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Measuring Devices and Power Monitoring

SENTRON

Configu-ration Manual

Edition 2014

Answers for infrastructure and cities.

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Measuring Devices and Power Monitoring



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For further technical product information:

Service & Support Portal:
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PC-based power monitoring system

Overview



Components of the PC-based power monitoring system



User interface of powermanager

Power monitoring system with the SENTRON product family

The SENTRON product family offers the user not only power monitoring software in the form of the powermanager, but also the corresponding hardware in the form of 7KT/7KM PAC measuring devices and 3WL/3VL circuit breakers for implementing a complete power monitoring system.

The components are optimally coordinated with each other. For example, special drivers for the SENTRON devices are integrated in the power monitoring software so that on the one hand, power data acquisition can take place without any great configuration effort and, on the other, the most important measured values or states are indicated by predefined displays.

This reduces the engineering work for the customer and gives the user the assurance of knowing that the device functions are optimally supported in the software.

Features of powermanager

The powermanager power monitoring software is the central feature of the PC-based power monitoring system and

- is an independent power monitoring software.
- can be operated using a PC and measuring devices with Ethernet connection.
- is expandable from the simple standard application to a fully flexible customer solution.
- is fully scalable with regard to the number of devices and the software's functions.
- ensures optimum integration of measuring devices from the 7KT/7KM PAC range, as well as 3WL/3VL circuit breakers and other Modbus devices.

Benefits

- Transparency of power flows
- Exact knowledge of the consumption profile
- Increased power efficiency
- Optimization of power supply contracts
- Compliance with contractual terms
- Allocation of power costs to cost centers
- Optimization of plant maintenance
- Identification of critical plant conditions
- Available languages:
  German, English, Spanish, Portuguese
- Support of the various device communication interfaces (Modbus RTU, Modbus TCP)
- Status display of devices

Application

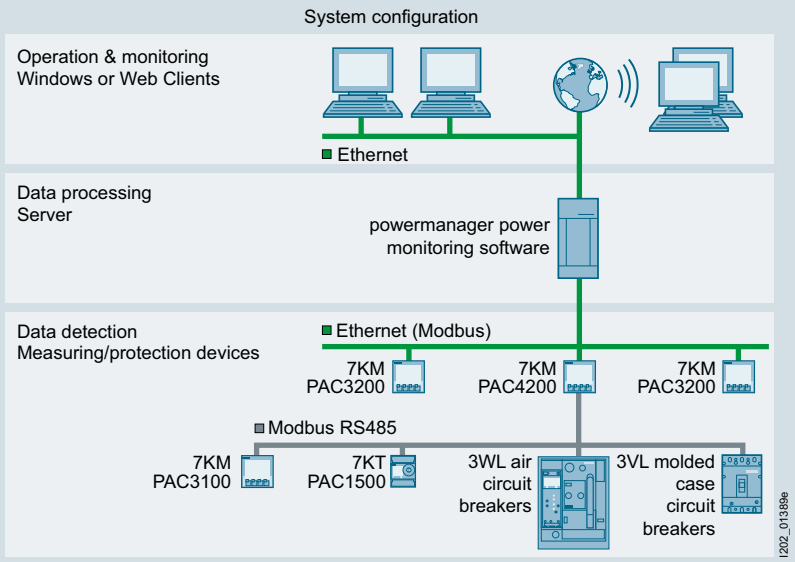
Applications

The product offers a standard power monitoring solution which provides the user with the following basic functions:

- Collection of measured quantities from the devices
- Presentation of the measured quantities from the devices in a predefined standard view for the 7KT PAC1500, 7KM PAC3100, 7KM PAC3200, 7KM PAC4200 measuring devices and 3WL/3VL circuit breakers
- Free presentation of measured quantities possible, including those from non-Siemens devices using generic Modbus drivers
- Archiving of measured quantities
- Monitoring of status and limits, with generation of corresponding signals
- Load curve display for visualizing the archived data and online data
- Cost center reports based on predefined tariffs and the archived consumption data
- OPC server
- Configuration of the system including user management
- Load monitoring for complying with power limits
- Virtual computation

This standard solution is designed with cost-efficiency and simple system commissioning in mind.

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System overview

System configuration

- Integration of measuring devices by means of predefined device templates for the 7KT/7KM PAC measuring devices and the 3WL/3VL circuit breakers
- Easy integration of existing modbus-capable measuring devices
- Communication through Standard Ethernet
- Integration of devices with RS 485 interface (ModbusRTU) through Modbus gateway, e.g. the 7KM PAC4200 measuring device can be used as the gateway

Industries

The energy efficiency that can be achieved with consistent power monitoring and the derived optimization measures is crucial for all industries, e. g. the manufacturing industry, in non-residential buildings, in the field of services, and in infrastructure projects. This has a particular impact on competitiveness, particularly in view of rising energy prices.

More information

TÜV certification



Components of the PC-based power monitoring system

The hardware components of the PC-based power monitoring system are

- 7KM/7KT PAC measuring devices, in this chapter
- 3WL air circuit breakers, see Chapter 1 in Catalog LV 10
- 3VL molded case circuit breakers, see Chapter 2 in Catalog LV 10

Software of the PC-based power monitoring system

The PC-based power monitoring system software is powermanager, see Chapter 13 in Catalog LV 10.

Powermanager system packages with software and hardware are an easy and low-cost way to get started in a power monitoring system, see Chapter 13 in Catalog LV 10.

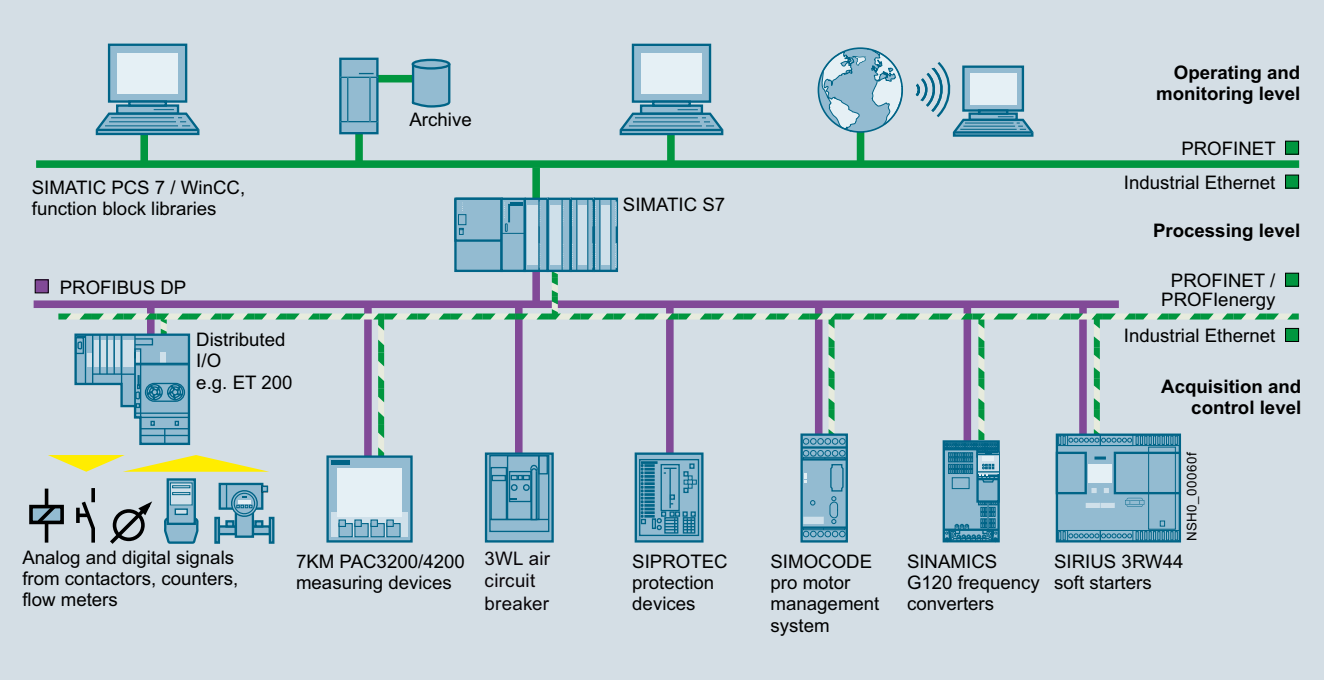
Internet

You can find more information on the Internet at:
www.siemens.com/lowvoltage/powermonitoring

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SIMATIC-based power data management system

Overview



SIMATIC-based solutions for the process and manufacturing industry

A key feature of the process and manufacturing industry is its very high power consumption. It therefore makes sense to integrate a power data management system in existing systems.

Communication through PROFIBUS DP

PROFIBUS DP enables integration of a wide range of devices:

- For the protection of distribution boards and loads: protective devices, such as circuit breakers
- For open-loop and closed-loop control: frequency converters, motor management systems and soft starters
- For detection
  - electrical measured quantities: via the 7KM PAC3200/4200 measuring devices
  - non-electrical measured quantities: via analog/digital converters

PROFINET and PROFIenergy

An increasing number of devices in automation technology offer PROFINET. An expansion module is also available for the 7KM PAC3200 and 7KM PAC4200 measuring devices 7KM PAC Switched Ethernet PROFINET.
PROFIenergy is a "Common Application Profile" from PROFIBUS International. Thanks to PROFIenergy it is possible to create a power data management system with standardized device interfaces.

Function block libraries for SIMATIC PCS 7 and WinCC

The function block library for SIMATIC PCS 7 and WinCC ensures device integration as follows:

- Measured quantities and states can be connected via CFC.
- Structured display of measured quantities and protection parameters for the 3WL/3VL circuit breakers.
- Limit value violations are displayed, archived and acknowledged in the relevant communications system in the usual way
- Circuit breakers can be program-controlled or manually operated with the appropriate user authorization.

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Benefits

- Increased energy efficiency due to precise knowledge of the load profile
- Optimization of power supply contracts
- Allocation of power costs to cost centers
- Optimization of plant maintenance
- Identification of critical plant conditions
- Reliable monitoring of the power limit through automatic load management

Application

The SIMATIC-based power data management system is used in all industries in which PCS 7 and WinCC are used, and the transparency and monitoring of power flows is crucial.

More information

Hardware components

The hardware components of the SIMATIC-based power data management system are

- 7KM PAC measuring devices see Chapter 11 in Catalog LV 10
- 3WL air circuit breakers, see Chapter 1 in Catalog LV 10
- 3VL molded case circuit breakers, see Chapter 2 in Catalog LV 10

Software components

The software components of the SIMATIC-based power data management system are

- Library 7KM PAC3200 for SIMATIC PCS 7
- Library 3WL/3VL for SIMATIC PCS 7
- Library 7KM PAC3200 for SIMATIC WinCC

For more information on all software components see Chapter 13 in Catalog LV 10.

Internet

You can find more information on the Internet at:
www.siemens.com/lowvoltage/powermonitoring

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Hardware and software components

Overview

7KT/7KM PAC measuring devices

	7KT PAC1500	7KM PAC3100	7KM PAC3200	7KM PAC4200
				
	The entry-level solution when it comes to energy measurement	The cost-effective solution for digital measurement	The specialist solution for precise energy measurement	The professional solution for communication and monitoring
Measuring range/connection				
• Max. input voltage L-L/L-N	400 V/230 V	480 V/276V	690 V/400 V[1]	690 V/400 V[1]
• Transformer connection version	x/5A	x/5A	x/1A/x/5A	x/1A/x/5A
• Direct connection version	80 A/125 A	–	–	–
• DC power supply unit with extra-low voltage version	–	–	22 ... 65 V	22 ... 65 V
• Single-phase counter version	3	–	–	–
Basic measured quantities				
• Voltage, current, power, frequency, power factor	✓[2]	✓	✓	3
Energy measurement				
• Apparent, active, reactive energy	– I ✓ I ✓	– I ✓ I ✓	✓ I ✓ I ✓	✓ I ✓ I ✓
Extended measured quantities				
• Load profile record with time stamp and min/max values	–	–	–	✓
• Distortion factor THD (voltage, current)	–	–	✓	✓
• Harmonics (voltage, current)	–	–	–	3. - 31.
• Phase angle/phase chart	–	–	–	✓
Monitoring functions				
• Operating hours counter	–	–	✓	✓
• Limit monitoring	–	–	✓	✓
• Logic functions	–	–	✓	✓
• Event log	–	–	–	> 4000 events
• Gateway function	–	–	–	✓
System integration and communication				
• Digital inputs (DI)/digital outputs (DO)	–	2/2	1/1	2/2
• S0 interface	✓	✓	✓	✓
• 4DI/2DO expansion module	–	–	–	Optional
• M-Bus	Optional	–	–	–
• Instabus KNX	Optional	–	–	–
• Modbus RTU	Optional	✓	Optional	Optional
• Ethernet with Modbus TCP	–	–	✓	✓
• PROFIBUS DPV1	–	–	Optional	Optional
• PROFINET IO/ PROFIenergy	–	–	Optional	Optional
• Parameterization software	✓	powerconfig	powerconfig	powerconfig
• Integration in power monitoring system	powermanager	powermanager	powermanager	powermanager
General data				
• Measuring accuracy, active energy, reactive energy	1 I 2	1 I 3	0.5 S I 2	0.2 S I 2
• MID version	✓	–	–	–
• Installation	Standard mounting rail	Front mounting	Front mounting	Front mounting
• Dimensions (1 MW = 18 mm)	2 MW/4 MW/6 MW	96 × 96 × 56 mm	96 × 96 × 56 mm	96 × 96 × 82 mm

1) With the exception of devices with power supply units with extra-low voltage

2) On the display - energy and power values only. Additional measured quantities are transmitted via the optional expansion modules 7KT Modbus and 7KT M-Bus

✓ Available/possible

-- Not available/not possible

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Accessories for 7KM PAC measuring devices







	7KT PAC expansion modules				7KT LAN couplers
	M-Bus	Modbus RTU	RS485	KNX	Web servers
Specification	Up to 9 600 bit/s	Up to 115 200 bit/s	For connection to the 7KT LAN coupler	Up to 19 200 bit/s	For up to 30 7KT PAC1500 measuring devices

Accessories for 7KM PAC measuring devices



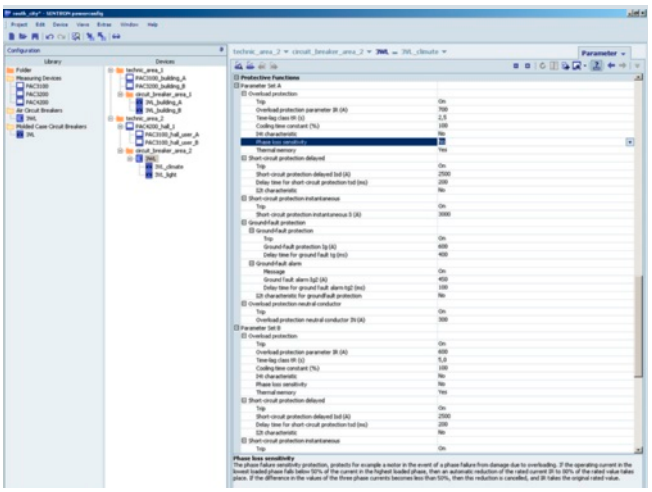




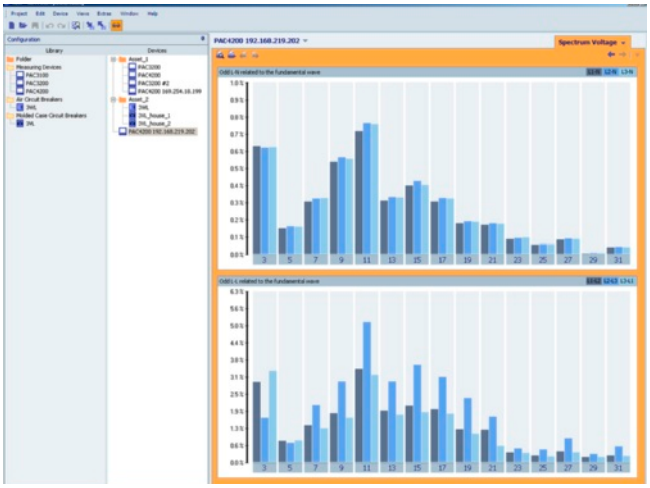
	7KM PAC expansion modules				Standard mounting rail adapter
	Switched Ethernet	PROFIBUS DP	RS485	4DI/2DO	7KM PAC TMP2
	For 7KM PAC3200, 7KM PAC4200	For 7KM PAC3200, 7KM PAC4200	For 7KM PAC3200, 7KM PAC4200	For 7KM PAC4200 (number of digital inputs/ outputs per module 4/2)	For 7KM PAC3100/ 3200/4200 for mounting on a standard mounting rail
Maximum number of modules that can be connected	1	1	1	2	
Protocol	PROFINET IO PROFIenergy Modbus TCP	DPV1	Modbus RTU	S0 interface	

The powerconfig software for commissioning

	Software tool for the efficient commissioning and diagnosis of communication-capable SENTRON components
License	Free use
Supported devices	7KM PAC3100/3200/4200 measuring devices, incl. expansion modules 3WL/3VL circuit breakers
General range of functions	The PC-based tool facilitates parameterization of the devices, resulting in substantial time savings, particularly when several devices have to be set up. The device settings can be stored in the PC and printed out. The tool enables monitoring of instantaneous measured quantities, which can be printed out if required. Execution of specific device functions, such as resetting of devices and setting of energy counters
Supported languages	English, German
Service functions	Firmware updates and switching of language packs for 7KM PAC measuring devices
Range of functions with 7KM PAC4200	Readout of data stored in the device (events; load profile history; daily energy counters), which are saved in csv format



Setting the parameters of a SENTRON device



Display of current measured variables (harmonics)

For more information on powerconfig see Chapter 13 in Catalog LV 10

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Introduction

Overview

Devices	Page	Application	Standards	Used in		
				Non-residential buildings	Residential buildings	Industry
7KM PAC measuring devices						
 **7KM PAC3100 measuring device** AC/DC wide-range power supply unit, screw connection	11	Control panel instrument with graphics display, integrated digital inputs and outputs and an RS485 interface for the transmission of measured values and configurations. Display of 30 electrical measured values and consumption values in switchgear assemblies, infeeds or outgoing feeders. International standards and multi-lingual displays for worldwide use.	IEC 61557-12	✓	--	✓
 **7KM PAC3200 measuring device** 3 versions: • AC/DC wide-range power supply unit, screw connection • DC power supply unit with extra-low voltage, screw connection • AC/DC wide-range power supply unit, ring cable lug connection	11	Control panel instrument with graphics display, integrated digital inputs and outputs and an integrated Ethernet interface for the transfer of measured values and configurations. Display of over 50 electrical measured values for switchgear assemblies, infeeds or outgoing feeders. Dual-tariff measuring devices for precise energy measurement for power import and feedback. The following components are available: • 7KM PAC Switched Ethernet PROFINET • 7KM PAC RS485 • 7KM PAC PROFIBUS DP	Measuring accuracy for energy acc. to IEC 62053-22/23 and IEC 61557-12	✓	--	✓
 **7KM PAC4200 measuring device** 3 versions: • AC/DC wide-range power supply unit, screw connection • DC power supply unit with extra-low voltage, screw connection • AC/DC wide-range power supply unit, ring cable lug connection	11	Control panel instrument with graphics display, user-defined displays, memory, clock and calendar function, digital inputs and outputs and an integrated Ethernet interface with gateway function to transfer measured values and configurations. Display of over 200 electrical measured values for switchgear assemblies, infeeds or outgoing feeders. Extensive functions for precise energy measurement for power import and feedback and assessment of the system quality. The following components are available: • 7KM PAC Switched Ethernet PROFINET • 7KM PAC RS485 • 7KM PAC PROFIBUS DP • 7KM PAC 4DI/2DO	Measuring accuracy for energy acc. to IEC 62053-22/23 and IEC 61557-12	✓	--	✓
 **7KM PAC expansion modules**	11	• The 7KM PAC Switched Ethernet PROFINET expansion module serves to connect the 7KM PAC3200 and 7KM PAC4200 measuring devices to Switched Ethernet PROFINET (PROFIenergy). • The 7KM PAC PROFIBUS DP expansion module is used to connect the 7KM PAC3200 and 7KM PAC4200 measuring devices to the PROFIBUS DPV1 • The 7KM PAC RS485 expansion module is used for connecting simple devices with RS485 interface, such as the 7KM PAC3100, and supports the Modbus RTU protocol. • The 7KM PAC 4DI/2DO expansion module is used to expand the 7KM PAC4200 measuring device to up to 10 digital inputs and 6 digital outputs.	IEC 62053-31	✓	--	✓

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Devices		Page	Application	Standards	Used in		
					Non-residential buildings	Residential buildings	Industry
7KT PAC measuring devices							
	**7KT PAC1500 measuring device, three-phase** 7KT154	35	Measurement of consumption data in three-phase systems of plant sections, offices or holiday apartments.	EN 50470-1, EN 50470-3 EN 62052-23, EN 62053-31	✓	✓	✓
	**7KT PAC1500 measuring device, single-phase** 7KT153	38	For the measurement of consumption data in single-phase systems, e.g. in industrial plants, offices and apartments in apartment blocks.	EN 50740-1, EN 50470-3, EN 62053-31	✓	✓	✓
	**7KT PAC expansion modules** 7KT19	41	Communication interfaces with IrDA infrared interface for 7KT PAC1500 measuring devices. Modules are available for the following bus systems: • M-Bus • Modbus RTU • RS485 (7KT1391 LAN coupler connection) • KNX/EIB	EN 13321-1, EN 13757 ISO/IEC 14543-3 EN 50090	✓	✓	✓
	**7KT LAN couplers**	45	Web server with 2 GB internal storage, for up to 30 7KT15.. measuring devices Global view and Excel export of current consumption data via LAN or Internet using a web browser, such as Firefox	IEEE 802	✓	--	✓

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Introduction

Devices		Page	Application	Standards	Used in		
					Non-residential buildings	Residential buildings	Industry
Other measuring devices							
	**Digital measuring devices** 7KT111, 7KT112	48	Voltage and current measurement with large 3-digit LEDs for monitoring incoming/outgoing currents and device currents in order to prevent plant overload.	DIN 43751-1, DIN 43751-2	✓	--	✓
	**Time and pulse counters for standard rail mounting** 7KT58	50	For monitoring operating hours and starting operations for the planning of preventative maintenance tasks and preventing sudden shutdowns	IEC 60255-6, EN 60255-6 (VDE 0435-301) UL 94	✓	✓	✓
	**Time counters for front-panel mounting** 7KT55, 7KT56	52	For monitoring operating hours and starting operations for planning preventative maintenance tasks and preventing sudden shutdowns.	IEC 60255-6, EN 60255-6 (VDE 0435-301)	✓	✓	✓
Accessories							
	**7KT12 current transformers**	53	Straight-through transformers for installation in distribution boards and non-contact measuring of primary currents. Ideal for combination with switch disconnectors, measuring devices and counters.	IEC 60044-1, EN 60044-1 (VDE 0414 T 44-1)	✓	--	✓
	**7KT90 measuring selector switches**	54	For switching over the phases for voltmeters and ammeters		✓	--	✓

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Overview

Measuring precisely with 7KM PAC3100/3200/4200



The 7KM PAC measuring devices:
PAC3200 (left), PAC3100 (center) and PAC4200 (right)

The 7KM PAC measuring devices are used to measure and display all relevant system parameters in low-voltage power distribution. They can be used for both single-phase and multi-phase measurements in 3 and 4-conductor power supply systems (TN, TT, IT).

They record energy values for main distribution boards, electrical branches or individual loads precisely and reliably, and also supply key measured values for assessment of the state of the plant and the quality of the power supply.

Features

7KM PAC measuring devices, general

The measuring devices of the 7KM PAC series offer the following key features:

- Simple mounting and commissioning
- High IP65 degree of protection (front side, when installed) permits usage in extremely dusty and wet environments
- Intuitive operation using 4 function buttons and multilingual plain text displays
- Easy adaptation to different systems using integrated and optional
  - Digital inputs and outputs
  - Communication interfaces
- Worldwide use
  - At least 8 languages
  - International approvals
  - Developed and tested to European and international standards
- Low mounting depth

7KM PAC3200 and 7KM PAC4200 measuring devices

Additional performance characteristics of the 7KM PAC3200 and 7KM PAC4200:

- Precise energy measurement
- Versatile system integration
  - Integrated Ethernet interface
  - Optional communication modules available
  - Multifunctional digital inputs and outputs
  - Limit monitoring
- Can be connected directly to power supply networks up to 690 V AC (UL-L), CATIII without voltage transformers.
- Easy-to-use configuration software included in the scope of delivery

7KM PAC4200 measuring device

Additional performance characteristics of the 7KM PAC4200:

- Monitoring the plant status and the power supply quality
  - Basic information for evaluating the power supply quality
  - Logging of plant history in the form of operation, control and system-related events
- Recording of the power range through power averaging (load profile)
- Daily energy meters for apparent, active and reactive energy across 365 days for cut-off date assessment
- Detection of gas, water, compressed air or other energy sources via pulse counter to the digital inputs
- Can be expanded using modules to up to 10 digital inputs and 6 digital outputs
- Counters for apparent, active and reactive energy for the precise detection of the power consumption of a partial process or manufacturing process
- 10/100 Mbit/s Ethernet interface with gateway function for the easy connection of devices with serial RS485 interface via expansion module 7KM PAC RS485 to an Ethernet network
- Comprehensive user-friendly indicators, such as user-defined displays, bar and status indicators, phase diagram and list and histogram graphics
- Satisfies the accuracy requirements of class 0.2S high-precision meters used by power supply companies according to IEC 62053-22, which are normally reserved for exacting industrial applications

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Application

Three-phase measuring devices are used to measure and display all relevant network parameters of an electrical installation and they monitor these parameters permanently.

Applications

Wherever power has to be distributed, be it in industrial or infrastructural buildings, the 7KM PAC measuring device supplies important information to the building services system or the power controlling system.

The many different communication options offered by the 7KM PAC make it an indispensable supplier of data for power management systems and for plant and building automation.

Industries

Power distribution systems for the power supply are needed in all areas of industry. The 7KM PAC measuring devices are used accordingly in all areas where power consumption and electrical parameters are to be measured.

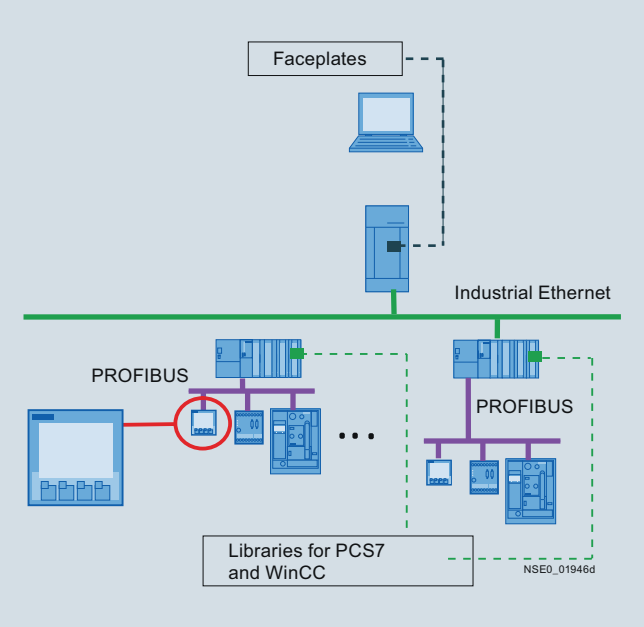
Integration of 7KM PAC3200 and 7KM PAC4200

When the 7KM PAC3200 and 7KM PAC4200 measuring devices are fully integrated into a power monitoring system, they monitor the power consumption and help to monitor the operating state of the plant. Measured values, limit value violations, operating hours of a connected load or power flows are supplied by the instruments quickly and reliably.

Using the optionally available interface modules, it is possible to integrate both instruments in every control system or every SIMATIC S7 environment.

System integration using function block libraries

Optionally available function block libraries make it easy to integrate the measuring devices in the SIMATIC PCS 7 process control system and the SIMATIC WinCC SCADA system. Together with the faceplates as user interface for the 7KM PAC3200, the driver blocks and diagnostics blocks in the control system enable the display and monitoring of technologically important values and functions of the measuring devices in the respective target system.



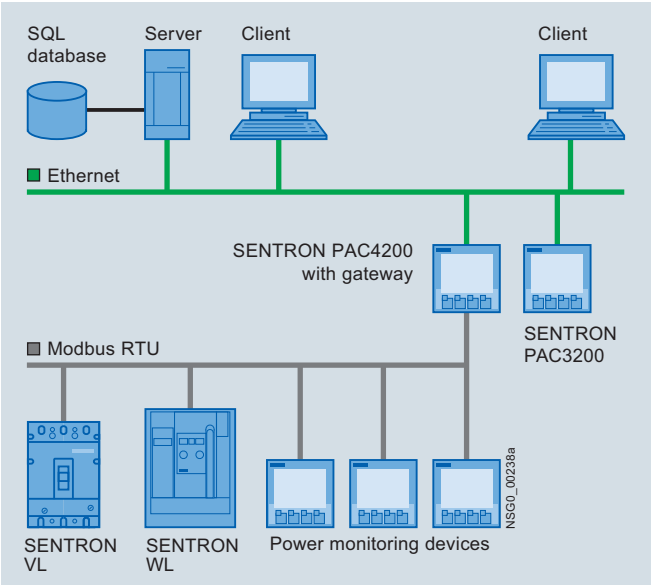
Integration of the 7KM PAC3200 in SIMATIC PCS 7/WinCC

System integration of RS485 fieldbus devices through Ethernet

A special feature is the integrated gateway function of the 7KM PAC4200. It enables a cost-effective and simple connection of devices with a serial RS485 interface to an Ethernet network.

Everything required is provided by the 7KM PAC RS485 expansion module, to which a maximum of 31 lower-level devices can be connected without a repeater and as many as 247 with a repeater.

The gateway function of the 7KM PAC4200 supports the Modbus protocol and can be parameterized using powerconfig.



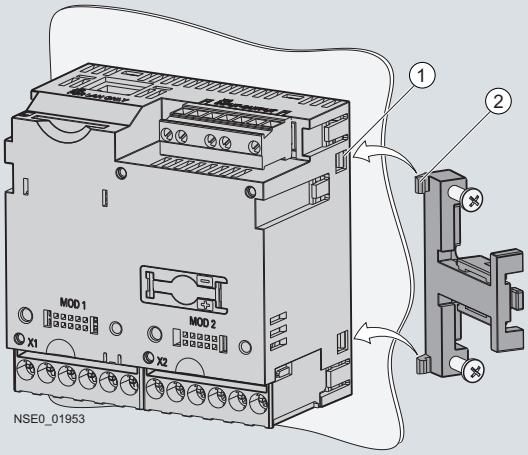
Connecting Modbus RTU devices to a power monitoring system through 7KM PAC4200

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Design

Installation

The 7KM PAC3100/3200/PAC4200 measuring devices come with a plastic enclosure for installation in control panels. It is fastened by one holder on the right side of the device and one on the left side.



① Opening in the device for attaching the mounting holder
② Device holder with retention lugs

Mounting of the 7KM PAC3100, 7KM PAC3200 and 7KM PAC4200

To mount the devices they are inserted from the front through the square cutout in the control cabinet door and secured with the supplied combination latching holders.

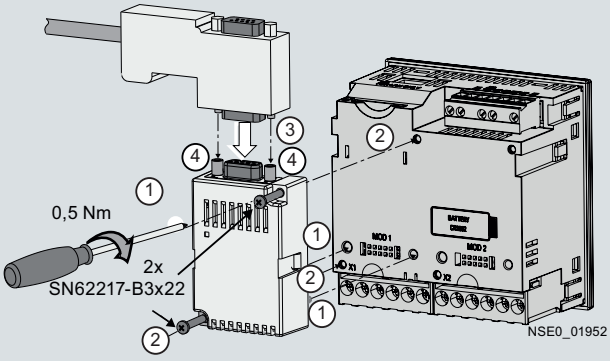
The pair of combination latching holders performs two functions:

- Thanks to the latching mechanism the fitter can fasten the device in the control panel quickly and without the use of any tools.
- If greater protection is required, the four latching holder screws can be used to increase contact pressure evenly on all sides so that the control panel cutout is completely sealed by the integrally molded gasket, which is a standard feature. It is no longer necessary to insert an accessory gasket in addition.

From the front, i.e. in the installed state, the device thus complies with safety class II with degree of protection IP65.

As the result of the easy-to-use combination latching holders and the small mounting depth it is easy to mount several devices side by side.

The following illustration of the rear view of the 7KM PAC3200 and top view of the expansion module (in this case: 7KM PROFIBUS DP) shows by way of example how the 7KM PAC3200 and the expansion module are joined together. An expansion module is mounted on a 7KM PAC4200 in similar manner.

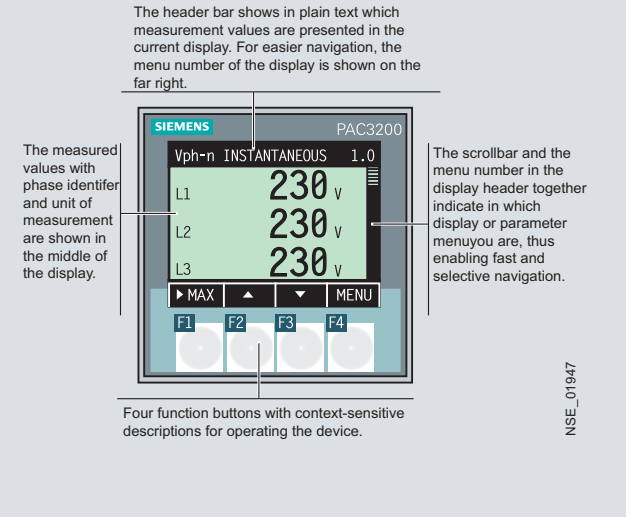


① Device and module enclosure
② Fixing screws and related holes in the enclosure
③ PROFIBUS connectors
④ Fixtures for the PROFIBUS connector

Mounting the expansion module, for example the PAC PROFIBUS DP on the 7KM PAC3200 and 7KM PAC4200

Operator controls and displays

The following picture shows the device from the front, divided into the function blocks provided for operation and monitoring, including a description.



Device front of the 7KM PAC 3100, 7KM PAC3200 and 7KM PAC4200 measuring devices (here for example the 7KM PAC3200)

The devices are operated using 4 function keys, which correspond to the 4 text fields situated above them. The key are each assigned with several functions; their function at any time depends on the menu then displayed. Which function a key has in the respective menu is indicated by the text in the related display.

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Function

Precise measurement of variables

7KM PAC3100 measuring device

The 7KM PAC3100 measuring device provides Class 1 measuring accuracy for voltages, currents, active power, apparent power, and active energy (in accordance with IEC 61557-12).

7KM PAC3200 measuring device

With its high accuracy, the 7KM PAC3200 meets the increasing demand for precise power measurement. It satisfies the accuracy requirements of Class 0.5S according to IEC 62053-22 for electronic active consumption meters.

7KM PAC4200 measuring device

The 7KM PAC4200 measuring device supplies measurement data of far greater accuracy for determining and processing power data and for assessing the quality of the network:

- For voltage, current, active power and active energy the device achieves for example Class 0.2 according to IEC 61557-12.
- For active energy this corresponds to Class 0.2S according to the international meter standard IEC 62053-22.

The 7KM PAC4200 thus meets the accuracy requirements of the high-precision meters used by the power supply companies, which are normally reserved for exacting industrial applications.

Transparency in power matters

Altogether 10 power meters for active, reactive and apparent energy monitor the power import and power feedback continuously and separately according to high tariff and low tariff.

In addition to the continuous counters for apparent, active and reactive energy, the 7KM PAC4200 saves the power consumption levels per day for a period of 365 days. A cut-off date assessment accurate to the day is possible by entering the required calculation period. The power consumption for a preselected period can be called up either directly on the device or by using the communication interface.



Daily counter indicator of the 7KM PAC4200

The 7KM PAC3200 and 7KM PAC4200 measuring devices supply the required power demands for active and reactive power for load profile recording and serve as reliable suppliers of data for a higher-level power management system.

Load profile recording with the 7KM PAC4200

As soon as the power draw conditions per demand period or also reactive energy components affect the power costs it is important to obtain an exact picture of your own plant's load profile.

With its generously sized memory, the 7KM PAC4200 is ideal for this purpose. With a set demand period of 15 minutes it records the load profile for apparent, active and reactive power with minimum and maximum values for import and feedback over a period of 40 days. The recording duration can be increased or decreased depending on the demand period selected.

The demand period can be synchronized to the period of the power supply company so that the measured data can be compared with the power supply company's records. This can be done using either one of the digital inputs or a synchronization command via the communication interface. If no synchronization option is available, the device synchronizes itself with its internal clock.

For load profile recording the 7KM PAC4200 supports the fixed block method (only one demand period) or the rolling block method (division of the demand period into several sub-periods). In addition it is possible to choose between arithmetic or cumulated power demand calculation.

Load profile recording can be individually adapted with the powerconfig configuration software.

Powerful communication

7KM PAC3100 measuring device

The 7KM PAC3100 measuring device has an integrated RS485 port and can be operated with the Modbus RTU protocol.

Ethernet interface (7KM PAC3200/4200 measuring devices)

The 7KM PAC3200/4200 measuring devices have an Ethernet interface as a standard feature which can be used not only for configuration purposes using powerconfig but also for system communication in a higher-level power management system. This makes additional hardware superfluous.

The 10 Mbit/s Ethernet interface of the 7KM PAC3200 permits one communication connection while the 10/100 Mbit/s Ethernet interface of the 7KM PAC4200 permits three such connections simultaneously. Both devices support the Modbus TCP protocol.

The Ethernet interface of the 7KM PAC4200 offers not only a higher data transmission rate but also additional functions:

- Auto MDI(X) (auto crossover) and auto negotiation
- Serial gateway for connecting devices with an RS485 interface to an Ethernet network

PROFIBUS DP interface
(7KM PAC3200/4200 measuring devices)

Use of the power monitoring devices in PROFIBUS DP is made possible by the optionally available 7KM PAC PROFIBUS DP expansion module.

Integration in PROFIBUS DP takes place using a standardized text file, the device master data file (GSD). This GSD file is read into the master with the help of the PROFIBUS configuration tool. The master thus receives the slave-specific communication framework of the PAC3200 or PAC4200 and can start cyclic operation immediately. With DP V1 the PAC PROFIBUS DP expansion module also supports acyclic data traffic.

Modbus RTU interface

Use of the power monitoring devices in Modbus RTU fieldbuses is made possible by the optionally available PAC RS485 expansion module.

Integration in Modbus RTU systems takes place through parameterization of the device address and baud rate using the device keyboard or via powerconfig.

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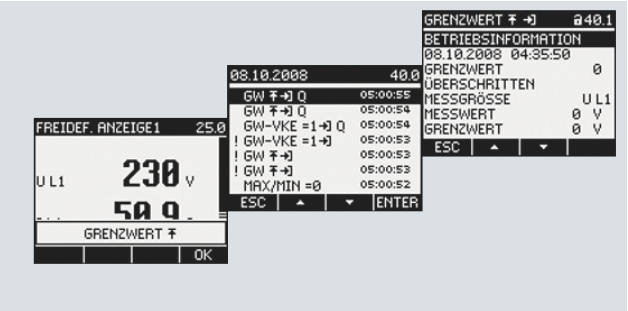
Technical specifications and project planning aids

The 7KM PAC4200 provides comprehensive information about events

Voltage failures, limit value violations, switching operations, device configuration changes, counter resets or deleting of the memory are just some of the possible events which the 7KM PAC4200 records and saves to the events list.

The integrated memory has space for more than 4000 operation, control and system-related events, which the user can organize according to his requirements.

For example, in addition to the three selectable alert levels for information, warning or alarm it is possible to choose the priority of each event independently of each other. And it is also possible of course to choose whether an event is to be recorded at all and in which order the events are to be shown on the display.



Three-level event displays on the 7KM PAC4200

Events are displayed in three levels:

- Popup window for signaling important events, e.g. in the case of alarm messages. Mandatory acknowledgment is selectable for particularly important events.
- Events list for clear representation of the individual events with symbols indicating the alert level
- Detail window with particulars of the event, e.g. event class, date and time of occurrence, reason for triggering the event and, where applicable, the measurement variable in question with its measured value and limit value

Event recording can be configured with the powerconfig configuration software.

Plain-text displays

A large, fully graphic LCD display enables easy reading even from great distances. To make sure that this is also the case in poor light conditions, the backlighting can be individually adapted to the actual requirements.

In addition to the standard displays of the 7KM PAC3100/3200, the 7KM PAC4200 measuring device offers up to four user-definable displays. These displays can be used for individual arrangement of the desired measured variables and for their representation as bar or digital displays.

Operation, also multilingual

Operation is quick to learn thanks to the intuitive user guidance using the four function keys in conjunction with multilingual plain text displays. The experienced operator can also use direct navigation for quicker selection of the desired display menu.

Following languages can be selected: English, Chinese, French, German, Italian, Portuguese, Russian, Spanish and Turkish.

The product documentation is also available in 9 languages.

Multifunctional digital inputs and outputs

The 7KM PAC3200 measuring device is equipped with one digital input and output each, and the 7KM PAC3100 and 7KM PAC4200 measuring devices with two multifunctional digital inputs and outputs, to each of which various functions can be assigned.

Functions of the digital inputs:

7KM PAC measuring device	3100	3200	4200
Number of integrated digital inputs	2	1	2
Count input for energy pulses (kWh, kvarh) from third-party devices	--	✓	✓ + any energy form
Status monitoring of a switching device	✓	✓	✓
Tariff switching between high tariff and low tariff	--	✓	✓
Signal input for synchronization of the demand period	--	✓	✓
Time synchronization of the internal clock to a master clock	--	--	✓

Functions of the digital outputs:

7KM PAC measuring device	3100	3200	4200
Number of integrated digital outputs	2	1	2
Pulse output for sending energy pulses (kWh, kvarh)	✓	✓	✓
Alarm output for signaling limit value violations	--	✓	✓
Operating status display	--	✓	✓
Direction of rotation indicator	--	✓	✓
Switching output for remote control via system software	✓	✓	✓
Synchronization of third-party devices to own demand period	--	--	✓

✓ Available

-- Not available

Monitoring of measured variables for limit value violation (7KM PAC3200 and 7KM PAC4200 only)

The 7KM PAC3200 has a function for monitoring up to 6 measured variables, and the 7KM PAC4200 up to 12 measured variables, for violation of an adjustable upper or lower limit value.

The following variables can be monitored: voltage, current, power, power factor, THD for voltage and current, frequency, unbalance of voltage and current.

In addition it is possible with the 7KM PAC4200 to monitor the phase angle, distortion current strength, individual line harmonics from the 3rd to the 31st harmonic, and sliding window demand values.

The following can be assigned to each limit value:

- A measured variable
- The monitoring mode (overshooting or undershooting)
- A limit value
- A delay time and
- A hysteresis

It is possible to select the action to be triggered by violation of a limit value.

For example, a signal can be sent through the digital output or the communication interface. The integrated universal counter can be used to total the number of limit value violations. Whether a limit value has been violated is indicated on the device.

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Interconnected with logic operations...

The 7KM PAC3200 and 7KM PAC4200 measuring devices have a function for interconnecting limit values using logic operations as follows:

- 7KM PAC3200: AND/OR
- 7KM PAC4200: AND/OR/NAND/NOR/XOR/XNOR

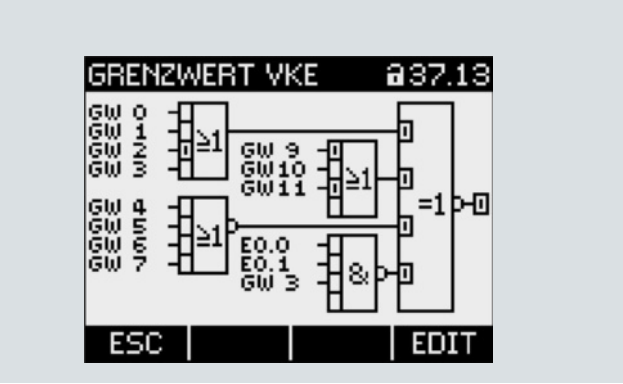
Like the individual limit values, the result of the logic operation can also trigger selective actions, which were previously described in the section "Monitoring of measured variables for limit value violations".

…and conveniently programmed with the 7KM PAC4200

In addition to the interconnection of limit values it is also possible with the 7KM PAC4200 to include the digital inputs in the logic operation.

On the 7KM PAC4200 the logic operations are configured in user-friendly manner using a graphic programming interface. To each of the 5 logic gates it is possible to assign 4 random inputs (limit value or digital input) and one logic function (AND, OR, NAND, …).

From the small black bar at the inputs of the gates the user can see the state of the input at a glance.



Logic operations with limit value events on the 7KM PAC4200 measuring device

Monitoring of voltage and current for unbalance (7KM PAC4200 only)

The 7KM PAC4200 measuring device measures, among other things, the unbalance of voltage and current in the line. Now that a limit value can also be assigned to these two parameters, problems due to unsymmetrical loads in the installation can be detected early on and avoided.

Operating hours counters (7KM PAC3200 and PAC4200 measuring devices)

An important service function is performed by the integrated operating hours counter, which can be used to monitor e.g. pumps, motors or machines. The counter measures the runtime of a connected load, helping to ensure that important maintenance intervals are observed.

The count can be read out and evaluated by a PC. A higher-level power management system is thus able to generate relevant maintenance information.

Universal in use

The 7KM PAC3100, 7KM PAC3200 and 7KM PAC4200 can all be used for measuring in two, three and four-wire networks. Single-phase, two-phase and three-phase measurements are possible.

Thanks to their large measuring voltage range, the devices can be directly connected in every low-voltage system up to a rated line voltage of 690 V (V_{L-L})[1)] . Higher voltages can be measured using voltage transformers.

For measuring currents it is possible to use both x/1A and x/5A current transformers (for 7KM PAC3100 only x/5A x/5A current transformers). Transformer ratios and current direction can be programmed on the device for adaptation to local conditions.

Protection against unauthorized access

The 7KM PAC3100, 7KM PAC3200 and 7KM PAC4200 come with integrated password protection so that the energy and parameter data are safe from unauthorized access. Changes to the parameterization can be traced using a configuration counter which can be read out through the communication interface.

[1)] Max. 500 V (VL-L) for version with DC power supply unit with extra-low voltage (7KM2111-1BA00-3AA0).

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Technical specifications

Device			7KM PAC3100	7KM PAC3200	7KM PAC4200
Measurement					
Systems					
Voltage types			Only for alternating voltage systems	Only for alternating voltage systems	Only for alternating voltage systems
Number of phases			Single-, two- or three-phase	Single-, two- or three-phase	Single-, two- or three-phase
Number of conductors			3 or 4 conductors	3 or 4 conductors	3 or 4 conductors
Load type			Same or any load	Same or any load	Same or any load
Quadrants			4 quadrants (import and export)	4 quadrants (import and export)	4 quadrants (import and export)
Frequency of the relative fundamental		Hz	50/60	50/60	50/60
Signal detection	For energy, current and voltage		Seamless	Seamless	Seamless
Waveform			Sine or distorted	Sine or distorted	Sine or distorted
Measuring inputs for voltage					
Rated voltage 3 AC U_e (max.)					
Device with AC/DC wide-voltage power supply unit			7KM3 133-0BA00-3AA0	7KM2 112-0BA00-3AA0 or 7KM2 112-0BA00-2AA0	7KM4 212-0BA00-3AA0 or 7KM4 212-0BA00-2AA0
	Phase/N	V AC	277 (max. 347 for Vph) +20 %	400 (max. 347 for Vph) +20 %	400 (max. 347 for Vph) +20 %
	Phase/phase	V AC	480 (max. 600 for UL) +20 %	690 (max. 600 for UL) +20 %	690 (max. 600 for UL) +20 %
Device with DC power supply unit with extra-low voltage			--	7KM2111-1BA00-3AA0	7KM4 211-1BA00-3AA0
	Phase/N	V AC	--	289 +20 %	289 +20 %
	Phase/phase	V AC	--	500 +20 %	500 +20 %
Minimum measurable voltage	Phase/N	V AC	11.6	40	11.5
	Phase/phase	V AC	20	69.3	20
Surge strength					
	1.2/50 µs	kV	6.5	9.5	9.5
Input resistance					
	Phase/N	MΩ	0.84	1.05	1.05
Power consumption					
	Per phase	mW	131	220	220
Measuring category			CAT III	CAT III	CAT III
Measuring of voltages > 690 or 500 V AC using voltage transformer					
Measuring inputs for current					
Rated current 3 AC I_e per phase	Adjustable	A AC	5	1 or 5	1 or 5
Permanent load capacity	Permanent	A AC	10	10	10
Surge withstand capability	For 1 second	A AC	100	100	100
Power consumption	Per phase	mVA	500 at 6 A	4 at 1 A, 115 at 5 A	4 at 1 A, 115 at 5 A
Measuring category			CAT III	CAT III	CAT III
Zero point suppression level	Adjustable		10 mA in the phases 45 mA in the neutral conductor	0 ... 10 %	0 ... 10 %
Measuring of currents using current transformer			x/5 A	x /1 A or x/5 A	x /1 A or x/5 A
Supply voltage					
AC/DC wide-voltage power supply unit			7KM3 133-0BA00-3AA0	7KM2112-0BA00-3AA0 or 7KM2112-0BA00-2AA0	7KM4212-0BA00-3AA0 or 7KM4212-0BA00-2AA0
Primary operating range		V AC	100 … 240 ±10%	95 … 240 ±10%	95 … 240 ±10%
		V DC	110 … 250 ±10%	110 … 340 ±10%	110 … 340 ±10%
Rated frequency of the AC operating range		Hz	50/60	50/60	50/60
DC extra-low voltage power supply unit			--	7KM2111-1BA00-3AA0	7KM4 211-1BA00-3AA0
Primary operating range		V DC	--	22 … 65 ±10%	22 … 65 ±10%
Power consumption (max.)					
Without optional expansion module		AC VA	10	6	11
		DC W	5	3	5.5
Including optional expansion module		AC VA	--	8	32
		DC W	--	3.5	11
Overvoltage category			CAT III	CAT III	CAT III

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Device			7KM PAC3100	7KM PAC3200	7KM PAC4200
Error limits					
Accuracy class according to IEC 61557-12:2007 The accuracy class according to IEC 61557-12 is the value in % relative to the measured value under reference conditions.			Yes	No --	Yes
Voltage	Phase/N		1	±0.3 %	0.2
	Phase/phase		1	±0.3 %	0.2
Current			1	±0.2 %	0.2
Apparent power			1	±0.5 %	0.5
Active power			1	±0.5 %	0.2
Reactive power			3	±2 %	1.0
Frequency			0.1	±0.05 %	0.1
cos φ			--	--	0.2 %[1]
Power factor (p.f.)			2	±0.5 %	2.0
Phase angle			--	--	±1°[1]
Apparent energy			--	±0.5 %	0.5
Active energy			1	Class 0.5S according to IEC 62053-22	0.2
Reactive energy			3	Class 2 according to IEC 62053-23	2
When measuring on external current transformers or voltage transformers, the accuracy of the measurement depends on the quality of the transformer.					
Digital inputs					
Number			2	1	2
Rated value		V DC	24	24	24
Maximum input voltage		V DC	30 (SELV or PELV supply)	30 (SELV or PELV supply)	30 (SELV or PELV supply)
Input threshold	Signal "1"	V DC	> 13	> 13	>19
	Signal "0"	V DC	< 8	< 8	< 10
Input current	Signal "1"	mA DC	2.5 ... 10	7	4
Max. input delay	From "0" to "1"	ms	5	5	5
	From "1" to "0"	ms	5	5	5
Digital outputs					
Number			2	1	2
Function			Switching or pulse output	Switching or pulse output	Switching or pulse output
Required operational voltage		V DC	12 ... 24	12 ... 24	12 ... 24
Max. switched output voltage		V DC	30 (SELV or PELV supply)	30 (SELV or PELV supply)	30 (SELV or PELV supply)
Output current signal "1"					
Typical		mA DC	10 ... 27	10 ... 27	10 ... 27
Permanent	max.	mA DC	50 (thermal overload protection)	100	100 (thermal overload protection)
Short-time overload for max. 100 ms		mA DC	130	300	300
Resistive load		mA DC	100	100	100
Switching frequency	max.	Hz	17	17	17
Max. output delay	From "0" to "1"	ms	5	5	5
	From "1" to "0"	ms	5	5	5
Pulse output function			Signal characteristics acc. to IEC 62053-31	Signal characteristics acc. to IEC 62053-31	Signal characteristics acc. to IEC 62053-31
Adjustable pulse duration		ms	30…500	30…500	30…500
Minimum adjustable time frame		ms	10	10	10
Short-circuit protection			Yes	Yes	Yes

[1] 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.

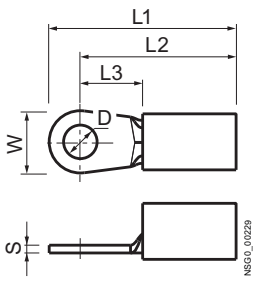
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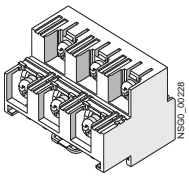
Device			7KM PAC3100	7KM PAC3200	7KM PAC4200
Communication					
Ethernet			--		
Version			--	RJ45 (8P8C)	RJ45 (8P8C)
Usable cable types (ground necessary)			--	Twisted pair (CAT 5)	Twisted pair (CAT 5)
Protocol			--	Modbus TCP	Modbus TCP
Transmission rate max.		MBit/s	--	10	10/100
Supported functions			--	--	Auto negotiation and auto MDI(X)
TCP/IP ports			--	1	2
Max. number of simultaneous connections			--	1	3
Max. refresh time at the interface for instantaneous values		ms	--	200	200
Serial Gateway					
Protocol (Ethernet)			--	--	Modbus TCP
Protocol (lower-level devices)			--	--	Modbus RTU
Use requirement			--	--	7KM PAC RS485 expansion module
Max. number of lower-level devices			--	--	Without repeater: 31 With repeater: 247
PROFIBUS DP					
Through the 7KM PAC PROFIBUS DP V1 expansion module			--	Yes	Yes
Transmission rate max.		MBit/s	--	12	12
Measured variables to be transferred			--	Definable using GSD file	Definable using GSD file
RS485					
Through expansion module	7KM PAC RS485		No, integrated	Yes	Yes
Transfer rates		kBd	Optionally 4.8/9.6/19.2/38.4	Optionally 4.8/9.6/19.2/38.4	Optionally 4.8/9.6/19.2/38.4
Protocol			Modbus RTU	Modbus RTU	Modbus RTU
Display and operator control					
Display type			LCD, monochrome	LCD, monochrome	LCD, monochrome
Displays/indicators			Alphanumeric and text	Alphanumeric and text	Full graphics
Resolution		Dots	128 x 96	128 x 96	128 x 96
Size		mm	72 x 54	72 x 54	72 x 54
Contrast			Adjustable	Adjustable	Adjustable
Representation			Display invertible, pos/neg mode	Display invertible, pos/neg mode	Display invertible, pos/neg mode
Backlighting					
Background color			White	White	White
Lighting intensity			Adjustable	Adjustable	Adjustable
Lighting intensity reduced			Adjustable	Adjustable	Adjustable
Time until reduction of lighting intensity		min	0 ... 99	0 ... 99	0 ... 99
Refresh time		s	0.33 … 3, adjustable		
Keyboard			4 function keys F1 to F4 on the front		

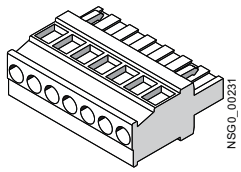
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Device			7KM PAC3100	7KM PAC3200	7KM PAC4200
Connection elements and terminals					
Measuring inputs and supply voltage			**Screw connection**		
			7KM3133-0BA00-3AA0	**7KM2112-0BA00-3AA0 7KM2112-1BA00-3AA0**	**7KM4212-0BA00-3AA0 7KM4212-1BA00-3AA0**
Conductor cross-sections	Solid	mm^2	1 x 0.5 ... 4	1 x 0.5 ... 4	1 x 0.5 ... 4
			AWG 1 x 20 ... 12	AWG 1 x 20 ... 12	AWG 1 x 20 ... 12
		mm^2	2 x 0.5 ... 2.5	2 x 0.5 ... 2.5	2 x 0.5 ... 2.5
			AWG 2 x 20 ... 14	AWG 2 x 20 ... 14	AWG 2 x 20 ... 14
	Finely stranded with end sleeve	mm^2	1 x 0.5 ... 2.5	1 x 0.5 ... 2.5	1 x 0.5 ... 2.5
			AWG 1 x 20 … 14	AWG 1 x 20 … 12	AWG 1 x 20 … 12
		mm^2	2 x 0.5 ... 1.5	2 x 0.5 ... 1.5	2 x 0.5 ... 1.5
			AWG 2 x 20 … 16	AWG 2 x 20 … 16	AWG 2 x 20 … 16
Tool size	± screw, Pozidriv		2	2	2
Measuring inputs and supply voltage			**Ring cable lug connection**		
			--	**7KM2112-0BA00-2AA0**	**7KM4212-0BA00-2AA0**
Conductor cross-sections	Dependent on ring terminal lug used	mm^2	--	1 x 1.0...6.0	1 x 1.0...6.0
			--	AWG 1 x 18...10	AWG 1 x 18...10
		mm	--	D: 3...4	D: 3...4
				S: 0.75 ... 1.0	S: 0.75 ... 1.0
				W: ≤ 8	W: ≤ 8
				L1 : ≤ 24	L1 : ≤ 24
				L2 : ≤ 20	L2 : ≤ 20
				L3 : ≥ 8	L3 : ≥ 8
		inch	--	D: 0.118 ... 0.157	D: 0.118 ... 0.157
				S: 0.029 ... 0.039	S: 0.029 ... 0.039
				W: ≤ 0.314	W: ≤ 0.314
				L1 : ≤ 0.944	L1 : ≤ 0.944
				L2 : ≤ 0.787	L2 : ≤ 0.787
				L3 : ≥ 0.314	L3 : ≥ 0.314
Tool size	± screw, Pozidriv		--	2	2
Required tool			--	Crimping or fitting tool for ring terminal lugs	
Digital output, digital input			**Screw connection (for all measuring device versions)**		
Conductor cross-sections	Solid	mm^2	1 x 0.2 … 2.5	1 x 0.2 … 2.5	1 x 0.2 … 2.5
		mm^2	2 x 0.2 … 1.0	2 x 0.2 … 1.0	2 x 0.2 … 1.0
			AWG 1 x 24 ... 12	AWG 1 x 24 ... 12	AWG 1 x 24 ... 12
	Finely stranded with end sleeve	mm^2	1 x 0.25 … 2.5	1 x 0.25 … 2.5	1 x 0.25 … 2.5
		mm^2	2 x 0.25 … 1.0	2 x 0.25 … 1.0	2 x 0.25 … 1.0
			AWG 1 x 24 … 12	AWG 1 x 24 … 12	AWG 1 x 24 … 12
Tool size	± screw, Pozidriv		1	1	1
RS485 connection			**Screw connection**	**(RS485 connection using 7KM PAC RS485 expansion module)**	
Connection designations			Com, +/B, -/A	--	--
Conductor cross-sections	Solid	mm^2	1 x 0.2 … 2.5	--	--
		mm^2	2 x 0.2 … 1.0	--	--
			AWG 1 x 24 ... 12	--	--
	Finely stranded with end sleeve	mm^2	1 x 0.25 … 2.5	--	--
		mm^2	2 x 0.25 … 1.0	--	--
			AWG 1 x 24 … 12	--	--
Tool size	± screw, Pozidriv		1		







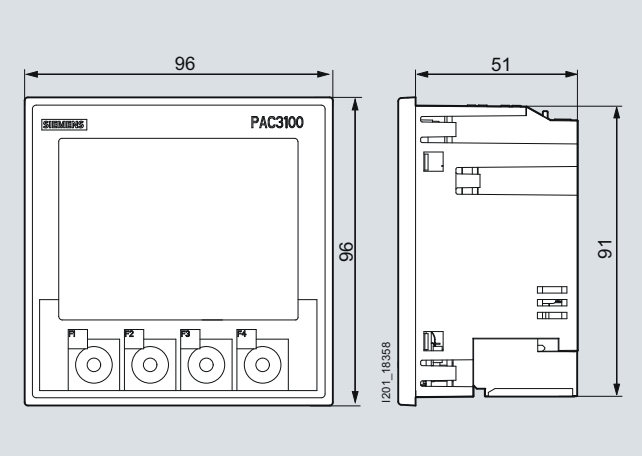
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Device			7KM PAC3100	7KM PAC3200	7KM PAC4200
Dimensions and weights					
Enclosure dimensions (W x H x D)					
Without expansion module		mm	96 x 96 x 56	96 x 96 x 56	96 x 96 x 82
With expansion module		mm	--	96 x 96 x 78	96 x 96 x 104
Mounting depth					
Without expansion module		mm	51	51	77
With expansion module		mm	--	73	99
Weight					
Without expansion module	Approx.	g	325	325	450
With expansion module	Approx.	g	--	370	540
Switchboard cutout		mm	$92^{+0.8}$ x $92^{+0.8}$	$92^{+0.8}$ x $92^{+0.8}$	$92^{+0.8}$ x $92^{+0.8}$
Enclosure for panel mounting			Acc. to IEC 61554	Acc. to IEC 61554	Acc. to IEC 61554
Control panel thickness		mm	0.5 … 4	0.5 … 4	0.5 … 4
Mounting position			Vertical	Vertical	Vertical
Degree of protection and safety class					
Safety class acc. to EN 61010-1					
From the front when installed			II	II	II
Degree of protection according to EN 60529					
All devices	Front		IP65	IP65	IP65
Device with screw terminals	Rear		IP20	IP20	IP20
Device with ring cable lug terminals	Rear		--	IP10	IP10
Ambient conditions					
Temperature range					
Operating temperature		°C	-10 … + 55	-10 … + 55	-10 … + 55
Storage and transport temperature		°C	-25 … + 70	-25 … + 70	-25 … + 70
Relative humidity At 25 °C without condensation		%	95	95	95
Altitude					
Above sea level up to max.		m	2000	2000	2000
Pollution degree			2	2	2
Battery for measured variables buffer					
Recommended battery types	Non-rechargeable types		--	--	BR2032 or CR2032
Approval			--	--	Acc. to UL1642
Nominal voltage / nominal discharge current		V/mA	--	--	3/0.2
Minimum permissible reverse current		mA	--	--	5
Suitable for ambient temperatures up to at least		°C	--	--	70
Access protection					
Password protection			4-digit numerical code	4-digit numerical code	4-digit numerical code
Password protection prevents the following:			Effective through:	Effective through:	Effective through:
• Changing of device settings, including password			• Direct input on the device	• Direct input on the device	• Direct input on the device
• Changing and deleting of values					• Via the Ethernet interface
• Deleting of data and memory content					• Via the 7KM PAC RS485 expansion module
• Setting and resetting of counts					
Reading out of measured values and memory content			Possible without restriction	Possible without restriction	Possible without restriction
Standards and approvals					
CE	EU		Acc. to the CE Declaration of Conformity	Acc. to the CE Declaration of Conformity	Acc. to the CE Declaration of Conformity
cULus	USA/Canada		Acc. to UL File E314880	Acc. to UL File E314880	Acc. to UL File E314880
UL50			Type enclosure 5	Type enclosure 5	Type enclosure 5
FCC			Class A, Part 15 Subpart B	Class A, Part 15 Subpart B	Class A, Part 15 Subpart B
Environmental tests			IEC 60068	IEC 60068	IEC 60068

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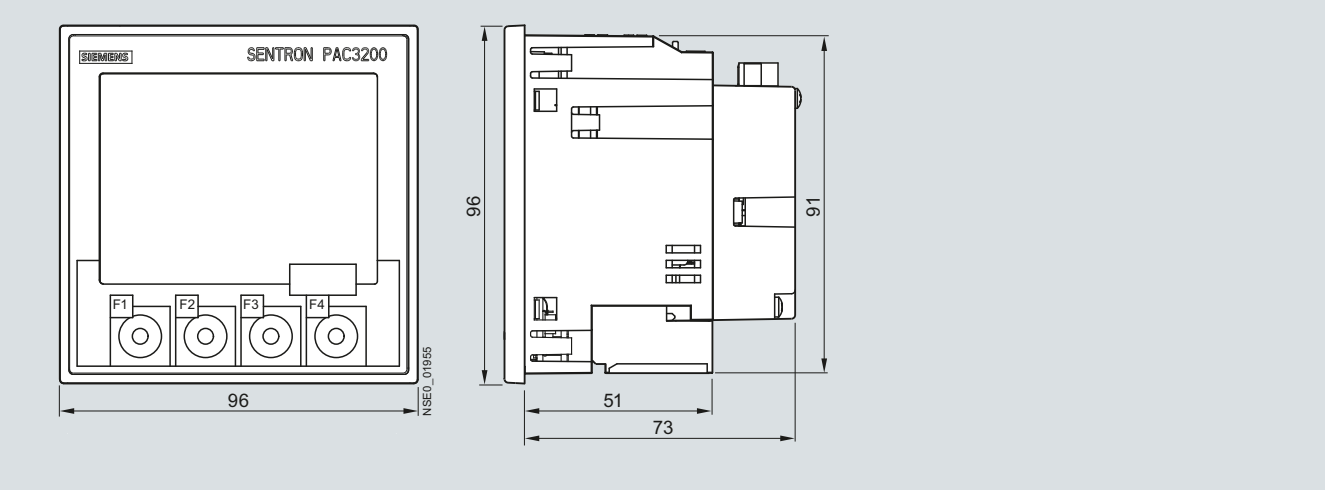
Dimensional drawings

Dimensions of the 7KM PAC3100



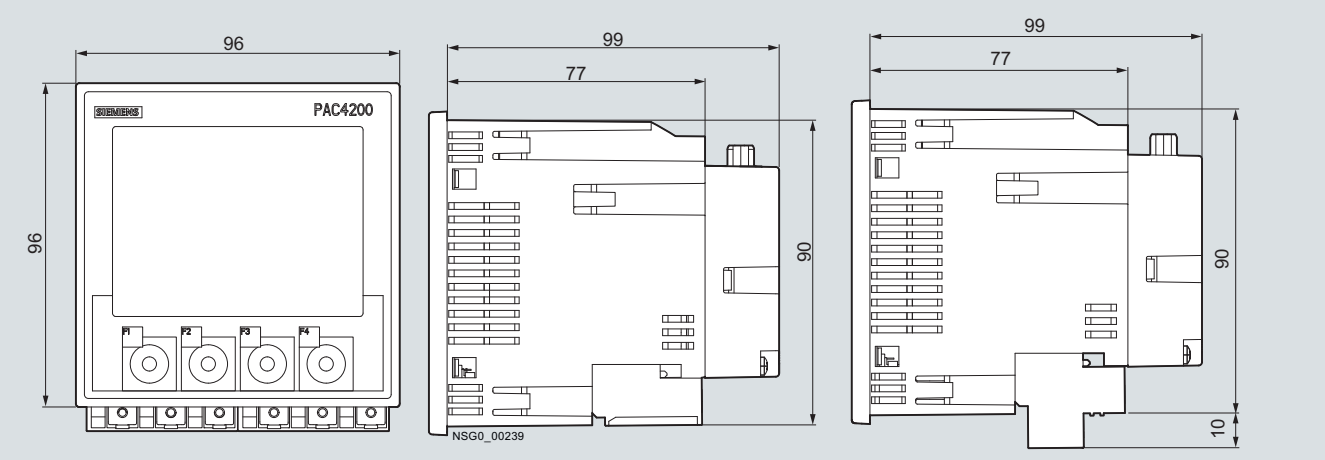
Left: Front view with screw terminals;
right: Side view with screw terminals:

Dimensions of the 7KM PAC3200



Left: Front view with screw terminals; center: Side view with screw terminals; right: Side view with ring cable lug terminals

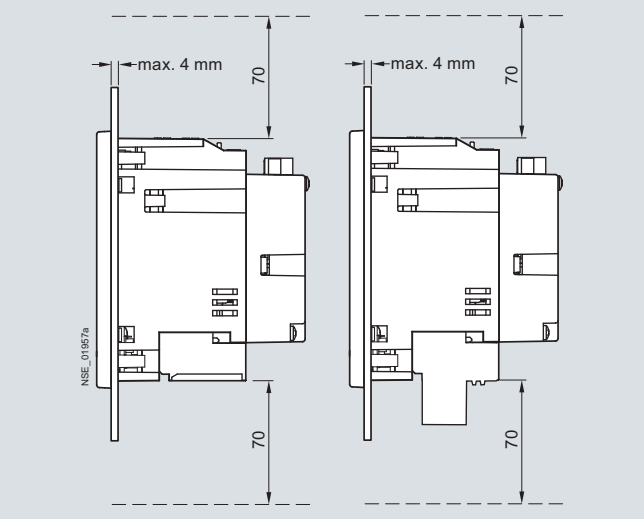
Dimensions of the 7KM PAC4200



Left: Front view with ring cable lug terminals; center: Side view with screw terminals; right: Side view with ring cable lug terminals

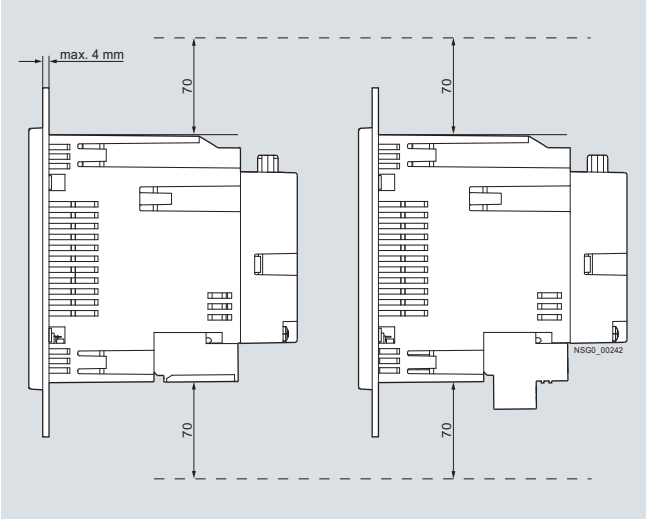
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Control panel cutout on the 7KM PAC3200, lateral



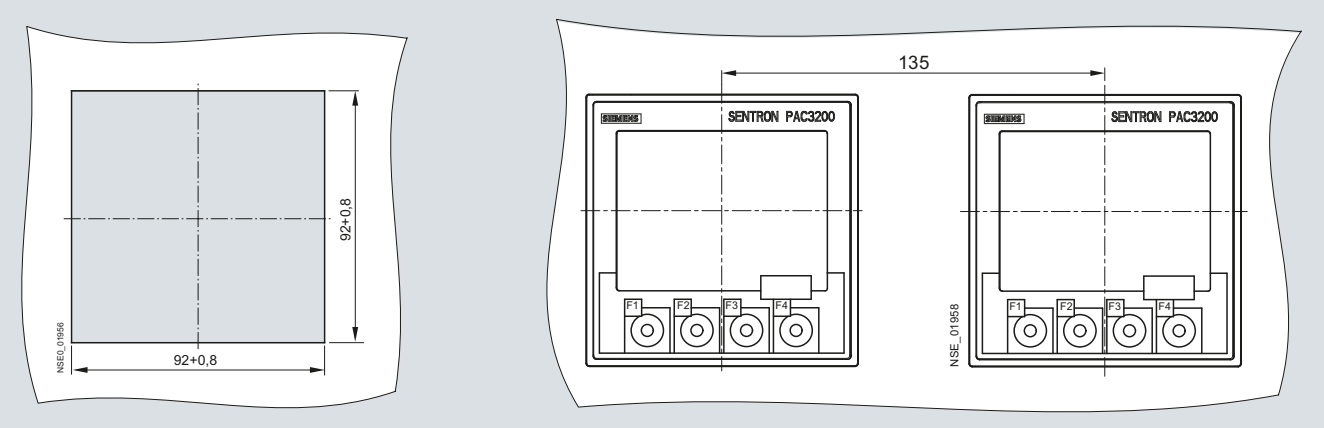
Left: 7KM PAC3200 with screw terminals,
right: 7KM PAC3200 with ring cable lug terminals

Control panel cutout on the 7KM PAC4200, lateral



Left: 7KM PAC4200 with screw terminals,
right: 7KM PAC4200 with ring cable lug terminals

Control panel cutout and mounting clearances for 7KM PAC3100, PAC3200 and 7KM PAC4200



Left: Control panel cutout from the front (here for example the 7KM PAC3200)

Right: mounting clearances of two devices

Circuit diagrams

Connection examples

Following connection examples apply for the measuring devices 7KM PAC3200, 7KM PAC4200 and partly for the 7KM PAC3100. More information can be found in the respective manuals.

Note

In the examples, some elements are shown with one asterisk (*) and/or two asterisks (**). Their meanings are as follows:

* Fuses must be provided by the user

** Connection of supply voltage

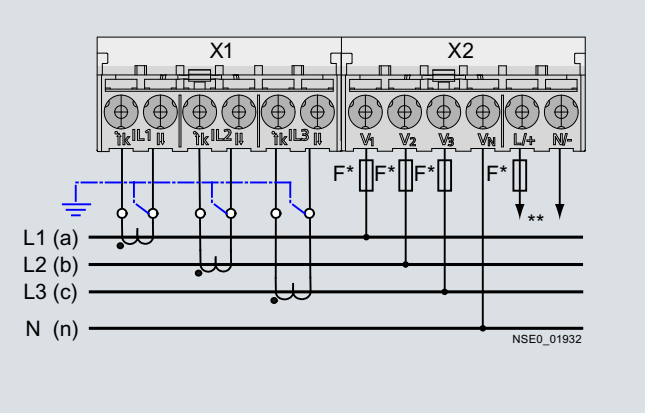
Fuses

Protection of the supply voltage input:

Fuse holders	Cylindrical fuse links
3NW7-5130HG	3NW1006-0HG (0.6A)

Connection example 1:

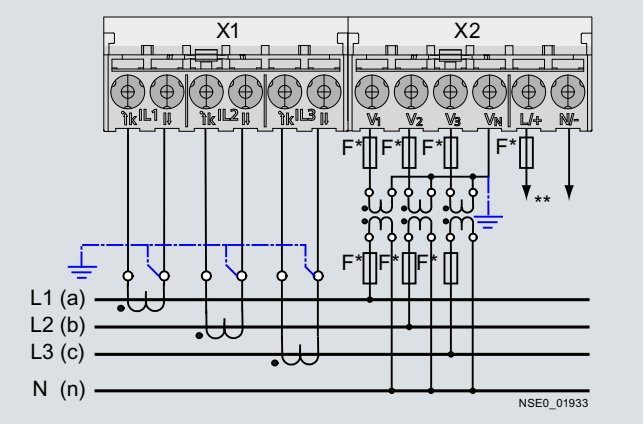
Three-phase measurement, four conductors, unbalanced load, without voltage transformer, with three current transformers



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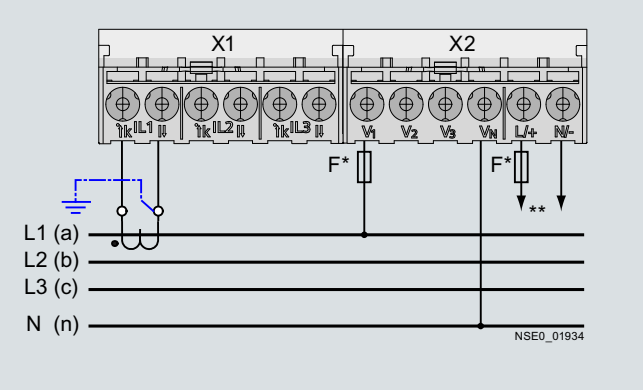
Connection example 2:

Three-phase measuring, four conductors, unbalanced load, with voltage transformer, with three current transformers



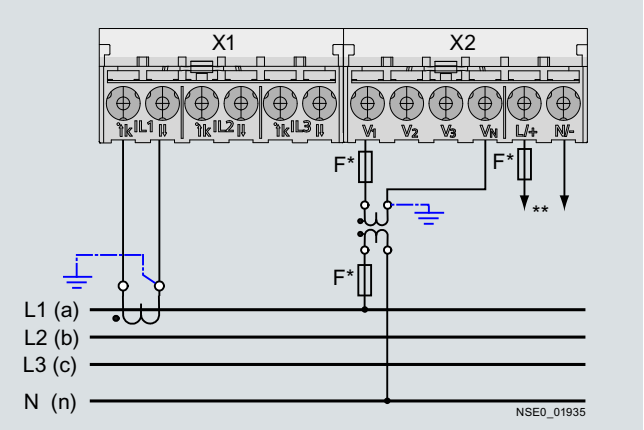
Connection example 3:

Three-phase measuring, four conductors, balanced load, without voltage transformers, with one current transformer



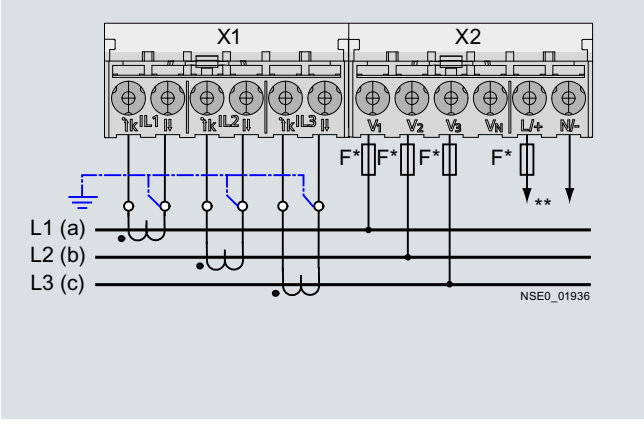
Connection example 4:

Three-phase measuring, four conductors, balanced load, with voltage transformers, with one current transformer



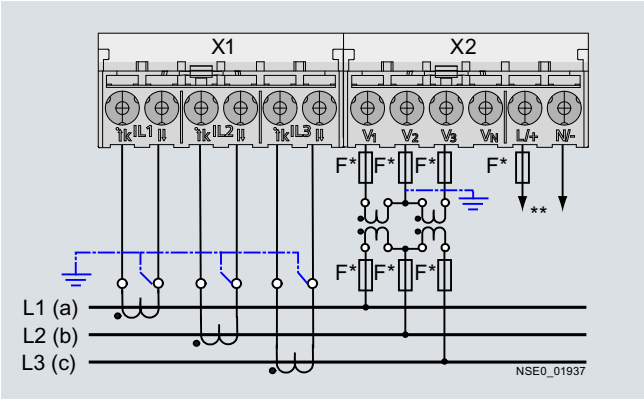
Connection example 5:

Three-phase measuring, three conductors, unbalanced load, without voltage transformers, with three current transformers



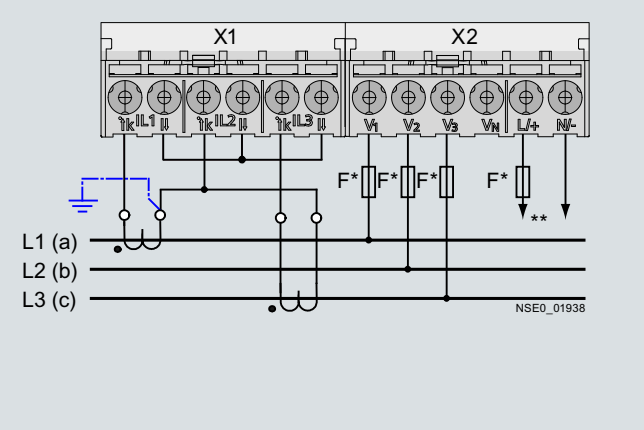
Connection example 6:

Three-phase measuring, three conductors, unbalanced load, with voltage transformers, with three current transformers



Connection example 7:

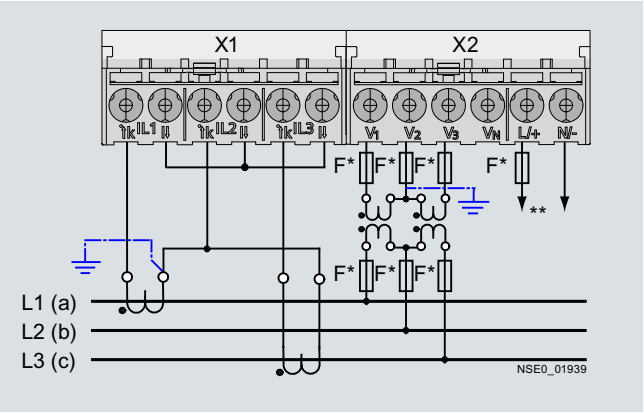
Three-phase measuring, three conductors, unbalanced load, without voltage transformers, with two current transformers



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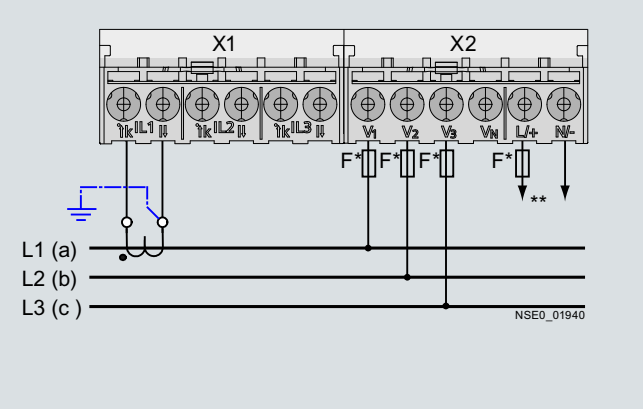
Connection example 8:

Three-phase measuring, three conductors, unbalanced load, with voltage transformers, with two current transformers



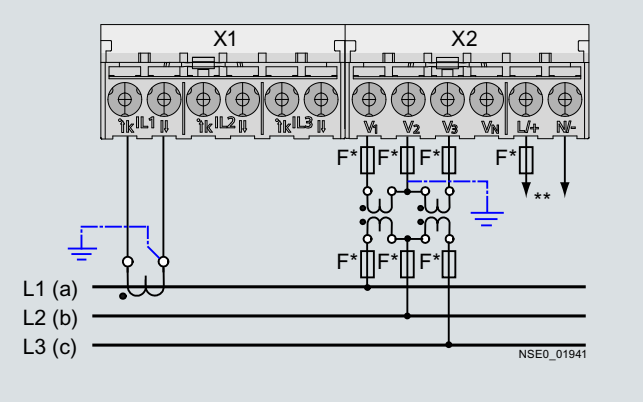
Connection example 9:

Three-phase measuring, three conductors, balanced load, without voltage transformers, with one current transformers



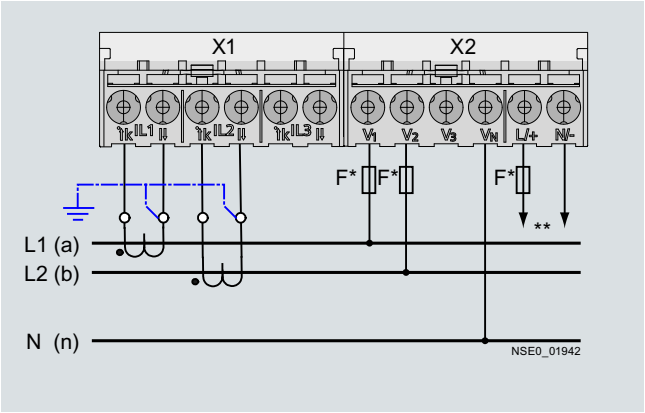
Connection example 10:

Three-phase measuring, three conductors, balanced load, with voltage transformers, with one current transformer



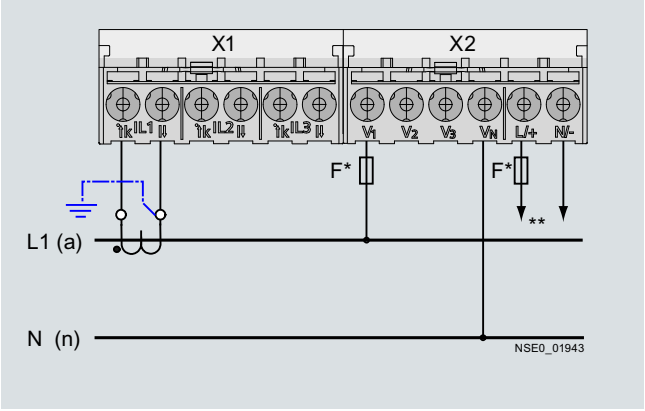
Connection example 11:

Two-phase measuring, three conductors, unbalanced load, without voltage transformers, with two current transformers



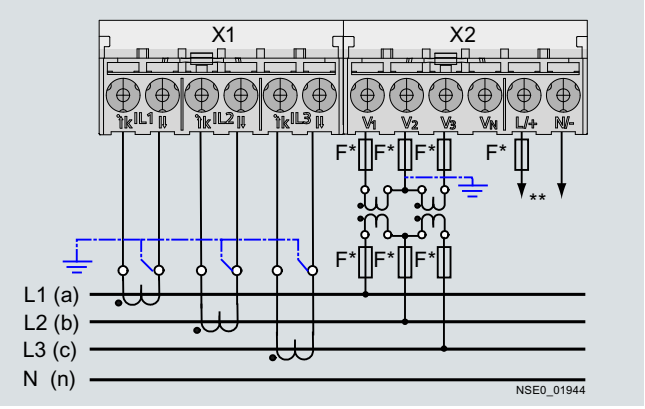
Connection example 12:

Single-phase measuring, two conductors, without voltage transformers, with one current transformer



Connection example 13:

Three-phase measuring, four conductors, unbalanced load, with voltage transformer, with three current transformers

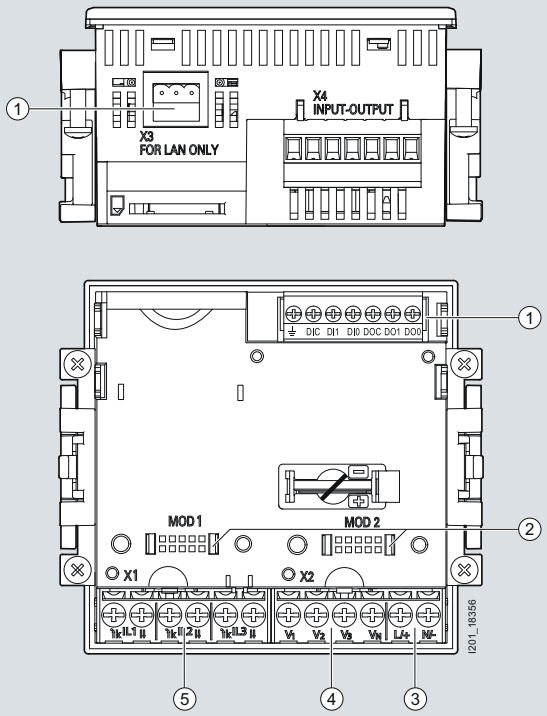


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Technical specifications and project planning aids

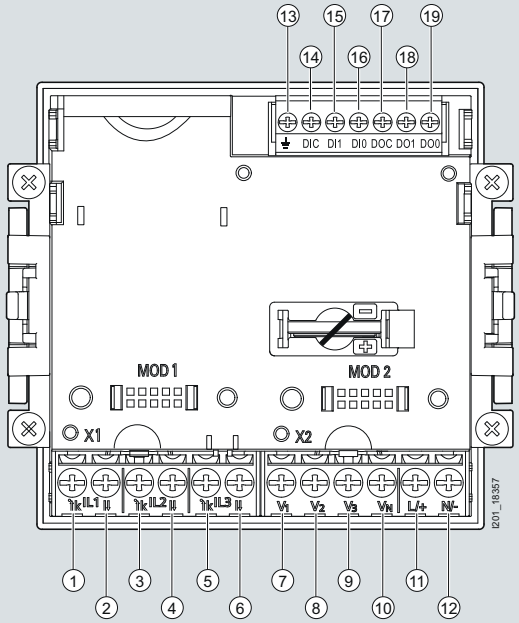
Connection graphics

Connection graphics for 7KM PAC3100



No.	Function
①	Digital inputs and outputs, functional ground
②	Slot not assigned
③	Supply voltage L+, N/-
④	Measuring inputs voltage V1, V2, V3, VN
⑤	Measuring inputs current IL1, IL2, IL3
⑥	RS485 connection

7KM PAC3100 terminal assignment as overview
Top: top side, Bottom: rear
Device with screw terminals

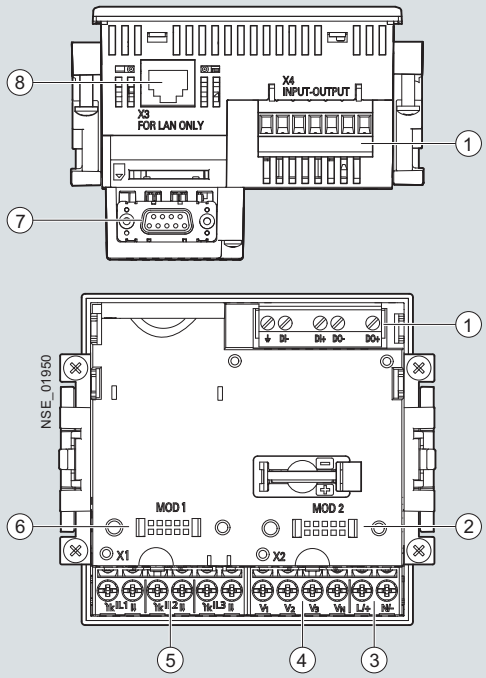


No.	Terminal	Function
①	IL1 k	Phase current, IL1, input
②	IL1 l	Phase current, IL1, output
③	IL2 k	Phase current, IL2, input
④	IL2 l	Phase current, IL2, output
⑤	IL3 k	Phase current, IL3, input
⑥	IL3 l	Phase current, IL3, output
⑦	V1	Phase voltage UL1
⑧	V2	Phase voltage UL2
⑨	V3	Phase voltage UL3
⑩	VN	Neutral conductor UN
⑪	L/+	AC: Connection: Conductor (phase voltage) DC: Connection: +
⑫	N/-	AC: Connection: Neutral conductor DC: Connection: -
⑬		Functional ground
⑭	DIC	Digital input (common)
⑮	DI1	Digital input 1
⑯	DI0	Digital input 0
⑰	DOC	Digital output (common)
⑱	DO1	Digital output 1
⑲	DO0	Digital output 0

7KM PAC3100 terminal assignment in detail (rear)
Device with screw terminals

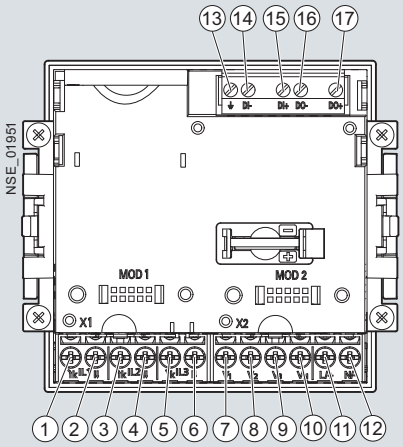
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Connection graphics for 7KM PAC3200



No.	Function
①	Digital inputs and outputs, functional ground
②	Slot not assigned
③	Supply voltage L+, N/-
④	Measuring inputs voltage V1, V2, V3, VN
⑤	Measuring inputs current IL1, IL2, IL3
⑥	Slot for optional expansion modules
⑦	Optional expansion module, not included in scope of supply
⑧	Ethernet interface

7KM PAC3200 terminal assignment as overview
Top: top side, Bottom: rear
Device with screw terminals



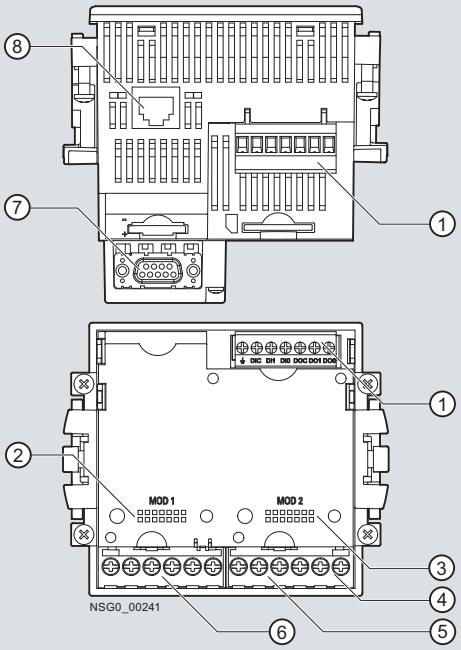
No.	Terminal	Function
①	IL1 k	Phase current, IL1, input
②	IL1 l	Phase current, IL1, output
③	IL2 k	Phase current, IL2, input
④	IL2 l	Phase current, IL2, output
⑤	IL3 k	Phase current, IL3, input
⑥	IL3 l	Phase current, IL3, output
⑦	V1	Phase voltage UL1
⑧	V2	Phase voltage UL2
⑨	V3	Phase voltage UL3
⑩	VN	Neutral conductor UN
⑪	L/+	AC: Connection: Conductor (phase voltage) DC: Connection: +
⑫	N/-	AC: Connection: Neutral conductor DC: Connection: -
⑬		Functional ground
⑭	DI-	Digital input -
⑮	DI+	Digital input +
⑯	DO-	Digital output -
⑰	DO+	Digital output +

7KM PAC3200 terminal assignment in detail (rear)
Device with screw terminals

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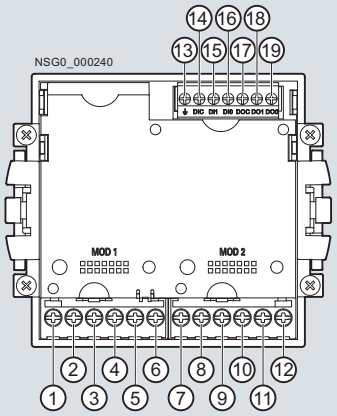
Technical specifications and project planning aids

Connection graphics for 7KM PAC4200



No.	Function
1	Digital inputs and outputs, functional ground
2	Slot for optional expansion modules
3	Slot for optional expansion modules
4	Supply voltage L/+, N/-
5	Measuring inputs voltage V1, V2, V3, VN
6	Measuring inputs current IL1, IL2, IL3
7	Optional expansion module, not included in the scope of supply
8	Ethernet interface

7KM PAC4200 terminal assignment as overview
Top: top side, Bottom: rear
Device with screw terminals



No.	Terminals	Function
1	IL1 k	Phase current, IL1, input
2	IL1 l	Phase current, IL1, output
3	IL2 k	Phase current, IL2, input
4	IL2 l	Phase current, IL2, output
5	IL3 k	Phase current, IL3, input
6	IL3 l	Phase current, IL3, output
7	V1	Phase voltage UL1
8	V2	Phase voltage UL2
9	V3	Phase voltage UL3
10	VN	Neutral conductor UN
11	L/+	AC: Connection: Conductor (phase voltage) DC: Connection: +
12	N/-	AC: Connection: Neutral conductor DC: Connection: -
13		Functional ground
14	DIC	Digital inputs (common)
15	DI1	Digital input 1
16	DI0	Digital input 0
17	DOC	Digital outputs (common)
18	DO1	Digital output 1
19	DO0	Digital output 0

7KM PAC4200 terminal assignment in detail (rear)
Device with screw terminals

More information

Current transformers

Suitable current transformers can be found
- in Chapter 2 "Molded Case Circuit Breakers (MCCBs)" in Catalog LV 10
- In the Industry Mall, section "Industry Automation and Drive Technologies" --> "Low-Voltage Power Distribution and Electrical Installation Technology" --> "Protective Devices" --> "Molded Case Circuit Breakers" --> "3VL Molded Case Circuit Breakers" --> "3VL Molded Case Circuit Breakers up to 1600 A" --> "Accessories and Spare Parts"

Software components

For more information on software components see Chapter 13 in Catalog LV 10 and visit the Internet at www.siemens.com/lowvoltage/powermonitoring

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Overview



Expansion modules are used as communication interfaces and for expanding the digital inputs/outputs for 7KM PAC measuring devices.

The expansion modules are plugged in at the back of the measuring device. The device identifies the module automatically and presents the relevant parameters for this module for selection in the parameterization menu.

The following expansion modules are available (shown from left to right in the figure on the left):

- 7KM PAC Switched Ethernet PROFINET expansion module
- 7KM PAC PROFIBUS DP expansion module
- 7KM PAC RS485 expansion module
- 7KM PAC 4DI/2DO expansion module

More information

For more information on software components
see Chapter 13 in Catalog LV 10 and visit the Internet at
www.siemens.com/lowvoltage/powermonitoring

Expansion module	Use in 7KM		
	PAC3100	PAC3200	PAC4200
7KM PAC expansion modules			
 **7KM PAC Switched Ethernet PROFINET expansion module (7KM9300-0AE01-0AA0)** The 7KM PAC Switched Ethernet PROFINET expansion module is a plug-in communication module for 7KM PAC3200 and 7KM PAC4200 measuring devices. It provides the following features: • Standardized PROFIenergy interface to the measured quantities. • The measured quantities can be individually selected using a GSDML file. This permits use of cost-effective S7 CPUs. • Easy parameter assignment using the device display and STEP 7. • Integrated Ethernet switching allows networking with short cables without additional switches. • Direct integration in production machine networks using IRT (IRT = Isochronous-Real-Time). • Full support of PROFINET IO (DHC, DNS, SNMP, SNTP). • Device replacement without PG in the PROFINET assembly using LLDP. • Deterministic reversing time through ring redundancy (MRP). • Modbus TCP communication • Communication with powermanager or powerconfig • 2 x Ethernet (RJ45) sockets. • Baud rates 10 and 100 Mbit/s. • Protocols PROFINET IO, PROFIenergy and Modbus TCP. • No external auxiliary power necessary • Status display via the device display and via LEDs on the module All measured variables from 7KM PAC3200 and 7KM PAC4200 can be individually selected and cyclically transmitted by means of the GSDML file. This enables optimum use of the process image of the PROFINET controller, e.g. CPU 315-2 PN/DP of SIMATIC S7. The measured variables can be read out in acyclic mode using PROFIenergy, a PNO protocol profile. Thanks to PROFIenergy, it is possible to assemble a power monitoring system with devices from various manufacturers using PROFINET.	--	✓	✓
 **7KM PAC PROFIBUS DP expansion module (7KM9300-0AB01-0AA0)** The 7KM PAC PROFIBUS DP expansion module has the following features: • Plug-in communication module for measuring devices for connection to PROFIBUS DPV1 • 7KM PAC3200 and 7KM PAC4200 • Configurable from the front of the device or using parameterization software • Using PROFIBUS DPV1, data can be transferred in both cyclic and acyclic modes • Easy engineering thanks to integration in SIMATIC STEP 7 and/or simple integration via GSD file for other programming systems • Optimum use of process image of a control system for selection of individual measured quantities for cyclical transfer • All baud rates from 9.6 kbit/s up to 12 Mbit/s are supported • Connection through 9-pole Sub-D connector according to IEC 61158 • No external auxiliary power necessary • Status display via the device display and via LEDs on the module	--	✓	✓

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7KM PAC expansion modules

Expansion module		Use in 7KM		
		PAC3100	PAC3200	PAC4200
	**7KM PAC RS485 expansion module (7KM9300-0AM00-0AA0)** The 7KM PAC RS485 expansion module has the following features: • Plug-in 7KM PAC RS485 communication module for 7KM PAC3200 and 7KM PAC4200 measuring devices • Configurable from the front of the device or using parameterization software • Support for the Modbus RTU protocol • Plug and play • Baud rates 4.8/9.6/19.2 and 38.4 kbit/s are supported • Connection by means of 6-pole screw terminals • No external auxiliary power necessary • Status indication by LED on the module • The 7KM PAC RS485 expansion module is required for the gateway function of the 7KM PAC4200 for communication with simple devices with RS485 interface, such as the 7KM PAC3100, via Ethernet (Modbus TCP).	--	✓	✓
	**7KM PAC 4DI/2DO expansion module (7KM9200-0AB00-0AA0)** The 7KM PAC 4DI/2DO expansion module is used to expand the 7KM PAC4200 measuring device to up to 10 digital inputs and 6 digital outputs and offers the following features: • Up to two 7KM PAC 4DI/2DO modules can be plugged onto a 7KM PAC4200. • The 7KM PAC 4DI/2DO modules mean that the internal digital inputs and outputs can be expanded by up to 8 inputs and 4 outputs. • The 7KM PAC 4DI/2DO expansion modules can be configured locally at the front of the device or via the powerconfig parameterization software. • The digital inputs can be used without the need for an external power supply as they are self-powered. This is particularly useful for the integration of non-electric measuring devices, such as water or compressed-air counters. • All functions of the integrated multifunctional inputs/outputs on the 7KM PAC4200 are also available in the 7KM PAC 4DI/2DO expansion module. • Inputs and outputs can be used as an S0 interface conforming to IEC 62053-31. • The connection is made via a 9-pole screw terminal. • No external auxiliary power supply is required.	--	--	✓

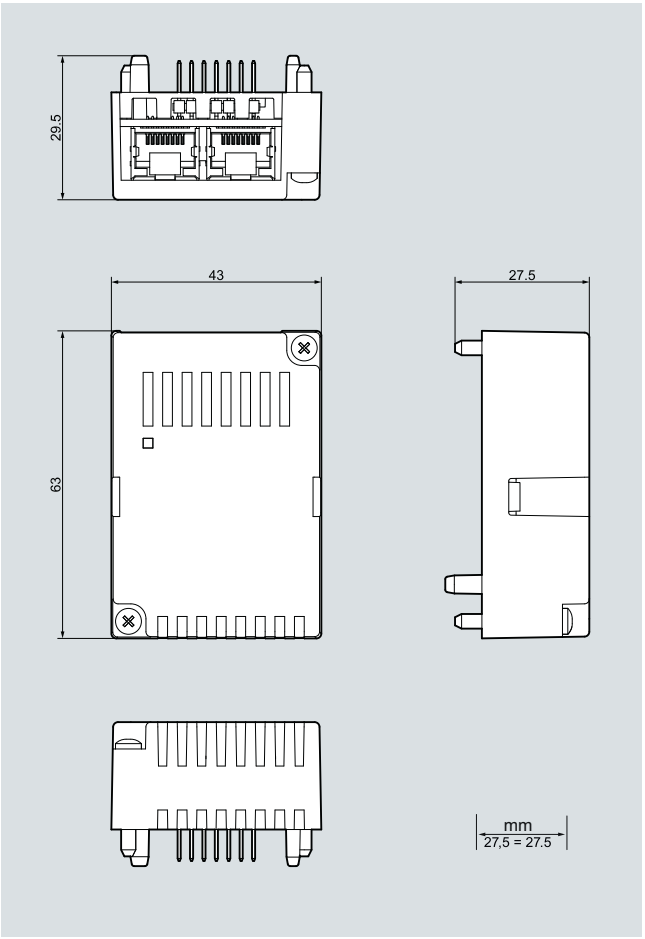
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Technical specifications

Communication		
Industrial Ethernet:		10/100 Mbit/s
Integrated IRT-enabled switch		Auto crossover
With 2 x 8-pole RJ45 sockets		Auto negotiation
Power supply		
		From 7KM PAC measuring device
Dimensions and weights		
Enclosure dimensions (W x H x D)		
Module enclosure for plug-in mounting	mm	43 x 63 x 22
Weight approx.	g	36
Degree of protection		
Degree of protection according to EN 60529		IP20
Ambient conditions		
Temperature range		
Operating temperature	°C	-10 … + 55
Storage and transport temperature	°C	-25 … + 70
Relative humidity		
At 25 °C without condensation	%	95
Altitude		
Above sea level up to max.	m	2000
Pollution degree		2

Dimensional drawings

Dimensions of SWITCHED ETHERNET PROFINET expansion module at the side and from above



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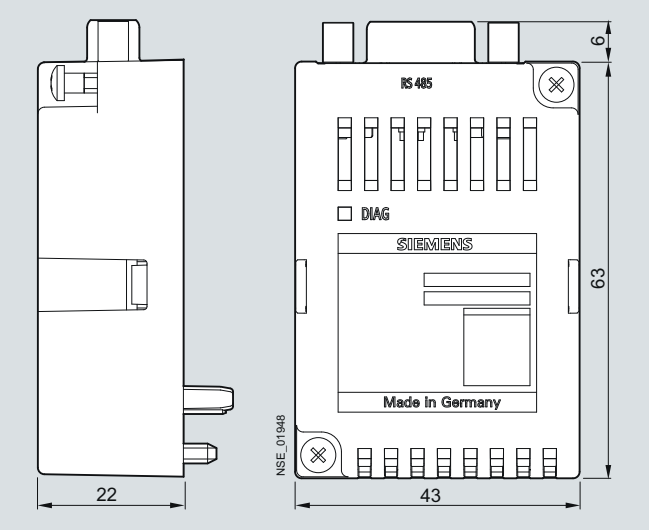
7KM PAC expansion modules
7KM PAC PROFIBUS DP expansion module

Technical specifications

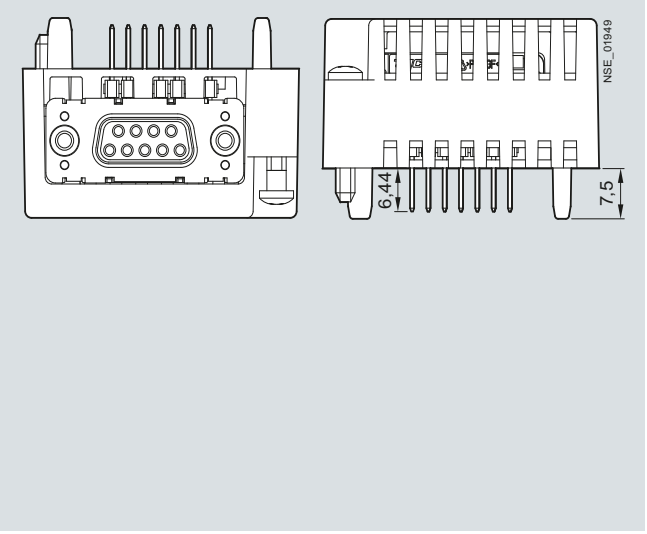
Communication		
PROFIBUS DP		
Transfer rate max.	MBit/s	12
Protocol		PROFIBUS DPV1
Measured variables to be transferred		Definable using GSD file
Dimensions and weights		
Enclosure dimensions (W x H x D)		
Module enclosure for plug-in mounting	mm	43 x 63 x 22
Weight approx.	g	45
Degree of protection		
Degree of protection according to EN 60529		IP20
Ambient conditions		
Temperature range		
Operating temperature	°C	-10 … + 55
Storage and transport temperature	°C	-25 … + 70
Relative humidity		
At 25 °C without condensation	%	95
Altitude		
Above sea level up to max.	m	2000
Pollution degree		2

Dimensional drawings

Dimensions of 7KM PAC PROFIBUS DP expansion module at the side and from above



Dimensions of the plug connector between the 7KM PAC PROFIBUS DP expansion module and the 7KM PAC measuring device



More information

Software components

For more information on software components
see Chapter 13 in Catalog LV 10 and visit the Internet at
www.siemens.com/lowvoltage/powermonitoring

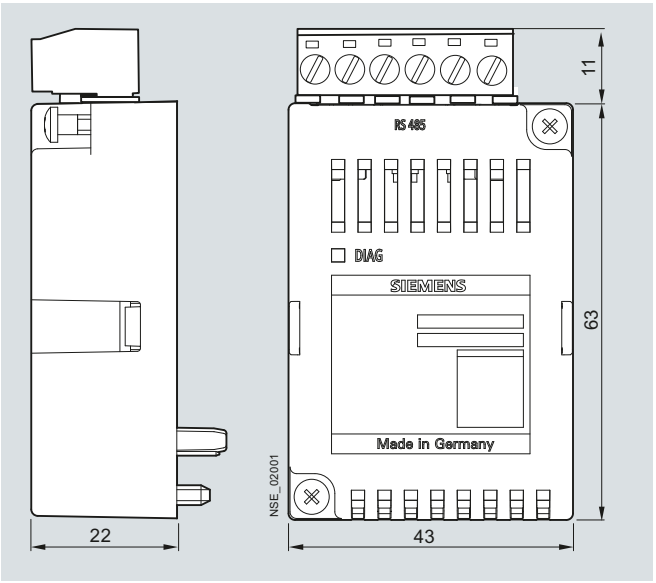
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Technical specifications

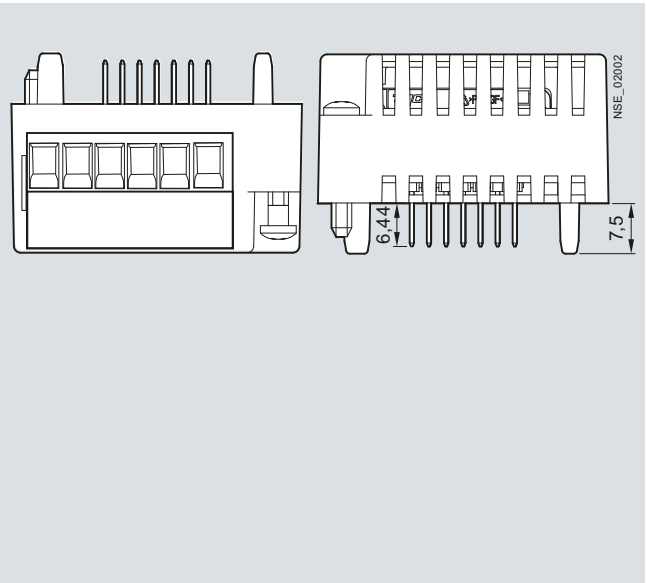
Communication		
RS485		
Transfer rates	kBd	Optionally 4.8/9.6/19.2/38.4
Protocol		Modbus RTU
Dimensions and weights		
Enclosure dimensions (W x H x D)		
Module enclosure for plug-in mounting	mm	43 x 63 x 22
Weight approx.	g	41
Degree of protection		
Degree of protection according to EN 60529		IP20
Ambient conditions		
Temperature range		
Operating temperature	°C	-10 … + 55
Storage and transport temperature	°C	-25 … + 70
Relative humidity		
At 25 °C without condensation	%	95
Altitude		
Above sea level up to max.	m	2000
Pollution degree		2

Dimensional drawings

Dimensions of 7KM PAC RS485 expansion module at the side and from above



Dimensions of the plug connector between the 7KM PAC RS485 expansion module and the 7KM PAC measuring device



More information

Software components

For more information on software components
see Chapter 13 in Catalog LV 10 and visit the Internet at
www.siemens.com/lowvoltage/powermonitoring

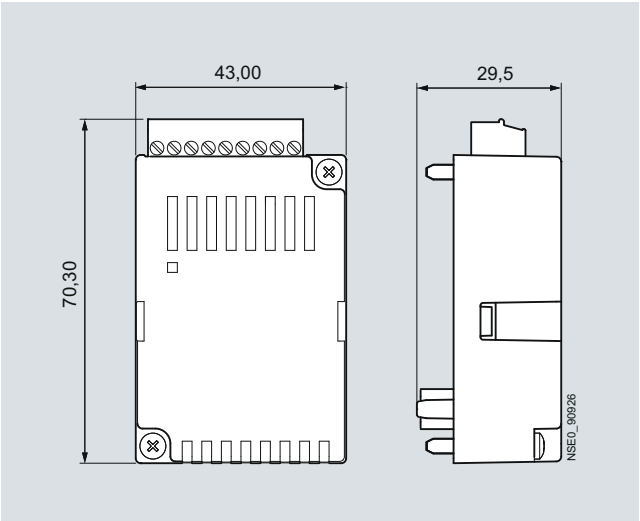
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Technical specifications

Inputs/outputs		
Digital outputs		
Number		4
Type		Internal power supply
Design/function		Switching output or pulse output according to IEC 62053-31 Class B
External operating voltage		0 ... 30 V DC, (optional))
Input resistance		
• "1" signal detection		≤ 1 kΩ
• "0" signal detection		≥ 100 kΩ
Input resistance		
• "1" signal detection		≥ 2.5 mA
• "0" signal detection		≤ 0.5 mA
Digital outputs		
Number		2
Type		Bidirectional
Design/function		Switching output or pulse output according to IEC 62053-31 Class B
Rated voltage		0 ... 30 V DC, typical 24 V DC (SELV or PELV supply)
Output current for "1" signal		
• Continuous load		≤ 50 mA (internal resistance 55 Ω)
• Transient overload		≤ 130 mA for 100 ms
Output current for "0" signal		
• Continuous load		≤ 0.2 mA
• Transient overload		≤ 130 mA for 100 ms
Dimensions and weights		
Enclosure dimensions (W x H x D)		
Module enclosure for plug-in mounting	mm	43 x 63 x 22
Weight approx.	g	38
Degree of protection		
Degree of protection according to EN 60529		IP20
Ambient conditions		
Temperature range		
Operating temperature	°C	-10 … + 55
Storage and transport temperature	°C	-25 … + 70
Relative humidity		
At 25 °C without condensation	%	95
Altitude		
Above sea level up to max.	m	2000
Pollution degree		2

Dimensional drawings

Dimensions of 7KM PAC 4DI/2DO expansion module at the side and from above



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Overview



7KT PAC1500 measuring devices, three-phase, for direct connection up to 80 A / 125 A

The measuring devices (power meters) are used to record the amount of electrical energy and power exported and imported. Siemens compact measuring devices are designed as modular devices for alternating current and can be mounted on standard mounting rails. They comply with the metering equipment standard EN 50470 (Part 1 and 3) and come with an LCD display.

The three-phase measuring devices for direct connection are available up to 125 A and in versions with transformer connections (…/5 A to 10000/5 A).

The measuring devices store active and reactive energy and all comply with accuracy class 1 (for active energy).

All measuring devices have a pulse output (S0) and are designed for 2-tariff measurements. The MID versions comply with the new Measuring Instruments Directive 2004/22/EC.

The measuring devices also have an integrated optical interface (IrDA) for connecting communication modules, which enables their integration in a range of other systems, such as power management systems.

Technical specifications

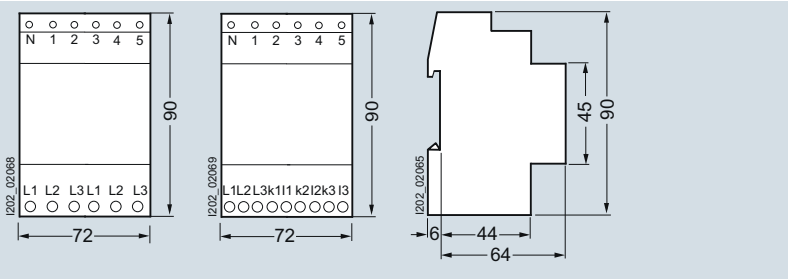
7KT PAC1500 measuring device, three-phase			7KT1540 7KT1542	7KT1543 7KT1545	7KT1546 7KT1548
Standards			EN 50470-1, EN 50470-3, EN 62053-23, EN 62053-31		
Connection					
• Direct connection			--	80 A	125 A
• Transformer current connection			.../5 A	--	--
General data					
• Enclosures	Acc. to DIN 43880	MW (1 MW = 18 mm)	4	4	6
• Mounting	Acc. to EN 60715		35 mm		
• Mounting height		mm	70		
Function					
• Connection	Single-phase or three-phase	Number of conductors	4	2 ... 4	2 ... 4
• Storage of setting and counter reading	Via (EEPROM)		Yes	Yes	Yes
• Tariffs	For active and reactive energy		T1/T2	T1/T2	T1/T2
Supply (through measuring terminals)					
• Rated control supply voltage U_n		V AC	230		
• Voltage range		V	184 ... 276		
• Rated frequency f_n		Hz	50		
Measuring accuracy at (at 23 ±1 °C)	Based on nominal value				
• Active energy and active power	Acc. to EN 50470-3		Class B		
• Reactive energy and reactive power	Acc. to EN 62053-23		Class 2		
Measuring inputs					
• Connection type			Transformer TA-TC .../5 A	Direct	Direct
• Terminal capacitance, operational and main current paths	Rigid, min. (max.) Flexible min. (max.)	mm^2 mm^2	1.5 (6) 1.5 (6)	1.5 (35) 1.5 (35)	5 (50) 5 (50)
• Voltage U_n	Phase/phase Phase/N	V V	400 230		
• Operating range voltage	Phase/phase Phase/N	V V	319 ... 480 184 ... 276		
• Current I_{ref}		A	--	5	5
• Current I_n		A	5	--	--
• Current I_{min}		A	0.05	0.25	0.25
• Operating range current (A_{ct} … I_{max})	Direct connection Transformer connection	A A	-- 0.003 ... 6	0.015 ... 80 --	0.020 ... 125 --
• Transformer current	Primary current of the transformer Smallest input step	A A	5 ... 10000 5	-- --	-- --
• Input ripple form			Sinusoidal		
• Operational starting current I_{st}		mA	3	15	20
S0 interface	Acc. to EN 62053-31				
• Pulse outputs for absorbed active and reactive energy T1 + T2			Yes		
• Pulse count	For input current I_{max} Automatic for transformers	Pulses/kWh Pulses/kWh	-- 100 - 10 - 1	500 --	500 --

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7KT PAC1500 measuring devices, three-phase

7KT PAC1500 measuring device, three-phase	7KT1540 7KT1542	7KT1543 7KT1545	7KT1546 7KT1548
IR interface			
• At the side for connecting communication modules	M-Bus/Modbus RTU/RS485/KNX		

Dimensional drawings

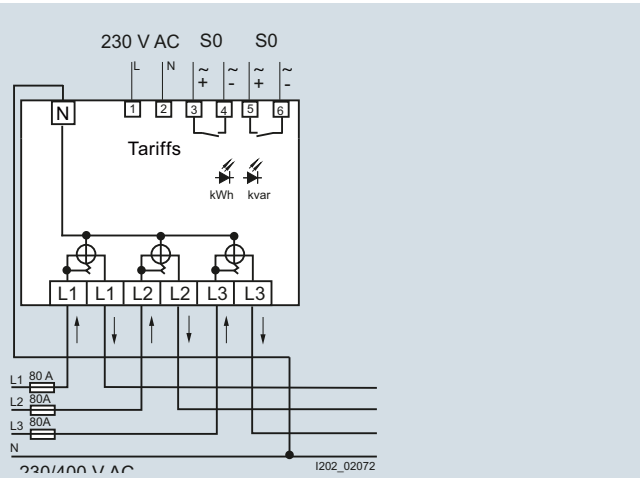


7KT1543
7KT1545

7KT1540

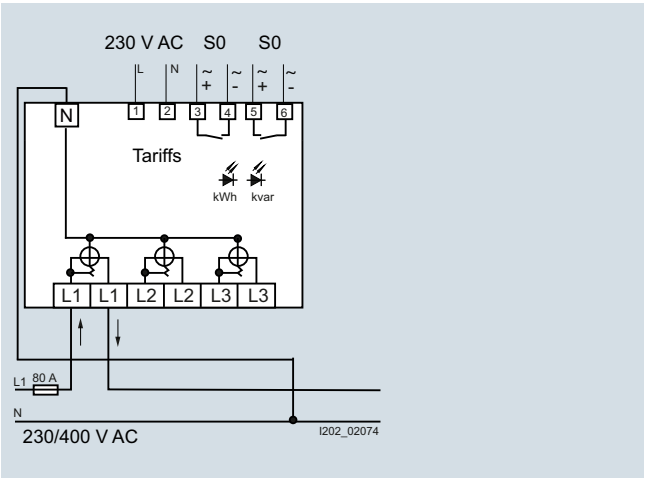
7KT1543 , 7KT1545, 7KT1540, view from the left

Circuit diagrams



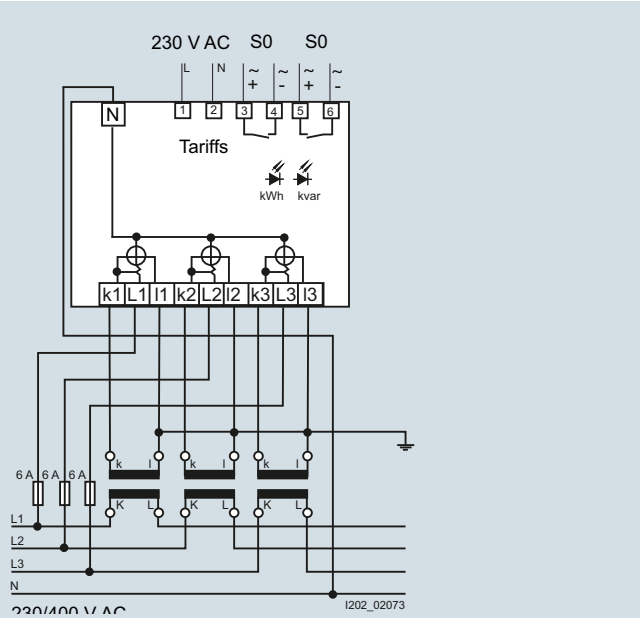
7KT543, 7KT545, three-phase connection

To achieve the specified accuracy, the N conductor must be connected to the counter.



7KT543, 7KT545, single-phase connection

With single-phase connection the display lighting cannot be activated.



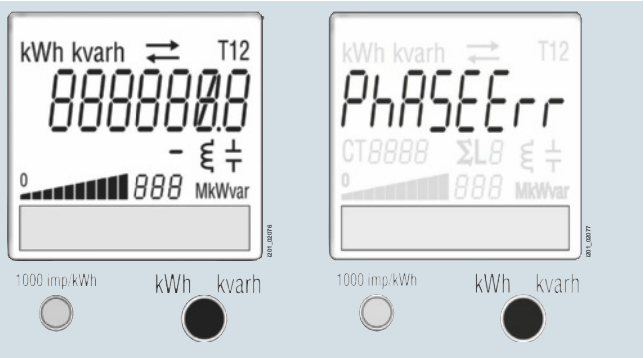
7KT540

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More information

Display representation

- Green, backlit LCD
- The control button is used to select the different display levels.



Connection error and phase failure

kWh Kvarh	kWh display kvarh display
⇄	Power import display Power export display
T12	Selected/active tariff
L8	Phase value of energy display (L1-2-3) and SL
ΣL	Phase total value of energy display
ε	Display for inductive power
⊥	Display for capacitive power
888	Display for active and reactive power
CT8888	Display for the current transformer ratio, primary side
	Bar diagram (in percent of I_{max})
	Device name and approval data
	LED accuracy check display
	Control button

Operation

The large number of measured variables makes it necessary to present the data in 2 display levels:

A) Default and
B) E-counter states

A) Default display level

- The default display level shows the sum of the active and reactive energy:
  - Sum of active energy (E1-E2+E5-E6)
  - Sum of reactive energy (E3-E4+E7-E8)
  - Software version
  - Checksum
- The various measured variables can be called up by briefly pressing the control button.
- A 3-digit display indicates the instantaneous power. A bar display indicates the instantaneous current in steps of 10 % in relation to the maximum load rating (I_{max}) (transformer connection in relation to $I_{secondary}$). The bar display is refreshed every 2 s.
- Note:
  In this display level the symbol indicator (import/export) refers to the actual power and not to the energy consumption value.

Display test control button

- If the control button is pressed and held for longer than 10 s, a display test will be activated.
- This test takes 30 s to complete. The DEFAULT display level then appears.

B) E-counter states display level

- This display level presents the energy values E1 to E8.
- To switch to the E1 to E8 energy values, press and hold the control button until the red LED lights up (approx. 4 s). The power indicators go out and the display shows the energy values E1 to E8.
- A brief press of the control button enables these measured values to be shown in a loop.
- To return to the default display level, press and hold the control button for approx. 4 s or wait approx. 30 s for automatic switchover to the initial display.
- To view all the energy registers per phase (active and reactive energy for consumed and supplied energy for T1 and T2) in a loop, press the control button for 2 s.
- The display lighting is switched off automatically after 40 s of inactivity.

Resetting all energy registers

- If the control button is pressed and held for longer than 20 s, the word "rESEt" will appear.
- After the control button is pressed again for at least another 4 seconds, all the energy registers are set to ZERO.

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7KT PAC1500 measuring device, single-phase

Overview



The 7KT PAC1500 single-phase measuring devices (power meters) are used to record the amount of electrical energy and power exported and imported. They comply with the metering equipment standard EN 50470 (Part 1 and 3) and come with an LCD display.

The 7KT PAC1500 single-phase measuring devices for direct connection are available up to 80 A. They store active and reactive energy, and all comply with accuracy class 1 (for active energy).

All measuring devices have a pulse output (S0) and are designed for 1-tariff or 2-tariff measurements, depending on the version.

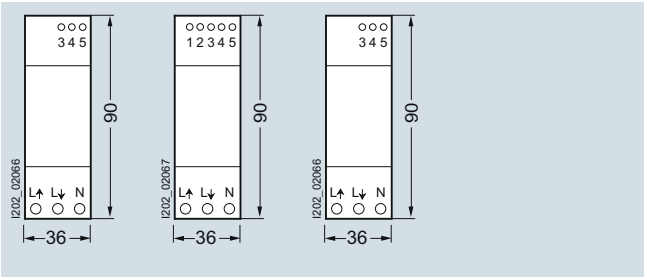
The MID versions comply with the new Measuring Instruments Directive 2004/22/EC. The measuring devices (with the exception of 7KT1530) also have an integrated optical interface (IrDA) for connecting communication modules.

Technical specifications

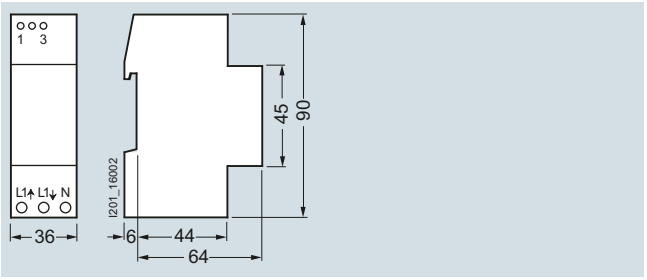
7KT PAC1500 measuring device, single-phase direct connection up to 80 A			**7KT530**	**7KT531 7KT533**
Standards			EN 50470-1, EN 50470-3, EN 62053-23, EN 62053-31	
General data				
• Enclosures	Acc. to DIN 43880	MW	2	
• Mounting	Acc. to EN 60715		35 mm	
• Mounting height		mm	70	
Function				
• Operating mode	Single-phase loads	Conductors	2	
• Storage of setting and counter reading	Via (EEPROM)		Yes	
• Tariff	for active energy For reactive energy		T1 T1	T1 + T2 T1 + T2
Supply (through measuring terminals)				
• Rated control supply voltage U_n		V AC	230	
• Voltage range		V	184 ... 276	
• Rated frequency f_n		Hz	50	
Measuring accuracy at (at 23 ±1 °C)	Based on nominal value			
• Active energy and active power	Acc. to EN 50470-3		Class B	
• Reactive energy and reactive power	Acc. to EN 62053-23		Class 2	
Measuring inputs				
• Connection type	Phase/N		Direct	
• Terminal capacitance, operational and main current paths	Rigid, min. (max.)	mm^2	1.5 (35)	1.5 (35)
	Flexible min. (max.)	mm^2	1.5 (35)	1.5 (35)
• Operating range voltage	Phase/N	V AC	184 ... 276	
• Current I_{ref}		A	15	
• Current I_{min}		A	0.75	
• Operating range current (I_{st} ... I_{max})	Direct connection	A	0.025 ... 80	
• Current waveform			Sinusoidal	
• Operational starting current I_{st}		mA	25	
S0 interface	Acc. to EN 62053-31			
• Pulse outputs for consumed active and reactive energy			Yes	
• Pulse count		Pulses/kWh	1000	
IR interface				
• At the side for connecting communication modules (M-Bus/Modbus RTU/RS485/KNX)			--	Yes

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Dimensional drawings

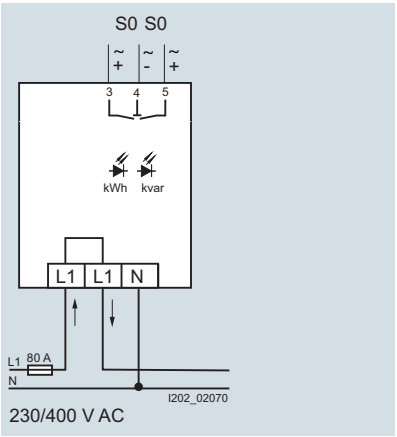


7KT530 7KT531, 7KT533

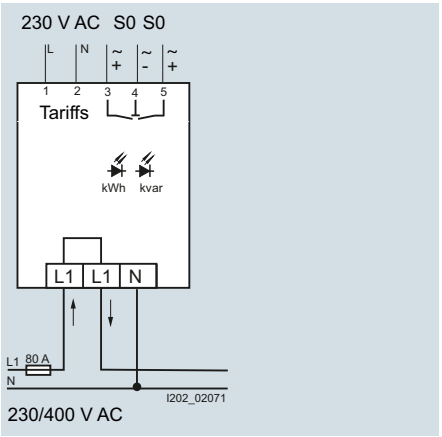


7KT140

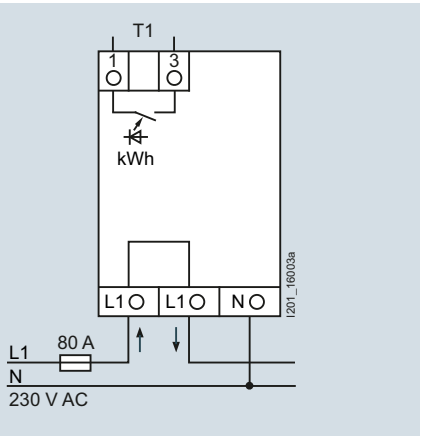
Circuit diagrams



7KT530



7KT531, 7KT533



7KT140

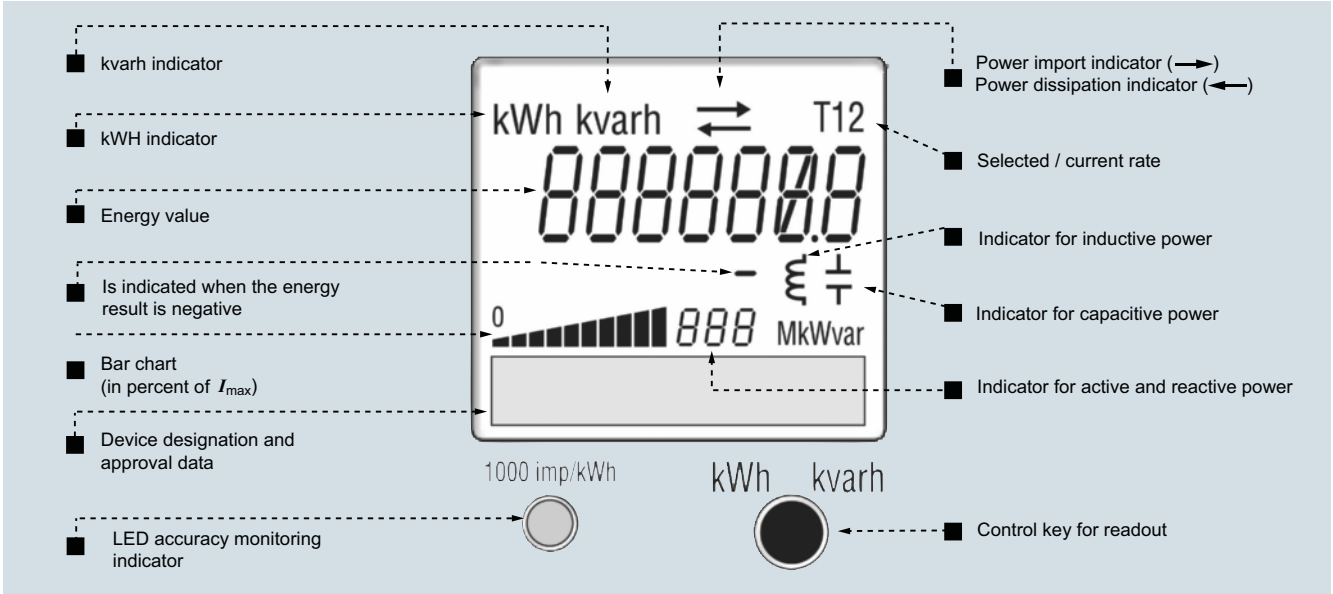
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7KT PAC1500 measuring device, single-phase

More information

Digital 7KT53. single-phase E-counters, display representation

- Green, backlit LCD
- The control button is used to select the different display levels.



Operation

The large number of measured variables makes it necessary to present the data in 2 display levels:

A) Default
B) E-counter states

A) Default display level

- The default display level shows the sum of the active and reactive energy:
  - Sum of active energy (E1-E2 for 7KT1530 and E1-E2+E5-E6 for 7KT1531, 7KT1533)
  - Sum of reactive energy (E3-E4 for 7KT1530 and E3-E4+E7-E8 for 7KT1531, 7KT1533)
  - Software version
  - Checksum
- The various measured variables can be called up by briefly pressing the control button.
- A 3-digit display indicates the instantaneous power. A bar display indicates the instantaneous current in steps of 10 % in relation to the maximum load rating (I_{max}). The bar display is refreshed every second.
- Note:
  In this display level the symbol indicator (import/export) refers to the actual power and not to the energy consumption value.

Display test control button

If the control button is pressed and held for longer than 10 s, a display test will be activated.

This test takes 30 s to complete. The DEFAULT display level then appears.

B) E-counter states display level

- This display level presents the energy values E1 to E8.
- To switch to this display level, press and hold the control button until the red LED lights up (approx. 4s). The power indicators disappear and the display shows the energy values E1-E8.
- A brief press of the control button enables the loop display of these measured values.
- To return to the default display level, press and hold the control button for 4 seconds.
- The display lighting is switched off automatically after 40 s of inactivity.

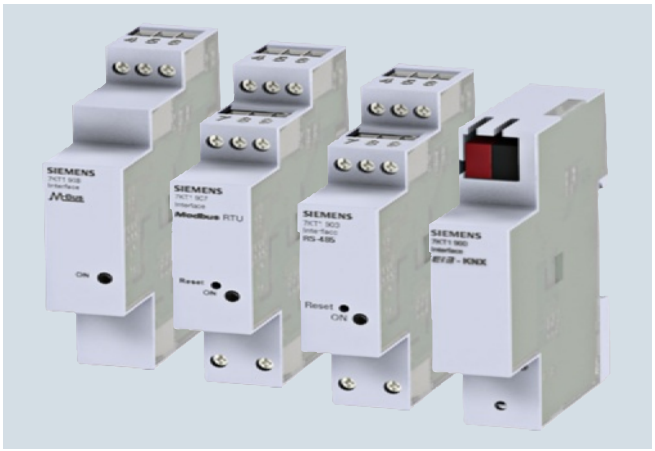
Resetting of all energy registers (except for 7KT1533)

If the control button is pressed and held for longer than 20 s, the word "rESEt" will appear.

Pressing the control button again for at least another 4 seconds, resets all the energy registers to ZERO.

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Overview



7KT PAC expansion modules, from left to right:
Expansion modules for M-Bus, Modbus RTU, RS485, Instabus KNX

The 7KT PAC expansion modules are used as communication interfaces for 7KT PAC1500 measuring devices. They have the following features:

- The expansion modules can be selected independently of the measuring device. This means they can also be retrofitted in already installed measuring devices.
- Data transmission between the measuring devices and expansion modules is executed via the IrDA infrared interface.
- The expansion modules are placed alongside the measuring devices in the installation direction so that their IrDA interfaces are exactly opposite each other.

M-Bus expansion module (7KT1908)

- Power supply through bus cable
- Baud rates: 300 to 9 600 kbit/s
- Status indication by LED on the module
- Can be parameterized using M-Bus Master software

Modbus RTU expansion module (7KT1907)

- Power supply: 230 V AC
- Baud rates: 4.8 / 9.6 / 19.2 and 38.4 kbit/s are supported.
- Status indication by LED on the module
- Configurable via RS485 master software

RS485 expansion module (7KZ1903)

- Power supply: 230 V AC
- Status indication by LED on the module

7KNX/EIB expansion module (7KT1900)

- Power supply through the KNX/EIB bus cable
- Status indication by LED on the module

Dimensional drawings

Expansion module M-Bus

Dimensional drawings see
http://support.automation.siemens.com/WW/view/en/39963313/td

Expansion module Modbus RTU

Dimensional drawings see
http://support.automation.siemens.com/WW/view/en/42261531/td

RS485 expansion module

Dimensional drawings see
http://support.automation.siemens.com/WW/view/en/45510722/td

7KNX/EIB expansion module

Dimensional drawings see
http://support.automation.siemens.com/WW/view/en/46373272/td

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7KT PAC3000 measuring devices

Overview



7KT PAC3000 measuring devices

Features

- Measuring devices with LED display
- For direct connection (80A) and transformer connection (/5A)
- Indication of 38 measured values possible
- 9 display levels, each with 6 display blocks (one level is freely configurable)
- Password-protected menu setting
- S0 pulse output
- Integrated RS485 interface (for connection to the 7KT1391 LAN coupler or for communication using Modbus RTU)

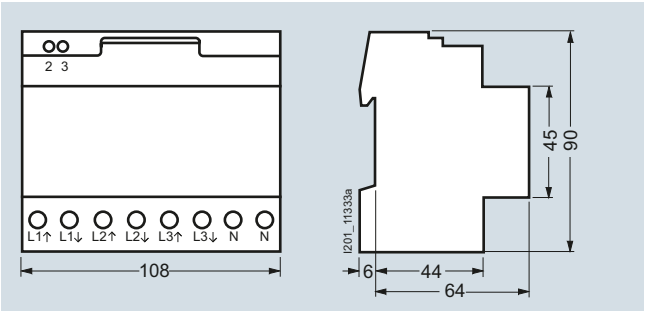
Technical specifications

7KT PAC3000 measuring device without communication **7KT PAC3000 measuring device with RS485 interface (Modbus RTU/LAN coupler)**			**7KT310** **7KT340**	**7KT311** **7KT341**
Standards			EN 50470-1, EN 50470-3, EN 62053-23, EN 62053-31, IEC 61010-1	
General data				
• Enclosures	Acc. to DIN 43880		6 modules	
• Mounting	Acc. to EN 60715		35 mm	
• Mounting height		mm	70	
Supply				
• Rated control supply voltage U_n		V AC	230	
• Primary operating range		$\times U_n$	0.8 ... 1.2	
• Rated frequency		Hz	50	
• Rated power dissipation P_v		VA	< 5	
Measuring accuracy				
• Voltage		%	± 1	
• Current		%	± 2	
• Services		%	± 1	
• Active energy	Acc. to EN 50470-3		Class B	
• Reactive energy	Acc. to IEC 62053-23		Class 2	
• p.f.		%	± 2	
• Frequency		%	± 0.2	
Measuring inputs				
• Connection type			Direct	Transformer /5 A
• Voltage U_n	Phase/phase Phase/N	V V	400 230	
• Operating range voltage	Phase/phase Phase/N	V V	87 ... 480 50 ... 276	
• Current I_n/I_{ref}		A	5	1 or 5
• Operating range current		A	0.0015 ... 80	0.003 ... 6
• Transformer current	Primary current of the transformer Smallest input step	A A	-- --	5 ... 10000 1 or 5
• Frequency		Hz	50	
S0 interface	According to IEC 62053-31		Class A	
• Pulse outputs	For active and reactive energy T1 and T2		Yes	Yes
• Pulse count	At 80 A, max. Depending on the transformer factor, adjustable, max.	Pulses/kWh Pulses/kWh	500 --	-- 10000
Modbus RTU interface (only for 7KT1340 - 7KT1341)				
• Transmission rate		kbit/s	9.6-19.2	9.6-19.2
Ambient conditions				
• Mechanical environment			M1	
• Electromagnetic environment			E2	
• Operating temperature		°C	-10 ... +55	
• Temperature limits for storage and transport		°C	-25 ... +70	
• Relative humidity (without condensation)		%	< 80	
• Vibrations	Sine amplitude at 50 Hz	mm	± 0.075	
• Degree of protection	Installed device front side/terminals		IP51[1]/PI20	

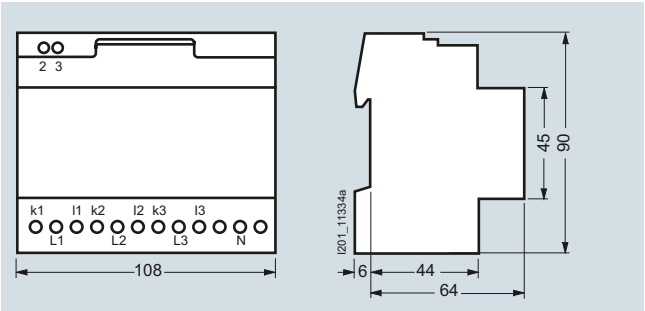
[1] For installation in a distribution board with at least IP51 degree of protection.

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Dimensional drawings



7KT300



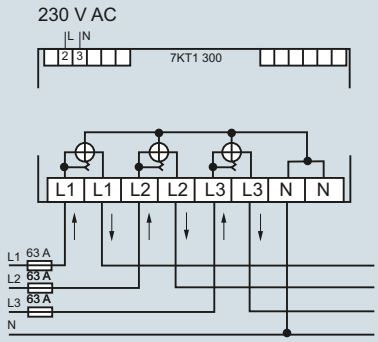
7KT301

Circuit diagrams

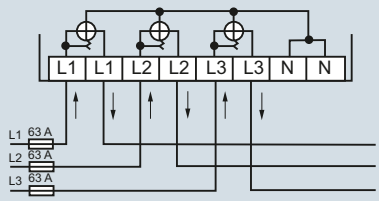
Information on the connection of transformer counters:

In the case of cross-section reduction, a short-circuit resistant cable is required for the power supply of terminal 2, depending on the fusing for phases L1, L2, L3. A fuse of 6 A is recommended for line protection.

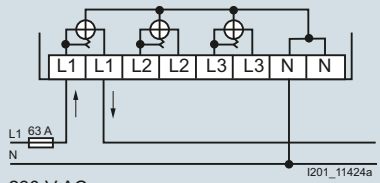
Current transformers must not be operated with open terminals as this can result in dangerously high voltages, which may cause personal injury and/or property damage. It can also lead to a thermal overload of the transformers.



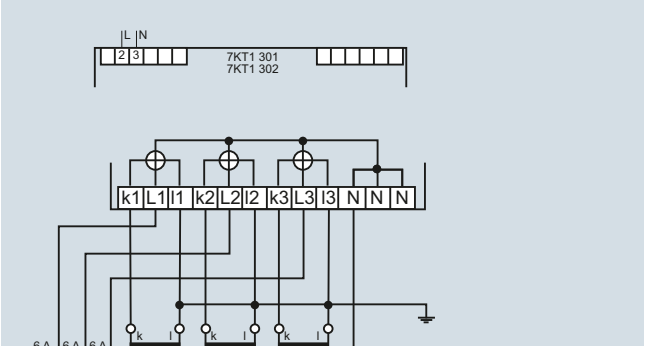
230/400 V AC
Direct connection 63 A, 4-wire circuit



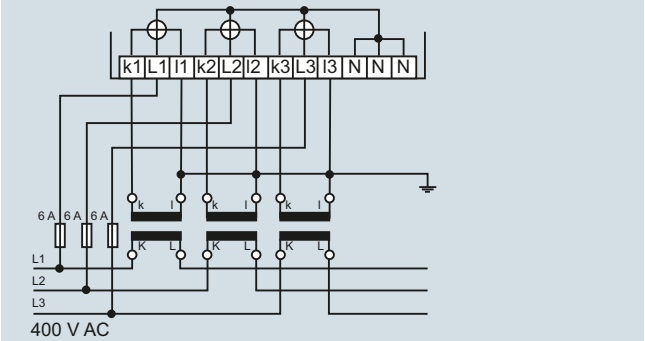
400 V AC
Direct connection 63 A, 3-wire circuit



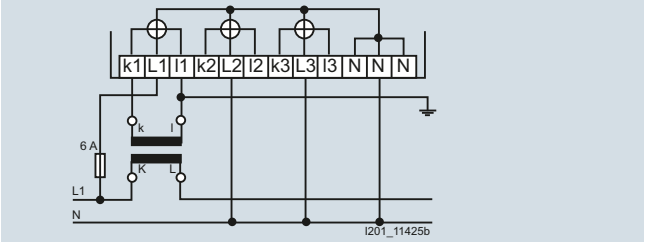
230 V AC
Direct connection 63 A, single-phase



230/400 V AC
Current transformer connection, 4-wire circuit



400 V AC
Current transformer connection, 3-wire circuit



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7KT PAC3000 measuring devices

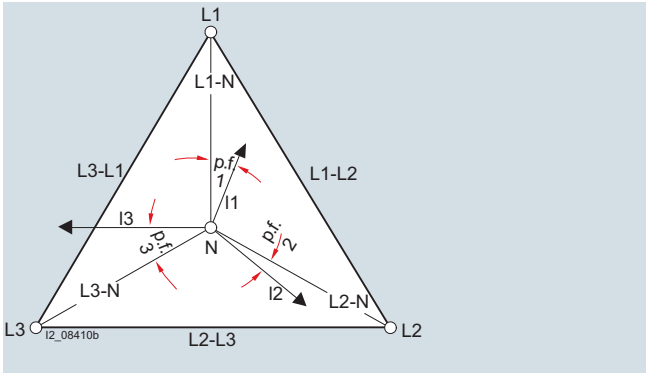
More information

Voltage measurement

The multimeter measures the delta voltages L1 to L2; L2 to L3 and L3 to L1 or the star voltages L1, L2, L3 to N.

ΣL symbol for the three-phase system

This indicates that all physical units shown under this symbol are always 3-phase.



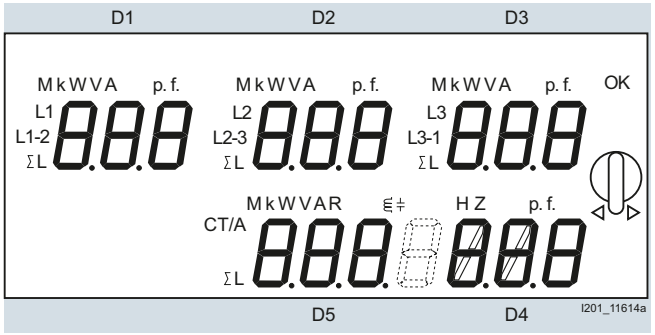
Display values

You can continuously display 5 measured variables from the following 23 options.

No.	Measured value	Display	Unit	Assign-ment
1	Active power	D1	W	L1
2	Voltage	D1	V	L1
3	Current	D1	A	L1
4	Apparent power	D1	VA	L1
5	p.f.	D1	p.f.	L1
6	Voltage	D1	V	L1–L2
7	Active power	D2	W	L2
8	Voltage	D2	V	L2
9	Current	D2	A	L2
10	Apparent power	D2	VA	L2
11	p.f.	D2	p.f.	L2
12	Voltage	D2	V	L2–L3
13	Active power	D3	W	L3
14	Voltage	D3	V	L3
15	Current	D3	A	L3
16	Apparent power	D3	VA	L3
17	p.f.	D3	p.f.	L3
18	Voltage	D3	V	L3 – L1
19	Active power	D1, D2, D3, D5	W	ΣL
20	Apparent power	D1, D2, D3, D5	VA	ΣL
21	Reactive power	D5	var	ΣL
22	Frequency	D4	Hz	ΣL
23	p.f.	D1, D2, D3, D4	p.f.	ΣL
2 set values are also displayed:				
24	Transformer setting	D5	CT/A	/5
25	Transformer setting		CT/A	5 ... 5000

Display

The multimeters have a covered, brightly lit LED display. The measured values are indicated on an 11-mm high, green 7-segment LED, the physical units are indicated by orange text abbreviations. Both colors are easier to recognize than the red LEDs used for conventional displays. Capacitive loads are automatically indicated by a capacitor symbol, inductive loads by a coil symbol – also in orange.



Matrix selection

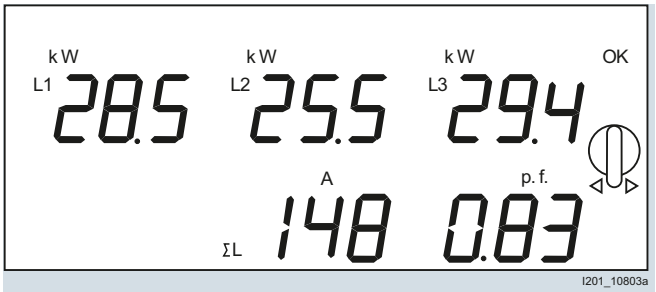
Conventional measuring instruments display voltages, currents, powers, etc. in a rigid sequence on several "screens". These multimeters allow users to define their own standard for measured variables per display field, so that they can be implemented far more universally and flexibly.

A special feature is the analysis of the different loads on the phases. Phase displacement and unsymmetrical or unbalanced loads can cause partial overloads. These multimeters offer a range of different options for combining and assessing measured values.

The display fields are selected using rotary pushbuttons and the desired indications confirmed with OK. By making the horizontal selection e.g. W, V, A or p.f., and the vertical selection, e.g. L1, L1–L2 or ΣL, users can then define the desired measured variables for this display field.

The vertical data on the display can be assigned to any measured value in the horizontal data. The letters M(ega) and k(ilo) are automatically assigned according to measuring range, i.e. measured value, e.g. kW or MW. Capacitive loads are automatically indicated by a capacitor, inductive loads by a coil.

The following diagram shows an example of what your matrix selection might look like.



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Overview



7KT 391 LAN couplers

A LAN coupler supports worldwide data retrieval from 7KT PAC measuring devices, as long as there is a LAN link to the Internet.

Up to 30 devices can be connected to a LAN coupler via a web browser, such as Firefox. In turn, the LAN coupler is connected to a LAN.

Data communication between the LAN coupler and the PC takes place using the TCP/IP protocol.

Application

Suitable 7KT PAC measuring devices

The following measuring devices can be connected to the LAN coupler:

	Order No.
Energy measuring devices	
7KT PAC1500 digital three-phase counters	
• For direct connection 80 A, double tariff	7KT1543
• For direct connection 80 A, double tariff, calibrated version	7KT1545
• For transformer connection .../5 A, double tariff	7KT1540
• For transformer connection .../5 A, double tariff, calibrated version	7KT1542
• For direct connection 125 A, double tariff	7KT1546
• For direct connection 125 A, double tariff, calibrated version	7KT1548
• For direct connection 63 A, double tariff	7KT1520
• For transformer connection .../5 A, double tariff	7KT1521
• Digital 1-phase counters	
• For direct connection 80 A, double tariff	7KT1531
• For direct connection 80 A, double tariff, calibrated version	7KT1533
7KT PAC3000 measuring devices	
• 7KT PAC3000, for direct connection	7KT1340
• 7KT PAC3000, for transformer connection .../5 A	7KT1341

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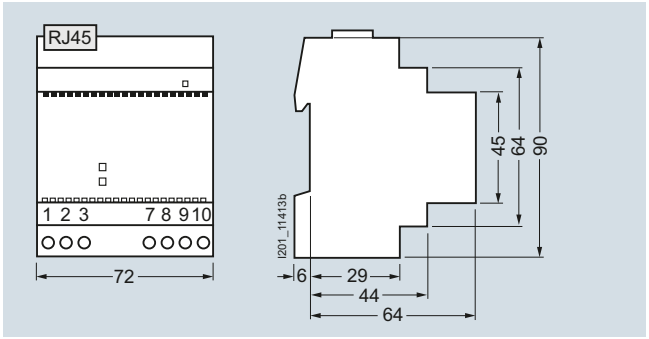
7KT LAN couplers

Technical specifications

			7KT1391 LAN couplers
Standards			IEEE 802.3 AS, IEC 60950, EN 61000-6-2, EN 61000-6-3
General data			
• Enclosures	Acc. to DIN 43880		4 modules
• Mounting	Acc. to EN 60715		Mounting on standard mounting rail (35 mm)
• Mounting height		mm	70
Supply			
• Rated power dissipation P_v		VA	≤ 10
• Rated control supply voltage U_c		V AC	230
• Primary operating range		$\times U_c$	0.9 ... 1.10
• Rated frequency		Hz	50
• Frequency ranges		Hz	45 ... 65
Function			
• System start			Automatic upon switching on
• LAN server identification			Over the IP address of the PC
• Transmission rate	Limitation by LAN	Mbit/s	100
• Operating system			Windows XP/Vista/7
• Browser			IE 7, 8; Mozilla Firefox 3.09 / 3.5.3 / 3.6; Opera 9.64 / 10 / 10.5; Safari 3.2.2 /4.0.5; Google Chrome 3.0.195.27.
LAN interface			
• HW interface			Connection RJ 45
• SW interface			TCP/IP
Interface to measuring devices			
• HW interface	RS485 terminals	Number	3 (+/-/shielded twisted pair)
• Line	Version		STP (shielded twisted pair)
	Minimum cross-section	mm^2	2 × 0.2 or 2 x AWG 24
	Maximum line capacitance	pF/m	< 50
	Impedance	W	100
	Maximum overall cable length	m	≤ 1200
	Type of installation		Serial
Measuring devices can be connected directly		Number	30
Environmental conditions			
• Temperatures	In operation	°C	-10 ... +55
	Storage and transport	°C	-25 ... +70
• Relative humidity	In operation	%	≤ 80
• Vibrations	Sine amplitude at 50 Hz	mm	± 0.25
• Safety class	Acc. to IEC 60950		III
• Degree of protection	Installed device front side (terminals)		IP20

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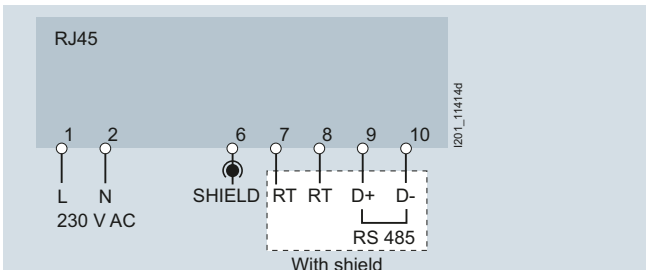
Dimensional drawings



7KT391

Circuit diagrams

Graphic symbols

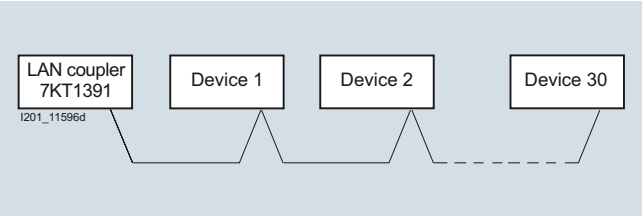


Grounding potential

Both the LAN cable with the RJ45 connector and the shielded cable of the RS485 bus system must be grounded. This also applies to the devices connected to the LAN coupler.

Connecting the devices to the LAN coupler

All the devices are connected in parallel with a shielded two-wire cable. Point-to-point installations, junctions or ring installations are not possible.



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Digital voltmeters and ammeters

Overview



Digital measuring devices: 7KT1 left voltmeter, 7KT1 right ammeter

These devices for measuring voltages and currents can be used for monitoring incoming and outgoing currents or device currents in electric plants.

They are suitable for direct connection in a single-phase system or with measuring transducers in three-phase systems.

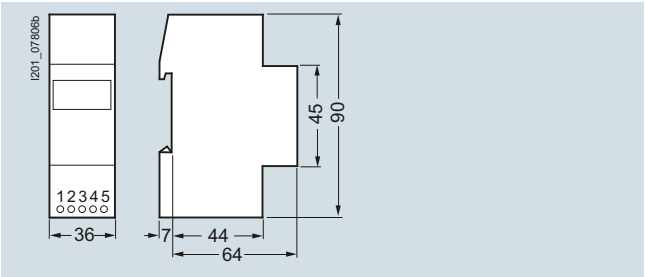
The measuring ranges of the ammeter are set locally at the device using a coding switch.

Technical specifications

			7KT110	7KT120
Standards			DIN 43751-1, -2	
Rated control supply voltage U_c		V AC	230	
Primary operating range		× U_c	0.9 ... 1.15	
Rated frequency		Hz	45 ... 65	
Measuring range				
• Voltage	Direct measurement	V AC	12 ... 600	--
• Current	Direct measurement Transformer measurement	A AC A AC	-- --	0.4 ... 20 direct 0.1 ... 1000/5
Measuring accuracy	At 23 °C	%	±0.5 ±1 digit	
Overload capability				
• Voltage	Continuous Short-time for 1 s	V V	720 780	-- --
• Current	Continuous, direct Continuous, transformer	A A	-- --	22 5.5
	Short-time for 1 s, direct Short-time for 1 s, transformer	A A	-- --	200 50
Terminals	± screw (Pozidriv)		1	
Conductor cross-sections	Rigid, max. Flexible, with end sleeve, min.	mm^2 mm^2	1 × 6/2 × 4 0.75	
Degree of protection			IP20, with connected conductors	

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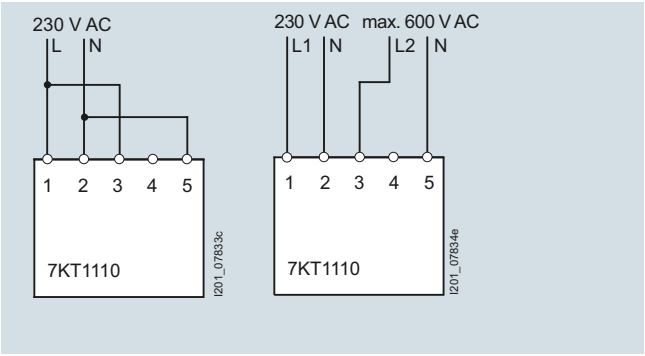
Dimensional drawings



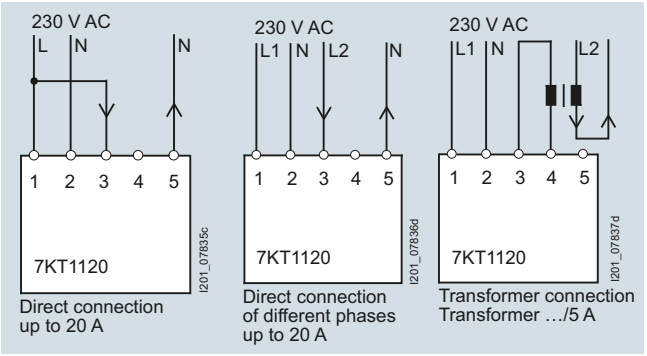
7KT110, 7KT120

Circuit diagrams

Typical circuit diagrams



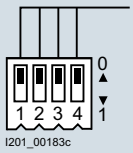
Digital voltmeters



Digital ammeters

More information

Range selector switch for 7KT120 digital ammeter

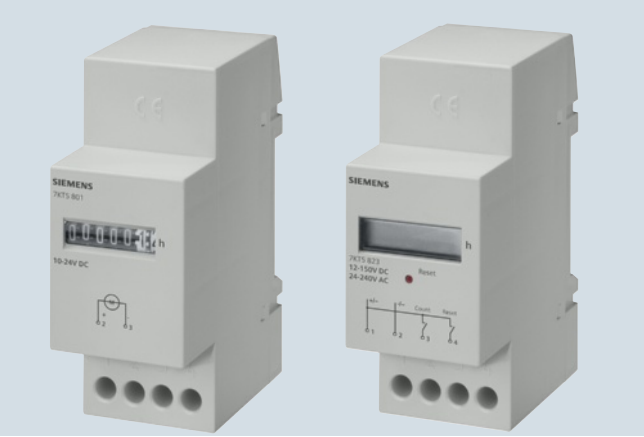


1 2 3 4			
Direct measurement			
0 0 0 0	20 A AC		
Transformer measurement			
1 0 0 0	25/5 A AC	0 0 0 1	200/5 A AC
0 1 0 0	40/5 A AC	1 0 0 1	250/5 A AC
1 1 0 0	50/5 A AC	0 1 0 1	400/5 A AC
0 0 1 0	60/5 A AC	1 1 0 1	500/5 A AC
1 0 1 0	80/5 A AC	0 0 1 1	600/5 A AC
0 1 1 0	100/5 A AC	1 0 1 1	800/5 A AC
1 1 1 0	150/5 A AC	0 1 1 1	999/5 A AC

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Time and pulse counters for standard rail mounting

Overview



Time counters: Left: electromechanical, right: electronic

Time and pulse counters are used for the reliable monitoring of production and service times, which enables the exact planning and monitoring of production sequences, maintenance cycles and warranty times.

As well as the proven electromechanical time and pulse counters for mounting in distribution boards, we also supply digital time and pulse counters.

The fields of application for both counter types are very diverse, such as the recording of operating hours of machines, systems or building management systems, as well as pulse counting for general volume flow counting, registration of starting frequencies, starting cycles or production quantities in systems and machines.

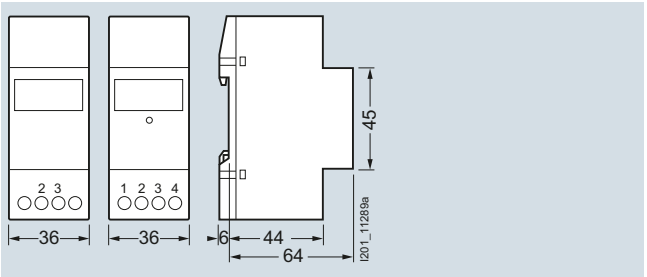
Technical specifications

			7KT5801	7KT5802	7KT5803	7KT5804	7KT5806	7KT5807
Standards **Approvals**			EN 60255-6; UL 863 UL 863, UL File No. E300537, CSA C22.2 No. 6 and 55					
Rated control supply voltage U_c		V AC V DC	-- 12 ... 24	24 --	115	230	115	230
Primary operating range	At 50/60 Hz	× U_c	0.9 ... 1.1					
Rated frequency		Hz	--	50			60	
Rated power dissipation P_v		VA	< 1		< 2			
Method of operation	Counting of		Hours					
Display	Drum-type register	h	00000.00					
Terminals	± screw (Phillips)		1					
Conductor cross-sections	Rigid Flexible, with end sleeve, min.	mm^2 mm^2	1.5 0.75					
Permissible ambient temperature		°C	-10 ... +70					
Degree of protection	Acc. to EN 60529		IP20, with connected conductors					
Safety class	Acc. to EN 61140/VDE 0140-1		II					
Permissible humidity		%	< 80					

			7KT5811	7KT5812	7KT5814	7KT5821	7KT5822	7KT5823	7KT5833
Standards **Approvals**			EN 60255-6; UL 863 UL 863, UL File No. E300537, CSA C22.2 No. 6 and 55						
Rated control supply voltage U_c		V AC V DC	-- 12 ... 24	24 --	230 --	24 ... 240 12 ... 150			
Primary operating range	At 50/60 Hz	× U_c	0.9 ... 1.1						
Rated frequency		Hz	--	50/60					
Rated power dissipation P_v		VA	< 1		< 2	< 1			
Method of operation	Counting of		Pulses			Hours			Pulses
Display	Drum-type register LCD	⎍⎍ h ⎍⎍	0000000 -- --			-- 000000.0 --			-- -- 0000000
Counting frequency		Hz	10			--			10
Pulse duration		ms	50			--			50
Resetting	Electrical Mechanical		--				Yes		
			--					Yes	
Terminals	± screw (Phillips)		1						
Conductor cross-sections	Rigid Flexible, with end sleeve, min.	mm^2 mm^2	1.5 0.75						
Permissible ambient temperature		°C	-10 ... +70						
Degree of protection	Acc. to EN 60529		IP20, with connected conductors						
Safety class	Acc. to EN 61140/VDE 0140-1		II						
Permissible humidity		%	< 80						

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Dimensional drawings

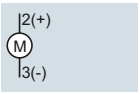


7KT580.
7KT581.

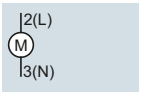
7KT582.
7KT5833

Circuit diagrams

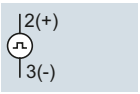
Connections



7KT5801



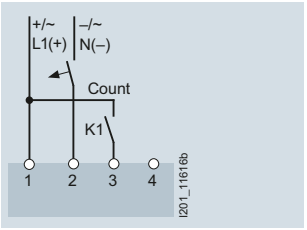
7KT5802
7KT5803
7KT5804
7KT5806
7KT5807



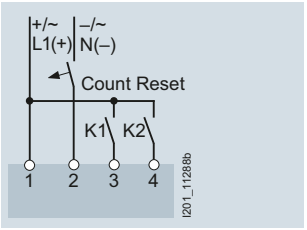
7KT5811



7KT5812
7KT5814



7KT5821



7KT5822, 7KT5823, 7KT5833

More information

Time counters count the time in hours with an accuracy of two decimal places (hundredths of hours). The pulse counter adds the number of pulses, e.g. the making operations of devices.

A power supply is required at terminals 1 and 3 of the electronic counters so that the device can constantly display the measured values. Once terminal 3 is supplied with voltage (for DC "+"), the counting procedure starts. If terminal 4 is supplied short-time with voltage (for DC "+"), the counter is reset.

In the case of electronic counters, the counting result is saved indefinitely in the event of a power failure (EEPROM). On recovery of the power, the counting is continued from the saved value. As well as a modern design, the electronic counter has a 7-digit LCD, which can be reset electrically or manually.

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Time counters for front-panel mounting

Overview



Time counters: Left: Counting mechanism, right: Counting mechanism with front frame

Time and pulse counters for control cabinets, control systems and mechanical engineering are used, e.g. in boilers, machine tools or compressors. The pulse counters count the starting frequencies. This supports planning for preventative maintenance.

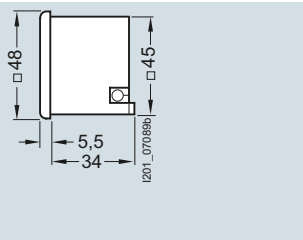
In-time and regular maintenance is the best protection against unexpected shutdowns.

Technical specifications

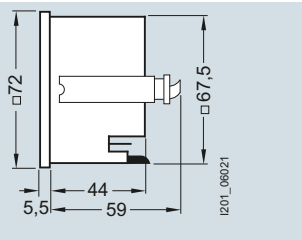
			7KT5500	7KT5501	7KT5502	7KT5503	7KT5504	7KT5505
Standards			EN 60255-6					
Rated control supply voltage U_c		V AC V DC	-- 10 ... 80	115 --	230	115	230	24
Rated frequency		Hz	--	50		60		50
Front-panel mounting	Switchboard cutout							
• Without masking frame 55 mm × 55 mm		mm × mm	$45.2 \times 45.2^{+0.3}$					
• With masking frame 55 mm × 55 mm		Ø mm	$50.2^{+0.3}$					

			7KT5600	7KT5601	7KT5602	7KT5603	7KT5604
Standards			EN 60255-6				
Rated control supply voltage U_c		V AC V DC	-- 10 ... 50	115 --	230	115	230
Rated frequency		Hz	--	50		60	
Front-panel mounting	Switchboard cutout	mm × mm	$68^{+0.5} \times 68^{+0.5}$				

Dimensional drawings



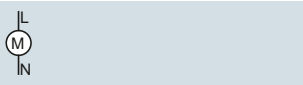
7KT55



7KT56

Circuit diagrams

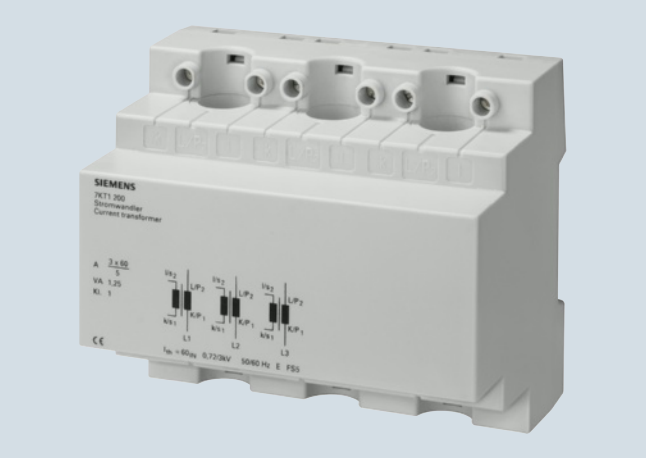
Connections



7KT55, 7KT56

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Overview



7KT12 current transformers

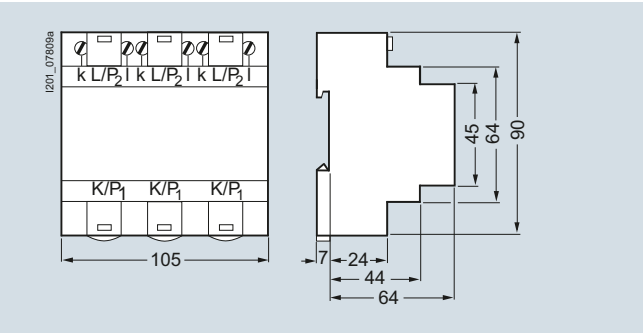
The three-phase 7KT12 current transformer can be used in distribution boards according to DIN 43880. The measuring leads are routed vertically through the standard mounting rail.

This type of current transformer is suitable for infeeds or outgoing lines in connection with the installation of a 5TE8 switch or a 5TE1 disconnector, as the primary connecting leads do not have to be interrupted.
The current transformer is designed for cables of up to 13 mm in diameter, e.g. H07V-R with 50 mm^2 conductor cross-section.

Technical specifications

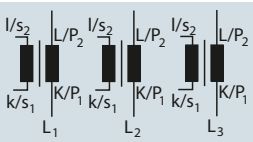
			7KT1200	7KT1201	7KT1202
Standards			EN 60044-1		
Secondary rated current strength		A	5		
Accuracy class		Cl.	1		
Rated power		VA	1.25	2.5	3.75
Rated frequency f_n		Hz	50/60		
Thermal current limit I_{th}	Short-time	A	60 × I_e		
Thermal continuous current		A	1 × I_e		
Overcurrent limit factor		FS	5		
Rated impulse withstand voltage U_{imp}		kV	> 3		
Creepage distances and clearances		mm	> 3		
Rated operational voltage U_e		V AC	720		
Rated operational current I_e		A AC	3 × 60	3 × 100	3 × 150
Terminals ±screw (Pozidriv)			PZ 1		
Conductor cross-sections					
- Rigid		mm^2	0.5 ... 4		
- Flexible, with end sleeve		mm^2	0.5 ... 2.5		
Permissible ambient temperature		°C	-5 ... +60		
Resistance to climate	Acc. to EN 60068-1		20/60/4		

Dimensional drawings



7KT200
7KT201
7KT202

Circuit diagrams



7KT200
7KT201
7KT202

Note:

Current transformers must not be operated with open terminals, as this can result in dangerously high voltages, which may cause personal injury and/or property damage. It also exposes the transformer to thermal overload.

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7KT90 measuring selector switches

Overview

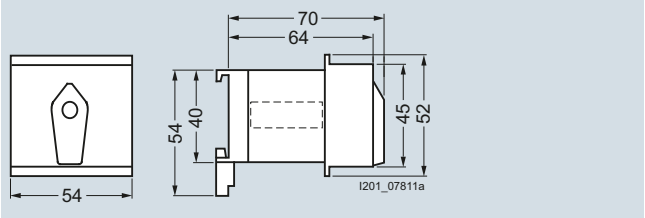


Measuring selector switch (voltmeter selector switch)

Measuring selector switches are used as CO contacts of the phases for voltages and currents in three-phase systems for voltmeters and ammeters.

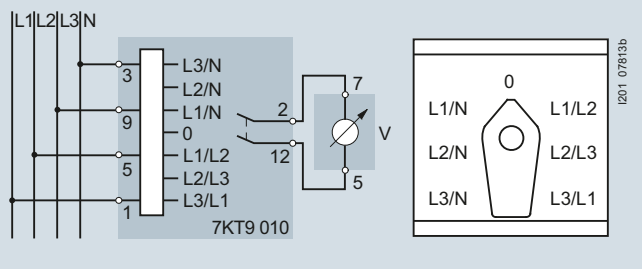
The design of these switches is adapted to match the modular installation devices. They support use in compliance with EN 60947-3.

Dimensional drawings

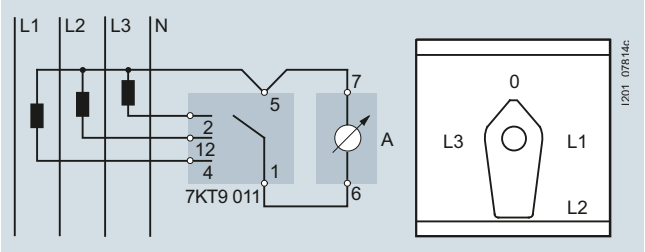


7KT9010
7KT9011

Circuit diagrams



Voltmeter switching



Ammeter switching

Internal interconnection of the phases in the ammeter selector switch for the prevention of glitches at the connections of the current transformers:

Switch position	Short-circuited phases		
	L1	L2	L3
0	✓	✓	✓
L1	--	✓	✓
L2	✓	--	✓
L3	✓	✓	--

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