SIEMENS

Power Monitoring Device and Power Quality Recorder

SENTRON PAC5100/5200 7KM5212/5412

V1.00

Device Manual

E50417-H1040-C568-A1

NOTE

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

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Preface

Purpose of this Manual

This manual describes the application, functions, installation, commissioning, and operation of the Power Monitoring Device and Power Quality Recorder SENTRON PAC5100/5200 7KM5212/5412.

Target Group

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

Scope of Validity of this Manual

This manual is valid for the Power Monitoring Device and Power Quality Recorder SENTRON PAC5100/5200 7KM5212/5412.

Further Support

For any questions concerning your system, please contact your Siemens representative.

Siemens provides around-the-clock support.

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Fax: +49 (911) 895-7223

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e-mail: poweracademy@siemens.com

Notes On Safety

This manual is not a complete index of all safety measures required for operation of the equipment (module, device). However, it comprises important information that must be noted for purposes of personal safety, as well as in order 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** occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent death or severe injury.

WARNING

WARNING means that death or severe injury **can** occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent death or severe injury.

CAUTION

CAUTION means that minor or moderate injury **can** occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent minor injury.

NOTICE

NOTICE means that damage to property **can** occur if the appropriate safety measures are not taken.

- ✧ Follow all advice instructions to prevent damage to property.

NOTE

is important information about the product, the handling of the product, or the part of the documentation in question to which special attention must be paid.

Personnel Qualified in Electrical Engineering

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 manual 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.

Use as Prescribed

The equipment (device, module) must not be used for any other purposes than those described in the Catalog and the Technical Description. If it is used together with third-party devices and components, these must be recommended or approved by Siemens.

If the device is not used in accordance with the operating instruction and this manual, the scheduled protection is impaired.

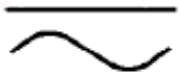
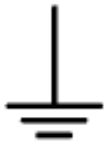
Problem-free and safe operation of the product depends on the following:

- 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).
- Equipment with exposed current transformer circuits must not be operated. Prior to disconnecting the equipment, ensure that the current transformer circuits are short-circuited.
- The limit values stated in the document may not be exceeded. This must also be considered during testing and commissioning.

Used Symbols

No.	Symbol	Description
1		Direct current IEC 60417-5031
2		Alternating current IEC 60417-5032
3		Direct and alternating current IEC 60417-5033
4		Three-phase alternating current
5		Earth (ground) terminal IEC 60417-5017
6		Protective conductor terminal IEC 60417-5019
7		Caution, risk of electric shock
8		Caution, risk of danger ISO 7000-0434

Statement of Conformity

CE	This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Council Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage Directive 2006/95/EC). This conformity has been established by means of tests conducted by Siemens AG according to the Council Directive in agreement with the generic standards EN 61000-6-2 and EN 61000-6-4 for the EMC directives, and with the standard EN 61010-1 for the low-voltage directive. The device has been designed and produced for industrial use. The product conforms to the standard IEC 61557-12.

Further Standards

This product is UL-certified to Standard UL 61010-1, third edition, based on the specification stated in Chapter 12 (Technical Data). UL File No.: E228586	
c UL US LISTED	Open-type Measuring Equipment 2UD1

For further information see UL database on the internet: **http://ul.com**.

Chose **Online Certifications Directory** and insert E228586 under **UL File Number**.

Open Source Software

The product contains, among other things, Open Source Software developed by third parties. The Open Source Software used in the product and the license agreements concerning this software can be found in the Readme_OSS.

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Contents

1 User Information

Application

The multifunctional SENTRON PAC5100/5200 devices record and process measurands and events according to IEC 61000-4-30 Power Quality (PQ) standard. The devices are used on all voltage levels of power-supply systems. SENTRON PAC5100/5200 devices are used in 1-phase systems, 3-phase systems, and 4-phase systems (with neutral conductor).

In addition to the measuring function, SENTRON PAC5200 features various recorders (e.g. Measurement recorder) to record the measurands in programmable time intervals. Long-term data and events are analyzed and output as report according to power quality standards, for example, EN 50160. The device features a 2-GB memory for data storage.

The input circuits for voltage measurement are galvanically isolated and can be used in IT, TT, and, TN networks. To ensure galvanic separation for current measurements, the lines connected to the current measuring inputs are galvanically separated from the current transformers.

The measurements are obtained from the alternating quantities of current and voltage supplied to the AC inputs. When no external voltage and current transformers are used, the device can process rated input alternating voltages of up to V_{P-N} = 400 V (347 V for UL condition) and V_{P-P} = 690 V (600 V for UL condition) and rated input alternating currents up to 5 A.

The integrated web server can be used to set the parameters and display the measured values on HTML pages from the connected PC or notebook. The softkeys located on the front of devices with an optional display enable a limited parameterization and measured value output on the display.

An Ethernet interface is available for communicating with the control center and other process automation systems.

Measurands

The following measurands can be recorded or calculated from the measured quantities:

- Alternating voltage and alternating current
- Unbalanced of alternating voltage and alternating current
- Active, reactive, and apparent power
- Active, reactive, and apparent energy
- Power frequency
- Phase angle
- Power factor and active power factor
- THDS (Subgroup Total Harmonic Distortion) of alternating voltage and alternating current
- Harmonics of alternating voltage and alternating current
- Flicker acc. to IEC 61000-4-15 (only SENTRON PAC5200)

The uncertainty of operational measurements of the measurands is defined as per IEC 62586-1 product standard, class S (leading standard), the IEC 61000-4-30 power quality standard, and the IEC 61557-12 standard.

For detailed information on measurands and measurements, see Chapter 4.2 and the technical data in Chapter 13.

Functionality of the Recorders in SENTRON PAC5200

The recorders are capable of recording both measurands and events in parameterizable time intervals. The following recorder types are used in SENTRON PAC5200:

- Measurement recorder: recording of PQ measurands (acc. to IEC 61000-4-30) and non-PQ measurands over parameterized periods, for example, 10-second frequency, aggregation of voltage, current, power etc.
- Trend recorder: long-term recording and monitoring of the voltage change history over a parameterized period of time in programmable tolerance ranges; 1/2 RMS values
- Fault recorder: Recording of sampled values of voltage and current using programmable triggers.
- Event recorder: recording of voltage events, frequency events, and voltage unbalance events

The device features a 2-GB memory for storing the recorder data.

Communication

To communicate with the systems control and other process automation equipment, the device features an Ethernet interface.

Ethernet supports the device parameterization, the transmission of measured data, counter values and indications/events, and the time synchronization via NTP. The communication protocols are HTTP and Modbus TCP.

Time Synchronization

During operation SENTRON PAC5100/5200 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 using the Modbus TCP communication protocol
- 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 PC or notebook. Internet Explorer 6 (or higher) is required for this purpose. Devices featuring a display offer a limited parameterization function using the front softkeys.

2 Overview

2.1 Device Versions

The multifunctional SENTRON PAC5100/5200 devices are used to detect, calculate, evaluate, display, and transmit measured electrical quantities such as alternating current, alternating voltage, power values etc.

SENTRON PAC5200 devices additionally feature memory options for recorder functions such as mean values, minimum and maximum values, and fault records.

The properties of the device versions can see you from the ordering information (see Table 2-1) .

SENTRON PAC5x00 Variant, DIN Rail Device

SENTRON PAC5x00 as DIN Rail Device, DIN Rail Side

SENTRON PAC5x00 as DIN Rail Device, Terminal Side

Figure 2-1 SENTRON PAC5x00 Variant, DIN Rail Device

SENTRON PAC5x00 Variant with Graphic Display, Panel Flush Mounting

SENTRON PAC5x00 for Panel Flush Mounting, Display Side

SENTRON PAC5x00 for Panel Flush Mounting, Terminal Side

Figure 2-2 SENTRON PAC5x00 Variant with Graphic Display

2.2 Ordering Information and Scope of Delivery

Ordering Information

Use the following ordering code to order SENTRON PAC5100/5200 devices:

Table 2-1 Ordering Information SENTRON PAC5100/5200

Properties	**7KM5212-6CA00-1EA8** (SENTRON PAC5100)	**7KM5412-6CA00-1EA8** (SENTRON PAC5200)	**7KM5212-6BA00-1EA2** (SENTRON PAC5100)	**7KM5412-6BA00-1EA2** (SENTRON PAC5200)
Device type				
Dimensions 96 mm x 96 mm x 100 mm 4 Inputs for AC voltage measurements 3 Inputs for AC current measurements 2 Binary outputs Galvanic isolated voltage measurement inputs Web server for parameterization, visualization and data management Online value visualization Measurement acc. to standard IEC 61000-4-30, class S Communication via Ethernet (RJ45) with Modbus TCP protocol UL Certification	x	x	x	x
Monitoring, Recording and Power Quality (PQ) Functions				
Basic measurements: V, I, f, P, Q, S, cos phi, limit violations, energy measurements, measurements till 40th harmonics	x		x	
Basic measurements and advanced measurements: Power Quality instrument Measurement min/max/mean values Recorder for Power Quality measurements Various recorders for other measurements Event detection (e.g. Vdip), visualisation Flicker acc. to IEC 61000-4-15 Online PQ reporting e.g. acc. to EN 50160 Data export acc. to IEEE Std. 1159-3 (PQDIF and COMTRADE data) Internal memory 2 GB		x		x
Housing and front degree of protection				
Snap on mounting unit without graphical display IP20	x	x		
Panel mounted instrument with graphical display IP40			x	x

Scope of Delivery

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

- SENTRON PAC5100/5200 according to ordering code (see Table 2-1)
- Battery (insulated in the battery compartment of the device)
- Operating instruction

3 Device Design

3.1 Mechanical Design

The electrical modules are installed in a plastic case with the dimensions 96 mm x 96 mm x 100 mm (W x H x D).

In panel flush mounting devices, the display side accommodates the display, 4 softkeys located below and 4 LEDs of which the H1, H2, and ERROR LEDs can be parameterized. The ERROR LED can only be parameterized for error messages.

The device top side holds the RJ45 Ethernet plug connector with 2 LEDs. 4 additional LEDs are identical to the LEDs on the display side. At the cover of the battery compartment there is a labeling strip for the configurable LEDs H1/H2 and a battery symbol that indicates the polarity. The label is also located on the top side and provides among other information the most important rated data of the device. A lithium battery is located under the removable cover of the battery compartment.

On the terminal side are available: terminals for all inputs and outputs, terminals for power supply and protective grounding.

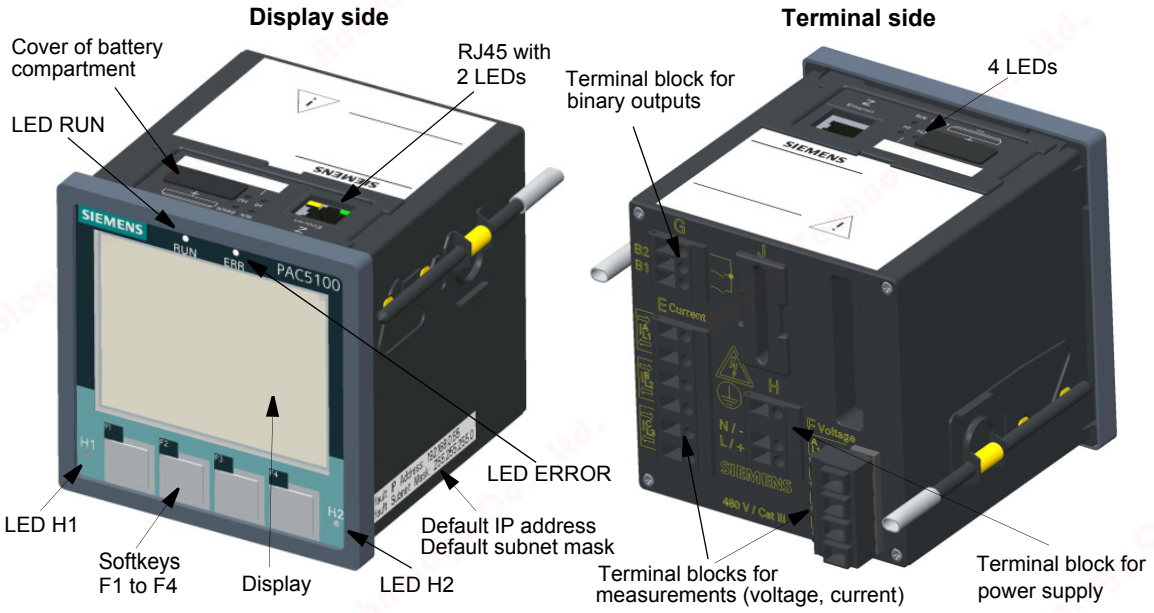


Figure 3-1 Layout of the Panel Flush Mounting Version of SENTRON PAC5x00 with Display

NOTE

DIN rail devices have a DIN rail support instead of the display. Therefore, this device side is referred to as the DIN rail side.

3.2 Display and Softkeys

Display

The layout of the display is shown in the following figure.

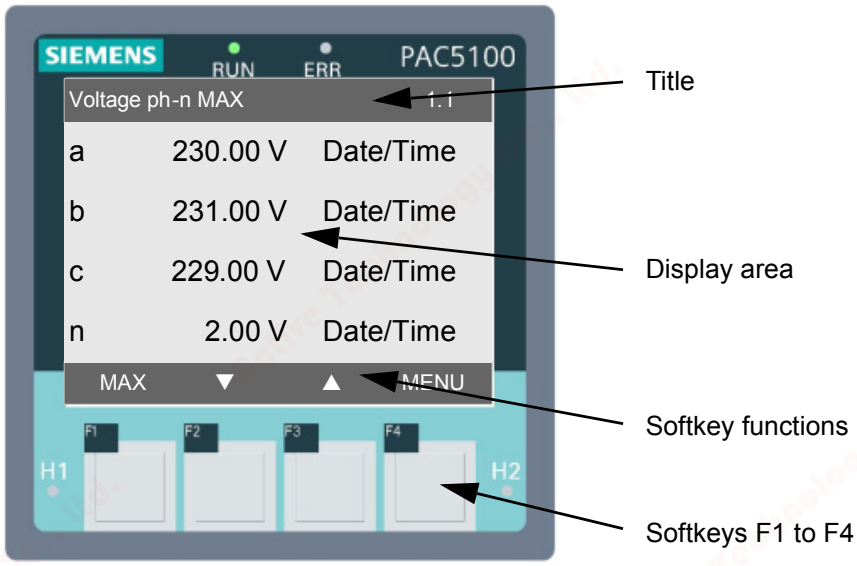


Figure 3-2 Display and Softkeys

The top line (**title**) shows the name of the current display in the display area.

The **display area** below shows parameter settings, measured values, and graphic pictures.

The bottom line shows the 4 current functions of the softkeys below the display used to set the parameters.

Softkeys

The 4 softkeys on the display side are used to make the desired entries at the device.

To call and activate the IP address, press softkey F4 (for > 3 s, see Figure 3-2) on the right during system startup if necessary. The IP address and the standard subnet mask are imprinted on the side panel of the device (see Figure 3-1).

Chapter 8 gives a detailed description of the softkey functions.

3.3 Electrical Design

SENTRON PAC5100/5200 contains the following electrical modules:

- Digital signal processor (DSP)
- Display and Softkeys (optional)
- 4 inputs for alternating voltage measurements
- 3 inputs for alternating current measurements
- 2 binary outputs
- Supply voltage
- Ethernet interface

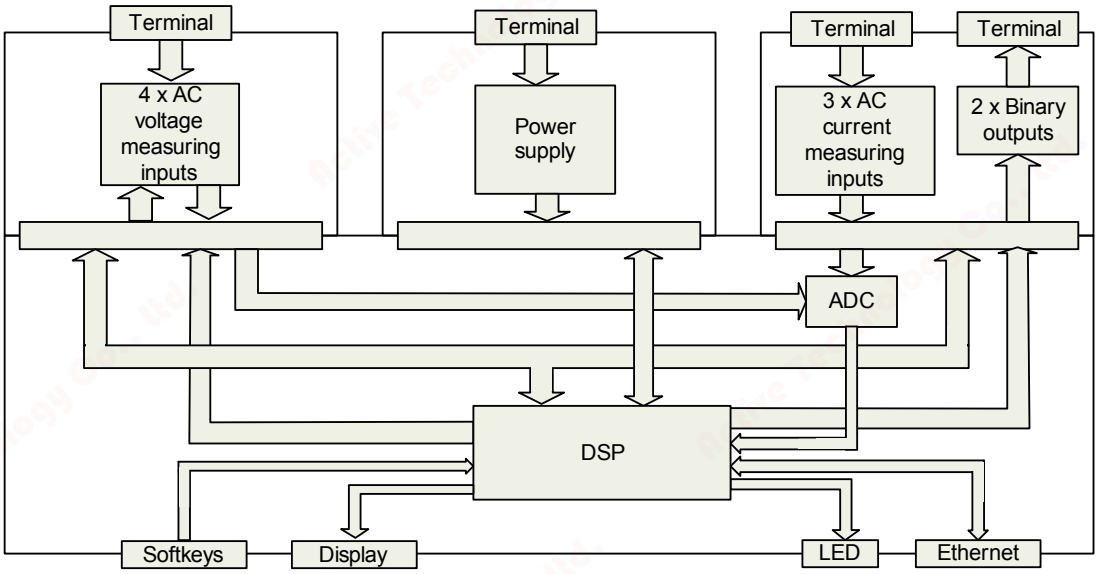


Figure 3-3 Block Diagram SENTRON PAC5x00 with Display (Optional)

4 Measurands and Recording

4.1 Measuring and Recording System

4.1.1 Functioning of the Measuring System according to IEC 61000-4-30

SENTRON PAC5100/5200 devices measure the power quality according to IEC 61000-4-30 in 1-phase or multi-phase distribution systems. The measuring system is implemented according to class A. In terms of functional scope, measuring ranges, and accuracy, the SENTRON PAC5100/5200 devices are class S.

The basic measuring interval for determining the values for mains voltage, harmonics of mains voltage, and mains voltage unbalance is a 10-period time interval for 50-Hz distribution systems or a 12-period time interval for 60-Hz distribution systems. The measurement of the 10-/12-period time intervals is resynchronized at each RTC 10-minute limit.

Subsequently, the values for the 10-/12-period time intervals are aggregated over additional time intervals (for example, 10-minute interval at SENTRON PAC5200).

10-Minute Interval (SENTRON PAC5200)

The value aggregated in a 10-minute interval is tagged with the absolute time (for example 01:10:00). The time at the end of the aggregation interval is indicated as the time qualifier. The values for the 10-minute time interval are calculated without interruption from the 10-/12-period time intervals.

- Each 10-minute interval begins at an RTC 10-minute limit. At this 10-minute limit, the 10-/12-period time intervals are aggregated over a 10-minute interval. The last 10-/12-period time interval in a 10-minute aggregation interval overlaps in time at an RTC 10-minute limit. Each overlapping 10-/12-period time interval (for the overlapping area, see Figure 4-1) is included in the aggregation interval of the preceding 10-minute interval.
- The aggregation interval enables the power system quality to be evaluated according to EN 50160. The aggregation interval can be adjusted to other applications using a parameter. A shorter aggregation interval increases the storage capacity required for measured values and reduces the maximum possible recording time in the memory.

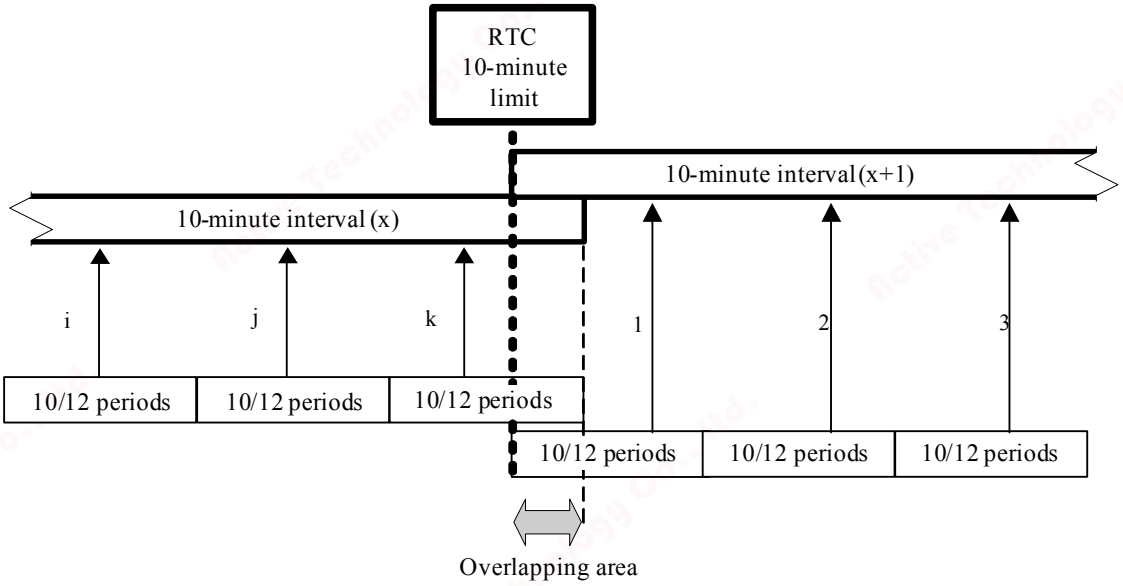


Figure 4-1 Synchronization of the Aggregation Intervals for Class A

Flagging Concept

During conditions of undervoltage, overvoltage, or voltage interruption, the measurement method can return implausible values for other measurands (for example, frequency measurement, voltage harmonics). The flagging concept therefore prevents an individual event from being accounted for multiple times in different measurands (for example, a single undervoltage event both as undervoltage and simultaneously as a frequency change).

Flaggings are only triggered by undervoltage, overvoltage, and voltage interruptions. Undervoltage and overvoltage detection is based on a threshold value selected by the user. This value determines whether data are **flagged**.

The flagging concept is used when measuring the power frequency, mains voltage, mains voltage unbalance, and harmonics of the mains voltage.

If a value was flagged within a given time interval, the aggregated value containing that value will be flagged, too. Flagged values are stored and optionally integrated in the calculation or hidden.

Table 4-1 Overview of the Measurands to Determine the Power Quality

Measurand	Method of Measurement	Measurement Uncertainty and Measuring Range	SENTRON PAC5100/5200	Flagging
Power frequency	Class A	**Class S** ±50 mHz in the measuring ranges: 50 Hz: 42.5 Hz to 57.5 Hz 60 Hz: 51.0 Hz to 69.0 Hz	50 mHz (see Table 4-17)	x
Mains voltage level	Class A	**Class S** smaller than ±0.5 % Udin in the range from 20 % Udin to 120 % Udin	0.2 %	x
Undervoltages and overvoltages of the mains voltage, Voltage interruptions	Class A	**Class S** ±1.0 % of Udin, 1 period	0.2 %	-
Unbalance of the mains voltage	Class A	**Class S** U_2 and U_0 smaller than ±0.3 % in the range 1 % to 5 % U_2, U_1	0.2 %	x
Harmonics of the mains voltage	Class A	**Class S** Vm > 3 % Udin: ±5% V_m Vm < 3 % Udin: ±0.15 % Udin 10 % to 100 % of the compatibility levels of class 3 or IEC 61000-2-4 Measurement uncertainty: Measuring range 200 %, IEC 61000-4-7, Class 2	Condition: $V_m \geq 10\ \% V_{rated}$ Maximum error: ±5 % V_m --- Condition: $V_m < 10\ \% V_{rated}$ Maximum error: ±0.5 % V_{rated}	x
Flicker	Class A	**Class S** IEC 61000-4-30: Pst: ±10 % Plt: ±10 % Pinst: ±16 %	Pst: ±10 % Plt: ±10 % Pinst: ±16 %	-

Udin: Declared input voltage (The primary nominal voltage is used for it in the SENTRON PAC5100/5200. At use of a voltage converter the primary nominal voltage and the secondary nominal voltage of the transducer are used.)
V_m: Measured value
V_{rated}: Rated voltage

Definition of the Measurands

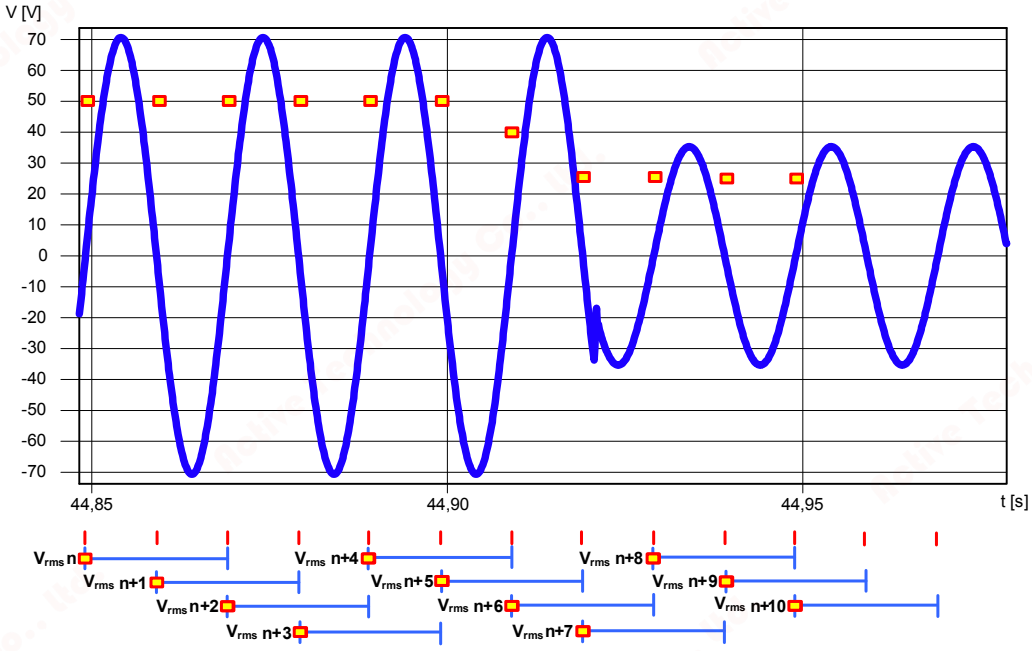
Mains Voltage Level

- The measurement determines the RMS value of the mains voltage over a 10-period time interval for 50-Hz distribution systems and over a 12-period time interval for 60-Hz distribution systems. All 10-/12-period time intervals are measured without interruption and overlapping (the overlapping area excluded, see Figure 4-1).

Undervoltage of the Mains Voltage

- The basic measurement of the RMS value V_{rms} of an undervoltage is the determination of the RMS value V_{rms} (1/2) for each single measuring channel (see Figure 4-2). The limiting value for undervoltages is a percentage value of Udin.
- The factory setting of the hysteresis is 2 % of Udin. It can be set from 1 % to 6 %.
- In multi-phase systems, all channels are independently synchronized in the zero point of the voltage.
- In 1-phase systems, undervoltage begins when the voltage V_{rms} falls below the threshold of the undervoltage. Undervoltage ends when the voltage V_{rms} rises above the threshold value of the undervoltage plus the hysteresis.
- In multi-phase systems, undervoltage begins when the voltage V_{rms} falls below the threshold of the undervoltage in one or more channels. Undervoltage ends when the voltage V_{rms} rises above the threshold value of the undervoltage plus the hysteresis in all measured channels.
- The undervoltage threshold value and the hysteresis are parameterized according to the measuring task.
- Undervoltage is characterized by the data pair **residual voltage (V_{res})** and **duration (t)**:

  The residual voltage is the smallest voltage value of V_{rms} which is measured in a channel during undervoltage.



V_{rms}(1/2): RMS value over one period synchronized to the zero point of the fundamental component, updated after each half period .
This value is only used to detect undervoltages , overvoltages and voltage interruptions.

Figure 4-2 Undervoltage Representation

Overvoltage of the Mains Voltage

- The basic measurement of the RMS value V_{rms} of overvoltage is the determination of the RMS value V_{rms} (1/2) for each single measuring channel. The limiting value for overvoltages is a percentage value of Udin.
- The factory setting of the hysteresis is 2 % of Udin. It can be set from 1 % to 6 %.
- In multi-phase systems, all channels are independently synchronized in the zero point of the voltage.
- In 1-phase systems, overvoltage begins when the voltage V_{rms} rises above the threshold of the overvoltage. Overvoltage ends when the voltage V_{rms} falls below the threshold value of the overvoltage minus the hysteresis.
- In multi-phase systems, overvoltage begins when the voltage V_{rms} rises above the threshold of the overvoltage in one or more channels. Overvoltage ends when the voltage V_{rms} falls below the threshold value of the overvoltage minus the hysteresis in all measured channels.
- The overvoltage threshold value and the hysteresis were parameterized according to the measuring task.
- Overvoltage is characterized by the data pair **Maximum value of overvoltage** and **duration (t)**:

  The maximum value of an overvoltage is the highest voltage value of V_{rms} which is measured in a channel during overvoltage.

Voltage Interruption

- In 1-phase systems, a voltage interruption begins when the voltage V_{rms} falls below the threshold of the voltage interruption. The voltage interruption ends when the voltage V_{rms} rises above the threshold value of the voltage interruption plus the hysteresis.
- In multi-phase systems, the voltage interruption begins when the voltages V_{rms} fall below the threshold of the voltage interruption in all channels. The voltage interruption ends when the voltage V_{rms} rises above the threshold value of the voltage interruption plus the hysteresis in any of the measured channels.
- The voltage interruption threshold value and the hysteresis are parameterized according to the measuring task.
- The factory setting of the hysteresis is 2 % of Udin. It can be set from 1 % to 6 %.

Unbalance of the Mains Voltage

- The mains voltage unbalance is determined using the method of the symmetrical components. In case of unbalance, the negative-sequence component U_2 is determined in addition to the positive-sequence component U_1. The fundamental component of the voltage is measured over a 10-period time interval for 50-Hz distribution systems and over a 12-period time interval for 60-Hz distribution systems.

Harmonics of the Mains Voltage

- interruption-free 10-/12-period measurement of a harmonics subgroup $U_{sg,n}$ according to IEC 61000-4-7.
- The total distortion is calculated as the subgroup total harmonic distortion (THDS) according to IEC 61000-4-7.
- Measurements are performed up to the 40th harmonics order.

Flicker

- The short-term flicker value Pst and long-term flicker value Plt are determined for phase-to-ground voltages and delta voltages. The flicker measurement is performed according to EN 61000-4-15.
- The flicker measurement is performed on all 3 voltage channels.
- Flickers appear with a frequency from 0.005 to 35 Hz. The instantaneous flicker value is displayed in perceptibility units P.
- Short-term flicker value Pst
  - determined over 10 min (short-term flicker), fixed
- Long-term flicker value Plt
  - over 2 h (12 Pst values), fixed
- Perceptibility Pinst

4.1.2 Recording of Measurands and Events in SENTRON PAC5200

4.1.2.1 Recorder Types

SENTRON PAC5200 provides various recording options to monitor and analyze the power quality.

Table 4-2 Recording Measured Values

Recording	Measurands	Storage interval/storage method	Application
Measurement recorder	Frequency	10 s (fixed)	Long-time monitoring of the power quality for example according to EN50160
	Mains voltage level	10 min (30 s, 1 min, 10 min, 15 min, 30 min, 1 h, 2 h)	
	Unbalance of the mains voltage		
	Harmonics of the mains voltage		
	Additional data (for example power values, min/max values etc.)		
	Flicker	Pst determined over 10 min; Plt over 2 h (12 Pst values)	Monitoring of the power quality according to IEC 61000-4-15
Event recorder	Voltage dips, Voltage interruptions	Residual voltage V_{rms} (1/2) and time stamp (duration)	Long-time monitoring of the power quality according to EN50160, classification of voltage events, for example ITIC curve
	Voltages swells	Maximum voltage amplitude V_{rms} (1/2) and time stamp (duration)	
Trend recorder	V_{rms} (1/2)	For measured value changes (in percent or absolute) and cyclic (time interval)	Subsequent analysis of the power quality with any grid codes
Fault recorder	Voltages, Currents	Voltage/current variation triggers, acquisition of sampled values	Analyzing the causes of power quality problems

The respective measuring interval of the recording is time-stamped to enable a correct time evaluation.

The interaction of the recorders is depicted in the following figure:

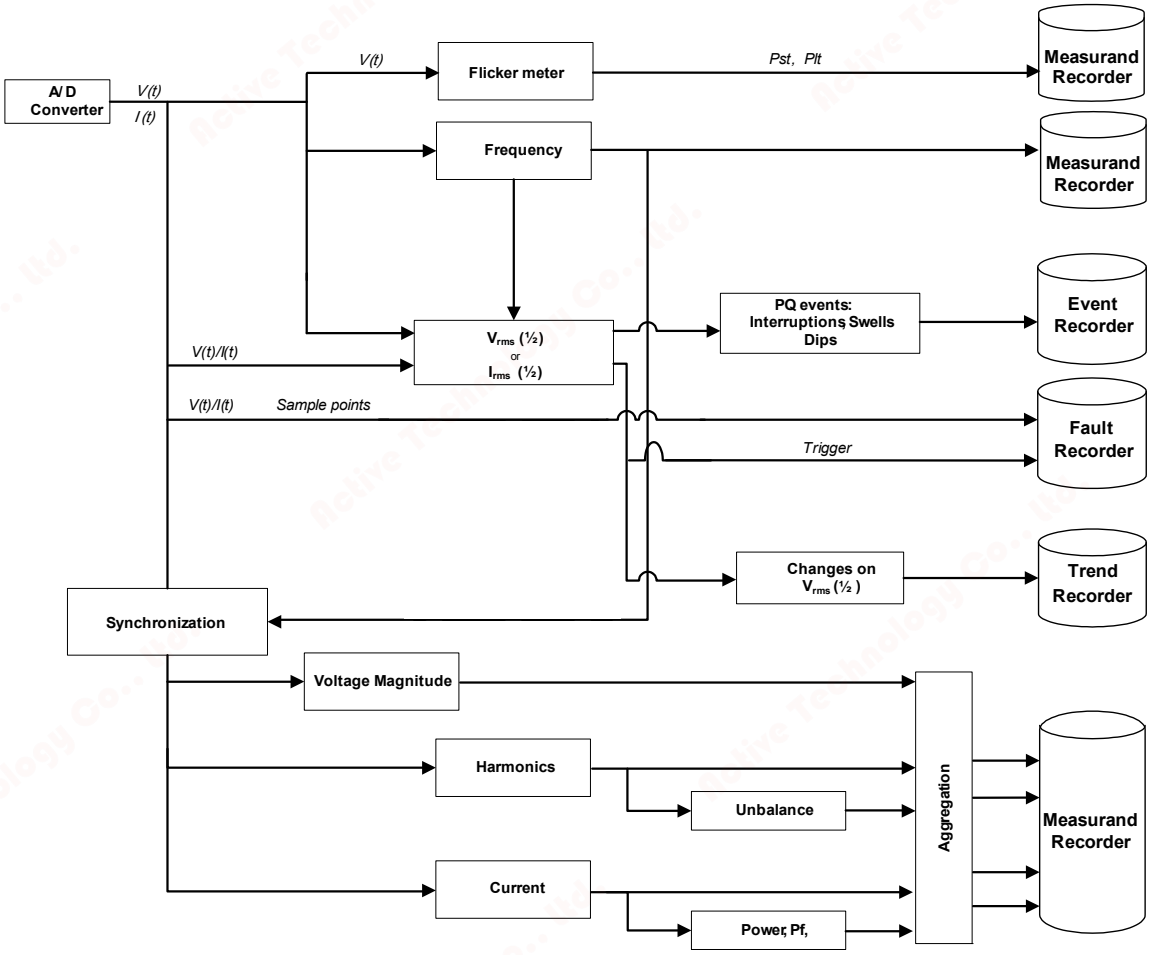


Figure 4-3 Block Diagram of Recorders

4.1.2.2 Measurement Recorder

In addition to measured values used to determine the power quality, the Measurement recorder also records a number of other measured values (for example min/max values). Recording of the following measurands can be parameterized via the user interface:

- PQ measurands to determine the power quality:
  - Frequency averaging intervals (fixed to 10 s)
  - Averaging intervals for voltage, voltage unbalance, and harmonics (30 s, 1 min, 10 min, 15 min, 30 min, 1 h, 2 h)
  - Flicker (Pst, determined over 10 min; Plt, 12 Pst values over 2 h)
- Power/THDS measurands: current, current unbalance, active power, apparent power, reactive power, THDS of voltage, THDS of current, power factor, active power factor, phase angle
- Recording of the minimum values (mean values)
- Recording of the maximum values (mean values)

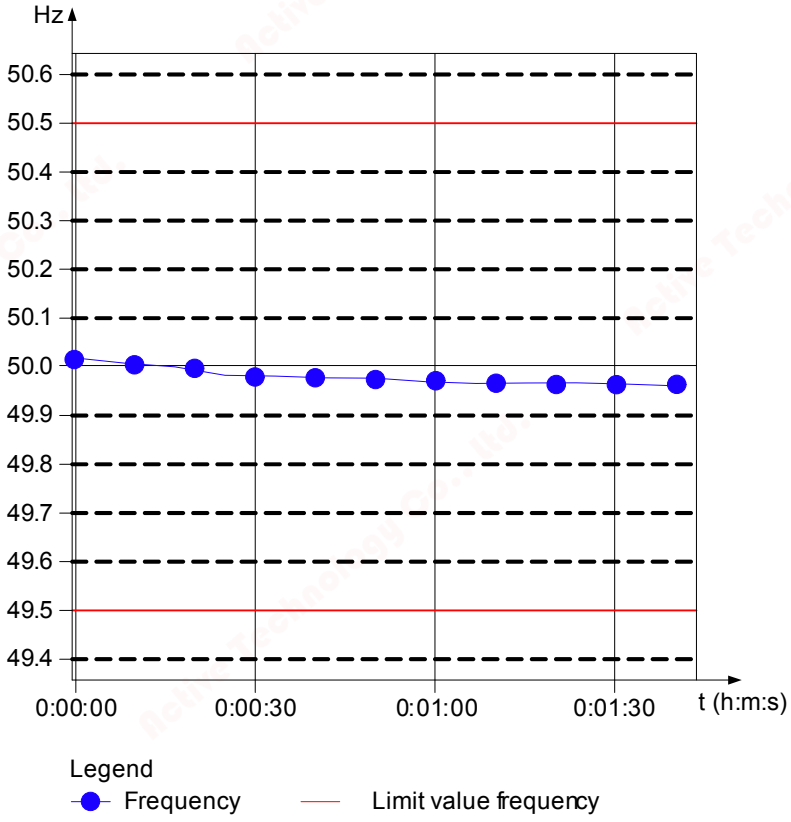


Figure 4-4 Functioning of the Measurement Recorder, Frequency Measurement (PQ Value)

The measuring interval can be set in various increments from 30 s to 2 h. All measurands except for the frequency thus have a common time basis. For flicker the time base is adjusted tightly. The measuring interval for frequency measurement is permanently set to 10 s. Several of the measurands are optional. For more detailed information, see Chapter 4.2.

4.1.2.3 Trend Recorder

The trend recorder ensures the acquisition and long-term monitoring of the voltage V_{rms} (1/2) during voltage changes. If a change of the measured value compared to the RMS value recorded last occurs during the parameterized measuring interval, which exceeds or falls below the tolerance limit, this new RMS value will be recorded.

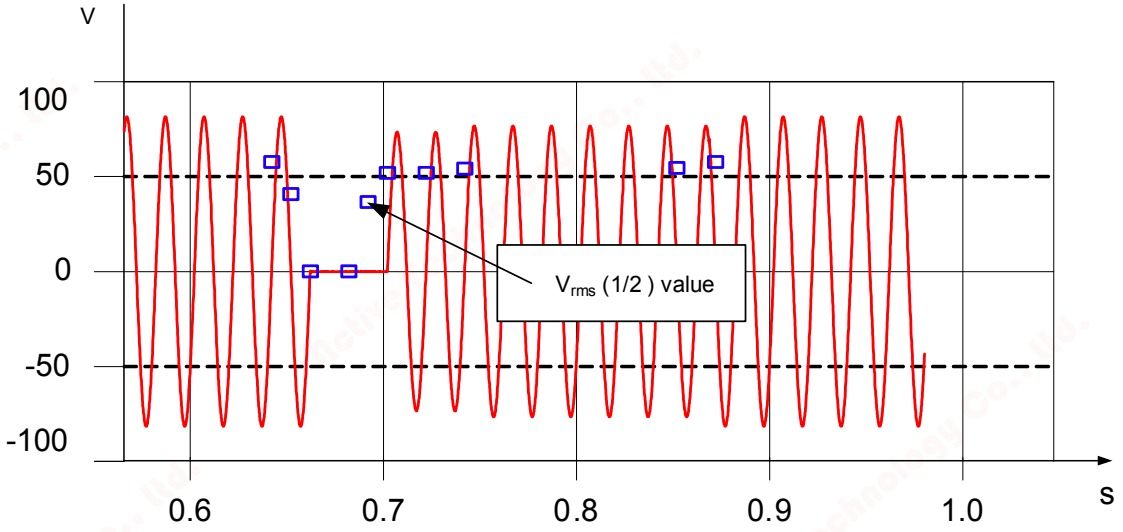


Figure 4-5 Functioning of the Trend Recorder, Voltage Interruption

Once the measuring interval has been finished, the next measuring interval starts automatically.

You can set the following parameters via the user interface:

- Tolerance unit (% or numerical)
- Voltage tolerance range (1 % to 5 % referred to the primary nominal voltage)
- Maximum recording interval (10 min to 24 h)

4.1.2.4 Event Recorder

The Event Recorder exclusively records PQ events (undervoltage, overvoltage, voltage interruptions). The use nominal voltage is the reference value for the analysis.

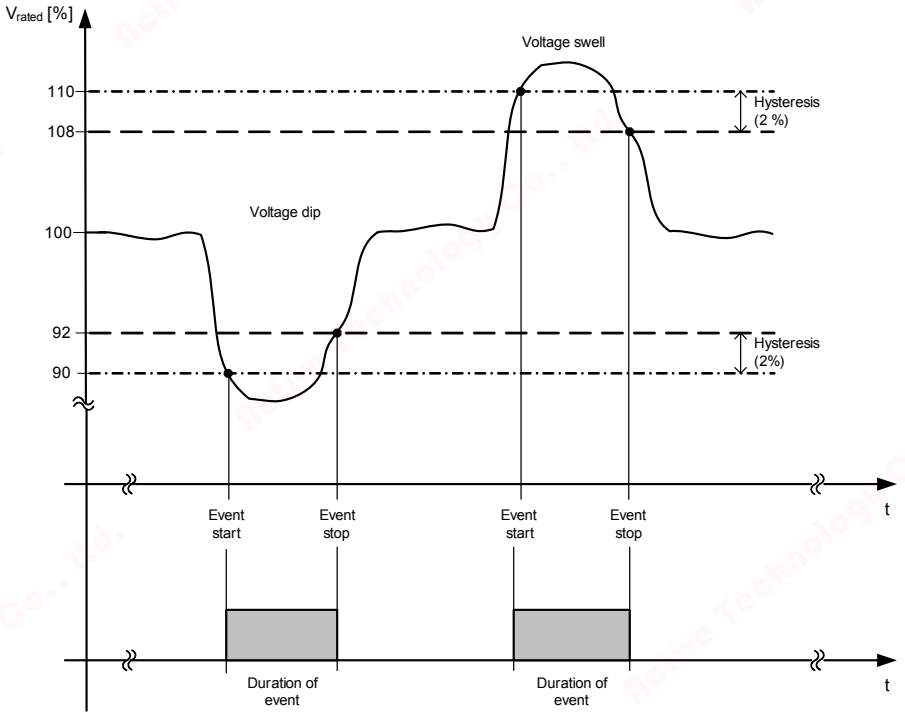


Figure 4-6 Recording of the Event Recorder, Overvoltage and Undervoltage

Voltage Event

- Dip threshold: 75 % to 95 % (default 90 %)
- Swell threshold: 105 % to 140 % (default 110 %)
- Voltage interruption threshold: 1 % to 10 % (default 5 %)
- Event hysteresis: 1 % to 6 % (default 2 %)

Frequency Event

- Underfrequency threshold: 0.1 % to 5 % (default 1 %)
- Overfrequency threshold: 0.1 % to 5 % (default 1 %)

Voltage Unbalance Event

- Voltage unbalance threshold: 1 % to 5 % (default 5 %)

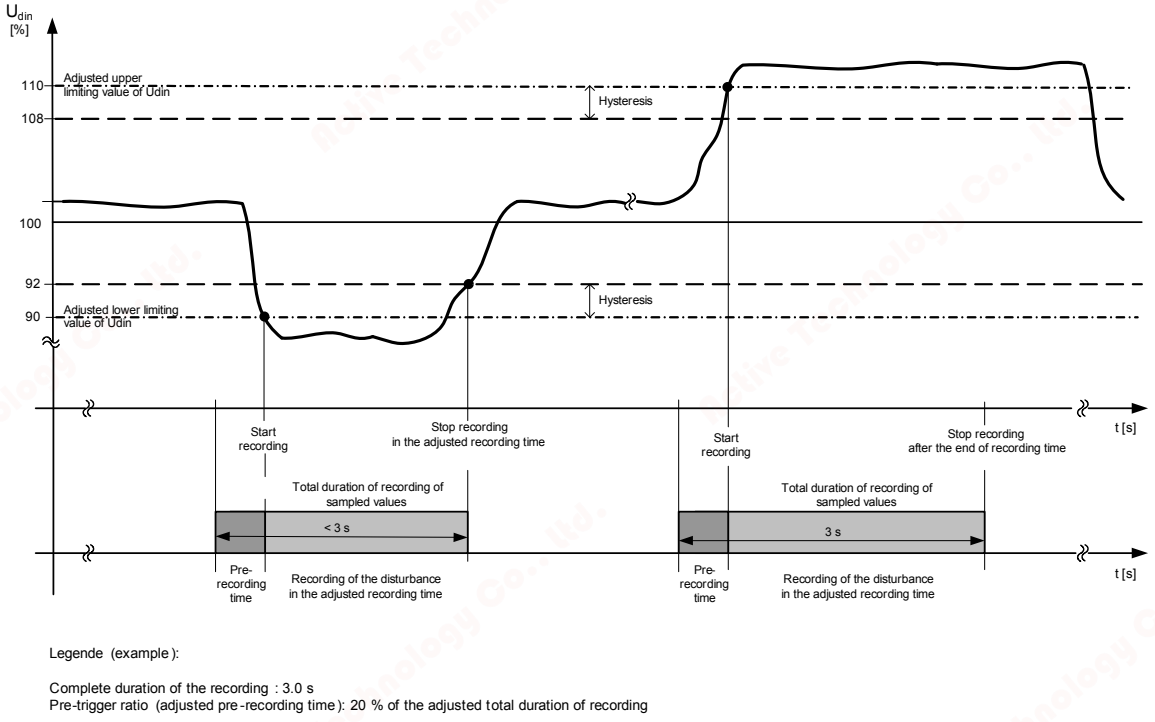
4.1.2.5 Fault Recorder

After a trigger has been activated, the fault recorder records the sampled values of voltage curves and/or current curves. A trigger is activated when a measured value exceeds or falls short of a parameterized threshold value. For this purpose, the trigger function block permanently compares the measured V_{rms} (1/2) values with declared input voltage Udin or I_{rms} (1/2) with rated current I_{rated}. The function block starts a fault record (sampled values) as soon as parameterized threshold values are violated in either direction. The fault record is written to the device-internal memory card for subsequent evaluation.

The fault recording ends is according to the configured recording duration.

The triggers for voltage and current monitoring can be parameterized separately and can be switched on and off individually. No recording is initiated when the trigger is switched off.

The lower and upper threshold values can be parameterized in percent or numerically.



Legende (example):

Complete duration of the recording : 3.0 s
Pre-trigger ratio (adjusted pre-recording time): 20 % of the adjusted total duration of recording

Figure 4-7 Recording of the fault recorder, example

The fault recorder records 2048 sampled values per 10/12 cycles, approximately 204 samples per cycle.

You can set the following parameters on the user interface:

- recording the voltage and/or current
- activation/deactivation of the fault recorder triggering
- tolerance unit: in percent or numerical
- lower threshold value, referred to U_{din} or I_{rated}
  - voltage (in percent): 0.00 % to 99.99 %
  - voltage (numerical): 0.0 V to 1 000 000.0 V
  - current (in percent): 0.00 % to 99.99 %
  - current (numerical): 0.0 A to 1 000 000.0 A
- upper threshold value, referred to U_{din} or I_{rated}
  - voltage (in percent): 100.0 % to 10 000.0 %
  - voltage (numerical): 0.0 V to 1 000 000 V
  - current (in percent): 100.0 % to 10 000.0 %
  - current (numerical): 0.0 A to 1 000 000 A
- hysteresis 0.0 % to 50.0 % referred to Udin or Irated

4.1.2.6 Storing and Transmitting Recorder Data in SENTRON PAC5200

Data Storage

SENTRON PAC5200 features an internal 2-GB data storage for storing the recorder data. You can manually parameterize the data volume that can be stored for each recorder from 0 % to 100 %:

- Measurement recorder: 33 % to 65 %
- Fault recorder: 3 % to 35 %
- Event recorder: 1 % to 33 %
- Trend recorder: residual capacity (min. 31 %)

When the maximum storage capacity is exceeded, the oldest data are overwritten with the up-to-date data.

The data is output as time-stamped list. The period of time over which data are output can be parameterized.

Data Transmission

Data are transmitted from the internal 2-GB memory as HTTP download with the data types COMTRADE (fault recorder data) or PQDIF (measured recorder, trend recorder), see SENTRON PAC5100/5200 Communication Manual.

4.2 Measurands

4.2.1 Measurands in 1-phase Systems

The SENTRON PAC5100/5200 can measure and calculate quantities in 1-phase systems, Chapter 4.2.3 contains a detailed list of all measurands.

Measured and Calculated Quantities

The operational measurands alternating voltage V_P, alternating current I_P, and frequency are measured. All other operational measurands, harmonics, THDS (Subgroup Total Harmonic Distortion), and power and energy types are calculated from the measured operational measurands.

Operational Measured Values

- Alternating voltage V_{ph} (mains voltage referred to the neutral conductor/protective ground N; RMS value): Va
- Alternating current I_P (current through the conductor, RMS value): Ia
- Active power factor cos φ: cos φ(a)
- Power factor PF: PFa
- Phase angle φ: φa
- Frequency (system frequency): f
- Flicker (only SENTRON PAC5200): Pst, Plt

Harmonics

- Fundamental V
- Harmonics V, magnitude: H_Va-x
- Fundamental I
- Harmonics I, magnitude: H_Ia-x
- Subgroup Total Harmonic Distortion V: THDS_Va
- Subgroup Total Harmonic Distortion I: THDS_Ia

Power Quantities

- Active power P: Pa
- Reactive power Q: Qa
- Reactive power (fundamental) Q1: Q1a
- Apparent power S: Sa

Energy Quantities

- Active energy WP: WPa (supply and demand)
- Reactive energy WQ: WQa (inductive and capacitive)
- Apparent energy WS: WSa

4.2.2 Measurands in 3-wire and 4-wire Networks

The Digital Transducer SENTRON PAC5100/5200 can measure or calculate the following quantities in 3-wire and
4-wire networks (delta and star connection): Chapter 4.2.3 contains a detailed list of all measurands.

Measured and Calculated Quantities

The operational quantities alternating voltage V_{ph-N}, alternating voltage V_{ph-ph}, alternating current I_{ph}, alternating voltage across the neutral conductor V_N, and frequency f are measured directly. All other operational measurands, harmonics, THDS (Subgroup Total Harmonic Distortion), power and energy quantities are calculated from the measured operational quantities.

Operational Measurands

- Alternating voltage phase-neutral conductor (neutral conductor connected to protective conductor; star connection) V_{ph-N}: Va, Vb, Vc
- Alternating voltage phase-phase (delta connection) V_{ph-ph}: Vab, Vbc, Vca
- Alternating voltage across the neutral conductor: V_N
- Unbalanced voltage: U_2
- Mean value of the 3 phase-ground voltages: V_{avg}
- Alternating current I_P (current through the conductor): Ia, Ib, Ic
- Current in neutral conductor: I_N
- Unbalanced current: I_{unbal}
- Mean value of the 3 phase currents: I_{avg}
- Active power factor cos φ: cos φ(a), cos φ(b), cos φ(c), cos φ
- Power factor PF: PFa, PFb, PFc, PF
- Phase angle φ: φa, φb, φc, φ
- Frequency (power frequency): f (see Table 4-17)
- Flicker (only SENTRON PAC5200): Pst, Plt

Harmonics

- Fundamental V
- Harmonics V, magnitude: H_Va-x, H_Vb-x, H_Vc-x
- Fundamental I
- Harmonics I, magnitude: H_Ia-x, H_Ib-x, H_Ic-x
- Subgroup Total Harmonic Distortion V: THDS_Va, THDS_Vb, THDS_Vc and
  when 3-wire network is selected: THDS_Vab, THDS_Vbc, THDS_Vca
- Subgroup Total Harmonic Distortion I: THDS_Ia, THDS_Ib, THDS_Ic

Power Quantities

- Active power P: Pa, Pb, Pc, P
- Reactive power Q: Qa, Qb, Qc, Q
- Reactive power (fundamental) Q1: Q1a, Q1b, Q1c, Q1
- Apparent power S: Sa, Sb, Sc, S

Energy Quantities

- Active energy WP: WPa, WPb, WPc, WP (for supply and demand respectively)
- Reactive energy WQ: WQa, WQb, WQc, WQ (inductive and capacitive respectively)
- Apparent energy WS: WSa, WSb, WSc, WS

4.2.3 Measurands Depending on the Connection Type

4.2.3.1 Operational Measurands and Connection Types

Table 4-3 Operational Measurands, Connection Types in Power Systems

Measurand (x = 1 to 40)	**Circuit**	**1-phase System**	**3-wire Network (Delta)**			**4-wire Network (Star)**	
			Balanced (1l)	**Unbal-anced (3l)**	**Unbal-anced (2l)**	**Balanced (1l)**	**Unbal-anced (3l)**
Alternating 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	a, b, c	-	-	-	-	-	x
Vavg	a-N, b-N, c-N	-	-	-	-	-	Σ Vph/3
Vavg	a-b, b-c, c-a	-	Σ Vph/3	Σ Vph/3	Σ Vph/3	-	
U_2	a-b, b-c, c-a	-	x	x	x	-	x
Alternating Current							
Ia	a	x	x	x	x	x	x
Ib	b	-	-	x	x	-	x
Ic	c	-	-	x	x	-	x
I_N	a, b, c	-	-	-	-	-	x
Iavg	a, b, c	-	-	x	x	-	Σ Iph/3
Iunbal	a, b, c	-	-	x	x	-	x
Active Power Factor							
cos φ(a)	a	x	-	-	-	-	x

Table 4-3 Operational Measurands, Connection Types in Power Systems (cont.)

Measurand (x = 1 to 40)	Circuit	1-phase System	3-wire Network (Delta)			4-wire Network (Star)	
			Balanced (1I)	Unbal-anced (3I)	Unbal-anced (2I)	Balanced (1I)	Unbal-anced (3I)
cos φ(b)	b	-	-	-	-	-	x
cos φ(c)	c	-	-	-	-	-	x
cos φ	a, b, c	-	x	x	x	x	Σ Vph/3
Power Factor							
PFa	a	x	-	-	-	-	x
PFb	b	-	-	-	-	-	x
PFc	c	-	-	-	-	-	x
PF	a, b, c	-	x	x	x	x	Σ Vph/3
Phase Angle							
φa	a	x	-	-	-	-	x
φb	b	-	-	-	-	-	x
φc	c	-	-	-	-	-	x
φ	a, b, c	-	x	x	x	x	Σ Vph/3
Frequency							
f (System freq.)	see Table 4-17	x	x	x	x	x	x
Flicker							
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	-	-
Pst_b-c	b-c	-	x	x	x	-	-
Pst_c-a	c-a	-	x	x	x	-	-
Long term flicker							
Plt_a-N	a-N	x	-	-	-	x	x

Table 4-3 Operational Measurands, Connection Types in Power Systems (cont.)

Measurand (x = 1 to 40)	**Circuit**	**1-phase System**	**3-wire Network (Delta)**			**4-wire Network (Star)**	
			Balanced (1l)	**Unbal-anced (3l)**	**Unbal-anced (2l)**	**Balanced (1l)**	**Unbal-anced (3l)**
Plt_b-N	b-N	-	-	-	-	-	x
Plt_c-N	c-N	-	-	-	-	-	x
Plt_a-b	a-b	-	x	x	x	-	-
Plt_b-c	b-c	-	x	x	x	-	-
Plt_c-a	c-a	-	x	x	x	-	-
Instantaneous flicker							
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	-	-
Pinst-b-c	b-c	-	x	x	x	-	-
Pinst-c-a	c-a	-	x	x	x	-	-

4.2.3.2 Harmonics, Connection Types

Table 4-4 Harmonics, Connection Types in Power Systems

Measurand (x = 1 to 40)	**Circuit**	**1-phase System**	**3-wire Networ (Delta)**			**4-wire Network (Star)**	
			Balanced (1I)	**Unbal-anced (3I)**	**Unbal-anced (2I)**	**Balanced (1I)**	**Unbal-anced (3I)**
Harmonics, Voltage, Magnitude							
H_Va-x	a-N	x	-	-	-	x	x
H_Vb-x	b-N	-	-	-	-	-	x
H_Vc-x	c-N	-	-	-	-	-	x
Harmonics, Current, Magnitude							
H_Ia-x	a	x	x	x	x	x	x
H_Ib-x	b	-	-	x	x	-	x
H_Ic-x	c	-	-	x	x	-	x
THDS, Voltage							
THDS_Va/Vab	a-N/ab	x	-	-	-	x	x
THDS_Vb/Vbc	b-N/bc	-	-	-	-	-	x
THDS_Vc/Vca	c-N/ca	-	-	-	-	-	x
THDS, Current							
THDS_Ia	a	x	x	x	x	x	x
THDS_Ib	b	-	-	x	x	-	x
THDS_Ic	c	-	-	x	x	-	x

4.2.3.3 Measurands of Power, Connection Types

Table 4-5 Measurands of Power, Connection Types in Power Systems

Measurand	Circuit	1-phase System	3-wire Network (Delta)			4-wire Network (Star)	
			Balanced (1l)	Unbal-anced (3l)	Unbal-anced (2l)	Balanced (1l)	Unbal-anced (3l)
Active Power							
Pa	a	x	-	-	-	-	x
Pb	b	-	-	-	-	-	x
Pc	c	-	-	-	-	-	x
P	a, b, c	-	x	x	x	x	Σ Vph/3
Reactive Power							
Qa	a	x	-	-	-	-	x
Qb	b	-	-	-	-	-	x
Qc	c	-	-	-	-	-	x
Q	a, b, c	-	x	x	x	x	Σ Vph/3
Apparent Power							
Sa	a	x	-	-	-	-	x
Sb	b	-	-	-	-	-	x
Sc	c	-	-	-	-	-	x
S	a, b, c	-	x	x	x	x	Σ Vph/3
Reactive Power (Fundamental)							
Q1a	a	x	-	-	-	x	x
Q1b	b	-	-	-	-	-	x
Q1c	c	-	-	-	-	-	x
Q1	a, b, c	-	-	-	-	x	x

4.2.3.4 Measurands of Energy, Connection Types

Table 4-6 Measurands of Energy, Connection Types in Power Systems

Measurand	Circuit	1-phase System	3-wire Network (Delta)			4-wire Network (Star)		Intervals (Cycle)
			Balanced (1l)	Unbalanced (3l)	Unbalanced (2l)	Balanced (1l)	Unbalanced (3l)	
Active Energy - Supply								
WPa_ Supply	a	x	-	-	-	-	x	10/12
WPb_ Supply	b	-	-	-	-	-	x	10/12
WPc_ Supply	c	-	-	-	-	-	x	10/12
WP_ Supply	a, b, c	-	x	x	x	x	x	10/12
Active Energy - Demand								
WPa_ Demand	a	x	-	-	-	-	x	10/12
WPb_ Demand	b	-	-	-	-	-	x	10/12
WPc_ Demand	c	-	-	-	-	-	x	10/12
WP_ Demand	a, b, c	-	x	x	x	x	x	10/12
Reactive Energy - Inductive								
WQa_ inductive	a	x	-	-	-	-	x	10/12
WQb_ inductive	b	-	-	-	-	-	x	10/12
WQc_ inductive	c	-	-	-	-	-	x	10/12
WQ_ inductive	a, b, c	-	x	x	x	x	x	10/12

Table 4-6 Measurands of Energy, Connection Types in Power Systems (cont.)

Measur-and	Circuit	1-phase System	3-wire Network (Delta)			4-wire Network (Star)		Inter-vals (Cycle)
			Balanced (1l)	Unbal-anced (3l)	Unbal-anced (2l)	Balanced (1l)	Unbal-anced (3l)	
Reactive Energy - Capacitive								
WQa_ capacitive	a	x	-	-	-	-	x	10/12
WQb_ capacitive	b	-	-	-	-	-	x	10/12
WQc_ capacitive	c	-	-	-	-	-	x	10/12
WQ_ capacitive	a, b, c	-	x	x	x	x	x	10/12
Apparent Energy								
WSa	a	x	-	-	-	-	x	10/12
WSb	b	-	-	-	-	-	x	10/12
WSc	c	-	-	-	-	-	x	10/12
WS	a, b, c	-	x	x	x	x	x	10/12

4.2.4 Data Availability for SENTRON PAC5100

4.2.4.1 Data Availability of the Operational Measurands for SENTRON PAC5100

Table 4-7 Data Availability of the Operational Measurands for SENTRON PAC5100

Measurand (x = 1 to 40)	**Limit violation**	**HTML and Display**	**Operational Measurands (Mean Value)**
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
Alternating Voltage			
Va	x	x	x
Vb	x	x	x
Vc	x	x	x
Vab	x	x	x
Vbc	x	x	x
Vca	x	x	x
V_N	x	x	x
Vavg	x	x	x
U_2	x	x	x
Alternating Current			
Ia	x	x	x
Ib	x	x	x
Ic	x	x	x
I_N	x	x	x
Iavg	x	x	x
Iunbal	x	x	x
Active Power Factor			
cos φ(a)	x	x	x
cos φ(b)	x	x	x

Table 4-7 Data Availability of the Operational Measurands for SENTRON PAC5100 (cont.)

Measurand (x = 1 to 40)	**Limit violation**	**HTML and Display**	**Operational Measurands (Mean Value)**
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
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			
φa	x	x	x
φb	x	x	x
φc	x	x	x
φ	x	x	x
Frequency			
f (System freq.)	x	x	x
Harmonics, Voltage, Magnitude			
H_Va-x	x	x	x
H_Vb-x	x	x	x
H_Vc-x	x	x	x
Harmonics, Current, Magnitude			
H_Ia-x	x	x	x
H_Ib-x	x	x	x
H_Ic-x	x	x	x
THDS, Voltage			
THDS_Va	x	x	x

Table 4-7 Data Availability of the Operational Measurands for SENTRON PAC5100 (cont.)

Measurand (x = 1 to 40)	**Limit violation**	**HTML and Display**	**Operational Measurands (Mean Value)**
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
THDS_Vb	x	x	x
THDS_Vc	x	x	x
THDS, Current			
THDS_Ia	x	x	x
THDS_Ib	x	x	x
THDS_Ic	x	x	x

4.2.4.2 Data Availability of the Measurands of Power for SENTRON PAC5100

Table 4-8 Data Availability of the Measurands of Power for SENTRON PAC5100

Measurand	Limit violation	HTML and Display	Operational Measurands (Mean Value)
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
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
Reactive Power (Fundamental)			
Q1a	x	x	x
Q1b	x	x	x
Q1c	x	x	x
Q1	x	x	x
Apparent Power			
Sa	x	x	x
Sb	x	x	x
Sc	x	x	x
S	x	x	x

4.2.4.3 Data Availability of the Measurands of Energy for SENTRON PAC5100

Table 4-9 Data Availability of the Measurands of Energy for SENTRON PAC5100

Measurand	Limit violation	HTML and Display	Operational Measurands (Mean Value)
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
Active Energy – Supply			
WPa_Supply	-	x	x
WPb_Supply	-	x	x
WPc_Supply	-	x	x
WP_Supply	-	x	x
Active Energy – Demand			
WPa_Demand	-	x	x
WPb_Demand	-	x	x
WPc_Demand	-	x	x
WP_Demand	-	x	x
Reactive Energy – Inductive			
WQa_inductive	-	x	x
WQb_inductive	-	x	x
WQc_inductive	-	x	x
WQ_inductive	-	x	x
Reactive Energy – Capacitive			
WQa_capacitive	-	x	x
WQb_capacitive	-	x	x
WQc_capacitive	-	x	x
WQ_capacitive	-	x	x
Apparent Energy			

Table 4-9 Data Availability of the Measurands of Energy for SENTRON PAC5100 (cont.)

Measurand	Limit violation	HTML and Display	Operational Measurands (Mean Value)
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
WSa	-	x	x
WSb	-	x	x
WSc	-	x	x
WS	-	x	x

4.2.5 Data Availability for SENTRON PAC5200

4.2.5.1 Data Availability of the Operational Measurands for SENTRON PAC5200

Table 4-10 Data Availability of the Operational Measurands for SENTRON PAC5200

Measurand (x = 1 to 40)	**Limit violation**	**HTML and Display**	**Operational Measurands (Mean Value)**
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
Alternating Voltage			
Va	x	x	x
Vb	x	x	x
Vc	x	x	x
Vab	x	x	x
Vbc	x	x	x
Vca	x	x	x
V_N	x	x	x
Vavg	x	x	x
U_2	x	x	x
Alternating Current			
Ia	x	x	x
Ib	x	x	x
Ic	x	x	x
I_N	x	x	x
Iavg	x	x	x
Iunbal	x	x	x
Active Power Factor			
cos φ(a)	x	x	x
cos φ(b)	x	x	x

Table 4-10 Data Availability of the Operational Measurands for SENTRON PAC5200 (cont.)

Measurand (x = 1 to 40)	**Limit violation**	**HTML and Display**	**Operational Measurands (Mean Value)**
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
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			
φa	x	x	x
φb	x	x	x
φc	x	x	x
φ	x	x	x
Frequency			
f (System freq.)	x	x	x
Harmonics, Voltage, Magnitude			
H_Va-x	x	x	x
H_Vb-x	x	x	x
H_Vc-x	x	x	x
Harmonics, Current, Magnitude			
H_Ia-x	x	x	x
H_Ib-x	x	x	x
H_Ic-x	x	x	x
THDS, Voltage			
THDS_Va	x	x	x

Table 4-10 Data Availability of the Operational Measurands for SENTRON PAC5200 (cont.)

Measurand (x = 1 to 40)	**Limit violation**	**HTML and Display**	**Operational Measurands (Mean Value)**
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
THDS_Vb	x	x	x
THDS_Vc	x	x	x
THDS, Current			
THDS_Ia	x	x	x
THDS_Ib	x	x	x
THDS_Ic	x	x	x

4.2.5.2 Data Availability of the Measurands of Power for SENTRON PAC5200

Table 4-11 Data Availability of the Measurands of Power for SENTRON PAC5200

Measurand	Limit violation	HTML and Display	Operational Measurands (Mean Value)
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
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
Reactive Power (Fundamental)			
Q1a	x	x	x
Q1b	x	x	x
Q1c	x	x	x
Q1	x	x	x
Apparent Power			
Sa	x	x	x
Sb	x	x	x
Sc	x	x	x
S	x	x	x

4.2.5.3 Data Availability of the Measurands of Energy for SENTRON PAC5200

Table 4-12 Data Availability of the Measurands of Energy for SENTRON PAC5200

Measurand	Limit violation	HTML and Display	Operational Measurands (Mean Value)
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
Active Energy – Supply			
WPa_Supply	-	x	x
WPb_Supply	-	x	x
WPc_Supply	-	x	x
WP_Supply	-	x	x
Active Energy – Demand			
WPa_Demand	-	x	x
WPb_Demand	-	x	x
WPc_Demand	-	x	x
WP_Demand	-	x	x
Reactive Energy – Inductive			
WQa_inductive	-	x	x
WQb_inductive	-	x	x
WQc_inductive	-	x	x
WQ_inductive	-	x	x
Reactive Energy – Capacitive			
WQa_capacitive	-	x	x
WQb_capacitive	-	x	x
WQc_capacitive	-	x	x
WQ_capacitive	-	x	x
Apparent Energy			

Table 4-12 Data Availability of the Measurands of Energy for SENTRON PAC5200 (cont.)

Measurand	Limit violation	HTML and Display	Operational Measurands (Mean Value)
			Interface/Protocol Ethernet/Modbus TCP
	10/12 cycle	**10/12 cycle**	**10/12 cycle**
WSa	-	x	x
WSb	-	x	x
WSc	-	x	x
WS	-	x	x

4.2.5.4 Recording and Evaluation of the Operational Measurands of SENTRON PAC5200

Table 4-13 Recording and Evaluation of the Operational Measurands of SENTRON PAC5200

Measurand (x = 1 to 40)	Measurement Recorder [1]			Event Recorder [2]	Fault Recorder [3]	Trend Recorder [4]
	AVG	Max. Value	Min. Value	Values	COMTRADE	PQDIF
Alternating Voltage						
Va	x	x	x	x	x	x
Vb	x	x	x	x	x	x
Vc	x	x	x	x	x	x
Vab	x	x	x	x	x	x
Vbc	x	x	x	x	x	x
Vca	x	x	x	x	x	x
V_N	x	x	x	-	x	-
Vavg	x	-	-	-	-	-
U_2	x	x	x	-	-	-
Alternating Current						
Ia	x	x	x	-	x	-
Ib	x	x	x	-	x	-
Ic	x	x	x	-	x	-
I_N	x	-	-	-	-	-
Iavg	x	-	-	-	-	-
Iunbal	x	x	x	-	-	-
Active Power Factor						
cos φ(a)	x	x	x	-	-	-
cos φ(b)	x	x	x	-	-	-

Table 4-13 Recording and Evaluation of the Operational Measurands of SENTRON PAC5200 (cont.)

Measurand (x = 1 to 40)	Measurement Recorder [1]			Event Recorder [2]	Fault Recorder [3]	Trend Recorder [4]
	AVG	Max. Value	Min. Value	Values	COMTRADE	PQDIF
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						
φa	x	x	x	-	-	-
φb	x	x	x	-	-	-
φc	x	x	x	-	-	-
φ	x	x	x	-	-	-
Frequency						
10s freq (10 s freq.)	x [5]	x [5]	x [5]	-	-	-
Harmonics, Voltage, Magnitude						
H_Va-x	x	x	-	-	-	-
H_Vb-x	x	x	-	-	-	-
H_Vc-x	x	x	-	-	-	-
Harmonics, Current, Magnitude						
H_Ia-x	x	x	-	-	-	-
H_Ib-x	x	x	-	-	-	-
H_Ic-x	x	x	-	-	-	-
THDS, Voltage						

Table 4-13 Recording and Evaluation of the Operational Measurands of SENTRON PAC5200 (cont.)

Measurand (x = 1 to 40)	Measurement Recorder [1]			Event Recorder [2]	Fault Recorder [3]	Trend Recorder [4]
	AVG	Max. Value	Min. Value	Values	COMTRADE	PQDIF
THDS_Va	x	x	x	-	-	-
THDS_Vb	x	x	x	-	-	-
THDS_Vc	x	x	x	-	-	-
THDS, Current						
THDS_Ia	x	x	x	-	-	-
THDS_Ib	x	x	x	-	-	-
THDS_Ic	x	x	x	-	-	-
Short Term Flicker						
Pst_a	x	x	x	-	-	-
Pst_b	x	x	x	-	-	-
Pst_c	x	x	x	-	-	-
Long Term Flicker						
Plt_a	x	x	x	-	-	-
Plt_b	x	x	x	-	-	-
Plt_c	x	x	x	-	-	-

1) Interface: protocol Modbus TCP;
settable aggregation times: 30 s, 60 s, 10 min, 15 min, 30 min, 1 h, 2 h

2) Interfaces: protocols Modbus TCP, HTML, display
determining overvoltage, undervoltage and voltage interruption according to EN 50160, for example

3) Interface: protocol HTML

4) Interface: protocol HTML
1/2 period, RMS values

5) The frequency is permanently defined with 10 s mean value recording.

4.2.5.5 Recording and Evaluation of the Power Types of SENTRON PAC5200

Table 4-14 Recording and Evaluation of the Power Types of SENTRON PAC5200

Measurand	Measurement Recorder [1]		
	AVG	Max. Value	Min. Value
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
Reactive Power (Fundamental)			
Q1a	x	x	x
Q1b	x	x	x
Q1c	x	x	x
Q1	x	x	x
Apparent Power			
Sa	x	x	x
Sb	x	x	x
Sc	x	x	x
S	x	x	x

1) Interface: protocol Modbus TCP;
settable aggregation times: 30 s, 60 s, 10 min, 15 min, 30 min, 1 h, 2 h

4.3 Display of Measurands

4.3.1 Measurands and Operational Measurement Uncertainty acc. to IEC 62586-1 Product Standard, Class S, and Standards IEC 61000-4-30, Ed. 2 and IEC 61000-4-7 and IEC 61000-4-15

Table 4-15 Measurands and their Operational Measurement Uncertainty

Measurands	Unit	Rated Value	Measurement Range	Operat. Measurem. Uncertainty acc. to IEC 62586-1, Class S, IEC 61000-4-30, IEC 61000-4-7 IEC 61000-4-15
Voltage V_{ph-ph} (delta) Acc. to parameterization	V	AC 110 V AC 190 V AC 400 V AC 690 V AC 600 V for UL conditions	0 % to 120 % V_{rated}	±0.2 %
Voltage V_{ph-N} (star) Acc. to parameterization	V	AC 63.5 V AC 110 V AC 230 V AC 400 V AC 347 V for UL conditions	0 % to 120 % V_{rated}	±0.2 %
Voltage V_N	V	AC 63.5 V AC 110 V AC 230 V AC 400 V AC 347 V for UL conditions	0 % to 120 % V_{rated}	±0.2 %
Voltage unbalance U_2	%	-	0 % to 100 % V_{rated}	±0.2 %
Frequency f	Hz	50 Hz (±7.5 Hz) 60 Hz (±9 Hz)	42.5 Hz to 57.5 Hz 51.0 Hz to 69.0 Hz	50 mHz (see Table 4-17)
Flicker Pst, Plt (only SENTRON PAC5200)	-	-	Pst, Plt: 0,4 to 4 Pinst: 0 to 40	Acc. to class S, IEC 61000-4-30: Pst: ±10 % Plt: ±10 % Pinst: ±16 %
Harmonics of voltage H_xV_{ph}	% or V	-	-	Condition: $V_m \geq 3$ % V_{rated} Maximum error: ±5 % V_m --- Condition: $U_m < 3$ % V_{rated} Maximum error: ±0.15 % V_{rated}

4.3.2 Measurands and Operational Measurement Accuracy acc. to IEC 61557-12

Table 4-16 Measurands and their Operational Measurement Accuracy

Measurands	Unit	Rated Value	Measurement Range	Accuracy Class
Current I Acc. to parameterization	A	AC 1 A AC 5 A	20 % to 200 % I_{rated}	0.2
Current unbalance I_{unbal}	%	-	0 % to 100 % I_{rated}	0.2
Active power P + demand, - supply	W	-	20 % to 200 % I_{rated}	0.5
Reactive power Q + inductive, - capacitive	var	-	20 % to 200 % I_{rated}	0.5
Apparent power S	VA	-	20 % to 200 % I_{rated}	0.5
Power factor PF 1)	-	-	0 to 1	1.0
Active power factor cos φ 1)	-	-	-1 to +1	1.0 %
Phase angle φ 1)	Degree	-	-180° to +180°	±2° 2)
Active energy WP +demand, -supply	Wh	-	20 % to 200 % I_{rated}	0.5 Class 0.5S acc. to IEC62053-22
Reactive energy WQ inductive, capacitive	varh	-	20 % to 200 % I_{rated}	0.5 Class 2 acc. to IEC62053-23
Apparent energy WS	VAh	-	20 % to 200 % I_{rated}	0.5
Subgroup Total harmonics distortion of voltage THDS V_{ph}	%	-	0 % to 100 %	0.5
Subgroup Total harmonics distortion of current THDS I_{ph}	%	-	0 % to 100 %	0.5
Harmonics of current H_xI_{ph}	A	-	-	Condition: $I_m \geq 10$ % I_{rated} Maximum error: ±5 % I_m --- Condition: $I_m < 10$ % I_{rated} Maximum error: ±0.5 % I_{rated}

1) Measurement from 2 % of the rated apparent power value onwards in the selected measuring range (see Chapter 12.2)

2) The IEC 61557-12 standard does not specify any accuracy class for these variables. The specifications refer to the maximum deviation from the actual value.

4.3.3 Accuracy of the Frequency Measurement

Table 4-17 Accuracy of the Frequency Measurement

Circuit	Accuracy
Voltage to V_{a-N}	0 % to 15 % V_{rated}: invalid
	15 % to 30 % V_{rated}: 40 mHz
	30 % to 120 % V_{rated}: 10 mHz
Voltage to V_{b-N}	0 % to 15 % V_{rated}: invalid
	15 % to 30 % V_{rated}: 40 mHz
	30 % to 50 % V_{rated}: 30 mHz
	50 % to 120 % V_{rated}: 20 mHz
Voltage to V_{c-N}	0 % to 15 % V_{rated}: invalid
	15 % to 30 % V_{rated}: 40 mHz
	30 % to 120 % V_{rated}: 10 mHz

NOTE

The frequency at measuring circuit V_{a-N} is measured first. If the voltage V_{a-N} is smaller than 30 % of V_{rated}, the measurement will automatically be carried out at measuring circuit V_{c-N}. If the voltages V_{a-N} and V_{c-N} are smaller than 30 % of V_{nom}, the measurement will automatically be carried out at measuring circuit V_{b-N}.

5 Getting Started

5.1 Unpacking, Inspecting the Delivery, and Installing the Battery

Unpacking

The SENTRON PAC5100/5200 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

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 just 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 are deleted and the real-time clock is reset (2000-01-01 00:00).

Customer-specific parameters are permanently stored in the Flash-EPROM even without a battery.

To insert the battery, observe the notes in the supplied operating instruction and proceed as follows:

✧ Lever the cover of the battery compartment out of the socket with a suitable tool (for example precision engineer screwdriver 2.0 mm).

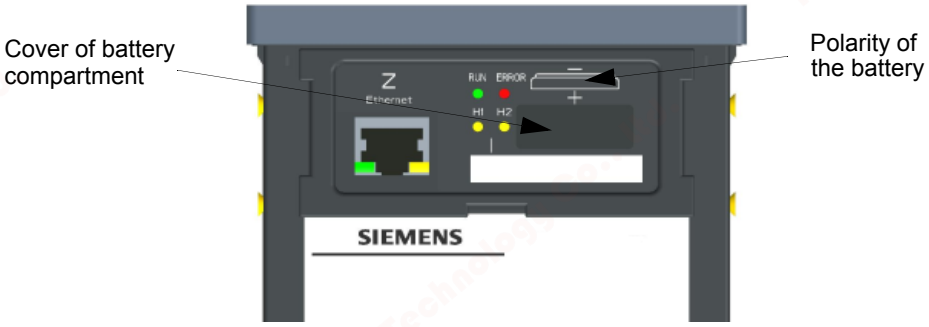


Figure 5-1 Top side of the SENTRON PAC5100/5200

- ✧ Take the wrapped battery out of the battery compartment.
- ✧ Remove the plastic foil from the battery.
- ✧ Insert the battery into the battery compartment with the polarity imprinted on the top side of the device (see Figure 5-1).
- ✧ Close the cover of the battery compartment.

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.

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 attempt to open the battery.
- Do not attempt to recharge the battery.
- Servicing of the circuitry involving the batteries and replacement of the lithium batteries shall be done by a trained technician.
- Replace battery with VARTA 6032 101 501 or PANASONIC CR2032 only. Use of another battery may present a risk of fire or explosion. See manual for safety instructions.
- Caution: 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 three LEDs H1/H2/ERROR or switched to one of the binary outputs.

When the "Battery Failure" indication is displayed, replace the battery as follows:

- ✧ Lever the cover of the battery compartment out of the socket with a suitable tool (e.g. precision engineer screwdriver 2.0 mm).
- ✧ Use an appropriate non-conducting tool (for example plastic tweezers) to pull the battery out of the 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.
- ✧ Press the cover of the battery compartment back into the housing and make sure it is in the correct position.

NOTE on 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.

Information on battery life can be found in chapter 12.1.5.

5.2 Assembly

5.2.1 General Assembly Notes

Depending on the model, SENTRON PAC5100/5200 is designed either for panel flush mounting (device with display) or for DIN rail assembly (device without display).

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 the technical data in chapter 12).
- Operating the device outside the permitted operating temperature range can lead to measuring errors and device failure.
- The terminals are designed for wire cross-sections of 2.5 mm² max.
- 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.

5.2.2 Assembly

Devices with Display for Panel Flush Mounting

To install the device into a switch panel, proceed as follows:

- ✧ Push the device in installation position into the cut-out of the switch panel and hold the device tight.
- ✧ Attach one of the supplied mounting elements each on both sides of the housing.

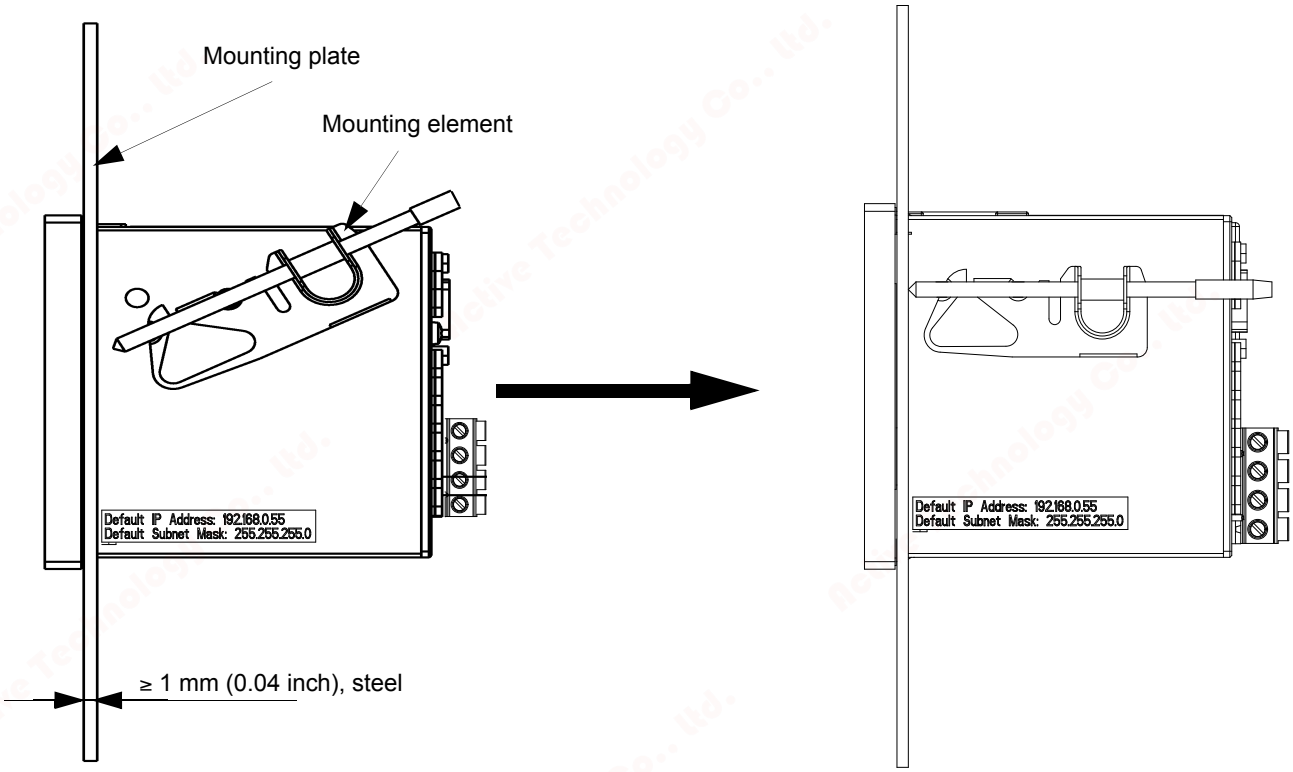


Figure 5-2 Stepwise Installation of the SENTRON PAC5100/5200 into a Switch Panel (devices with display)

- ✧ Swing the mounting element (provided with the device) over the rear cone.
- ✧ Move the mounting element to the position. Use a screw driver (0.6 mm x 4.5 mm) to fix the mounting elements until the slipping clutch takes effect.

NOTE

The above mounting instructions must be performed correctly to provide sufficient protection against touching live parts.

UL-Certification Conditions

Field Wires of Control Circuits shall be separated from other circuits with respect to the end-use requirements!

Devices without Display for DIN Rail Mounting

To mount the device on a DIN rail, proceed as follows:

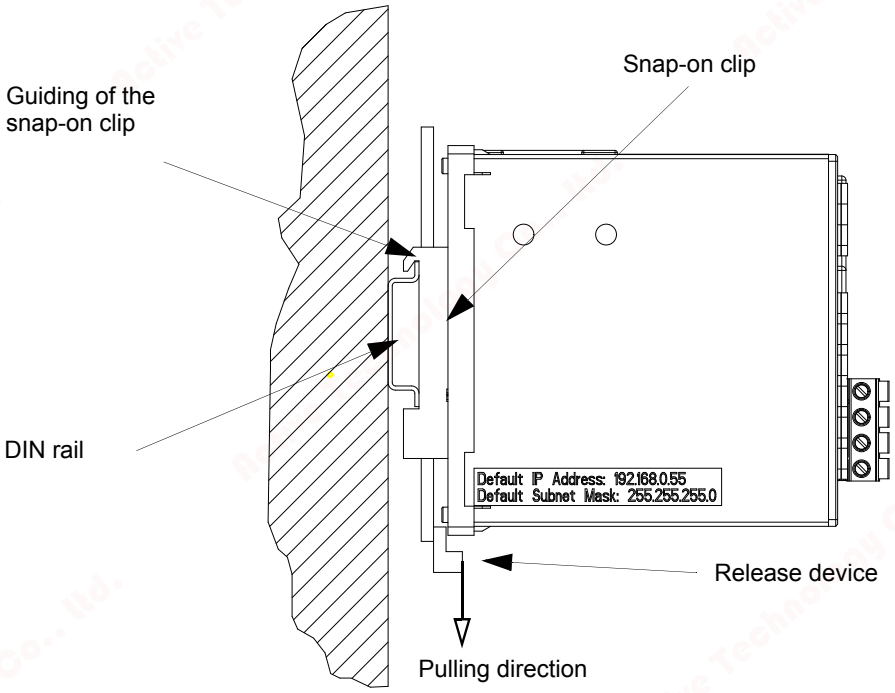


Figure 5-3 Assembly of the DIN Rail Device

- ✧ Pull down the release device at the snap-on clip and hold it in this position.
- ✧ Slide the device with the guiding of the snap-on clip on to one side of the DIN rail.
- ✧ Move the device into the desired position on the DIN rail.
- ✧ Release the release device. The device is now firmly mounted on the DIN rail.

The snap-on clip is set to a certain height position by default. To change the height position, proceed as follows:

- ✧ Lever the release device out of its guiding (no special tool required).
- ✧ Move the release device into the desired position.
- ✧ Press the release device back into its guiding.

NOTE

The assembly instructions above must be carried out correctly to ensure sufficient protection against touching live parts.

UL-Certification Conditions

Field Wires of Control Circuits shall be separated from other circuits with respect to the end-use requirements!

5.3 Electrical Connection

5.3.1 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 (see Preface) 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 2006/95/EG.

- Before commissioning the device, check that all connections are made properly.
- Connect the protective grounding terminal H ⏚ to the protective conductor of the switch panel or of the control cabinet.
- The secondary connections of interconnected current transformers must be short-circuited at these before you disconnect the power supply 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.

NOTE

Before you switch on the supply voltage, verify that the operational data match the rated data on the label and the technical data according to chapter 12. This applies in particular to the supply voltage V_H and to the maximum values of alternating current and alternating voltage.

5.3.2 Electrical Connection of SENTRON PAC5100/5200

NOTE

The electrical terminal connections of the device models are identical.

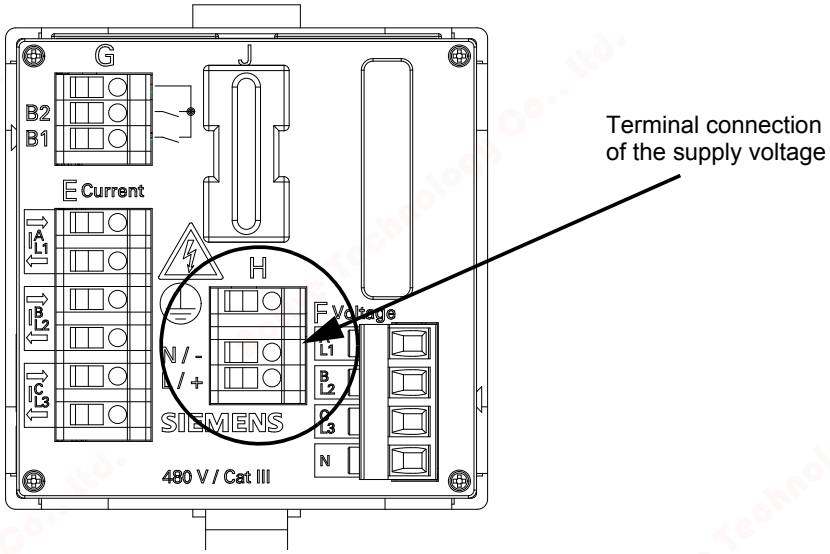


Figure 5-4 Terminal Connection of the Supply Voltage at the SENTRON PAC5100/5200

DANGER

Hazard due to high voltage

Non-observance will lead to death or serious injury.

Work may only be carried out by trained personnel (see Preface) 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.

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 conductor of the supply voltage
Terminal L/+:	Phase of the supply voltage
Terminal ⏚ :	Protective grounding terminal

Supply from a Direct Voltage Source

Terminal N/-:	Negative supply voltage
Terminal L/+:	Positive supply voltage
Terminal ⏚ :	Protective grounding terminal

NOTE

Always connect the grounding at the SENTRON PAC5100/5200 to the terminal for the protective conductor ⏚ (terminal block H).

Terminals

Terminals for supply voltage (H), inputs for current measurement (E), inputs for voltage measurement (F), binary outputs (G) on the terminal side:

Conductor cross-section, rigid max.	2.5 mm² (AWG 14)
Conductor cross-section (conductor with ferrule)	1.5 mm² (AWG 16)
Conductor cross-section (conductor with ferrule, terminal F)	2.5 mm² (AWG 14)
Tightening torque	0.4 Nm to 0.5 Nm (3.5 in-lb to 4.5 in-lb)
Ethernet interface (Z) on the top side:	Ethernet patch cable or crossover cable

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!

5.4 System Requirements

To operate SENTRON PAC5100/5200 with a PC or notebook, the following system requirements must be met:

- PC or notebook with Intel Pentium processor (or compatible type); clock frequency min. 800 MHz
- Operating system: Microsoft Windows XP Professional and Windows 7 with Internet Explorer 6.0 (or higher)
- Minimum 1 GB RAM primary storage
- VGA display 1024 x 768 with truecolor

5.5 Access Rights

Access Rights for Configuration and Maintenance

To determine access rights, you have to set up passwords when configuring the device. You have to specify an activation password and a maintenance password; chapter 7.3.6.3 describes how to set up passwords.

The **activation password** is required to enable parameter changes in the device.

The **maintenance password** is required to make changes in the device using the Maintenance tab.

NOTE

If you do not specify new passwords, the factory-set default passwords (see chapter 7.3.6.3) are valid.

Access Rights for Communication

The access rights for the communication via **Ethernet** with **Modbus TCP** protocol are made for port 502 and for the user port. You can assign either full access rights or read-only authorization; chapter 7.3.6.2 describes the settings.

5.6 Meaning of the LEDs

7KM5212/5412 automatically monitors the functions of its hardware and software components. The LEDs on the top side of the housing indicate the current device status.

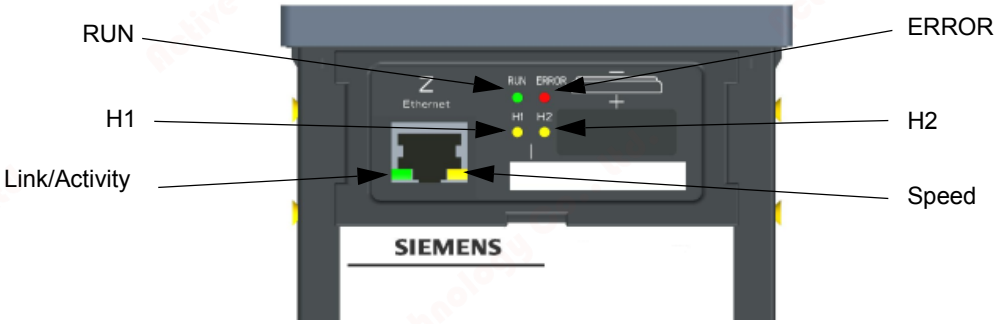


Figure 5-5 Designation of the LEDs

Depending on the status, the LEDs can be permanently on, flashing, or off. The states are described in chapter 12.3. The meaning of the LEDs during normal operation is explained in the following table:

Table 5-1 Meaning of the LEDs

LED	Meaning
RUN	Device active
ERROR	Indicates an error according to parameterization
H1	According to parameterization
H2	According to parameterization
Link/Activity	LED on: Ethernet link is up LED flashing: Ethernet link is up and data are transferred LED off: no Ethernet partners connected
Speed	LED on: 100 Mbit/s LED off: 10 Mbit/s

5.7 Commissioning

5.7.1 Initial Commissioning

DANGER

Hazard due to high voltage

Non-observance will lead to death or serious injury.

Work may only be carried out by trained personnel (see Preface) 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.

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 12). 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 terminals needed for this purpose

- On the terminal side of the device connect the measuring lines linked with the measurement objects at the terminal blocks E (current) and F (voltage); chapter 6 describes interfaces, connection principles, and examples of connection possibilities.
- On the terminal side of the device, connect the process connections required for the measurements.
- On the top side of the device, connect the network cable to the PC at the RJ45 socket 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

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 minutes, the device will stay within the tolerances specified in the technical data.

✧ Switch the alternating voltages and alternating currents to be measured at the measurement object on the measuring lines.

✧ Carry out the measurements as described in chapter 7 or chapter 8.

NOTE

The operation requires JavaScript. If JavaScript is not yet enabled, activate it as described in chapter 7.2.2.

5.7.2 Changes During Operation

The device is designed for permanent operation.

If you want to change the measurement setup, for example by connecting terminals so far unused, proceed analogously to the Initial Commissioning.

NOTE

If you change the measurement setup, de-energize the supply voltage lines and all measuring lines before opening the control cabinet. Note the warnings in chapter 5.7.1.

5.7.3 Starting the Device with the Default IP Address

SENTRON PAC5100/5200 has the following internal default IP address: **192.168.0.55**.

If you have entered a custom IP address during device configuration, you can temporarily activate the internal default IP address of the device if necessary.

Devices with Display

✧ Hold down the F4 softkey located in the right part of the display side of the device for at least 3 s.

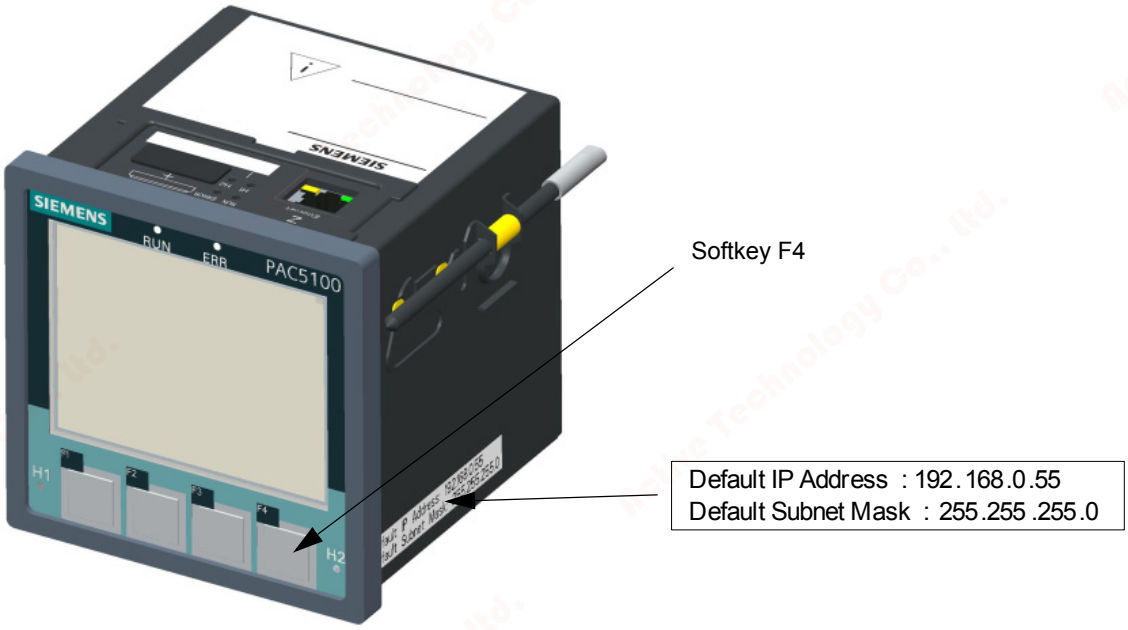


Figure 5-6 Location of the Softkey F4 for Activating the Default IP Address

When you press the softkey F4, SENTRON PAC5100/5200 will reset and use the default IP address until you have set a new IP address or switched the device off and on again.

NOTE

Changing the IP address causes the device to reset and the LEDs signal that the device was started with the default IP address (see chapter 12.3).

In this case, the parameterized IP address and the default IP address are displayed on the **Information** tab, **Device information** menu item (see chapter 7.2.5)

After starting the device with the default IP address, the factory-set passwords are active, too, (see chapter 7.3.6.3).

DIN Rail Devices

✧ Press the IP-Addr. push-button on the DIN Rail Site for at least 3 s.

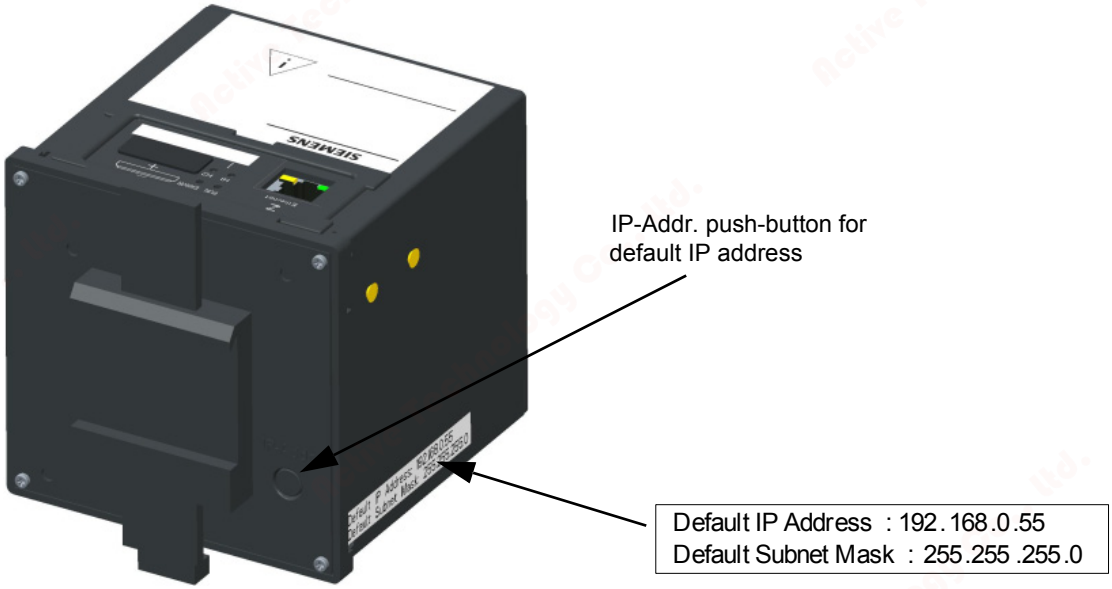


Figure 5-7 Location of the Push-button for Activating the Default IP Address

When you press the IP-Addr. push-button, SENTRON PAC5100/5200 will reset and use the default IP address until you have set a new IP address or switched the device off and on again.

NOTE

Changing the IP address will lead to a device reset, and the LEDs indicate that the device was started with the default IP address (see chapter 12.3).

In this case, the parameterized IP address and the default IP address are displayed on the **Information** tab, **Device information** item (see chapter 7.2.5).

When the device has started with the default IP address, the factory-set default passwords are also active (see chapter 7.3.6.3).

6 Connection Principle

6.1 Terminals

The terminals on the terminal side of the device are designed as terminal blocks:

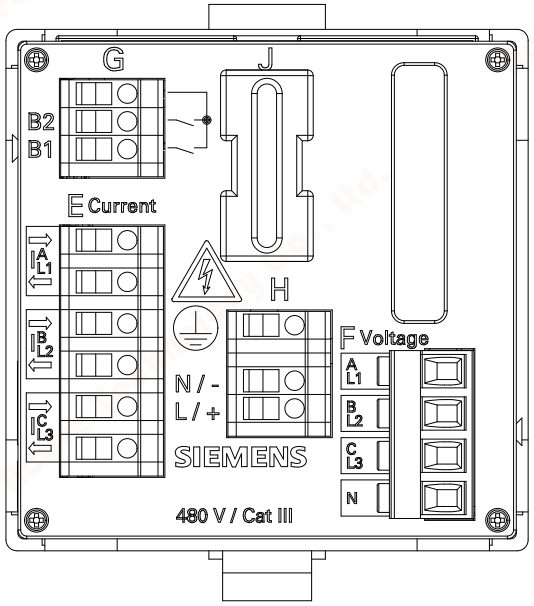


Figure 6-1 Terminal Blocks on the Terminal Side of the SENTRON PAC5100/5200

SENTRON PAC5100/5200 has the following terminal blocks:

Table 6-1 Terminal Blocks at SENTRON PAC5100/5200

Terminal Block	Description
E	3 inputs for alternating current measurement
F	4 inputs for alternating voltage measurement
G	2 binary outputs (freely programmable)
H	Supply voltage

Functions of the Terminals at SENTRON PAC5100/5200

Table 6-2 Functions of the Terminals

Terminal	Assigned Function, Measured Value or Indication	Description
E: $I^{A}_{L1}{}^{=>}$	Ia	Conductor a, input, current measurement
E: $I^{A}_{L1}{}^{<=}$	Ia	Conductor a, output, current measurement
E: $I^{B}_{L2}{}^{=>}$	Ib	Conductor b, input, current measurement
E: $I^{B}_{L2}{}^{<=}$	Ib	Conductor b, output, current measurement
E: $I^{C}_{L3}{}^{=>}$	Ic	Conductor c, input, current measurement
E: $I^{C}_{L3}{}^{<=}$	Ic	Conductor c, output, current measurement
F: $^{A}_{L1}$	Van	Conductor a, voltage measurement
F: $^{B}_{L2}$	Vbn	Conductor b, voltage measurement
F: $^{C}_{L3}$	Vcn	Conductor c, voltage measurement
F: N	N	Neutral conductor, voltage measurement
G:	Root	Common root for both binary outputs
G: B2	Binary output 2	Binary output 2
G: B1	Binary output 1	Binary output 1
H: ⏚	Protective conductor	-
H: N / -	N/-	Neutral conductor of the mains voltage or negative supply voltage
H: L / +	ph/+	Phase of the mains voltage or positive supply voltage

6.2 Ethernet Interface

The Ethernet interface **Z** is located on the top side of the SENTRON PAC5100/5200. Data are exchanged via the RJ45 Ethernet socket, see also detailed information in Communication Manual SENTRON PAC5100/5200.

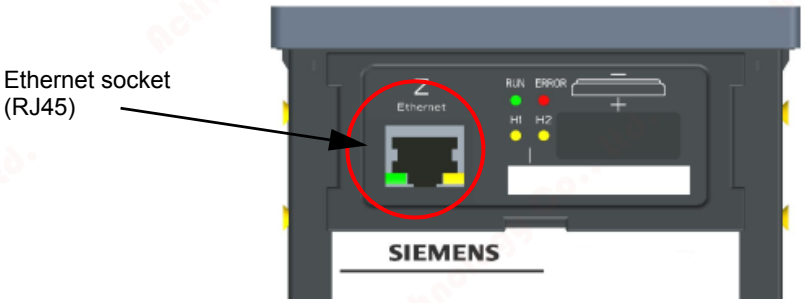


Figure 6-2 Ethernet Interface Z (Detail of the Top Side)

NOTE

If you do not connect a cable to the RJ45 socket, Siemens recommends to cover the socket with a cap or dummy plug (not included in the delivery) to prevent the contacts from becoming dirty.

6.3 Connection Types and Connection Examples

6.3.1 Using SENTRON PAC5100/5200 in the Power Systems IT, TT, and TN

When using SENTRON PAC5100/5200 in the power systems IT, TT, and TN, no special operating conditions must be observed.

6.3.2 Connection Types

SENTRON PAC5100/5200 supports the following connection types:

- 1-phase system
- 3-wire network (balanced)
- 3-wire network (unbalanced), 2 current inputs
- 3-wire network (unbalanced), 3 current inputs
- 4-wire network (balanced)
- 4-wire network (unbalanced)

6.3.3 Examples - Standard Application

The following input wiring diagrams are examples. Up to the maximum allowable current and voltage values (see chapter 13) SENTRON PAC5100/5200 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

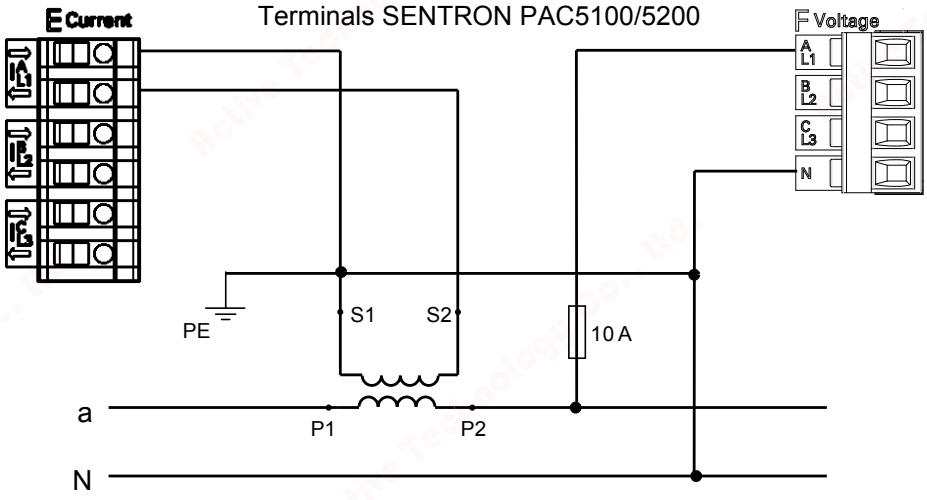


Figure 6-3 Example 1-phase System, No Voltage Transformer

Example 3-wire Network, 2 Voltage Transformers and 1 Current Transformer, Balanced

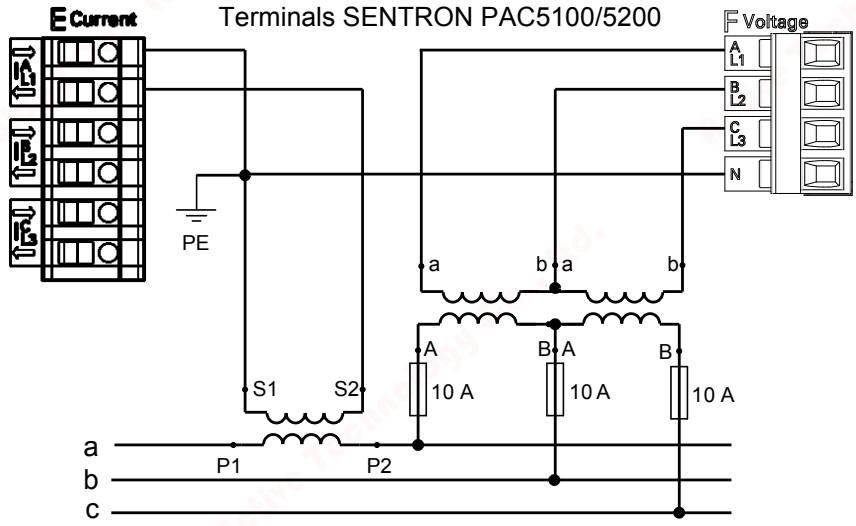


Figure 6-4 Example 3-wire Network, 2 Voltage Transformers and 1 Current Transformer, Balanced

NOTICE

The secondary voltage on terminal F (voltage) must not exceed AC 480 V (AC 347 V for UL conditions).

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, No Voltage Transformer, 3 Current Transformers, Unbalanced

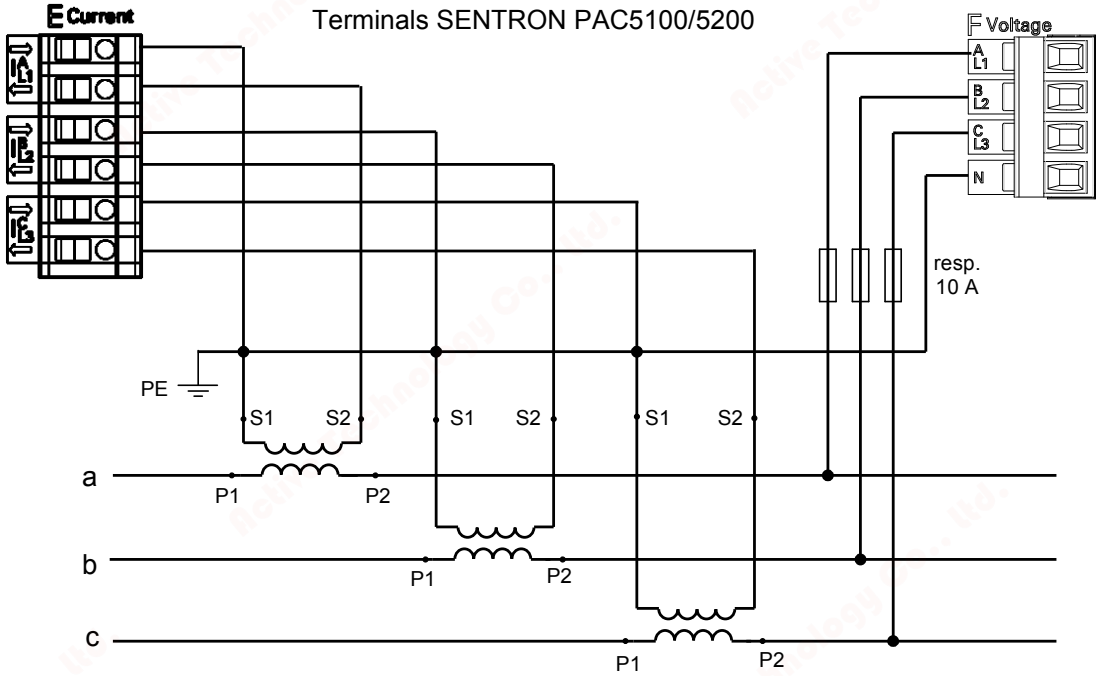


Figure 6-5 Example 3-wire Network, No Voltage Transformer, 3 Current Transformers, Unbalanced

Example 3-wire Network, No Voltage Transformer, 2 Current Transformers, Unbalanced

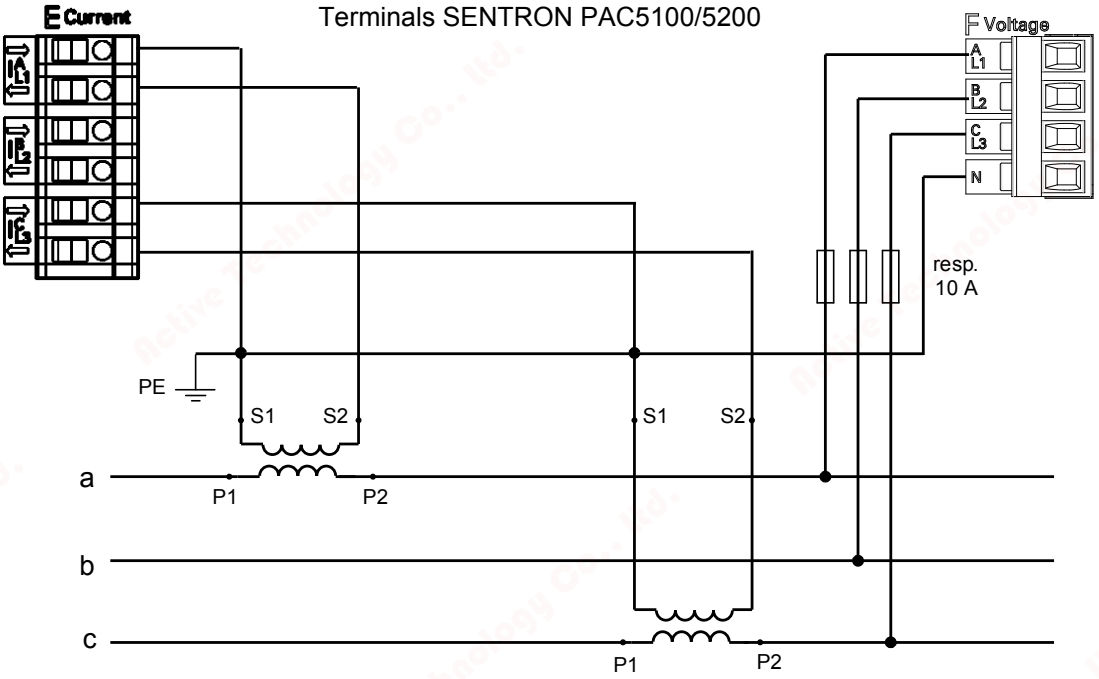


Figure 6-6 Example 3-wire Network, No Voltage Transformer, 2 Current Transformers, Unbalanced

Example 3-wire Network, 2 Voltage Transformers and 2 Current Transformers, Unbalanced

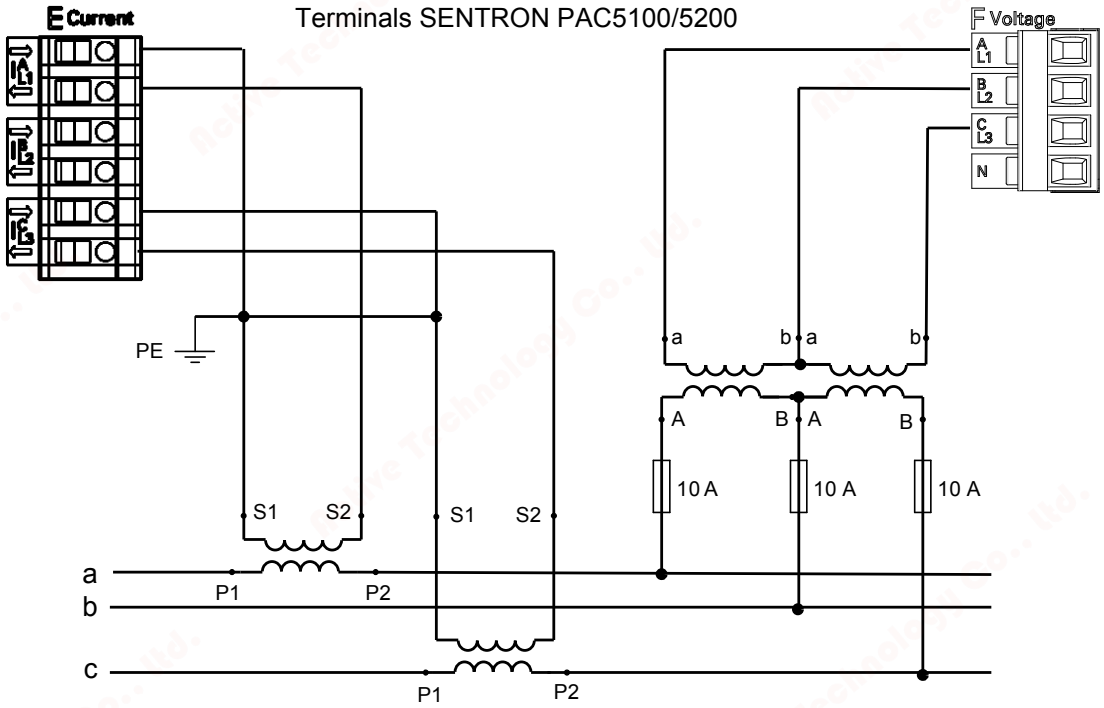


Figure 6-7 Example 3-wire Network, 2 Voltage Transformers and 2 Current Transformers, Unbalanced

NOTICE

The secondary voltage on terminal F (voltage) must not exceed AC 480 V (AC 347 V for UL conditions).

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

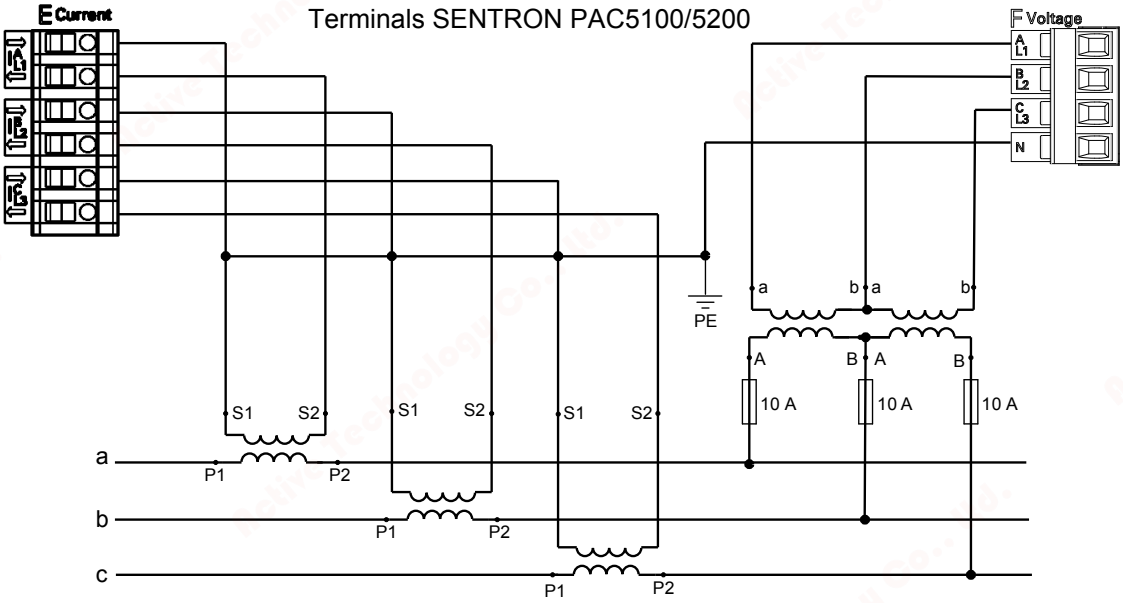


Figure 6-8 Example 3-wire Network, 2 Voltage Transformers and 3 Current Transformers, Unbalanced

NOTICE

The secondary voltage on terminal F (voltage) must not exceed AC 480 V (AC 347 V for UL conditions).

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

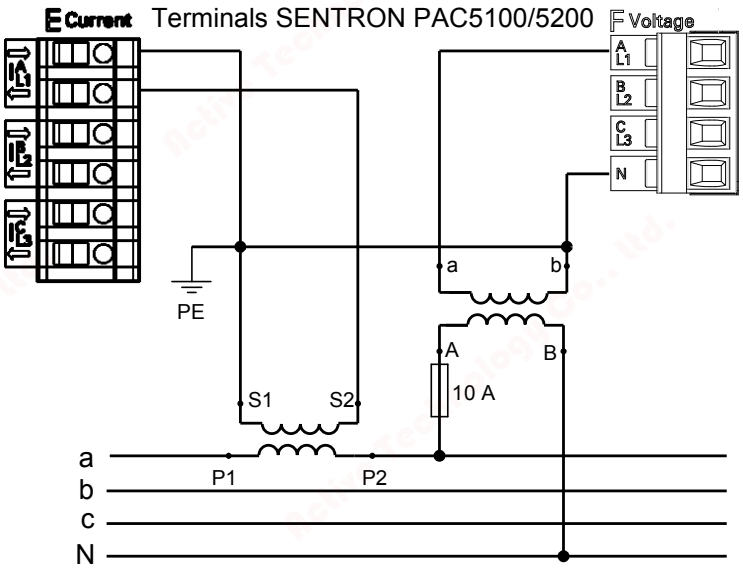


Figure 6-9 Example 4-wire Network, 1 Voltage Transformer and 1 Current Transformer, Balanced

Example 4-wire Network, No Voltage Transformer, 3 Current Transformers, Unbalanced

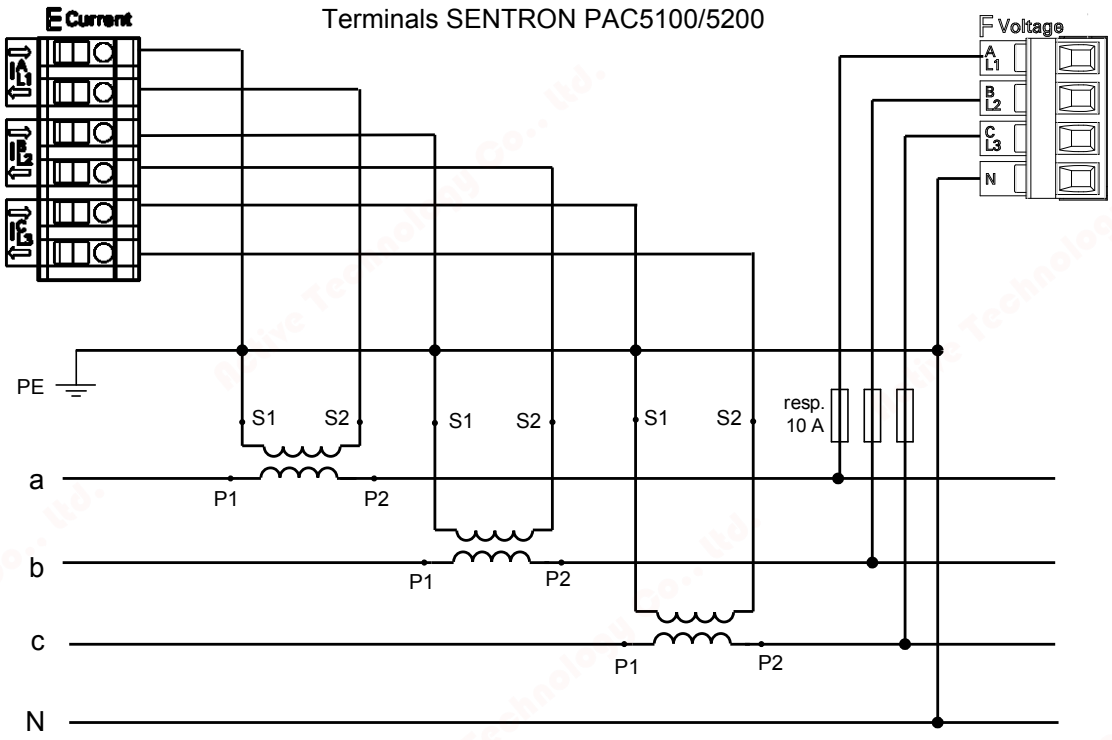


Figure 6-10 Example 4-wire Network, No Voltage Transformer, 3 Current Transformers, Unbalanced

Example 4-wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced

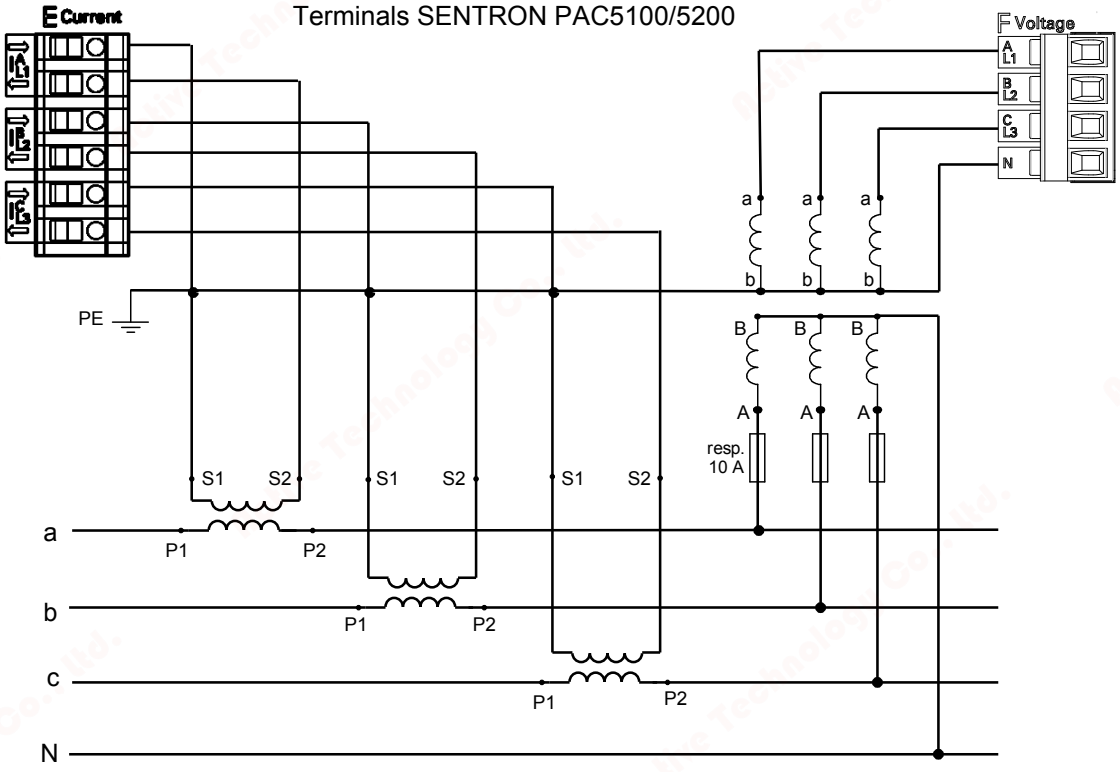


Figure 6-11 Example 4-wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced

6.3.4 Example - Special Application

Example 3-wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced

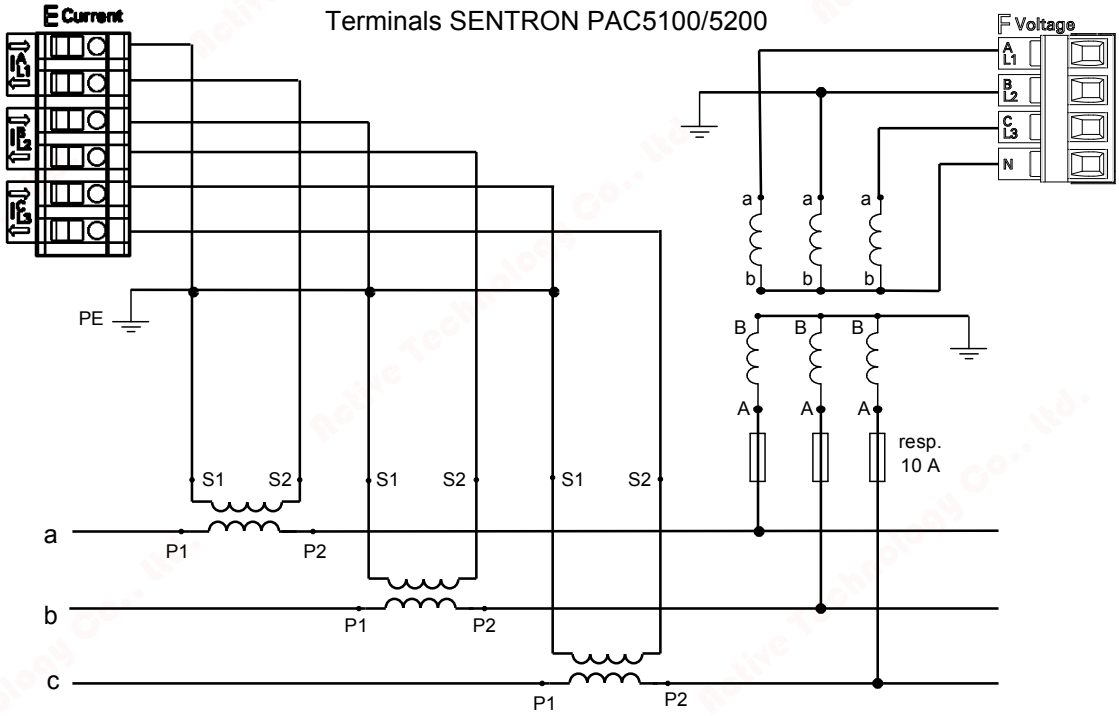


Figure 6-12 Example 3-wire Network, 3 Voltage Transformers and 3 Current Transformers, Unbalanced

7 Operation at Use of a PC

7.1 General Usage Notes

All SENTRON PAC5100/5200 device models can be operated via the HTML pages from the connected PC. Devices with a display can additionally be operated using the softkeys on the display side. This chapter describes the PC-based operation; Operation at Use of the Display covers the operation using the softkeys.

The graphical user interface is stored in the device. To display the user interface, start Microsoft Internet Explorer 6.0 (or higher) and enter the IP address of the device.

You can navigate through Microsoft Internet Explorer using the icons on the toolbar, for example back, forward, print etc. 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.

The following table lists the control elements.

Table 7-1 Control Functions

Control Element	Control Function
	Option button: selects one option
	List box: selects an item from a list
	Button: Executing an action by clicking the button, that is the current settings on the user interface are transmitted to the device.
	Active tab (light blue)
	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 Setting the Operational Parameters. 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 file which is suitable for the network type. If there are invalid values or a wrong ICD file, restart the device.

NOTE

If you change settings in tabs, click **Send** on each tab to confirm the new setting. The settings are **activated** only after the entire parameterization has been completed.

7.2 Start and Design of the User Interface

7.2.1 Initial Start of the Operation

Before starting the user interface, the following preconditions must be satisfied:

- ✧ Assemble the SENTRON PAC5100/5200 as described in Assembly.
- ✧ Connect the lines for measurement, communication and supply voltage as described in Electrical Connection and observe the safety provisions.
- ✧ Switch on the devices needed for the measurement.
- ✧ Switch on the supply voltage of the SENTRON PAC5100/5200.
- ✧ Check whether the LEDs at the SENTRON PAC5100/5200 indicate that the device is ready (see Dimensions).
- ✧ 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 up. Activate the LAN connection if it is down (see the Windows manual or the Windows online help for information).
- ✧ For checking purposes, carry out the ping test as follows (example for Windows XP):
  - Click **Start** on the Windows interface.
  - Select **Execute...**.
  - Enter **cmd** in the dialog and click **OK**.
  - Enter: **ping 192.168.0.55**.
  - Press **ENTER**.
  - Check the following output in the window.

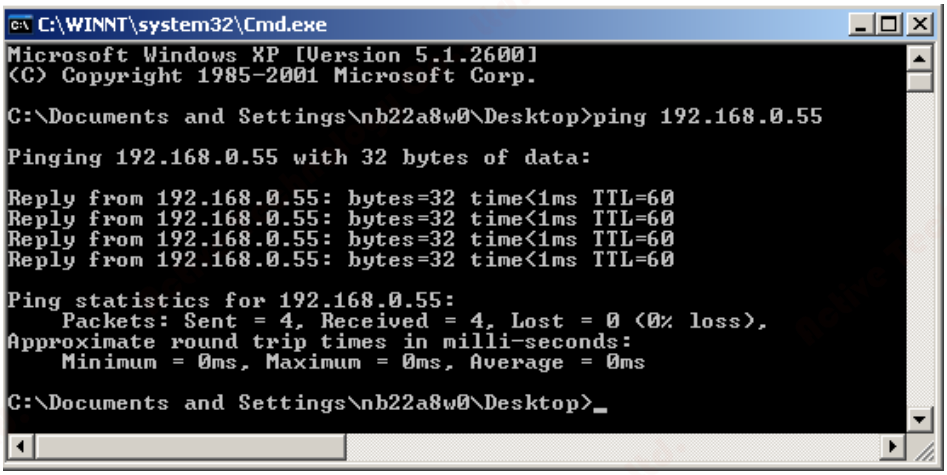


Figure 7-1 Ping Test

- ✧ Start Microsoft Internet Explorer.
- ✧ Enter the IP address in Microsoft Internet Explorer (for example default IP address: http://192.168.0.55) of SENTRON PAC5100/5200 and press **ENTER**.

  The user interface opens with the **Information** tab → **Show device information** (see Figure 7-4).

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 (see Configuration of the Device).

To set a different user language for the user interface, open the **Administrative** menu on the **Configure** tab, select the **Device and language** menu item and change the language as described in Device and Language.

NOTE

If the user interface does not open or the displayed user interface does not show the view depicted in Figure 7-3, JavaScript may be the cause. The operation of user interface requires JavaScript. You may have to activate JavaScript as described in the following chapter.

7.2.2 Enabling JavaScript

The operation of the user interface requires JavaScript.

Enable JavaScript as follows:

- ✧ Start Microsoft Internet Explorer.
- ✧ Select the **Tools** menu on the menu bar of Microsoft Internet Explorer.
- ✧ Select **Internet options...** from the **Tools** menu.
- ✧ In the **Internet options** dialog, open the **Security** tab.

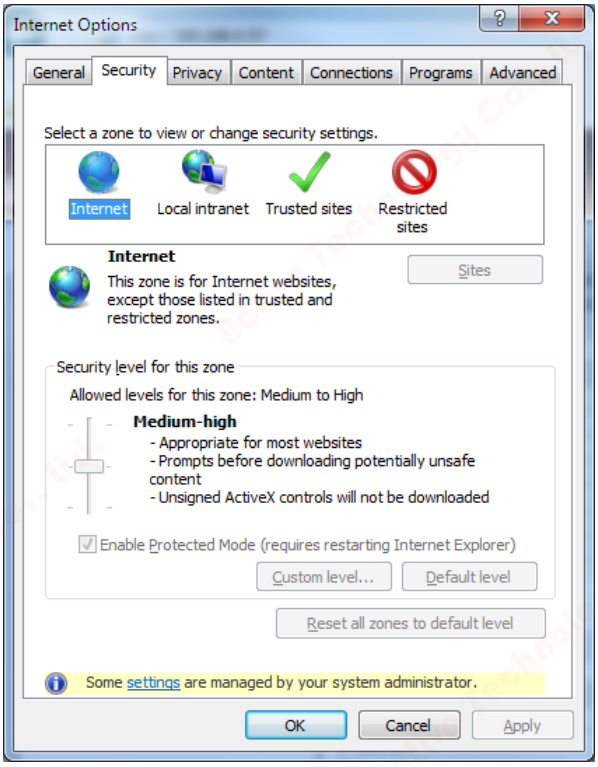


Figure 7-2 Enabling JavaScript

- ✧ In the window of the **Security** tab, select the **Internet** icon.
- ✧ On the **Security** tab, scroll to **Medium** by moving the scroll bar with your mouse. Alternatively, if there is no scroll bar, click **Default Level** and set the scroll bar that appears to **Medium**.
- ✧ Click **Apply**.
- ✧ Click **OK**.

7.2.3 Number of Connections via HTML

A maximum of 3 connections is possible via HTML.

7.2.4 Layout of the User Interface

The user interface has the following layout:

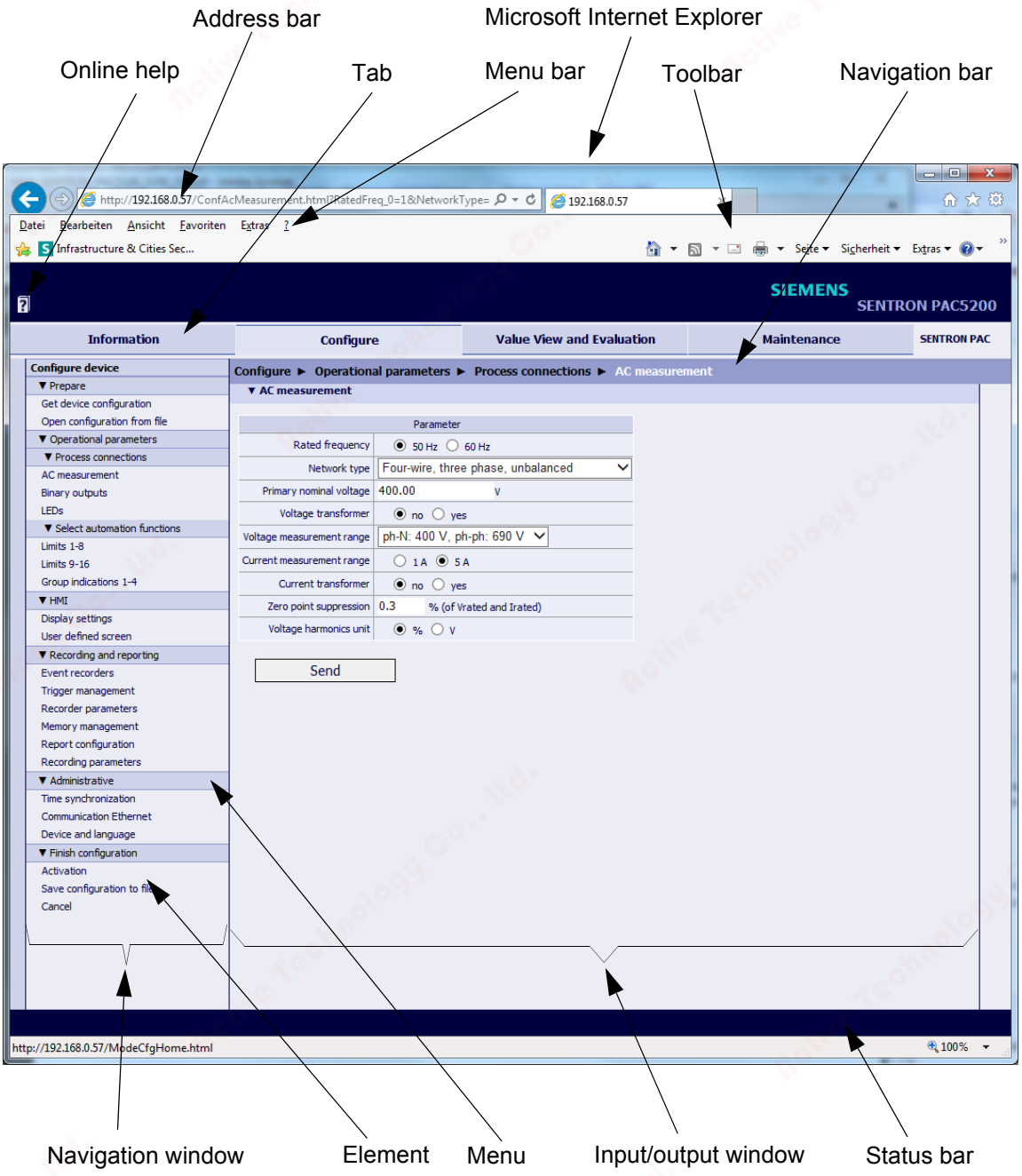


Figure 7-3 Designations in the User Interface

7.2.5 Starting the User Interface during Operation

Starting the User Interface

To start the user interface, proceed as follows:

- ✧ Start Microsoft Internet Explorer.
- ✧ Enter the IP address in Microsoft Internet Explorer (for example the default IP address: 192.168.0.55) of SENTRON PAC5100/5200 and press ENTER.

  The user interface opens with the **Information** tab → **Show device information** item (see figure 7-4).

Information Tab

Figure 7-4 Information Tab, Show Device Information Input/Output Window

Navigation Window of the Information Tab

The navigation window of the **Information** tab contains the elements **Show device information**, **Save device information and message logs** and the **Message Logs** menu with the elements **Operational log** and **Error log**.

7.2.5.1 Show Device Information

✧ Click the **Show device information** item in the navigation window.

The **Show device information** input/output window shows the following information (see figure 7-4):

- **Device information**: Information about the device and the installed software
- **Communication**: Information about the data transmission between device and periphery
- **Device date and time**: Information about the time settings of the device
- **Parameter set**: Information about the active and passive set of parameters

7.2.5.2 Save Device Information and Message Logs

✧ Click the **Save device information and logs** item in the navigation window.

The **Save device information** input/output window displays **Save**.

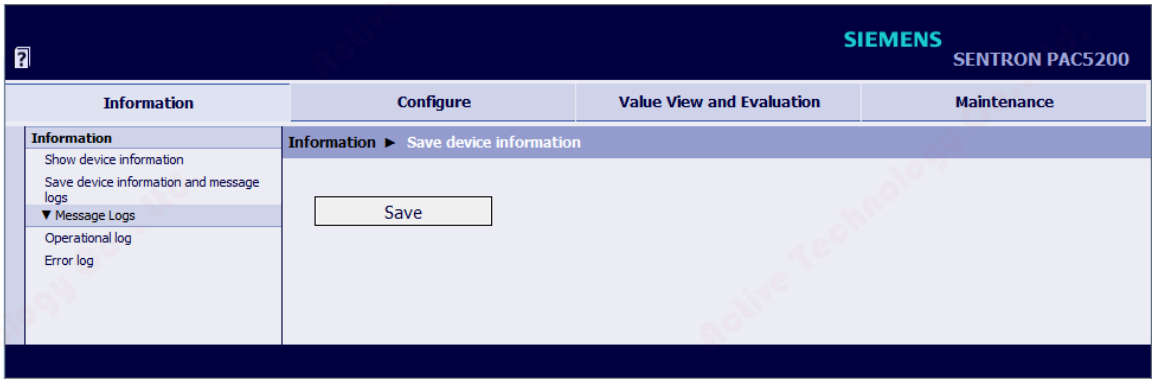


Figure 7-5 Information Tab, Save Device Information Input/Output Window

✧ Click **Save**.

The **Open/Save/Cancel** button choice opens.

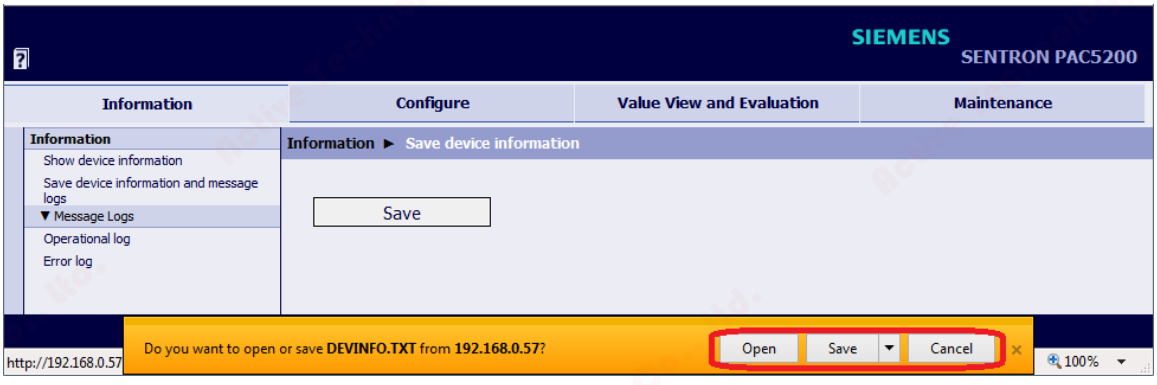


Figure 7-6 Open/Save/Cancel Button Choice

Save As

✧ Select in the button choice **Open/Save/Cancel** → **Save** → **Save As**:

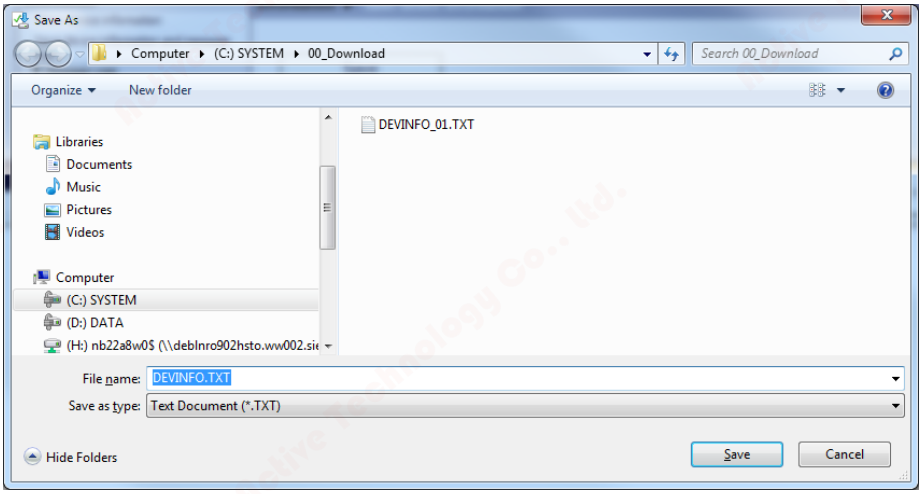


Figure 7-7 Save As Dialog

✧ Select the file path.

✧ Use the file name suggested in the **File name:** list box or enter a new file name with the file extension .TXT.

✧ Click **Save**.

✧ Close the button choice **Download has completed**.

Open

Alternatively, you can view the device information and logs on the screen and print them if needed. Proceed as follows:

✧ Click **Open** in **Open/Save/Cancel** button choice.

A text editor opens containing the device information (DEVICE INFORMATION), the operational indications (OPERATIONAL LOG) and the error messages (ERROR LOG) and file information.

✧ On the menu bar of the text editor, click **File** → **Print...**.

✧ Select the desired printer in the **Print** dialog and click **Print**.

The list is printed on the connected printer.

✧ Close the text editor.

✧ Click an element on the navigation window or a tab, or alternatively, click the **Back** icon on the toolbar of Microsoft Internet Explorer twice.

7.2.5.3 Message Logs Menu

The **Message Logs** menu contains operational indications and error messages registered and saved by the device during operation. The device can save up to 128 operational indications and up to 128 error messages. When the storage capacity is exceeded, the oldest indications will be overwritten successively.

Operational Log

To show the operational indications, proceed as follows:

✧ In the navigation window, select the **Message Logs** menu and then the **Operational log** menu item.

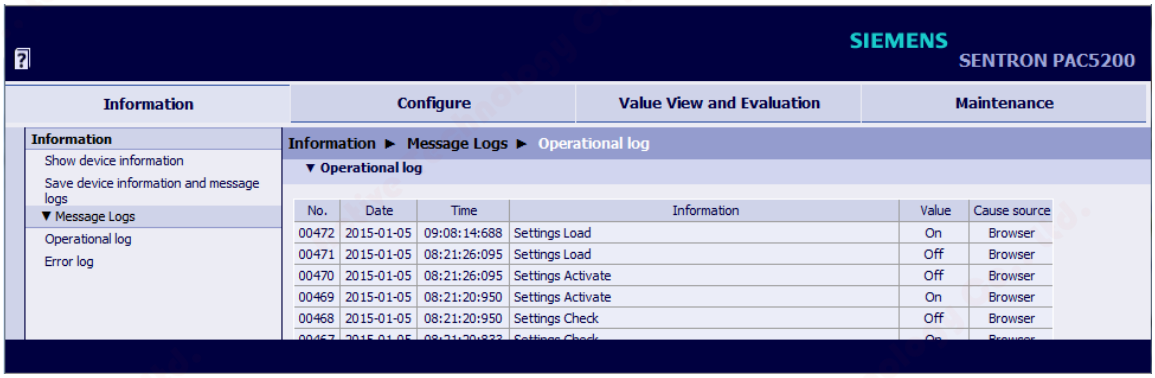


Figure 7-8 Information Tab, Operational Log

- Serial **No**.
- **Date** of registration
- **Time** of registration
- **Information** on the indication
- **Value** of the indication (On, Off or Invalid)
- **Cause source** of the indication (for example Internal, Browser)

NOTE

The operational indications can be printed as described in Save Device Information and Message Logs, section **File Download → Open**.

The Operational Log explains how to delete the operational indications manually.

Error Log

NOTE

The information about error messages described below is intended for service purposes. Inform the customer service about this information when there are problems with your device.

To display the error messages, proceed as follows:

✧ In the navigation window, click the **Message Logs** menu and then **Error log**.

The error messages are listed in the input/output window as follows:

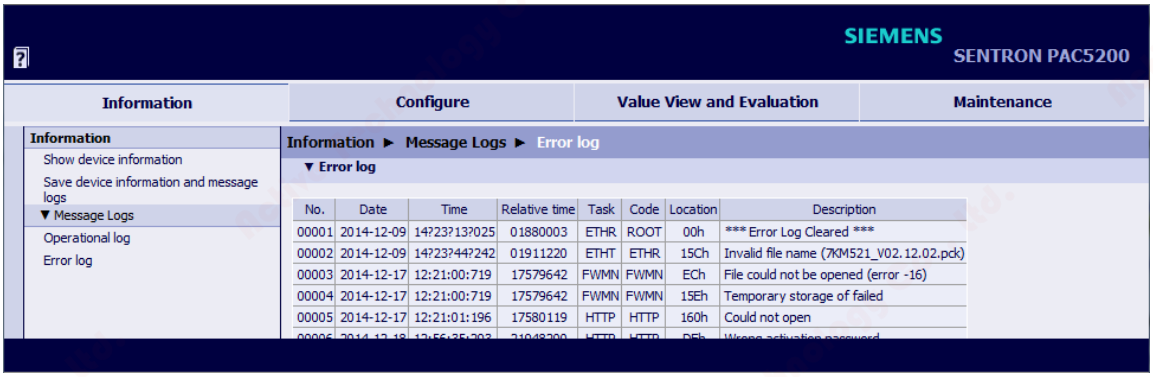


Figure 7-9 Information Tab, Error Log

- 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

The error messages can be printed as described in Save Device Information and Message Logs, section **File Download → Open**.

The Error Logs explains how to delete the error messages manually.

7.3 Configuration of the Device

NOTE

The device contains two 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**.

The following sections describe how to change and enable the passive set of parameters.

7.3.1 Device Configuration Procedure

If you have not changed the set of parameters since the first start of the device (see Initial Start of the Operation), use the factory settings (see Setting the Operational Parameters to Setting Administrative Parameters). To change the settings of the set of parameters, proceed as follows:

✧ Click the **Configure** tab on the user interface.

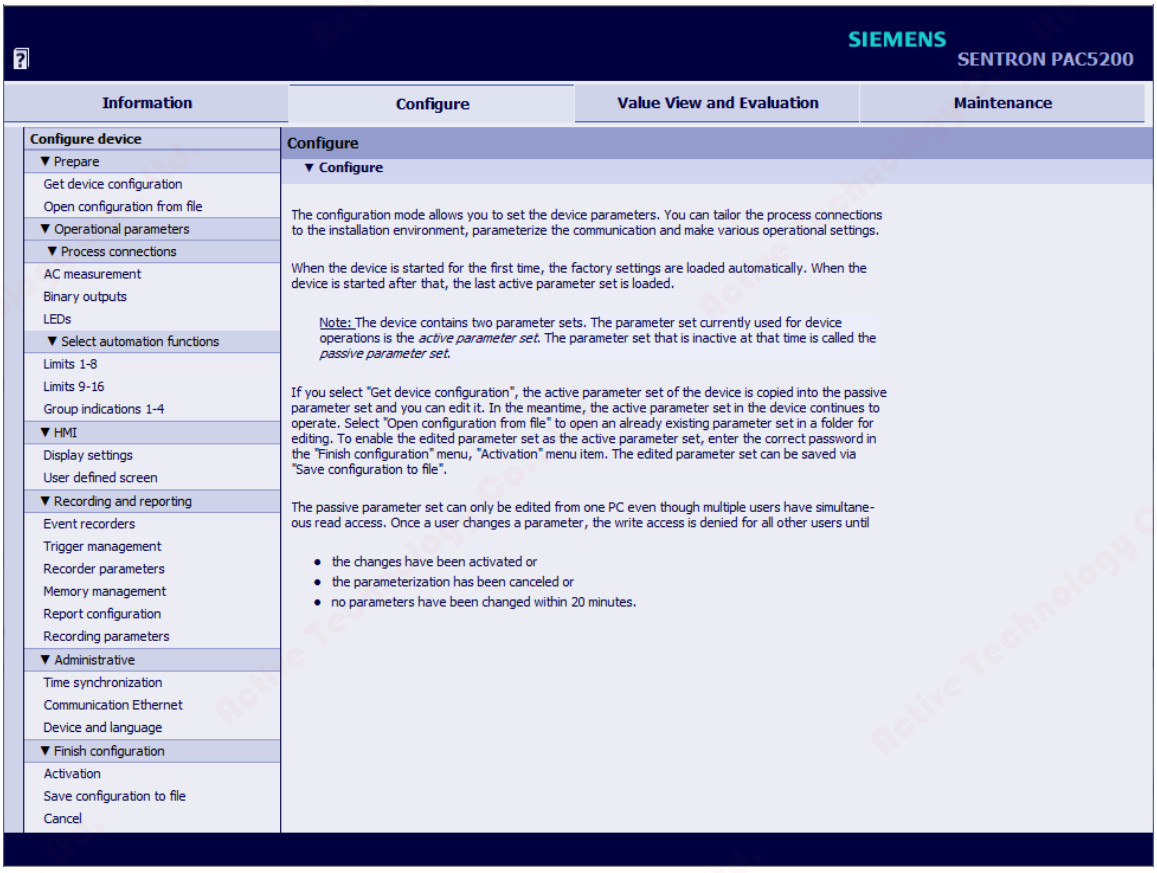


Figure 7-10 Configure Tab

✧ Select the **Prepare** menu in the navigation window and then either **Get device configuration** or **Open configuration from file**.

NOTE

If you have selected **Get device configuration**, an editable copy of the active parameter set of the device is displayed on the screen. In the meantime, the active parameter set in the device continues to operate.

If you have selected **Open configuration from file**, you can open and enable or edit the copy of a parameter set that was already created and saved to a folder.

7.3.1.1 Get Device Configuration

If you have selected **Get device configuration** in the **Configure** tab, you can open and edit either the **Get active configuration** or the **Get default configuration** in the input/output window. Proceed as follows:

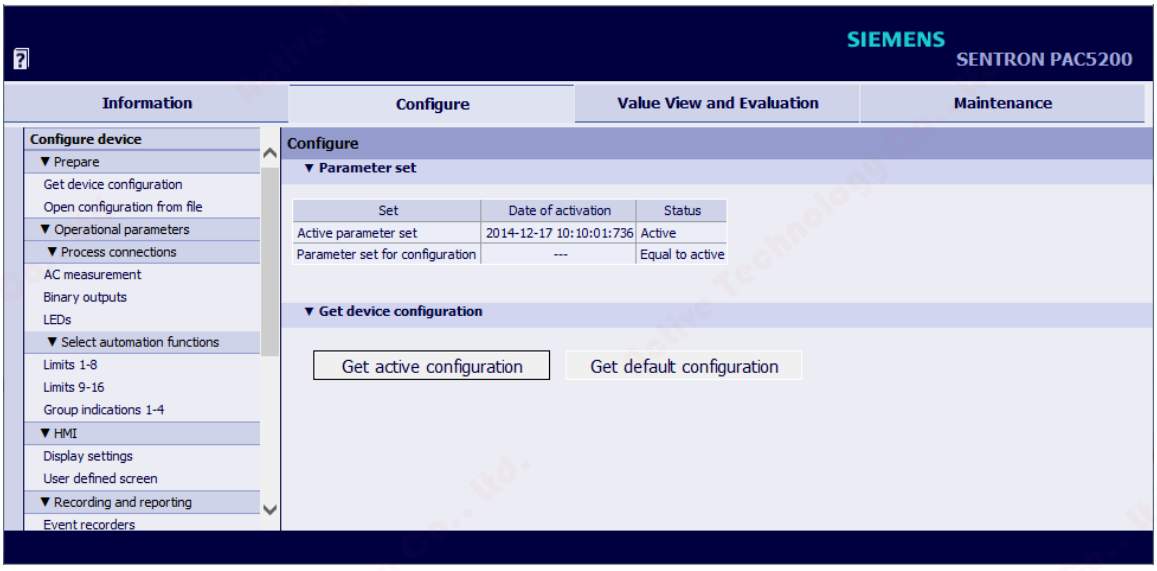


Figure 7-11 Configure Tab, Get Device Configuration

Get Active Configuration and Editing

✧ Click **Get active configuration**.

A copy of the active set of parameters (= passive set of parameters) of the device is opened for editing.

✧ Check and, if necessary, change the set parameters by opening the desired menus in the navigation window:

– **Operational parameters** menu according to Setting the Operational Parameters

– **Display** settings according to HMI

– **PQ Management** according to Recording and Reporting

– **Administrative** menu according to Setting Administrative Parameters.

✧ Activate the modified configuration as described in Finish Configuration.

Get Default Configuration and Editing

✧ Click **Get default configuration**.

A copy of the factory settings (= passive set of parameters) of the device is opened for editing.

NOTE

You can edit the displayed factory settings, activate and use them as active set of parameters. The original factory settings are not overwritten and can be used at anytime.

✧ Activate the modified configuration as described in Finish Configuration.

7.3.1.2 Open Configuration from File

If you have selected **Open configuration from file** in the **Configure** tab, you can open an already existing file in a folder. Proceed as follows:

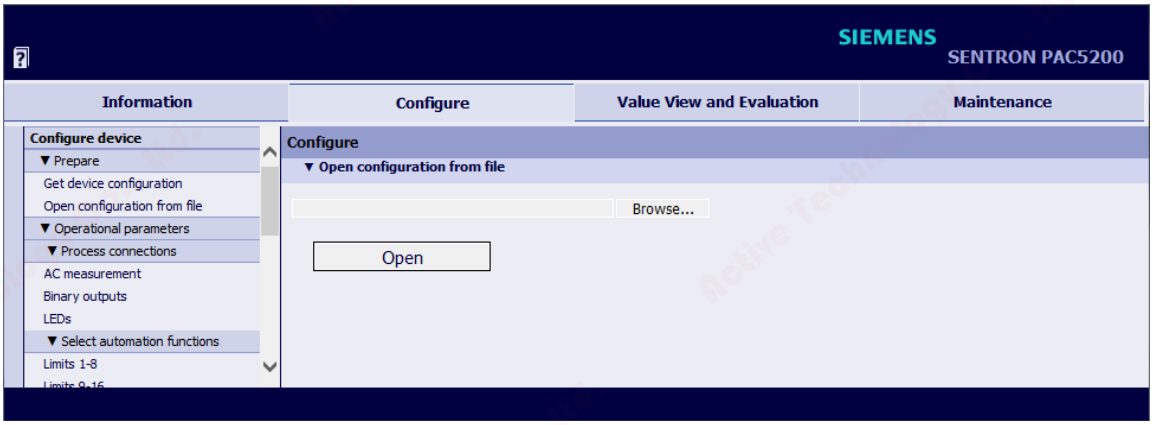


Figure 7-12 Configure Tab, Open Configuration from File

✧ Click **Browse...**.

The **Choose file** dialog opens.

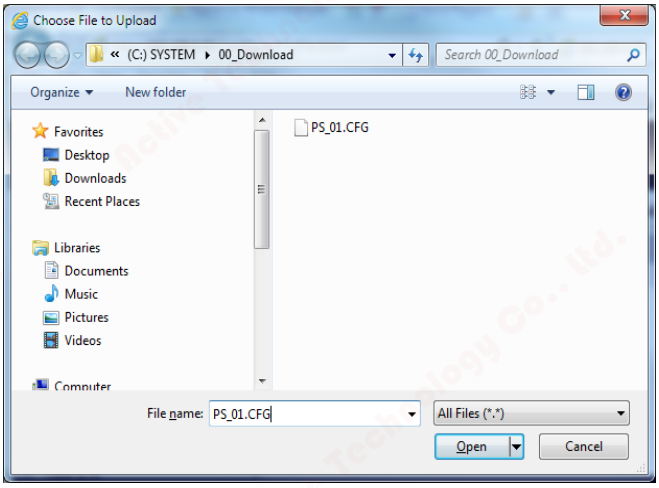


Figure 7-13 Choose File

✧ Select the desired file (extension .cfg) in the directory.

NOTE

You can open only files with the following properties of the file name:

- Maximum 8 characters and extension (.cfg)
- Only containing:
  - Letters: a to z, A to Z
  - Numbers: 0 to 9
  - Hyphen (-) and underline (_)

✧ Click **Open**.

The selected path is inserted into the **Browse** field in the input/output window, Figure 7-12.

✧ Click **Open**.

The device configuration from the CFG file is loaded.

7.3.1.3 Finish Configuration

When you have changed the configuration, you must either enable it as the active set of parameters or save it.

Activating the Set of Parameters

To **activate** the set of parameters, proceed as follows:

✧ In the navigation window, select the **Finish configuration** menu and click **Activation**.

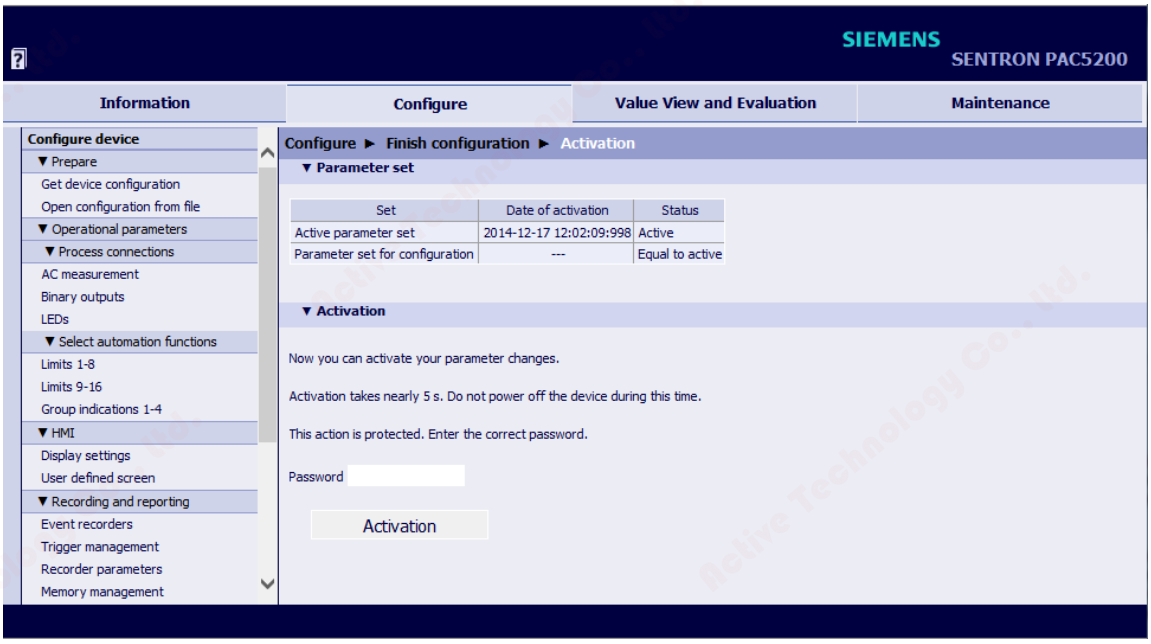


Figure 7-14 Configure Tab, Activation Input/Output Window

✧ In the **Activation** input/output window, enter the valid activation password into the **password** field. Device and Language explains how to set the activation password.

✧ Click **Activation**.

At first the message **Parameter activation is still in progress** will be shown and then the message **Parameter activation is complete** in the input/output window.

The modified set of parameters is loaded as the active set of parameters into the device and the new parameters take effect immediately.

If the password is wrong, this message appears: **The password is wrong. Please enter the correct password.**

NOTE

The active and passive set of parameters are listed in the **Activation** input/output window in the **Set** column for your information.

Save Configuration to File

You can save both the active and the passive configuration to a file. Proceed as follows:

✧ In the navigation window, select the **Finish configuration** menu and click **Save Configuration to File**.

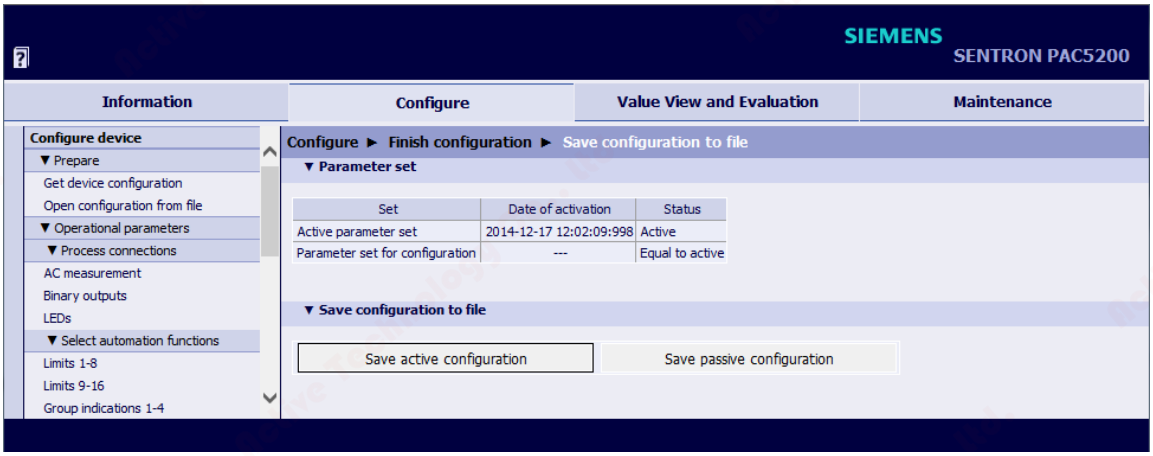


Figure 7-15 Configure Tab, Save Configuration to File Input/Output Window

✧ Click either **Save active configuration** or **Save passive configuration**.
The **Open/Save/Cancel** button choice opens.

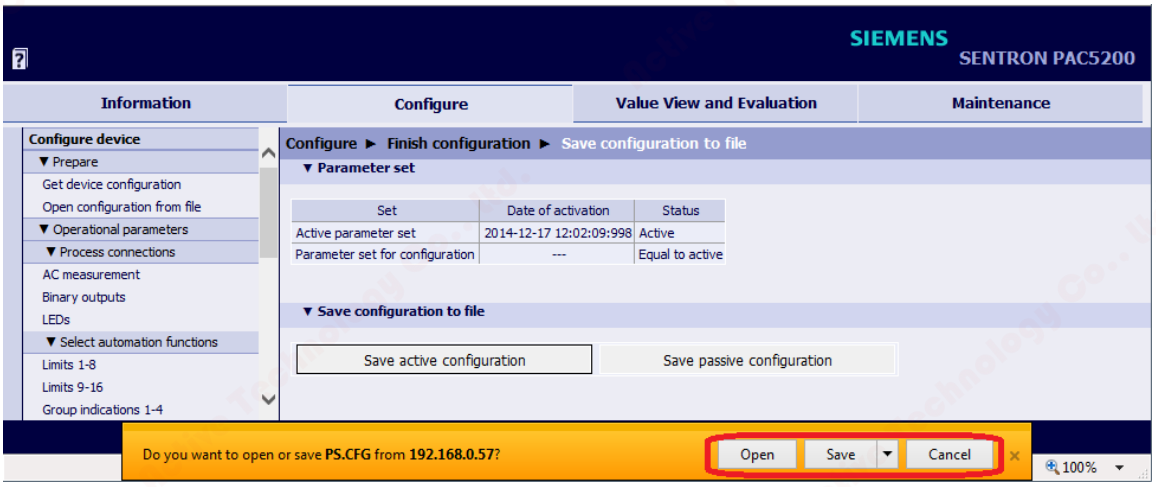


Figure 7-16 Open/Save/Cancel Button Choice

Save As

✧ Select in the button choice **Open/Save/Cancel** → **Save** → **Save As**:

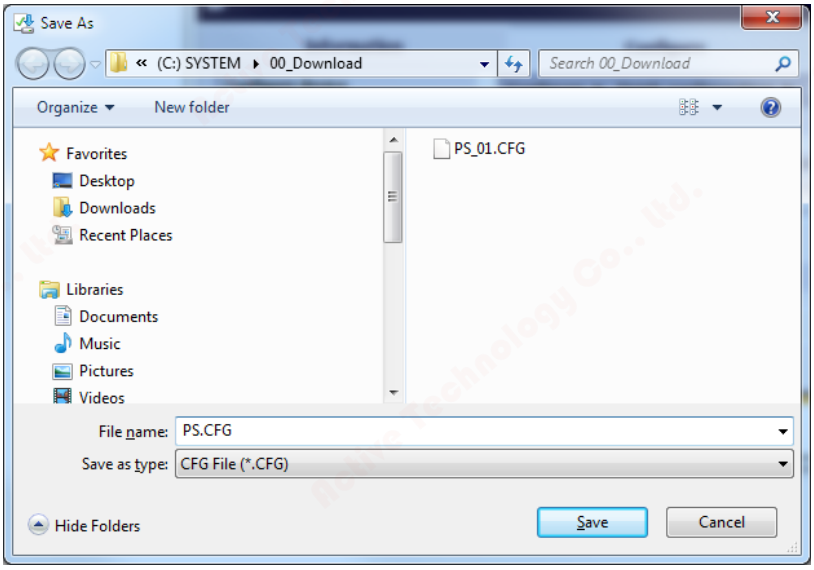


Figure 7-17 Save As Dialog

✧ Select the file path.

✧ Use the file name suggested in the **File name:** list box or enter a new file name with the file extension *.CFG.

NOTE

The length of file names must not exceed 8 characters. Use only characters according to NOTE in „**Open Configuration from File**“.

✧ Click **Save**.

✧ Close the button choice **Download has completed**.

Cancel

To cancel the configuration, proceed as follows:

✧ In the navigation window, select the **Finish configuration** menu and click **Cancel**.

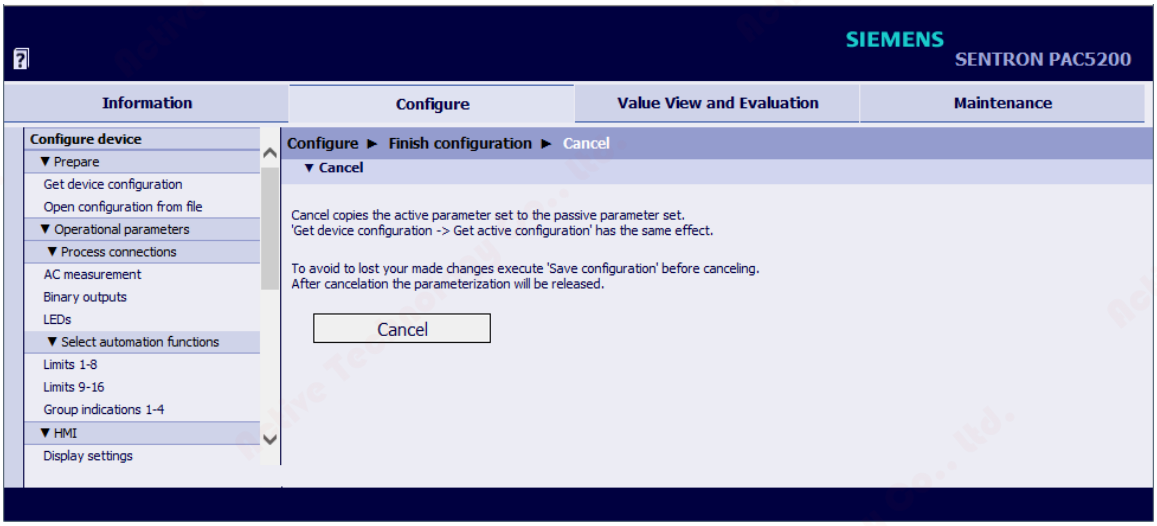


Figure 7-18 Configure Tab, Cancel Input/Output Window

✧ Click **Cancel** in the input/output window.

NOTE

After clicking **Cancel**, the active set of parameters is copied into the passive set of parameters. This action is the same as **Get device configuration** → **Get active configuration** described in Get Device Configuration.

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

7.3.2 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 3 web servers to the passive set of parameters.

Editing the Passive Set of Parameters

The passive set of parameters can only be edited from one computer or notebook even though multiple users have simultaneous read access.

Once a user changes a parameter on the user interface, 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 user interface. The user making the changes will see **modified** without brackets.

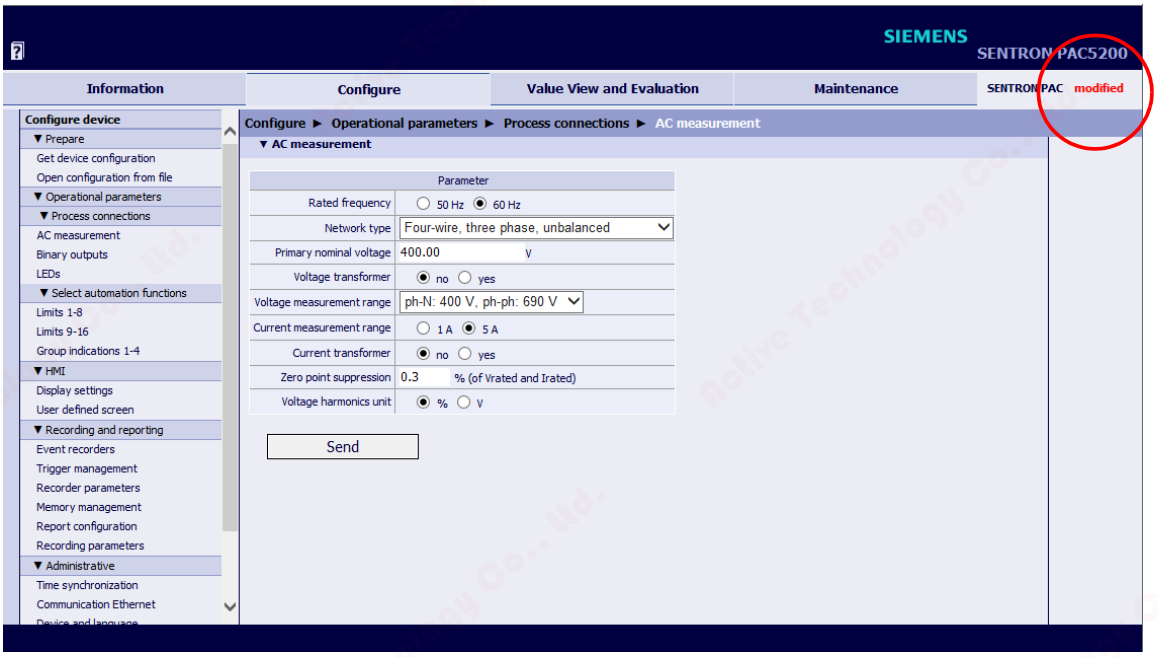


Figure 7-19 Access Blocked

If a user makes a change, 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.

7.3.3 Setting the Operational Parameters

In the **Configure** tab you can view and edit the set operational parameters. You can select the parameters in the **Operational** menu in the navigation window. The submenus **Process connections**, **Select automation function**, **HMI**, **PQ Management** and **Administrative** are available for making the settings. The submenus contain the following elements:

- Process connections
  - AC measurement
  - Binary outputs
  - LEDs
- Select automation functions
  - Measurand limits 1-8
  - Measurand limits 9-16
  - Group indications 1-4

NOTE

Observe the procedure for the device configuration described in Device Configuration Procedure when you set the operational parameters.

NOTE

If you change the **Network type** during ongoing operation, check the settings, measured values, and limiting values for inconsistencies. Check also the ICD 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.

7.3.3.1 Process Connections

7.3.3.1.1 AC Measurement

Default Settings and Setting Ranges of Measured-value Acquisition

NOTE

When setting the parameters, make sure that the set values are not contradictory.

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.

If the settings of the **Voltage transformer** (primary rated voltage and secondary rated voltage) are invalid (red) referred to the **Network type** and **Primary nominal voltage** of the network, they are not adjustable either (gray). The **Send** button is disabled. An entry is added in **Error log** message logs.

Table 7-2 Settings for Measured-value Acquisition

Parameter	Default Setting	Setting Range
Rated frequency	50 Hz	Setting 50 Hz: 50 Hz ±7.5 Hz Setting 60 Hz: 60 Hz ±9 Hz
Network type	Four-wire, 3-phase, unbalanced	Acc. to list box (see Operating Parameters)
Primary nominal voltage	AC 400.00 V	AC 1 V to AC 1 000 000 V, dependent on the setting range in the selected network type (see table 7-3)
Voltage transformer	no	yes no
At voltage transformer: yes		
Primary rated voltage	AC 400.00 V	AC 100.00 V to 1 000 000.00 V
Secondary rated voltage	AC 400.00 V	AC 1.0 V to 1000.0 V
Voltage measurement range	ph-N: AC 400 V (inject a maximum of AC 347 V for UL) ph-ph: AC 690 V (inject a maximum of AC 600 V for UL)	Acc. to list box (see Operating Parameters)
Current measurement range	AC 5 A	AC 1 A AC 5 A
Current transformer	no	yes no
At current transformer: yes		
Primary rated current	AC 1000.00 A	AC 1.00 A to 100 000.00 A
Secondary rated current	AC 1.00 A	AC 0.01 A to 10.00 A
Zero-point suppression [1)]	0.3 % (from Vrated, Irated)	0.0 % to 10.0 %
Voltage harmonic unit	%	% V

1) Voltage and current values smaller than/equal to the setting referred to 100 % are not included in the calculation and display.

To change the parameters of the measured-value acquisition, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Process connections** submenu and click **AC measurement**.

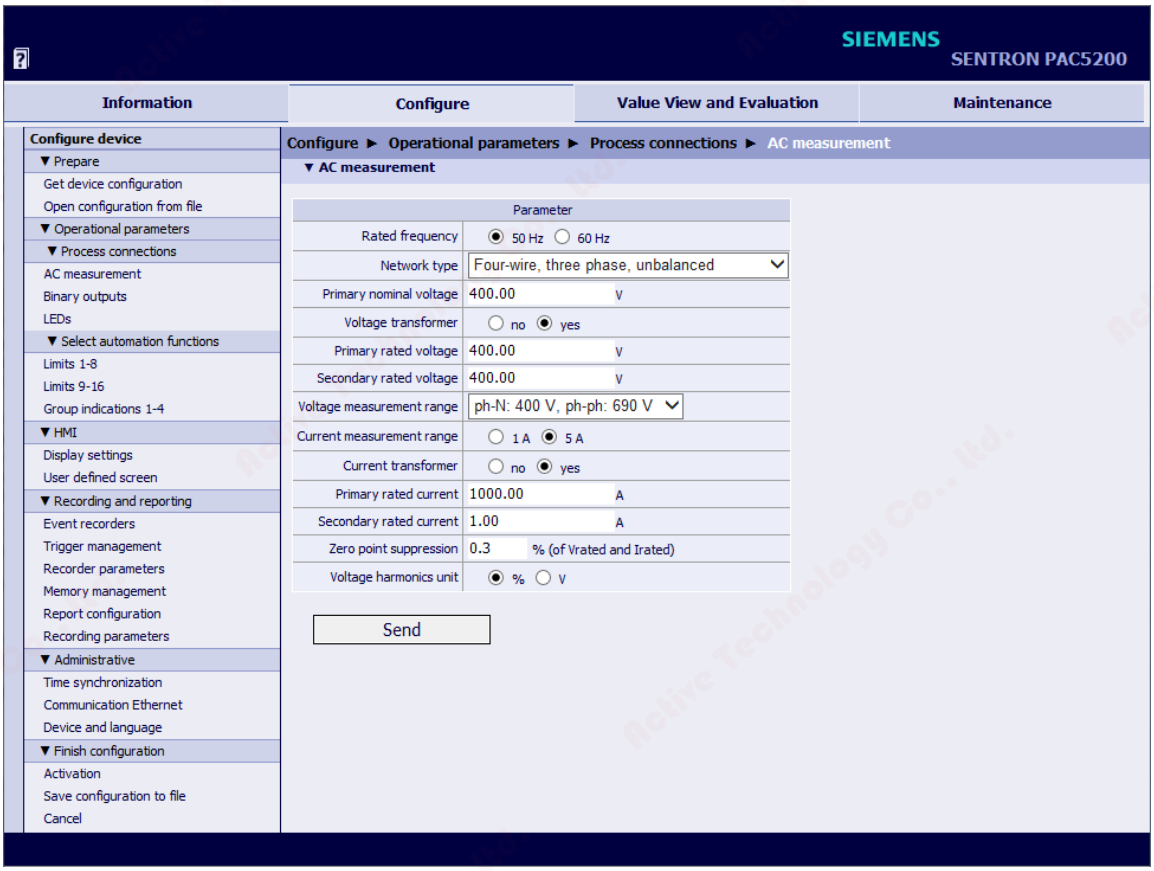


Figure 7-20 Configure Tab, AC Measurement Input/Output Window

✧ Enter the desired values in the fields and select the parameters in the list boxes and option fields as described in Table 7-2.

Dependent on the parameterized **Primary nominal voltage**, the following **Voltage measurement ranges** are set automatically and the following network types are possible:

Table 7-3 Settings for Primary Nominal Voltage

Primary Nominal Voltage	Selection of the Voltage Measurement Range	Selectable Network Types
AC 230 V	ph-N: 230 V, ph-ph: 400 V All other voltage measurement ranges are disabled.	all
AC 380 V (> AC 230 V * 1.2)	ph-N: 400 V, ph-ph: 690 V All other voltage measurement ranges are disabled.	all
> AC 480 V (> AC 400 V * 1.2)	ph-N: 400 V, ph-ph: 690 V All other voltage measurement ranges are disabled.	all three-wire network types

- ✧ If you are not using a voltage transformer and/or current transformer between the measurement object and SENTRON PAC5100/5200, click **no** in the respective option field. The associated fields for primary and secondary values are hidden in this case.
- ✧ After the parameterization click **Send**.

  The parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.3.1.2 Binary Outputs

Default Settings and Setting Ranges of the Binary Outputs

Table 7-4 Settings of Binary Outputs

Parameter	Default Setting	Setting Range
Source type	Indication	Indication Energy counter
Source Type Indication		
Indication	-none-	Acc. to list box (see Operating Parameters)
Source inverted	no	no yes
Operating mode	Persistent	Persistent Persistent with fail safe Pulse Pulse with retrigger
Output time for pulse operating mode (setting only possible if operating modes *Pulse* and *Pulse with retrigger*)	20 * 10 ms = 200 ms	50 ms to 3 600 000 ms
Source Type Energy Counter		
Energy counter	-none-	Acc. to list box (see Operating Parameters)
Energy increase per pulse	1.0 Wh	0.1 Wh/VAh/varh to 1 000 000 Wh/VAh/varh
Output time for pulse operating mode	20 * 10 ms = 200 ms	50 ms to 3 600 000 ms

To change the outputs of a binary output, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Process connections** submenu and click **Binary outputs**.

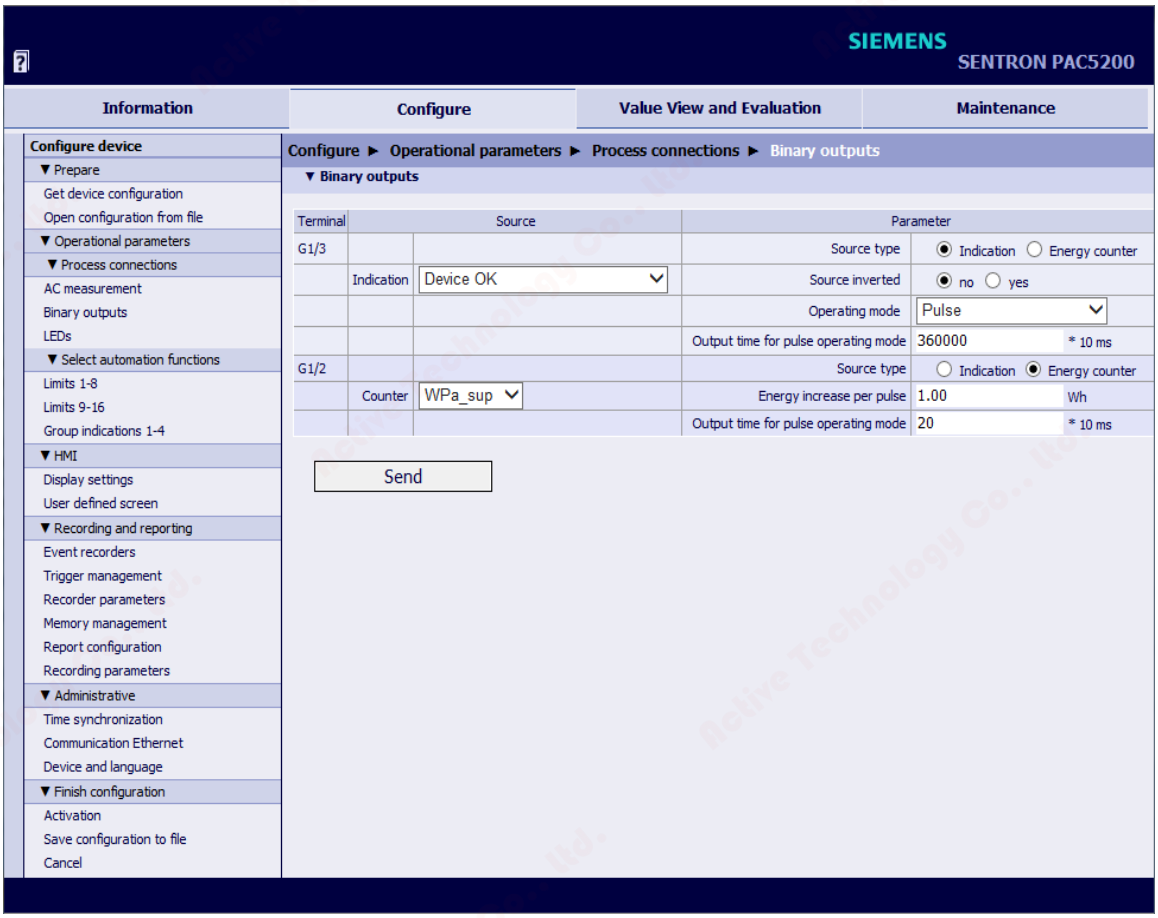


Figure 7-21 Configure Tab, Binary Outputs Input/Output Window

NOTE

The parameterization of both binary outputs is identical. Figure 7-21 depicts binary output **Terminal G1/3** as output for indications and binary output **Terminal G1/2** as energy counter.

You can only set either an indication or an energy counter for a binary output.

Parameterizing an Indication

✧ Select the desired parameters for an **indication** in the list boxes and option fields as described in Table 7-4.

NOTE

If you select **-not assigned-** as the **source** of an **indication** and/or **energy counter**, the corresponding binary output is inactive.

✧ You can select the following output types in the **Operating mode** list box:

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

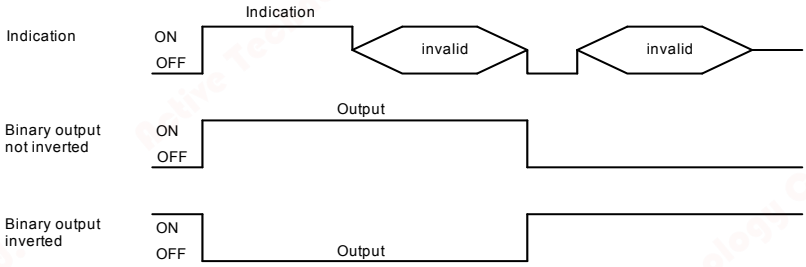


Figure 7-22 Persistent

– **Persistent with fail save**: If the indication becomes invalid, the binary output switches into the OFF state, that is if **Source inverted** = **no**, or it switches into the ON state if **Source inverted** = **yes**.

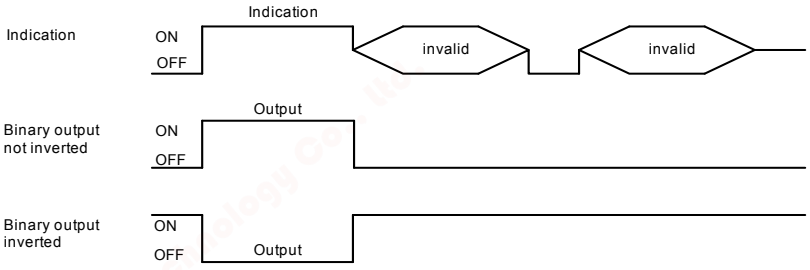


Figure 7-23 Persistent with Fail Save

– **Pulse** without retrigger: 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.

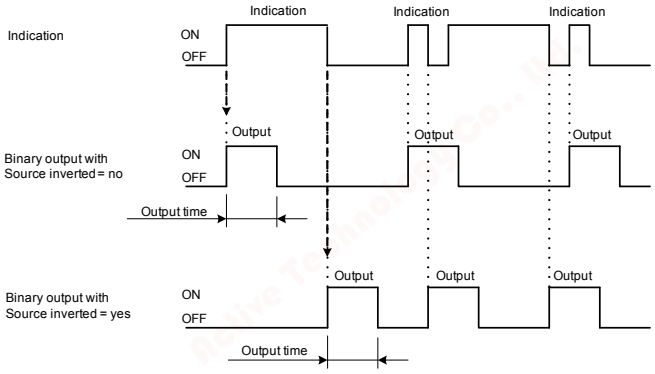


Figure 7-24 Pulse without Retrigger

– **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.

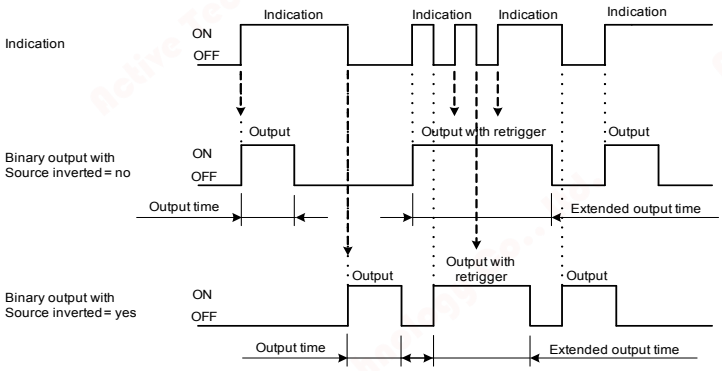


Figure 7-25 Pulse with Retrigger

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

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.

✧ After the parameterization click **Send**.
The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

Parameterizing an Energy Counter (see Figure 7-21, for example terminal G1/2)

✧ Enter the desired values into the fields and select the parameter in the list box as described in Table 7-4.

✧ After the parameterization click **Send**.
The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.3.1.3 LEDs

Default Settings and Setting Options of the LEDs

Table 7-5 LED Settings

LED	Default Setting	Setting Options
RUN	Device ready	Not settable
ERROR	-none-	Errors are signaled as parameterized (only error indications can be parameterized). Acc. to list box (see Operating Parameters)
H1	-none-	Acc. to list box (see Operating Parameters)
H2		
Indication inverted	no	no yes

To change the outputs of the LEDs H1, H2, and ERROR, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Process connections** submenu and click **LEDs**.

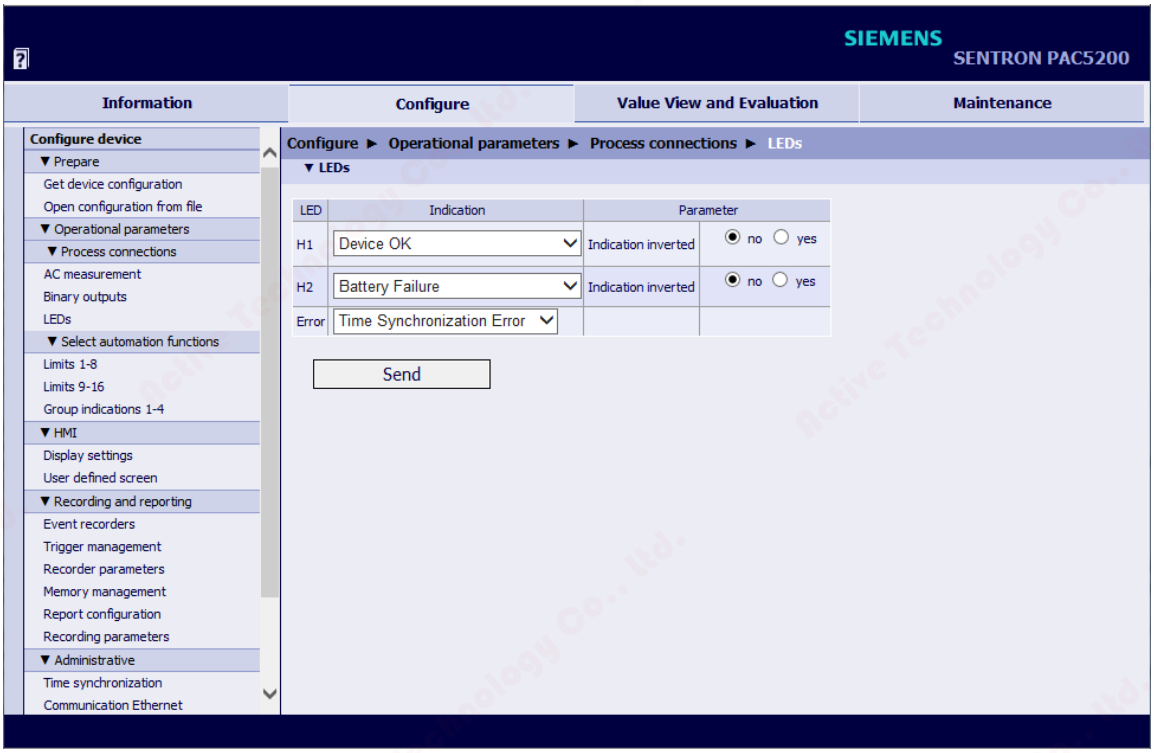


Figure 7-26 Configure Tab, LEDs Input/Output Window

✧ Select the desired parameters in the list boxes and option fields as described in Table 7-5.

NOTE

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

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

Behavior of the LEDs

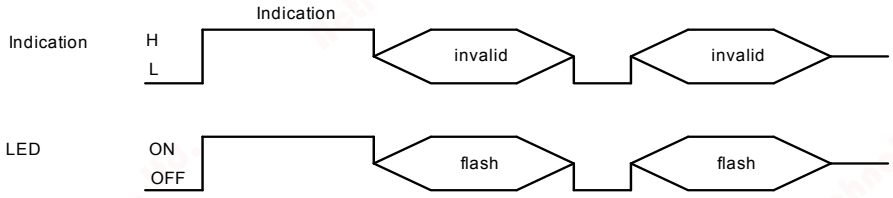


Figure 7-27 Behavior of the LEDs

7.3.3.2 Automation Functions

7.3.3.2.1 Limit Settings

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 value range can be output as indications. Up to 4 limiting value violations can be signaled at the device via the two binary outputs and the LEDs H1 and H2. Furthermore, all 16 limit violations can be sent to peripheral devices via Ethernet.

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

Default Settings and Setting Ranges of the Limits

Table 7-6 Limit Settings

Parameter	Default Setting	Setting Range
Measurand	-none-	Acc. to list box (see Operating Parameters)
Limit	0.0	-1 000 000 000 to 1 000 000 000 (unit)
Limit type	Lower	Lower Upper
Hysteresis (%)	1.0	0.0 to 10.0
Violation indication	Limit Violation x (x = 1 to 16)	The name of the limit violation indication is customizable.

Parameterizing a Limit

To change, for example, limit 1, proceed as follows:

✧ In the navigation window, select the **Operational** menu, then the **Select automation functions** submenu and click **Measurand limits 1-8**.

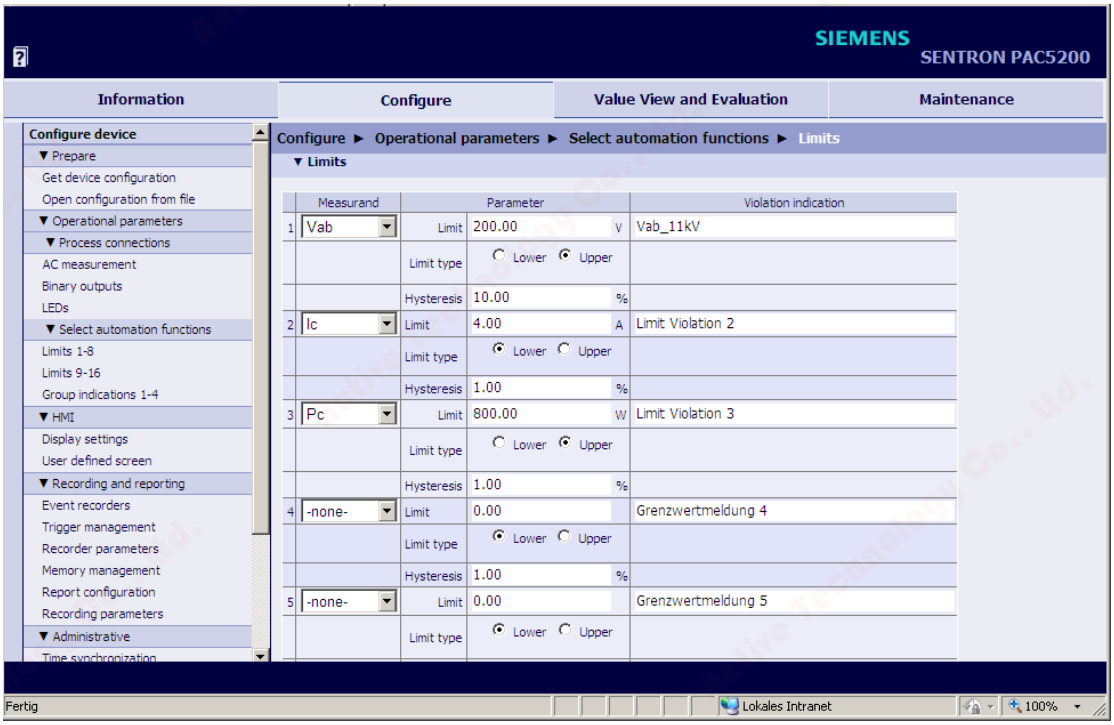


Figure 7-28 Configure Tab, Measurand Limits 1-8 Input/Output Window (Detail)

✧ Enter the desired values in the fields and select the parameters in the list boxes and option fields as described in Table 7-6.

Hysteresis of the Limit Value Violation

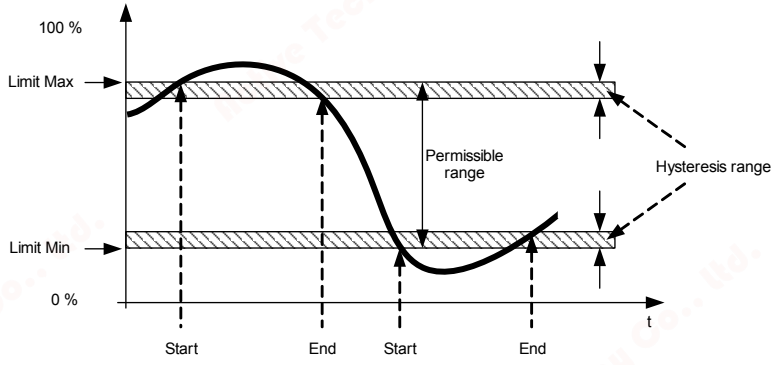


Figure 7-29 Hysteresis (General Representation)

NOTE

Select **Measurand -none-** to disable the corresponding measurand limit indication.

NOTE

Which quantities are offered in the **Measurand** list box depends on the configured network type. The **Network type** is specified in the **Process connections** submenu, **AC measurement** input/output window, see AC Measurement.

- ✧ After the parameterization click **Send**.
  The parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.3.2.2 Group Indications

In the **Select automation functions** menu, up to 4 **Group indications** can be parameterized and each of them can be assigned up to 4 logically linked single-point indications. The single-point indications can be inverted.

Default Settings and Setting of the Group Indications

Table 7-7 Group Indications

Parameter	Default Setting	Setting Range
Source	-none-	Acc. to list box (see Operating Parameters)
Source inverted	no	no yes
Logic operation	NONE	NONE OR AND
Group indication name	Group Indication x (x = 1 to 4)	Any

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

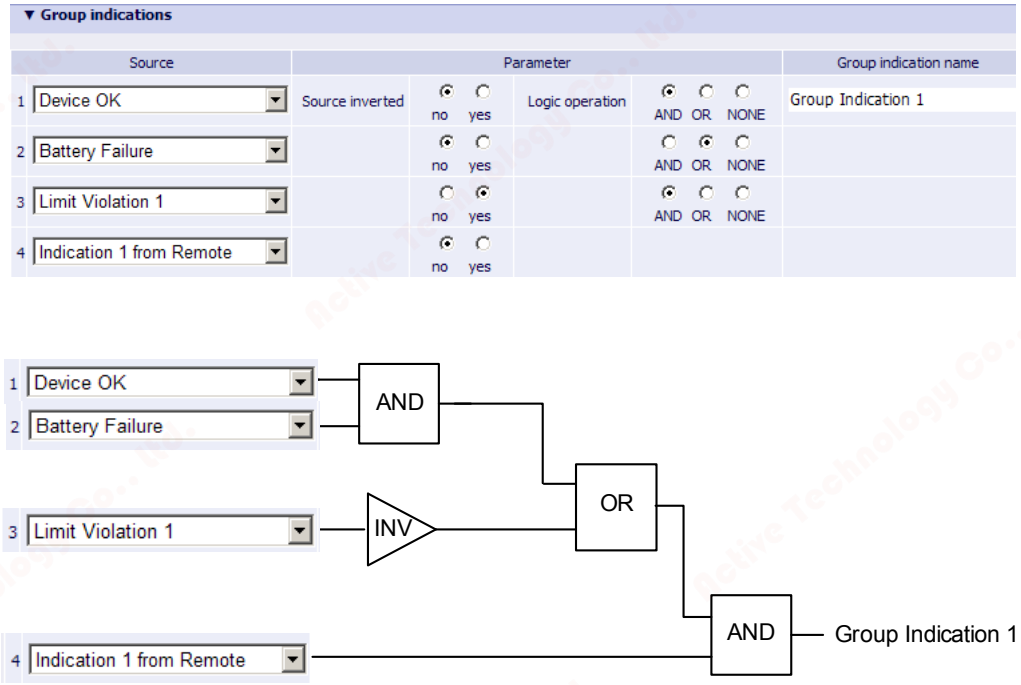


Figure 7-30 Example: Linking 4 Indications to a Group Indication

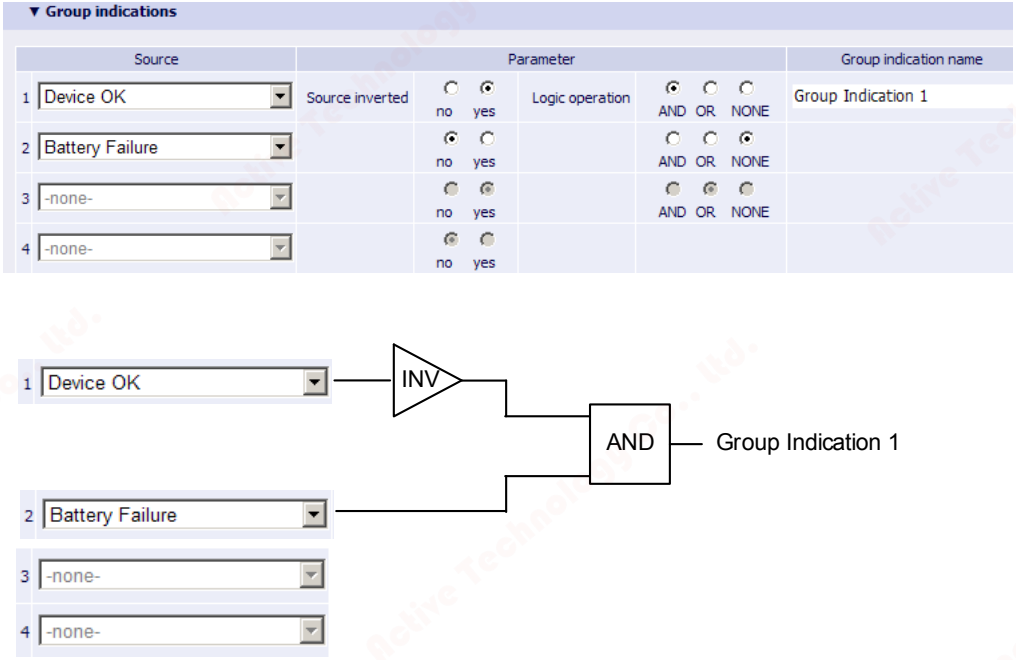


Figure 7-31 Example: Linking 2 Indications to a Group Indication

Parameterizing a Group Indication

To change, for example, group indication 1, proceed as follows:

✧ In the navigation window, select the **Operational parameters** menu, then the **Select automation functions** submenu and click **Group indications 1-4**.

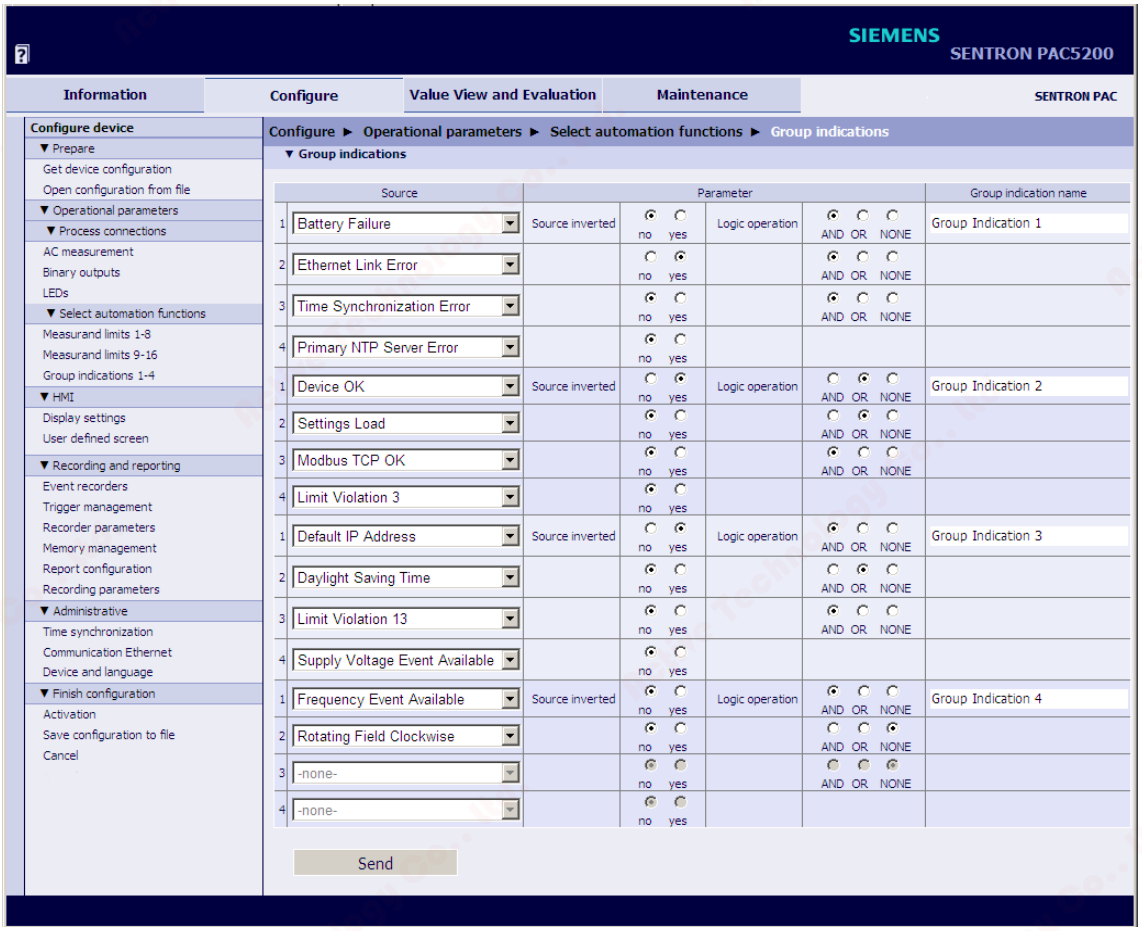


Figure 7-32 Configure Tab, Group Indications Input/Output Window (Detail)

✧ Select the desired parameters in the list boxes and option fields as described in Table 7-7.

NOTE

If you select **-none-** for all 4 indications of a group indication, the respective group indication is inactive.

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

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.4 HMI

7.3.4.1 Display Settings

Default Settings and Setting Ranges

Table 7-8 Display Settings

Parameter	Default Setting	Setting Range
Contrast	8	0 to 10
Time until dimmed	10	0 min to 99 min
Refresh time	1000	330 ms to 3000 ms
Inverse display	no	no yes
Phase label	(L1,L2,L3)	(L1,L2,L3) (a,b,c)
Use password	yes	no yes

To change the properties of the display, proceed as follows:

✧ In the navigation window, select the **HMI** menu and click **LCD Property**.

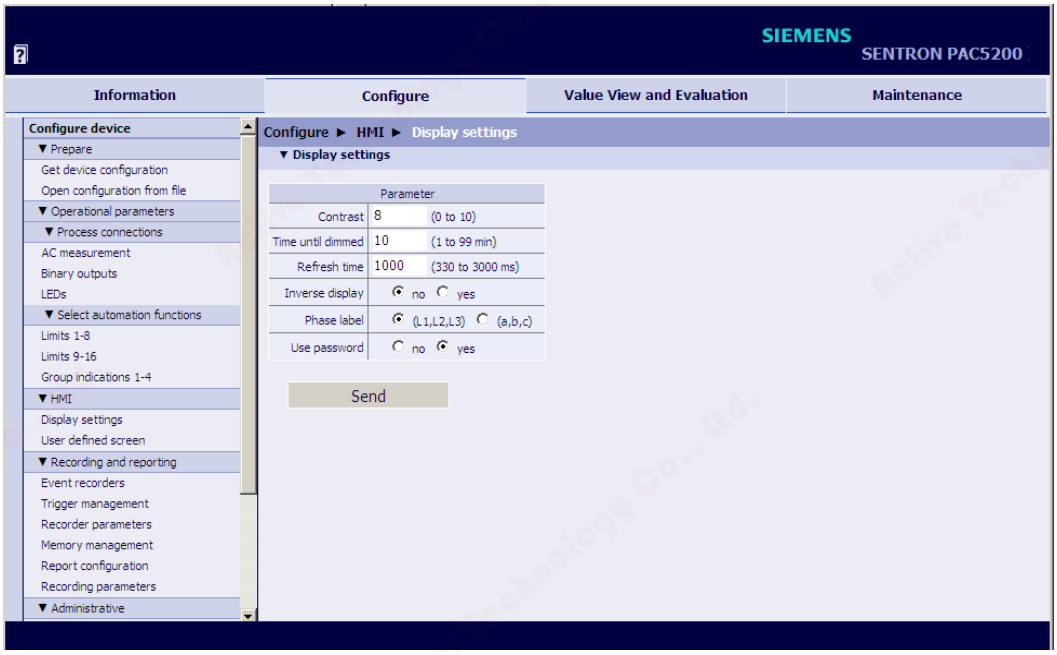


Figure 7-33 Configure Tab, Display Settings Input/Output Window

- ✧ Enter the desired values into the fields and select the corresponding parameters in the option fields as described in Table 7-8.
- ✧ After the parameterization click **Send**.

  The parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

Use Password

If you select the option **Use password = no**, no password is required to parameterize the device with the softkeys.

If you select the option **Use password = yes**, you must first enter the activation password (default setting 000000) before you can edit the device settings. After you have entered the correct password, you can change the parameterization using the softkeys within the next 15 minutes. After this time you have to re-enter the password at the device.

7.3.4.2 User Defined Screens

In the **User defined screen** menu 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 is presently displayed on the device, you must use the device softkeys and the HTML page.

Default Settings and Setting Ranges

Table 7-9 Settings of User Screens

Parameter	Default Setting	Setting Range
Screen type	-none- [1)]	-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)	any
2 measured values, numerical Display 1, numerical Display 2, numerical	-none-	Acc. to list box (see Operating Parameters)
4 measured values, numerical Display 1, numerical Display 2, numerical Display 3, numerical Display 4, numerical	-none-	Acc. to list box (see Operating Parameters)
2 measured values, graphical and numerical Display 1, graph./num. Display 2, graph./num.	-none-	Acc. to list box (see Operating Parameters)
3 measured values, graphical and numerical Display 1, graph./num. Display 2, graph./num. Display 3, graph./num.	-none-	Acc. to list box (see Operating Parameters)
Display x, graph./num. (x = 1 to 3) Min value Max value	 1.0 10.0 (unit according to measured value)	 The minimum and maximum value are defined by the selected parameters (see AC Measurement).

[1)] If you have not made any selection, the displays explained in the following do not exist.

To change the User define screens, proceed as follows:

✧ In the navigation window, select the **HMI** menu and click **User Define Screen**.

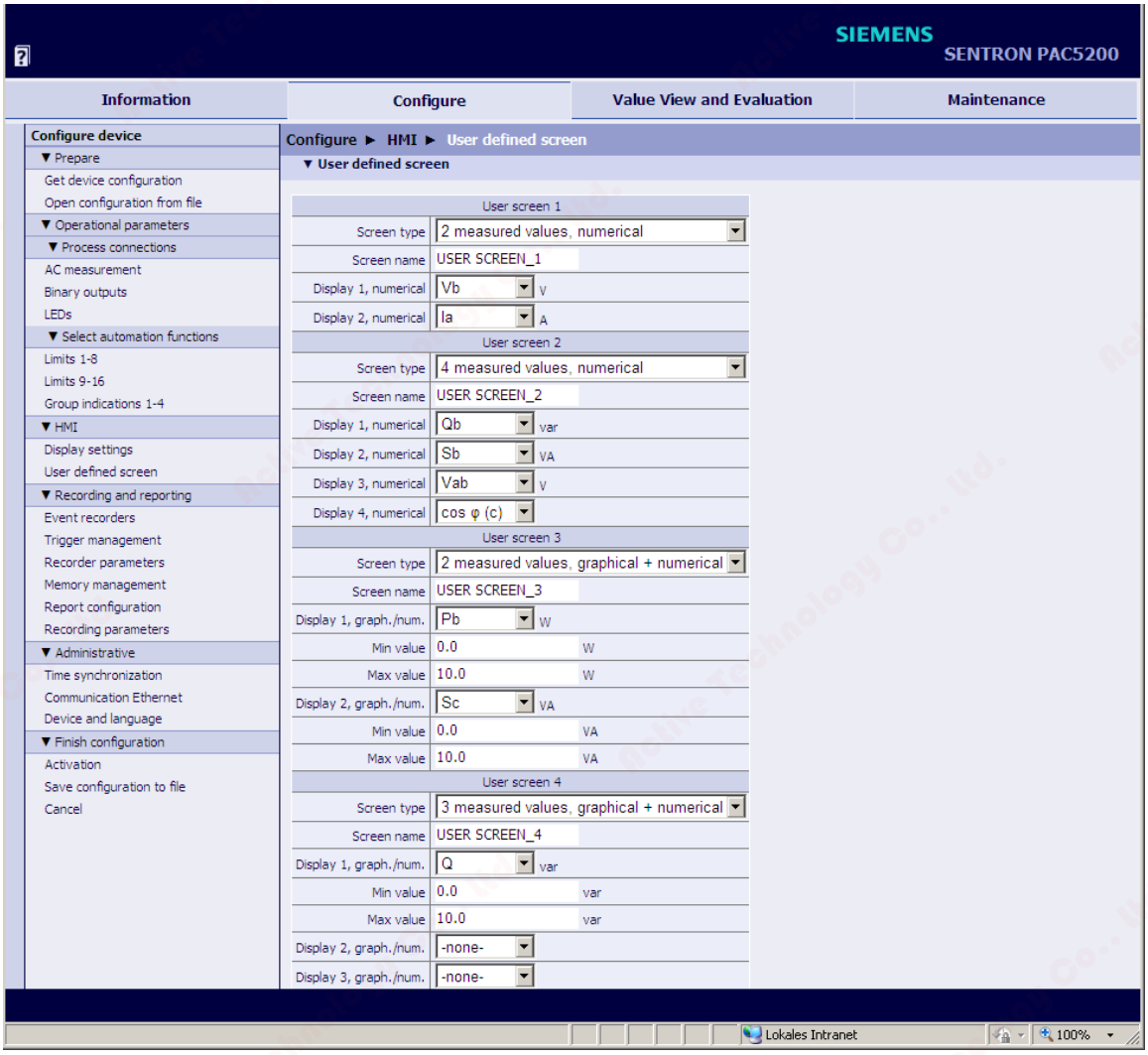


Figure 7-34 Configure Tab, User Define Screen Input/Output Window

✧ Select the respective parameters in the list boxes according to Table 7-9.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.5 Recording and Reporting

7.3.5.1 Event Recorders

Default Settings and Setting Ranges

Table 7-10 Event Recorders

Parameter	Default Setting	Setting Range
Supply voltage		
Swell threshold	110 %	105 % to 140 % in 5-% steps
Dip threshold	90 %	75 % to 95 % in 5-% steps
Interruption threshold	5 %	1 %, 2 %, 3 %, 5 %, 8 % 10 %
Event hysteresis	2 %	1 % to 6 % in 1-% steps
Frequency		
Underfrequency threshold	1 %	0.1 % to 0.9 % in 0.1-% steps 1 % to 5 % in 1-% steps
Overfrequency threshold	1 %	0.1 % to 0.9 % in 0.1-% steps 1 % to 5 % in 1-% steps
Unbalance		
Voltage unbalance threshold	5 %	1 % to 5 % in 1-% steps

To change the **Event Recorders**, proceed as follows:

✧ In the navigation window, select the **Recording and Reporting** menu and click **Event Recorders**.

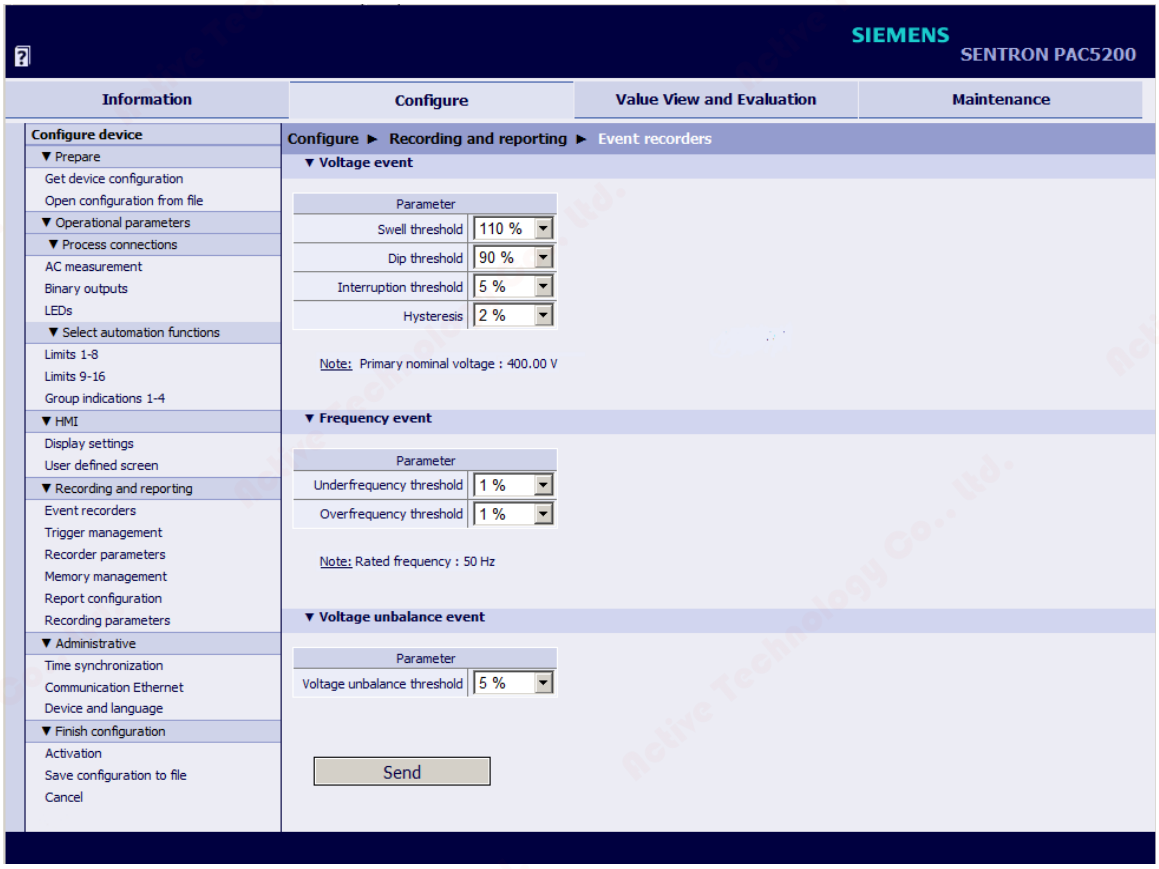


Figure 7-35 Configure Tab, Event Recorders Input/Output Window

✧ Select the respective parameters in the list boxes according to Table 7-10.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.5.2 Trigger Management

Default Settings and Setting Ranges

Table 7-11 Trigger Management

Parameter	Default Setting	Setting Range
Voltage trigger limits		
Trigger active	no	no yes
Tolerance unit	Percentage	Percentage Numerical
Lower threshold	90.00 % of the primary nominal voltage	0.00 % to 99.99 % of the of the primary nominal voltage 0.0 V to 1 000 000.0 V
Upper threshold	110.00 % of the primary nominal voltage	100.0 % to 10 000.0 % of the of the primary nominal voltage 0.0 V to 1 000 000.0 V
Hysteresis	2.00 % of the primary nominal voltage	0.0 % to 50.0 % of the of the primary nominal voltage
Current trigger limits		
Trigger active	no	no yes
Tolerance unit	Percentage	Percentage Numerical
Lower threshold	90.00 % of nominal current In	0.00 % to 99.99 % of of nominal current In 0.0 A to 1 000 000.0 A
Upper threshold	110.00 % of nominal current In	100.0 % to 10 000.0 % of of nominal current In 0.0 A to 1 000 000 A
Hysteresis	2.00 % of nominal current In	0.0 % to 50.0 % of of nominal current In
Waveform capture setting		
Total recording duration	2.0 s	0.2 s to 3.0 s in 0.2-s steps
Pretrigger ratio	10 %	0 % to 30 % in 5-% steps
Record ph-ph voltage	no	no yes

To change the **trigger management** settings, proceed as follows:

✧ In the navigation window, select the **Recording and Reporting** menu and click **Trigger management**.

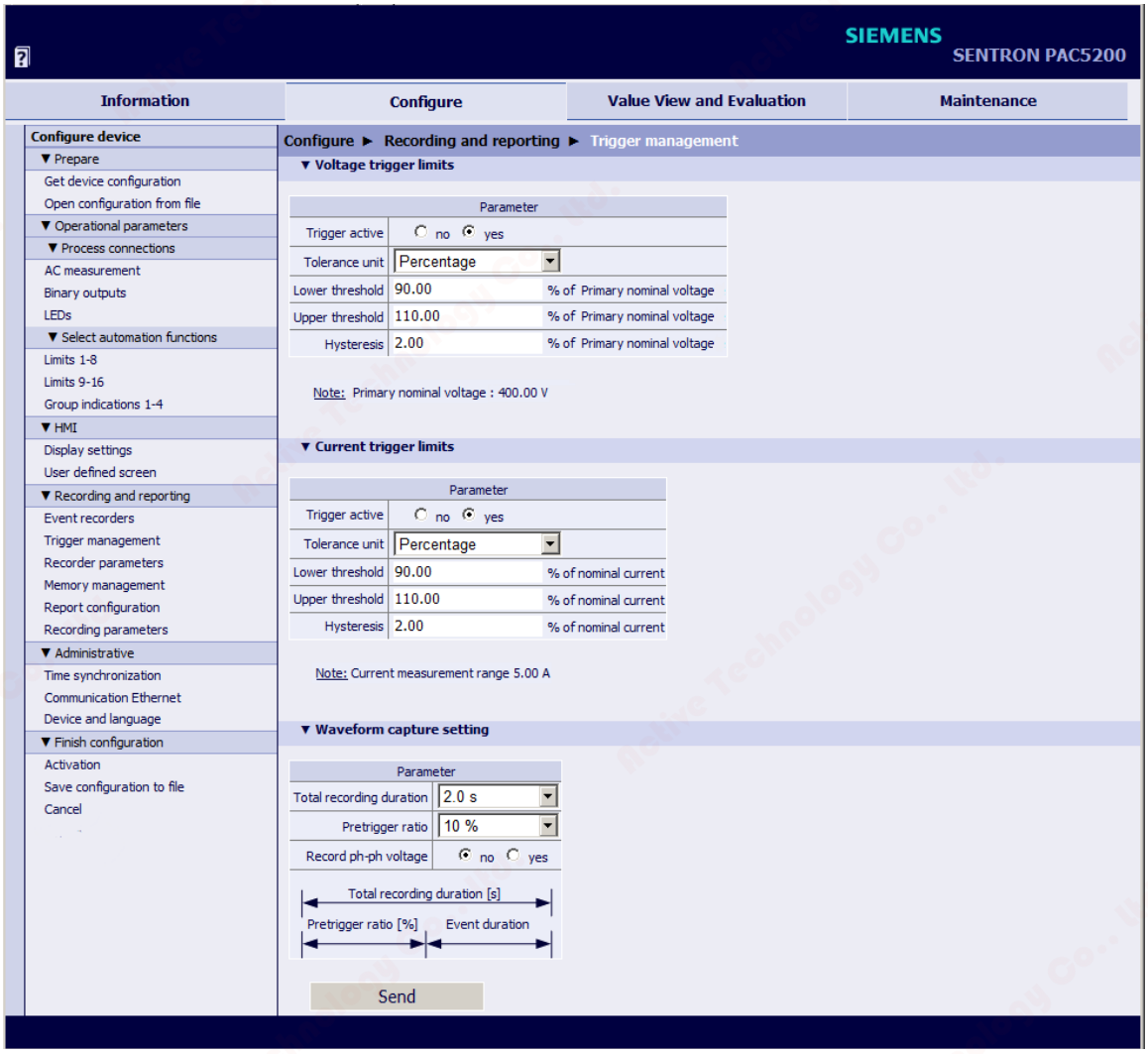


Figure 7-36 Configure Tab, Trigger Management Input/Output Window

✧ Select the respective parameters in the list boxes according to Table 7-11.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.5.3 Recorder Parameters

Default Settings and Setting Ranges

Table 7-12 Recorder Management

Parameter	Default Setting	Setting Range	
Measurement Recorder			
Average intervals - Frequency	10 s	fixed	
Short term flicker	10 min	fixed	
Long term flicker	2 h	fixed	
Average interval - Voltage / Unbalance / Harmonics	10 min	30 s, 1 min, 10 min, 15 min, 30 min, 1 h, 2 h	
Record additional data (I, P, Q, S etc.)	no	no yes	
Recorder of average - Min	no	no yes	
Recorder of average - Max	no	no yes	
Harmonics	Odd	Even Odd All	
File generation every: (corresponds to the setting of the *Average interval* parameter) The created PQDIF files can be downloaded via the User Interface.	24 h	File generation every:	At average interval
		1 h (fix)	30 s
		2 h (fix)	1 min
		2 h	10 min, 15 min, 30 min, 1 h or 2 h
		4 h	
		6 h	
		12 h	
		24 h	
Recorded file type	PQDIF	PQDIF (see chapter 7.4.2.4) CSV All	
Flicker lamp model	230 V	230 V 120 V	
Trend Recorder			
Tolerance unit	Percentage	Percentage Numerical	
Tolerance number	Percentage: 3 % of declared input voltage Udin, Numerical: 0.50 V	1 % to 5 % in 1 % steps 0.2 V to 500.0 V	
Maximum recording interval	10 min	10 min, 30 min, 1 h, 2 h, 4 h, 6 h, 12 h, 24 h [1)]	

1) The trend recorder also creates a PQDIF file when 1024 data points (voltage values with a time stamp) have been generated within the recording interval.

To change the **Recorder parameters**, proceed as follows:

✧ In the navigation window, select the **Recording and Reporting** menu and click **Recorder parameters**.

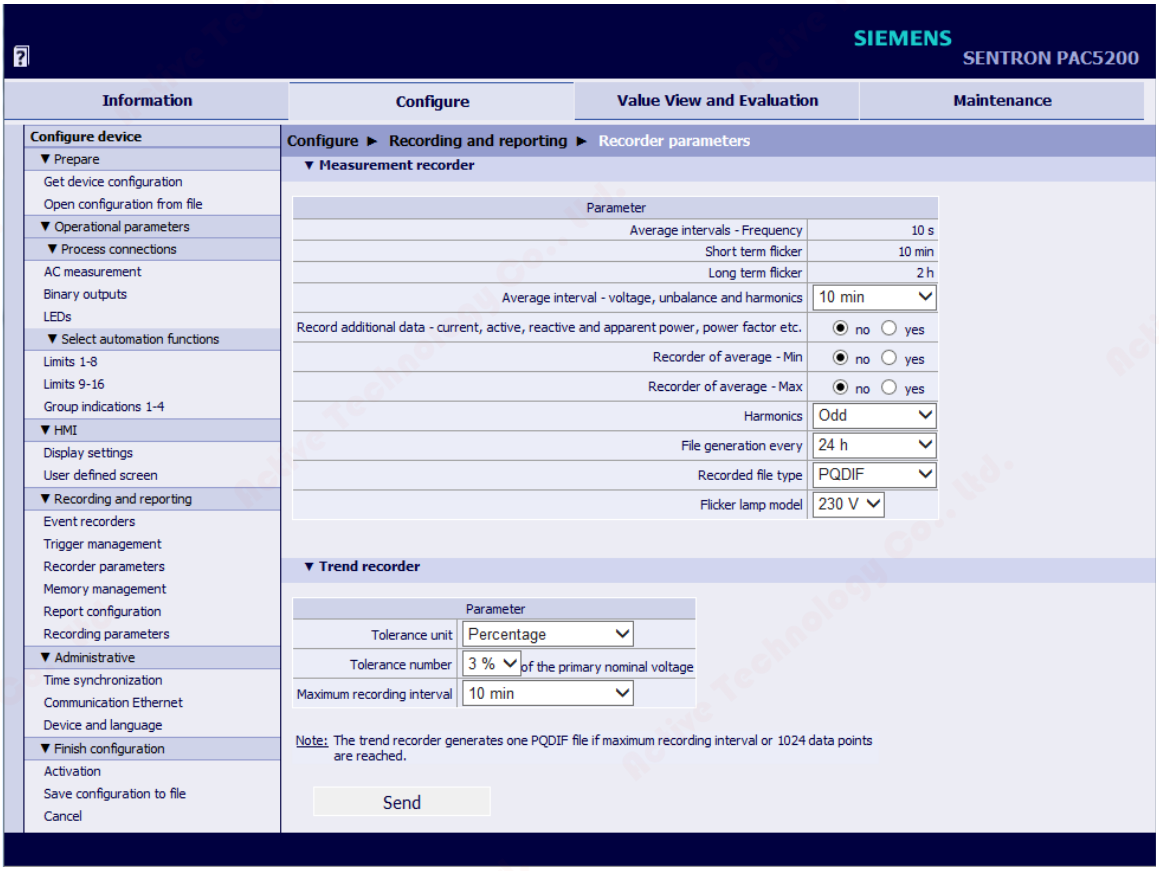


Figure 7-37 Configure Tab, Recorder Parameters Input/Output Window

✧ Select the desired parameters in the list boxes and option fields as described in Table 7-12.

NOTE

The voltage is recorded in the following connection types:

- in the connection type 3P4W (3 phases/4 wires): phase-to-phase voltage or phase-to-ground voltage
- in the connection type 3P3W (3 phases/3 wires): only phase-to-phase voltage

NOTE

Siemens recommends selecting the **PQDIF** setting from the **Recorded file type** list box. When selecting **All** or **CSV**, the internal memory will be full prematurely if the CSV file becomes very large compared to the PQDIF file.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

The Measured Value Recorder Intervals and the PQDIF Files

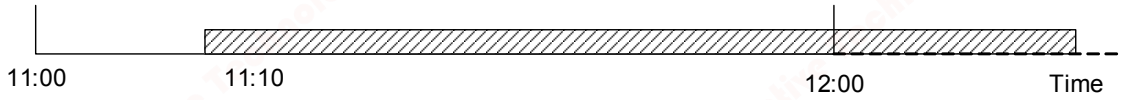
The measurement value recorder is responsible for recording average values, min and max values.

The measured values recorder intervals are defined according to the averaging intervals setting.

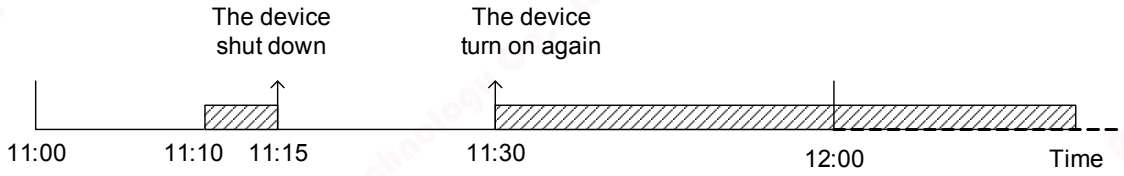
Table 7-13 PQDIF File Interval (measured value recorder)

Set averaging interval	Recording duration for creating a PQDIF file	Time at start of recording of a complete PQDIF file	Start of recording (recorder start option)
30 s	1 h	00:00 h 01:00 h 02.00 h .... 22:00 h 23:00 h	- start at the next minute limit - start at the next 10-minute limit - immediate start - start at the next hour limit - start next day
1 min	2 h	00:00 h 02:00 h 04.00 h .... 20:00 h 22:00 h	
10 min	2 h, 4 h, 6 h, 12 h oder 24 h		
15 min			
30 min			
1 h			
2 h			

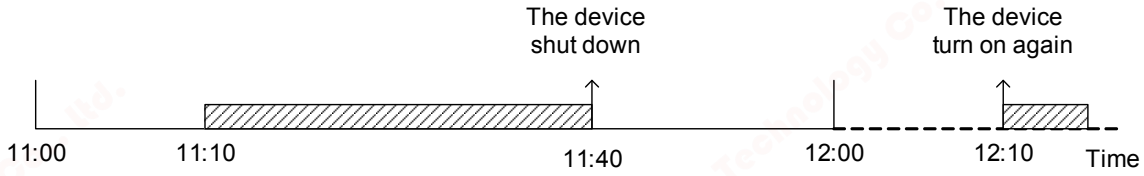
A new file is created after a PQDIF file has been completely recorded.



1) 11:10 a.m. to 12:00 p.m. : 1st PQDIF file
2) 12:00 p.m. to 01:00 p.m. : 2nd PQDIF file
…



1) 11:10 a.m. to 12:00 p.m. : 1st PQDIF file
2) 12:00 p.m. to 01:00 p.m. : 2nd PQDIF file
…



1) 11:10 a.m. to 12:00 p.m. : 1st PQDIF file
2) 12:00 p.m. to 01:00 p.m. : 2nd PQDIF file
…

Data (recording status)

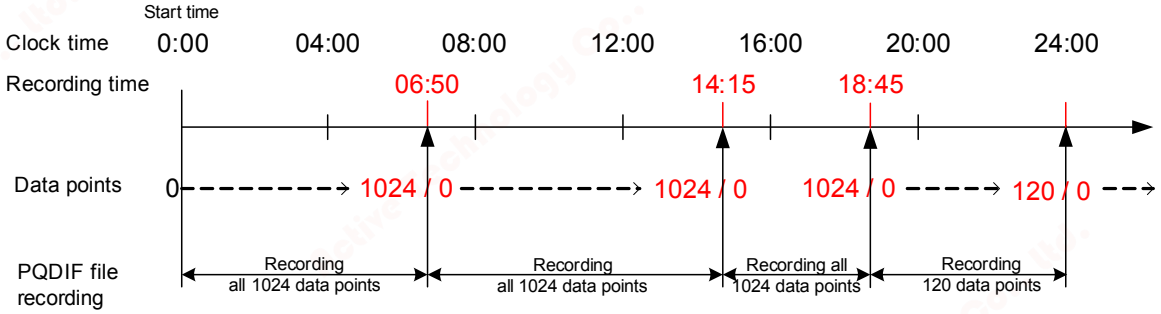
Figure 7-38 Creating PQDIF Files of the Measured Value Recorder

Recording with the Trend Recorder

The trend recorder is used for recording the voltage events. This is used for the displaying in webserver.

The recording of data points (voltage values with a time stamp) that have exceeded/fallen below the parameterized **tolerance value** (fault) and the associated creation of a PQDIF file is determined by two trigger criteria:

- Creation of a PQDIF file after the parameterized **Maximum recording interval** (for example, 24 h) has been reached if within this interval no 1024 data points have been generated yet.
- Creation of a PQDIF file when the voltage has exceeded/fallen below the tolerance range 1024 times and therefore 1024 data points have been generated.



NOTE
Data point: A data point is created when the voltage exceeds or falls below the parameterized tolerance value. The data point represents this voltage value in the PQDIF file.

Figure 7-39 Trend Recorder, Function When the 24 h Interval Is Set

7.3.5.4 Memory Management

Default Settings and Setting Ranges

Table 7-14 Memory Management

Parameter	Default Setting	Setting Range
Splitting		
Event recorder	1.0 %	1 % to 33 % [1]
Measurement recorder	35.0 % (the recording time depends on the aggregation interval)	33 % to 65 % [1]
Trend recorder	61.0 % (residual storage capacity)	31 % to 63 % [2] [3]
Fault recorder	3.0 % (Numbers of records depends on the fault record time.)	3 % to 35 % [1]

1) The memory sizes for event list, PQ records and fault records can be changed.

2) The memory size for trend recording is calculated automatically and forms the difference to 100 % of the total memory size. The maximum total memory size of 100 % cannot be exceeded due to parameterization errors.

3) If the rest storage capacity fall below 31 %, it will mark as red color on User Interface, then the activation is not possible.

To change the memory management, proceed as follows:

NOTE

When the device has been recording data for a longer period already, a modification of the memory areas might lead to the following message:

„*Memory size should not be changed now. If you active changes, all PQ data will be lost. Please backup data before activation or cancel changes.*"

This message is only output if the stored data and the data to be expected exceed the storage capacity of the SD card.

✧ In the navigation window, select the **Recording and Reporting** menu and click **Memory management**.

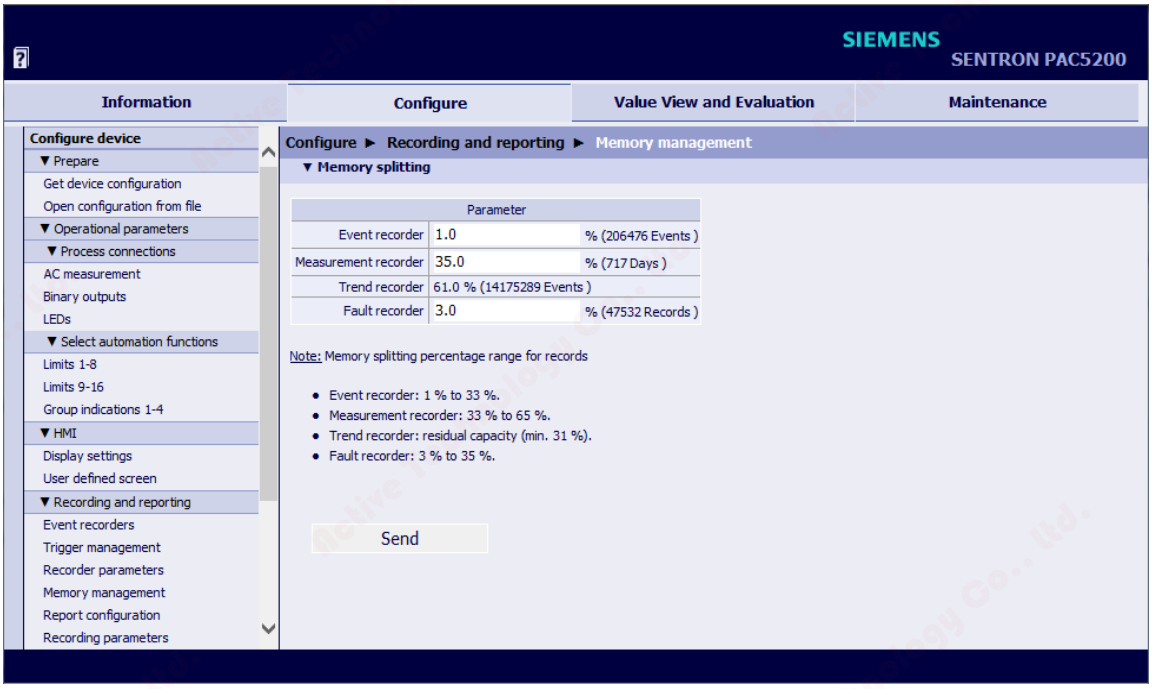


Figure 7-40 Configure Tab, Storage Input/Output Window

✧ Select the respective parameters in the list boxes according to Table 7-14 and enter the desired values in the associated fields.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.5.5 Report Configuration

The **Report configuration** allows you to parameterize the PQ threshold parameters (**User defined**). You can adjust the process connections to the installation environment and enter different operational settings. Alternatively, you can use the default values according to **EN 50160 LV&MV** or **EN 50160 HV**.

Default Settings and Setting Ranges

Table 7-15 Report Configuration

Parameter	Default Setting	Setting Range
General Information		
Company: Department: Supervisor: Inspector: Location: Comment:	-	Any text displayed in the printout of the power quality report
Power Quality Report		
Evaluation mode according to:	EN 50160 LV&MV	EN 50160 LV&MV EN 50160 HV User defined
Flagging acc. to IEC 61000-4-30	no	no yes [1]
Power frequency 99.5 % of measurand should be in -1.0 % to 1.0 % deviation of the power frequency. 100 % of measurand should be in -6.0 % to 4.0 % deviation of the power frequency.		Any setting for user-defined evaluation mode
Power supply voltage magnitude 95 % of measurand should be in -10.0 % to 10.0 % deviation of the declared input voltage Udin. 100 % of measurand should be in -15.0 % to 10.0 % deviation of the declared input voltage Udin.		Any setting for user-defined evaluation mode
Flicker severity 95 % of measurand should be less than 1.0		
Voltage unbalance [2] 95 % of measurand should be less than 2.0 %. 100 % of measurand should be less than 3.0 %.		Any setting for user-defined evaluation mode
Subgroup Total Harmonic Distortion factor (THDS) 95 % of measurand should be less than 8.0 %.		Any setting in % for user-defined evaluation mode
Voltage event interruptions 1. Short interruption until 1 second duration 2. Short interruption until 3 minute duration 3. Long interruption longer than 3 minute duration		Any setting for user-defined evaluation mode
Harmonic voltages Even harmonics Odd harmonics: multiples of 3 Odd harmonics: not multiples of 3		Any setting for user-defined evaluation mode

1) When an event has occurred, with this setting the recordings of the measurement recorder and trend recorder are marked in red on the **Find result** list (see Functioning of the Measuring System according to IEC 61000-4-30, 7.4.2.1 and 7.4.2.2).

2) According to EN 50160, up to 3 % unbalance can occur in 3-wire networks in areas with many 1-wire and 2-wire connections.

NOTE

The factory settings are based on EN 50160. If you have changed the settings, the set parameters are applied after a device restart. Resetting to the factory settings is possible.

To change the report configuration, proceed as follows:

✧ In the navigation window of the **Recording and Reporting** menu click **Report configuration**.

Figure 7-41 Configure Tab, Report Configuration Input/Output Window (Excerpt)

✧ Use the buttons to select the evaluation mode or enter the user-defined mode into the fields according to Table 7-15.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

NOTE

Power Quality Report describes the output of the power quality report.

7.3.5.6 Recording Parameters

Default Settings and Setting Ranges

Table 7-16 Reporting Parameters

Parameter	Default Setting	Setting Range
Start record option	Start next 10th minute	Start next minute Start next 10th minute Start immediately Start next hour Start next day
Start time	-	Display of the start time according to the settings of the Date/time format, see Device and Language.
Recording status	-	not settable Recorder status display started or recorder stopped

To change the recording parameter settings, proceed as follows:

✧ In the navigation window of the **Recording and Reporting** menu click **Recording parameters**.

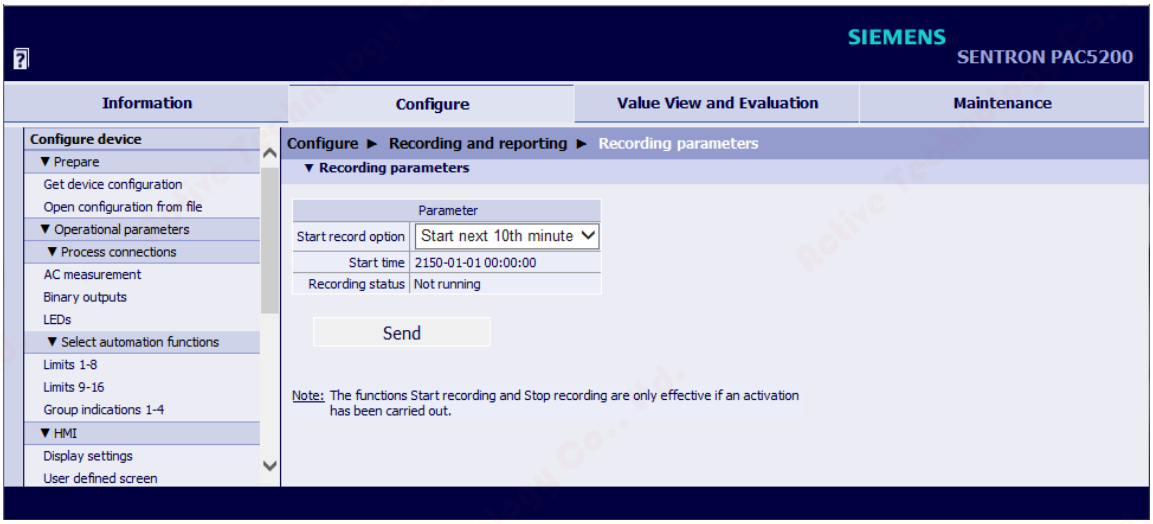


Figure 7-42 Configure Tab, Recording Parameters Input/Output Window (Excerpt)

✧ Select the parameter in the list box according to Table 7-16.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

- ✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

Depending on the parameterized **Start record option**, the **Start time** field shows the start time of the recording. After activation, the recording starts automatically at the specified time. If the **Start immediately** option is selected, the recording also only starts after activation.

After recording has started, the **Recording status** fields shows the entry **Running**.

- ✧ If you want to stop the recording, click on **Stop recording** and execute the activation.

  The **Recording status** field shows the entry **Not running** and **Start recording** is displayed on the user interface.

NOTE

The restart of the record is carried out after a power failure automatically.

The status will change from **Not running** to **Running** when user change and activate parameters.

Recording Power Quality Data

When the device is started for the first time, it is necessary for the recording of power quality data that the **Time synchronization** of the device is set to the current time first. If the time is incorrect, the power quality measurements do not conform to the current time. Proceed as follows:

- ✧ Refresh the time via **Ethernet NTP** or **Field bus** in line with Time Synchronization or with the device-**internal** clock in line with Date/Time.
- ✧ Configure all necessary parameters (for example, AC measurement, Communication, etc.) on the relevant tabs, **except for** the **Recording parameters** settings.

  When setting the parameters, make sure that the settings are consistent with each other (for example, setting of the flicker lamp model consistent with the primary nominal voltage).
- ✧ **At last**, parameterize the **Recording parameters** and activate the settings.

7.3.6 Setting Administrative Parameters

In the **Configure** tab you can view and if necessary edit the administrative settings. You can select the parameters in the **Administrative** menu in the navigation window. These parameters can be changed in the input/output windows **Time synchronization**, **Communication Ethernet** and **Device and language**.

NOTE

Observe the procedure for the device configuration described in Device Configuration Procedure when setting the administrative parameters.

7.3.6.1 Time Synchronization

Default Settings and Setting Ranges of the Time Synchronization

Table 7-17 Time Synchronization Settings

Parameter	Default Setting	Setting Range
Source time synchronization	Internal	Internal Ethernet NTP Fieldbus
Time zone offset to UTC	+00:00	-12 to +13 (hours) (in increments of 0.5 h)
Daylight Saving Time switchover	yes	no yes
DST offset to UTC	+01:00	0 to + 2 (hours) (in increments of 0.5 h)
Start of DST	March Last week Sunday 02:00 AM	Acc. to list boxes (see Operating Parameters)
End of DST	October Last week Sunday 03:00 AM	Acc. to list boxes (see Operating Parameters)
Additional Parameters if the Source is Ethernet NTP		
Primary NTP server IP address	192.168.0.254	Any
Secondary NTP server IP address	192.168.0.253	Any No polling of the NTP server if 0.0.0.0 was entered
Error indication after	10 min	2 min to 120 min
Additional Parameter if the Source is Fieldbus		
Error indication after	10 min	2 min to 120 min

To change the time synchronization, proceed as follows:

✧ In the navigation window, select the **Administrative** menu and click **Time synchronization**.

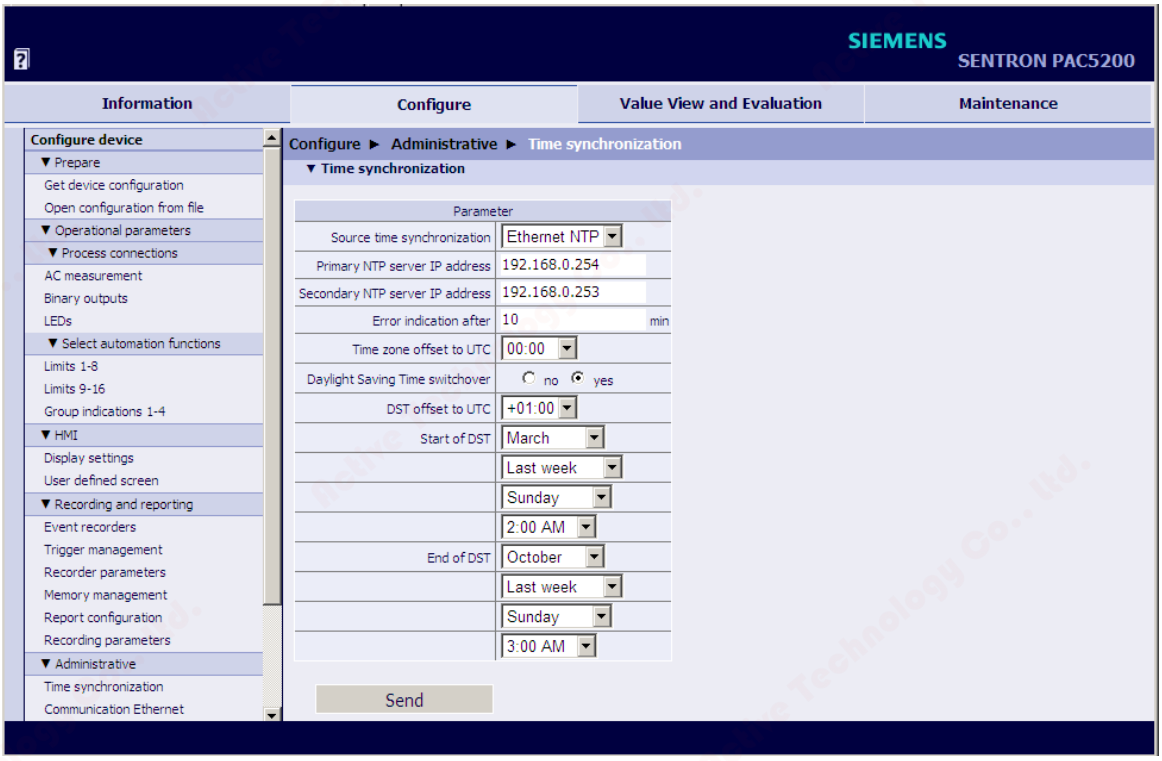


Figure 7-43 Configure Tab, Time Synchronization Input/Output Window, Ethernet NTP Selected

✧ Enter the desired values in the fields and select the parameters in the list boxes and in the option field as described in Table 7-17.

✧ After the parameterization click **Send**.

The parameters are transmitted to the device but not enabled yet (passive set of parameters).

If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.6.2 Communication Ethernet

Default Settings and Setting Ranges of the Communication Ethernet

Table 7-18 Communication Ethernet Settings

Parameter	Default Setting	Setting Range
IP address [1]	192.168.0.55	Any 0.0.0.0 = DHCP
Subnet mask [1]	255.255.255.0	Any
Default gateway [1]	192.168.0.1	Any
Enable SNMP	no	no yes
Bus protocol	Modbus TCP	-none- Modbus TCP
Bus Protocol Modbus TCP		
Use a user-port number [2]	no	no yes
User-port number [2] (can only be set when *Use a user-port number* is parameterized with *yes*)	10000	10000 to 65535
Access rights for user port (can only be set when *Use a user-port number* is parameterized with *yes*)	Full	Full Read only
Access rights for port 502	Full	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

1) After the parameter changes have been enabled, the device will reset.
2) After enabling the parameter changes, any currently active Modbus TCP connections will be closed. The Modbus TCP client must later reopen these connections.

To change the Ethernet communication settings, proceed as follows:

✧ In the navigation window, select the **Administrative** menu and click **Communication Ethernet**.
The **Communication Ethernet** input/output window with **Protocol Modbus TCP** opens.

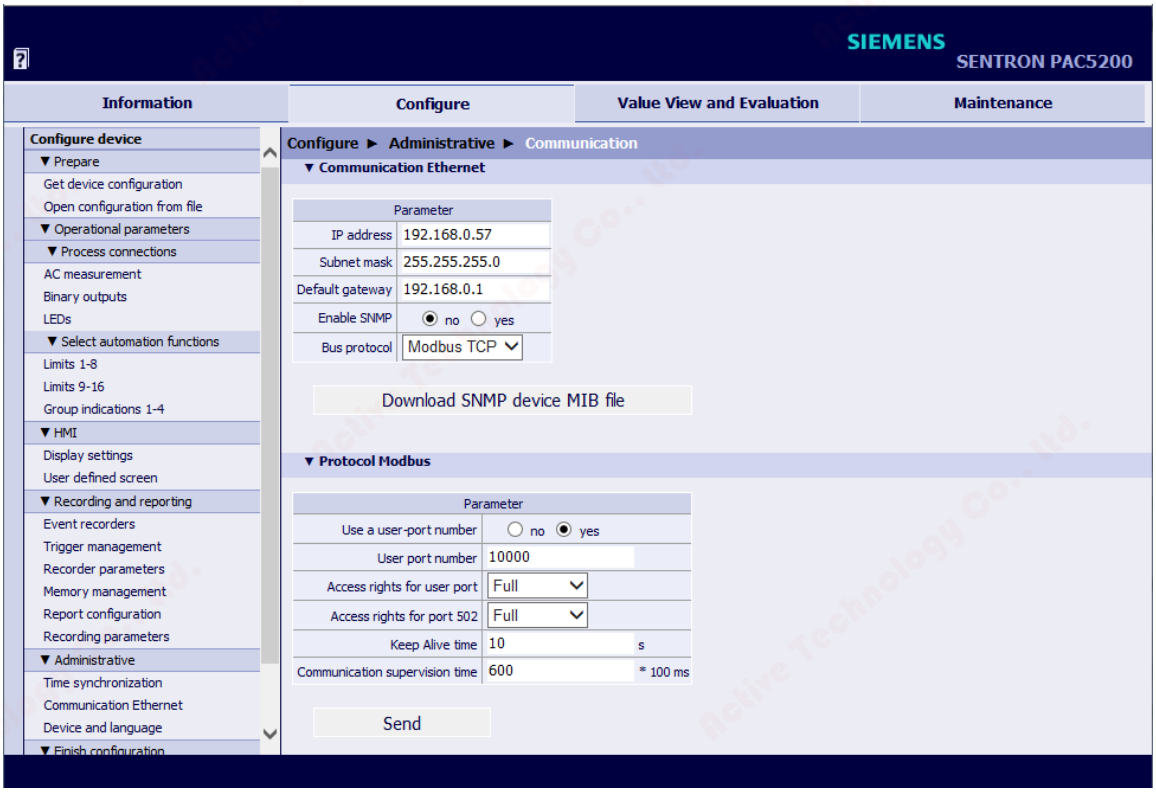


Figure 7-44 Configure Tab, Communication Ethernet via Modbus TCP Input/Output Window

✧ Enter the desired values in the fields and select the parameters in the list boxes and in the option field as described in Table 7-18.

NOTE

The enabling of SNMP via option **Enable SNMP** is only required if you want to save the **MIB** file and use it in a MIB browser.

Download SNMP Device MIB File

NOTE

The SNMP protocol is implemented in SENTRON PAC5100/5200 in order to be able to retrieve manufacturer-specific information.
To retrieve information via SNMP, a MIB browser and the MIB file are required. The MIB browser allows the displaying of SNMP information objects and their content.

✧ Select **yes** in the **Enable SNMP** option (see figure 7-44).

✧ In the **Communication Ethernet** input/output window, click **Download SNMP device MIB file**.

The **Open/Save/Cancel** button choice opens.

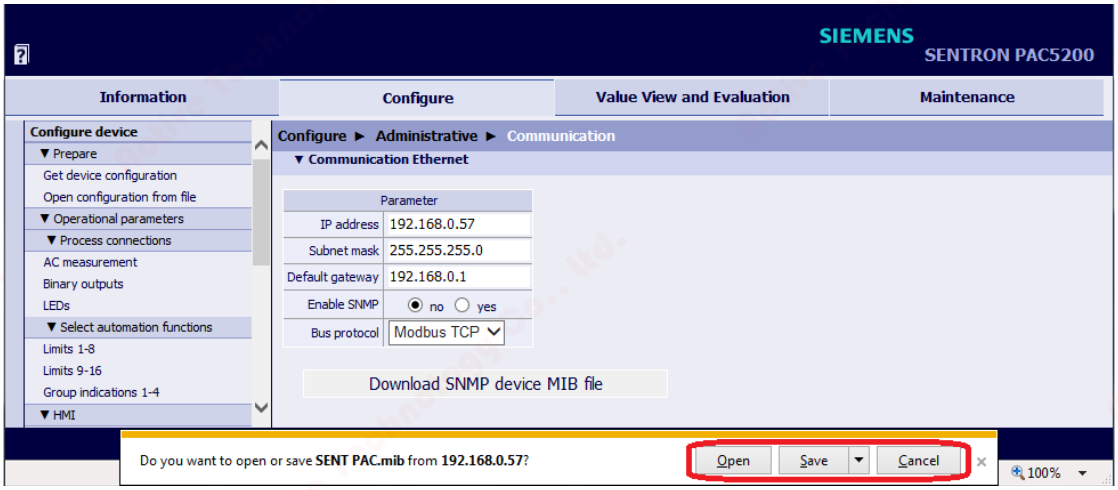


Figure 7-45 Open/Save/Cancel Button Choice

- ✧ Select in the button choice **Open/Save/Cancel** → **Save** → **Save As**: see figure 7-7.
- ✧ Select the file path.
- ✧ Use the file name suggested in the **File name:** list box or enter a new file name with the file extension *.mib.

NOTE

The length of file names must not exceed 8 characters. Use only characters according to NOTE in „**Open Configuration from File**“.

- ✧ Click **Save**.
- ✧ Close the button choice **Download has completed**.

Ethernet Communication with Bus Protocol Modbus TCP (see figure 7-44)

- ✧ In the **Bus protocol** list box select the entry **Modbus TCP**.
- ✧ Enter the desired values in the fields and select the parameters in the list boxes and in the option field as described in Table 7-18.

NOTE

If you have selected **no** under **Use a user-port number**, you can adjust only the **Access rights for user port 502**, the **Keep Alive time** and the **Communication supervision time** parameters.

- ✧ After the parameterization click **Send**.

  After clicking **Send**, the parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

NOTE

After changing the network settings and subsequent parameter activation the device will reset.

7.3.6.3 Device and Language

Default Settings and Setting Ranges for Device and Language

Table 7-19 Device and Language Settings

Parameter	Default Setting	Setting Range
Device name	SENTRON_PAC	Max. 32 characters
Language	ENGLISH (US)	ENGLISH (US) DEUTSCH (DE)
Date/time format	YYYY-MM-DD, Time with 24 hours	Acc. to list box (see Operating Parameters)
Activation password	000000	Any 6 to 14 characters
Maintenance password	311299	Any 6 to 14 characters

To change the settings of device and language, proceed as follows:

✧ In the navigation window, select the **Administrative** menu and click **Device and language**.

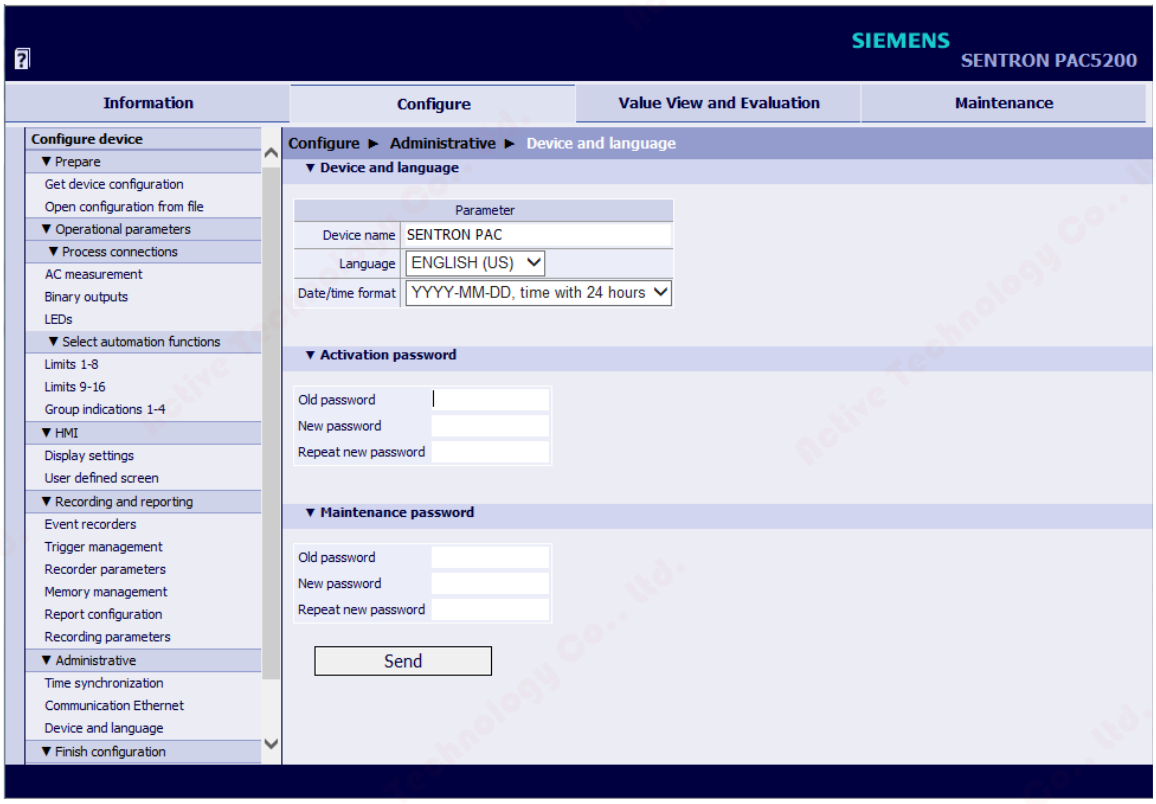


Figure 7-46 Configure Tab, Device and Language Input/Output Window

- ✧ Select the desired parameters in the list box according to Table 7-19.
- ✧ Change the passwords if necessary.
- ✧ After the parameterization click **Send**.

  After clicking **Send**, the parameters are transmitted to the device but not enabled yet (passive set of parameters).
- ✧ If you do not want to make any additional settings, continue with the **Activation** of the device configuration according to section **Activating the Set of Parameters**. If you want to change other settings, enter the changes and then enable the device configuration as described in section **Activating the Set of Parameters**.

7.3.6.4 Finish Configuration

The items in the **Finish configuration** menu in the navigation window are described in Device Configuration Procedure, Device Configuration Procedure, in these subsections:

Activation: see **Activating the Set of Parameters**

Save configuration to file: see **Save Configuration to File**

Cancel: see **Cancel**

7.4 Value View and Evaluation

7.4.1 Process Connections and Automation Functions

The values for **Operational parameters** (**Process connections** and **Automation functions**) are displayed in the **Value view and Evaluation** tab. To display the values on the screen, proceed as follows:

✧ Select the **Value view and Evaluation** tab on the user interface.

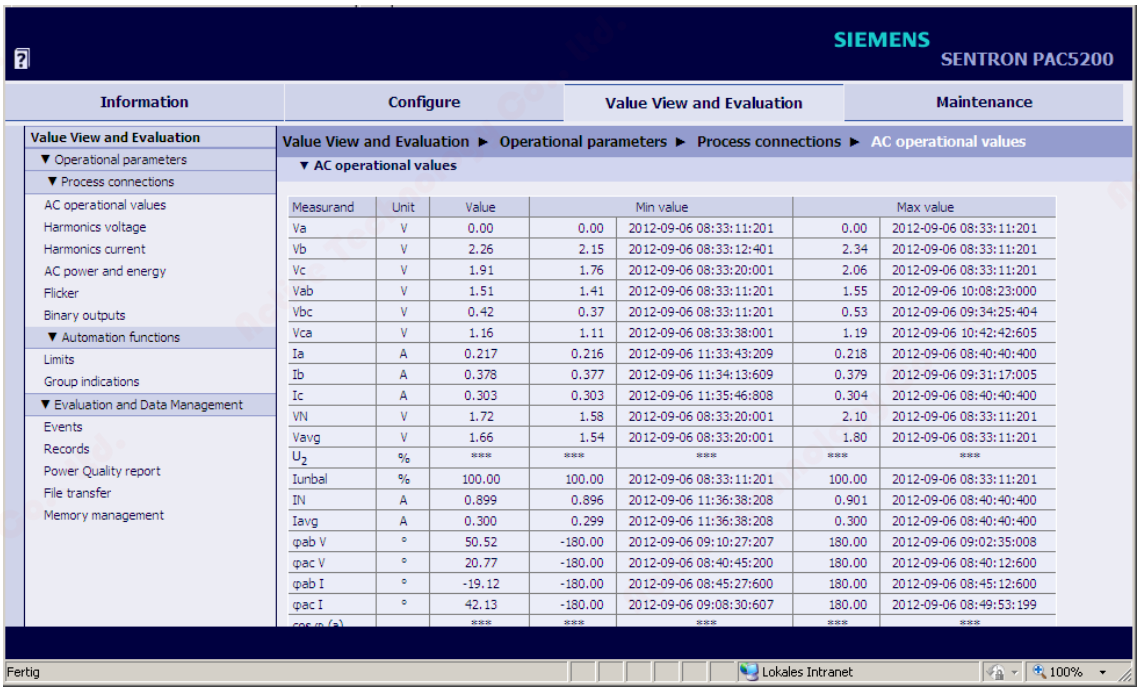


Figure 7-47 Value View and Evaluation Tab

✧ In the navigation window, open the **Operational** menu, then the **Process connections** or **Automation functions** submenu and click one of the following items:

- AC operational values
- Harmonics voltage
- Harmonics current
- AC power and energy
- Flicker
- Binary outputs
- Measurand limits
- Group indications

Depending on which operational parameters are selected, the input/output window displays the measured values of the measurands with the corresponding unit or indications in a tabular list that is updated every 5 s. Harmonics can represent you in tabular form or graphically.

NOTE

The operational measured values cos φ (a) to cos φ (c) and cos φ as well as φUIa to φUIc and φUI are additionally marked with "**i**" for *inductive* or "**c**" for *capacitive* in the table.

NOTE

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

If ^^^ is displayed instead of a measured value, this measurand is in overflow.

To print out the measured values, click the  (**Print**) icon on the toolbar of Microsoft Internet Explorer.

7.4.2 Evaluation and Data Management

The power quality values and other events are output on the **Value View and Evaluation** tab in the **Evaluation and Data Management** menu. The menu contains the following items:

- Events
- Records
- Power quality report
- File transfer
- Memory management

To display the values on the screen, proceed as follows:

✧ Select the **Value View and Evaluation** tab on the user interface.

✧ Select the desired values according to **Evaluation and Data Management** menu in the navigation window.

7.4.2.1 Events

Default Settings and Setting Options

Table 7-20Value View and Evaluation - Events

Parameter	Default Setting	Setting Options
Event record type	Supply Voltage	Supply Voltage Frequency Unbalance
Start time	Current date/time	Any with calendar function Time format: depends on date/time format config.
End Time	Current date/time	Any with calendar function Time format: depends on date/time format config.
Measurement output	Table	Table CSV

To display the values on the screen, proceed as follows:

✧ In the navigation window, select the **Evaluation and Data Management** menu and click **Events**.
The **Events** input/output window opens.

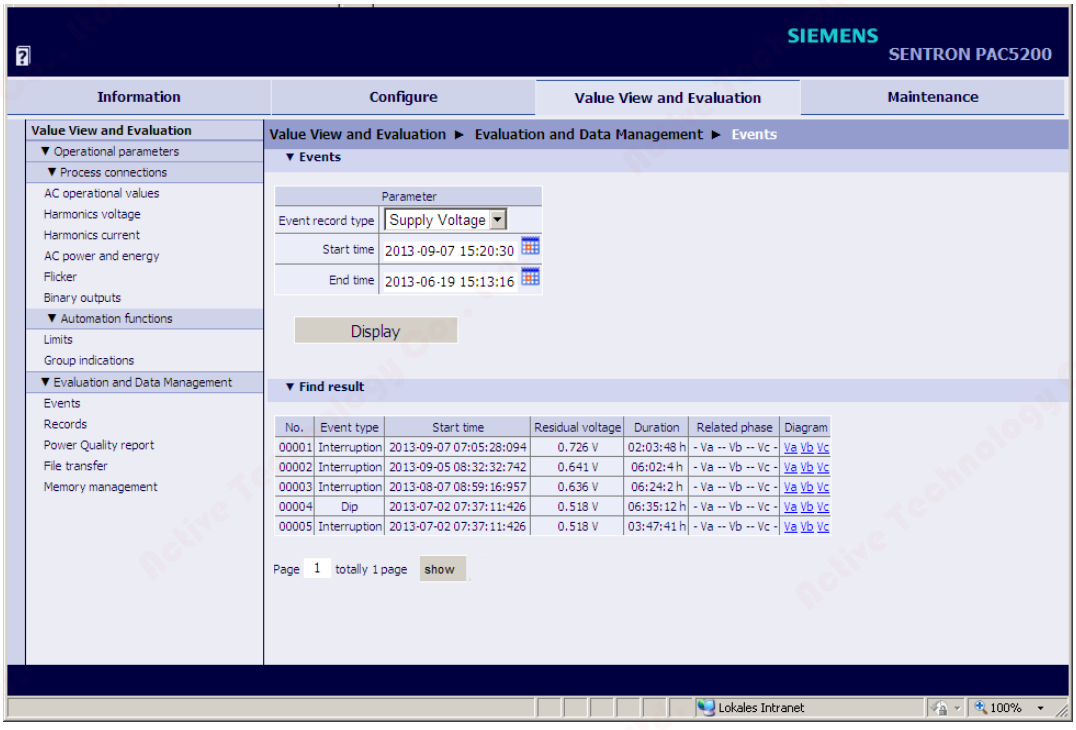


Figure 7-48 Value View and Evaluation Tab, Events Input/Output Window, Supply Voltage

✧ Select the desired **Event record type** in the list box according to Table 7-20 and specify the **Start time** and **End time** using the calendar function.

✧ Select from the **Measurement output** list box whether the measured values are to be output as a **Table** or a **CSV** file is to be created.

Measurement Output as Table

✧ Click **Display**.

The determined results are displayed in a table. In multi-paged tables you can navigate forward and back in the pages using the **>>** and **<<** buttons. If you want to view a certain page, enter the page at the bottom and click on **show**.

The results can be displayed graphically using COMTRADE viewer (link in **Diagram** column).

NOTE

When an event has occurred, with this setting the recordings are marked in red on the record list under **Find result** list. And a message is showed under the list when event happen. For information about the flagging concept, please refer to Functioning of the Measuring System according to IEC 61000-4-30.

Measurement Output as CSV File

✧ Click **Download**.

The **Open/Save/Cancel** button choice opens.

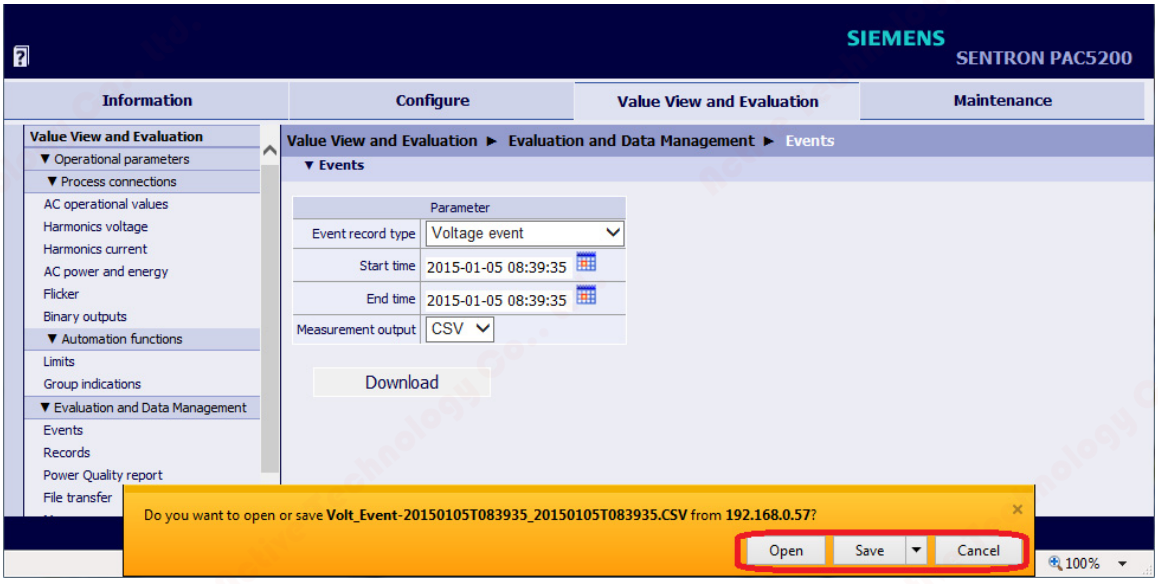


Figure 7-49 Open/Save/Cancel Button Choice

Save CSV File

✧ Select in the button choice **Open/Save/Cancel** → **Save** → **Save As**: see figure 7-7.

✧ Select the file path.

✧ Use the file name suggested in the **File name:** list box or enter a new file name with the file extension *.csv.

NOTE

The length of file names must not exceed 8 characters. Use only characters according to NOTE in **Open Configuration from File**.

- ✧ Click **Save**.
- ✧ Close the button choice **Download has completed**.

Open CSV File

Alternatively, you can view the event data on the screen and print them if needed. Proceed as follows:

- ✧ In the **Open/Save/Cancel** button choice (see figure 7-49) click **Open**.
  The selected CSV file is opened in Microsoft Excel and the event data are displayed in table form.
- ✧ On the menu bar, click **File** → **Print...**.
- ✧ Select the desired printer in the **Print** dialog and click **Print**.
  The list is printed on the connected printer.
- ✧ Close Microsoft Excel.

7.4.2.2 Records

Default Settings and Setting Options

Table 7-21 Value View and Evaluation - Records

Parameter	Default Setting	Setting Options
Record Type	Measurement recorder	Trend Recorder Measurement recorder
Measurement Recorder		
Start time	Current time	Any with calendar function Time format: depends on date/time format config.
End time	no setting, only display	
Measurand source	Frequency 10 s	Frequency 10 s Voltage Current Voltage angle Current angle Active power Reactive power Apparent power Active power factor Power factor Phase angle Frequency Unbalance THDS voltage THDS current Q1 Harmonic voltage magnitude Harmonic current magnitude Short term flicker Long term flicker
Measurands	f - 10 s	The selectable **Measurands** depend on the selected **Measurand Source**.
Aggregation Type (The aggregation type is **not** displayed if the frequency is 10 s, and flicker)	AVG	AVG MIN (not for harmonics) MAX
Measurement output	Table	Diagram Table CSV
Trend Recorder		
Query method (only for trend recorder query)	By time	By time By event

Table 7-21 Value View and Evaluation - Records (cont.)

Parameter	Default Setting	Setting Options
By time Start time	Current time	Any with calendar function Time format: depends on date/time format config.
End time	no setting, only display (1 h after start)	
By event Event list	Selection of a displayed event	
Measurand Source	Voltage	Voltage
Measurands	Va	Va, Vb, Vc Vab, Vbc, Vca
Measurement output	Table	Diagram Table CSV

To display the values on the screen, proceed as follows:

✧ In the navigation window, select the **Evaluation and Data Management** menu and click **Records**. The **Records** input/output window opens.

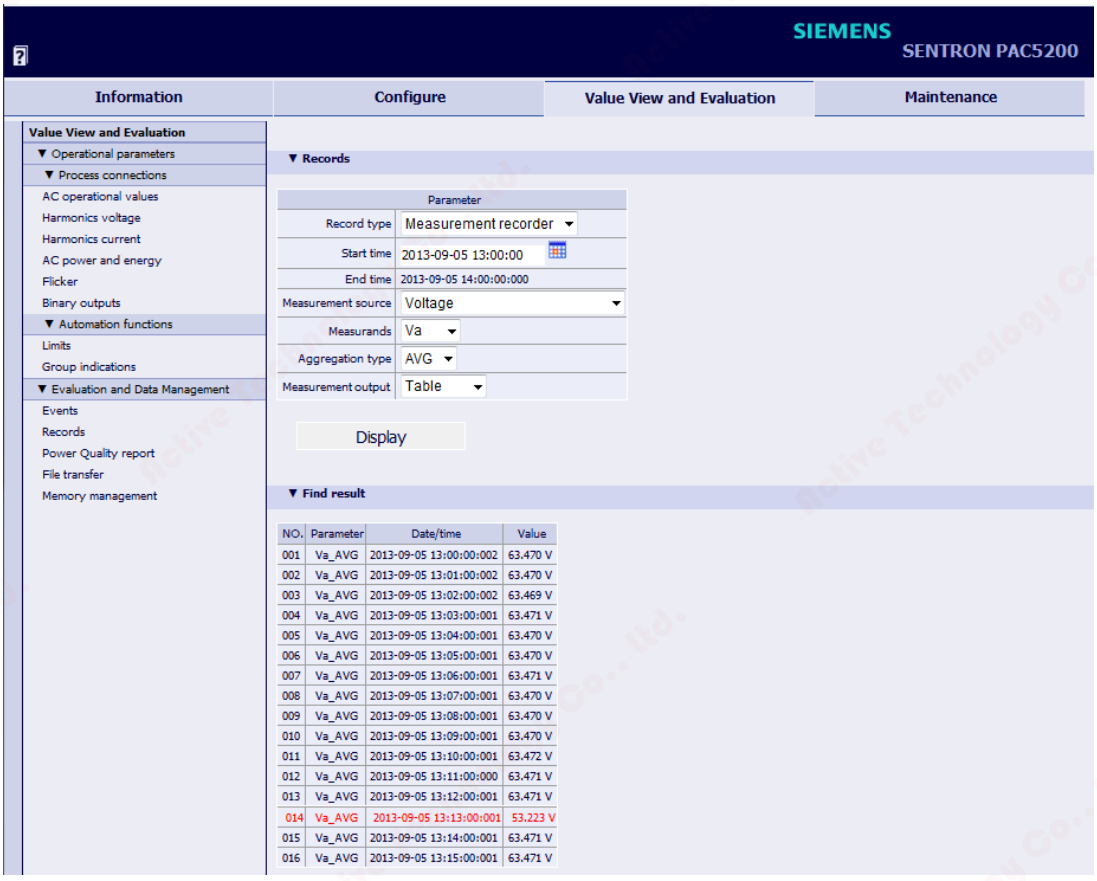


Figure 7-50 Value View and Evaluation Tab, Records Input/Output Window, Measurement Recorder

✧ Select the respective recording settings in the list box according to Table 7-21.

Measurement Output as Diagram or Table

✧ If you selected **Diagram** or **Table** for **Measurement output**, click on the **Display** button.

Dependent on the selection, the determined results will be displayed in a table or diagram. In multi-paged tables you can navigate forward and back in the pages using the **>>** and **<<** buttons. If you want to view a certain page, enter the page at the bottom and click on **show**.

NOTE

When an event has occurred, with this setting the recordings are marked in red on the record list under **Find result** list. And a message is showed under the list when event happen. For information about the flagging concept, please refer to Functioning of the Measuring System according to IEC 61000-4-30.

Measurement Output as CSV File

✧ If you selected **CSV** for **Measurement output**, click on the **Download** button.

The measured values are downloaded as an CSV file and exported to the storage location you selected (see Events, Measurement Output as CSV File).

7.4.2.3 Power Quality Report

Default Settings and Setting Options

Table 7-22 Power Quality Report

Parameter	Default Setting	Setting Options
Start Time	Current time	Any with calendar function Time format: depends on date/time format config.
End Time	Current time	Any with calendar function Time format: depends on date/time format config.
Record list	no	List of reports created within the parameterized time

To display the values on the screen, proceed as follows:

✧ In the navigation window, select the **Evaluation and Data Management** menu and click **Power quality report**.

The **Power quality report** input/output window opens.

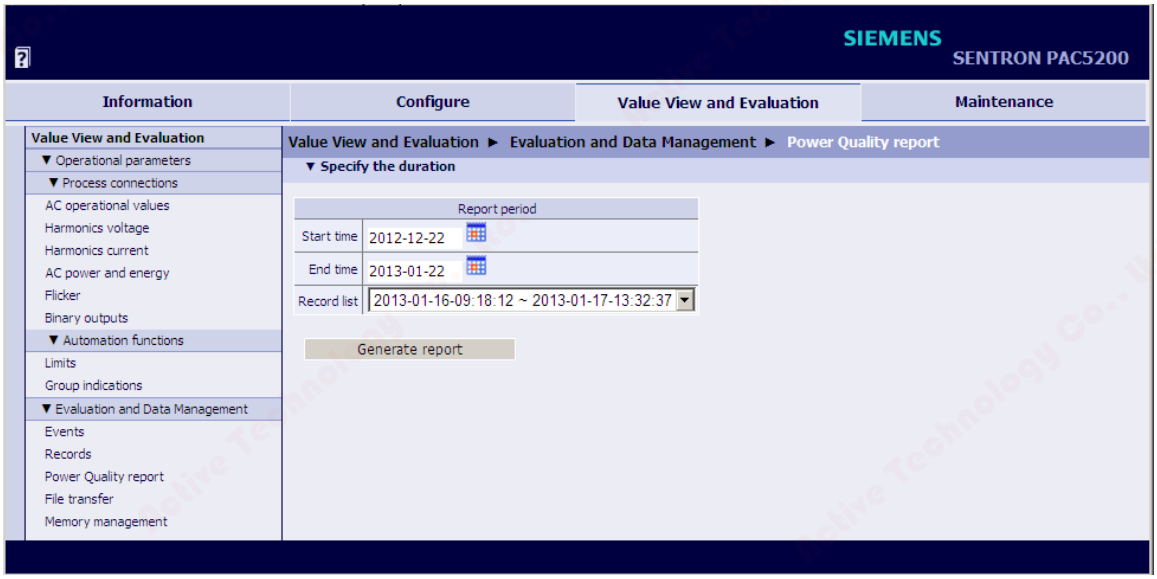


Figure 7-51 Value View and Evaluation Tab, Power Quality Report Input/Output Window

✧ Enter the **Start time** and **End time** using the calendar function.

✧ Click **Generate report**.

The report is displayed in a separate window and can be printed out or saved.

7.4.2.4 File Transfer

You can download the data from the SENTRON PAC5100/5200 in the standard format.

- Trend records: PQDIF files
- Measurements: PQDIF files and CSV files
- Records fron fault recorder: COMTRADE files

Default Settings and Setting Ranges

Table 7-23 File Transfer

Parameter	Default Setting	Setting Range
Start date	Current date	any Calendar function Time format: YYYY-MM-DD
End date	Current date	any Calendar function Time format: YYYY-MM-DD
Record type	Trend recorder (PQDIF)	Trend recorder (PQDIF) Measurement recorder (PQDIF) Measurement recorder (CSV) Fault recorder (COMTRADE)
Download type	Single file download	Single file download Multiple file download [1)]
Record list	-none-	A file is generated as recording list in the corresponding data format depending on the parameterized data type and recorder type.

[1)] Observe the information on how to download multiple files given in this chapter.

To change the file transfer, proceed as follows:

✧ In the navigation window, select the **Evaluation and Data Management** menu and click **File Transfer**.
The **File Transfer** input/output window opens.

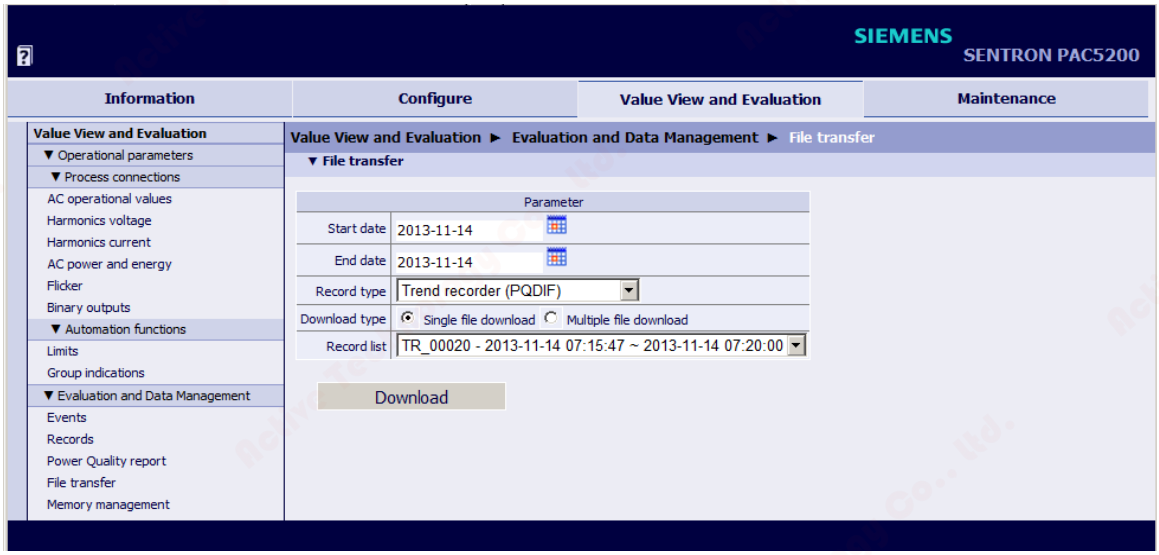


Figure 7-52 Value View and Evaluation Tab, File Transfer Input/Output Window

✧ Select the respective parameters in the list boxes according to Table 7-23.

Option: Single file download

NOTE

The button **Download** only is displayed if a **Record list** is available.

✧ Click **Download**.
The **Open/Save/Cancel** button choice opens.

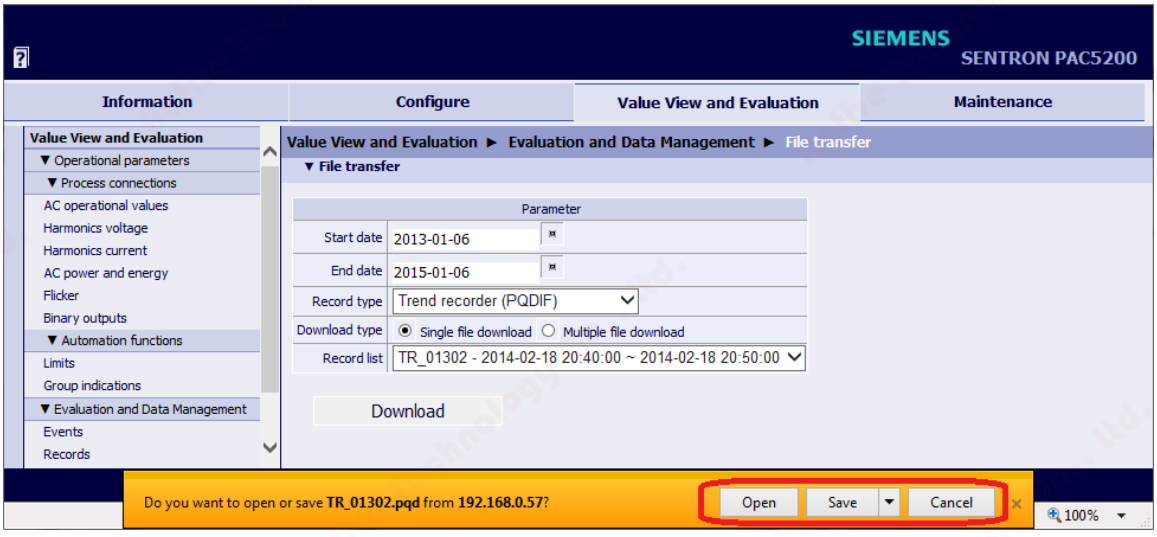


Figure 7-53 Open/Save/Cancel Button Choice

- ✧ Select in the button choice **Open/Save/Cancel** → **Save** → **Save As**: see figure 7-7.
- ✧ Select the file path.
- ✧ Use the file name suggested in the **File name:** list box or enter a new file name with the displayed file extension, for example *.pqd for files of the trend recorder.

NOTE

The length of file names must not exceed 8 characters. Use only characters according to NOTE in **Open Configuration from File**.

- ✧ Click **Save**.
- ✧ Close the button choice **Download has completed**..

Option: Multiple File Download

Preparation

If you want to use the **Multiple File Download** option, you have to make the following change once with the Registry Editor of your computer:

- ✧ Start → Search → regedit → regedit.exe → OK
  The Registry Editor opens.
- ✧ Find in the directory: [HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Internet Explorer\ActiveX Compatibility\{00000566-0000-0010-8000-00AA006D2EA4}] \Compatibility Flags
- ✧ Click on Compatibility Flags and change the value to 0.

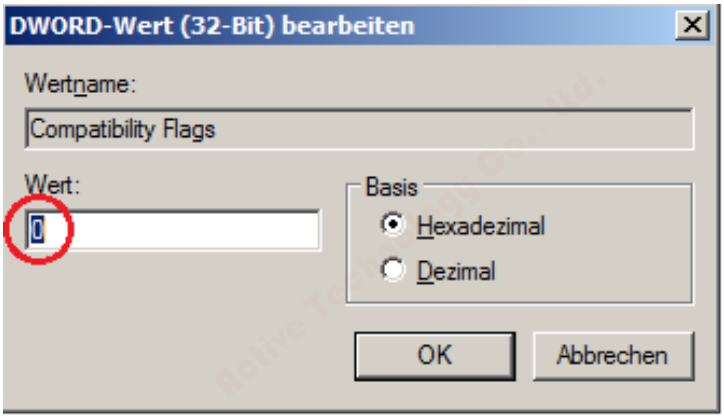


Figure 7-54 Changing the Compatibility Flag Value

✧ Confirm with OK.

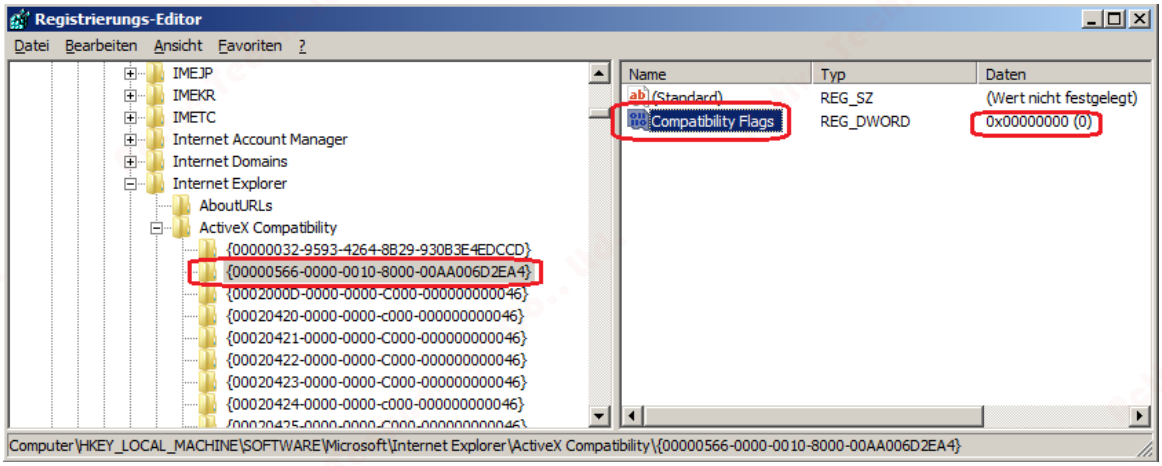


Figure 7-55 Changed Registry

✧ Close the Registry Editor.

✧ In the Internet-Explorer on menu, select Tools → Internet Options → Security → Trusted Sites.

If in the Internet-Explorer trust sites are blocked by IE policies, then you proceed as follows:

✧ Start the SENTRON PAC5100/5200.

✧ In the Internet-Explorer on menu, select Tools → Internet Options → Security → Trusted Sites. Click on **Sites** button.

✧ Start → Search → regedit → regedit.exe → OK

The Registry Editor opens.

✧ Find in the directory:
[HKEY_LOCAL_MACHINE\SOFTWARE\Policies\Microsoft\Windows\CurrentVersion\Internet Settings\ZoneMap\Ranges]

✧ Insert in the directory a key with the name **Rangexxx**.

✧ Insert the following 2 values in this key:

– Type string:
Name: „:**Range**“, Type: „**REG_SZ**“, Data: „**192.168.0.204**“

– Type dword:
Name: „http“, Type „**REG_DWORD**“, Data: „**2**“

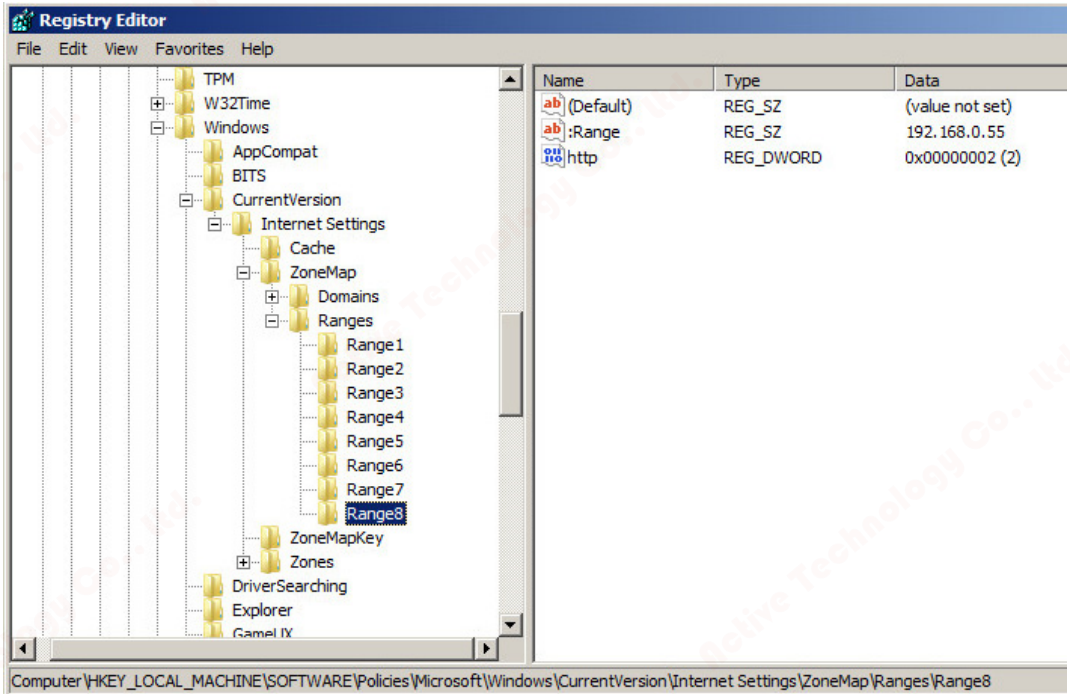


Figure 7-56 Registry (Detail)

✧ Check the following entry after closing the registry in the tab **Information** in the status line:
Trusted sites I Protected Mode: Off

Multiple File Download

✧ On the **Record list**, select the files using the normal Windows method.

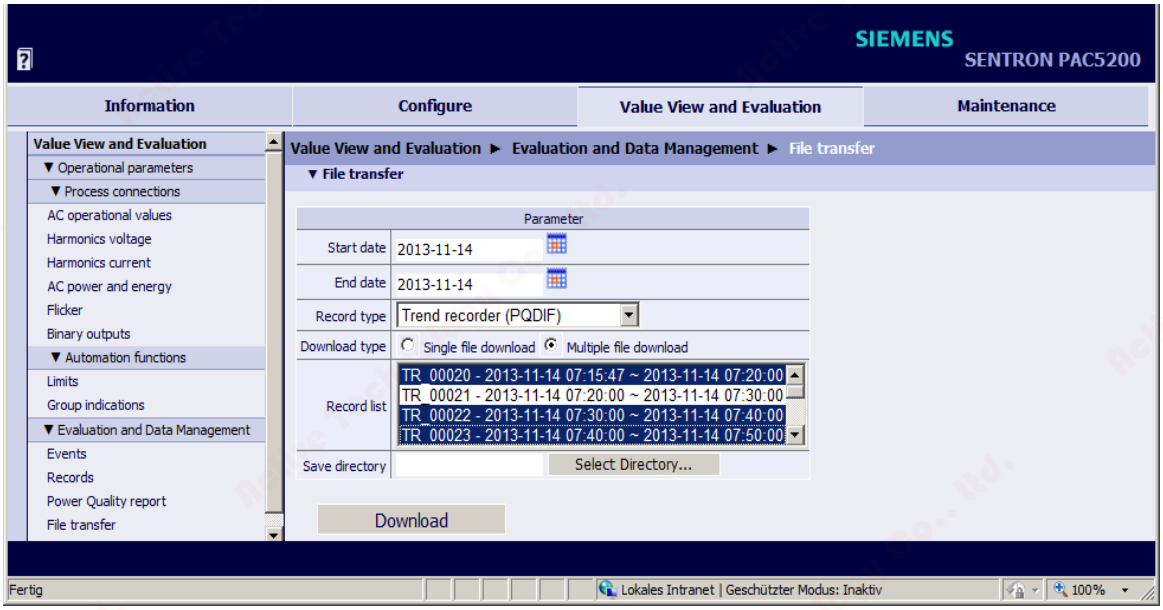


Figure 7-57 File Selection

✧ Enter a **Save directory** for file storage or select a path for file storage at **Select Directory**.

✧ Click on **Download**.

The download progress is indicated and the selected files are stored in the specified directory.

Visualizing the Transmitted Recorder Data

You can display the transmitted recorder data with the help of other programs. Use the following programs for that:

- **SIGRA**: COMTRADE files of the fault recorder

  Contact the Siemens Hotline for information on that; see Preface.

- **SIGRA Plugin**: HTML data of the event recorder and recorder values on recorder page

  Contact the Siemens Hotline for information on that; see Preface.

- **PQDiffractor**: PQDIF files of the trend recorder and measurement recorder

  Download the program from the Internet: http://www.pqview.com/download-pqdif/

7.4.2.5 Memory Management

Memory Management shows the current utilization (**Used ratio**) of the storage capacity for the individual recorders.

To display the **Used ratio** on the screen, proceed as follows:

✧ In the navigation window, select the **Evaluation and Data Management** menu and click **Memory Management**.

The **Memory Management** input/output window opens.

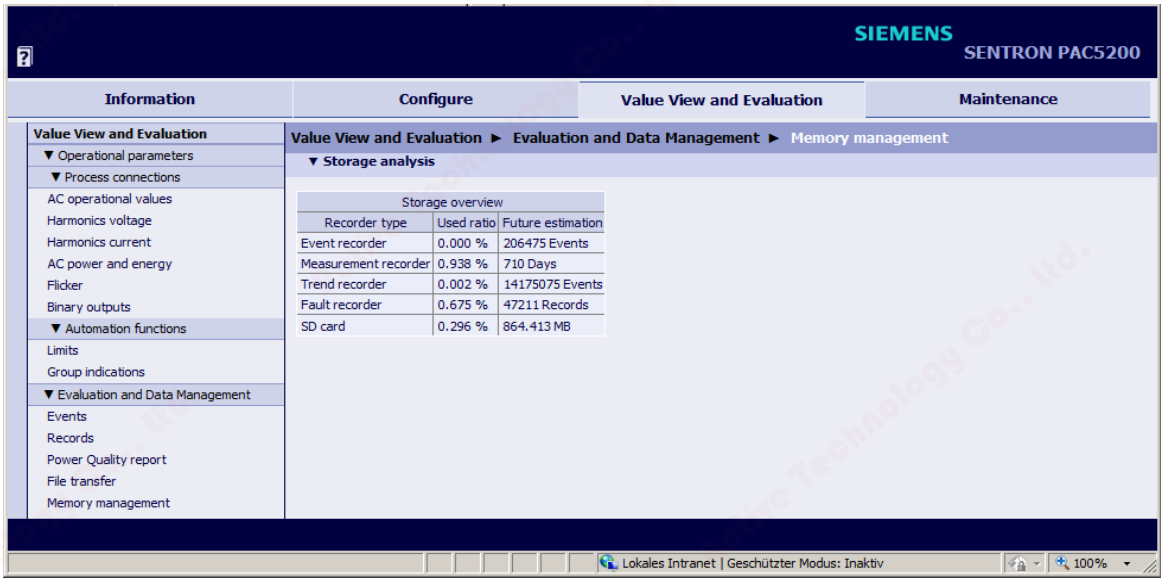


Figure 7-58 Value View and Evaluation Tab, Memory Management Input/Output Window

7.5 Maintenance

In the **Maintenance** tab you can start the following functions:

- Update the firmware
- Format SD card
- Make various presettings
- View and delete logs
- Analyze protocol-specific communication data

If you want to edit this tab, you need the Maintenance password.

To open the **Maintenance** tab, proceed as follows:

✧ Select the **Maintenance** tab on the user interface.

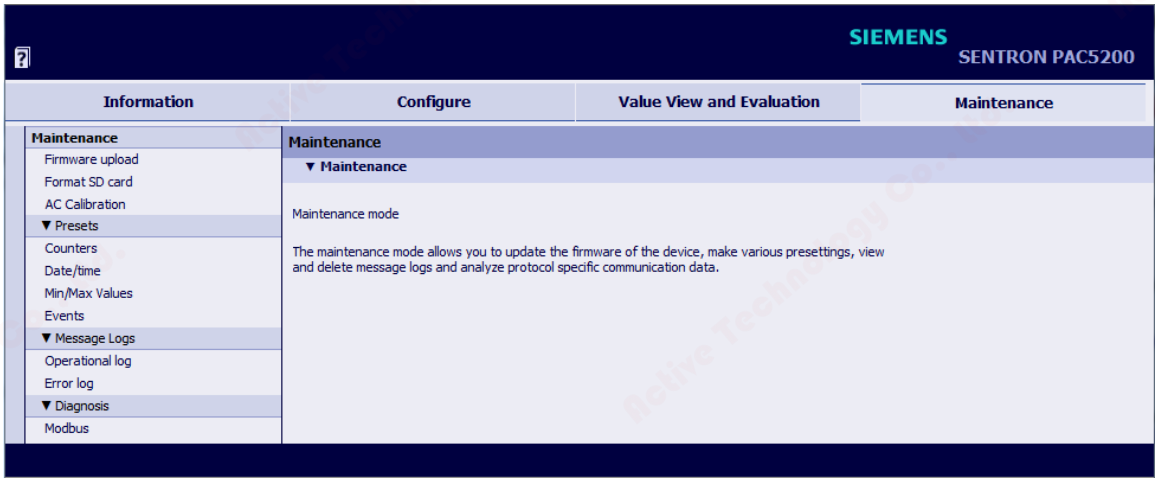


Figure 7-59 Maintenance Tab

7.5.1 Firmware Upload

During a firmware update, the device firmware, the default set of parameters, text libraries, HTML files or parts thereof are updated.

NOTE

Before updating the firmware, Siemens recommends saving the current parameters set as described in section **Save Configuration to File**.

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.

To update the firmware proceed as follows:

✧ Select **Firmware upload** in the navigation window.

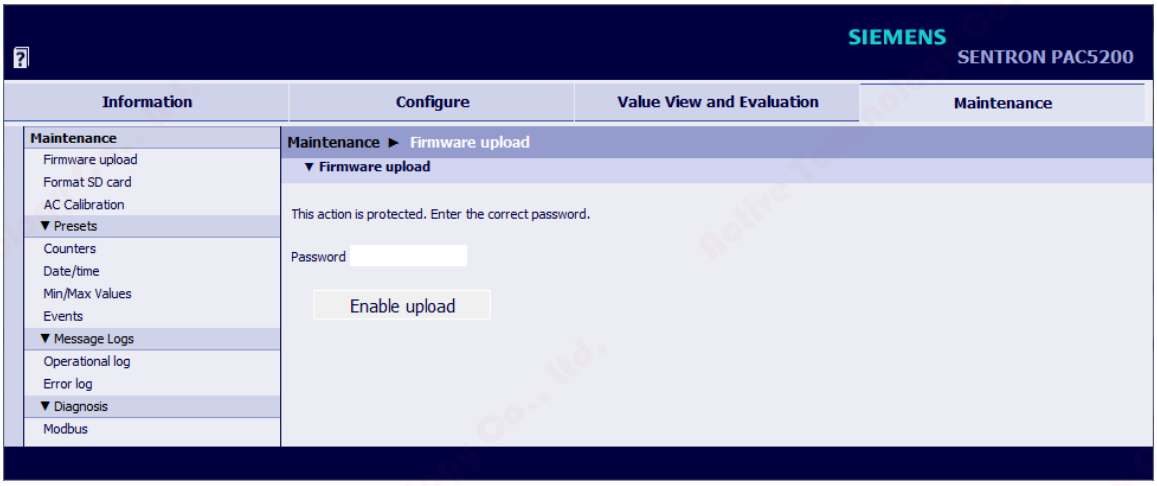


Figure 7-60 Maintenance Tab, Firmware Upload - Enable Upload Input/Output Window

✧ Enter the maintenance password

✧ Click **Enable upload**.

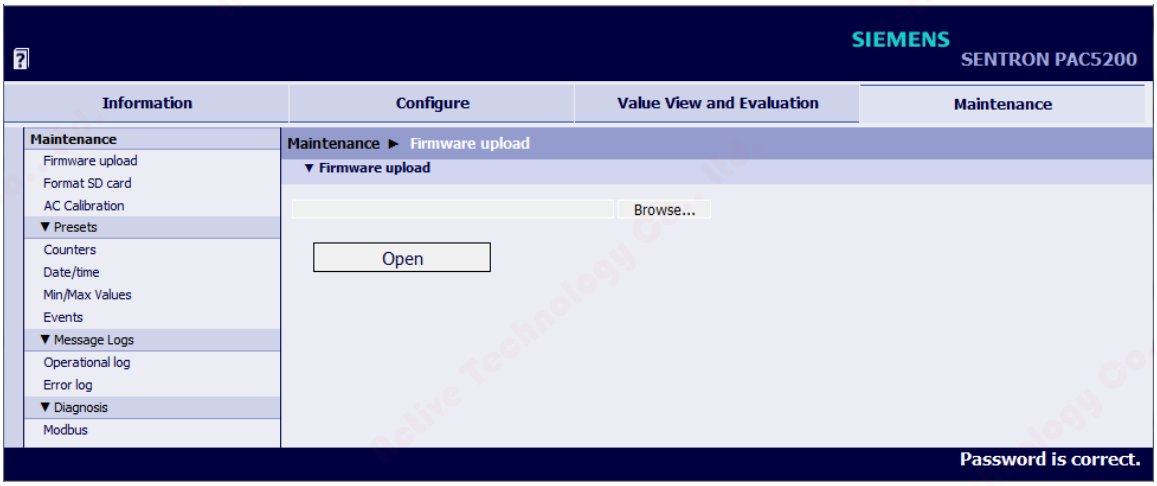


Figure 7-61 Maintenance Tab, Firmware Upload - Open Input/Output Window

- ✧ Click **Browse...**.
  The **Choose File to Upload** dialog opens.
- ✧ Select the desired update (extension .pck) in the directory.
- ✧ Click **Open**.
  The selected path is inserted in the input/output window, Figure 7-61, into the **Browse...** field.
- ✧ Click **Open** on the tab.
- ✧ After approx. 2 s, the message **Action was successful!** is displayed in the input/output window.
  Device firmware, default set of parameters, text libraries, HTML files or parts thereof are uploaded within one minute.

  The device then restarts automatically.

NOTE

If you want to carry out a firmware update, you must stop the record manually before., see **Recording Parameters**.

Do not switch off the supply voltage during the upload process as this can lead to data loss.

7.5.2 Formatting the SD Card

NOTE

When you format the SD card, all recorded data will get lost. If you want to preserve the data, save them before formatting as described in chapter 7.4.2.1, Save CSV File, and chapter 7.4.2.4.

If you want to format the SD card, proceed as follows:

- ✧ Click on **Format SD card** in the navigation window.

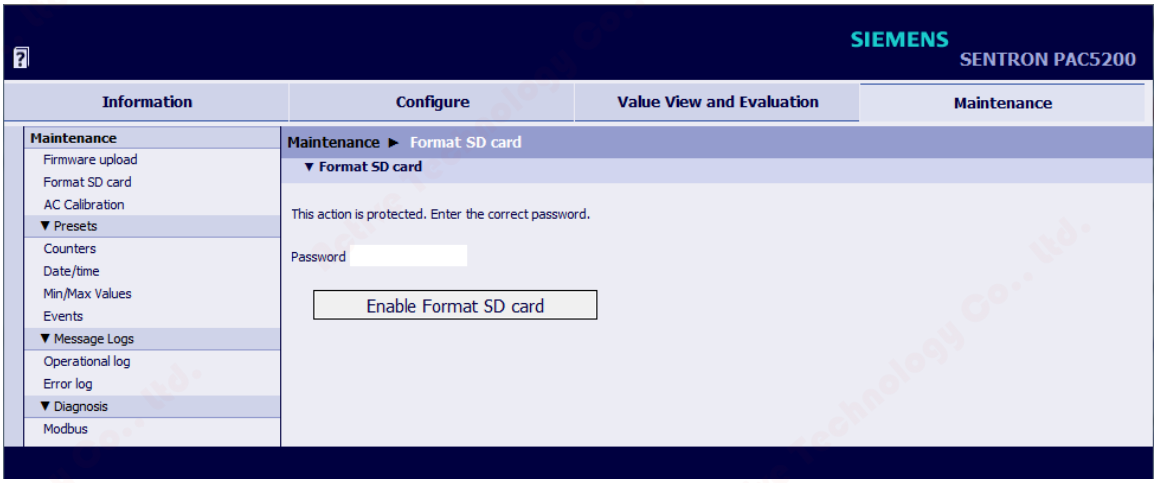


Bild 7-62 Maintenance Tab, Format SC card

- ✧ Enter the maintenance password in the **Password** field.
- ✧ Click on **Enable Format SD card**.
  Observe the warning on the **Format SD card** tab.
- ✧ Click on **Format SD card**.
  The SD card is formatted and the following message appears:

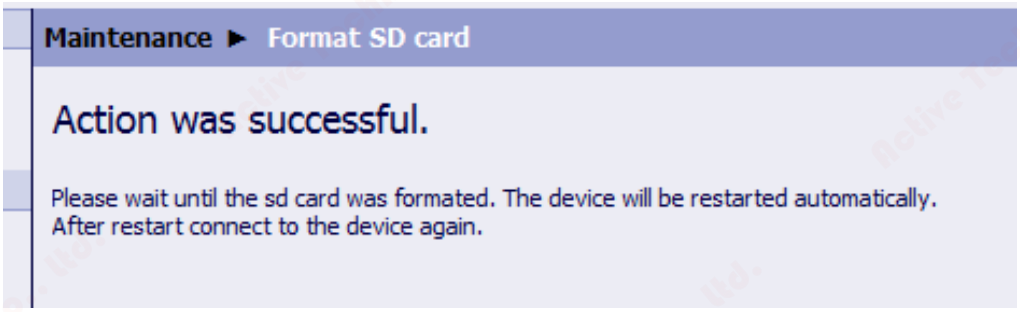


Bild 7-63 Maintenance Tab, Format SC card Completed

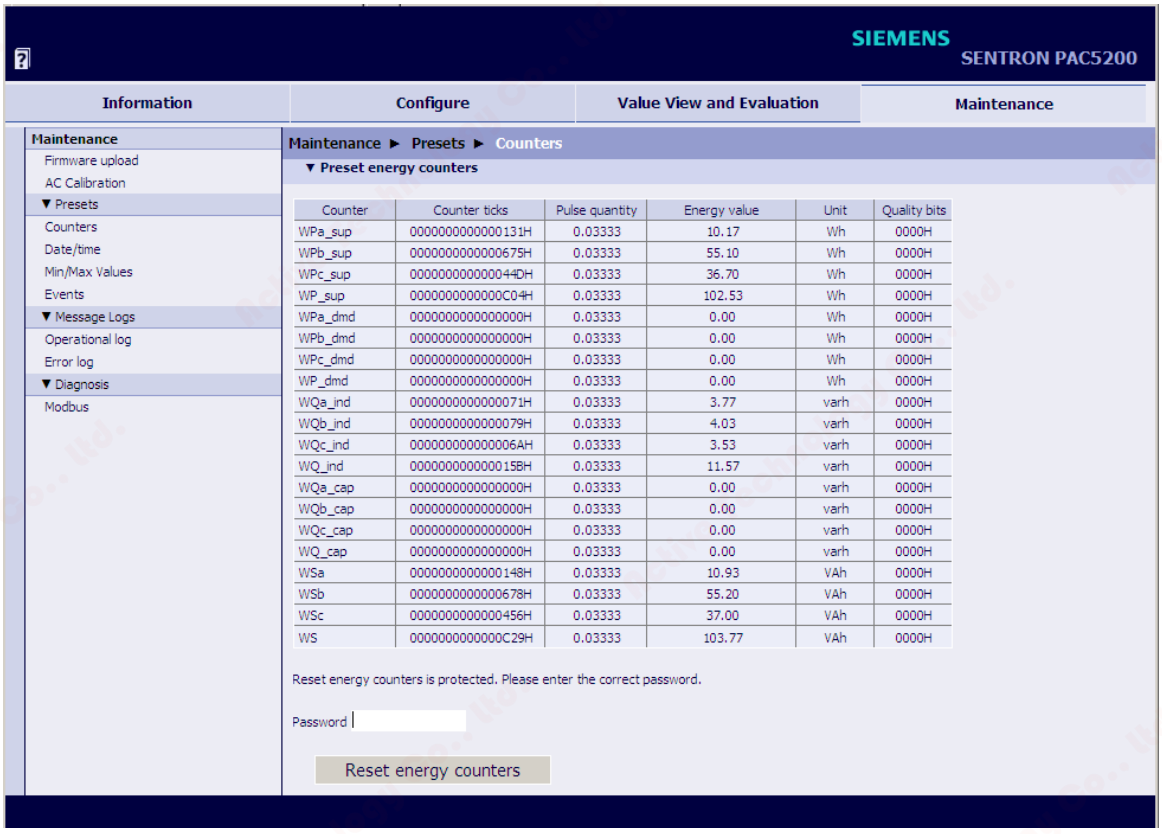
- ✧ Follow the instructions in the message.
- ✧ Observe messages that can appear if no or a faulty SD card is used

7.5.3 Presets

7.5.3.1 Counters (Energy Counters)

To display and reset the energy counters, proceed as follows:

✧ In the navigation window, select the **Presets** menu and click **Counters**.



Counter	Counter ticks	Pulse quantity	Energy value	Unit	Quality bits
WPa_sup	000000000000131H	0.03333	10.17	Wh	0000H
WPb_sup	000000000000675H	0.03333	55.10	Wh	0000H
WPc_sup	00000000000044DH	0.03333	36.70	Wh	0000H
WP_sup	0000000000000C04H	0.03333	102.53	Wh	0000H
WPa_dmd	0000000000000000H	0.03333	0.00	Wh	0000H
WPb_dmd	0000000000000000H	0.03333	0.00	Wh	0000H
WPc_dmd	0000000000000000H	0.03333	0.00	Wh	0000H
WP_dmd	0000000000000000H	0.03333	0.00	Wh	0000H
WQa_ind	000000000000071H	0.03333	3.77	varh	0000H
WQb_ind	000000000000079H	0.03333	4.03	varh	0000H
WQc_ind	00000000000006AH	0.03333	3.53	varh	0000H
WQ_ind	00000000000015BH	0.03333	11.57	varh	0000H
WQa_cap	0000000000000000H	0.03333	0.00	varh	0000H
WQb_cap	0000000000000000H	0.03333	0.00	varh	0000H
WQc_cap	0000000000000000H	0.03333	0.00	varh	0000H
WQ_cap	0000000000000000H	0.03333	0.00	varh	0000H
WSa	000000000000148H	0.03333	10.93	VAh	0000H
WSb	000000000000678H	0.03333	55.20	VAh	0000H
WSc	00000000000456H	0.03333	37.00	VAh	0000H
WS	0000000000C29H	0.03333	103.77	VAh	0000H

Figure 7-64 Maintenance Tab, Preset Counters

✧ Enter the maintenance password into the **Password** field.

✧ Click **Reset energy counters**.

The **Counter ticks**, the calculated **Energy value** and the corresponding **Quality bits** are reset for all energy counters. The **Action was successful** indication is displayed on the status bar.

7.5.3.2 Date/Time

NOTE

If you want to change the date and time, you have to set the **Source time synchronization** to **Internal** on the **Configure** → **Administrative** → **Time synchronization** tab.

NOTE

If you want to change the date and time, make sure that any previously set **Start record option** (**Recording parameters** tab) conforms to the newly set time. If the Start record option is earlier than Date/time, no recording takes place and an error message is output.

To set the date and time, proceed as follows:

✧ In the navigation window, select the **Presets** menu and click **Date/time**.

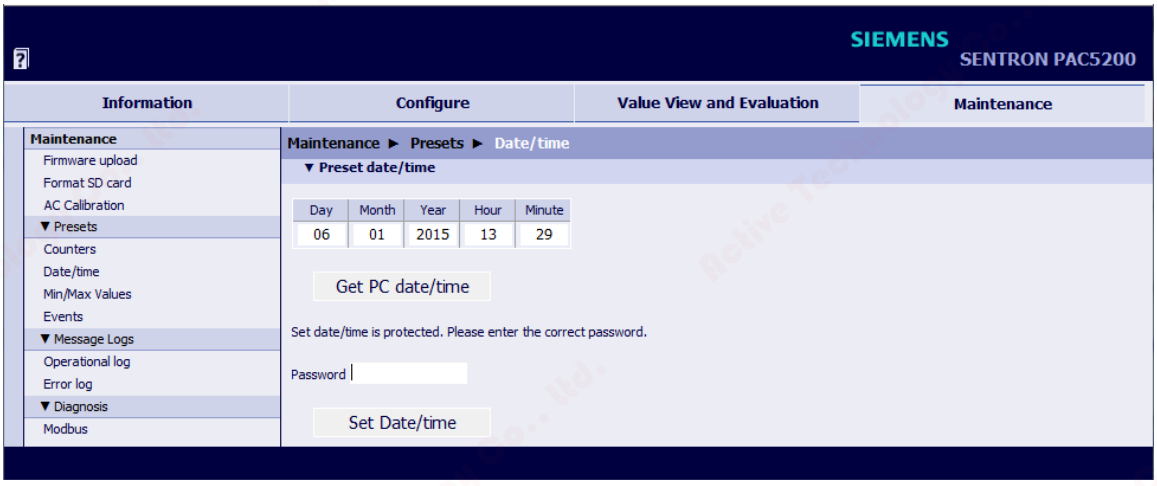


Figure 7-65 Maintenance Tab, Preset Date/time

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

Get PC Date and Time

✧ In the input/output window, click **Get PC date/time**.
The computer time is displayed in the fields of the input/output window and applied in the device.

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

✧ In the input/output window enter the desired time into the fields **Day** (format dd), **Month** (format mm), **Year** (format yyyy), **Hour** (format hh), and **Minute** (format mm).

✧ Enter the maintenance password into the **Password** field.

✧ Click **Set Date/time**.

The time you have entered is displayed in the fields of the input/output window and applied in the device. The **Action was successful** indication is displayed on the status bar.

7.5.3.3 Min/Max Values (only SENTRON PAC5200)

To reset the min/max values, proceed as follows:

✧ In the navigation window, select the **Presets** menu and click **Min/Max Values**.

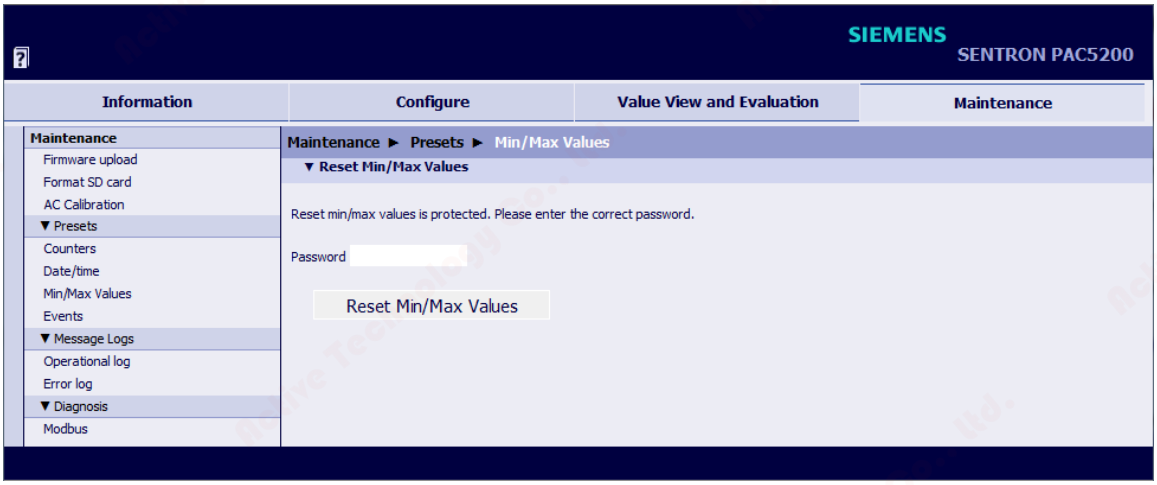


Figure 7-66 Maintenance Tab, Preset Min/Max Values

✧ Enter the maintenance password into the **Password** field.

✧ Click **Reset Min/Max Values**.

All min/max values are reset. The **Action was successful** indication is displayed on the status bar.

7.5.3.4 Events (Only SENTRON PAC5200)

To reset the PQ events, proceed as follows:

✧ In the navigation window, select the **Presets** menu and click **Events**.

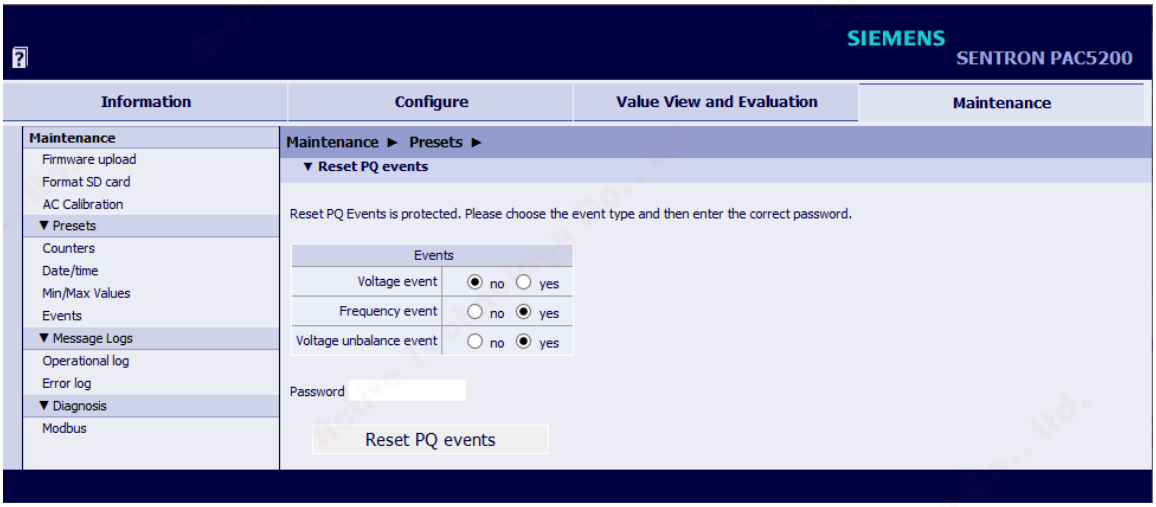


Figure 7-67 Maintenance Tab, Events Default Setting

✧ Select the events you want to reset using the option fields.

✧ Enter the maintenance password in the **Password** field.

✧ Click **Reset PQ events**.

The selected PQ events are reset. The **Action was successful** indication is displayed on the status bar.

7.5.4 Message Logs

7.5.4.1 Operational Log

To view and clear the **Operational log** (max. 128), proceed as follows:

NOTE

The last 128 operational indications are displayed, older indications are automatically deleted.

✧ In the navigation window, select the **Message Logs** menu and click **Operational log**.

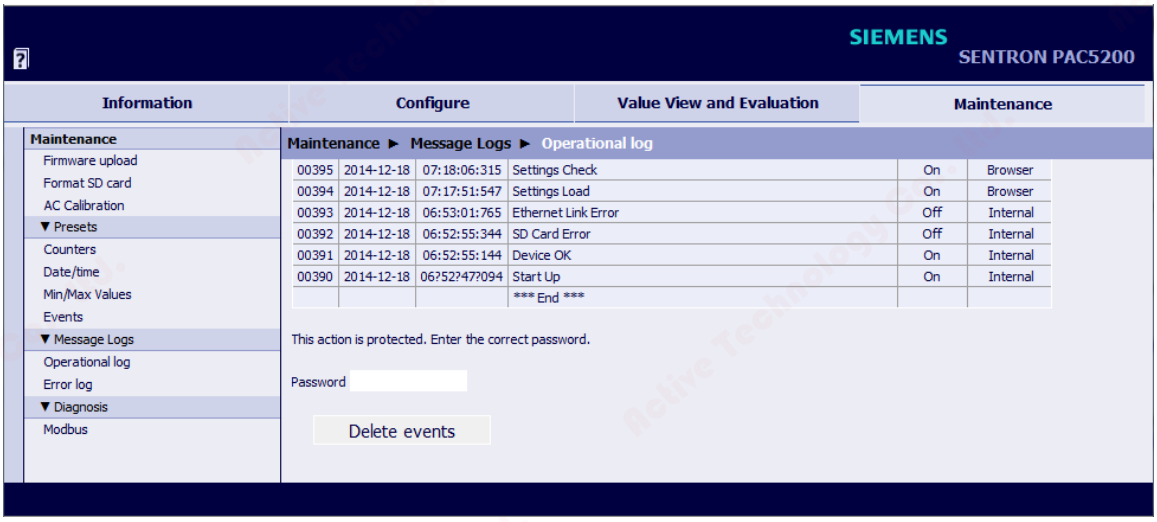


Figure 7-68 Maintenance Tab, Delete Log

✧ Enter the maintenance password into the **Password** field.

✧ Click **Delete log** in the input/output window.

All operational indications in the input/output window are deleted without backup. The indication no. 0001 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 as described in Save Device Information and Message Logs.

7.5.4.2 Error Logs

NOTE

Error messages are service information that you quote to the service department upon request in case of an error.

To view and clear the **Error log** (max. 128), proceed as follows:

✧ In the navigation window, select the **Message Logs** menu and click **Error log**.

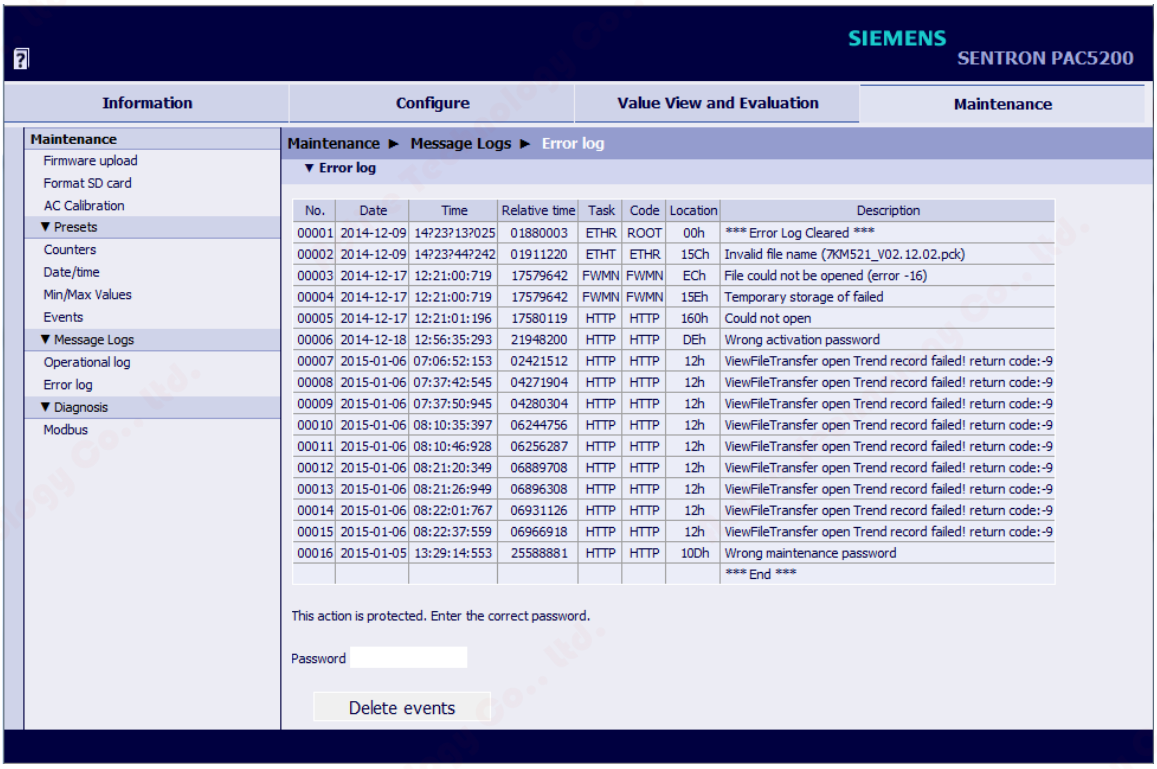


Figure 7-69 Maintenance Tab, Delete Error Log

✧ Enter the maintenance password into the **Password** field.

✧ Click **Delete log** in the input/output window.

All error messages in the input/output window are deleted without backup. The indication no. 0001 appears in the log list: ***Error Log Cleared***.

NOTE

If you need the error messages, for example for subsequent analysis, save or print them out as described in Save Device Information and Message Logs.

7.5.5 Diagnosis Modbus TCP

NOTE

The data for diagnosing Modbus TCP is only displayed if you have selected this bus protocol on the **Configure** tab → **Administrative** menu → **Ethernet communication** menu item.

✧ In the navigation window, select the **Diagnosis** menu and click **Modbus**.

The **Modbus** input/output window opens and the **Modbus TCP** protocol is displayed. For Modbus TCP the **Standard server** and the **User-port server** are analyzed.

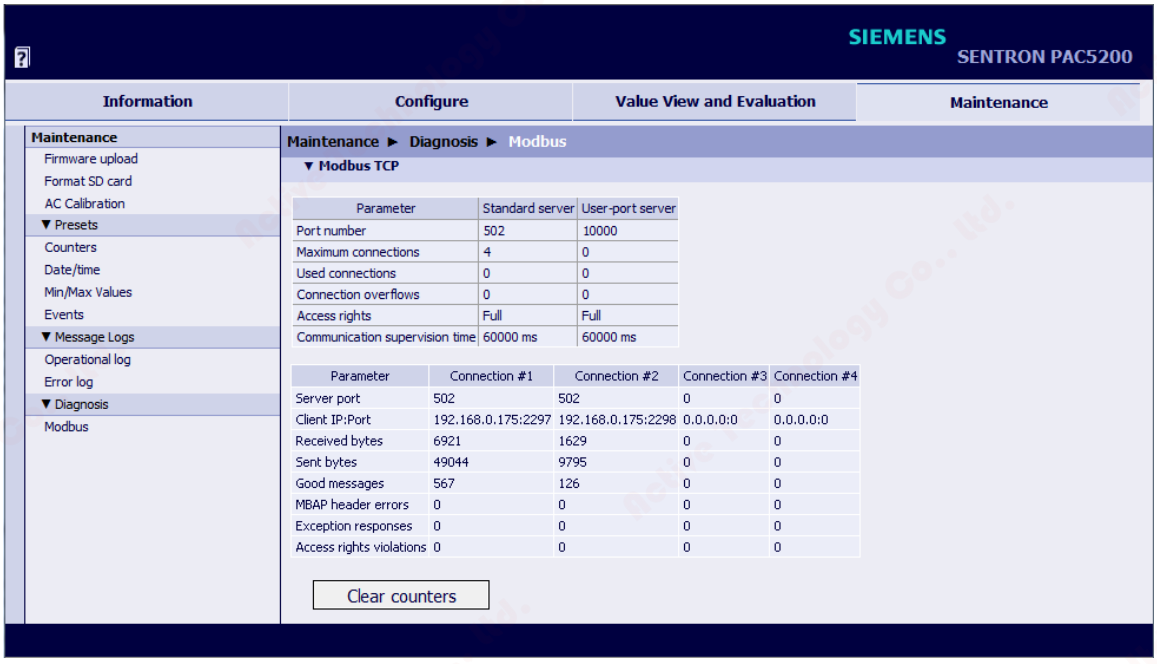


Figure 7-70 Maintenance Tab, Diagnosis Modbus Input/Output Window

✧ To clear the counters for Modbus TCP, click **Clear counters**.

All counters are reset to 0.

NOTE

The Communication manual gives more details about diagnosing Modbus.

7.6 Example of a Parameterization and Measured Value Evaluation for SENTRON PAC5200

7.6.1 Task Definition

- ✧ Set the parameters via the Ethernet interface using the default IP address set upon delivery of the device.
- ✧ Configure SENTRON PAC5200 according to the topology.
- ✧ Parameterize the indication of a measurand limit violation for V_{ab} > 11 kV with 10 % hysteresis and name the indication.
- ✧ Parameterize a binary output that is switched on for the duration of the measurand limit violation.
- ✧ Parameterize the Ethernet communication according to the network configuration specified by the system operator.
- ✧ Assign any name and specify the time/date format as YYYY-MM-DD and the time in 24-hour format.
- ✧ Parameterize the Measurement recorder with an averaging time of 2 hours and activate the averaging recorders for minimum and maximum values. Record all voltage harmonics.
- ✧ Allocate 50 % storage capacity to the Measurement recorder.
- ✧ Take over the factory-set report configuration.
- ✧ Activate the device configuration you have created as the active parameter set.
- ✧ Perform measurements, acquire the measurand limiting value indication and record the measured values as defined in the task.

7.6.2 Initial Situation

Topology

- 4-wire system, unbalanced
- Primary nominal voltage: 400 V
- Voltage transformer: 10 000 V : 100 V
- Primary rated current: AC 100 A
- Current measurement range: 1 A
- Current transformer: 100 A : 1 A
- Rated frequency: 50 Hz
- Communication via Ethernet interface

Network Configuration

- IP address: 192.168.0.55
- Subnet mask: 255.255.255.0
- Default gateway: 192.168.1.1

Features of the SENTRON PAC5200 Device

- 3 inputs for alternating current measurements
- 4 inputs for alternating voltage measurements
- 2 binary outputs
- Ethernet interface with Modbus TCP protocol
- 4 LEDs for displaying operating states
- Recorder

Connection Diagram

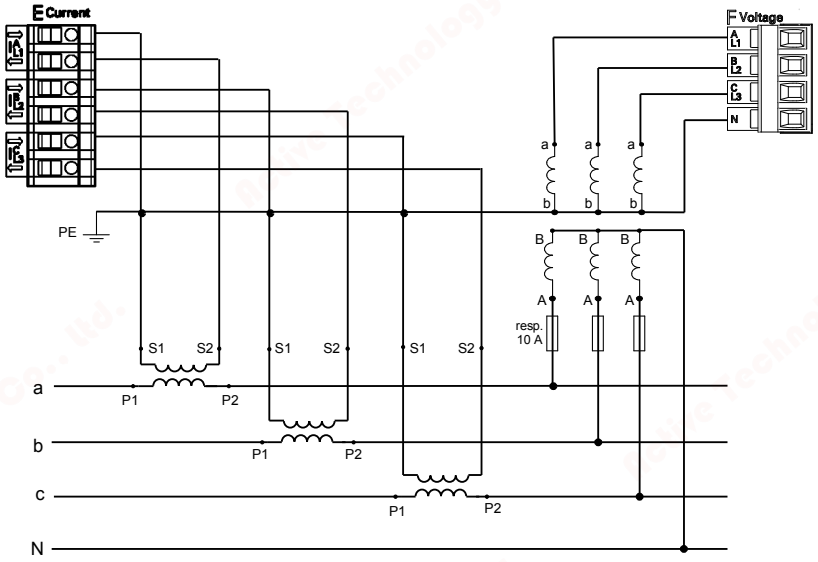


Figure 7-71 Connection Diagram

Device Terminals Used for Measurements and Communication

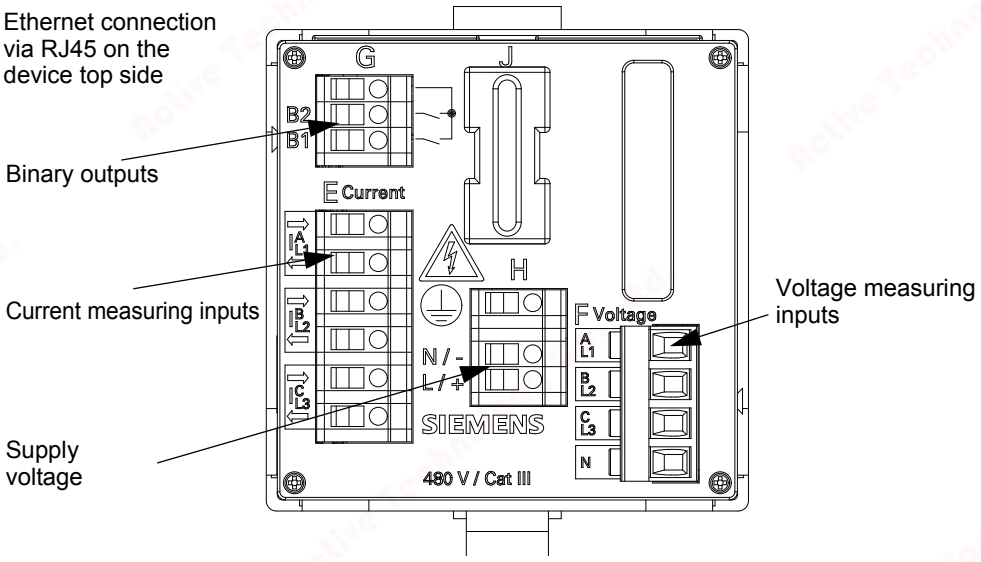


Figure 7-72 Terminals and Interface Used at the Device

7.6.3 Parameterization as Defined by the Task

Requirements

SENTRON PAC5200 is electrically connected to the system and commissioned as described in Commissioning. Rated voltages and currents at the measuring inputs are switched off.

Parameterization

NOTE

If you change settings in tabs, click **Send** on each tab to confirm the new setting. The settings are **activated** only after the entire parameterization has been completed.

- ✧ Start the user interface as described in Initial Start of the Operation (initial startup) or Starting the User Interface during Operation (start during operation). Use the factory-preset IP address for this purpose.
- ✧ On the **Configure** tab, configure the element **AC measurement** (see AC Measurement) according to the following topology specifications:

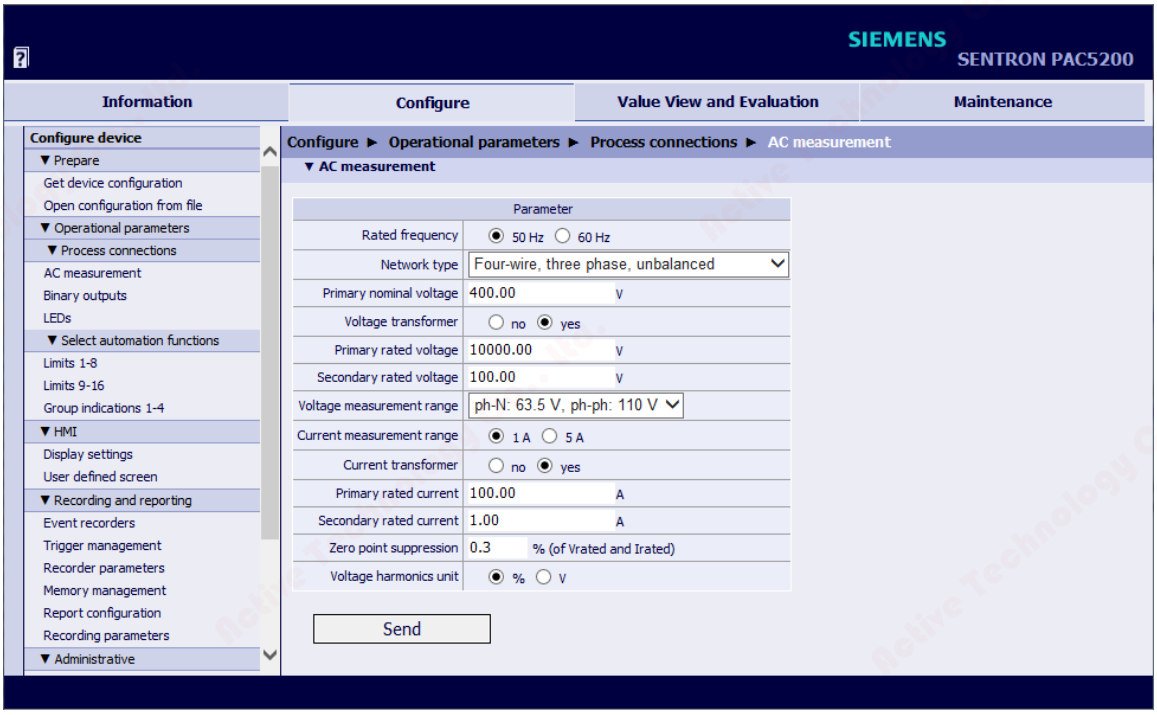


Figure 7-73 Configure Tab, AC Measurement Example

✧ Configure a limit violation indication on the **Configure** tab, **Limits 1-8** item (see Automation Functions) as follows:

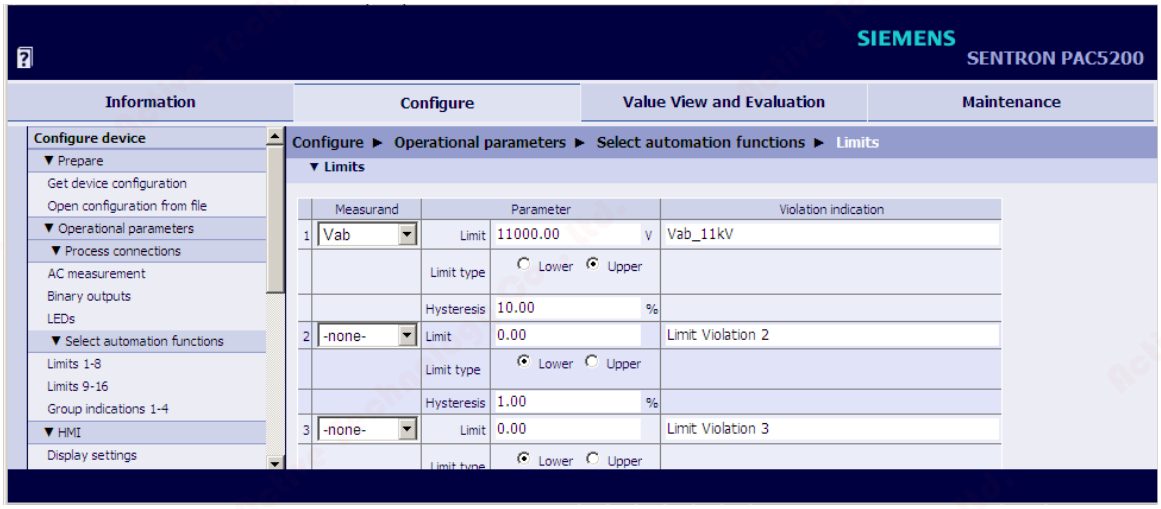


Figure 7-74 Configure Tab, Measurand Limits Example

✧ Configure binary output G1/3 on the **Configure** tab, **Binary outputs** item (see Binary Outputs) as follows:

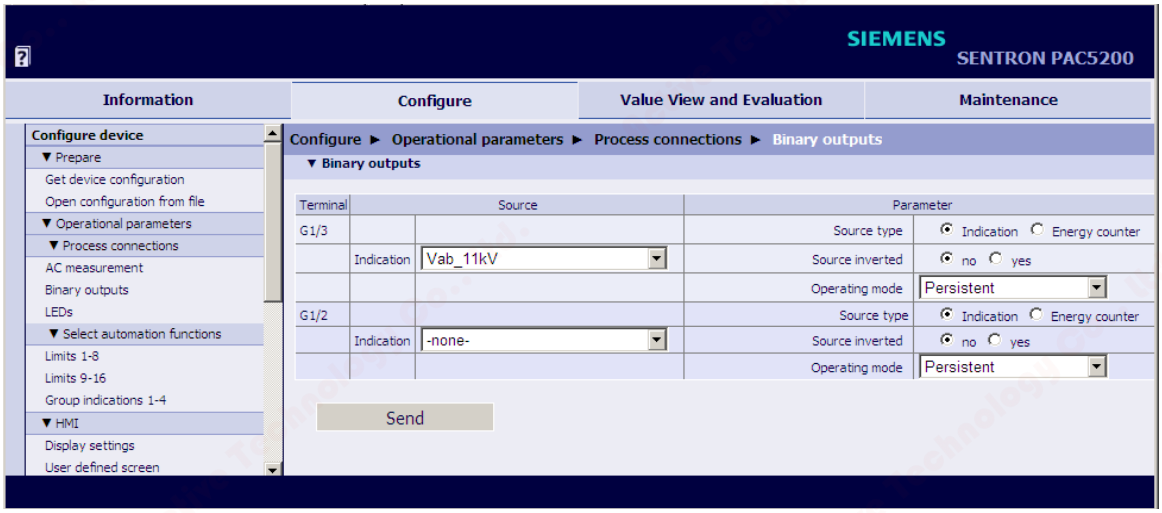


Figure 7-75 Configure Tab, Binary Outputs Example

✧ On the **Configure** tab set the **Communication Ethernet** item (see Communication Ethernet) according to the configuration specified by the system operator, for example as follows:

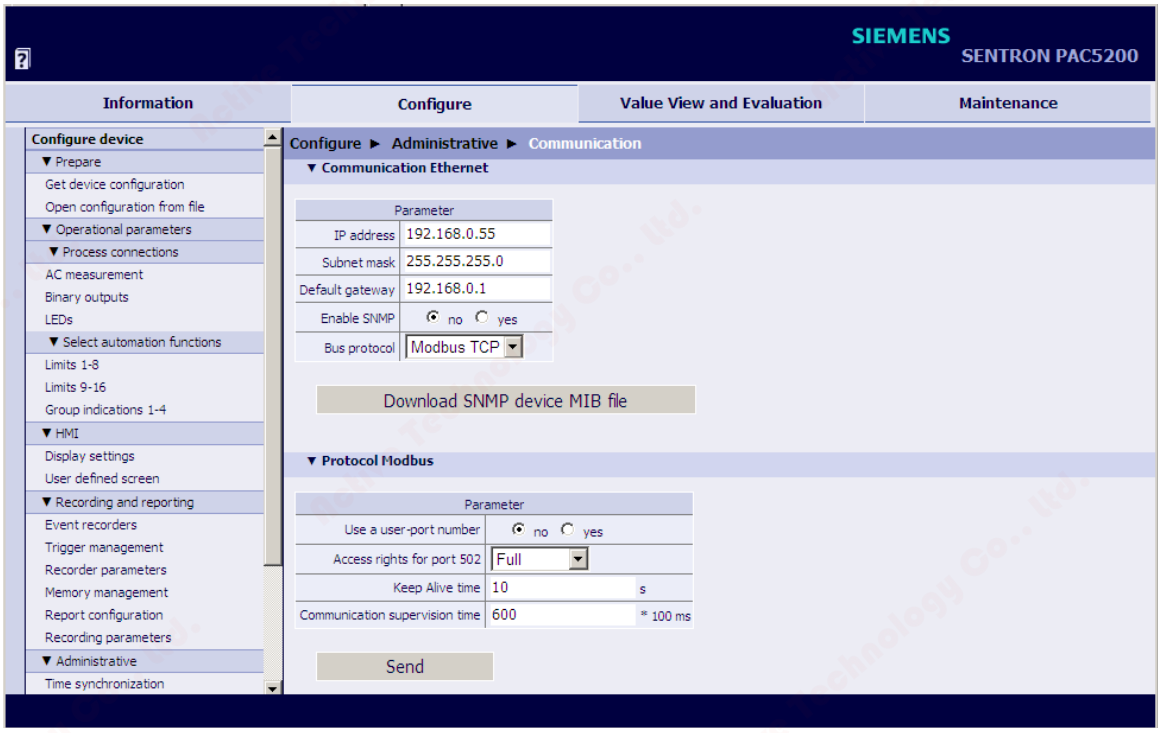


Figure 7-76 Configure Tab, Communication Ethernet Example

✧ On the **Configure** tab, **Device and language** item assign a device name and the format for the date and time display on the HTML pages as described in Device and Language.

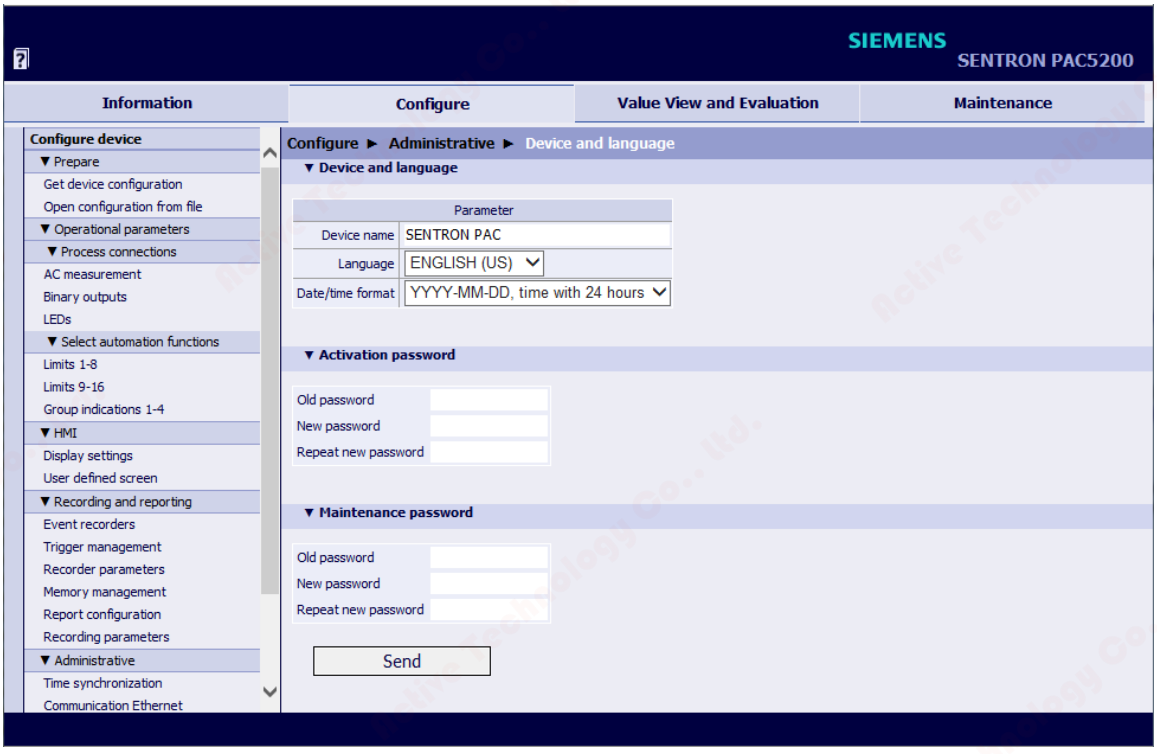


Figure 7-77 Configure Tab, Device and Language Example

✧ On the **Configure** tab, **Recorder parameters** item (see Recorder Parameters), configure the **Measurement recorder** with an averaging time of 2 hours and the recorders of average to record all voltage harmonics.

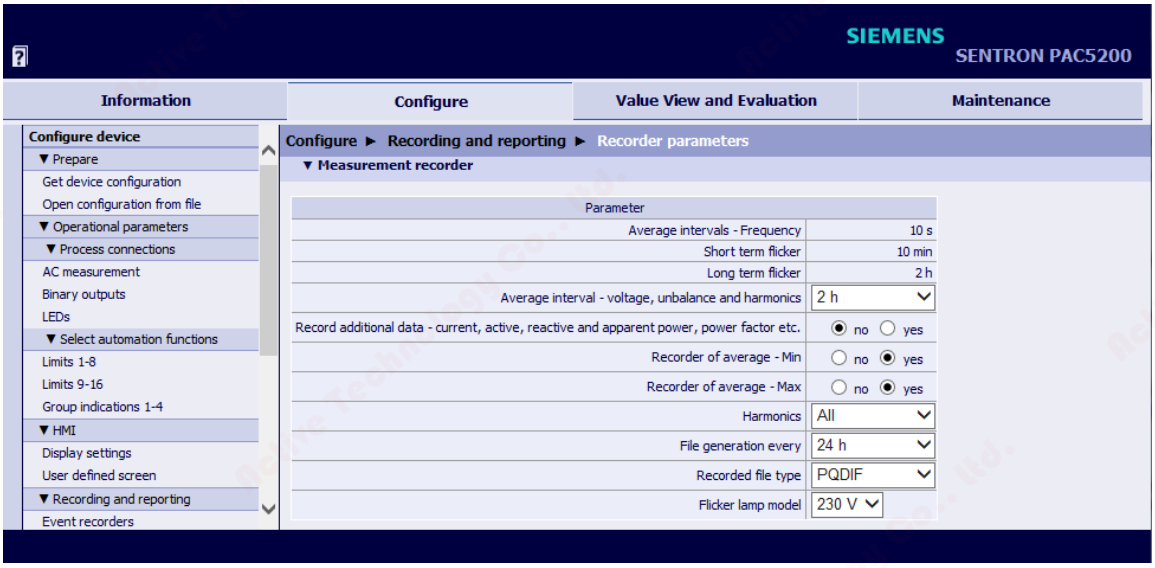


Figure 7-78 Configure Tab, Recorder Management Example

✧ On the **Configure** tab, **Memory management** item (see Memory Management) allocate 50 % of the storage capacity to the Measurement recorder.

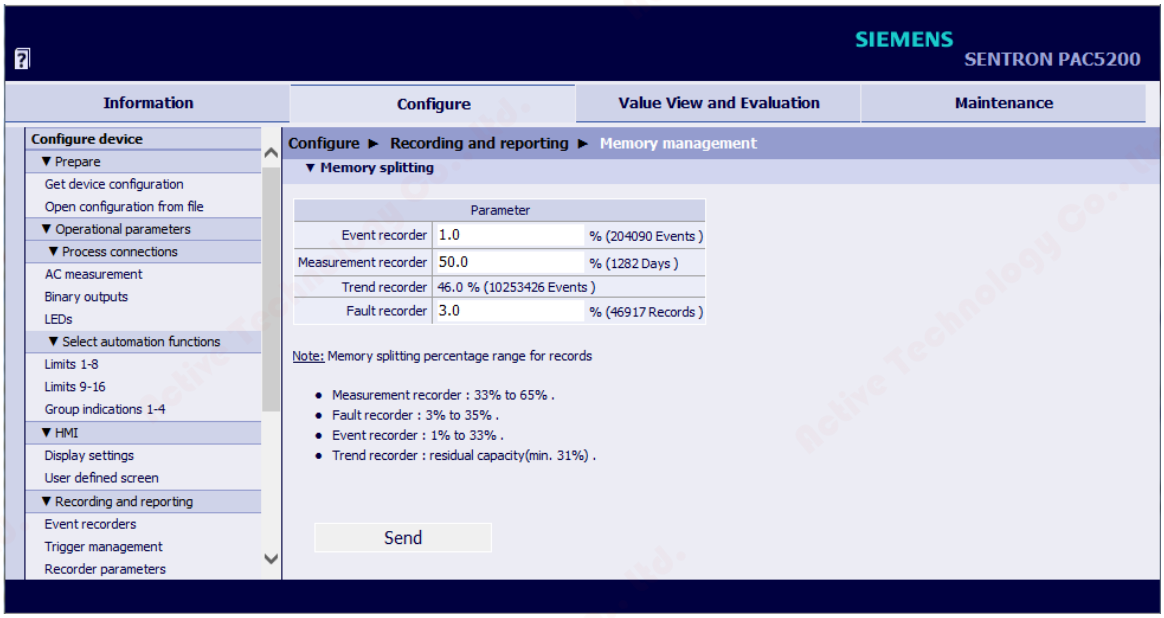


Figure 7-79 Configure Tab, Memory Management Example

✧ Confirm the factory-set report configuration (see Report Configuration).

✧ On the **Configure tab**, **Recording parameters** item (see Recording Parameters) select Start immediately.

Figure 7-80 Configure Tab, Start Immediately Example

✧ Go to the **Configure** tab, **Save configuration to file** menu item to save your device configuration as the active parameter set as described in **Save Configuration to File**.

✧ Enable the active parameter set in the device as described in **Activating the Set of Parameters**.

NOTE

After changing the network settings and subsequent parameter activation the device will reset.

7.6.4 Performing the Measurement

✧ Switch on the rated voltages and rated currents at the measuring inputs E and F of SENTRON PAC5200 observing the safety notes given in Commissioning.

✧ Read the measured values from the **Value view and Evaluation** tab by calling the **Operational parameters**, **Harmonics**, **AC power and energy**, **Binary outputs** and **Limits** menu items according to Value View and Evaluation in the navigation window.

The user interface displays the status of binary output G1/3 which corresponds to the parameterized indication Vab_>11kV.

If the parameterized limit of the voltage Vab is exceeded, a corresponding limit violation indication is displayed in the table.

NOTE

Measured values and indications are refreshed after 5 s on the **Value view and Evaluation** tab.

✧ Display the power quality events and the memory utilization on the **Value view and Evaluation** tab.

8 Operation at Use of the Display

8.1 General Operating Instructions

The SENTRON PAC5100/5200 with display can be operated both using HTML pages from the connected PC and the softkeys at the device. This chapter describes the softkey-based operation.

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 8-1 Control Functions of the Softkeys

Softkey Functions	F1	F2	F3	F4
General Softkey Functions				
Display of the instantaneous value	INST			
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				
Graphic representation of the value	TAB.			
Displaying the graph	GRAPH			
Displaying additional information		INFO		
Active energy supply	SUP			
Active energy consumption	DMD			
Inductive reactive energy	IND			

Table 8-1 Control Functions of the Softkeys (cont.)

Softkey Functions	F1	F2	F3	F4
Capacitive reactive energy	CAP			
Scrolling left				
Scrolling right				
Displaying the next additional information				
Switching to edit mode				EDIT
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 (e.g. password protection on → password protection off)				

Table 8-2 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.

8.2 Starting Operation

Before starting the device, the following preconditions must be satisfied:

- ✧ Mount the SENTRON PAC5100/5200 as described in Chapter 5.2.
- ✧ Connect the lines for measurement, communication and supply voltage as described in Chapter 5.3 and observe the safety provisions.
- ✧ Switch on the devices needed for the measurement.
- ✧ Switch on the supply voltage of the SENTRON PAC5100/5200.
- ✧ Check whether the LEDs at the SENTRON PAC5100/5200 signal that the device is ready (see Chapter 12.3).

The following picture is displayed while the device is being initialized after switching on the supply voltage:

Figure 8-1 Start Screen

Once the device has initialized, the currently selected screen with measured values is displayed.

NOTE

The following pictures only show the display without the front view of the device.

8.3 Display Content

Display of the Menus

In the main menu all submenus are listed on the display:

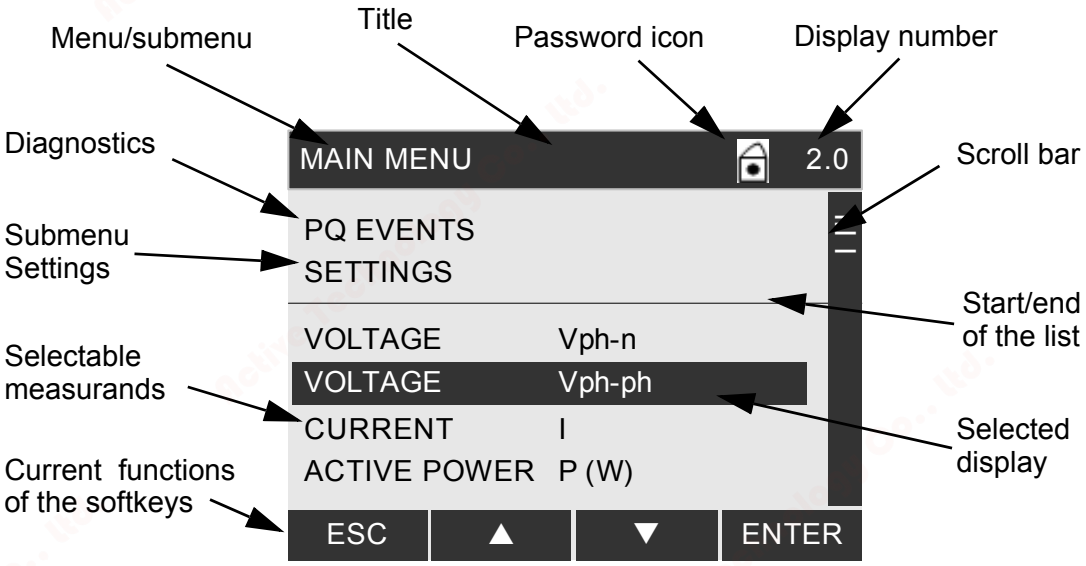


Figure 8-2 Display Content

The display can be switched between inverse mode and non-inverse mode, see Chapter 8.4.4, **submenu display number 32.6: Display**).

Display of Measured Values

Measured values are displayed as follows:

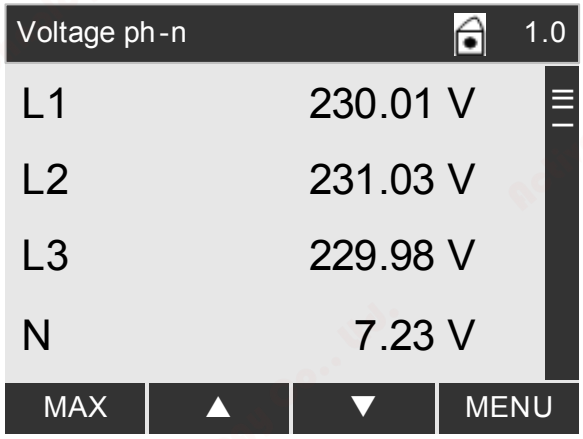


Figure 8-3 Display of Measured Values

Display of Bar Charts

Bar charts are displayed as follows:

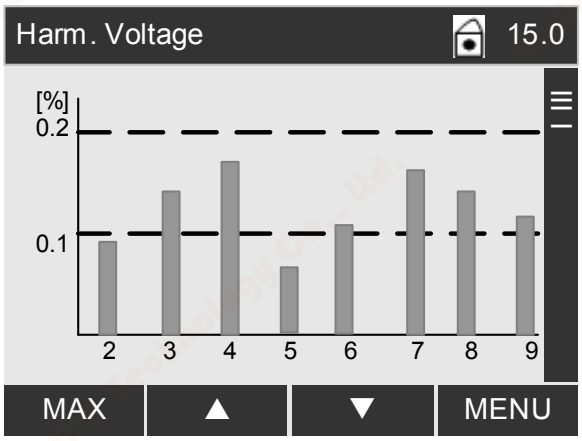


Figure 8-4 Bar Chart Display

Display of Phasor Diagrams

Phasor diagrams are displayed as follows:

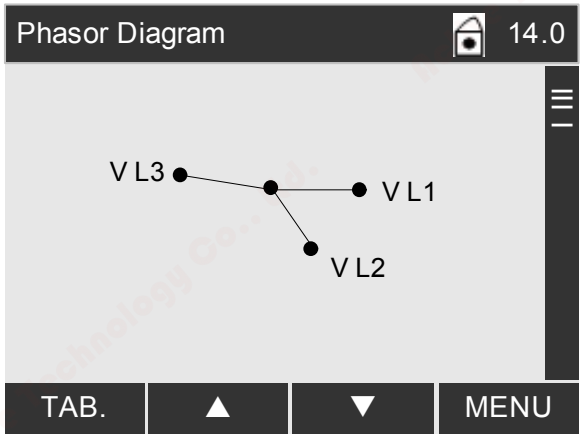


Figure 8-5 Display of Phasor Diagrams

8.4 Parameterization

Softkeys F1 to F4 are used for parameterization taking the display content into consideration. Proceed as described in the following menus.

NOTE

Remember that the parameterization on the device is subject to restrictions. Full parameterization requires a PC and the HTML pages.

8.4.1 Menu Tree of the Main Menu

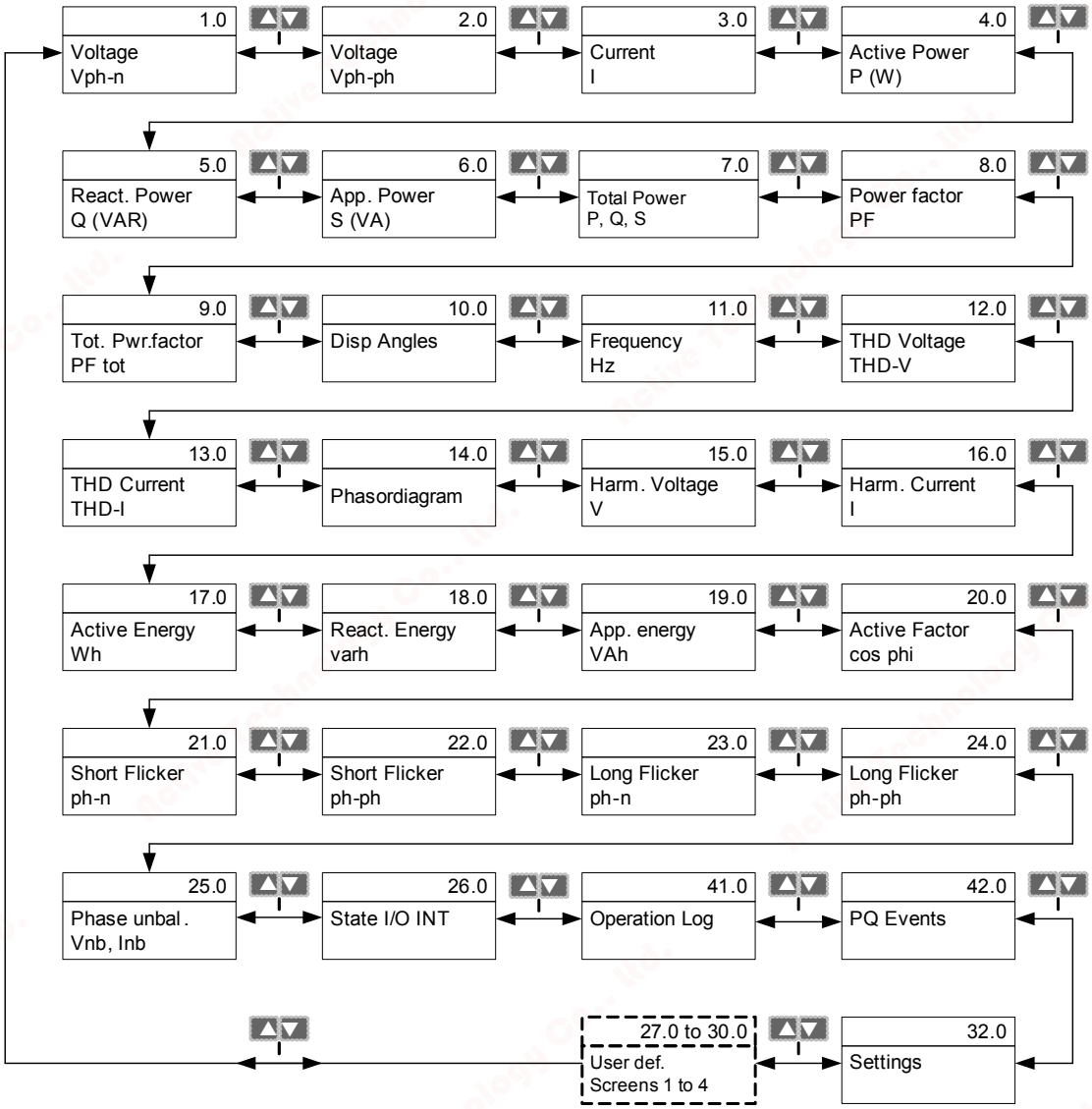


Figure 8-6 Menu Tree of the Main Menu

NOTE

The user-defined screens (27.0 through 30.0) are only visible on the display if they were activated using the HTML pages (see Chapter 7.3.4.2).

8.4.2 Measurands Submenus

NOTE

To return to the main menu from within any submenu, press the F4 **MENU** softkey.

Submenu Display Number 1 through 11, 20 and 25: Measurands

- 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
- Counter
- Phase unbal. Vnb, Inb

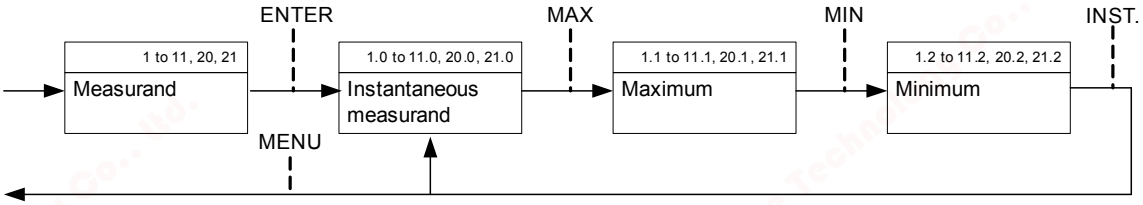


Figure 8-7 Submenus of the Display Numbers 1 to 11, 20 and 21, Various Measurands

Submenu Display Number 12 and 13: THDS Voltage and THDS Current

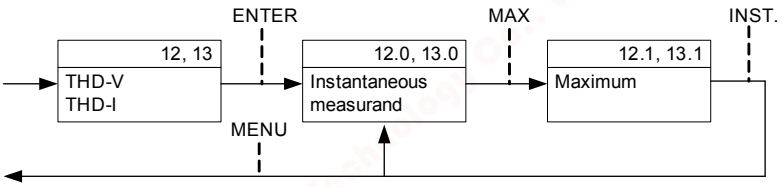


Figure 8-8 Submenu Display Number 12 and 13, THDS V and THDS I

Submenu Display Number 14: Phasor Diagram

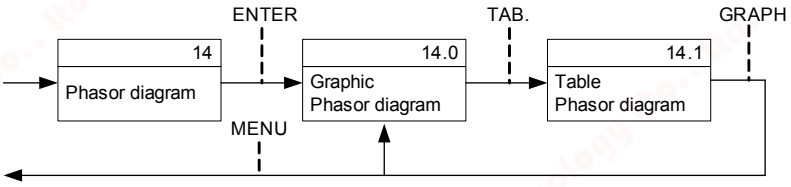


Figure 8-9 Submenu Display Number 14, Phasor Diagram

Submenu Display Number 15 and 16: Harmonics V and Harmonics I

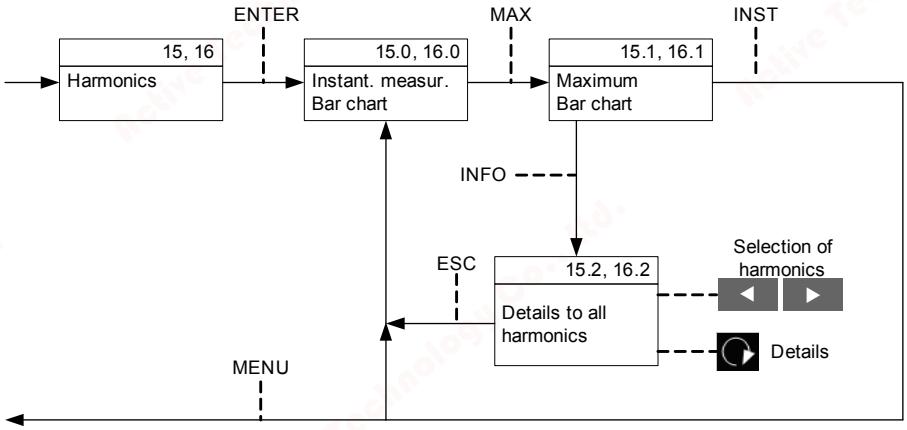


Figure 8-10 Submenu Display Number 15 and 16, Harmonics V and Harmonics I

Submenu display number 17: Active energy

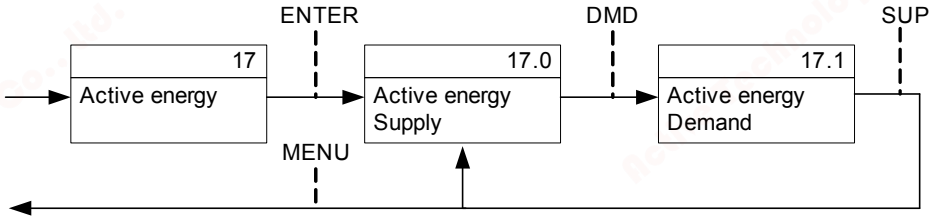


Figure 8-11 Submenu Display Number 17, Active Energy

Submenu display number 18: Reactive energy

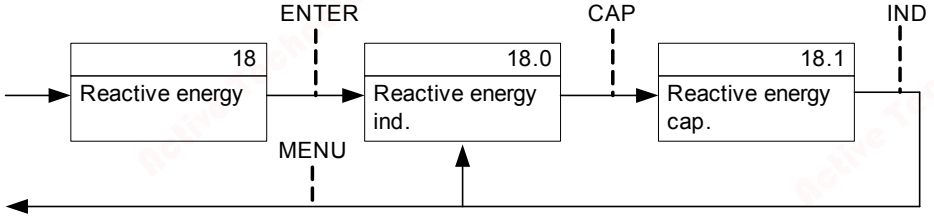


Figure 8-12 Submenu Display Number 18, Reactive Energy

Submenu display number 19: Apparent energy

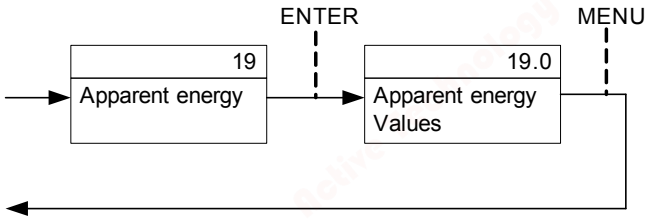


Figure 8-13 Submenu Display Number 19, Apparent Energy

Submenu Display Number 21 to 24: Flicker

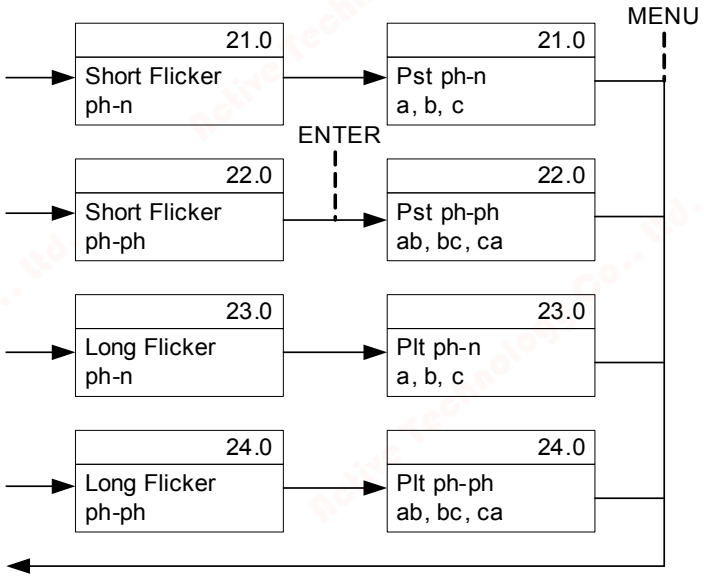


Figure 8-14 Submenu Display Number 21 through 24, Flicker

Submenu Display Number 26: State I/O INT

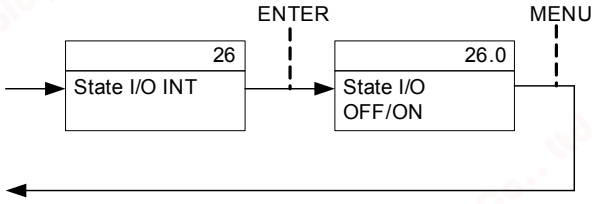


Figure 8-15 Submenu Display Number 26, State I/O INT

8.4.3 Submenus for Diagnostics

NOTE

To return to the main menu from within any submenu, press the F1 **ESC** softkey.

Submenu Display Number 41: Messages

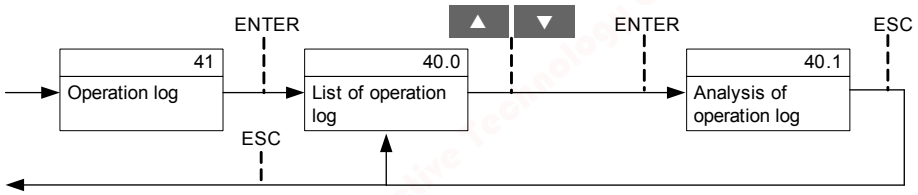


Figure 8-16 Submenu Display Number 41, Messages

Submenu Display Number 42: PQ Events

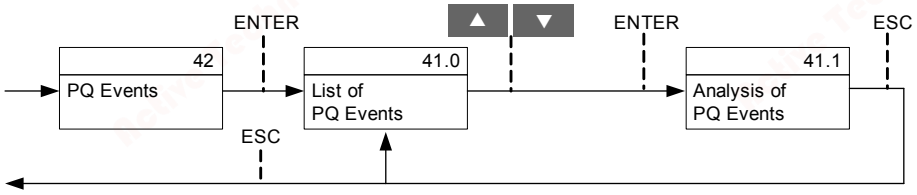


Figure 8-17 Submenu Display Number 42, PQ Events

8.4.4 Menu Tree of the Settings Submenu

NOTE

To return to the main menu, press the F1 **ESC** softkey from within any item of the **Settings** submenu.

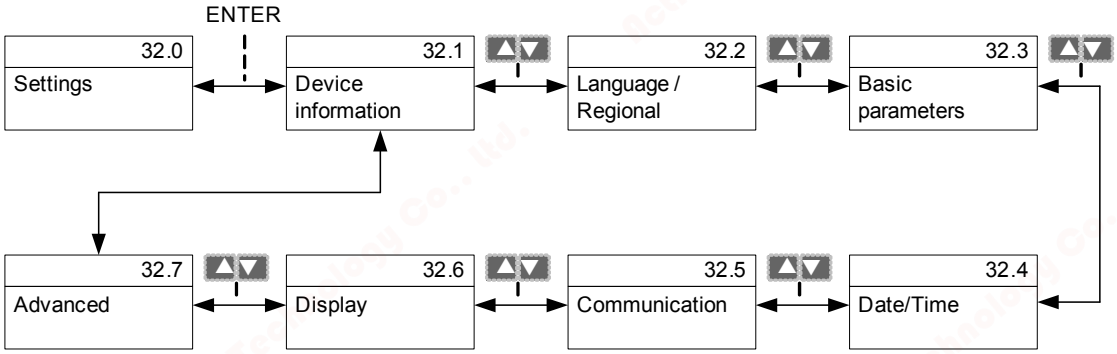


Figure 8-18 Menu Tree of Submenu 32.0, Settings

NOTE

You cannot make any settings in the **Device information 32.1** submenu.

All other submenus will prompt you to enter a password before editing settings when the device has restarted.

Submenu Display Number 32.2: Language/Regional

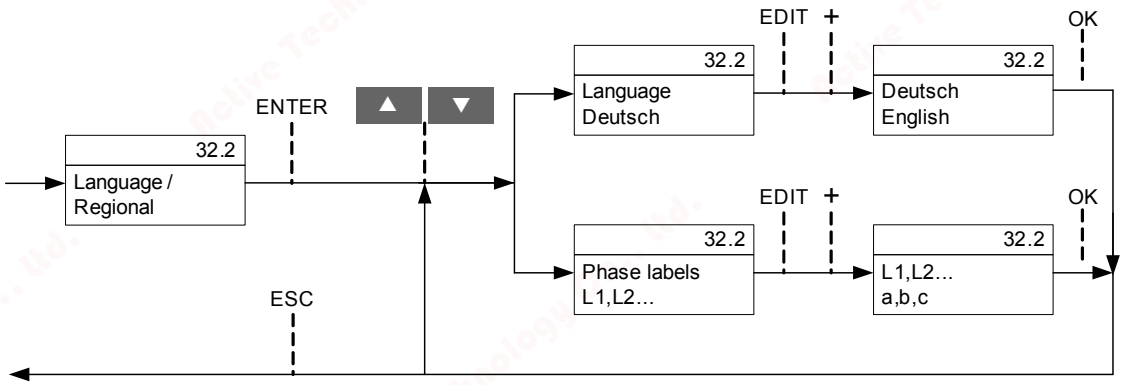


Figure 8-19 Submenu Display Number 32.2, Language/Regional

Submenu Display Number 32.3: Basic Parameters

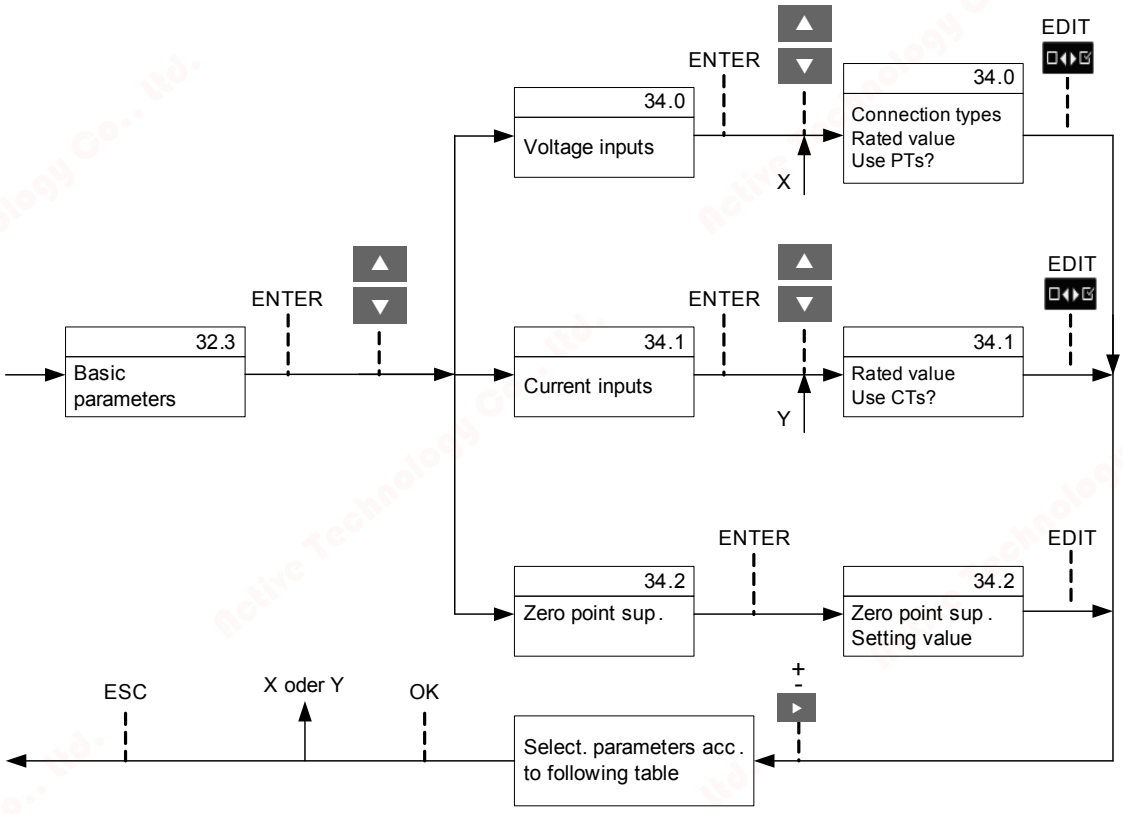


Figure 8-20 Submenu Display Number 32.3, Basic Parameters

NOTE

The selection of the transformers only becomes active after a delay of 5 s.

Table 8-3 Basic Parameter Settings

Parameter	Default Setting	Setting Range
Voltage Inputs		
Connection type	The connection type is indicated on the display. However, it can be set via the User interface only.	
Rated value	The rated value is indicated on the display. However, it can be set via the User interface only.	
Use PTs?	No (no checkmark)	Yes (checkmark) No (no checkmark)
Use PTs: V primary Primary rated voltage Ph-Ph	AC 10,000.00 V	AC 100.00 V to 1,000,000.00 V
Use PTs: V secondary Secondary rated voltage Ph-Ph	AC 100 V	AC 1.0 V to 1000.0 V
Current Inputs		
Rated value	AC 5 A	AC 1 A AC 5 A
Use CTs?	No (no checkmark)	Yes (checkmark) No (no checkmark)
Use CTs: I primary primary rated current	AC 1,000.00 A	AC 1.0 A to 100,000.0 A
Use CTs: I secondary secondary rated current	AC 1.00 A	AC 0.01 A to 10 A
Zero-Point Suppression		
Zero-point suppression (in % of Vrated and Irated)	0.3 %	0.0 % to 10.0 %

Submenu Display Number 32.4: Date/Time

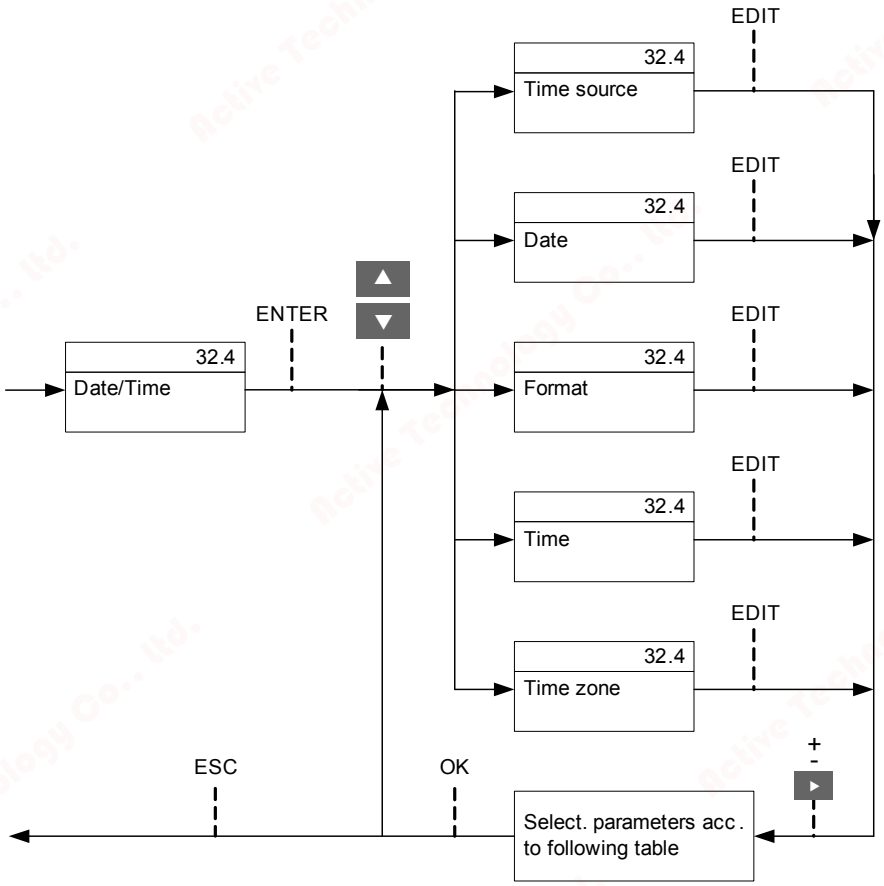


Figure 8-21 Submenu Display Number 32.4, Date/Time

Table 8-4 Date/ Time Settings

Parameter	Default Setting	Setting Range
Time source	internal	internal Ethernet NTP Fieldbus
Date	Current date	setting according to format
Format	YYYY-MM-DD24	YYYY-MM-DD24 YYYY-MM-DD12 DD.MM.YYYY24 DD.MM.YYYY12 MM/DD/YY24 MM/DD/YY12
Time	Current time	setting according to format
Time zone	00:00	-12 to +13 (hours) (in increments of 0.5 h)

Submenu Display Number 32.5: Communication

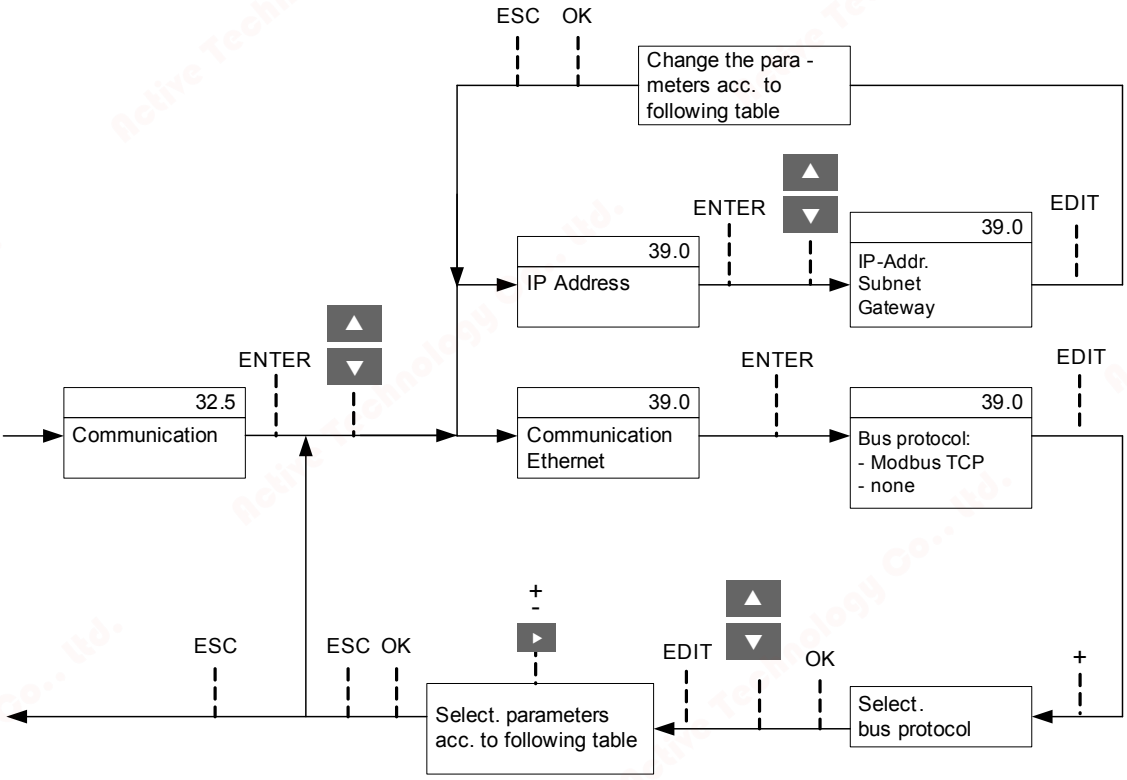


Figure 8-22 Submenu Display Number 32.5, Communication

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**.

Table 8-5 IP Address Settings

Parameter	Default Setting	Setting Range
MAC address	fixed	
IP address [1)]	192.168.0.55	Any 0.0.0.0 = DHCP
Subnet [1)]	255.255.255.0	Any
Gateway [1)]	192.168.0.1	Any

1) After the communication parameters have been changed, the device restarts. For this purpose, a prompt is displayed which you must acknowledge with **OK**.

Table 8-6 Ethernet Communication Settings

Parameter	Default Setting	Setting Range
Bus protocol	Modbus TCP	none Modbus TCP
Ethernet Communication - Modbus TCP Bus Protocol		
Access rights for port 502	full	full read only
Keepalive time	10 s	0 s = switched off 1 s to 65,535 s
Communication monitoring time	600 * 100 ms	0 s = none 100 ms to 6,553,400 ms
Set user port number [1)]	No	No Yes
User port number [1)] (only settable if *Set user port number* is parameterized with *yes*)	10000	10,000 to 65,535
Access right for user port (only settable if *Set user port number* is parameterized with *yes*)	full	full read only

1) After enabling the parameter changes, any currently active Modbus TCP connections will be closed. The Modbus TCP client must later re-open these connections.

Submenu Display Number 32.6: Display

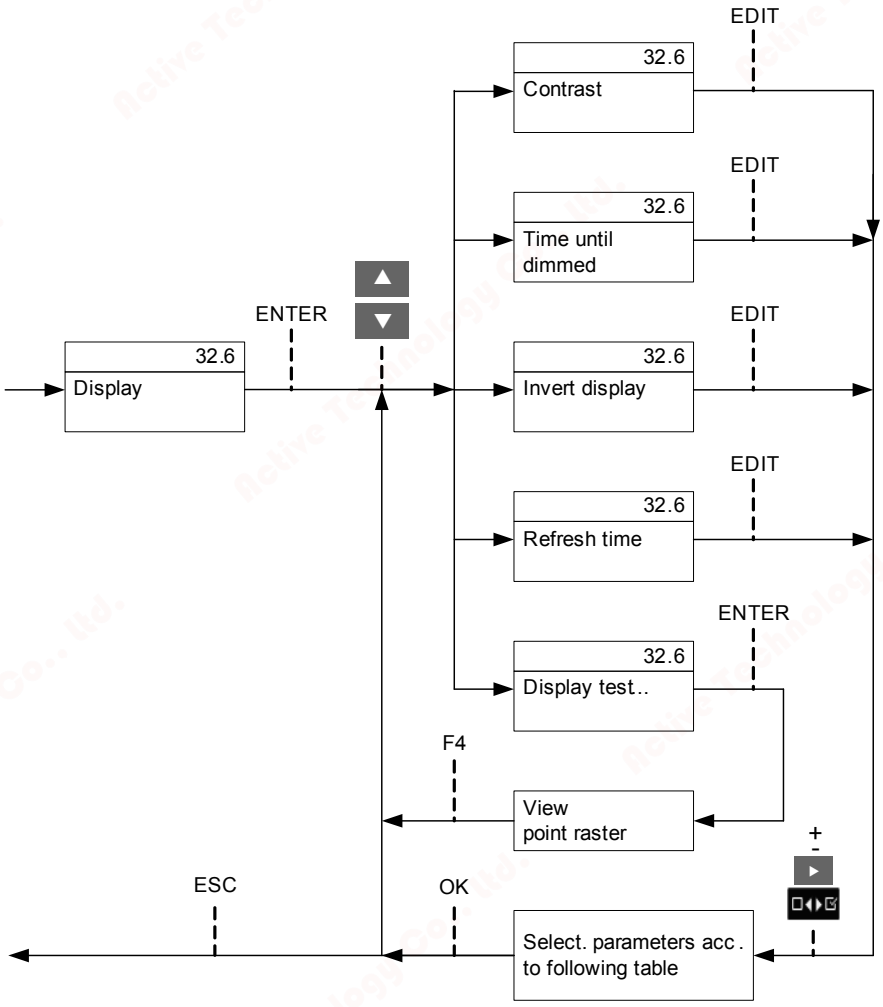


Figure 8-23 Submenu Display Number 32.6, Display

Table 8-7 Display Settings

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

Submenu Display Number 32.7: Advanced

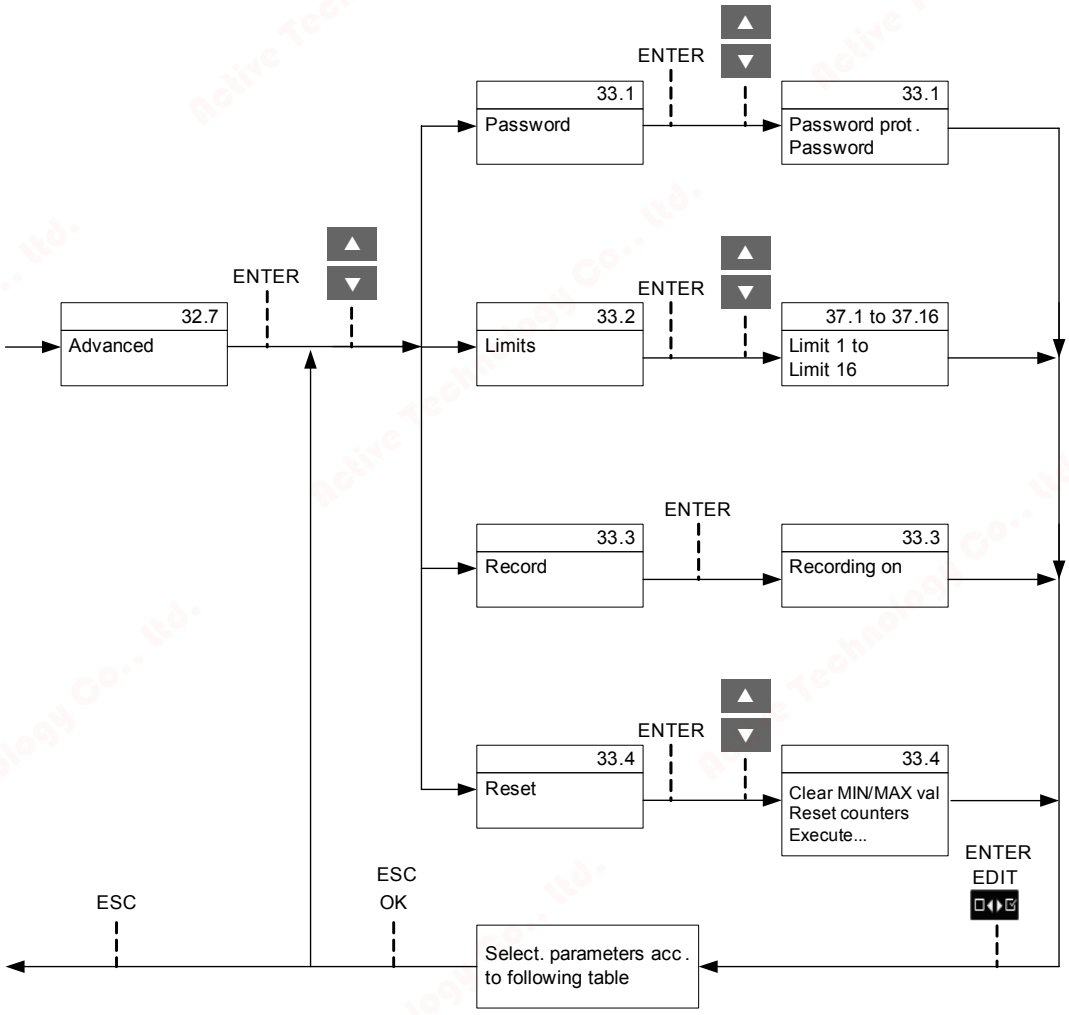


Figure 8-24 Submenu Display Number 32.7, Advanced

Table 8-8 Advanced Settings

Parameter	Default Setting	Setting Range
Password Protection		
Password protection	on	on (checkmark) off
password	000000	any 6 digits
Limit Values 1 to 16		
Source	-none-	According to selection list (for the selection, see Chapter 14)

Table 8-8 Advanced Settings (cont.)

Parameter	Default Setting	Setting Range
Mode	lower than	greater than smaller than
Value	0	-1 000 000 000 to +1 000 000 000 (unit)
Reset hysteresis	1.0 %	0.0 % to 10.0 %
State	ON	ON OFF (O) acc. to current configuration
Record		
Recording on	No (no checkmark)	Yes (checkmark) No (no checkmark)
Reset		
Clear MIN/MAX val	No (no checkmark)	Yes (checkmark) No (no checkmark)
Reset counters	No (no checkmark)	Yes (checkmark) No (no checkmark)
in process (prompt whether selected function is executed)	-	NO OK

Password Protection

If you have selected the option **Use password = no** on the HTML page (see Chapter 7.3.4.1), you can use the softkeys to parameterize the device without entering a password.

If you have selected the option **Use password = yes** on the HTML page (see Chapter 7.3.4.1), you must first enter the activation password (default setting 000000) before you can edit the device settings. A prompt is displayed for this purpose.

After you have entered the correct password, you can edit the parameterization using the softkeys within the next 15 minutes. After this time you have to re-enter the password at the device.

8.4.5 User-defined Screens Submenus

NOTE

The user-defined screens (27.0 through 30.0) are only visible on the display if they were activated using the HTML pages (see Chapter 7.3.4.2).

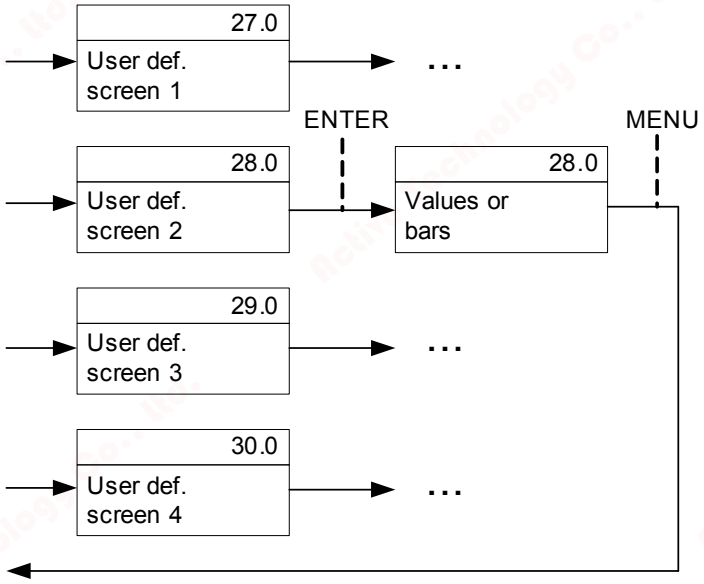


Figure 8-25 Submenus User-defined Screens 1 to 4

Depending on which display type was selected, the measured values are displayed numerically or as bars.

9 Time Synchronization

9.1 General

During operation, SENTRON PAC5100/5200 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 SENTRON PAC5100/5200 is necessary to guarantee a common time basis for the communication with peripheral devices and time stamping of the process data.

SENTRON PAC5100/5200 supports both external and internal time synchronization. The type of time synchronization is specified during the parameterization (see chapter 7.3.6.1). The external time synchronization from an NTP server is preferred.

9.2 Internal Time Keeping

9.2.1 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 (see chapter 7.3.6.1).

9.2.2 Status Bits

FAIL Status Bit

The **FAIL** status bit implemented in the SENTRON PAC5100/5200 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 14.1.

The following table lists the time stamps of events or indications for the displayed operational and error logs according to status bit set/not set using the example of *date 2010-09-26, time 13:49.35246*:

Tabelle 9-1 FAIL Status Bit for Time Synchronization via NTP Server

FAIL	Output
0	2010-09-26 13:49.35:246
1	2010-09-26 13?49?35?246

DST Status Bit

With "1", the **DST** status bit implemented in the SENTRON PAC5100/5200 signals that the local daylight saving time is active. The operational indication "Daylight saving time" is displayed.

9.3 External Time Synchronization per NTP

General

To synchronize the time via an external source, SENTRON PAC5100/5200 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.

The chapter 7.3.6.1 describes how to set the parameters of the 2 servers.

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 ±5 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.

NOTE

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

Time Synchronization Procedure

The device was set to external time synchronization (**Ethernet NTP**) during the parameterization. After switching on or resetting the device, the FAIL bit is first set to "1" (=invalid) and 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 14.1.

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 the two NTP servers, see chapter 7.3.6.1.

SENTRON PAC5100/5200 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 are met:

- No response from the primary NTP server to 2 successive requests
- The "Alarm" indication is set in the time information of the primary NTP server.
- The primary NTP server responds with 0.
- The message runtime in the network is > 5 ms.
- The stratum of the primary NTP server is 0 (unknown) or > 3.

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 primary to secondary NTP server; "Secondary NTP Server Error" indication was already output) or
- The secondary server has recently been available for less than 10 minutes.

In these cases, SENTRON PAC5100/5200 is not 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 14.1.

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.

NOTE

The Communication Manual SENTRON PAC5100/5200 provides information on the data format.

9.4 External Time Synchronization via Fieldbus

The time information can also be transmitted from the systems control via **Modbus TCP** using Ethernet interface. When using the Ethernet connection, Siemens recommend, however, to synchronize the device from an NTP server, see chapter 9.3.

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.

NOTE

The Communication Manual SENTRON PAC5100/5200 provides information on the data format.

9.5 Internal Time Synchronization via RTC

Besides external time synchronization, the internal time synchronization is also possible using the battery-buffered RTC (Real Time Clock). SENTRON PAC5100/5200 features a quartz oscillator for this purpose.

The time offset of internal time synchronization is 86 ms/day maximum. Due to the reduced accuracy, RTC should only be used in case of failure or unavailability of the external time synchronization.

NOTE

The Communication Manual SENTRON PAC5100/5200 provides information on the data format.

10 Maintenance, Storage, Transport

10.1 Maintenance

Except for a battery replacement, the SENTRON PAC5100/5200 is maintenance-free.

Wipe the device using a clean, dry and soft cloth if necessary. Do not use solvents.

The operating instruction enclosed with the device describes how to replace the battery.

10.2 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, pay attention to the commissioning notes in chapter 5.7.

The Lithium batteries used in Siemens devices are subject to 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.

10.3 Transport

For reshipment, Siemens recommends using the original transport packaging of the devices. If you use another packaging, make sure that the packaging meets the requirements concerning the stress during transport according to the requirements of standard ISO 2248. The storage packing of the individual devices is not adequate for transport purposes.

The Lithium-batteries in our equipment are subject to 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.

11 Failures and LED Indications

11.1 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 as described in Chapter 5.2 at the intended location
- Compliance with the environmental conditions specified in Chapter 12.1.4 of the technical data
- Correct connection of supply voltage and grounding conductors according to Chapter 5.3
- Correct connection of measuring and communication lines according to Chapter 5.7.1

Function Checks

Additionally, check the following aspects:

- Functioning of the display according to Chapter 8.4 and good visibility of the display
- Correct functioning of peripheral devices (e.g. connected PC, series-connected current transformers)
- Compliance with the system requirements specified in Chapter 5.4
- Compliance with the access rights according to Chapter 5.5
- Compliance with the commissioning sequence of the device according to Chapter 5.7
- Evaluation of the LED failure indications, see Chapter 11.3.

11.2 Commissioning during Failures

11.2.1 Automatic Start of the Boot Loader

If a firmware update has failed or the device startup was unsuccessful, Internet Explorer will automatically open the HTML page **Boot Loader**.

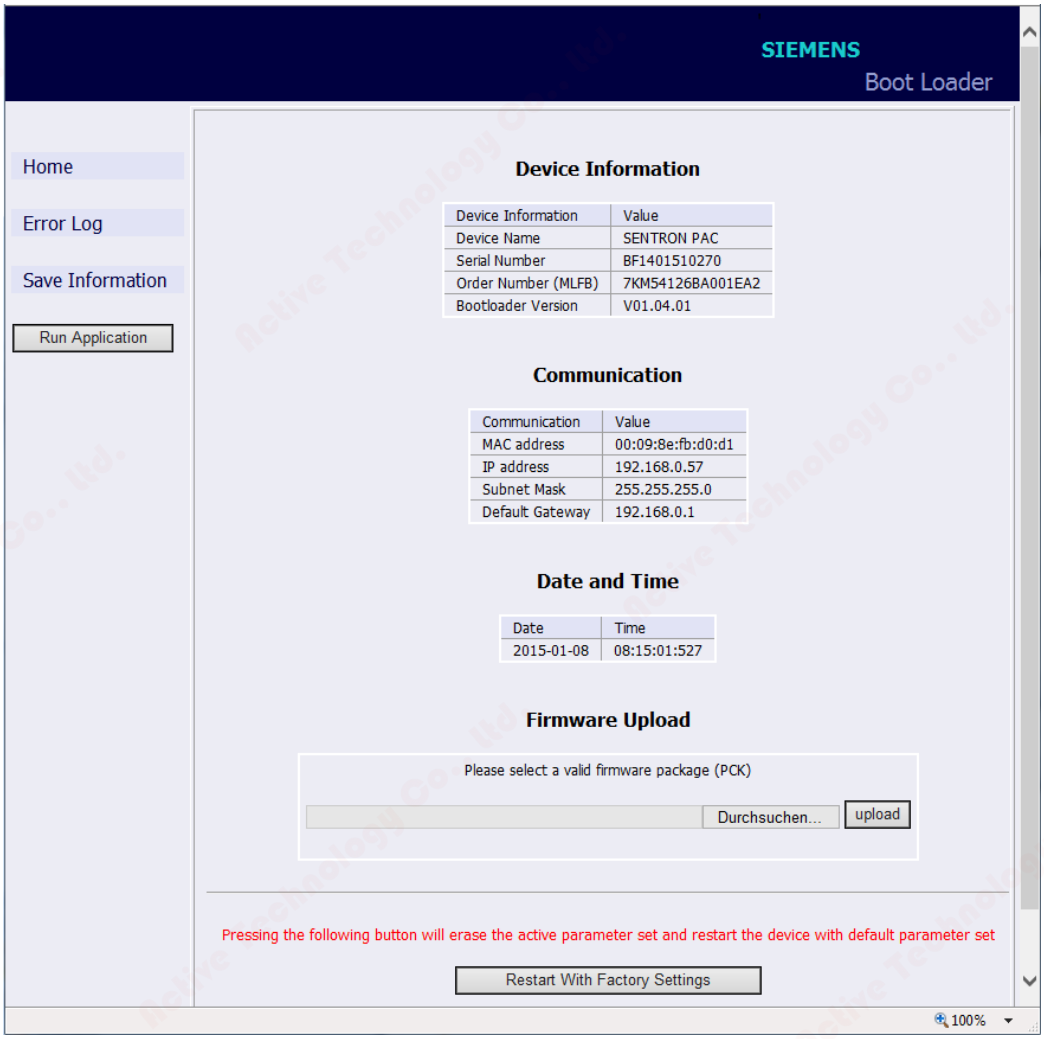


Figure 11-1 Boot Loader

Starting User Interface <u>without</u> Loading a New/Different Firmware

✧ Click **Run Application**. The following message appears:

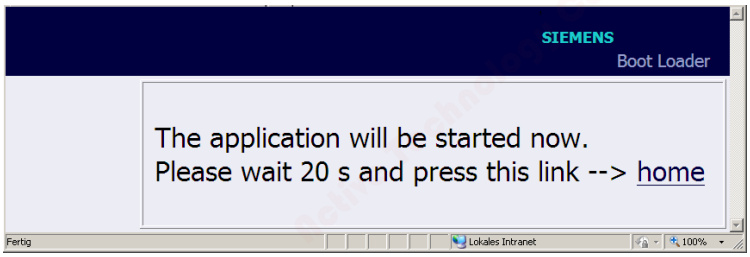


Figure 11-2 Boot Loader Message of Run Application

- ✧ Wait for at least 20 s and then click the **home** link.
  The user interface opens.

Starting User Interface with Loading a New/Different Firmware

- ✧ Click **Browse...**. The **Choose file** dialog opens.
- ✧ In the **Choose file** dialog, select the current firmware update (file extension .pck) in the **Look in:** list box and click **Open**.
  The path appears in the **Browse...** field.
- ✧ Click **upload**.
  The firmware is uploaded from the device to the PC and the following information is displayed in the Boot Loader window:

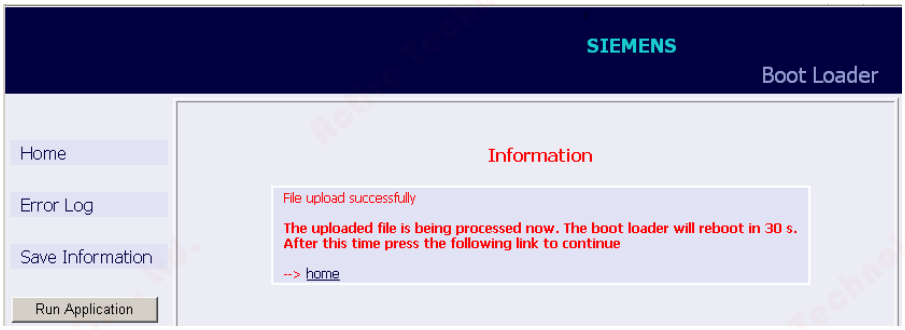


Figure 11-3 Information in the Boot Loader

- ✧ Wait for at least 30 s and then click the **home** link.
  The user interface opens.

11.2.2 Manual Start of the Boot Loader

If it is necessary to start the Boot Loader manually, proceed as follows:

- ✧ If the SENTRON PAC5100/5200 is still energized by the supply voltage, switch off the supply voltage.
- ✧ Press the F4 softkey on the SENTRON PAC5100/5200 (device with display) or the IP-Addr. push-button (device without display) (see Chapter 5.7.3) and switch on the supply voltage while holding the F4 softkey or IP address button down.
- ✧ Hold the softkey F4 or the IP-Addr. push-button down until the LEDs ERROR (red) and H2 (yellow) on the device top side are lit (LEDs RUN (green) and H1 (yellow) are off).
- ✧ Release the softkey F4 or the IP-Addr. push-button.
  SENTRON PAC5100/5200 starts the Boot Loader with the **Boot Loader** HTML page (Figure 11-1).

11.3 Indications Signaled by LEDs

SENTRON PAC5100/5200 automatically monitors the functions of its hardware, software, and firmware components. The LEDs on the top side of the housing and on the display side (only in devices with display) indicate the current device status.

Designation of the LEDs on the Top Side of Housing

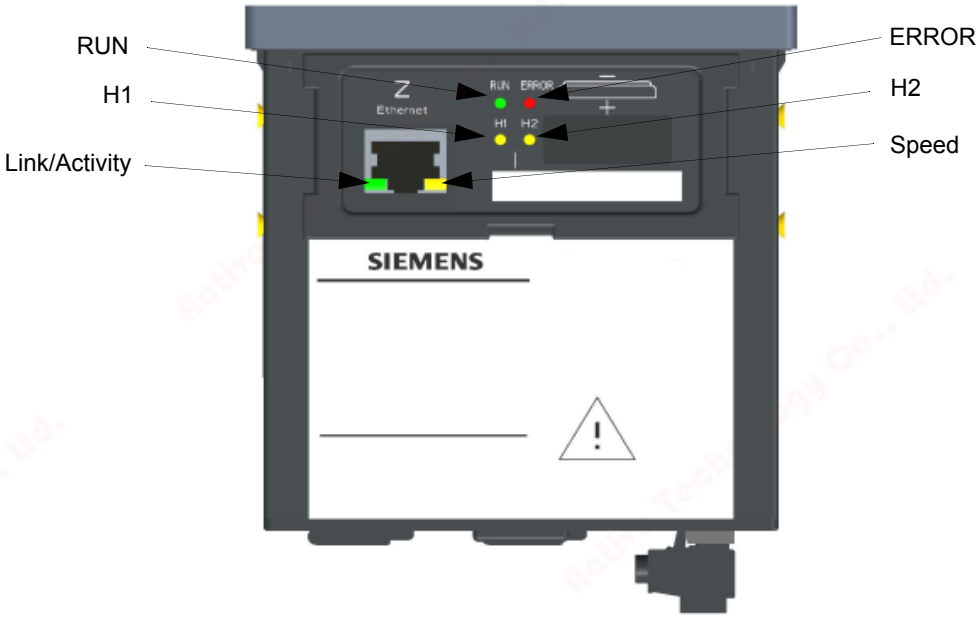


Figure 11-4 Designation of the LEDs on the Top Side of Housing

Designation of the LEDs on the Display Side

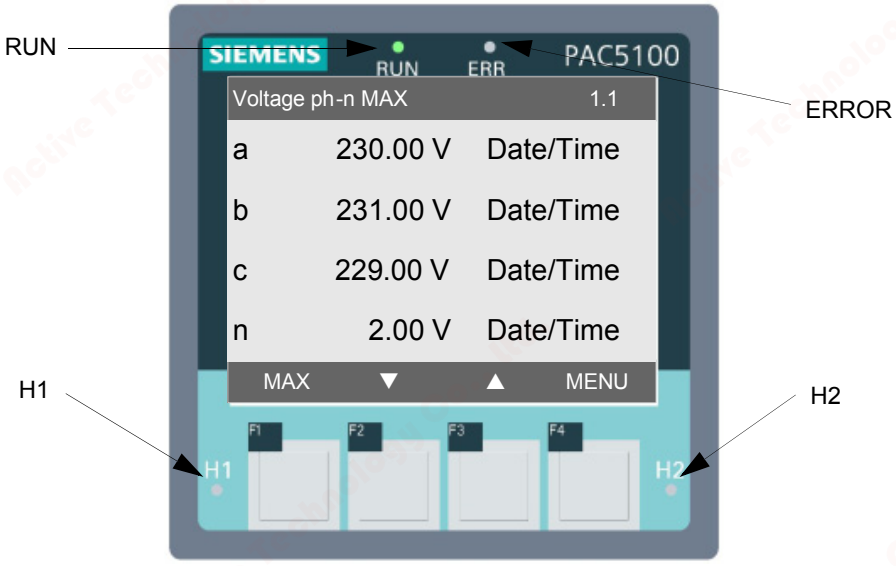
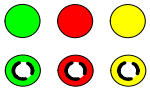


Figure 11-5 Designation of the LEDs on the Display Side

Meaning of the LEDs



LED (green, red, yellow): on

LED (green, red, yellow): flashes

LEDs H1/H2/ERROR: according to parameterization

LED: off

LED Speed (yellow):

off: 10 Mbit/s

on: 100 Mbit/s

LED Link/Activity (green):

LED on: Ethernet link is up

LED flashing: Ethernet link is up and data is transferred

LED off: no Ethernet partners connected

NOTE

The designations and functions of the LEDs on the top side and on the display side of the housing are identical. Therefore, only the LEDs on the top side of the housing are described in the following table.

NOTE

In the following table, the F4 softkey is pressed in order to call the default IP address. Devices without display have the IP-Addr. push-button located on the DIN rail side, see Chapter 5.7.3, Figure 5-7.

Table 11-1 Indications Signaled by LEDs on the Top Side of the Housing

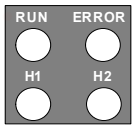
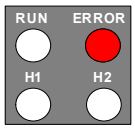
LED	Meaning
	Device switched off
	No firmware loaded

Table 11-1 Indications Signaled by LEDs on the Top Side of the Housing (cont.)

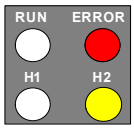
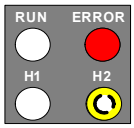
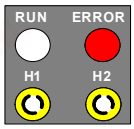
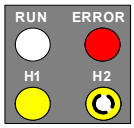
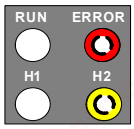
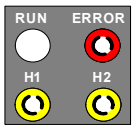
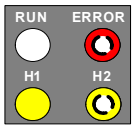
LED	Meaning
Boot Loader	
	F4 softkey was pressed while switching on the supply voltage (calling default IP address).
	The boot program is started after the F4 softkey was pressed (calling the default IP address) during startup when switching on the supply voltage. The IP address was configured or received from DHCP.
	DHCP active (H1 switches off after receiving the IP address via DHCP)
	The default IP address was confirmed by pressing the F4 softkey.
	Boot loader started; no process application exists The IP address was configured or received from DHCP.
	DHCP active (LED H1 switches off after receiving the IP address via DHCP)
	The default IP address was confirmed by pressing the F4 softkey.

Table 11-1 Indications Signaled by LEDs on the Top Side of the Housing (cont.)

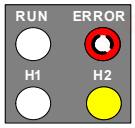
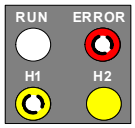
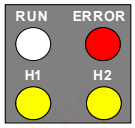
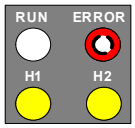
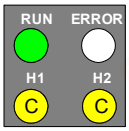
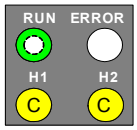
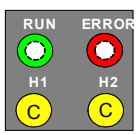
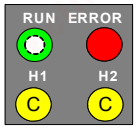
LED	Meaning
	Boot loader was started because an error occurred in the process application. The IP address was configured or received from DHCP.
	DHCP active (LED H1 switches off after reception of the IP address via DHCP)
	Boot loader started, process application is being loaded.
	Double IP address is detected
Process Application	
	Normal mode: IP address has been configured or received from DHCP.
	DHCP: LED RUN (green) is lit after the IP address was received from the DHCP server.
	The default IP address was confirmed by pressing the F4 softkey.

Table 11-1 Indications Signaled by LEDs on the Top Side of the Housing (cont.)

LED	Meaning
	Double IP address is detected.

11.4 Troubleshooting and Repair

General Troubleshooting

You are not authorized to troubleshoot the defective device beyond the measures described in Chapter 11 and make repairs yourself. Special electronic modules are inserted in the SENTRON PAC5100/5200 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 quote to the service department upon request in case of an error.

The error messages can be saved as described in Chapter 7.2.5.2, section **Save As**.

The error messages can be printed as described in Chapter 7.2.5.2, section **Open**.

12 Technical Data

12.1 General Device Data

12.1.1 Power Supply

Direct Voltage

Rated input voltages	24 V to 250 V
Admissible input voltage tolerance	±20 %
Permitted ripple of the input voltage	15 %
Maximum inrush current	
At ≤ 110 V	< 15 A
At 220 V to 300 V	≤ 22 A; after 250 µs: < 5 A
Maximum power consumption	5 W

Alternating Voltage

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 ≤ 115 V	< 15 A
At 230 V	≤ 22 A; after 250 µs: < 5 A
Maximum power consumption	16 VA

12.1.2 Inputs and Outputs

Inputs for Alternating Voltage Measurements (Connector Block F)

Rated input alternating voltages	
Phase-N/PE	63.5 V 110 V 230 V 400 V (347 V for UL conditions)
Phase-phase	110 V 190 V 400 V 690 V (600 V for UL conditions)
Maximum input alternating voltage (depending on the parameterization)	1.2 x rated input alternating voltage
Maximum input alternating voltage	
Phase-N/PE	480 V (347 V for UL conditions)
Phase-phase	831 V (600 V for UL conditions)
Input impedances	
a, b, c to N	6.0 MΩ
a-b, b-c, c-a	6.0 MΩ
Further information about the voltage measuring inputs	
Power consumption per input for V_{rated} 400 V	38 mW
Permissible power frequency	42.5 Hz to 69.0 Hz
Measuring error (with calibration) at 23 °C ± 1 °C 50 Hz or 60 Hz	typically 0.1 % for reference conditions

Inputs for Alternating Current Measurements (Connector Block E)

Input alternating currents	
Rated input current range	1 A 5 A
Max. input current	2 x rated input alternating current
Power consumption per input	
at 1 A	1 mVA
at 5 A	2.5 mVA
Further information about the current measuring inputs	
Max. rated input voltage	150 V
Measuring error (with calibration) at 23 °C ± 1 °C 50 Hz or 60 Hz	Typically 0.1 % at reference conditions
Thermal stability	10 A continuous 100 A for max. 1 s

Binary Outputs (Connector Block G)

Maximum contact voltage	
Alternating voltage	230 V
Direct voltage	250 V
Maximum currents	
Maximum continuous contact current	100 mA
Maximum pulse current for 0.1 s	300 mA
Further information about the binary outputs	
Internal impedance	35 Ω
Admissible switching frequency	10 Hz
Number of switching cycles	Unlimited

12.1.3 Communication Interface

Ethernet (Connector Z)

Ethernet, electrical	Connection	Device top side RJ45 connector socket 10/100Base-T acc. to IEEE802.3 LED yellow: 100 Mbit/s (off/on) LED green: – flashing: active – on: not active – off: no connection
	Protocol	Modbus TCP
	Voltage strength	DC 700 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 well installed

12.1.4 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	Max. altitude above sea level	2000 m

12.1.5 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		
DIN rail housing	IP20	
Panel flush mounting (front)	IP40 (with display, without door) IP51 (with display and door)	
Terminals	IP2x	

12.2 Test Data

Reference Conditions according to IEC 62586-1 for Determining the 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

12.2.1 Electrical Tests

Standards

Standards:	IEC EN 61000-6-2 IEC EN 61000-6-4 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 2.3 kV	Cat. III
Voltage measurement inputs	Reinforced	480 V	Surge voltage 9.76 kV	Cat. III
Supply voltage	Reinforced	300 V	DC 3.125 kV	Cat. III
Binary outputs	Reinforced	300 V	AC 3.536 kV	Cat. III
Ethernet interface	Function	< 50 V	DC 700 V	Cat. III

EMC Tests for Immunity (Type Tests)

Standards:		IEC EN 61000-6-2 For more standards see also individual functions
Electrostatic discharge, Class III, IEC 61000-4-2		6 kV contact discharge; 8 kV air discharge, both polarities; 150 pF; R_i = 330 Ω with connected Ethernet cable
High frequency electromagnetic field, amplitude-modulated, Class III IEC 61000-4-3		10 V/m; 80 MHz to 3 GHz; 80 % AM; 1 kHz
Fast transient bursts, Class III IEC 61000-4-4		2 kV; 5 ns/50 ns; 5 kHz; Burst length = 15 ms; Repetition rate 300 ms; Both polarities; R_i = 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
Power system frequency magnetic field IEC 61000-4-8, Class IV;		30 A/m continuous; 300 A/m for 3 s
1 MHz test, Class III, IEC 61000-4-18		2.5 kV (peak); 1 MHz; τ = 15 µs; 400 Surges per s; Test duration 1 min; R_i = 200 Ω

EMC Test for Noise Emission (Type Test)

Standard:	IEC EN 61000-6-4
Disturbance voltage to lines, only auxiliary voltage IEC-CISPR 22	150 kHz to 30 MHz Limit Class A
Disturbance-field strength IEC-CISPR 22	30 MHz to 1000 MHz Limit Class A

12.2.2 Mechanical Stress Tests

Vibration and Shock Stress during Stationary Operation

Standards:	IEC 60068
Oscillation 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 rate 1 octave/min 20 cycles in 3 orthogonal axes.
Shock IEC 60068-2-27 test Ea	Semi-sinusoidal 5 g acceleration, duration 11 ms, each 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
Oscillation 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, each 3 shocks (in both directions of the 3 axes)
Continuous Shock IEC 60068-2-29 test Eb	Semi-sinusoidal 10 g acceleration, duration 16 ms, each 1000 shocks (in both directions of the 3 axes)
Free fall IEC 60068-2-32 test Ed	0.5 m

12.2.3 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

12.2.4 Safety Standards

Standards: EN 61010
IEC EN 61010-1, IEC EN 61010-2-30

12.3 Dimensions

Mass	DIN Rail device: Device with display:	approx. 0.49 kg approx. 0.52 kg
Dimension (W x H x D)	96 mm x 96 mm x 100 mm 3.78 inch x 3.78 inch x 3.94 inch	

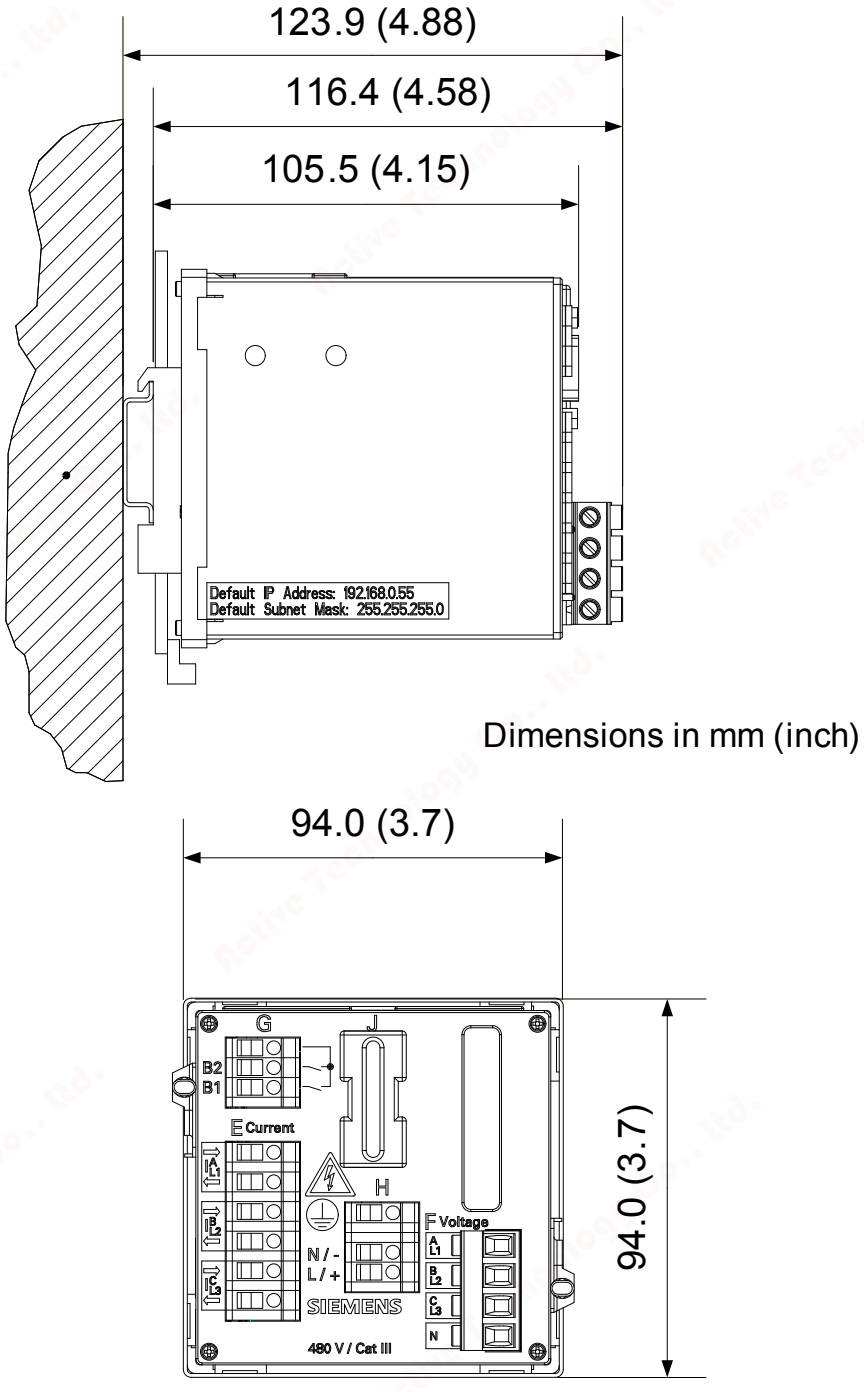


Figure 12-1 Dimensional Drawing of SENTRON PAC5x00

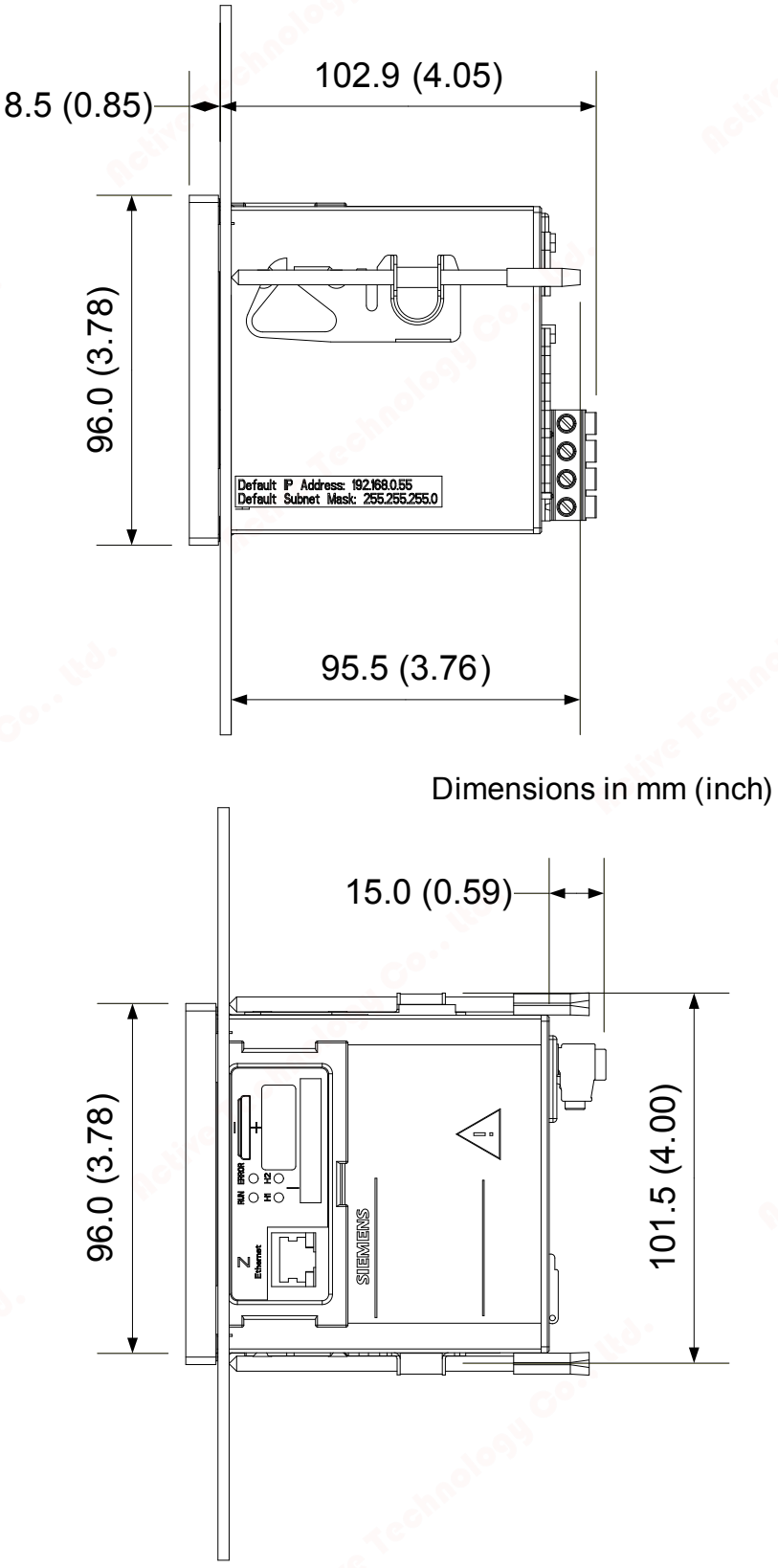


Figure 12-2 Dimensional Drawing of SENTRON PAC5100/5200 with Display

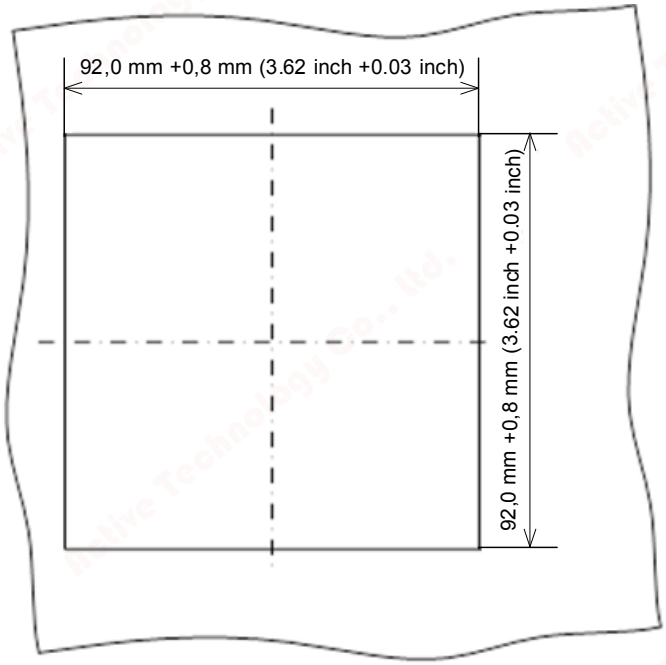


Figure 12-3 Cut-out in Switch Panel

13 Operational Indications

Indication	Description	Notes
Device OK	The device startup was successful.	Indication on: Device ready
Battery Failure	Battery voltage < 2.7 V or no battery inserted	Indication on: Battery failure
Time Synchronization Error	Error during the time synchronization from the NTP server or from the field bus	Indication off: At least one 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 7.3.6.1 Error sources with RTC: - no valid time after device startup Error sources with NTP or field bus: - „**Error indication after**" timer expires and no synchronization message was received
	Error during internal time synchronization	Indication on: RTC time invalid Indication off: After setting the clock via HTML (see chapter 7.3.6.1) During battery failure at device startup
Default IP Address	The IP-Addr. push-button has been pressed for more than 3 s.	Indication on: IP-Addr. push-button was pressed The device restarts and applies the default IP address.
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 period of 10 min Only for time synchronization via Ethernet NTP (see chapter 7.3.6.1)
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 period of 10 min Only for time synchronization via Ethernet NTP (see chapter 7.3.6.1)

Indication	Description	Notes
Daylight Saving Time	Switching between daylight saving time/standard time	Indication on: Daylight saving time Indication off: Standard time
Ethernet Link Error	Ethernet connection error	Indication on: Error Indication off: Ethernet link recognized
Modbus TCP OK (Modbus TCP Server)	At least one Modbus TCP link has received Modbus messages.	Indication on: At least one Modbus message was received during the set monitoring time. The time stamp is set when the first valid message is received. Indication off: No Modbus message was received during the set monitoring time. See chapter 7.3.6.2
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
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 (e.g. 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		
Binary Output 1	Status of binary outputs ON/OFF	Indication on: ON Indication off: OFF Only if not output as counter output (for counter output = 0)
Binary Output 2		
Reset Energy	The energy counters were reset.	Indication on: Energy counters reset

Indication	Description	Notes
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 anti-clockwise Indication invalid: Direction of rotation can not calculated (e.g. no voltage applied)
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 (x = 1 to 4) can be parameterized.
Supply Voltage Event Available	Indication of a supply voltage event	Overvoltage, undervoltage, frequency interruption
Frequency Event Available	Indication of a frequency event	Overfrequency or underfrequency
Volt. Unbalance Event Available	Indication of a voltage unbalance event	Voltage unbalance
PQ Event	Indication of a fault recorder event	A fault record was recorded.
SD Card Error	Indication of an SD card error	SD card defective or read/write error [1)]

1) The SD card has no contact or is defective; you must not replace the card yourself. The device also works without active SD card. However, data storage when operating the recorders is not possible. In this case, the recorder data can be forwarded and processed only via communication.

14 Operating Parameters

NOTE for user on the online help

This chapter is integrated as an online help in the user interface.

The description of parameterization of the operating parameters can be found in the manual SENTRON PAC5100/5200.

14.1 Process Connections

The following process connections are available:

- AC Measurement
- Binary Outputs
- LEDs

14.1.1 AC Measurement

Parameter	Default Settings	Setting Range
Rated frequency	50 Hz	50 Hz (± 7.5 Hz) 60 Hz (± 9 Hz)
Network type	Four-wire, 3-phase, unbalanced	1-phase network Three-wire, 3-phase balanced Three-wire, 3-phase, unbalanced (2 * I) Three-wire, 3-phase, unbalanced (3 * I) Four-wire, 3-phase, balanced Four-wire, 3-phase, unbalanced
Primary nominal voltage	AC 400.00 V	AC 1 V to AC 1 000 000 V, dependent on the setting range in the selected network type
Voltage transformer	no	yes no
At voltage transformer: yes		
Primary rated voltage	AC 400.00 V	AC 100.00 V to 1 000 000.00 V
Secondary rated voltage	AC 400.00 V	AC 1.0 V to 1000.0 V
Voltage measurement range	ph-N: AC 400 V (inject a maximum of AC 347 V for UL), ph-ph: AC 690 V (inject a maximum of AC 600 V for UL)	ph-N: AC 63.5 V, ph-ph: AC 110 V ph-N: AC 110 V, ph-ph: AC 190 V ph-N: AC 230 V, ph-ph: AC 400 V ph-N: AC 400 V (max. 347 V for UL) ph-ph: AC 690 V (max. 600 V for UL)
Current measurement range	AC 5 A	AC 1 A AC 5 A
Current transformer	no	yes no
At current transformer: yes		
Primary rated current	AC 1000.00 A	AC 1.00 A to 100 000.00 A
Secondary rated current	AC 1.00 A	AC 0.01 A to 10.00 A
Zero point suppression	0.3 % (from Vrated, Irated)	0.0 % to 10.0 %
Voltage harmonic unit	%	% V

14.1.2 Binary Outputs

Parameter	Default Settings	Setting Range
Source type	Indication	Indication Energy counter
Indication (only if source type = indication)	-none-	-none- Device OK Battery Failure Settings Load Settings Check Settings Activate Modbus TCP OK Ethernet Link Error Time Synchronization Error Primary NTP Server Error Secondary NTP Server Error Daylight Saving Time Default IP Address Limit Violation y (y = 1 to 16) Indication 1 from Remote Indication 2 from Remote Rotation Voltage Clockwise Group Indication x (x = 1 to 4) SD Card Error Supply Voltage Event Available Frequency Event Available Voltage Unbalance Event Available
Energy counter (only if source type = energy counter)	-none-	WPa_sup WPb_sup WPc_sup WP_sup WPa_dmd WPb_dmd WPc_dmd WP_dmd WQa_ind WQb_ind WQc_ind WQ_ind WQa_cap WQb_cap WQc_cap WQ_cap WSa WSb WSc WS
Source inverted (only if source type = indication)	no	no yes

Parameter	Default Settings	Setting Range
Operating mode (only if source type = indication)	Persistent	Persistent Persistent with fail safe Pulse Pulse with retrigger
Energy increase per pulse (only if source type = energy counter)	1.0 Wh	0.1 Wh/VAh/varh to 1 000 000 Wh/VAh/varh
Output time pulse operating mode (only if source type = indication and pulse output or pulse output with retrigger or if source type = energy meter)	20 * 10 ms = 200 ms	50 ms to 3 600 000 ms

14.1.3 LEDs

LED	Default Setting	Setting Range
RUN	Device ready	Not settable
ERROR	-none-	-none- Battery Failure Ethernet Link Error Time Synchronization Error Primary NTP Server Error Secondary NTP Server Error SD Card Error
H1 H2	-none-	-none- Device OK Battery Failure Settings Load Settings Check Settings Activate Modbus TCP OK Ethernet Link Error Time Synchronization Error Primary NTP Server Error Secondary NTP Server Error Daylight Saving Time Default IP Address Limit Violation y (y = 1 to 16) Indication 1 from Remote Indication 2 from Remote Rotating Field Clockwise Group Indication x (x = 1 to 4) SD Card Error Supply Voltage Event Available Frequency Event Available Volt. Unbalance Event Available
Indication inverted	no	no yes

14.2 Automation Functions

The following automation functions are available:

- Limit violation 1-8
- Limit violation 9-16
- Group indication 1-4

14.2.1 Limit Violation 1-8 and 9-16

Parameter	Default Setting	Setting Range
Measurand	-none-	-none- Va; Vb; Vc Vab; Vbc; Vca Ia; Ib; Ic VN; Vavg IN; Iavg Pa; Pb; Pc; P Qa; Qb; Qc; Q Sa; Sb; Sc; S cos φ (a); cos φ (b); cos φ (c); cos φ PFa; PFb; PFc; PF φUIa; φUIb; φUIc; φUI f U_2 Iunbal THDS Va, THDS Vb, THDS Vc THDS Ia, THDS Ib, THDS Ic φab V, φca V φab I, φca I Q1a, Q1b, Q1c; Q1 Pinst (a-n), Pinst (b-n),Pinst (c-n) Pst (a-n), Pst (b-n),Pst (c-n) Plt (a-n), Plt (b-n),Plt (c-n) Pinst (a-b), Pinst (b-c),Pinst (c-a) Pst (a-b), Pst (b-c),Pst (c-a) Plt (a-b), Plt (b-c),Plt (c-a) (Setting ranges pending from network type)
Limit	0.00	-1 000 000 000 to 1 000 000 000 (unit)
Limit type	Lower	Lower Upper
Hysteresis (%)	1.0	0.0 to 10.0
Violation indication	Limit Violation x (x = 1 to 16)	The name of the limiting value indication is customizable.

14.2.2 Group Indications 1-4

Parameter	Default Setting	Setting Range
Source	-none-	-none- Device OK Battery Failure Settings Load Settings Check Settings Activate Modbus TCP OK Ethernet Link Error Time Synchronization Error Primary NTP Server Error Secondary NTP Server Error Daylight Saving Time Default IP Address Limit Violation y (y = 1 to 16) Indication 1 from Remote Indication 2 from Remote Rotation Field Clockwise Group Indication x (x = 1 to 4) SD Card Error Supply Voltage Event Available Frequency Event Available Volt. Unbalance Event Available
Source inverted	no	no yes
Logic operation	NONE	NONE OR AND
Group indication name	Group Indication x	Any

14.3 HMI

14.3.1 Display Settings

Parameter	Default Setting	Setting Range
Contrast	8	0 to 10
Time until dimmed	10	0 min to 99 min
Refresh time	1000	330 ms to 3000 ms
Inverse display	no	no yes
Phase label	(L1,L2,L3)	(L1,L2,L3) (a,b,c)
Use password	yes	no yes

14.3.2 User Defined Screen

Parameter	Default Setting	Setting Range
Screen type	-none-	-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)	any
2 measured values, numerical Display 1, numerical Display 2, numerical	-none-	-none- Va; Vb; Vc Vab; Vbc; Vca Ia; Ib; Ic VN; Vavg IN; Iavg Pa; Pb; Pc; P Qa; Qb; Qc; Q Sa; Sb; Sc; S cos φ (a); cos φ (b); cos φ (c); cos φ PFa; PFb; PFc; PF φUIa; φUIb; φUIc; φUI f U_2 Iunbal THDS Va, THDS Vb, THDS Vc THDS Ia, THDS Ib, THDS Ic φab V, φca V φab I, φca I Q1a, Q1b, Q1c; Q1 Pinst (a-n), Pinst (b-n),Pinst (c-n) Pst (a-n), Pst (b-n),Pst (c-n) Plt (a-n), Plt (b-n),Plt (c-n) Pinst (a-b), Pinst (b-c),Pinst (c-a) Pst (a-b), Pst (b-c),Pst (c-a) Plt (a-b), Plt (b-c),Plt (c-a) (Setting ranges pending from network type)
4 measured values, numerical Display 1, numerical Display 2, numerical Display 3, numerical Display 4, numerical	-none-	
2 measured values, graphical and numerical Display 1, graph./num. Display 2, graph./num.	-none-	
3 measured values, graphical and numerical Display 1, graph./num. Display 2, graph./num. Display 3, graph./num.	-none-	
Display x, graph./num. (x = 1 to 3) Min value Max value	 1.0 10.0 (unit according to measured value)	The minimum and maximum value is defined by the selected parameters (see chapter 7.3.3.1.1).

14.4 Recording and Reporting

14.4.1 Event Recorders

Parameter	Default Setting	Setting Range
Supply Voltage		
Swell threshold	110 %	105 % to 140 % in 5-% steps
Dip threshold	90 %	75 % to 95 % in 5-% steps
Interruption threshold	5 %	1 %, 2 %, 3 %, 5 %, 8 % 10 %
Event hysteresis	2 %	1 % to 6 % in 1-% steps
Frequency		
Underfrequency threshold	1 %	0.1 % to 0.9 % in 0.1-% steps 1 % to 5 % in 1-% steps
Overfrequency threshold	1 %	0.1 % to 0.9 % in 0.1-% steps 1 % to 5 % in 1-% steps
Unbalance		
Voltage unbalance threshold	5 %	1 % to 5 % in 1-% steps

14.4.2 Trigger Management

Parameter	Default Setting	Setting Range
Voltage trigger limits		
Trigger active	no	no yes
Tolerance unit	Percentage	Percentage Numerical
Lower threshold	90.00 % of the of the primary nominal voltage	0.00 % to 99.99 % of the of the primary nominal voltage 0.0 V to 1 000 000.0 V
Upper threshold	110.00 % of the of the primary nominal voltage	100.0 % to 10 000.0 % of the primary nominal voltage 0.0 V to 1 000 000.0 V

Hysteresis	2.00 % of the of the primary nominal voltage	0.0 % to 50.0 % of the of the primary nominal voltage
Current trigger limits		
Trigger active	no	no yes
Tolerance unit	Percentage	Percentage Numerical
Lower threshold	90.00 % of nominal current In	0.00 % to 99.99 % of of nominal current In 0.0 A to 1 000 000.0 A
Upper threshold	110.00 % of nominal current In	100.0 % to 10 000.0 % of of nominal current In 0.0 A to 1 000 000 A
Hysteresis	2.00 % of nominal current In	0.0 % to 50.0 % of of nominal current In
Waveform capture setting		
Total recording duration	2.0 s	0.2 s to 3.0 s in 0.2-s steps
Pretrigger ratio	10 %	0 % to 30 % in 5-% steps
Record ph-ph voltage	no	no yes
Record current	no	no yes (max. 2x Irated

14.4.3 Recorder Management

Parameter	Default Setting	Setting Range	
Measurement Recorder			
Average intervals - Frequency	10 s	fixed	
Short term flicker	10 min	fixed	
Long term flicker	2 h	fixed	
Average interval - Voltage / Unbalance / Harmonics	10 min	30 s, 1 min, 10 min, 15 min, 30 min, 1 h, 2 h	
Record additional data (I, P, Q, S etc.)	no	no yes	
Recorder of average - Min	no	no yes	
Recorder of average - Max	no	no yes	
Harmonics parity	Odd	Even Odd All	
File generation every: (corresponds to the setting of the *Average interval* parameter)	24 h	File generation every:	At average interval
		1 h	30 s
		2 h	1 min
		2 h	10 min, 15 min, 30 min, 1 h or 2 h
		4 h	
		6 h	
		12 h	
		24 h	
Recorded file type	PQDIF	PQDIF CSV All	
Flicker lamp model	230 V	230 V 120 V	
Trend Recorder			
Tolerance unit	Percentage	Percentage Numerical	
Tolerance number	Percentage: 3 % of declared input voltage Udin, Numerical: 0.50 V	1 % to 5 % in 1 % steps 0.20 V to 500.0 V	
Maximum recording interval	10 min	10 min, 30 min, 1 h, 2 h, 4 h, 6 h, 12 h, 24 h [1)]	

1) The trend recorder also creates a PQDIF file when 1024 data points have been generated within the recording interval.

14.4.4 Memory Management

Parameter	Default Setting	Setting Range
Splitting		
Event recorder	1.0 %	1 % to 33 % [1]
Measurement recorder	35.0 % (the recording time depends on the aggregation interval)	33 % to 65 % [1]
Trend recorder	61.0 % (residual storage capacity)	31 % to 63 % [2] [3]
Fault recorder	3.0 % (Numbers of records depends on the fault record time.)	3 % to 35 % [1]

1) The memory sizes for event list, PQ records and fault records can be changed.

2) The memory size for continuous recording is calculated automatically and forms the difference to 100 % of the total memory size. The maximum total memory size of 100 % cannot be exceeded due to parameterization errors.

3) If the residual storage capacity falls below 30 %, then the activation is not possible. In this case appear the report was not successfully action in the status line.

14.4.5 Report Configuration

Parameter	Default Setting	Setting Range
General Information		
Company: Department: Supervisor: Inspector: Location: Comment:	-	Any text displayed in the print-out of the power quality report
Power Quality Report		
Evaluation mode according to:	EN 50160 LV&MV	EN 50160 LV&MV EN 50160 HV User defined
Flagging acc. to IEC 61000-4-30	no	no yes
Power frequency: 99.5 % of measurand should be in -1.0 % to 1.0 % deviation of the power frequency. 100 % of measurand should be in -6.0 % to 4.0 % deviation of the power frequency.		Any setting for user-defined evaluation mode
Power supply voltage magnitude: 95 % of measurand should be in -10.0 % to 10.0 % deviation of the clared input voltage Udin. 100 % of measurand should be in -15.0 % to 10.0 % deviation of the clared input voltage Udin.		Any setting for user-defined evaluation mode
Voltage unbalance: [1)] 95 % of measurand should be less than 2.0 %. 100 % of measurand should be less than 3.0 %.		Any setting for user-defined evaluation mode
Subgroup Total Harmonic Distortion (THDS): 95 % of measurand should be less than 8.0 %.		Any setting for user-defined evaluation mode
Supply voltage interruptions: 1. Short interruption until 1 second duration 2. Short interruption until 3 minute duration 3. Long interruption longer than 3 minute duration		Any setting for user-defined evaluation mode
Harmonic voltages: Even harmonics Odd harmonics: multiples of 3 Odd harmonics: not multiples of 3		Any setting for user-defined evaluation mode

1) According to EN 50160, up to 3 % unbalance can occur in 3-wire networks in areas with many 1-wire and 2-wire connections.

14.4.6 Recording Parameters

Parameter	Default Setting	Setting Range
Start record option	Start next 10th minute	Start next minute Start next 10th minute Start immediately Start next hour Start next day
Start time	-	Display of the start time in: Depends on the configuration of Date/time format.
Recording status	-	Not settable Status display of recorder started or recorder stopped

14.5 Administrative

The following administrative settings are available:

- Time Synchronization
- Ethernet Communication
- 2) After enabling the parameter changes, any currently active Modbus TCP connections will be closed. The Modbus TCP client must later re-open these connections.
- 2) After enabling the parameter changes, any currently active Modbus TCP connections will be closed. The Modbus TCP client must later re-open these connections.Device and Language

14.5.1 Time Synchronization

Parameter	Default Settings	Setting Range
Source time synchronization	Internal	Internal Ethernet NTP Fieldbus
Time zone offset to UTC	+00:00	-12 to +13 (hours) (in increments of 0.5 h)
Daylight Saving Time switchover	yes	no yes
DST offset to UTC	+01:00	0 to + 2 (hours) (in increments of 0.5 h)
Start of DST	March Last week Sunday 02:00 AM	January to December First week Second week Third week Fourth week Last week Sunday to Saturday 0:00 to 23:00 (full hour)
End of DST	October Last week Sunday 03:00 AM	January to December First week Second week Third week Fourth week Last week Sunday to Saturday 0:00 to 23:00 (full hour)
Additional Parameters if the Source is Ethernet NTP		
Primary NTP server IP Address	192.168.0.254	Any
Secondary NTP server IP Address	192.168.0.253	Any No polling of the NTP server if 0.0.0.0 was entered
Error indication after	10 min	2 min to 120 min
Additional Parameter if the Source is Fieldbus		
Error indication after	10 min	2 min to 120 min

14.5.2 Ethernet Communication

Parameter	Default Settings	Setting Range
IP Address [1]	192.168.0.55	Any 0.0.0.0 = DHCP
Subnet mask [1]	255.255.255.0	Any
Default gateway [1]	192.168.0.1	Any
Enable SNMP	no	no yes
Bus protocol	Modbus TCP	Modbus TCP -none-
Bus Protocol Modbus TCP		
Use a user-port number [2]	no	no yes
User-port number [2] (can only be set when *Use a user-port number* is parameterized with *yes*)	10000	10000 to 65535
Access rights for user port (can only be set when *Use a user-port number* is parameterized with *yes*)	Full	Full Read only
Access rights for user port 502	Full	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

[1] After the parameter changes have been enabled, the device resets.

[2] After enabling the parameter changes, any currently active Modbus TCP connections will be closed. The Modbus TCP client must later re-open these connections.

14.5.2.1 Device and Language

Parameter	Default Settings	Setting Range
Device name	SENTRON_PAC	Any Max. 32 characters
Language	ENGLISH (US)	ENGLISH (US) DEUTSCH (DE)
Date/time format	YYYY-MM-DD, Time with 24 hours	YYYY-MM-DD, Time with 24 hours YYYY-MM-DD, Time with 12 h AM/PM DD-MM-YYYY, Time with 24 hours DD-MM-YYYY, Time with 12 h AM/PM MM/DD/YYYY, Time with 24 hours MM/DD/YYYY, Time with 12 h AM/PM
Activation password	000000	Any 6 to 14 characters
Maintenance password	311299	Any 6 to 14 characters

Glossary

A

AC	**A**lternating **C**urrent
ADC	**A**nalog-**d**igital **C**onverter
ARP	**A**ddress **R**esolution **P**rotocol: Network protocol
ASDU	**A**pplication **S**ervice **D**ata **U**nit

B

Big-Endian format	The most significant byte is stored first, that is at the memory location with the lowest address.
Boot Application	Starting a device with the firmware required for the microcontroller
Broadcast message	Message in the network where data packets are transmitted to all devices on the network from one point

C

Client	Device in the communication network that sends data requests or commands to the server devices and receives responses from them
CRC error	**C**yclic **R**edundancy **C**heck: The cyclic redundancy check is a method of determining a test value for data (e.g. for data transmission in computer networks) with the purpose to detect errors during the transmission or duplication of data.

D

DC	**D**irect **C**urrent
DHCP	**D**ynamic **H**ost **C**onfiguration **P**rotocol enables the network configuration to be assigned to the devices by a DHCP server
DSP	**D**igital **S**ignal **P**rocessor
DST	**D**aylight **S**aving **T**ime

E

Ethernet	Cable-based data network technology for local data networks

F

FW	**F**irm**w**are: Program code for execution in a microcontroller

G

Gateway	Enables networks based on different protocols to communicate with each other

H

Holding register	Area for representing data in Modbus communication

I

IEC	**I**nternational **E**lectrotechnical **C**ommission, standards organization; Communication standard for substations and protection equipment
Indication off	The status of the indication changes from ON to OFF, that is the indication is deleted.
Indication on	The status of the indication changes from OFF to ON, that is the indication is currently present.
+Inf	Stands for *Infinity* and denotes a counter overflow. Extremely large number or infinitely positive number
IP	**I**nternet **P**rotocol
IP address	Addresses in computer networks based on the Internet protocol

J

JavaScript	Script language mainly used by Web browsers

K

KeepAlive	KeepAlive on TCP level is a feature intended to verify the availability and functioning of the communication partner (client) and to maintain a TCP network link if the network is inactive. The server sends KeepAlive messages (TCP packets without data) to the client in regular intervals (KeepAlive time) while the network is inactive, and the client responds to these messages. If the client does not respond to a KeepAlive message, the server assumes that the link is down or the client is inactive and closes the TCP link.

L

LED	**L**ight-**E**mitting **D**iode
Limit violation	A value exceeding or falling under a parameterized limiting value.
LSB	**L**east **S**ignificant **B**it

M

MAC-Address	**M**edia **A**ccess **C**ontrol address: Hardware address that clearly identifies the device on the network.
MBAP	**M**od**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).

MIB	Management Information Base: Information which can be retrieved or modified via the SNMP network management protocol
Modbus	The Modbus protocol is a communication protocol based on a client-server architecture.
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.
MSB	**M**ost **S**ignificant **B**it

N

NaN	**N**ot **a** **N**umber means "invalid": Result of an invalid computing operation
NTP	**N**etwork **T**ime **P**rotocol: Standard for synchronizing clocks in computer systems using packet-based communication networks

P

PQ	**P**ower **Q**uality

R

RJ45	Ethernet plug connector
RTC	**R**eal-**T**ime **C**lock

S

Server	Sends data upon request by the client
SNMP	**S**imple **N**etwork **M**anagement **P**rotocol: Serves for monitoring and controlling network elements of a central station
SNTP	**S**imple **N**etwork **T**ime **P**rotocol: Simplified version of the NTP
SW	**S**oft**w**are: Program executed on a computer
STP	**S**hielded **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 and which IP addresses it tries to reach via routers in other networks.

T

TCP/IP	**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol: Family of network protocols

U

UTC	**U**niversal **T**ime **C**oordinated: Universal time standard referred to the time at the prime meridian

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