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Product Manual

SENTRON

Measuring Devices 7KM

PAC2200

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7KM measuring device PAC2200

Manual

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Legal information

Warning notice system

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

WARNING

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

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Disclaimer of Liability

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

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Introduction

1.1 Components of the product

The package includes:

- 1 x PAC2200 measuring device
- PAC2200 operating instructions:

Available accessories

- SENTRON powerconfig software
(<https://support.industry.siemens.com/cs/document/63452759/update-version-powerconfig-v3-7?dti=0&lc=en-WW>)
- SENTRON powermanager software
(<https://support.industry.siemens.com/cs/document/64850998/powermanager-v3-3-incl-hf1?dti=0&lc=en-WW>)

1.2 Latest information

Up-to-the-minute information

You can find further assistance:

on the Internet:

Website (<https://support.industry.siemens.com/my/ww/en/requests>)

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Siemens AG Energy Management, Low Voltage & Products
Siemensstrasse 10
93055 Regensburg
Germany

Internet: Technical Assistance (<https://support.industry.siemens.com/My/ww/en/requests>)

Subject: Open source request (please state product name and version, as applicable).

SIEMENS can charge a fee of up to 5 euros for processing the request.

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

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The customer is responsible for preventing unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the Internet if necessary and only to the extent necessary and with appropriate protective measures (e.g. use of firewalls and network segmentation) in place.

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Industrial security (<http://www.siemens.com/industrialsecurity>)

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends applying product updates as soon as they are available and always using the latest product versions. Using versions that are obsolete or are no longer supported can increase the risk of cyber threats.

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

Technical Support (<https://support.industry.siemens.com/cs/start?lc=en-WW>)

Note

Risk of manipulation

Several protective mechanisms can be activated in the device.

In order to reduce the risk of manipulation occurring on the device, it is recommended that the protective mechanisms available in the device are activated.

See Section on "Performance features" (Page 11)

General safety instructions

**DANGER****Hazardous Voltage**

Will cause death or serious injury.

Turn off and lock out all power supplying this device before working on it.

Safety-related symbols on the device

	Symbol	Meaning
(1)		Risk of electric shock
(2)		General Warning Symbol
(3)		Electrical installation demands technical competence

Description

2.1 Features

The PAC2200 is a measuring device for measuring the basic electrical variables in low-voltage power distribution. All measured variables are shown on the display of the PAC2200. The device is capable of single-phase, two-phase, or three-phase measurement and can be used in three-wire or four-wire TN and TT networks.

The PAC2200 is mounted on a DIN rail.

The PAC2200 measuring device is available in several versions:

- **5 A device:**

x / 1 A and x / 5 A current transformers can be used for current measuring.

- **65 A device:**

No current transformers are required for current measuring. The device is connected directly to the low-voltage network. Current of up to 65 A can be measured directly.

Depending on the device version, the PAC2200 measuring device has an integrated Ethernet, RS485 or M-BUS interface.

Thanks to its large measuring voltage range, the PAC2200 measuring device can be connected directly in any low-voltage system up to a voltage UL-L 480 V.

Measurement

- Measurement of all relevant electrical variables in an AC system.

Counters and power demand

- Recording of active, reactive and apparent energy by means of several energy counters
- Calculation and storage of the last measuring period demand for active power and reactive power for simple generation of load profiles using software (programmable measuring period of between 1 and 60 min.).

Display and operator control

- LC display
- Four control keys with variable function assignment
- LEDs for Ethernet, active energy
- SENTRON powerconfig from Version 3.7.
- SENTRON powermanager from Version 3.4.

Interfaces

- Ethernet (optional)
- RS485 interface (optional)
- M-BUS (optional)
- Digital Input
- Digital output

Security

- Hardware write protection
- Password protection
- Modbus TCP port, configurable
- HTTP port, configurable
- DHCP protocol included
- SNTP protocol included
- Attachment of lead seals possible

Using "Password protection" and "Hardware write protection", you can protect against write access to the device settings of the PAC2200.

The protection takes effect in case of the following actions:

- Modify parameters in device
- Reset maximum
- Reset minimum
- Reset counter
- Reset device
- Reset device to factory defaults
- Reset password
- Update firmware on the device

Note**Activate hardware write protection**

When connecting the measuring device to a network, it is recommended that the hardware write protection is activated.

2.2 Measuring inputs

Current measurement

NOTICE**AC current measurement only**

The device is not suitable for measuring DC current.

The 5 A device is designed for:

- **Measuring current of 5 A for connecting standard current transformers.** Each current measuring input can take a continuous load of 10 A. A momentary overcurrent of up to 100 A and a duration of 1 s is possible.

The current direction can be changed for each phase individually. It is not necessary to change the terminal connections of the current transformers in the event of connection errors.

The 65 A device is designed for:

- **Direct connection to the low-voltage network.**

Voltage measurement

NOTICE**AC voltage measurement only**

The device is not suitable for measuring DC voltage.

PAC2200 is designed for:

- **Direct measurement on the network.**
- **Measurement voltage up to 277 V / 480 V.** The device is designed for measuring input voltages up to 277 V to the neutral conductor and for measuring input voltages up to 480 V to the external conductor.

Connection types

Two connection types have been provided. The device can be used in three-wire or four-wire, TN, TT and IT networks.

Table 2- 1 Available connection types

Short code	Connection type
3P4W (factory setting)	3 phases, 4 conductors, unbalanced load
1P2W	1 phase, 2 conductors, unbalanced load

The input circuit of the device must correspond to one of the connection types listed. Select the suitable connection type for the purpose.

Connection examples can be found in chapter Connection (Page 25)

NOTICE
The wrong system connection can destroy the device. Before connecting the PAC2200, you must ensure that the local power supply conditions agree with the specifications on the rating plate.

The short code of the connection type must be entered in the device settings at startup. You can find the instructions for parameterizing the connection type in chapter Commissioning (Page 39).

Display of the measured variables depending on the connection type

The table below shows which measured values can be represented depending on the connection type.

The availability of the measured variables depends on the type of readout.

Depending on the device version, several different readout types are available:

- Device display
- ModbusTCP
- ModbusRTU
- M-Bus
- Web server

Table 2- 2 Display of the measured variables depending on the connection type

Measured variable	Connection type	3P4W	1P2W
Voltage L ₁ -N		✓	✓
Voltage L ₂ -N		✓	—
Voltage L ₃ -N		✓	—
Voltage L ₁ -2		✓	—
Voltage L ₂ -3		✓	—
Voltage L ₃ -1		✓	—
Current L ₁		✓	✓
Current L ₂		✓	—
Current L ₃		✓	—
Apparent power L ₁		✓	✓
Apparent power L ₂		✓	—
Apparent power L ₃		✓	—
Active power L ₁		✓	✓
Active power L ₂		✓	—
Active power L ₃		✓	—
Reactive power L ₁		✓	✓
Reactive power L ₂		✓	—
Reactive power L ₃		✓	—
Total apparent power		✓	✓
Total active power		✓	✓
Total reactive power		✓	✓
Power factor L ₁		✓	✓
Power factor L ₂		✓	—
Power factor L ₃		✓	—
Total power factor		✓	✓
Frequency		✓	✓
Average voltage L - N		✓	—
Average voltage L - L		✓	—
Average current		✓	—
Binary outputs		✓	✓
Binary inputs		✓	✓
Tariff		✓	✓
Operating hours counter		✓	✓
Counter (configurable)		✓	✓
Active power import		✓	✓
Active power export (load profile)		✓	✓
Reactive power import (load profile)		✓	✓
Reactive power export (load profile)		✓	✓
Max. active power (load profile)		✓	✓
Min. active power (load profile)		✓	✓

Measured variable	Connection type	3P4W	1P2W
Max. reactive power (load profile)		✓	✓
Min. reactive power (load profile)		✓	✓
Total active energy import tariff 1		✓	✓
Total active energy import tariff 2		✓	✓
Total active energy export tariff 1		✓	✓
Total active energy export tariff 2		✓	✓
Total reactive energy import tariff 1		✓	✓
Total reactive energy import tariff 2		✓	✓
Total reactive energy export tariff 1		✓	✓
Total reactive energy export tariff 2		✓	✓
Total apparent energy tariff 1		✓	✓
Total apparent energy tariff 2		✓	✓
L1 active energy import tariff 1		✓	✓
L1 active energy import tariff 2		✓	✓
L1 active energy export tariff 1		✓	✓
L1 active energy export tariff 2		✓	✓
L1 reactive energy import tariff 1		✓	✓
L1 reactive energy import tariff 2		✓	✓
L1 reactive energy export tariff 1		✓	✓
L1 reactive energy export tariff 2		✓	✓
L1 apparent energy tariff 1		✓	✓
L1 apparent energy tariff 2		✓	✓
L2 active energy import tariff 1		✓	-
L2 active energy import tariff 2		✓	-
L2 active energy export tariff 1		✓	-
L2 active energy export tariff 2		✓	-
L2 reactive energy import tariff 1		✓	-
L2 reactive energy import tariff 2		✓	-
L2 reactive energy export tariff 1		✓	-
L2 reactive energy export tariff 2		✓	-
L2 apparent energy tariff 1		✓	-
L2 apparent energy tariff 2		✓	-
L3 active energy import tariff 1		✓	-
L3 active energy import tariff 2		✓	-
L3 active energy export tariff 1		✓	-
L3 active energy export tariff 2		✓	-
L3 reactive energy import tariff 1		✓	-
L3 reactive energy import tariff 2		✓	-
L3 reactive energy export tariff 1		✓	-
L3 reactive energy export tariff 2		✓	-

	Connection type	3P4W	1P2W
Measured variable			
L3 apparent energy tariff 1		✓	-
L3 apparent energy tariff 2		✓	-

See also

Introduction (Page 7)

2.3 Power demands and counters

Acquisition of power demand

Values that can be read out

- The PAC2200 measuring device supplies the power demand of the last completed measuring period:
- Mean values for active and reactive power, separately for import and export.
- Minimum and maximum active power and reactive power within the last measuring period.
- Length of the measuring period in seconds. The period may be shorter for reasons of external synchronization.
- Time in seconds since the last synchronization or since completion of the last period.

Example: Period length and length of the measuring period:

Period length: 15 minutes; time of day: 13:03; time in seconds: 180 s.

The following can be calculated from this: The last measuring period ended at 13:00. The active measuring period will end at 13:15 or in 12 minutes.

NoteThe power demand of the last measuring period can only be fetched during the current measuring period.

Adjustable parameters

- Time interval in minutes: 1 to 60 min adjustable, default 15 min

Energy counters

Available energy counters of the PAC2200 measuring device:

- Active energy import and export
L1, L2, L3, Σ for each of two tariffs + total from both tariffs
- Reactive energy import and export
L1, L2, L3, Σ for each of two tariffs + total from both tariffs
- Apparent energy:
L1, L2, L3, Σ for each of two tariffs + total from both tariffs
- Active energy Σ :
Secondary value (ignoring the transformer ratios), no tariff.

2.4 Digital inputs and outputs

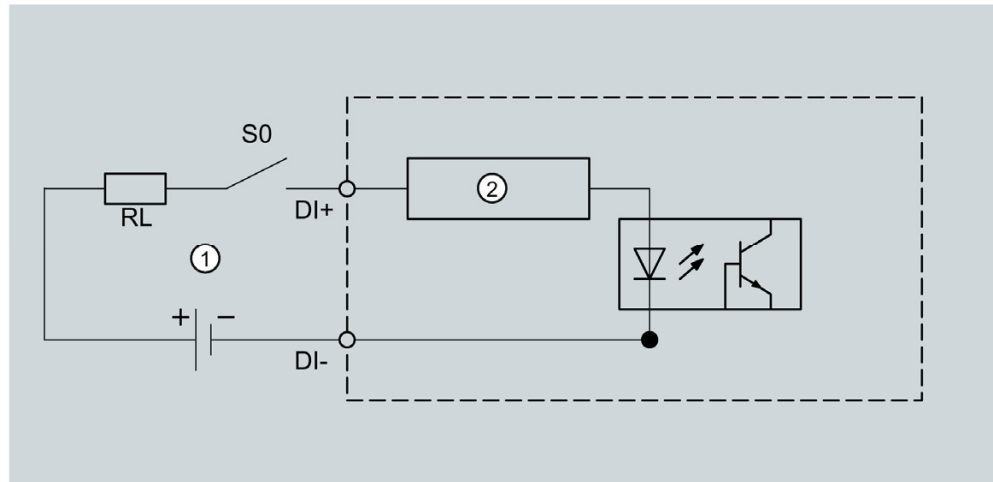
The PAC2200 has the following inputs/outputs:

- 1 digital input
- 1 digital output

Digital Input

The following functions can be assigned to the digital input:

- Status monitoring: Capturing statuses of connected signal encoders
- Tariff switch for two-tariff counters.
- Synchronization of the measuring period by means of the synchronization pulse of a system control center or other device.
- Input for energy pulses (S0 interface)



(1) External voltage power supply, max. 30 V, typically 24 V

(2) Input electronics

Figure 2-1 Block diagram: Digital inputs

Digital output

The following functions can be assigned to the digital output:

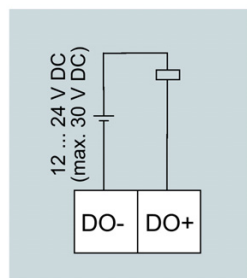


Figure 2-2 Block diagram: Digital outputs

Wiring

The digital output is passive and implemented exclusively as a switch.

Implementation of the pulse function corresponds to the IEC 62053-31 standard.



(1) Pulse length

(2) Turn-off time

Figure 2-3 Pulse length and turn-off time

- **Pulse length:**
Time for which the signal at the digital output is "high". The minimum pulse length is 30 ms and the maximum 500 ms.
- **Turn-off time:**
Time for which the signal at the digital output is "low". The turn-off time depends on the measured energy, for example, and can be days or months.
- **Minimum turn-off time:**
The minimum turn-off time corresponds to the programmed pulse length. 30 ms is the absolute minimum.

2.5 Communication

Depending on the device version, the devices may be fitted with the following communications interfaces:

- Ethernet
- RS 485
- M-BUS

The selection of the measured variables available for selection can vary according to the communication mode selected.

Ethernet

Permits communication via the following protocols:

- **Modbus TCP**

Protocol can be used for reading out the measured values and device configuration.

- **Web server (HTTP)**

Protocol can be used for reading out the measured values and device configuration.

- **SNTP**

Protocol is used for transmitting the time and for time synchronization.

- **DHCP**

Protocol can be used for reading out the measured values and device configuration. Network settings are assigned automatically.

RS 485

Permits communication via the MODBUS RTU protocol.

The data is transmitted differentially via two wires A and B. The third wire "COM" serves as the common ground potential.

M-BUS

Permits the transmission of the consumption data. The data is transmitted over a two-wire line.

Mounting

3.1 Introduction

**! WARNING**

Using devices when they are damaged may result in death, serious injury, or property damage!

Do not install or start up damaged devices.

Installation location

The PAC2200 device is mounted on a TH35 rail (complying with EN 60715) and is intended for installation in permanently installed systems within closed rooms.

Note**Avoid condensation**

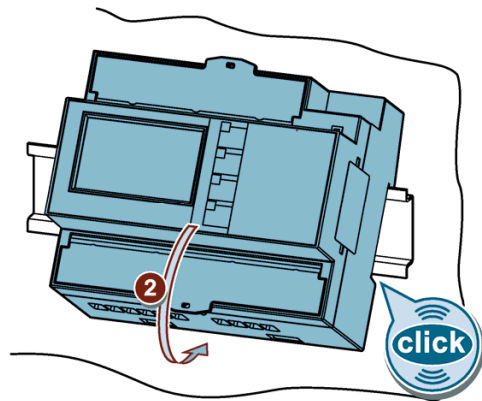
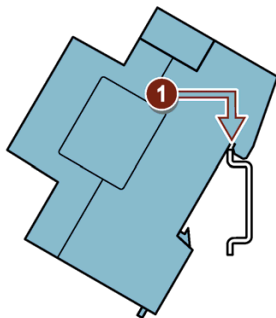
Sudden fluctuations in temperature can lead to condensation. Condensation can affect the function of the device. Store the device in the operating room for at least 2 hours before commencing installation.

3.2 Installation steps

To install the PAC PAC2200 you will need the following tools:

- Slotted screwdriver

Procedure



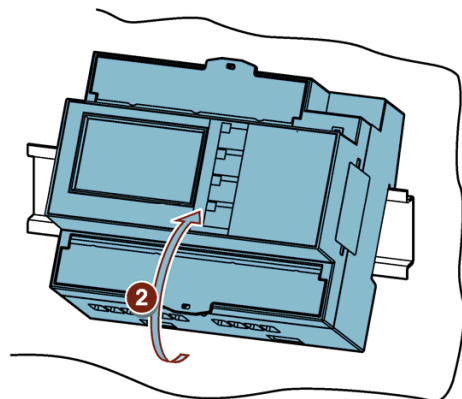
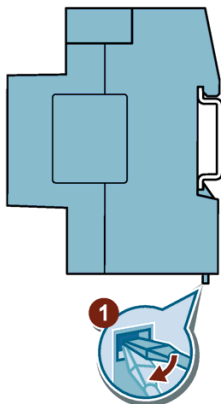
3.3 Deinstallation

Tools

You require the following tools to uninstall the device:

- Slotted screwdriver

Procedure



Connection

4.1 Safety notes

Notes



! DANGER

Hazardous Voltage

Failure to observe this notice will cause death, serious injury or property damage.

Turn off and lock out all power supplying this device before working on it.

Note

Some of the following tasks are carried out when hazardous voltage is present. For this reason, they must only be carried out by qualified personnel who are familiar with and follow the safety regulations and precautions.

- Wear the prescribed protective clothing. Observe the general equipment regulations and safety regulations for working on high-voltage installations (e.g. DIN VDE, NFPA 70E as well as national or international regulations).
- The limits given in the technical data must not be exceeded even during commissioning or testing.
- The secondary connections of intermediate current transformers must be short-circuited at the transformers before the power supply lines to the device are interrupted.
- The polarity and phase assignment of the instrument transformers must be tested.
- Before connecting the device, you must check whether the system voltage matches the voltage specified on the type plate.
- Check that all connections are correctly made before startup.
- Before power is applied to the device for the first time, it must have been located in the operating area for at least two hours in order to reach temperature balance and avoid humidity and condensation.
- Condensation on the device is not permissible during operation.

See also

Applying the measuring voltage (Page 40)

Measuring inputs (Page 13)

4.2 Connections

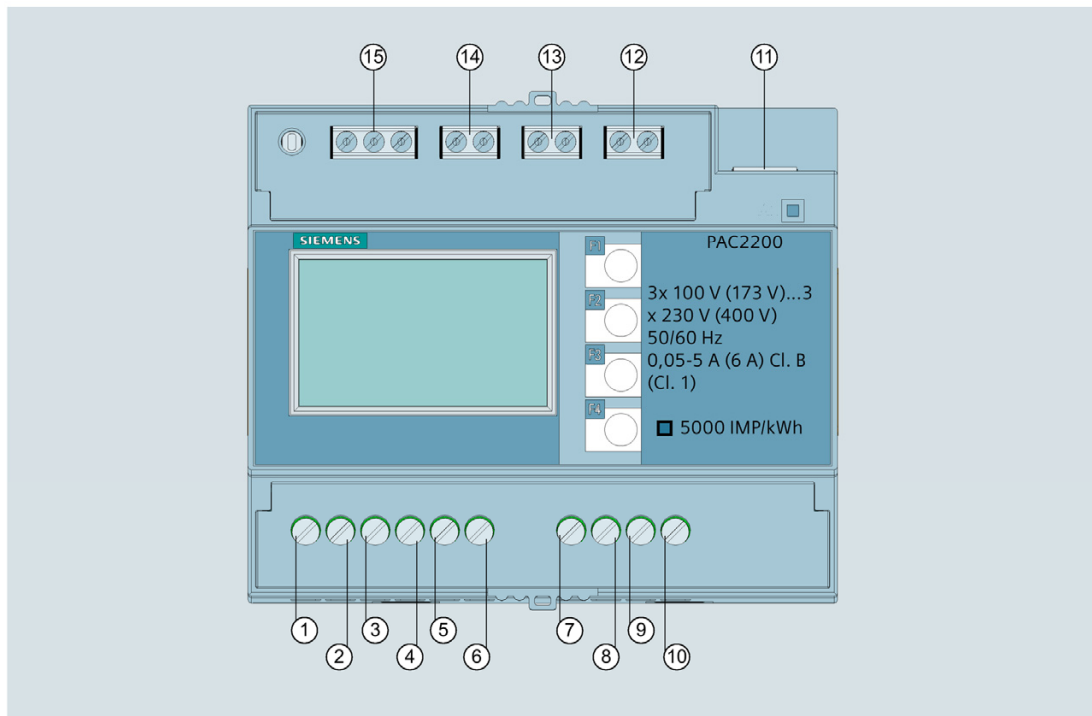


Figure 4-1 5 A device

No.	Terminal	Function
(1)	IL1 ° ↑ k	Current I _{L1} , input
(2)	IL1 I ↓	Current I _{L1} , output
(3)	IL2 ° ↑ k	Current I _{L2} , input
(4)	IL2 I ↓	Current I _{L2} , output
(5)	IL3 ° ↑ k	Current I _{L3} , input
(6)	IL3 I ↓	Current I _{L3} , output
(7)	V ₁	Voltage V _{L1-N}
(8)	V ₂	Voltage V _{L2-N}
(9)	V ₃	Voltage V _{L3-N}
(10)	V _N	Neutral conductor
(11)	LAN	Ethernet
(12)	DI	Digital Input
(13)	DO	Digital output
(14)	M-BUS	M-BUS interface
(15)	RS485	RS485 interface

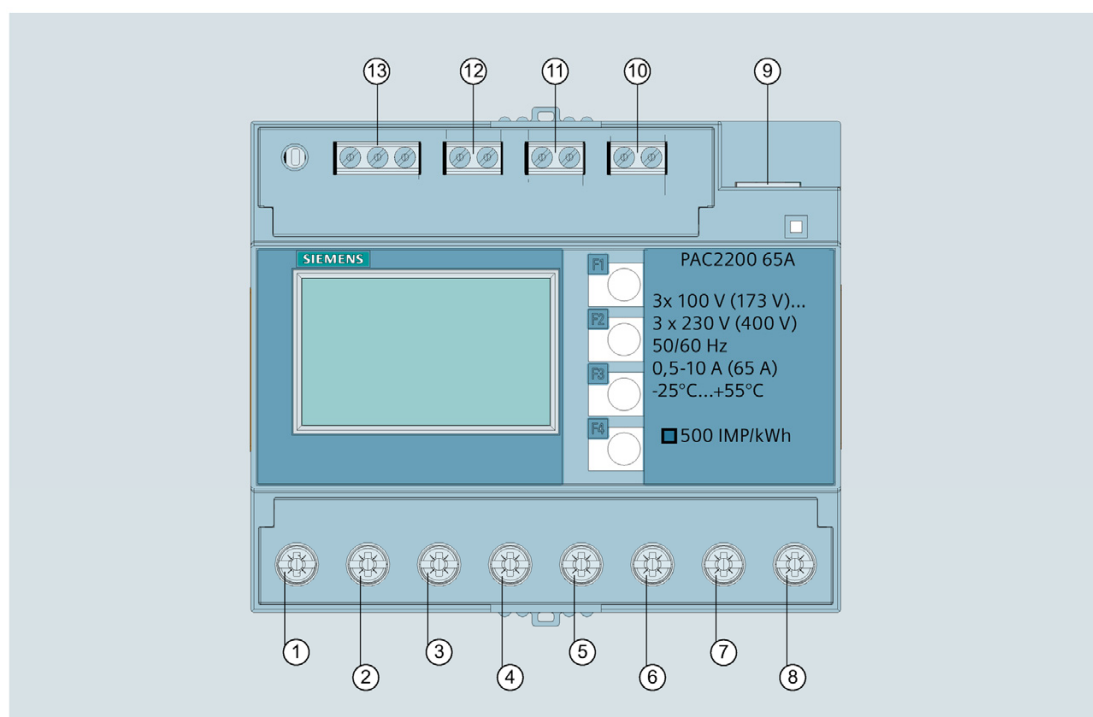


Figure 4-2 65 A device

No.	Terminal	Function
(1)	IL1 °↑k	Current I _{L1} , input
(2)	IL1 I↓	Current I _{L1} , output
(3)	IL2 °↑k	Current I _{L2} , input
(4)	IL2 I↓	Current I _{L2} , output
(5)	IL3 °↑k	Current I _{L3} , input
(6)	IL3 I↓	Current I _{L3} , output
(7)	N ↑	Current N, input
(8)	N ↓	Current N, output
(9)	LAN	Ethernet
(10)	DI	Digital Input
(11)	DO	Digital output
(12)	M-BUS	M-BUS interface
(13)	RS485	RS485 interface

4.3 Connection examples

Some connection examples for the following types of connection are listed below:

- 3P4W - 3 phases, 4 conductors
- 1P2W - 1 phase, 2 conductors

The selection of the connection types in the device can differ according to the device version.

For the 5 A device it is only possible to measure the current with current transformers.

For the 65 A device, no current transformers may be connected.

All input or output terminals not required for measuring remain free.

In the connection examples, the secondary side of the transformer can optionally be grounded at the "I" terminal. It can be grounded at either the "k" or the "I" terminal.

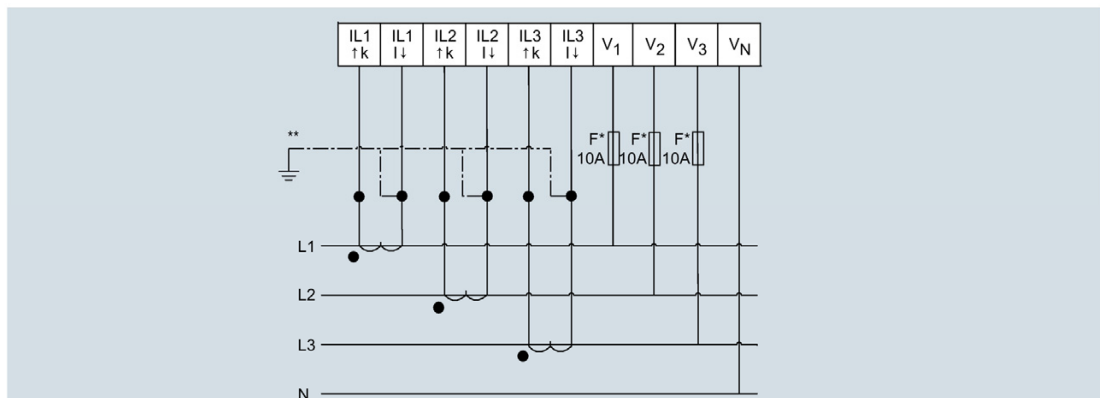
The grounding has no impact on the measurement.

Parameterization of the devices is described in section Parameterizing (Page 41).

Connection examples for 5 A device

(1) Three-phase measuring, four conductors, unbalanced load, with three current transformers

Connection type 3P4W



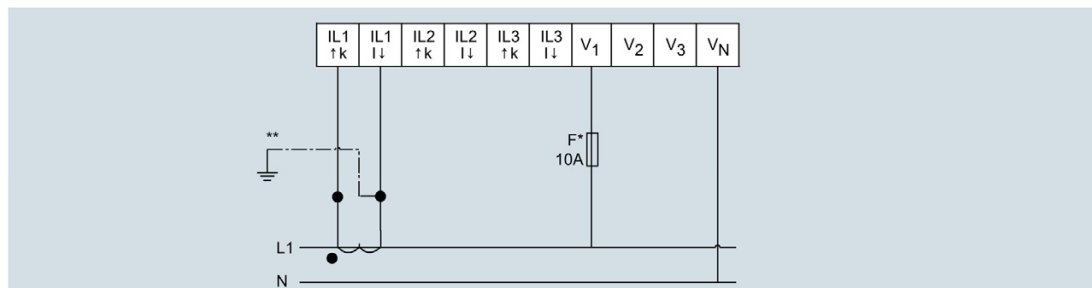
* Fuses must be provided by the customer: for V_1 , V_2 , V_3 : 10 A

** Grounding optional

Figure 4-3 Connection type 3P4W, with three current transformers

(2) Single-phase measuring, with one current transformer

Connection type 1P2W



* Fuses must be provided by the customer: for V₁: 10 A

** Grounding optional

Figure 4-4 Connection type 1P2W, with one current transformer

4.4 65 A device

Connection examples for 65 A device

(1) Three-phase measurement, four conductors, direct connection to the low-voltage network

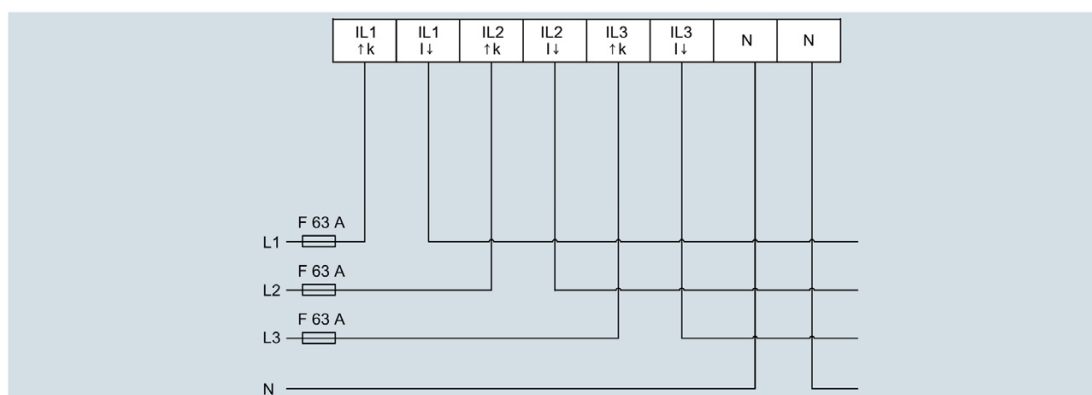


Figure 4-5 Direct connection to the low-voltage network.

4.5 Grounding of the Ethernet / RS485 cable

NOTICE

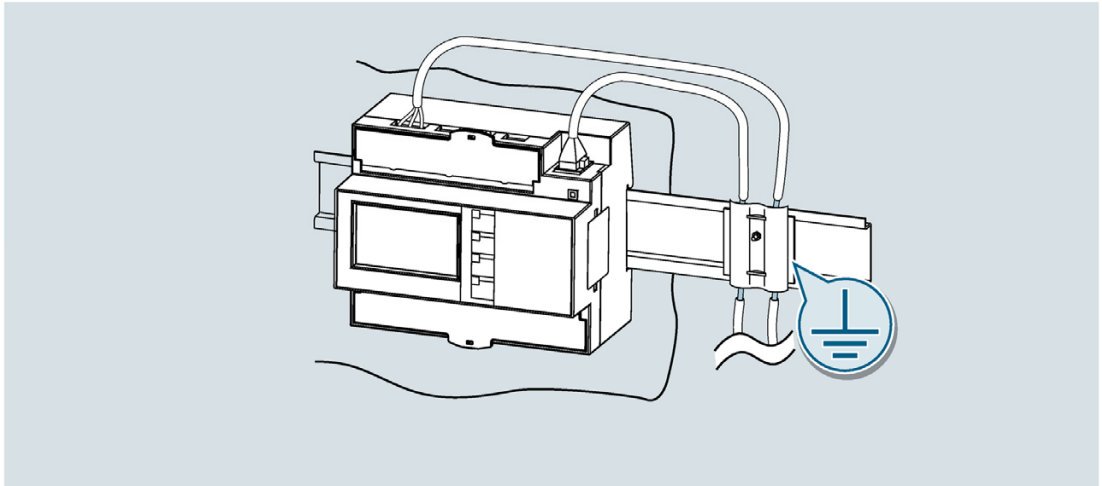
The upper limit values will be violated if the cable is not grounded.

Compliance with the technical limit values for noise radiation and noise immunity is only guaranteed if the cable is correctly grounded. The operator of the system is responsible for ensuring compliance with the statutory limit values (CE mark).

Make a shield connection on both sides as described here.

Implementation

Ground the Ethernet or RS485 cable at both ends. To do this, expose the foil shield of the cable. Connect the exposed shield to a suitable grounding point on the control cabinet, preferably a shielding bus.



- Be careful not to damage the foil shield of the cable when removing the cable jacket.
- Fasten the exposed shield with a metal cable clamp or alternatively with a hose tie. The clamp must clasp around a large portion of the shield and provide good contact.
- To allow good contact, a tin-plated or galvanically stabilized surface is ideal. With a galvanized surface, the contact should be achieved using suitable screws. A painted surface at the contact point is not suitable.

NOTICE**Loss of contact if the shield connection is incorrectly used for strain relief**

If the shield connection is used for strain relief, the grounding contact can deteriorate or be completely lost.

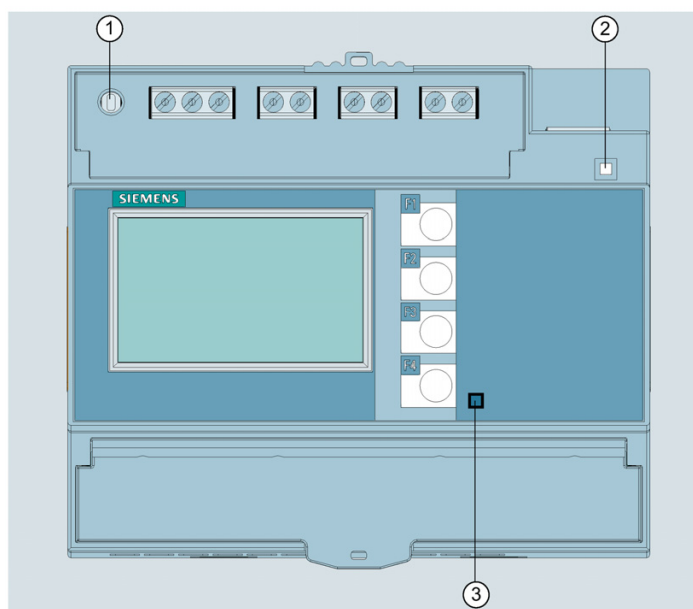
Do not use the contact point on the cable shield for strain relief.

Operation

5.1 Device interface

5.1.1 Displays and operator controls

The front of the PAC2200 contains the following displays and operator elements.



- (1) Software pushbutton
- (2) LED for Ethernet: Link / Activity
 - LED is illuminated: Data connection available
 - LED flashes: Data is being transferred
 - LED is off: No data connection available
- (3) Active energy pulse indicator

Figure 5-1 Device interface

5.1.2 Control keys

The device can be operated by means of four keys.

The keys are assigned different functions.

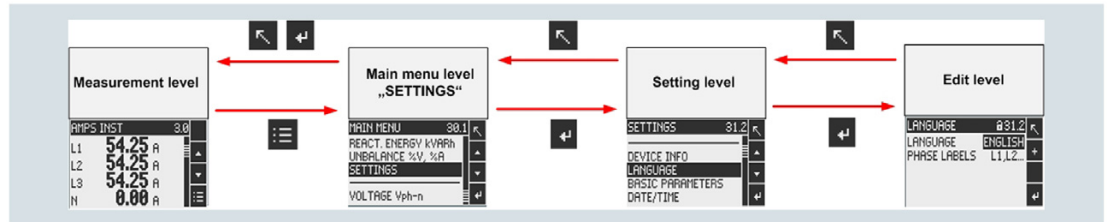
The functions of the keys depend on the menu level currently in use.

Keys	Possible assignment	Meaning
		No function
		Scroll between extended measured values
		Cancel the last action carried out
		Scroll up
		Increment selection
		Scroll down
		Select the editing location
		Decrement selection
		Main menu level
		ON/OFF
		Edit selection
		Confirm selection

5.2 Menu navigation

The device menu can be subdivided into four menu levels:

- Measured value level
- Main menu level
- Setting level
- Editing level



Depending on the device version and firmware status, the availability of the measured values may vary in the measured value and main menu levels. The selection of the parameters at the setting and editing levels can also differ from the device version and firmware status.

5.2.1 Measured value level

By default, the device is at the measured value level.

At this level, the available measured value can be read off.

Using the keys  and  you can scroll through the measured values.

When measured values are selected, additional information can be called up with the  key.

The  key returns the device to the "Main menu level".

5.2.2 Main menu level

At this level all available measured variables are listed.

The  key returns the device to the measured value menu level.

Using the keys  and  you can scroll through the measured variables.

The  key confirms the required selection and takes the device to the measured value level.

In the "SETTINGS" menu option, the device is set to the "Setting level" by actuating the  key.

5.2.3 Setting level

At the setting level the device can be configured. At this menu level all settable parameters are listed.

The  key returns the device to the "Main menu level".

Using the keys  and  you can scroll through the setting parameters.

The  key confirms the required selection and takes the device to the editing level.

5.2.4 Editing level

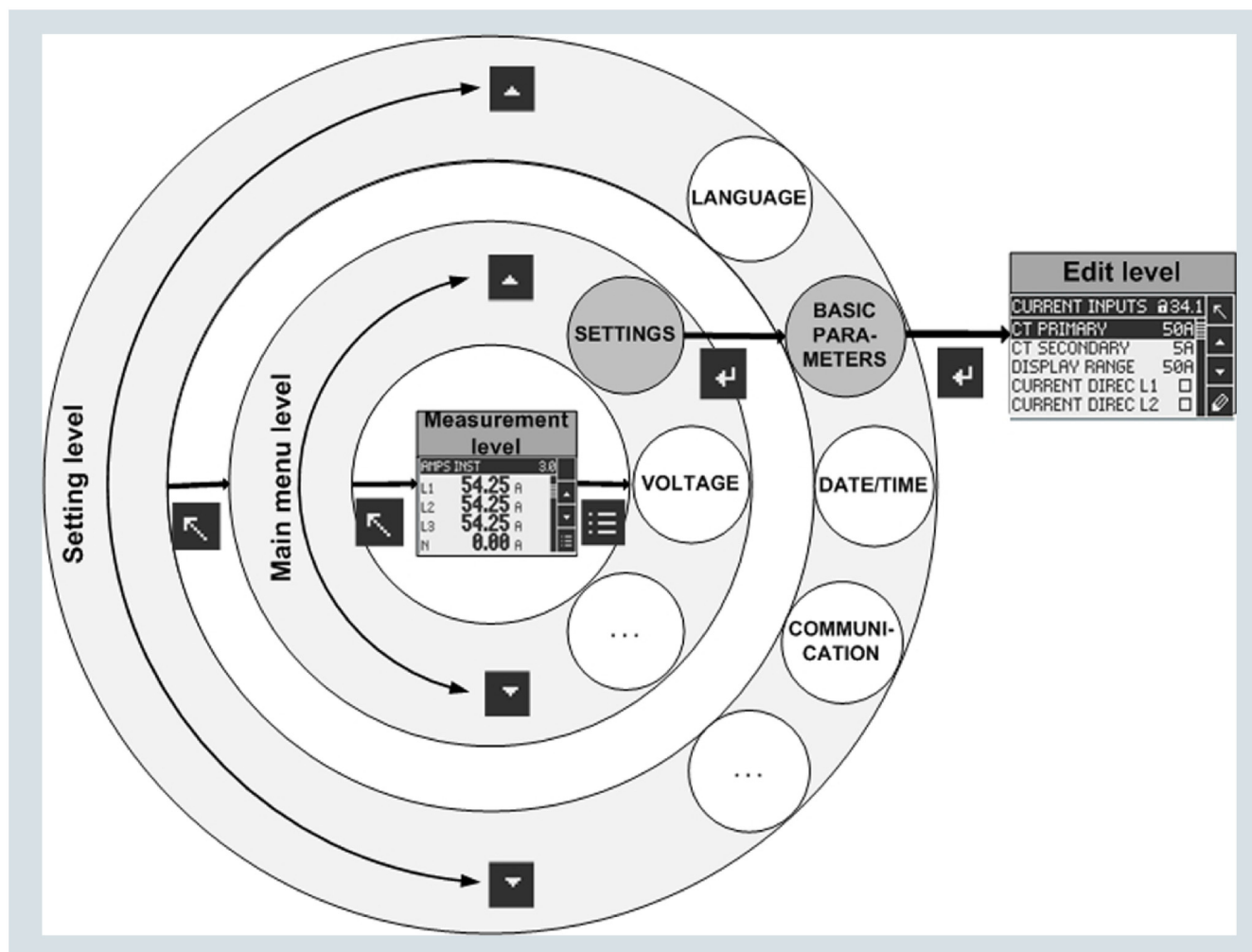
At the editing level it is possible to modify the device parameters.

The  key returns the device to the setting level.

The required value is entered using the  and  keys.

The input is confirmed with the  key.

Each input must be confirmed with the  key, otherwise the change that has been made is not accepted by the device.



5.3 Sentron powermanager

Using the SENTRON powermanager energy management software energy data of the PAC2200 measuring device can be acquired, monitored, evaluated, displayed and archived.

SENTRON powermanager offers the following functions for this purpose:

- Tree view of the customer's system (project tree)
- Measured value display with pre-defined user views
- Alarm management
- Demand curve
- Reporting, different report types (e.g. cost center report)
- Load monitoring of reaction plans
- Power peak analysis (available as of SENTRON powermanager V3.0 SP1)
- Support of distributed plants (systems)
- Archiving system
- User administration

Commissioning

6.1 Overview

Prerequisites

- The device has been installed.
- The device has been connected in accordance with the possible connection methods.

Steps for starting up the device

1. Apply the measuring voltage
2. Parameterize the device
3. Check measured values

Note

Check the connections

Incorrect connection can result in malfunctions and failure of the device.

Before starting up the PAC2200, check that all connections are correct.

Note

When performing an insulation test of the entire installation with AC or DC, the device should be disconnected before starting the test.

6.2 Applying the measuring voltage

A supply voltage is required to operate the device.

The device is supplied with power via the measuring voltage.

Please consult the technical data or the type plate for the type and level of the possible supply voltage.

Refer also to the diagram Connections (Page 26)



WARNING

Do not apply voltage in excess of the rated voltage limit.

Failure to observe this notice may result in death, serious injury, or property damage.

The limits given in the technical data and on the type plate must not be exceeded even at startup or when testing the device.

Protecting the current measuring inputs



DANGER

Open transformer circuits will result in electric shock and arc flashover.

Failure to observe this notice will cause death, serious injury or considerable damage to property.

For the 5 A device it is only possible to measure the current via external current transformers. When using the **current transformers**, the circuit is not protected by a fuse. Do not open the secondary circuit under load. Short circuit the secondary current terminals of the current transformer before removing this device. The safety information for the current transformers used must be followed.

Protecting the voltage measuring inputs

CAUTION

Non-fused voltage measuring inputs may lead to device and equipment damage.

Always protect the device with an IEC approved fuse or with an IEC approved miniature circuit breaker.

5 A device: 10 A

65 A device: 63 A

6.3 Parameterizing

6.3.1 Procedure for parameterizing

You can download the SENTRON powerconfig configuration software from the Industry Online Support Website (<https://support.industry.siemens.com/cs/document/63452759/update-version-powerconfig-v3-7?dti=0&lc=en-VW>).

Information and notes on how to use SENTRON powerconfig can be found in the Online Help of the configuration software or by contacting Technical Support.

You launch the Online Help in SENTRON powerconfig by pressing the "F1" key.

In order to be able to configure the PAC2200, the measuring voltage must be connected.

The device can be parameterized using the "Settings" menu option.

6.3.2 "Language" parameter

The menu guidance language can be set in the "Settings" menu by selecting the "Language" option.

This enables you to select either English or German. English is the default setting.

6.3.3 "Basic settings" parameter

Not available for 65 A devices.

"Voltage Input" parameter

Connection types:

- 3P4W: 3 phases, 4 wires
- 1P2W: 1 phase, 2 wires

Default setting: 3P4W

The "Connection type" parameter limits the total number of measuring values. The input circuit of the device must correspond to the parameterized connection type.

Inform the device of the connection type used by entering the connection type code in the device settings.

"Current input"

The "Current input" parameter specifies the values for the current input.

When measuring using current transformers, the device must know the current conversion ratio.

For this purpose, the primary and secondary current must be specified in the fields "PRIMARY CURRENT" and "SECONDARY CURRENT".

PRIMARY CURRENT	Range: 1 A to 99999 A, freely adjustable Default setting: 50 A
SECONDARY CURRENT	Range: 1 A, 5 A Default setting: 5 A
DISPLAY RANGE	1 A ... 99999 A Default setting: 1 A
CURRENT DIRECTION L1	The device interprets the current direction opposite to the wiring.
CURRENT DIRECTION L2	Separate setting direction for each phase.
CURRENT DIRECTION L3	No: The device interprets the current flow direction corresponding to the wiring. Yes: The direction of current flow is inverted. The device interprets the current flow direction opposite to the wiring. Default setting: No

"Write protection"

No write access is possible. In order to gain write access, the hardware write protection on the device must be deactivated.

ON: Hardware write protection is activated

OFF: Hardware write protection is deactivated

Request message "PRESS SW" appears on the display. By pressing the SW key on the device within this phase, the protection function is activated or deactivated.

Note

Activate hardware write protection

When connecting the device to a network, it is recommended that the hardware write protection is activated.

6.3.4 "Date/time" parameter

The date and time can be set by using the "Date/time" option in the "Settings" menu.

Date:	Displayed in accordance with the format
Format:	DD.MM.YYYY (default setting) MM/DD/YY YYYY-MM-DD
Time:	HH:MM:SS
Time zone:	00:00 (12/ +14)
Daylight saving:	Auto EU (default setting) Auto US Table OFF
SNTP (with Ethernet interface only):	OFF (default setting) Active Time synchronization via SNTP protocol
IP (with Ethernet interface only):	0.0.0.0 (for SNTP only) If an SNTP IP address is configured, only data from this address is accepted.

6.3.5 "Integrated I/O" parameter

"Digital Input"

The following functions can be assigned to the "Digital input" parameter:

- Tariff switch for two-tariff, active energy, and reactive energy counters.
- Synchronization of the measuring period by means of the synchronization pulse of a system control center or other device.

ACTION

Not used: Digital input is deactivated.

Count input pulses: Counting of input pulses

High tariff / low tariff switching: Switching between tariffs.
Low tariff if input active.

Demand synchronization: Synchronization of power demand.

Default setting: Not used.

UNIT

The "UNIT" property is only visible if "Count input pulses" is set for the "TYPE OF USE".

Countable unit with pulse counting:

- Active Energy (kWh)
- Reactive Energy (kvarh)

PULSES PER UNIT

The "PULSES PER UNIT" property is only visible if "Count input pulses" is set for the "TYPE OF USE".

Range: 1 to 4000

Default setting: 1

PRO (input pulse divider)

The "INPUT PULSE DIVIDER" property is only visible if "Count input pulses" is set for the "TYPE OF USE".

Range: 1; 10; 100; 1000

Default setting: 1

Formula:

$$\frac{\text{Pulses per unit}}{\text{Input pulse divider} \times \text{unit}} = \text{Value of pulse}$$

Example:

Pulses per unit: 50

Input pulse divider: 100

Unit: kWh

$$\frac{50}{100 \text{ kWh}} = 0.5 \text{ pulses per kWh} = 500 \text{ pulses per MWh}$$

"Digital output"

The following functions can be assigned to the "Digital output" parameter:

- Energy pulse output; can be programmed for active or reactive energy pulses
- Indication of the direction of rotation
- Operating state display of the device
- Switching output for remote control via the interface

ACTION

Not used: Digital output is deactivated.

Device ready: Digital output is activated.

Remote output: The digital output is controlled by remote access.

Direction of rotation: Digital output is switched on by an electric counter-clockwise rotating field and remains active for as long as the field is rotating in this direction.

Energy pulse: Digital output signals the number of pulses set for each energy unit (e.g. kWh). The energy counter specified in the "COUNTER SOURCE" field is evaluated here.

Default setting: Not used

UNIT

Selects the type of cumulative power and the import value that triggers the pulse when that value is reached.

Range: Counter import active energy (kWh), counter export active energy (kWh), counter import reactive energy (kvarh), counter export reactive energy (kvarh)

Default setting: Counter Import Active Energy (kWh)

The "COUNTER SOURCE" property is only visible if "Count input pulses" is set for the "TYPE OF USE".

PULSE DURATION

Duration of the energy pulses.

Range: 30 ms to 500 ms

Default setting: 100 ms

The "PULSE DURATION" property is only visible if "Count input pulses" is set for the "TYPE OF USE".

6.3.6 "Communication" parameter

The number of available communications interfaces can vary depending on the version of the device.

"MODBUS TCP"

DHCP	(Dynamic Host Configuration Protocol) The network configuration is assigned automatically.
IP	000.000.000.000 Manual setting of the IP address is only possible when DHCP is deactivated
SN	000.000.000.000 Manual setting of the subnet is only possible when DHCP is deactivated
GW	000.000.000.000 Manual setting of the gateway is only possible when DHCP is deactivated
Port	502 (default setting)
Firewall	OFF: Subnet firewall deactivated ON: Write access is rejected if the remote station is in another subnet.

"MODBUS RTU"

Address	1 - 247
Baud rate	4800/9600/19200/38400
Format	8N1/8N2/8E1/8O1/
Response time	0 - 255 ms

"MODBUS RTU"

Primary address	0 - 250
Baud rate	1200/2400/4800/9600

6.3.7 "Display" parameter

Contrast	The display contrast can be adjusted in steps. 0 - 10 (default setting 5)
Brightness	The intensity of the backlighting can be adjusted in steps. 0 - 3 (default setting 3)
Dimming	The dimming setting of the display can be adjusted in steps. 0 - 3 (default setting 3)
Dim after	On expiry of the set period, the backlighting is dimmed to the set intensity. 0 - 99 (default setting 3)
Test indicator	Display test indicator

6.3.8 "Extended" parameter

Password

The write access to the device settings can be protected by means of a password.

As soon as the password has been entered once for the device, it is not requested again for as long as the device is connected to the SENTRON powerconfig configuration software or is still in the "Settings" menu.

Display	No: Password protection deactivated Yes: Write access is password protected using keys on display (default setting: no)
Communication	No: Password protection deactivated Yes: Write access is password protected by means of communication (default setting: no)
Password	Password policy: four-digit number between 0000 ... 9999 (default setting 0000 - no password)

Note

If you have forgotten the password, please contact Technical Assistance, who will give you a new password.

Reset

Factory settings	All settings except the communication settings are reset to the as-delivered condition. No: Not active Yes: active
Communication settings	All communication settings are reset to the as-delivered condition. No: Not active Yes: active
Execute	Confirmation of the reset

Note

The reset must be confirmed by selecting the "Execute..." field. Otherwise the device reset is not executed.

Write protection

No write access is possible. In order to gain write access, the hardware write protection on the device must be deactivated.

No: Hardware write protection is deactivated

Yes: Hardware write protection is activated

(default setting: no)

Request message "PRESS SW" appears on the display. By pressing the SW key on the device within this phase, the protection function is activated or deactivated.

If the write protection is activated, the same request is shown on the display before the parameters are changed. The protection is only lifted temporarily. After returning to the setting level, the write protection is reactivated.

Note

Activate hardware write protection

On connecting the device to a network, it is recommended that the hardware write protection is activated.

Service and maintenance

7.1 Calibration

The device has been calibrated by the manufacturer before shipping. Recalibration is not required provided the environmental conditions are maintained.

7.2 Firmware updates

The PAC2200 supports firmware updates.

When updating, always use the latest version of the powerconfig configuration software. For update instructions, please see the related documentation and the online help for the configuration software.

The last devices settings made remain unchanged.

7.3 Troubleshooting guide

Remedies for the resolution of faults

Fault	Remedies
Device is not working	• Check power supply • Check fuse
Voltage or current measured values are not displayed	• Check fuse • Check configuration (see Parameterizing (Page 41))
Voltage values are not plausible	• If current transformer is available, check the settings and the connection of the current transformer and correct if necessary
Current values are not plausible	• Check the settings and the wiring of the current transformer and correct if necessary
No communication	• Check the communication settings (incorrect IP address, incorrect subnet, incorrect Modbus TCP port or gateway?) • Check firewall, if present (possibly preventing communication to the Modbus ports)
Power values are incorrect, although voltage and current are correctly applied	• Check voltages and currents of the phases (not properly connected to one another) • Check current transformer (incorrect polarity?)

7.4 Warranty

Procedure

Note

Loss of warranty

If you open the device, you will invalidate the Siemens warranty. Only the manufacturer is permitted to carry out repairs to the devices. Return faulty or damaged devices to Siemens for repair or replacement.

If the device is faulty or damaged, proceed as follows (only during the warranty period):

1. Uninstall the device; refer to section Deinstallation (Page 24).
2. Pack the device in a suitable manner to prevent it from being damaged during transport.
3. Return the device to Siemens. You can obtain the address from:
 - Your Siemens sales partner
 - Technical Assistance

See also

Latest information (Page 7)

7.5 Disposal

Disposal and recycling

Dispose of or recycle the module in accordance with the applicable laws and regulations in your country.

Technical data

8.1 Technical data

Device configuration

- 1 optically isolated digital input
- 1 optically isolated digital output
- 1 Ethernet interface, for connecting and configuring to the PC or network (optional)
- 1 M-Bus connection for reading out the measured values (optional)
- 1 RS485 port for readout and configuration (optional)

Measurement

Only for connection to AC voltage systems

Measuring method	
For voltage measurement	True root-mean-square measurement (TRMS)
For current measurement	True root-mean-square measurement (TRMS)
Measured value acquisition	
Energy	Contiguous (zero blind measuring)
Current, voltage	Contiguous (zero blind measuring)
Waveform	Sinusoidal or distorted
Frequency of the relative fundamental	50/60 Hz
Measured value acquisition mode	Automatic mains frequency acquisition

Measuring inputs for voltage (5 A device)

Measuring inputs	
Voltage U_n	220/230 VAC 50 / 60 Hz
Min. measurable voltage	
Voltage L-N	AC 3~ 230 V (+20%)
Voltage L-L	AC 3~ 400 V (+20 %)
Min. measurable voltage	
Voltage L-N	AC 3~ 230 V (-80%)
Voltage L-L	AC 3~ 400 V (-80%)
Zero point suppression level	
Voltage L-N	7 V
Voltage L-L	10 V
Impulse withstand voltage	6.5 kV (1.2/50 μ s)
Measuring category	(acc. to IEC 61010-2-030)
Input voltage V_i	CAT III
Input resistance (L-N)	1 M Ω
Max. power consumption per phase	80 mW

Measuring inputs for current (5 A device)

Only for connection to AC power systems via external current transformers (5 A device)

Measuring inputs	
Input current I_i	1 A / 5 A
Max. permissible continuous current	10 A
Current impulse overload capability	100 A for 1 s
Zero point suppression level	1 mA / 5 mA
Max. power consumption per phase	500 mVA at 6 A
Measuring range	1 ... 120%

Measuring inputs (65 A device)

For direct connection to the AC system.

Measuring inputs	
Input current I_n	10 A
Max. input current I_{max}	65 A
Maximum power consumption	0.4 VA / phase
Measuring range	0.5 ... 65 A

Measuring accuracy

Measured variable	Accuracy class acc. to IEC 61557-12 (K55)
Voltage	Class 0.5
Current	Class 0.5
Apparent power	Class 1
Active power	Class 1
Reactive power	Class 1
Total apparent power over all phases	Class 1
Total active power over all phases	Class 1
Total reactive power VAR1 over all phases	Class 2
Cumulated active power	Class 1
Cumulated reactive power	Class 2
Total power factor	Class 0.5
Line frequency	Class 0.05
Active energy	Class 1
Reactive energy	Class 2

When measuring on external current transformers or voltage transformers, the accuracy of the measurement depends on the quality of the transformer.

Digital Input

Digital Input	
Number	1
Type	Passive
Maximum switching voltage	30 V
Input current	
"1" signal detection	2.5 ... 10 mA
"0" signal detection	≤0.5 mA

Digital output

Digital output	
Number	1
Type	Passive
Design/function	Switching output or pulse output
Maximum switching voltage	30 V
Output current	
For signal "1"	Depends on the load and the external power supply
Continuous load	≤50 mA (thermal overload protection)
Transient overload	≤130 mA for 100 ms
For signal "0"	≤0.2 mA
Internal resistance	30 Ω
Overvoltage category	CAT I
Pulse output function	
Standard for pulse emitter	Signal characteristics in accordance with IEC 62053-31
Adjustable pulse duration	30 ... 500 ms
Min. settable time frame	10 ms
Max. switching frequency	17 Hz
Short-circuit protection	Yes

Communication

Ethernet interface	
Protocols	Modbus TCP; web server (HTTP); SNTP; DHCP
Ethernet connection	RJ-45
Data rate	10 / 100 Mbit/s

M-BUS interface	
Protocol	M-BUS
Connection	2-pole
Baud rate:	300/600/1200/2400/4800/9600/19200

RS 485 interface	
Protocol	MODBUS RTU
Connection	3-pole
Baud rate	4800/9600/19200/38400
Format	8N1/8N2/8E1/8O1/

Connection elements

Current, voltage and supply connection	5 A device	65 A device
Conductor cross section		
Rigid	0.2 ... 6 mm ²	0.75 ... 35 mm ²
Flexible	0.2 ... 4 mm ²	1 ... 35 mm ²
Flexible with end sleeve, without plastic sleeve	0.2 ... 4 mm ²	0.75 ... 25 mm ²
Flexible with end sleeve and plastic sleeve	0.25 ... 4 mm ²	0.75 ... 25 mm ²
AWG	24 ... 10	19 ... 2
2-wire, same cross-section		
Rigid	0.2 ... 1.5 mm ²	0.75 ... 10 mm ²
Flexible	0.2 ... 1.5 mm ²	1 ... 4 mm ²
Flexible with end sleeve, without plastic sleeve	0.25 ... 0.75 mm ²	0.75 ... 4 mm ²
Flexible with TWIN end sleeve and plastic sleeve	0.5 ... 2.5 mm ²	0.75 ... 4 mm ²
AWG	30 ... 10	19 ... 8
Tightening torque	0.5 ... 0.6 Nm	3 Nm
Communication ports		
Conductor cross section		
Rigid	0.14 ... 1.5 mm ²	
Flexible	0.14 ... 1.5 mm ²	
Flexible with end sleeve, without plastic sleeve	0.25 ... 1 mm ²	
Flexible with end sleeve and plastic sleeve	0.25 ... 1.5 mm ²	
AWG	26 ... 16	
2-wire, same cross-section		
Rigid	0.14 ... 0.75 mm ²	
Flexible	0.14 ... 0.75 mm ²	
Flexible with end sleeve, without plastic sleeve	0.25 ... 0.5 mm ²	
Flexible with TWIN end sleeve and plastic sleeve	0.5 ... 1 mm ²	
AWG	30 ... 14	
Tightening torque	0.5 ... 0.6 Nm	

Dimensions and weights

Dimensions and weights	
Type of fixing	Standard rail mounting TH35 to EN 60715
Construction type	6TE
Housing dimensions W x H x D	108 mm x 97 mm x 71 mm
Weight	
5 A device without packaging	310 g
5 A device with packaging	375 g
65 A device without packaging	415 g
65 A device with packaging	480 g

Degree of protection and protection class

Degree of protection and protection class	
Protection class	Safety class II
Degree of protection according to IEC 60529	
Front area	IP 40
Termination area	IP 20
If higher degree of protection requirements are placed on the application engineering, the customer must take suitable measures	

Environmental conditions

Operation is only permissible inside an enclosed dry room.

Environmental conditions	
Temperature range	
Ambient temperature during operating phase	-25 °C ... +55 °C (K55)
Ambient temperature during transport and storage	-25 °C ... +70 °C
Relative humidity	0 ... 75% RH
Installation altitude above sea level	max. 2000 m
Degree of pollution	2
Environmental tests	according to IEC 60068

Approvals

The PAC2200 complies with the requirements of the European Directives.

CE conformity  The SENTRON PAC2200 complies with the requirements of the following European Directives: DIRECTIVE 2014/30/EU OF THE EUROPEAN PARLIAMENT AND COUNCIL of February 26, 2014, on the harmonization of the laws of the Member States relating to electromagnetic compatibility and repealing the Directive 89/336/EEC DIRECTIVE 2014/35/EU OF THE EUROPEAN PARLIAMENT AND COUNCIL of February 26, 2014, on the harmonization of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND COUNCIL of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Conformity with these Directives is verified by compliance with the following standards: EN 61010-1: 2011 EN 61010-2-030: 2011 EN 61326-1: 2013 EN 61557-12: 2008 EN 50581: 2012	
Approvals for Australia and New Zealand  C-Tick Australian Radiocommunications Act, compliant with AS/NZS CISPR 11; Industrial Emissions	
Approval for Eurasian customs union (valid in Russia, Belarus, Kazakhstan, Kyrgyzstan and Armenia) 	

8.2 Labeling

Labels on the housing of the PAC2200

	Symbol, label	Explanation
(1)	PAC2200	Product designation
(2)	LQN/YYMMDDxxxxx x	Serial number of the device
(3)		EAC certification
(4)		Risk of electric shock
(5)		General Warning Symbol
(6)	CAT III	Overvoltage category CAT III for current and voltage inputs
(7)		Protective insulation, device with protection class II
(8)		CE mark. Confirmation of conformity of the product with the applicable EU directives and compliance with the essential requirements contained in these directives
(9)		C-Tick certification
(10)		Electrical installation demands technical competence

Dimension drawings

9.1 Dimensional drawings

Note: All dimensions in mm.

Frame dimensions

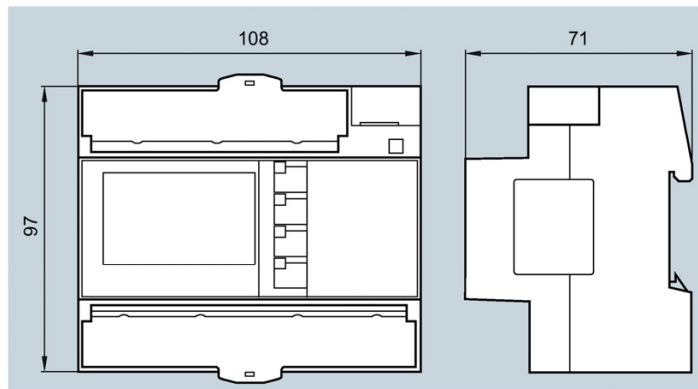


Figure 9-1 Frame dimensions

Appendix

A.1 Modbus TCP

Detailed information about Modbus TCP can be found at the Modbus Website (<http://www.modbus.org>)

A.1.1 Function codes

Function codes control the data exchange. In doing so, a function code tells the slave which action it is to take.

If an error occurs, the most significant bit (MSB) is set in the FC byte of the response frame.

Supported Modbus function codes

Table A- 1 Supported Modbus function codes

FC	Function in accordance with Modbus specification
0 x 01	Read Coils
0 x 02	Read Discrete Inputs
0 x 03	Read Holding Registers
0 x 04	Read Input Registers
0 x 05	Write Single Coil
0 x 06	Write Single Register
0 x 0F	Write Multiple Coils
0 x 10	Write Multiple Registers
0 x 2B	Read Device Identification
0 x 14	Read File Record (for mean values)

A.1.2 Modbus exception codes

Overview

Table A- 2 Modbus exception codes

Exception codes	Name	Meaning	Remedy
01	Illegal Function	Illegal function: - The function code in the request is not a permissible action for the slave. - The slave is in a status in which it cannot process a request of this type. This is the case, for example, if it has not yet been configured and is requested to return register values.	Check which function codes are supported.
02	Illegal Data Address	Illegal data address This address is not permissible for the slave. This is the case, for example, if the combination of start offset and transfer length is invalid.	Check the offset and the number of registers.
03	Illegal Data Value	Illegal data value: The request contains a data value that is not permissible for the slave. This indicates an error in the remaining structure of a complex request, e.g. an incorrect data length.	Check that the specified offset and the specified data length in the command are correct.
04	Slave Device Failure	Error in processing the data: An indefinite error occurred when the slave attempted to execute the requested action.	Check that the specified offset and the specified data length are correct.
F0	Write Protection ON	The action has been rejected because the write protection is set.	Deactivate write protection.

A.1.3 Modbus measured variables with the function codes 0x03 and 0x04

Addressing the measured variables

You can use the Modbus function codes 0x03 and 0x04 on all the measured variables listed below.

Note

Error in the case of inconsistent access to measured values

Please ensure the start offset of the register is correct when making **read accesses**.

Please ensure the start offset and the number of registers are correct when making **write accesses**.

Example: If a value consists of two registers, a read command applied in the second register will generate an error code. The PAC2200 will also output an error code if a write operation ends in the middle of a multi-register value.

Table A- 3 Available measured variables

Abbr. in the "Access" column	Abbreviation
R	Read access
W	Write access
RW	Read and write access

Offset	Number of registers	Name	Format	Unit	Value range	Access
1	2	Voltage V_{L1-N}	Float	V	-	R
3	2	Voltage V_{L2-N}	Float	V	-	R
5	2	Voltage V_{L3-N}	Float	V	-	R
7	2	Voltage V_{L1-L2}	Float	V	-	R
9	2	Voltage V_{L2-L3}	Float	V	-	R
11	2	Voltage V_{L3-L1}	Float	V	-	R
13	2	Current L1	Float	A	-	R
15	2	Current L2	Float	A	-	R
17	2	Current L3	Float	A	-	R
19	2	Apparent power L1	Float	VA	-	R
21	2	Apparent power L2	Float	VA	-	R
23	2	Apparent power L3	Float	VA	-	R
25	2	Active power L1	Float	W	-	R
27	2	Active power L2	Float	W	-	R
29	2	Active power L3	Float	W	-	R
31	2	Reactive power L1	Float	var	-	R
33	2	Reactive power L2	Float	var	-	R

Offset	Number of registers	Name	Format	Unit	Value range	Access
35	2	Reactive power L3	Float	var	-	R
37	2	Power factor L1	Float	-	0 ... 1	R
39	2	Power factor L2	Float	-	0 ... 1	R
41	2	Power factor L3	Float	-	0 ... 1	R
55	2	Frequency	Float	Hz	45 ... 65	R
57	2	Average voltage V_{L-N}	Float	V	-	R
59	2	Average voltage V_{L-L}	Float	V	-	R
61	2	Average Current	Float	A	-	R
63	2	Total apparent power	Float	VA	-	R
65	2	Total active power	Float	W	-	R
67	2	Total reactive power	Float	var	-	R
69	2	Total power factor	Float	-	-	R
205	2	Device diagnostics and device status *	Unsigned long	-	Byte 0 system status	R
207	2	Status of the digital outputs *	Unsigned long	-	Byte Bit 0 = Output 0	R
209	2	Status of the digital inputs *	Unsigned long	-	Byte 3 Bit 0 = Input 0	R
211	2	Active tariff	Unsigned long	-	0 = Tariff 1 1 = Tariff 2	R
213	2	Operating hours counter	Unsigned long	s	0 ... 999999999	RW
215	2	Universal counter	Unsigned long	-	0 ... 999999999	RW
217	2	Relevant parameter changes counter	Unsigned long	-	-	R
219	2	Counter all parameter changes	Unsigned long	-	-	R
501	2	Cumulated active power import	Float	W	-	R
503	2	Cumulated reactive power import	Float	var	-	R
505	2	Cumulated active power export	Float	W	-	R
507	2	Cumulated reactive power export	Float	var	-	R
509	2	Maximum active power reading during the period	Float	W	-	R
511	2	Minimum active power reading during the period	Float	W	-	R
513	2	Maximum reactive power reading during the period	Float	var	-	R
515	2	Minimum reactive power reading during the period	Float	var	-	R
517	2	Length of the current measuring period	Unsigned long	s	-	R
519	2	Time Since Start of the active demand period	Unsigned long	s	-	R
801	4	Active energy import tariff 1	Double	Wh	Overflow 1.0e+12	RW
805	4	Active energy import tariff 2	Double	Wh	Overflow 1.0e+12	RW
809	4	Active energy export tariff 1	Double	Wh	Overflow 1.0e+12	RW
813	4	Active energy export tariff 2	Double	Wh	Overflow 1.0e+12	RW

Offset	Number of registers	Name	Format	Unit	Value range	Access
817	4	Reactive energy import tariff 1	Double	varh	Overflow 1.0e+12	RW
821	4	Reactive energy import tariff 2	Double	varh	Overflow 1.0e+12	RW
825	4	Reactive energy export tariff 1	Double	varh	Overflow 1.0e+12	RW
829	4	Reactive energy export tariff 2	Double	varh	Overflow 1.0e+12	RW
833	4	Apparent energy tariff 1	Double	VAh	Overflow 1.0e+12	RW
837	4	Apparent energy tariff 2	Double	VAh	Overflow 1.0e+12	RW
841	4	L1 active energy import tariff 1	Double	Wh	Overflow 1.0e+12	RW
845	4	L1 active energy import tariff 2	Double	Wh	Overflow 1.0e+12	RW
849	4	L1 active energy export tariff 1	Double	Wh	Overflow 1.0e+12	RW
853	4	L1 active energy export tariff 2	Double	Wh	Overflow 1.0e+12	RW
857	4	L1 reactive energy import tariff 1	Double	varh	Overflow 1.0e+12	RW
861	4	L1 reactive energy import tariff 2	Double	varh	Overflow 1.0e+12	RW
865	4	L1 reactive energy export tariff 1	Double	varh	Overflow 1.0e+12	RW
869	4	L1 reactive energy export tariff 2	Double	varh	Overflow 1.0e+12	RW
873	4	L1 apparent energy tariff 1	Double	VAh	Overflow 1.0e+12	RW
877	4	L1 apparent energy tariff 2	Double	VAh	Overflow 1.0e+12	RW
881	4	L2 active energy import tariff 1	Double	Wh	Overflow 1.0e+12	RW
885	4	L2 active energy import tariff 2	Double	Wh	Overflow 1.0e+12	RW
889	4	L2 active energy export tariff 1	Double	Wh	Overflow 1.0e+12	RW
893	4	L2 active energy export tariff 2	Double	Wh	Overflow 1.0e+12	RW
897	4	L2 reactive energy import tariff 1	Double	varh	Overflow 1.0e+12	RW
901	4	L2 reactive energy import tariff 2	Double	varh	Overflow 1.0e+12	RW
905	4	L2 reactive energy export tariff 1	Double	varh	Overflow 1.0e+12	RW
909	4	L2 reactive energy export tariff 2	Double	varh	Overflow 1.0e+12	RW
913	4	L2 apparent energy tariff 1	Double	VAh	Overflow 1.0e+12	RW
917	4	L2 apparent energy tariff 2	Double	VAh	Overflow 1.0e+12	RW
921	4	L3 active energy import tariff 1	Double	Wh	Overflow 1.0e+12	RW
925	4	L3 active energy import tariff 2	Double	Wh	Overflow 1.0e+12	RW
929	4	L3 active energy export tariff 1	Double	Wh	Overflow 1.0e+12	RW
933	4	L3 active energy export tariff 2	Double	Wh	Overflow 1.0e+12	RW
937	4	L3 reactive energy import tariff 1	Double	varh	Overflow 1.0e+12	RW
941	4	L3 reactive energy import tariff 2	Double	varh	Overflow 1.0e+12	RW
945	4	L3 reactive energy export tariff 1	Double	varh	Overflow 1.0e+12	RW
949	4	L3 reactive energy export tariff 2	Double	varh	Overflow 1.0e+12	RW
953	4	L3 apparent energy tariff 1	Double	VAh	Overflow 1.0e+12	RW
957	4	L3 apparent energy tariff 2	Double	VAh	Overflow 1.0e+12	RW

The following tables contain further details of all measured variables indicated by a *.

A.1.4 Structure - Digital input status and digital output status with the function codes 0x03 and 0x04

The following are available via Modbus:

- "Status of the digital input"
- "Status of the digital output"

Input status and output status of the PAC2200

Table A- 4 Structure - Status of the digital inputs and outputs, Modbus offset 207 and 209

Name	Length	Status	Byte	Bit	Bit mask	Access
Status: Digital output	32 bits	DO	3	0	0x00000001	R
Status: Digital input	32 bits	DI	3	0	0x00000001	R

A.1.5 Structure - Device diagnostics and device status with the function codes 0x03 and 0x04

Structure

Table A- 5 Modbus offset 205, register 2: Structure device status and device diagnostics

Byte	Bit	Device status	Type	Bit mask	Value range	Access
0	0	No synchronization pulse	Status	0x01000000	0 = not active 1 = active	R
0	1	Device configuration menu is active	Status	0x02000000		R
0	2	Voltage overload	Status	0x04000000		R
0	3	Current overload	Status	0x08000000		R
0	5	Update status is active	Status	0x20000000		R
0	6	Hardware write protection is active	Status	0x40000000		R
0	7	Modbus communication is write-protected	Status	0x80000000		R
1	1	Maximum pulse rate exceeded	Status	0x00020000		R
1	7	Wait for user interaction	Status	0x00800000		R
2	0	Relevant parameter changes ¹⁾	saving	0x00000100		R
2	2	Maximum pulse rate exceeded ¹⁾	saving	0x00000400		R
2	3	Restart of the device ¹⁾	saving	0x00000800		R
2	4	Resetting of energy counter by user ¹⁾	saving	0x00001000		R
1) Only these device statuses are to be acknowledged.						

A.1.6 Modbus status parameters with the function code 0x02

Status parameters

You can use the Modbus function code 0x02 on all the status parameters listed below.

Table A- 6 Status parameters

Offset	Number of registers	Name	Format	Value range	Access
108	0	Relevant parameter changes	Bit	0 = not active 1 = active	R
109	0	Upper or lower limit violation	Bit		R
110	0	Maximum pulse rate exceeded	Bit		R
111	0	Restart of the device	Bit		R
112	0	Resetting of energy counter by user	Bit		R
117	0	Maximum pulse rate exceeded	Bit		R
124	0	No synchronization pulse	Bit		R
125	0	Device configuration menu is active	Bit		R
126	0	Voltage overload	Bit		R
127	0	Current overload	Bit		R
200	0	Digital input 0	Bit		R
300	0	Digital output 0	Bit		R

A.1.7 Modbus settings with the function codes 0x03, 0x04 and 0x10

Addressing the settings

You can use the Modbus function codes 0x03, 0x04 for read accesses and 0x10 for write accesses on all the settings parameters listed below.

Table A- 7 Settings parameters

Offset	Number of registers	Name	Unit	Format	Value range	Access
49999	2	Rated current display range	A	unsigned long	1 - 99999 A	RW
50001	2	Connection type	-	unsigned long	0 = 3P4W	RW
					4 = 1P2W	
50011	2	Primary current	A	unsigned long	1 ... 99999 A (5 A device)	RW
					65 A (65 A device)	R
50013	2	Secondary current	A	unsigned long	1 A, 5 A (5 A device)	RW
					65 A (65 A device)	R
50021	2	Demand period	Min.	unsigned long	1 ... 60	RW

Offset	Number of registers	Name	Unit	Format	Value range		Access
50023	2	Synchronization	-	unsigned long	0 =	No synchronization	RW
					1 =	Synchronization via bus	
					2 =	Synchronization via the digital input	
50243	2	Modification to current direction L1	-	unsigned long	0 =	No	RW
					1 =	Yes	
50245	2	Change of current direction L2	-	unsigned long	0 =	No	RW
					1 =	Yes	
50247	2	Change of current direction L3	-	unsigned long	0 =	No	RW
					1 =	Yes	

Table A- 8 Settings parameter for the digital input

Offset	Number of registers	Name	Unit	Format	Value range		Access
50025	2	Digital input "Action"	-	unsigned long	0 =	Status only	RW
					1 =	Pulse input	
					2 =	High tariff / low tariff switching	
					3 =	Synchronization	
50029	2	"Pulse input" mode	kWh	unsigned long	0 =	0 kWh	RW
					1 =	Export kWh	
50031	2	Pulses per unit (pulses per 1000 Wh / VARh)	-	unsigned long	1 ... 4000		RW
50239	2	Input pulse divider	kWh	unsigned long	0 =	1 kWh	RW
					1 =	10 kWh	
					2 =	100 kWh	
					3 =	1000 kWh	

Table A- 9 Settings parameter for the digital output

Offset	Number of registers	Name	Unit	Format	Value range		Access
50033	2	Switching function assignment to a vector group	-	unsigned long	0 ... 99		RW
50035	2	Digital output "Action"	-	unsigned long	0 =	Off	RW
					1 =	Device ON	
					2 =	Switching output	
					3 =	Phase sequence	
					4 =	Limit violation	

Offset	Number of registers	Name	Unit	Format	Value range	Access
					5 = Energy pulse	
50041	2	"Energy pulse" mode	-	unsigned long	0 = Import kWh 1 = Export kWh 2 = Import kVARh 3 = Export kVARh	RW
50043	2	Pulses per unit (pulses per 1000 Wh / VARh)	-	unsigned long	1 ... 4000	RW
50045	2	Pulse length	ms	unsigned long	30 ... 500	RW
50147	2	Digital output timeout	s	unsigned long	0 = AUS 0.1 ... 18000 = Output is reset after expiry of the time, provided there is no operator input.	RW
50237	2	Output pulse divider	kWh	unsigned long	0 = 1 kWh 1 = 10 kWh 2 = 100 kWh 3 = 1000 kWh	RW

A.1.8 Modbus communication parameters with the function codes 0x03, 0x04 and 0x10

Addressing the communication parameters

Table A- 10 Communication parameters

Offset	Number of registers	Name	Unit	Format	Applicable Modbus function codes	Value range	Access
62993	2	SNTP server IP address	-	unsigned long	• 0x03 • 0x04 • 0x10	0 ... FFFFFFFFh	RW
62995	2	SNTP client mode	-	unsigned long	• 0x03 • 0x04 • 0x10	0 = SNTP client OFF 1 = SNTP active client 2 = SNTP broadcast client	RW
62997	2	Subnet firewall ON/OFF	-	unsigned long	• 0x03 • 0x04 • 0x10	-	RW

Offset	Number of registers	Name	Unit	Format	Applicable Modbus function codes	Value range		Access
63001	2	IP address	-	unsigned long	0x03 0x04 0x10	0 ... FFFFFFFFh		RW
63003	2	Subnet mask	-	unsigned long	0x03 0x04 0x10	0 ... FFFFFFFFh		RW
63005	2	Gateway	-	unsigned long	0x03 0x04 0x10	0 ... FFFFFFFFh		RW
63007	2	Bootloader version	-	unsigned long	0x03 0x04	char, uchar, uchar, uchar		R
63009	2	Password protection ON/OFF	-	unsigned long	0x03 0x04	0; 1		R
63135	2	Modbus RTU address (if RS485 port is available)	-	unsigned long	0x03 0x04 0x10	1 - 247		RW
63137	2	MODBUS RTU baud rate (if RS485 port is available)	-	unsigned long	0x03 0x04 0x10	0 = 4800 baud 1 = 9600 baud 2 = 19200 baud 3 = 38400 baud		RW
63139	2	MODBUS RTU data bits/ parity/ stop bits (if RS485 port is available)	-	unsigned long	0x03 0x04 0x10	0 = 8N2 1 = 8E1 2 = 8O1 3 = 8N1		RW
63141	2	MODBUS RTU response time (if RS485 port is available)	ms	unsigned long	0x03 0x04 0x10	1 - 255		RW
64001	27	IM0 data	-	IM0STRUCT	0x03 0x04	-		R
64028	89	IM1 – IM4 data	-	IM14STRUCT	0x03 0x04 0x10	-		RW
65290	2	Hardware write protection ON/OFF (requires pressing of "SW" key on device)	-	unsigned long	0x10	0 =	ON	RW
						1 =	OFF	

A.1.9 Modbus device information with the function codes 0x03, 0x04 and 0x10

Addressing the device information parameters

You access the following device information parameters block-by-block only, e.g. read from Offset 64001 27 Register.

Note

Error in the case of inconsistent access to I&M data.

Please ensure the start offset and the number of registers are correct when making **read accesses** and **write accesses**. Always read or write the entire block.

Please ensure the start offset and the number of registers are correct when making **write accesses**.

If a value consists of several registers, a read command applied in the second register, for example, will generate an error code. The PAC2200 will also output an error code if, for example, a write operation ends in the middle of a multi-register value.

Table A- 11 I&M 0 parameters with the function codes 0x03 and 0x04

Offset	Total registers	Number of registers per parameter	Name	Format	Value range	Access
Start offset 64001	27	[1]	Manufacturer's ID	unsigned short	42*)	R
[64002]		[10]	Order No.	Char 20	ASCII	R
[64012]		[8]	Serial number	Char 16	ASCII	R
[64020]		[1]	Hardware version	unsigned short	0 ... 65535	R
[64021]		[2]	Firmware version	1 char, 3 unsigned char	V 0.0.0 ... V 255.255.255	R
[64023]		[1]	Counter for changes	unsigned short	1 ... 65535	R
[64024]		[1]	Profile ID	unsigned short	3A00 ... F6FF	R
[64025]		[1]	Specific Profile ID	unsigned short	-	R
[64026]		[1]	Version of the I&M data	2 unsigned char	0.0 ... 255.255	R
[64027]		[1]	Supported I&M data	unsigned short	00 ... FF	R
*) 42 stands for Siemens AG						

Table A- 12 I&M 1-4 parameters with the function codes 0x03, 0x04 and 0x10

Offset	Total registers	Number of registers per parameter	Name	Format	Value range	Access
Start offset 64028	89	[16]	Plant identifier	Char 32	ASCII	RW
[64044]		[11]	Location identifier	Char 22	ASCII	RW
[64055]		[8]	Installation date	Char 16	ASCII	RW
[64063]		[27]	Comment	Char 54	ASCII	RW
[64090]		[27]	Signature	Char 54	-	RW

A.1.10 Modbus command parameters

Addressing the command parameters

You can apply the Modbus function code 0x06 to the command parameters.

Table A- 13 Command parameters

Offset	Number of registers	Name	Unit	Format	Value range		Access
60004	1	Reset energy counter	-	unsigned short	0 =	all	W
					1 =	Active energy import tariff 1	
					2 =	Active energy import tariff 2	
					3 =	Active energy export tariff 1	
					4 =	Active energy export tariff 2	
					5 =	Reactive energy import tariff 1	
					6 =	Reactive energy import tariff 2	
					7 =	Reactive energy export tariff 1	
					8 =	Reactive energy export tariff 2	
					9 =	Apparent energy tariff 1	
					10 =	Apparent energy tariff 2	
60005	1	Synchronization of the demand period	Min.	unsigned short	1 ... 60		W
60006	1	Switching tariff	-	unsigned short	0 =	Main tariff	W

Offset	Number of registers	Name	Unit	Format	Value range		Access
					1 =	Secondary tariff	
60007	1	Acknowledge the diagnostics bit ¹⁾ (cf. stored bits in unsigned long beginning offset 205)	-	unsigned short	0 ... ffffh		W
60008	1	Switching outputs (if parameterized)	-	unsigned short	0ffh ... 1ffh		W
					Byte 0 = 0	Digital output 0.0	
					Byte 1 = 0	OFF	
					Byte 1 = 1	ON	
60009	1	Switching command for vector group	-	unsigned short	High 0 ... 99, Low 0 ... 1 High byte group assignment Low byte 1 = ON, 0 = OFF		W
65300	1	Activation of IP / Ethernet configuration	-	unsigned short	0		W

1) The Modbus Master must acknowledge these diagnostics bits.

A.1.11 Modbus standard device identification with the function code 0x2B

Addressing the Modbus standard device identification

You can use Modbus function code 0x2B on these device identification parameters.

Table A- 14 Parameter for Modbus standard device identification

Object ID	Name	Format	Access
OID 0	Manufacturer	String	R
OID 1	Manufacturer device name	String	R
OID 2	Firmware version / bootloader version	String	R

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