltage	100.00 % to 200.00 % of the primary voltage 1 to 2 times the primary voltage[92]
Lower threshold[93]	90.00 % of the primary voltage	0.00 % to 99.99 % of the primary voltage 0.00 V to the primary voltage[92]

88 According to IEC 61000-4-30 Edition 3.0, RVC hysteresis is recommended to be half of the threshold.

89 **Event detection mode** of RVC is always synchronized with the setting **Event detection mode** of the voltage event.

90 You must follow the setting rules as below: Upper threshold > lower threshold and (upper threshold - lower threshold) > 2 * hysteresis

91 This parameter is only available when the connection type is **4-wire, 3-phase, unbalanced**.

92 When **Tolerance unit** is selected as **numerical**, the threshold is in number.

93 This parameter is only available when the connection type is **4-wire, 3-phase, unbalanced**, and the **Trigger by ph-ph** is activated.

Parameter	Default Setting	Setting Range
Hysteresis[93]	2.00 % of the primary voltage	0.00 % to 50.00 % of the primary voltage
Current trigger limits[90]		
Trigger active	no	no yes
Tolerance unit	Percentage	Percentage Numerical
Upper threshold	120.00 % of the rated current In	5.00 % to 200.00 % of the rated current In (0.05 × In) A[94] to 1 000 000.00 A[92]
Lower threshold	0.00 % of the rated current In	0.00 % to 100.00 % of the rated current In 0.00 A to 1 000 000.00 A[92]
Hysteresis	2.00 % of the rated current In	0.00 % to 50.00 % of the rated current In 0.00 A to 500 000.00 A
Configuration binary trigger		
Trigger active	no	no yes
Trigger source	Binary input 1-S	Indication 1 from Remote Indication 2 from Remote Binary Input 1-S Binary Input 2-S Binary Input 3-S Binary Input 1-R Binary Input 2-R Binary Input 3-R Group Indication 1 Group Indication 2 Group Indication 3 Group Indication 4
Note: By default the option for group indications is not available for the parameter **Trigger source**. It is only available in the list after you configure the group indication in the menu **Select automation functions**. For more information, see *4.2.1 Function Description*. For the configuration of group indications used to trigger the waveform recorder, see *Rule for Linking Binary Inputs to a Group Indication, Page 132*.		
Trigger value	Off	Off On
Zero-sequence component voltage trigger limits		
Trigger active	no	no yes
Threshold	5 %	0.5 % to 10 %
Zero-sequence component current trigger limits		
Trigger active	no	no yes
Threshold	5 %	0.5 % to 10 %

94 **In** is equal to 5 A in case of no CT; otherwise, **In** is the primary rated CT current.

Parameter	Default Setting	Setting Range
Frequency trigger limits		
Trigger active	no	no yes
Upper threshold	50.50 Hz[95]	50 Hz to 55 Hz[95]
	60.60 Hz[96]	60 Hz to 66 Hz[96]
Lower threshold	49.50 Hz[95]	45 Hz to 50 Hz[95]
	59.40 Hz[96]	54 Hz to 60 Hz[96]
Note: The default setting and setting options of the frequency trigger limits automatically adapt to the network rated frequency range which is configured at **AC measurement**.		
Manual trigger		
Trigger active	no	no yes
Action	Trigger	If you set the **Trigger active** parameter to **yes**, the button **Trigger** is enabled.
Cyclic trigger		
Trigger active	no	no yes
Trigger time	00:00:00	You can edit the text box directly or select the trigger time from the calendar.
Recorder routing		
Voltage	yes	Not settable The channels of voltage are mandatorily recorded in COMTRADE files.
Current	yes	no yes
Binary inputs	yes	no yes
Frequency	no	no yes
Waveform capture setting		
Pretrigger time	0.2 s	0.1 s to 0.5 s Increments of 0.1 s
Recording time	2.0 s	0.5 s to 10.0 s Increments of 0.5 s

14.3.5.3 Measurement Records

Table 14-35 Settings for Measurement Records

Parameter	Default Setting	Setting Range
Template	IEC 61000-4-30	IEC 61000-4-30 Ed. 3 All measurement
Aggregation interval[97]	10 min	1 min, 10 min

95 The rated frequency of the network set under the menu **AC measurement** is 50 Hz.

96 The rated frequency of the network set under the menu **AC measurement** is 60 Hz.

97 For short-term flicker, the aggregation interval is fixed to 10 min; for long-term flicker, the aggregation interval is fixed to 2 h; for **10-s frequency**, the aggregation interval is fixed to 10 s.

Parameter	Default Setting	Setting Range
Energy recorder active	no	no, yes[98]
File generation interval[99]	24 h	2 h, 24 h

14.3.5.4 Trend Records

Table 14-36 Settings for Trend Records

Parameter	Default Setting	Setting Range
Tolerance number	Percentage: 3 % of the primary nominal voltage	1 % to 5 %, increments of 1 %
Maximum recording interval	2 h	2 h 24 h

14.3.5.5 Mains Signaling Voltage

NOTE

Only parameterizable for the following network types: 1P2W, 3P3W unbal, 3P4W unbal.

Table 14-37 Settings for Mains Signaling Voltage

Parameter	Default Setting	Setting Range
Mains Signaling Voltage Measurement		
MSV active	no	no yes
No. of MSV frequencies	1 frequency	1 frequency 2 frequencies
Frequency 1	216.60 Hz	100.00 Hz to 3000.00 Hz
Frequency 2	1060.00 Hz	100.00 Hz to 3000.00 Hz
Mains Signaling Voltage Capture Setting		
Detection threshold	1.00 % of Un	1.00 % to 15.00 % of Un
Pretrigger time	5 s	0 s to 10 s, step: 1 s
Recording time	60 s	10 s to 120 s, step: 10 s

The Total recording time is the sum of the Pretrigger time and the Recording time, and cannot be changed.

98 After you select **yes**, the energy value interval will show on the underside. The energy value interval is the same as the configured interval of **Energy freeze and reset**.

99 For 1-min aggregation, the file generate interval is fixed to 2 h; for other aggregations, the file generate interval is optional.

14.3.5.6 Transient Records

Table 14-38 Setting for Transients

Parameter	Default Setting	Setting Range
Transient active	no	no yes If you set the **Transient active** parameter to **no**, the transient configuration items are hidden, the transient record is disabled, and no data is recorded. When the transient is active again, the last selected values are used.
Cross trigger active	no	no yes If you set the **Cross trigger active** to **yes**, the detected transient can trigger the waveform recorder (see chapter *6.10.1 Function Description*).
If you set the **Transient active** parameter to **yes**, the following parameters are visible:		
Transient threshold	20 % of the primary nominal voltage	10 %, 15 %, 20 %, 25 %
Pretrigger time	5 ms	1 ms to 5 ms, increments of 1 ms
Recording time	10 ms	5 ms to 40 ms, increments of 5 ms

14.3.5.7 EN 50160 Report

Table 14-39 Settings for EN 50160 Report

<table>
<tr><th>Parameter</th><th>Default Setting</th><th>Setting Options</th></tr>
<tr><td colspan="3">General Information</td></tr>
<tr><td>Company:
Department:
Supervisor:
Inspector:
Location:
Comment:</td><td>–</td><td>Any text displayed in the printout of the power-quality report
Max. 32 characters</td></tr>
<tr><td colspan="3">Power Quality Report</td></tr>
<tr><td>Evaluation mode according to</td><td>EN 50160 LV</td><td>EN 50160 LV
EN 50160 MV
EN 50160 HV
User-defined</td></tr>
<tr><td>Flagging acc. to IEC 61000-4-30</td><td>no</td><td>no
yes</td></tr>
<tr><td rowspan="2">Power frequency</td><td>99.5 % of the measurement should be within a deviation of -1.0 % to 1.0 %</td><td rowspan="4">The settings are fixed for the template of EN 50160 LV, EN 50160 MV and EN 50160 HV.
You can edit the limiting values in the text box directly under the user-defined evaluation mode.</td></tr>
<tr><td>100 % of the measurement should be within a deviation of -6.0 % to 4.0 %</td></tr>
<tr><td rowspan="2">Supply voltage variations for the template of EN 50160 LV</td><td>95 % of the measurement should be within a deviation of -10.0 % to 10.0 %</td></tr>
<tr><td>100 % of the measurement should be within a deviation of -15.0 % to 10.0 %</td></tr>
</table>

Parameter		Default Setting	Setting Options
Supply voltage variations for the template of EN 50160 MV & HV		99 % of the measurement should be within a deviation of -10.0 % to 10.0 %	
		100 % of the measurement should be within a deviation of -15.0 % to 15.0 %	
Flicker severity		95 % of the measurement should be less than 1.0 %	
Supply voltage unbalance[100]		95 % of the measurement should be less than 2.0 %	
		100 % of the measurement should be less than 3.0 %	
Total harmonic distortion		95 % of the measurement should be less than 8.0 %	
Harmonic voltages for the template of EN 50160 LV	Odd harmonics	H3: 5.0, H5: 6.0, H7: 5.0, H9: 1.5, H11: 3.5, H13: 3.0, H15: 1.0, H17: 2.0, H19: 1.5, H21: 0.75, H23: 1.5, H25: 1.5	
	Even harmonics	H2: 2.0, H4: 1.0, H6: 0.5, H8: 0.5, H10: 0.5, H12: 0.5, H14: 0.5, H16: 0.5, H18: 0.5, H20: 0.5, H22: 0.5, H24: 0.5	
Harmonic voltages for the template of EN 50160 MV	Odd harmonics	H3: 5.0, H5: 6.0, H7: 5.0, H9: 1.5, H11: 3.5, H13: 3.0, H15: 0.5, H17: 2.0, H19: 1.5, H21: 0.5, H23: 1.5, H25: 1.5	
	Even harmonics	H2: 2.0, H4: 1.0, H6: 0.5, H8: 0.5, H10: 0.5, H12: 0.5, H14: 0.5, H16: 0.5, H18: 0.5, H20: 0.5, H22: 0.5, H24: 0.5	
Harmonic voltages for the template of EN 50160 HV	Odd harmonics	H3: 3.0, H5: 5.0, H7: 4.0, H9: 1.3, H11: 3.0, H13: 2.5, H15: 0.5, H17: u.c.[101], H19: u.c., H21: 0.5, H23: u.c., H25: u.c.	
	Even harmonics	H2: 1.9, H4: 1.0, H6: 0.5, H8: 0.5, H10: 0.5, H12: 0.5, H14: 0.5, H16: 0.5, H18: 0.5, H20: 0.5, H22: 0.5, H24: 0.5	
Mains communicating system for the template of EN 50160 LV & MV		99.0 % of 216.60 Hz MSV should be less than 9.0 % of primary nominal voltage. 99.0 % of "YYY" Hz MSV should be less than "xxx" % of the primary nominal voltage.[102]	
Interruptions of the supply voltage		Short interruption until 1-second duration	
		Short interruption until 3-minute duration	
		Long interruption longer than 3-minute duration	

100 According to the EN 50160, up to 3 % unbalance can occur in 3-wire networks in areas with many 1-wire and 2-wire connections.
101 Short for "under consideration"
102 The frequency "YYY" and the limit "xxx" are based on the configured frequency.

14.3.5.8 IEEE 519 Report

Table 14-40 Settings for the IEEE 519 Report

Parameter	Default Setting	Setting Range
IEEE 519 report active[103]	no	no yes
Voltage level	1.0 kV and below	1.0 kV and below Above 1.0 kV up to 69.0 kV Above 69.0 kV up to 161.0 kV Above 161.0 kV Not settable, depending on the value of the primary nominal voltage set in **AC measurement**, see *Table 2-6*
Maximum short-circuit current	1.0 A	1.0 A to 1 000 000.0 A
Maximum demand load current	1.0 A	1.0 A to 1 000 000.0 A

14.3.6 Administration

14.3.6.1 Account Management

Table 14-41 Settings for Creating an Initial Local Account

Parameter	Default Setting	Setting Range
Account type	Administrator	User Account Manager Administrator
User name	Empty	Up to 64 characters
New password Repeat new password	Empty	8 to 24 characters Contains at least: • 1 capital Latin letter (A to Z) • 1 small Latin letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?

[103] If you select to activate this function, Siemens recommends selecting 10 min as the aggregation interval in the **Measurement records**, see *Table 6-27*.

Table 14-42 Settings for Creating Local Accounts

Parameter	Default Setting	Setting Range
User name	Empty	Up to 64 characters
New password Repeat new password	Empty	8 to 24 characters Contains at least: • 1 capital letter (A to Z) • 1 small letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?
Roles	Empty	Click one or several option buttons to select a role or several roles for a user account according to *Table 8-6*.

Table 14-43 Overview of the Access Rights Assigned to Each Role

Description of the Access Rights	Role									
	Guest	Viewer	Operator	Backup Operator	Engineer	Installer	Security Administrator	Security Auditor	User Account Manager	Administrator
General information viewing	x[104]	x	x	x	x	x	x	x	x	x
Operational data viewing	–	x	x	x	x	x	–	–	–	x
Configuration settings viewing	–	x	x	x	x	x	–	–	–	x
Force values	–	–	x	–	–	–	–	–	–	x
Configuration downloading	–	–	–	x	x	x	–	–	–	x
Configuration change and uploading	–	–	–	–	x	x	–	–	–	x
Firmware change	–	–	–	–	–	x	–	–	–	x
User account management	–	–	–	–	–	–	x	–	x	x
Security management	–	–	–	–	–	–	x	–	–	x
Audit trail	–	–	–	–	–	–	-	x	–	x

104 X represents that the user with this role is assigned with related rights.

Table 14-44 Settings for Editing a Local User Account

Parameters	Default Setting	Setting Range
User name	Fixed, not configurable	The user name depends on the settings made by the account management.
New password (optional) Repeat new password (optional)	Empty	8 to 24 characters Contains at least: • 1 capital letter (A to Z) • 1 small letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?
Roles	Fixed	Click one or several option buttons according to the table *Table 8-6* to reselect the roles.

Table 14-45 Settings for HMI Password

Parameter	Default Setting	Setting Range
Use HMI password	no	no yes
New password	Empty	6 digital numbers (0 to 9)

Table 14-46 Settings for the RADIUS Server

Parameter	Default Setting	Setting Range
RADIUS active	no	no yes
Primary RADIUS server		
IP address	0.0.0.0	Any
Port	1812	0 to 65 535
Secret	Empty	Any (16 to 32 characters)
Secondary RADIUS server		
IP address	0.0.0.0	Any
Port	1812	0 to 65 535
Secret	Empty	Any (16 to 32 characters)

14.3.6.2 Security Settings

Table 14-47 Settings for Security Settings

Parameter	Default Setting	Setting Range
Maximum consecutive attempts	5	5 times to 12 times
Consecutive password attempt time period	5	1 min to 10 min
Logon block timeout	30	30 min to 360 min
Session timeout	10	0 min (no timeout) to 1440 min (1 day) If the device restarts, you must log on again.

14.3.6.3 Password Management

Table 14-48 Settings for Password Management

Parameter	Default Setting	Setting Range
User name	Fixed, not configurable	The user name and roles depend on the settings made by the account management.
Roles		
Current password	Empty	8 to 24 characters Contains at least: • 1 capital letter (A to Z) • 1 small letter (a to z) • 1 digital number (0 to 9) • 1 special character ~, !, @, #, $, %, ^, &, *, (,), _, +, -, =, [,], {, }, \, ;, ', :, ", comma, ., /, <, >, ?
New password		
Repeat new password		

Glossary

+Inf

Stands for *Infinity* and denotes a counter overflow, which is an extremely large number or infinitely positive number

AC

Alternating **C**urrent

ARP

Address **R**esolution **P**rotocol: Network protocol

Big-Endian format

The most significant byte is stored first, that is at the memory location with the lowest address.

Broadcast message

Message in the network where data packets are transmitted to all devices on the network from one point

Client

Device in the communication network that sends data requests or commands to the server devices and receives responses from them

COMTRADE

COMmon format for **TRA**nsient **D**ata **E**xchange

CRC error

Cyclic **R**edundancy **C**heck: The cyclic redundancy check is a method of determining a test value for data (for example, for data transmission in computer networks) with the purpose to detect errors during the transmission or duplication of data.

DC

Direct **C**urrent

DHCP

Dynamic **H**ost **C**onfiguration **P**rotocol enables the network configuration to be assigned to the devices by a DHCP server

DNP

Distributed **N**etwork **P**rotocol

DNS

Domain **N**ame **S**ystem, a system which translates domain names into IP addresses

DST

Daylight **S**aving **T**ime

Ethernet

Cable-based data network technology for local data networks

FTPS

File **T**ransfer **P**rotocol **S**ecure

Gateway

Enables networks based on different protocols to communicate with each other

Holding register

Area for representing data in Modbus communication

ICD file

IED **C**apability **D**escription file: Contains the standardized description of the device configuration

IEC

International **E**lectrotechnical **C**ommission, standards organization; Communication standard for substations and protection equipment

IEC 60870-5-103

Type of protocol for data transmission via serial networks (for example RS485)

IEC 61850

Type of protocol for data transmission via Ethernet

IED

Intelligent **E**lectronic **D**evice

IID

Instantiated **I**ED **D**escription file: It defines the configuration of one IED for a project and is used as data exchange format from the IED configurator to the system configurator.

Indication off

Status of the indication changes from ON to OFF, that is the indication is deleted

Indication on

Status of the indication changes from OFF to ON, that is the indication is currently present

IP

Internet **P**rotocol

IP address

Addresses in computer networks based on the Internet protocol

JavaScript

Script language mainly used by Web browsers

LED

Light-**E**mitting **D**iode

Limit violation

A value exceeding or falling under a parameterized limiting value

MAC-Address

Media **A**ccess **C**ontrol address: Hardware address that clearly identifies the device on the network

MBAP

Mod**b**us **A**pplication **P**rotocol

MBAP Header

Header of a Modbus TCP message consisting of these 4 parts: Transaction identifier (2 bytes), protocol identifier (2 bytes), length (2 bytes), unit identifier (1 byte)

Modbus

The Modbus protocol is a communication protocol based on a client-server architecture.

Modbus RTU

Modbus **R**emote **T**erminal **U**nit: Modbus protocol type for transmitting data via serial networks (for example, RS485)

Modbus TCP

Modbus **T**ransmission **C**ontrol **P**rotocol: Modbus protocol type for transmitting data as TCP/IP packets;
TCP port 502 is reserved for Modbus TCP.

MSV

Mains **S**ignaling **V**oltage

NaN

Not **a** **N**umber means **invalid**: Result of an invalid computing operation

NTP

Network **T**ime **P**rotocol: Standard for synchronizing clocks in computer systems using packet-based communication networks

Power System TN

The Power transformer is neutral-point grounding and the housing of the electric equipment is protective grounding.

Power System TT

The Power transformer is neutral-point grounding and the housing of the electric equipment connects to the neutral point.

PQ

Power **Q**uality

Response timeout

Time within which the Modbus slave has to respond to a request from the Modbus Master

RJ45

Connector type

RS485

Interface standard for digital, wire-based, differential, serial data transmission

RTC

Real-**T**ime **C**lock

RTU

See Modbus RTU

Server

Sends data upon request by the client

SMTP

Simple **M**ail **T**ransfer **P**rotocol: Communication protocol for email transmission

SNMP

Simple **N**etwork **M**anagement **P**rotocol: Serves for monitoring and controlling network elements of a central station

SNTP

Simple **N**etwork **T**ime **P**rotocol: Simplified version of the NTP

Software filter time

Software filter time has the effect that temporary switchover (L → H, H → L) at the binary inputs is not detected as real switchover (debouncing).

STP

Shielded **t**wisted **p**air is the cable for 100Base-T (Ethernet).

Stratum

Each NTP server is synchronized by a high-precision time standard or by another NTP server. The stratum is the position of the NTP server in the hierarchy of NTP servers polled by the device. The best stratum is 1, each further level in the NTP server hierarchy increases the stratum by 1.

Subnet mask

Bit mask in the network protocol that defines how many IP addresses the computer network encompasses. Together with the IP address of a device, the subnet mask defines which IP addresses the device searches in its own network.

TCP/IP

Transmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol: Family of network protocols

UTC

Universal **T**ime **C**oordinated: Universal time standard referred to the time at the prime meridian