

SIEMENS

SENTRON

Expansion module PAC RS485

Manual

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Safety Guidelines

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

| |
|--|
| ⚠ DANGER |
| indicates that death or severe personal injury will result if proper precautions are not taken. |
| ⚠ WARNING |
| indicates that death or severe personal injury may result if proper precautions are not taken. |
| ⚠ CAUTION |
| with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken. |
| CAUTION |
| without a safety alert symbol, indicates that property damage can result if proper precautions are not taken. |
| NOTICE |
| indicates that an unintended result or situation can occur if the corresponding information is not taken into account. |

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

Qualified Personnel

The device/system may only be set up and used in conjunction with this documentation. Commissioning and operation of a device/system may only be performed by **qualified personnel**. Within the context of the safety notes in this documentation qualified persons are defined as persons who are authorized to commission, ground and label devices, systems and circuits in accordance with established safety practices and standards.

Prescribed Usage

Note the following:

| |
|--|
| ⚠ WARNING |
| This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance. |

Trademarks

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Disclaimer of Liability

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

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Introduction

1.1 Purpose of this document

This manual is intended for:

- Planners
- Plant operators
- Commissioning engineers
- Service and maintenance personnel

This manual contains:

- Details of the design of the PAC RS485 expansion module
- Permissible conditions of use for the PAC RS485 expansion module

Required basic knowledge

General knowledge in the fields of automation and electrical engineering is required to understand this manual.

1.2 Orientation aids

General information

The manual includes the following orientation aids:

- Table of contents
- List of figures and tables
- List of abbreviations
- Glossary
- Index

1.3 Scope of supply

Description

The package includes:

- The PAC RS485 expansion module including 2 permanent screws
- Terminal block including 6 permanent screws
- The operating instructions for the PAC RS485 expansion module

1.4 Contents of the CD for the SENTRON PAC Power Monitoring Device

CD contents

The SENTRON PAC CD includes the following files:

- The manual for the SENTRON PAC Power Monitoring Device in all available languages
- The operating instructions for the SENTRON PAC Power Monitoring Device in all available languages
- The manual for the PAC PROFIBUS DP expansion module in all available languages
- The operating instructions for the PAC PROFIBUS DP expansion module in all available languages
- The GSD files for the PAC PROFIBUS DP expansion module and the SENTRON PAC Power Monitoring Device.

Note

Specific GSD file

This GSD file is only designed for the use of the PAC PROFIBUS DP expansion module with a specific type of the SENTRON PAC Power Monitoring Device.

- The manual for the PAC RS485 expansion module in all available languages
- The operating instructions for the PAC RS485 expansion module in all available languages
- The SENTRON powerconfig software including online help in all available languages.
- The language packages for the SENTRON PAC Power Monitoring Device

This CD is supplied with the SENTRON PAC Power Monitoring Device.

1.5 Technical support

Contact for technical problems and other questions

Help is available from:

- Service and support contacts in your region - worldwide
- Online service and support
- Technical support

Contacts in the region

Contacts in your region can provide support worldwide.

Table 1-1 Contacts in your region - worldwide

| Utility | Address, number |
|-----------|--|
| Internet: | Service and support (http://www.siemens.com/automation/service&support) under "Contact > Contacts worldwide" |

Support address:

SIEMENS AG
A&D CD MM1
Gleiwitzerstr. 555
D-90475 Nuremberg

Online support

This comprehensive information system is available day and night via the Internet. Online service and support offers product support, services and support, and support tools from the shop.

Table 1-2 Online service and support

| Utility | Address, number |
|-----------|--|
| Internet: | Online service and support (http://www.siemens.com/automation/service&support) |

Technical Support

Technical support offers:

- Expert advice on technical queries over a broad subject area
- Tailored services relating to our products and systems

If you require technical support or you have questions about the product, contact Technical Support.

Table 1-3 Technical Support

| Utility | Address, number |
|-----------|---|
| Phone: | +49 (0)180-50-50-222 |
| Fax: | +49 (0)180-50-50-223 |
| Internet: | Support request (http://www.siemens.com/automation/support-request) |

1.6 Further documentation

Overview

You can find further details in the following manuals:


- Manual for the SENTRON PAC Power Monitoring Device
- Operating instructions for the SENTRON PAC Power Monitoring Device
- Operating instructions for the PAC RS485 expansion module
- Modbus-IDA.org "MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1a"
- MODBUS.org "MODBUS over Serial Line Specification & Implementation guide V1.02"

Safety notes

2.1 Safety notes

General safety notes



|  DANGER | |
|---|--|
| Danger! High voltage | |
| Will cause death or serious injury. | |
| Turn off and lock out all power supplying this device before working on this device. | |

Description

3.1 Area of application

The PAC RS485 expansion module is designed for use with a SENTRON PAC Power Monitoring Device.

Area of application of the PAC RS485 expansion module

The PAC RS485 expansion module connects the SENTRON PAC Power Monitoring Device to the RS 485 bus. This integrates the SENTRON PAC Power Monitoring Device into power management systems and automation systems.

The PAC RS485 expansion module communicates with the SENTRON PAC Power Monitoring Device and with the master.

| |
|--|
| NOTICE |
| Purpose of the PAC RS485 expansion module |
| The PAC RS485 expansion module is only intended for use with a SENTRON PAC Power Monitoring Device. The guidelines for the SENTRON PAC Power Monitoring Device also apply to the PAC RS485 expansion module. |

3.2 Features

You can use the PAC RS485 expansion module to access the measuring stations during operation.

Overview

Features include:

- Communication based on the master-slave principle via the serial interface
- Function:
MODBUS RTU slave or SEABus slave with the SENTRON PAC3200 Power Monitoring Device

- Configuration via:
 - the SENTRON PAC Power Monitoring Device
 - the Ethernet interface
 - the RS 485 interface
- Unicast messages
- Broadcast commands with address 0 to the MODBUS slaves

See also

Parameters and function codes supported by the broadcast commands (Page 55)

3.3 Tasks

Description

The tasks of the PAC RS485 expansion module are as follows:

- Provides measured values, parameters and settings of the SENTRON PAC Power Monitoring Device via the RS 485 bus.
- Receives information, e.g. commands, via the RS 485 bus and forwards this to the SENTRON PAC Power Monitoring Device.
- Galvanic isolation between the SENTRON PAC Power Monitoring Device and the bus.

3.4 Structure

Structure of the PAC RS485 expansion module

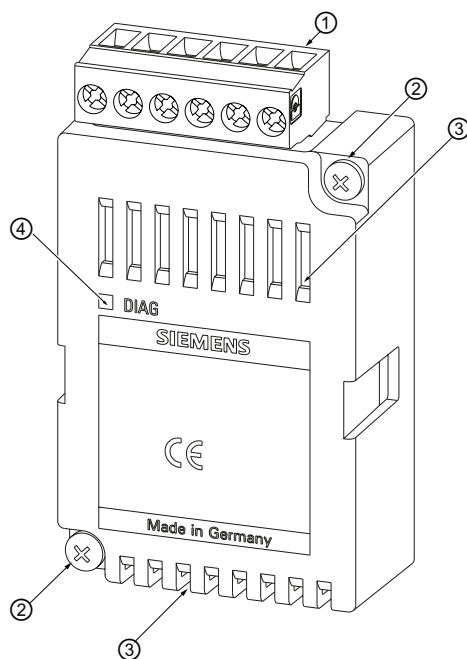


Figure 3-1 Schematic view of the side and front of the PAC RS485 expansion module

- (1) Terminal block
- (2) Screw for mounting the PAC RS485 expansion module on the SENTRON PAC Power Monitoring Device
- (3) Ventilation slots
- (4) LED

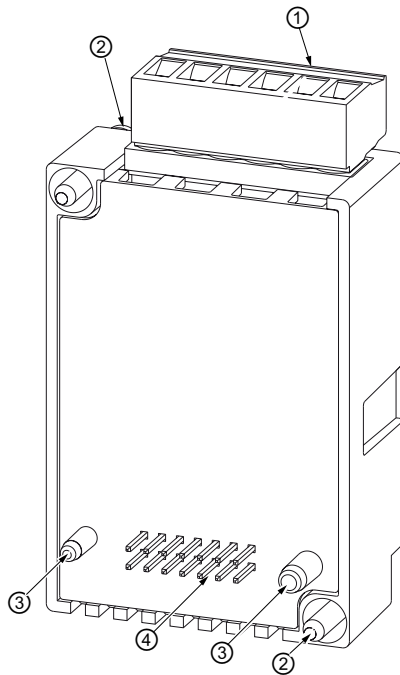


Figure 3-2 Schematic view of the rear of the PAC RS485 expansion module

- (1) Terminal block
- (2) Screw for mounting the PAC RS485 expansion module on the SENTRON PAC Power Monitoring Device
- (3) Guide pins; their guide for correct position ensures that the PAC RS485 expansion module is plugged into the SENTRON PAC Power Monitoring Device correctly
- (4) Pins

3.5 Firmware

General information

The PAC RS485 expansion module does not have its own firmware. The protocol of the PAC RS485 expansion module is integrated into the firmware of the SENTRON PAC Power Monitoring Device. New functions and changes to functions only become available after the firmware of the SENTRON PAC Power Monitoring Device has been updated.

NOTICE

The PAC RS485 expansion module will not work with the wrong firmware version

The SENTRON PAC3200 Power Monitoring Device must have at least firmware version FWV2.0X. Earlier versions do not support the PAC RS485 expansion module. If necessary, install the correct firmware version from V.1.0.1.0 with the program *SENTRON powerconfig*.

3.6 Bus and master

Restrictions

The following restrictions apply for the use of a bus and a master:

- You must use only broadcast commands that agree in syntax and meaning with the broadcast commands supported by the Power Monitoring Device.
- The following must be set on the bus and the master and on all nodes on the bus:
 - The same baud rate
 - The same communication settings, e.g. data bits, stop bits, parity bit
 - The same protocol

Description

3.6 Bus and master

Assembling

4.1 Procedure for installation and commissioning

The following system configuration information must be available:

- Installation location of the device
- Baud rate
- Planned address of the PAC RS485 expansion module

Procedure

1. Mount the SENTRON PAC Power Monitoring Device and the PAC RS485 expansion module.
2. Connect the SENTRON PAC Power Monitoring Device.
3. Connect the PAC RS485 expansion module to the RS 485 network.
4. Switch on the terminating resistor at the start and the end of the bus.
5. Apply supply voltage to the SENTRON PAC Power Monitoring Device. The SENTRON PAC Power Monitoring Device and expansion module are then ready for operation.
6. Set the language on the SENTRON PAC Power Monitoring Device.
7. Parameterize the SENTRON PAC Power Monitoring Device.
8. Set the following on the SENTRON PAC Power Monitoring Device.
 - The planned RS 485 address, e.g. the MODBUS address
 - The baud rate
 - The communication settings
 - The protocol, e.g. MODBUS RTU or SEAbus
 - The response time
9. Make the necessary settings on the master.
10. Check all connections and settings.

See also

Safety notes (Page 11)

Changing the address (Page 57)

Examples of MODBUS communication (Page 75)

Configuration of the PAC RS485 expansion module on the SENTRON PAC3200 Power Monitoring Device (Page 58)

4.2 Unpacking

Observe the ESD Guidelines. Open the packaging with care. Do not use excessive force.

Checks

After receiving the module, and before installing it, you should make the following checks:

- Check the packaging for damage.
- Make sure that the package contents are complete.
- Check the module for external damage.

Please contact your Siemens sales partner in the following cases:

- The packaging is damaged
- The contents of the package are not complete
- The module is damaged

Storage

Store the PAC RS485 expansion module in a dry place.

See also

Electrostatic sensitive devices (ESD) (Page 81)

4.3 Assembly

NOTICE

Condensation

Sudden fluctuations in temperature can lead to condensation. Condensation can affect the function of the PAC RS485 expansion module. Store the PAC RS485 expansion module in the operating room for at least 2 hours before commencing installation.

Tools

To install the PAC RS485 expansion module you will need the following tool:

- A cross-tip screwdriver PZ1, 0.5 Nm
cal. ISO 6789

Assembly

Mount the PAC RS485 expansion module before starting up the SENTRON PAC. Observe the ESD Guidelines.

CAUTION

Defective connector to SENTRON PAC Power Monitoring Device

Dirty or bent pins can affect the function of the connectors. The connectors can be destroyed. Do not allow the pins to become dirty.

Make sure that:

- There are no metal parts between the pins.
- There are no metal parts adhering to the pins.
- The pins do not bend.

Do not touch the pins.

NOTICE

Do not cover the ventilation slots!

If the ventilation slots are covered, the PAC RS485 expansion module can overheat. Make sure that the ventilation slots are not covered.

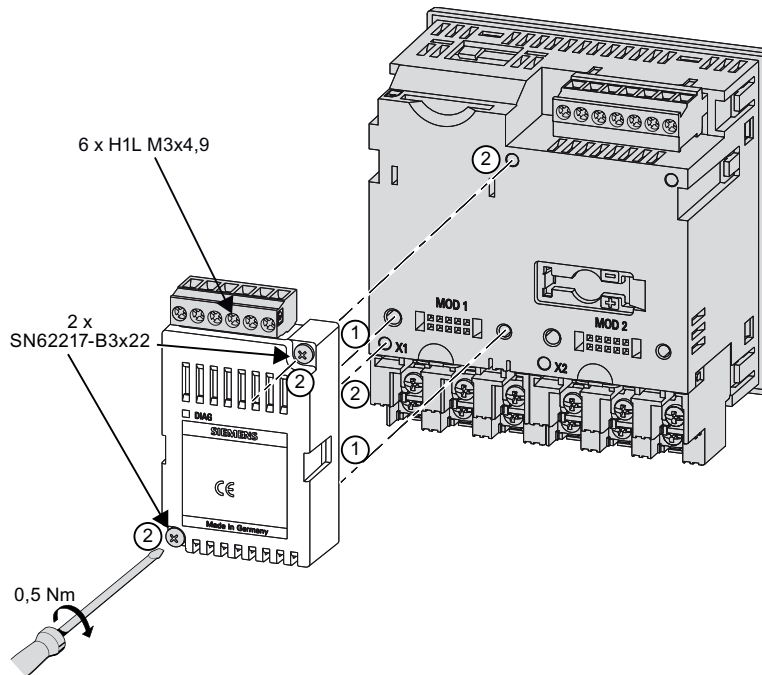


Figure 4-1 Schematic view of assembling the PAC RS485 expansion module

1. Ensure safe isolation from supply.
2. Discharge yourself.
3. Mount the SENTRON PAC Power Monitoring Device.
4. Connect the current terminals and voltage terminals to the SENTRON PAC.
5. Handle the PAC RS485 expansion module by the plastic housing only.
6. Connect the PAC RS485 expansion module to the SENTRON PAC. The guide for correct position of the guide pins will help you to plug in the PAC RS485 expansion module correctly. You can find more information about the slot in the SENTRON PAC manual.
7. Tighten the screws SN62217-B3x22 of the PAC RS485 expansion module to the SENTRON PAC with a torque of 0.5 Nm.



More information

Installing the SENTRON PAC Power Monitoring Device

You can find information about how to install the SENTRON PAC Power Monitoring Device in the operating instructions and manual for the SENTRON PAC Power Monitoring Device.

NOTICE

Damage due to moisture

Moisture or wetness can affect the operating capability of the PAC RS485 expansion module. Make sure that no moisture or wetness can find its way into the PAC RS485 expansion module. Clean the PAC RS485 expansion module using a dry, lint-free cloth only.

Do not operate the PAC RS485 expansion module in an environment affected by high humidity or wetness. Note the environmental requirements of the SENTRON PAC Power Monitoring Device.

See also

Electrostatic sensitive devices (ESD) (Page 81)

Connecting (Page 23)

Measures to be performed prior to start-up (Page 26)

4.4 Connecting

Tools required

To install the cables and the screw terminals, you will require:

- A cross-tip screwdriver PZ1, 0.5 Nm
cal. ISO 6789

If you use cables with wire end ferrules, you also require:

- A crimping tool in accordance with EN 60947-1

Procedure

Connect the PAC RS485 expansion module to the RS 485 bus. Please pay attention to the general topology of the twisted-pair cable.

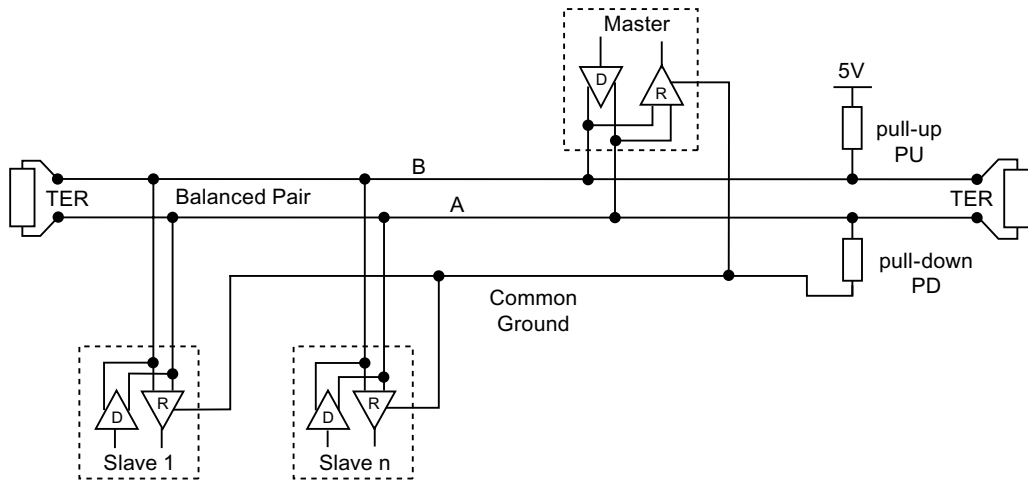


Figure 4-2 Block diagram: General topology of the twisted-pair cable

- +/B B signal; D1
- /A A signal; D0
- COM Common = Ground
- TER (Line) Termination = bus terminating resistor
- PU Pull-up resistor
- PD Pull-down resistor

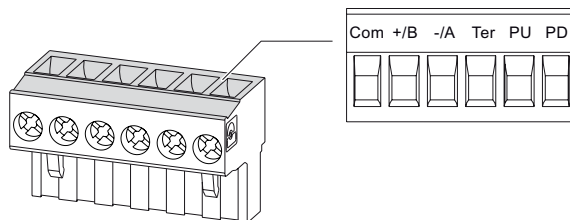


Figure 4-3 Terminal assignment

1. Connect the cables to the appropriate screw terminals on the terminal block. You can find the assignments of the terminals in the figure "Terminal assignment".
2. Connect the cable shield at one end with protective ground PE.
3. Connect the signal Common with protective ground. This grounds the expansion module.
4. On the first and last communication nodes, switch a bus terminating resistor between the positive signal and the negative signal. A 120-Ohm bus terminating resistor is implemented in the PAC RS485 expansion module for this purpose. In the case of other values, use an external bus terminating resistor. Attach this to the first and last communication node.

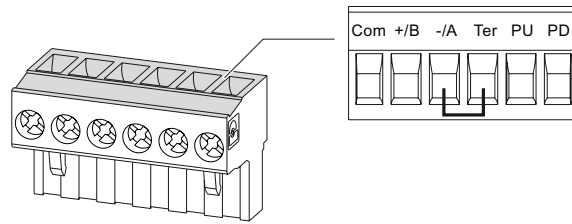


Figure 4-4 Terminal assignment with terminating resistor

NOTICE

Incorrect bus terminator

If you switch more than two bus terminating resistors on one bus, this can result, for example, in signal reflections that interfere with communication on the bus.

Never attach more than two bus terminators to one bus. Attach one bus terminating resistor at the start of the bus and one terminating resistor at the end of the bus.

5. Make sure that there is sufficient strain relief for the connected cables.

Line polarization

A resistor for line polarization is implemented in the terminal block.

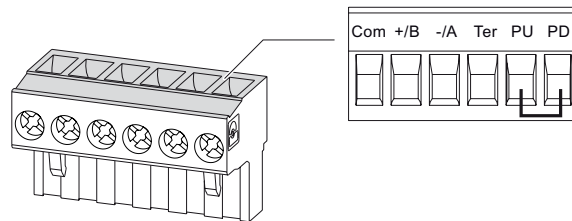


Figure 4-5 Terminal assignment with line polarization

If one or more communication nodes require line polarization, switch a resistor pair PU and PD on the RS 485 twisted-pair cable in the case of a PAC RS485 expansion module. To do so, switch on the resistor in the terminal block of the relevant PAC RS485 expansion module shown in the figure "Terminal assignment with line polarization".

See also

Assembly (Page 21)

Communication interface (Page 70)

4.5 Measures to be performed prior to start-up

| |
|--|
| CAUTION |
| Never start up damaged modules Damaged components can impair and endanger operation. Never use damaged components. |

| |
|--|
| NOTICE |
| Condensation Store the device in the service room for at least two hours before applying voltage to the device for the first time. This will equalize the temperature and prevent the formation of condensation. |

Checks

Once you have correctly installed the PAC RS485 expansion module, you should carry out the following checks:

1. Check that the PAC RS485 expansion module is connected to the SENTRON PAC Power Monitoring Device correctly.
2. Check that the cables are correctly connected and screwed to the terminal block.
3. Check that the RS 485 bus is correctly grounded and shielded.
4. Check that the ventilation slots are not covered.
5. Check that the relevant terminating resistors have been switched.

See also

Assembly (Page 21)

Connecting (Page 23)

4.6 Disassembly

Disassembling

1. Ensure safe isolation from supply.
2. Observe the ESD Guidelines. Discharge yourself. Handle the PAC RS485 expansion module by the plastic housing only.
3. Remove the terminal block from the expansion module, or detach the cable from the terminal block.
4. Unscrew the PAC RS485 expansion module from the SENTRON PAC Power Monitoring Device.
5. Remove the PAC RS485 expansion module from the SENTRON PAC Power Monitoring Device.
6. If necessary, disassemble the SENTRON PAC Power Monitoring Device.



More information

Disassembling the SENTRON PAC Power Monitoring Device

You can find information about how to disassemble the SENTRON PAC Power Monitoring Device in the manual for the SENTRON PAC Power Monitoring Device.

See also

Electrostatic sensitive devices (ESD) (Page 81)

Parameter assignment/Addressing

5.1 MODBUS RTU

5.1.1 Structure of the job message frame

Structure

Data traffic between the master and the slave and between the slave and the master begins with the address of the slave. The job message frame consists of the following elements:

1. Address of the MODBUS slave
2. Function code
3. Data of the message frame
4. Checksum of the message frame (CRC)

The structure of the data field depends on the function code used.

Table 5-1 Structure of the message frame

| Address | Function code | data | CRC |
|---------|---------------|--------|---------|
| Byte | Byte | n byte | 2 bytes |

Cyclic Redundancy Check (CRC)

The Cyclic Redundancy Check checks the data flow. The CRC consists of 2 Bytes:

- One LSB
- One MSB

The transmitting device calculates the CRC and appends it to the message. The receiving device calculates the CRC again and compares the newly calculated value with the received CRC. If the two values do not agree, an error has occurred.

End of a message frame

If no characters are transferred for the space of 3.5 bytes this is taken as the end of the message frame. A check is made to determine the validity of the message frame.

Validity of the message frame

Gaps in the message frame are filled with 0xFFFFFFFF. FFFFFFFF means the message frame contains no measured values. This means it is invalid. If the message frame has a different content it is in principle valid.

See also

Function codes (Page 31)

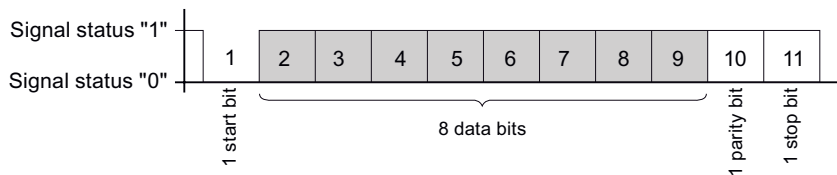
5.1.2 Character frame

The MODBUS RTU specification defines the data format. The user can change the data format.

Structure of the character frame

The data is transferred between the SENTRON PAC Power Monitoring Device and the MODBUS master via the serial interface in an 11-bit character frame. In exceptional cases, only 10 bits are used.

8 data bits: 1 start bit, 8 data bits, 1 parity bit, 1 stop bit



8 data bits: 1 start bit, 8 data bits, 2 stop bits

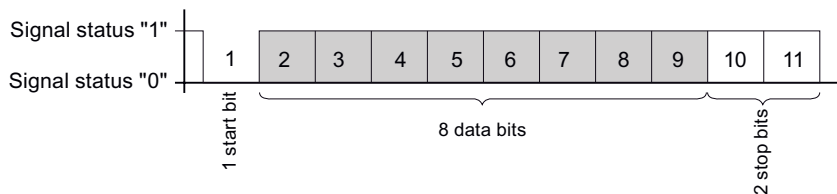


Figure 5-1 11-bit character frame

8 data bits: 1 start bit, 8 data bits, 1 stop bit



Figure 5-2 10-bit character frame

The Least Significant Bit (LSB) is sent at the start of the eight data bits, and the Most Significant Bit (MSB) is sent at the end.

See also

Configuration of the PAC RS485 expansion module on the SENTRON PAC3200 Power Monitoring Device (Page 58)

5.1.3 Function codes

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

If an error occurs, the MSB bit is set in the response frame in the FC byte.

Supported MODBUS function codes

Table 5-2 Supported function codes

| FC | Function in accordance with MODBUS specification | Data Type | | Access |
|----|--|-----------|--------|--------|
| 02 | Read Discrete Inputs | Bit | Input | R |
| 03 | Read Holding Registers | Register | Output | R |
| 04 | Read Input Registers | Register | Input | R |
| 06 | Write Single Register | Register | Output | RW |
| 10 | Write Multiple Registers | Register | - | RW |
| 2B | Read Device Identification | - | - | R |

FC 02

This function code reads individual bits from the slave.

Corresponding exception codes: 01, 02, 03 or 04
 Corresponding error code: 0x82
 Status: 0 = OFF
 1 = ON

FC 03

You can read out device registers with this function code.

Number of requested registers: At least 1 to maximum 125
 Corresponding exception codes: 01, 02, 03 or 04
 Corresponding error code: 0x83

FC 04

You can read out device registers with this function code.

| | |
|--------------------------------|---------------------------|
| Number of requested registers: | At least 1 to maximum 125 |
| Corresponding exception codes: | 01, 02, 03 or 04 |
| Corresponding error code: | 0x84 |

FC 06

This function code overwrites a slave register with a new value.

| | |
|--------------------------------|------------------|
| Corresponding exception codes: | 01, 02, 03 or 04 |
| Corresponding error code: | 0x86 |

FC 10

This function code writes a block of one to a maximum of 123 connected registers into the device.

| | |
|--------------------------------|------------------|
| Corresponding exception codes: | 01, 02, 03 or 04 |
| Corresponding error code: | 0x90 |

FC 2B

This function code reads a string. In conjunction with the MEIType 14 (0x0E), it reads the Device Identification. The ReadDevID code 01 controls reading of the Basic Device Identification. The object ID specifies whether the manufacturer, the manufacturer's device name, or the firmware version/bootloader version is to be read.

| | |
|--|------------------|
| Corresponding exception codes: | 01, 02, 03 or 04 |
| Corresponding error code: | 0xAB |
| MODBUS Encapsulated Interface type (MEItype) | 0x0E |
| ReadDevID code ¹⁾ | 01 |

1) Read Device Identification code

See also

MODBUS standard device identification with the function code 0x2B (Page 55)

Structure of the job message frame (Page 29)

Exception codes (Page 33)

5.1.4 Exception codes

Overview

Table 5-3 MODBUS exception codes

| Exception codes | Name | Meaning | Remedy |
|-----------------|----------------------|---|---|
| 01 | Illegal Function | Illegal function: <ul style="list-style-type: none"> • The function code in the request is not a permissible action for the slave. • The slave is in a status in which it cannot process a request of this type. This is the case, for example, if it has not yet been configured and is requested to return register values. | Check which function codes are supported. |
| 02 | Illegal Data Address | Illegal data address This address is not permissible for the slave. This is the case, for example, if the combination of start offset and transfer length is invalid. | Check the offset and the number of registers. |
| 03 | Illegal Data Value | Illegal data value: The request contains a data value that is not permissible for the slave. This indicates an error in the remaining structure of a complex request, e.g. an incorrect data length. | Check that the specified offset and the specified data length in the command are correct. |
| 04 | Slave Device Failure | Error in processing the data: An indefinite error occurred when the slave attempted to execute the requested action. | Check that the specified offset and the specified data length are correct. |

5.1.5 Modbus measured variables with the function codes 0x03 and 0x04

Measured variables of the SENTRON PAC Power Monitoring Device

The measured variables are provided by the SENTRON PAC Power Monitoring Device. You can use the MODBUS function codes 0x03 and 0x04 on all the measured variables listed below.

NOTICE

Error in the case of inconsistent access to measured values

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

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

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

Table 5-4 Available measured variables

| Offset | Number of registers | Name | Format | Unit | Value range | Access |
|--------|---------------------|----------------------------|--------|------|-------------|--------|
| 1 | 2 | Voltage V_{a-n} | Float | V | - | R |
| 3 | 2 | Voltage V_{b-n} | Float | V | - | R |
| 5 | 2 | Voltage V_{c-n} | Float | V | - | R |
| 7 | 2 | Voltage V_{a-b} | Float | V | - | R |
| 9 | 2 | Voltage V_{b-c} | Float | V | - | R |
| 11 | 2 | Voltage V_{c-a} | Float | V | - | R |
| 13 | 2 | Current a | Float | A | - | R |
| 15 | 2 | Current b | Float | A | - | R |
| 17 | 2 | Current c | Float | A | - | R |
| 19 | 2 | Apparent Power a | Float | VA | - | R |
| 21 | 2 | Apparent Power b | Float | VA | - | R |
| 23 | 2 | Apparent Power c | Float | VA | - | R |
| 25 | 2 | Active Power a | Float | W | - | R |
| 27 | 2 | Active Power b | Float | W | - | R |
| 29 | 2 | Active Power c | Float | W | - | R |
| 31 | 2 | Reactive Power a | Float | var | - | R |
| 33 | 2 | Reactive Power b | Float | var | - | R |
| 35 | 2 | Reactive Power c | Float | var | - | R |
| 37 | 2 | Power Factor a | Float | - | 0 ... 1 | R |
| 39 | 2 | Power Factor b | Float | - | 0 ... 1 | R |
| 41 | 2 | Power Factor c | Float | - | 0 ... 1 | R |
| 43 | 2 | THD-R Voltage a | Float | % | 0 ... 100 | R |
| 45 | 2 | THD-R Voltage b | Float | % | 0 ... 100 | R |
| 47 | 2 | THD-R Voltage c | Float | % | 0 ... 100 | R |
| 49 | 2 | THD-R Current a | Float | % | 0 ... 100 | R |
| 51 | 2 | THD-R Current b | Float | % | 0 ... 100 | R |
| 53 | 2 | THD-R Current c | Float | % | 0 ... 100 | R |
| 55 | 2 | Frequency | Float | Hz | 45 ... 65 | R |
| 57 | 2 | Average Voltage V_{ph-n} | Float | V | - | R |

| Offset | Number of registers | Name | Format | Unit | Value range | Access |
|--------|---------------------|----------------------------------|--------|------|-------------|--------|
| 59 | 2 | Average Voltage V_{ph-ph} | Float | V | - | R |
| 61 | 2 | Average Current | Float | A | - | R |
| 63 | 2 | Total Apparent Power | Float | VA | - | R |
| 65 | 2 | Total Active Power | Float | W | - | R |
| 67 | 2 | Total Reactive Power | Float | var | - | R |
| 69 | 2 | Total Power Factor | Float | | - | R |
| 71 | 2 | Amplitude Unbalance - Voltage | Float | % | 0 ... 100 | R |
| 73 | 2 | Amplitude Unbalance - Current | Float | % | 0 ... 200 | R |
| 75 | 2 | Maximum Voltage V_{a-n} | Float | V | - | R |
| 77 | 2 | Maximum Voltage V_{b-n} | Float | V | - | R |
| 79 | 2 | Maximum Voltage V_{c-n} | Float | V | - | R |
| 81 | 2 | Max. Voltage V_{a-b} | Float | V | - | R |
| 83 | 2 | Max. Voltage V_{b-c} | Float | V | - | R |
| 85 | 2 | Max. Voltage V_{c-a} | Float | V | - | R |
| 87 | 2 | Maximum Current a | Float | A | - | R |
| 89 | 2 | Maximum Current b | Float | A | - | R |
| 91 | 2 | Maximum Current c | Float | A | - | R |
| 93 | 2 | Maximum Apparent Power a | Float | VA | - | R |
| 95 | 2 | Maximum Apparent Power b | Float | VA | - | R |
| 97 | 2 | Maximum Apparent Power c | Float | VA | - | R |
| 99 | 2 | Maximum Active Power a | Float | W | - | R |
| 101 | 2 | Maximum Active Power b | Float | W | - | R |
| 103 | 2 | Maximum Active Power c | Float | W | - | R |
| 105 | 2 | Maximum Reactive Power a | Float | var | - | R |
| 107 | 2 | Maximum Reactive Power b | Float | var | - | R |
| 109 | 2 | Maximum Reactive Power c | Float | var | - | R |
| 111 | 2 | Maximum Power Factor a | Float | | 0 ... 1 | R |
| 113 | 2 | Maximum Power Factor b | Float | | 0 ... 1 | R |
| 115 | 2 | Maximum Power Factor c | Float | | 0 ... 1 | R |
| 117 | 2 | Maximum THD-R Voltage a | Float | % | 0 ... 100 | R |
| 119 | 2 | Maximum THD-R Voltage b | Float | % | 0 ... 100 | R |
| 121 | 2 | Maximum THD-R Voltage c | Float | % | 0 ... 100 | R |
| 123 | 2 | Maximum THD-R Current a | Float | % | 0 ... 100 | R |
| 125 | 2 | Maximum THD-R Current b | Float | % | 0 ... 100 | R |
| 127 | 2 | Maximum THD-R Current c | Float | % | 0 ... 100 | R |
| 129 | 2 | Max. Frequency | Float | Hz | 45 ... 65 | R |
| 131 | 2 | Max. Average Voltage V_{ph-n} | Float | V | - | R |
| 133 | 2 | Max. Average Voltage V_{ph-ph} | Float | V | - | R |
| 135 | 2 | Max. Average Current | Float | A | - | R |
| 137 | 2 | Max. Total Apparent Power | Float | VA | - | R |
| 139 | 2 | Max. Total Active Power | Float | W | - | R |

5.1 MODBUS RTU

| Offset | Number of registers | Name | Format | Unit | Value range | Access |
|--------|---------------------|---------------------------------------|---------------|------|------------------------------|--------|
| 141 | 2 | Max. Total Reactive Power | Float | var | - | R |
| 143 | 2 | Maximum Total Power Factor | Float | | - | R |
| 145 | 2 | Minimum Voltage V_{a-n} | Float | V | - | R |
| 147 | 2 | Minimum Voltage V_{b-n} | Float | V | - | R |
| 149 | 2 | Minimum Voltage V_{c-n} | Float | V | - | R |
| 151 | 2 | Min. Voltage V_{a-b} | Float | V | - | R |
| 153 | 2 | Min. Voltage V_{b-c} | Float | V | - | R |
| 155 | 2 | Min. Voltage V_{c-a} | Float | V | - | R |
| 157 | 2 | Minimum Current a | Float | A | - | R |
| 159 | 2 | Minimum Current b | Float | A | - | R |
| 161 | 2 | Minimum Current c | Float | A | - | R |
| 163 | 2 | Minimum Apparent Power a | Float | VA | - | R |
| 165 | 2 | Minimum Apparent Power b | Float | VA | - | R |
| 167 | 2 | Minimum Apparent Power c | Float | VA | - | R |
| 169 | 2 | Minimum Active Power a | Float | W | - | R |
| 171 | 2 | Minimum Active Power b | Float | W | - | R |
| 173 | 2 | Minimum Active Power c | Float | W | - | R |
| 175 | 2 | Minimum Reactive Power a | Float | var | - | R |
| 177 | 2 | Minimum Reactive Power b | Float | var | - | R |
| 179 | 2 | Minimum Reactive Power c | Float | var | - | R |
| 181 | 2 | Minimum Power Factor a | Float | - | 0 ... 1 | R |
| 183 | 2 | Minimum Power Factor b | Float | - | 0 ... 1 | R |
| 185 | 2 | Minimum Power Factor c | Float | - | 0 ... 1 | R |
| 187 | 2 | Min. Frequency | Float | Hz | 45 ... 65 | R |
| 189 | 2 | Min. Average Voltage V_{ph-n} | Float | V | - | R |
| 191 | 2 | Min. Average Voltage V_{ph-ph} | Float | V | - | R |
| 193 | 2 | Min. Average Current | Float | A | - | R |
| 195 | 2 | Min. Total Apparent Power | Float | VA | - | R |
| 197 | 2 | Min. Total Active Power | Float | W | - | R |
| 199 | 2 | Min. Total Reactive Power | Float | var | - | R |
| 201 | 2 | Minimum Total Power Factor | Float | var | - | R |
| 203 | 2 | Limit Violations* | Unsigned long | - | Byte 3 Bit 0 Limit 0 | R |
| 205 | 2 | Device Diagnostics and Device Status* | Unsigned long | - | Byte 0 System status | R |
| 207 | 2 | Status of the digital outputs* | Unsigned long | - | Byte 3 Bit 0 Output 0 | R |
| 209 | 2 | Status of the digital inputs* | Unsigned long | - | Byte 3 Bit 0 Input 0 | R |
| 211 | 2 | Active Tariff | Unsigned long | - | 0 = Tariff 1 1 = Tariff 2 | R |
| 213 | 2 | Working hours counter | Unsigned long | s | 0 ... 999999999 | RW |
| 215 | 2 | Universal counter | Unsigned long | - | 0 ... 999999999 | RW |
| 217 | 2 | Relevant Parameter Changes Counter | Unsigned long | - | - | R |

| Offset | Number of registers | Name | Format | Unit | Value range | Access |
|--------|---------------------|--|---------------|------|------------------|--------|
| 219 | 2 | Counter All Parameter Changes | Unsigned long | - | - | R |
| 221 | 2 | Counter Limit Violations | - | - | - | R |
| 501 | 2 | Demand Active Power - Import | Float | W | - | R |
| 503 | 2 | Demand Reactive Power - Import | Float | var | - | R |
| 505 | 2 | Demand Active Power - Export | Float | W | - | R |
| 507 | 2 | Demand Reactive Power - Export | Float | var | - | R |
| 509 | 2 | Maximum Active Power Reading during the period | Float | W | - | R |
| 511 | 2 | Minimum Active Power Reading during the period | Float | W | - | R |
| 513 | 2 | Maximum Reactive Power Reading during the period | Float | var | - | R |
| 515 | 2 | Minimum Reactive Power Reading during the period | Float | var | - | R |
| 517 | 2 | Demand Period | Unsigned long | s | - | R |
| 519 | 2 | Time Since Start of the active demand period | Unsigned long | s | - | R |
| 801 | 4 | Active Energy Import Tariff 1 | Double | Wh | Overflow 1.0e+12 | RW |
| 805 | 4 | Active Energy Import Tariff 2 | Double | Wh | Overflow 1.0e+12 | RW |
| 809 | 4 | Active Energy Export Tariff 1 | Double | Wh | Overflow 1.0e+12 | RW |
| 813 | 4 | Active Energy Export Tariff 2 | Double | Wh | Overflow 1.0e+12 | RW |
| 817 | 4 | Reactive Energy Import Tariff 1 | Double | varh | Overflow 1.0e+12 | RW |
| 821 | 4 | Reactive Energy Import Tariff 2 | Double | varh | Overflow 1.0e+12 | RW |
| 825 | 4 | Reactive Energy Export Tariff 1 | Double | varh | Overflow 1.0e+12 | RW |
| 829 | 4 | Reactive Energy Export Tariff 2 | Double | varh | Overflow 1.0e+12 | RW |
| 833 | 4 | Apparent Energy Tariff 1 | Double | VAh | Overflow 1.0e+12 | RW |
| 837 | 4 | Apparent Energy Tariff 2 | Double | VAh | Overflow 1.0e+12 | RW |

The following tables contain further details of all measured variables indicated by at least one *.

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

See also

Structure - Digital input status and digital output status with the function codes 0x03 and 0x04 (Page 38)

Structure - Device diagnostics and device status with the function codes 0x03 and 0x04 (Page 38)

Structure - Limit values with function codes 0x03 and 0x04 (Page 39)

5.1.6 Structure

5.1.6.1 Structure - Digital input status and digital output status with the function codes 0x03 and 0x04

The following are available via MODBUS:

- "Status of the Digital Inputs"
- "Status of the Digital Outputs"

Input status and output status of the SENTRON PAC Power Monitoring Device

Table 5-5 Structure - Status of the digital inputs and status of the digital outputs

| Name | Length | Status | Byte | Bit | Bit mask | Access |
|-------------------------------|---------|--------|------|-----|------------|--------|
| Status of the Digital Outputs | 32 bits | DO | 3 | 0 | 0x00000001 | R |
| Status of the Digital Inputs | 32 bits | DI | 3 | 0 | 0x00000001 | R |

See also

Modbus status parameters with the function code 0x02 (Page 39)

5.1.6.2 Structure - Device diagnostics and device status with the function codes 0x03 and 0x04

Design

Table 5-6 Modbus offset 205, tab 2: Structure device status and device diagnostics

| Byte | Bit | Device status | Type | Bit mask | Value range | Access |
|------|-----|---|--------|------------|--|--------|
| 0 | 0 | No synchronization pulse | Status | 0x01000000 | 0 = Not active 1 = active | R |
| 0 | 1 | Device Configuration menu is active | Status | 0x02000000 | | R |
| 0 | 2 | Voltage overload | Status | 0x04000000 | | R |
| 0 | 3 | Current overload | Status | 0x08000000 | | R |
| 1 | 0 | Module slot 1 | Status | 0x00010000 | | R |
| 1 | 1 | Maximum pulse rate exceeded | Status | 0x00020000 | | R |
| 2 | 0 | Relevant parameter changes ¹⁾ | saving | 0x00000100 | | R |
| 2 | 1 | Upper or lower limit violation ¹⁾ | saving | 0x00000200 | | R |
| 2 | 2 | Maximum pulse rate exceeded ¹⁾ | saving | 0x00000400 | | R |
| 2 | 3 | Restart of the device ¹⁾ | saving | 0x00000800 | | R |
| 2 | 4 | Resetting of energy counter by user ¹⁾ | saving | 0x00001000 | R | |

1) Only these device statuses are to be acknowledged.

See also

Modbus status parameters with the function code 0x02 (Page 39)

5.1.6.3 Structure - Limit values with function codes 0x03 and 0x04

Structure of the limit values

Table 5-7 Modbus Offset 203, Register 2: Limit Violations

| Byte | Bit | Status | Bit mask | Value range | Access |
|------|-----|-------------|------------|---|--------|
| 3 | 0 | Limit 0 | 0x00000001 | 0 = No limit violation 1 = Limit violation | R |
| 3 | 1 | Limit 1 | 0x00000002 | | R |
| 3 | 2 | Limit 2 | 0x00000004 | | R |
| 3 | 3 | Limit 3 | 0x00000008 | | R |
| 3 | 4 | Limit 4 | 0x00000010 | | R |
| 3 | 5 | Limit 5 | 0x00000020 | | R |
| 0 | 0 | Limit Logic | 0x01000000 | | R |

See also

Modbus status parameters with the function code 0x02 (Page 39)

5.1.7 Modbus status parameters with the function code 0x02

Status parameters

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

Table 5-8 Status parameters

| Offset | Number of registers | Name | Format | Value range | Access |
|--------|---------------------|-------------------------------------|--------|---|--------|
| 0 | 0 | Limit 0 status | Bit | 0 = No limit violation 1 = Limit violation | R |
| 1 | 0 | Limit 1 status | Bit | | R |
| 2 | 0 | Limit 2 status | Bit | | R |
| 3 | 0 | Limit 3 status | Bit | | R |
| 4 | 0 | Limit 4 status | Bit | | R |
| 5 | 0 | Limit 5 status | Bit | | R |
| 50 | 0 | Limit Logic status | Bit | 0 = Not active 1 = active | R |
| 108 | 0 | Relevant parameter changes | Bit | | R |
| 109 | 0 | Upper or lower limit violation | Bit | | R |
| 110 | 0 | Maximum pulse rate exceeded | Bit | | R |
| 111 | 0 | Restart of the device | Bit | | R |
| 112 | 0 | Resetting of energy counter by user | Bit | | R |
| 116 | 0 | Module slot 1 | Bit | | R |
| 117 | 0 | Maximum pulse rate exceeded | Bit | | R |

5.1 MODBUS RTU

| Offset | Number of registers | Name | Format | Value range | Access |
|--------|---------------------|-------------------------------------|--------|-------------|--------|
| 124 | 0 | No synchronization pulse | Bit | | R |
| 125 | 0 | Device Configuration menu is active | Bit | | R |
| 126 | 0 | Voltage overload | Bit | | R |
| 127 | 0 | Current overload | Bit | | R |
| 200 | 0 | Digital input 0 | Bit | | R |
| 300 | 0 | Digital output 0 | Bit | | R |

See also

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)

Structure - Digital input status and digital output status with the function codes 0x03 and 0x04 (Page 38)

Structure - Device diagnostics and device status with the function codes 0x03 and 0x04 (Page 38)

Structure - Limit values with function codes 0x03 and 0x04 (Page 39)

5.1.8 Modbus settings with the function codes 0x03, 0x04 and 0x10

Addressing the settings

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

Table 5-9 Settings parameters

| Offset | Number of registers | Name | Unit | Format | Value range | Access | |
|--------|---------------------|---|------|---------------|----------------|--------|----|
| 50001 | 2 | Connection type | - | unsigned long | 0 = | 3P4W | RW |
| | | | | | 1 = | 3P3W | |
| | | | | | 2 = | 3P4WB | |
| | | | | | 3 = | 3P3WB | |
| | | | | | 4 = | 1P2W | |
| 50003 | 2 | Voltage measurement using voltage transformers? | - | unsigned long | 0 = | No | RW |
| | | | | | 1 = | Yes | |
| 50005 | 2 | Primary voltage | - | unsigned long | 1 ... 999999 V | RW | |
| 50007 | 2 | Secondary voltage | - | unsigned long | 1 ... 690 V | RW | |
| 50011 | 2 | Primary current | - | unsigned long | 1 ... 99999 A | RW | |
| 50013 | 2 | Secondary current | - | unsigned long | 1 A, 5 A | RW | |
| 50015 | 2 | Invert CT polarity? | - | unsigned long | 0 = | No | RW |
| | | | | | 1 = | Yes | |

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|--|------|---------------|--|--------|
| 50019 | 2 | Zero point suppression level (% rated current) | % | float | 0.0 ... 10.0 | RW |
| 50021 | 2 | Demand Period | Min. | unsigned long | 1 ... 60 | RW |
| 50023 | 2 | Synchronization | - | unsigned long | 0 = No synchronization 1 = Synchronization via bus 2 = Synchronization via the digital input | RW |

Table 5-10 Settings parameter for the digital input

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|---|------|---------------|---|--------|
| 50025 | 2 | "Action" mode | - | unsigned long | 0 = Status only 1 = Pulse input 2 = High tariff/low tariff switch 3 = DEMAND synchronization | RW |
| 50029 | 2 | "Pulse input" mode | - | unsigned long | 0 = Import kWh 1 = Export kWh 2 = Import kvarh 3 = Export kvarh | RW |
| 50031 | 2 | Pulses per unit (pulses per 1000 Wh / VARh) | - | unsigned long | 1 ... 999 | RW |

Table 5-11 Settings parameter for the digital output

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|---|------|---------------|---|--------|
| 50033 | 2 | Switching function Assignment to a vector group | - | unsigned long | 0 ... 99 | RW |
| 50035 | 2 | "Action" mode | - | unsigned long | 0 = Off 1 = Device on 2 = Remote output 3 = Direction of rotation 4 = Limit violation 5 = Energy pulse | RW |

5.1 MODBUS RTU

| Offset | Number of registers | Name | Unit | Format | Value range | Access | |
|--------|---------------------|---|------|---------------|-------------|--------------|----|
| 50037 | 2 | "Limit violation" mode | - | unsigned long | 0 = | Limit Logic | RW |
| | | | | | 1 = | Limit 0 | |
| | | | | | 2 = | Limit 1 | |
| | | | | | 3 = | Limit 2 | |
| | | | | | 4 = | Limit 3 | |
| | | | | | 5 = | Limit 4 | |
| | | | | | 6 = | Limit 5 | |
| 50041 | 2 | "Energy pulse" mode | - | unsigned long | 0 = | Import kWh | RW |
| | | | | | 1 = | Export kWh | |
| | | | | | 2 = | Import kvarh | |
| | | | | | 3 = | Export kvarh | |
| 50043 | 2 | Pulses per unit (pulses per 1000 Wh / VARh) | - | unsigned long | 1 ... 999 | RW | |
| 50045 | 2 | Pulse length | ms | unsigned long | 30 ... 500 | RW | |

Table 5-12 Settings parameter for language, phase labels and universal counters source

| Offset | Number of registers | Name | Unit | Format | Value range | Access | |
|--------|---------------------|--------------------------|------|---------------|-------------|----------------|----|
| 50047 | 2 | Active language | - | unsigned long | 0 = | German | RW |
| | | | | | 1 = | English | |
| | | | | | 2 = | Portuguese | |
| | | | | | 3 = | Turkish | |
| | | | | | 4 = | Spanish | |
| | | | | | 5 = | Italian | |
| | | | | | 6 = | Russian | |
| | | | | | 7 = | French | |
| | | | | | 8 = | Chinese | |
| 50049 | 2 | Phase labels IEC/NAFTA | - | unsigned long | 0 = | IEC | RW |
| | | | | | 1 = | NAFTA | |
| 50051 | 2 | Universal counter source | - | unsigned long | 0 = | Digital input | RW |
| | | | | | 1 = | Digital output | |
| | | | | | 2 = | Limit Logic | |
| | | | | | 3 = | Limit 0 | |
| | | | | | 4 = | Limit 1 | |
| | | | | | 5 = | Limit 2 | |
| | | | | | 6 = | Limit 3 | |
| | | | | | 7 = | Limit 4 | |
| | | | | | 8 = | Limit 5 | |

Table 5-13 Settings parameter for the display

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|-------------------------------|------|---------------|--------------|--------|
| 50053 | 2 | Refresh time | ms | unsigned long | 330 ... 3000 | RW |
| 50055 | 2 | Contrast | - | unsigned long | 1 ... 10 | RW |
| 50057 | 2 | Backlight level - Normal mode | % | unsigned long | 0 ... 3 | RW |
| 50059 | 2 | Backlight dimmed | % | unsigned long | 0 ... 3 | RW |
| 50061 | 2 | Backlight time until dimmed | Min. | unsigned long | 0 ... 240 | RW |

Table 5-14 Settings parameter for limit value 0

| Offset | Number of registers | Name | Unit | Format | Value range | Access | |
|--------|---------------------|--------------------------|------|---------------|--------------|----------|----|
| 50063 | 2 | ON/OFF | - | unsigned long | 0 = | OFF | RW |
| | | | | | 1 = | ON | |
| 50065 | 2 | Hysteresis | % | float | 0.0 ... 20.0 | RW | |
| 50067 | 2 | Delay | s | unsigned long | 0 ... 10 | RW | |
| 50069 | 2 | Operation in Limit Logic | - | unsigned long | 0 = | not used | RW |
| | | | | | 1 = | AND | |
| | | | | | 2 = | OR | |
| 50071 | 2 | Source | - | unsigned long | 0 = | V_L1 | RW |
| | | | | | 1 = | V_L2 | |
| | | | | | 2 = | V_L3 | |
| | | | | | 3 = | V_L12 | |
| | | | | | 4 = | V_L23 | |
| | | | | | 5 = | V_L31 | |
| | | | | | 6 = | I_L1 | |
| | | | | | 7 = | I_L2 | |
| | | | | | 8 = | I_L3 | |
| | | | | | 9 = | VA_L1 | |
| | | | | | 10 = | VA_L2 | |
| | | | | | 11 = | VA_L3 | |
| | | | | | 12 = | P_L1 | |
| | | | | | 13 = | P_L2 | |
| | | | | | 14 = | P_L3 | |
| 15 = | VAR_L1 | | | | | | |
| 16 = | VAR_L2 | | | | | | |
| 17 = | VAR_L3 | | | | | | |
| 18 = | PF_L1 | | | | | | |
| 19 = | PF_L2 | | | | | | |
| 20 = | PF_L3 | | | | | | |
| 21 = | THDV_L1 | | | | | | |
| 22 = | THDV_L2 | | | | | | |

5.1 MODBUS RTU

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|-------------|------|---------------|---|--------|
| | | | | | 23 = THDV_L3 24 = THDI_L1 25 = THDI_L2 26 = THDI_L3 27 = FREQ 28 = V_LN_AVG 29 = V_LL_AVG 30 = I_AVG 31 = VA_SUM 32 = P_SUM 33 = VAR_SUM 34 = PF_SUM 35 = V_BAL 36 = I_BAL | |
| 50073 | 2 | Value | - | float | - | RW |
| 50075 | 2 | Modus ≥ / < | - | unsigned long | 0 = greater than 1 = less than | RW |

Table 5-15 Settings parameter for limit value 1

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|--------------------------|------|---------------|---|--------|
| 50077 | 2 | ON/OFF | - | unsigned long | 0 = OFF 1 = ON | RW |
| 50079 | 2 | Hysteresis | % | float | 0.0 ... 20.0 | RW |
| 50081 | 2 | Delay | s | unsigned long | 0 ... 10 | RW |
| 50083 | 2 | Operation in Limit Logic | - | unsigned long | 0 = not used 1 = AND 2 = OR | RW |
| 50085 | 2 | Source | - | unsigned long | 0 = V_L1 1 = V_L2 2 = V_L3 3 = V_L12 4 = V_L23 5 = V_L31 6 = I_L1 7 = I_L2 8 = I_L3 9 = VA_L1 10 = VA_L2 11 = VA_L3 12 = P_L1 | RW |

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|------------------|------|---------------|------------------|--------|
| | | | | | 13 = P_L2 | |
| | | | | | 14 = P_L3 | |
| | | | | | 15 = VAR_L1 | |
| | | | | | 16 = VAR_L2 | |
| | | | | | 17 = VAR_L3 | |
| | | | | | 18 = PF_L1 | |
| | | | | | 19 = PF_L2 | |
| | | | | | 20 = PF_L3 | |
| | | | | | 21 = THDV_L1 | |
| | | | | | 22 = THDV_L2 | |
| | | | | | 23 = THDV_L3 | |
| | | | | | 24 = THDI_L1 | |
| | | | | | 25 = THDI_L2 | |
| | | | | | 26 = THDI_L3 | |
| | | | | | 27 = FREQ | |
| | | | | | 28 = V_LN_AVG | |
| | | | | | 29 = V_LL_AVG | |
| | | | | | 30 = I_AVG | |
| | | | | | 31 = VA_SUM | |
| | | | | | 32 = P_SUM | |
| | | | | | 33 = VAR_SUM | |
| | | | | | 34 = PF_SUM | |
| | | | | | 35 = V_BAL | |
| | | | | | 36 = I_BAL | |
| 50087 | 2 | Value | - | float | - | RW |
| 50089 | 2 | Modus $\geq / <$ | - | unsigned long | 0 = greater than | RW |
| | | | | | 1 = less than | |

Table 5-16 Settings parameter for limit value 2

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|--------------------------|------|---------------|--------------|--------|
| 50091 | 2 | ON/OFF | - | unsigned long | 0 = OFF | RW |
| | | | | | 1 = ON | |
| 50093 | 2 | Hysteresis | % | float | 0.0 ... 20.0 | RW |
| 50095 | 2 | Delay | s | unsigned long | 0 ... 10 | RW |
| 50097 | 2 | Operation in Limit Logic | - | unsigned long | 0 = not used | RW |
| | | | | | 1 = AND | |
| | | | | | 2 = OR | |

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| Offset | Number of registers | Name | Unit | Format | Value range | Access | |
|--------|---------------------|-------------|------|---------------|-------------|--------------|----|
| 50099 | 2 | Source | - | unsigned long | 0 = | V_L1 | RW |
| | | | | | 1 = | V_L2 | |
| | | | | | 2 = | V_L3 | |
| | | | | | 3 = | V_L12 | |
| | | | | | 4 = | V_L23 | |
| | | | | | 5 = | V_L31 | |
| | | | | | 6 = | I_L1 | |
| | | | | | 7 = | I_L2 | |
| | | | | | 8 = | I_L3 | |
| | | | | | 9 = | VA_L1 | |
| | | | | | 10 = | VA_L2 | |
| | | | | | 11 = | VA_L3 | |
| | | | | | 12 = | P_L1 | |
| | | | | | 13 = | P_L2 | |
| | | | | | 14 = | P_L3 | |
| | | | | | 15 = | VAR_L1 | |
| | | | | | 16 = | VAR_L2 | |
| | | | | | 17 = | VAR_L3 | |
| | | | | | 18 = | PF_L1 | |
| | | | | | 19 = | PF_L2 | |
| | | | | | 20 = | PF_L3 | |
| | | | | | 21 = | THDV_L1 | |
| | | | | | 22 = | THDV_L2 | |
| | | | | | 23 = | THDV_L3 | |
| | | | | | 24 = | THDI_L1 | |
| | | | | | 25 = | THDI_L2 | |
| | | | | | 26 = | THDI_L3 | |
| | | | | | 27 = | FREQ | |
| | | | | | 28 = | V_LN_AVG | |
| | | | | | 29 = | V_LL_AVG | |
| | | | | | 30 = | I_AVG | |
| | | | | | 31 = | VA_SUM | |
| | | | | | 32 = | P_SUM | |
| | | | | | 33 = | VAR_SUM | |
| | | | | | 34 = | PF_SUM | |
| | | | | | 35 = | V_BAL | |
| | | | | | 36 = | I_BAL | |
| 50101 | 2 | Value | - | float | - | RW | |
| 50103 | 2 | Modus ≥ / < | - | unsigned long | 0 = | greater than | RW |
| | | | | | 1 = | less than | |

Table 5-17 Settings parameter for limit value 3

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|--------------------------|------|---------------|---------------|--------|
| 50105 | 2 | ON/OFF | - | unsigned long | 0 = OFF | RW |
| | | | | | 1 = ON | |
| 50107 | 2 | Hysteresis | % | float | 0.0 ... 20.0 | RW |
| 50109 | 2 | Delay | s | unsigned long | 0 ... 10 | RW |
| 50111 | 2 | Operation in Limit Logic | - | unsigned long | 0 = not used | RW |
| | | | | | 1 = AND | |
| | | | | | 2 = OR | |
| 50113 | 2 | Source | - | unsigned long | 0 = V_L1 | RW |
| | | | | | 1 = V_L2 | |
| | | | | | 2 = V_L3 | |
| | | | | | 3 = V_L12 | |
| | | | | | 4 = V_L23 | |
| | | | | | 5 = V_L31 | |
| | | | | | 6 = I_L1 | |
| | | | | | 7 = I_L2 | |
| | | | | | 8 = I_L3 | |
| | | | | | 9 = VA_L1 | |
| | | | | | 10 = VA_L2 | |
| | | | | | 11 = VA_L3 | |
| | | | | | 12 = P_L1 | |
| | | | | | 13 = P_L2 | |
| | | | | | 14 = P_L3 | |
| | | | | | 15 = VAR_L1 | |
| | | | | | 16 = VAR_L2 | |
| | | | | | 17 = VAR_L3 | |
| | | | | | 18 = PF_L1 | |
| | | | | | 19 = PF_L2 | |
| | | | | | 20 = PF_L3 | |
| | | | | | 21 = THDV_L1 | |
| | | | | | 22 = THDV_L2 | |
| | | | | | 23 = THDV_L3 | |
| | | | | | 24 = THDI_L1 | |
| | | | | | 25 = THDI_L2 | |
| | | | | | 26 = THDI_L3 | |
| | | | | | 27 = FREQ | |
| | | | | | 28 = V_LN_AVG | |
| | | | | | 29 = V_LL_AVG | |
| | | | | | 30 = I_AVG | |
| | | | | | 31 = VA_SUM | |
| | | | | | 32 = P_SUM | |

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| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|-------------|------|---------------|------------------|--------|
| | | | | | 33 = VAR_SUM | |
| | | | | | 34 = PF_SUM | |
| | | | | | 35 = V_BAL | |
| | | | | | 36 = I_BAL | |
| 50115 | 2 | Value | - | float | - | RW |
| 50117 | 2 | Modus ≥ / < | - | unsigned long | 0 = greater than | RW |
| | | | | | 1 = less than | |

Table 5-18 Settings parameter for limit value 4

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|--------------------------|------|---------------|--------------|--------|
| 50119 | 2 | ON/OFF | - | unsigned long | 0 = OFF | RW |
| | | | | | 1 = ON | |
| 50121 | 2 | Hysteresis | % | float | 0.0 ... 20.0 | RW |
| 50123 | 2 | Delay | s | unsigned long | 0 ... 10 | RW |
| 50125 | 2 | Operation in Limit Logic | - | unsigned long | 0 = not used | RW |
| | | | | | 1 = AND | |
| | | | | | 2 = OR | |
| 50127 | 2 | Source | - | unsigned long | 0 = V_L1 | RW |
| | | | | | 1 = V_L2 | |
| | | | | | 2 = V_L3 | |
| | | | | | 3 = V_L12 | |
| | | | | | 4 = V_L23 | |
| | | | | | 5 = V_L31 | |
| | | | | | 6 = I_L1 | |
| | | | | | 7 = I_L2 | |
| | | | | | 8 = I_L3 | |
| | | | | | 9 = VA_L1 | |
| | | | | | 10 = VA_L2 | |
| | | | | | 11 = VA_L3 | |
| | | | | | 12 = P_L1 | |
| | | | | | 13 = P_L2 | |
| | | | | | 14 = P_L3 | |
| | | | | | 15 = VAR_L1 | |
| | | | | | 16 = VAR_L2 | |
| | | | | | 17 = VAR_L3 | |
| | | | | | 18 = PF_L1 | |
| | | | | | 19 = PF_L2 | |
| | | | | | 20 = PF_L3 | |
| | | | | | 21 = THDV_L1 | |
| | | | | | 22 = THDV_L2 | |

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|--------------------|------|---------------|------------------|--------|
| | | | | | 23 = THDV_L3 | |
| | | | | | 24 = THDI_L1 | |
| | | | | | 25 = THDI_L2 | |
| | | | | | 26 = THDI_L3 | |
| | | | | | 27 = FREQ | |
| | | | | | 28 = V_LN_AVG | |
| | | | | | 29 = V_LL_AVG | |
| | | | | | 30 = I_AVG | |
| | | | | | 31 = VA_SUM | |
| | | | | | 32 = P_SUM | |
| | | | | | 33 = VAR_SUM | |
| | | | | | 34 = PF_SUM | |
| | | | | | 35 = V_BAL | |
| | | | | | 36 = I_BAL | |
| 50129 | 2 | Value | - | float | - | RW |
| 50131 | 2 | Modus \geq / $<$ | - | unsigned long | 0 = greater than | RW |
| | | | | | 1 = less than | |

Table 5-19 Settings parameter for limit value 5

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|--------------------------|------|---------------|--------------|--------|
| 50133 | 2 | ON/OFF | - | unsigned long | 0 = OFF | RW |
| | | | | | 1 = ON | |
| 50135 | 2 | Hysteresis | % | float | 0.0 ... 20.0 | RW |
| 50137 | 2 | Delay | s | unsigned long | 0 ... 10 | RW |
| 50139 | 2 | Operation in Limit Logic | - | unsigned long | 0 = not used | RW |
| | | | | | 1 = AND | |
| | | | | | 2 = OR | |
| 50141 | 2 | Source | - | unsigned long | 0 = V_L1 | RW |
| | | | | | 1 = V_L2 | |
| | | | | | 2 = V_L3 | |
| | | | | | 3 = V_L12 | |
| | | | | | 4 = V_L23 | |
| | | | | | 5 = V_L31 | |
| | | | | | 6 = I_L1 | |
| | | | | | 7 = I_L2 | |
| | | | | | 8 = I_L3 | |
| | | | | | 9 = VA_L1 | |
| | | | | | 10 = VA_L2 | |
| | | | | | 11 = VA_L3 | |
| | | | | | 12 = P_L1 | |

5.1 MODBUS RTU

| Offset | Number of registers | Name | Unit | Format | Value range | Access |
|--------|---------------------|-------------|------|---------------|------------------|--------|
| | | | | | 13 = P_L2 | |
| | | | | | 14 = P_L3 | |
| | | | | | 15 = VAR_L1 | |
| | | | | | 16 = VAR_L2 | |
| | | | | | 17 = VAR_L3 | |
| | | | | | 18 = PF_L1 | |
| | | | | | 19 = PF_L2 | |
| | | | | | 20 = PF_L3 | |
| | | | | | 21 = THDV_L1 | |
| | | | | | 22 = THDV_L2 | |
| | | | | | 23 = THDV_L3 | |
| | | | | | 24 = THDI_L1 | |
| | | | | | 25 = THDI_L2 | |
| | | | | | 26 = THDI_L3 | |
| | | | | | 27 = FREQ | |
| | | | | | 28 = V_LN_AVG | |
| | | | | | 29 = V_LL_AVG | |
| | | | | | 30 = I_AVG | |
| | | | | | 31 = VA_SUM | |
| | | | | | 32 = P_SUM | |
| | | | | | 33 = VAR_SUM | |
| | | | | | 34 = PF_SUM | |
| | | | | | 35 = V_BAL | |
| | | | | | 36 = I_BAL | |
| 50143 | 2 | Value | - | float | - | RW |
| 50145 | 2 | Modus ≥ / < | - | unsigned long | 0 = greater than | RW |
| | | | | | 1 = less than | |

See also

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)

5.1.9 Modbus command parameters

Addressing the command parameters

You can use MODBUS function code 0x06 on the command parameters.

Table 5-20 Command parameters

| Offset | Number of registers | Name | Unit | Format | Value range from ... to | Access | | | | | | | | | | | | | | | | | | | | | | |
|--------------|---------------------------------|--|------|----------------|---|--------------|-------------|--------------|-------------------------------|-----|-------------------------------|-----|-------------------------------|-----|-------------------------------|-----|---------------------------------|-----|---------------------------------|-----|---------------------------------|-----|---------------------------------|-----|--------------------------|------|--------------------------|---|
| 60002 | 1 | Reset maximum values | - | unsigned short | 0 | W | | | | | | | | | | | | | | | | | | | | | | |
| 60003 | 1 | Reset minimum values | - | unsigned short | 0 | W | | | | | | | | | | | | | | | | | | | | | | |
| 60004 | 1 | Reset energy counter | - | unsigned short | <table border="1"> <tr> <td>0 =</td> <td>All</td> </tr> <tr> <td>1 =</td> <td>Active Energy Import Tariff 1</td> </tr> <tr> <td>2 =</td> <td>Active Energy Import Tariff 2</td> </tr> <tr> <td>3 =</td> <td>Active Energy Export Tariff 1</td> </tr> <tr> <td>4 =</td> <td>Active Energy Export Tariff 2</td> </tr> <tr> <td>5 =</td> <td>Reactive Energy Import Tariff 1</td> </tr> <tr> <td>6 =</td> <td>Reactive Energy Import Tariff 2</td> </tr> <tr> <td>7 =</td> <td>Reactive Energy Export Tariff 1</td> </tr> <tr> <td>8 =</td> <td>Reactive Energy Export Tariff 2</td> </tr> <tr> <td>9 =</td> <td>Apparent Energy Tariff 1</td> </tr> <tr> <td>10 =</td> <td>Apparent Energy Tariff 2</td> </tr> </table> | 0 = | All | 1 = | Active Energy Import Tariff 1 | 2 = | Active Energy Import Tariff 2 | 3 = | Active Energy Export Tariff 1 | 4 = | Active Energy Export Tariff 2 | 5 = | Reactive Energy Import Tariff 1 | 6 = | Reactive Energy Import Tariff 2 | 7 = | Reactive Energy Export Tariff 1 | 8 = | Reactive Energy Export Tariff 2 | 9 = | Apparent Energy Tariff 1 | 10 = | Apparent Energy Tariff 2 | W |
| 0 = | All | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 = | Active Energy Import Tariff 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 = | Active Energy Import Tariff 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 = | Active Energy Export Tariff 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 = | Active Energy Export Tariff 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 = | Reactive Energy Import Tariff 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 = | Reactive Energy Import Tariff 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 = | Reactive Energy Export Tariff 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 = | Reactive Energy Export Tariff 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 = | Apparent Energy Tariff 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 = | Apparent Energy Tariff 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60005 | 1 | Synchronization of the demand period | Min. | unsigned short | 1 ... 60 | W | | | | | | | | | | | | | | | | | | | | | | |
| 60006 | 1 | Switching tariff | - | unsigned short | <table border="1"> <tr> <td>0 =</td> <td>High tariff</td> </tr> <tr> <td>1 =</td> <td>Low tariff</td> </tr> </table> | 0 = | High tariff | 1 = | Low tariff | W | | | | | | | | | | | | | | | | | | |
| 0 = | High tariff | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 = | Low tariff | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60007 | 1 | Acknowledge the diagnostics bit ¹ (cf. stored bits in unsigned long beginning offset 205) | - | unsigned short | 0 ... ffffh | W | | | | | | | | | | | | | | | | | | | | | | |
| 60008 | 1 | Switching outputs (if parameterized) | - | unsigned short | <table border="1"> <tr> <td>0 = output 0</td> <td>OFF</td> </tr> <tr> <td>1 = output 0</td> <td>ON</td> </tr> </table> | 0 = output 0 | OFF | 1 = output 0 | ON | W | | | | | | | | | | | | | | | | | | |
| 0 = output 0 | OFF | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 = output 0 | ON | | | | | | | | | | | | | | | | | | | | | | | | | | | |

5.1 MODBUS RTU

| Offset | Number of registers | Name | Unit | Format | Value range from ... to | Access |
|--------|---------------------|--|------|----------------|--|--------|
| 60009 | 1 | Switching command for vector group | - | unsigned short | High 0 ... 99, Low 0 ... 1 High byte group assignment Low byte 1 = ON, 0 = OFF | W |
| 65300 | 1 | Activation of a changed IP configuration/ Ethernet configuration | - | unsigned short | 0 | W |

1) The MODBUS master must acknowledge these diagnostics bits.

See also

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)

5.1.10 MODBUS communication parameter with the function codes 0x03, 0x04 and 0x10

Addressing the communication parameters

Table 5-21 Communication parameters

| Offset | Number of registers | Name | Unit | Format | Applicable MODBUS function codes | Value range from ... to | Access | | | | |
|--------|---------------------|----------------------------|------|---------------|--|---|--------|------------|-----|---------------|----|
| 63001 | 2 | IP address | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 0 ... FFFFFFFFh | RW | | | | |
| 63003 | 2 | Subnet mask | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 0 ... FFFFFFFFh | RW | | | | |
| 63005 | 2 | Gateway | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 0 ... FFFFFFFFh | RW | | | | |
| 63007 | 2 | Bootloader version | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 | char, uchar, uchar, uchar | R | | | | |
| 63009 | 2 | Password protection ON/OFF | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 | 0, 1 | R | | | | |
| 63015 | 2 | Ethernet protocol | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | <table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">0 =</td> <td style="padding: 2px;">MODBUS TCP</td> </tr> <tr> <td style="padding: 2px;">1 =</td> <td style="padding: 2px;">SEAbus TCP</td> </tr> </table> | 0 = | MODBUS TCP | 1 = | SEAbus TCP | RW |
| 0 = | MODBUS TCP | | | | | | | | | | |
| 1 = | SEAbus TCP | | | | | | | | | | |
| 63017 | 2 | Protocol ¹⁾ | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | <table border="1" style="border-collapse: collapse;"> <tr> <td style="padding: 2px;">0 =</td> <td style="padding: 2px;">MODBUS RTU</td> </tr> <tr> <td style="padding: 2px;">1 =</td> <td style="padding: 2px;">SEAbus serial</td> </tr> </table> | 0 = | MODBUS RTU | 1 = | SEAbus serial | RW |
| 0 = | MODBUS RTU | | | | | | | | | | |
| 1 = | SEAbus serial | | | | | | | | | | |

| Offset | Number of registers | Name | Unit | Format | Applicable MODBUS function codes | Value range from ... to | Access | | | | | | | | |
|--------|---------------------|---|------|---------------|--|---|--------|-----|-----|-----|-----|-----|-----|-----|----|
| 63019 | 2 | MODBUS address or Seabus address ¹⁾ | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 1 ... 247 | RW | | | | | | | | |
| 63021 | 2 | Baudrate ¹⁾ | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 0 = 4,800 bit/s 1 = 9,600 bit/s 2 = 19,200 bit/s 3 = 38,400 bit/s Default value = 2 | RW | | | | | | | | |
| 63023 | 2 | Data bits / Parity bits / Stop bits ¹⁾ | - | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | <table border="1"> <tr> <td>0 =</td> <td>8N2</td> </tr> <tr> <td>1 =</td> <td>8E1</td> </tr> <tr> <td>2 =</td> <td>8O1</td> </tr> <tr> <td>3 =</td> <td>8N1</td> </tr> </table> | 0 = | 8N2 | 1 = | 8E1 | 2 = | 8O1 | 3 = | 8N1 | RW |
| 0 = | 8N2 | | | | | | | | | | | | | | |
| 1 = | 8E1 | | | | | | | | | | | | | | |
| 2 = | 8O1 | | | | | | | | | | | | | | |
| 3 = | 8N1 | | | | | | | | | | | | | | |
| 63025 | 2 | Response time ¹⁾ | ms | unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 0 ... 255 0 = Auto | RW | | | | | | | | |

1) Only for the PAC RS485 expansion module

See also

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)

5.1.11 Modbus device information with the function codes 0x03, 0x04 and 0x10

Addressing the device information parameters

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

NOTICE

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

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

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

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

5.1 MODBUS RTU

Table 5-22 I&M 0 parameter of the SENTRON PAC Power Monitoring Device with the function codes 0x03 and 0x04

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

*) 42 stands for Siemens AG

Table 5-23 I&M 1-4 parameters with the function codes 0x03, 0x04 and 0x10

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

Table 5-24 I&M 0 parameter of the module in slot 1 with the function codes 0x03 and 0x04

| Offset | Total registers | Number of registers per parameter | Name | Format | Value range from ... to | Access |
|---------------------------|-----------------|-----------------------------------|-------------------------|-------------------------|---|--------|
| Start offset 64117 | 27 | [1] | Manufacturer's ID | unsigned short | 0 ... 65535 Standard: 42 ^{*)} | R |
| [64118] | | [10] | Order No. | Char 20 | ASCII | R |
| [64128] | | [8] | Serial number | Char 16 | ASCII | R |
| [64136] | | [1] | Hardware version | unsigned short | 0 ... 65535 | R |
| [64137] | | [2] | Firmware version | 1 char, 3 unsigned char | V 0.0.0 ... V 255.255.255 | R |
| [64139] | | [1] | Counter for changes | unsigned short | 1 ... 65535 | R |
| [64140] | | [1] | Profile ID | unsigned short | 3A00 ... F6FF | R |
| [64141] | | [1] | Specific Profile ID | unsigned short | - | R |
| [64142] | | [1] | Version of the I&M data | 2 unsigned char | 0.0 ... 255.255 | R |
| [64143] | | [1] | Supported I&M data | unsigned short | 00 ... FF | R |

*) 42 stands for Siemens AG

See also

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)

5.1.12 MODBUS standard device identification with the function code 0x2B

Addressing the MODBUS standard device identification

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

Table 5-25 MODBUS standard device identification parameters

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

See also

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)
Function codes (Page 31)

5.1.13 Parameters and function codes supported by the broadcast commands

Use of a bus and a master

| |
|--|
| CAUTION |
| Data conflict in the case of incompatibility of the broadcast commands When you use broadcast commands that have the same syntax as, but a different meaning to, those used on the SENTRON PAC Power Monitoring Device, data conflicts result on the bus. Send only broadcast commands that the SENTRON PAC Power Monitoring Device supports in structure and meaning. |

Supported parameters

The broadcast commands of the SENTRON PAC Power Monitoring Device only support certain parameters.

5.1 MODBUS RTU

Table 5-26 Parameters supported by the broadcast commands

| Offset | Number of registers | Name | Format | Applicable MODBUS function codes | Value range | Access | | | | | | | | |
|--------|---------------------------------------|---|----------------|--|---|--------|--------------------|-----|-------------------------|-----|---------------------------------------|-----|-----|----|
| 50023 | 2 | Synchronization | Unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | <table border="1"> <tr> <td>0 =</td> <td>No synchronization</td> </tr> <tr> <td>1 =</td> <td>Synchronization via bus</td> </tr> <tr> <td>2 =</td> <td>Synchronization via the digital input</td> </tr> </table> | 0 = | No synchronization | 1 = | Synchronization via bus | 2 = | Synchronization via the digital input | RW | | |
| 0 = | No synchronization | | | | | | | | | | | | | |
| 1 = | Synchronization via bus | | | | | | | | | | | | | |
| 2 = | Synchronization via the digital input | | | | | | | | | | | | | |
| 63021 | 2 | Baud rate ¹⁾ | Unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 0 = 4,800 bit/s 1 = 9,600 bit/s 2 = 19,200 bit/s 3 = 38,400 bit/s Standard value = 2 | RW | | | | | | | | |
| 63023 | 2 | Data bits / Parity bits / Stop bits ¹⁾ | Unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | <table border="1"> <tr> <td>0 =</td> <td>8N2</td> </tr> <tr> <td>1 =</td> <td>8E1</td> </tr> <tr> <td>2 =</td> <td>8O1</td> </tr> <tr> <td>3 =</td> <td>8N1</td> </tr> </table> | 0 = | 8N2 | 1 = | 8E1 | 2 = | 8O1 | 3 = | 8N1 | RW |
| 0 = | 8N2 | | | | | | | | | | | | | |
| 1 = | 8E1 | | | | | | | | | | | | | |
| 2 = | 8O1 | | | | | | | | | | | | | |
| 3 = | 8N1 | | | | | | | | | | | | | |
| 63025 | 2 | Response time ¹⁾ | Unsigned long | <ul style="list-style-type: none"> • 0x03 • 0x04 • 0x10 | 0 ... 255 0 = Auto | RW | | | | | | | | |
| 60005 | 1 | Synchronization of the demand period in minutes | Unsigned short | <ul style="list-style-type: none"> • 0x06 | 1 ... 60 | W | | | | | | | | |
| 60006 | 1 | Switching tariff | Unsigned short | <ul style="list-style-type: none"> • 0x06 | <table border="1"> <tr> <td>0 =</td> <td>High tariff</td> </tr> <tr> <td>1 =</td> <td>Low tariff</td> </tr> </table> | 0 = | High tariff | 1 = | Low tariff | W | | | | |
| 0 = | High tariff | | | | | | | | | | | | | |
| 1 = | Low tariff | | | | | | | | | | | | | |
| 60009 | 1 | Switching command for vector group | Unsigned short | <ul style="list-style-type: none"> • 0x06 | High 0 ... 99, Low 0 ... 1 High Byte Group assignment Low Byte 1 = ON, 0 = OFF | W | | | | | | | | |

1) Only for the PAC RS485 expansion module

Configuration

6.1 Default settings

Factory default settings

Table 6-1 Factory settings

| Parameter | Value |
|------------------------|--|
| Address | 126 |
| Baud rate | SENTRON PAC3200: 19200 baud |
| Response time | "0" = Auto |
| Communication protocol | MODBUS RTU |
| Settings | 8N2 |
| Language | The communication parameters are displayed in the language set on the SENTRON PAC Power Monitoring Device. Default setting: English |

See also

Changing the address (Page 57)

6.2 Changing the address

NOTICE

Abnormal bus behavior with identical addresses

Several PAC RS485 expansion modules with the same address can cause abnormal behavior of the entire serial RS 485 bus. The master can then not communicate with the slave devices connected to the RS 485 bus. Assign a unique address to every expansion module.

Setting a unique address

Every device requires a unique address. The address is stored in the non-volatile memory of the SENTRON PAC Power Monitoring Device.

Change the address of each device before you begin transferring data. You can change the address:

- Via the menu of the SENTRON PAC Power Monitoring Device
- Via the Ethernet interface, e.g.:
 - MODBUS TCP
 - SEAbus TCP
 - *Sentron powerconfig* from V.1.0.1.0
- RS 485 interface

| |
|---|
| CAUTION |
| Address changes on the device become valid after approx. 2 s |
| When you change the address of the slave on the SENTRON PAC, the new address is accepted as soon as you quit the "Change Address" menu. Reconfigure the master with the new address. Communication is interrupted until this change takes effect. |

See also

Configuration of the PAC RS485 expansion module on the SENTRON PAC3200 Power Monitoring Device (Page 58)

Default settings (Page 57)

6.3 Configuration of the PAC RS485 expansion module on the SENTRON PAC3200 Power Monitoring Device

When the PAC RS485 expansion module is mounted on the SENTRON PAC Power Monitoring Device, you can make the configuration settings for the PAC RS485 expansion module on the Power Monitoring Device.

| |
|---|
| NOTICE |
| Interrupted communication when the nodes on the bus are configured differently |
| If the nodes on the bus are configured differently, communication faults will occur on the bus. Ensure that for all nodes on the bus, the same baud rate, the same settings, the same protocol and the same response time are set on the bus and on the master. |

Settings on the SENTRON PAC Power Monitoring Device

In the main menu of the SENTRON PAC Power Monitoring Device, call "Settings " > "RS485 Module". You then see the following screen:

6.3 Configuration of the PAC RS485 expansion module on the SENTRON PAC3200 Power Monitoring Device

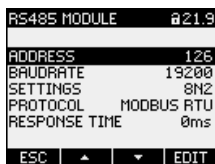


Figure 6-1 Configuring the PAC RS485 expansion module using buttons

"Address":

Each expansion module has a unique address. You set this here. The addresses from 1 to 247 are supported.

| |
|--|
| NOTICE |
| <p>Abnormal behavior of the bus with identical addresses</p> <p>If several expansion modules have the same address, this can result in abnormal behavior of the entire bus. Communication between the master and the slave devices connected to the bus is interrupted.</p> <p>Ensure that every expansion module has a unique address.</p> |

"Baud rate":

You set here the data transfer rate for the external communication of the PAC RS485 expansion module. The baud rate is stored in the non-volatile memory of the SENTRON PAC Power Monitoring Device.

"Settings":

This is where you set the data bits, the parity bit and the stop bits for external communication:

- 8E1 = 8 data bits, parity bit is even, 1 stop bit
- 8O1 = 8 data bits, parity bit is odd, 1 stop bit
- 8N2 = 8 data bits, no parity bit, 2 stop bits
- 8N1 = 8 data bits, no parity bit, 1 stop bit

Table 6-2 Structure of the setting versions

| Digit | Meaning | Possible settings | | |
|-------|---------------------|-------------------|---|---|
| 1 | Number of data bits | 8 | | |
| 2 | Parity bits | Even | = | The data bits are rounded up to an even number. |
| | | Odd | = | The data bits are rounded up to an odd number. |
| | | None | = | No parity bit is sent. |
| 3 | Number of stop bits | 1 or 2 | | |

"Protocol":

You set the communication protocol here:

- MODBUS RTU
- SEAbus

"Response time":

If the Power Monitoring Device communicates over the RS 485 bus with an older MODBUS module from another manufacturer, it may be necessary to delay the response of a slave to a request from the master. The response time corresponds to the set baud rate. At baud rates ≥ 19200 bit/s, the response time corresponds to a character interval of at least 3.5 with regard to the configured baud rate.

Table 6-3 Setting options

| Setting | Meaning |
|-----------|---|
| 0 = Auto | The device automatically sets a response time suitable to the baud rate. This is the minimal response time. |
| 1 ... 255 | Response time in ms |

If you change the baud rate to a value that does not suit the response time set, the program sets the response time to "Auto".

Table 6-4 Performance calculation

| Baud rate | Calculated response time |
|--------------------|--------------------------|
| 4800 baud | At least 9 ms |
| 9600 baud | At least 5 ms |
| $\geq 19,200$ baud | At least 3 ms |

See also

Changing the address (Page 57)

Character frame (Page 30)

Service and maintenance

7.1 Cleaning

Description

The PAC RS485 expansion module is maintenance-free.

| |
|--|
| CAUTION |
| Damage due to detergents Detergents can damage the device. Do not use detergents. |
| NOTICE |
| Defective connector Ensure that the pins of the connector between the expansion module and the SENTRON PAC Power Monitoring Device do not deform. Bent pins can destroy the connector. |

1. Use only a dry, lint-free, antistatic cloth to clean the housing.
2. Clean the pins carefully using a brush.

7.2 Repair

Procedure

| |
|--|
| NOTICE |
| Loss of certification and warranty If you open the module, the module certification will be lost and the Siemens warranty will be invalidated. Only the manufacturer is permitted to carry out repairs on the module. Return faulty or damaged modules to Siemens for repair or replacement. |

If the module is faulty or damaged, proceed as follows:

1. Discharge yourself.
2. Remove the module.
3. Pack the module in a suitable manner to prevent it from being damaged during transport.
4. Return the module to Siemens. You can obtain the address from:
 - Your Siemens sales partner
 - Technical support

See also

Electrostatic sensitive devices (ESD) (Page 81)

Disassembly (Page 27)

Technical support (Page 9)

7.3 Disposal

Disposal and recycling

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

Alarm, error, and system messages

8.1 Diagnostics concept

Diagnostics options

The following diagnostics options are available:

- A two-color LED on the PAC RS485 expansion module
- Evaluation of the following measured variables by the master or following display on the SENTRON PAC Power Monitoring Device:
 - Limit violations
 - Device diagnostics and device status
 - Status of the digital inputs
 - Status of the digital outputs
 - Limit violations counter
- Evaluation by the master of the exception codes and error codes contained in the message frame

See also

Diagnostics LED (Page 64)

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)

Structure - Digital input status and digital output status with the function codes 0x03 and 0x04 (Page 38)

Structure - Device diagnostics and device status with the function codes 0x03 and 0x04 (Page 38)

Structure - Limit values with function codes 0x03 and 0x04 (Page 39)

Function codes (Page 31)

Exception codes (Page 33)

8.2 Diagnostics LED

Significance of the diagnostics LED

The diagnostics LED indicates the communication status.

Table 8-1 Fault and status indication by the LED

| Color | Status | Description | Measure |
|------------------|------------|--|--|
| Green and yellow | Off | No voltage applied to the PAC RS485 expansion module | 1. Check that the PAC RS485 expansion module is correctly connected to the SENTRON PAC Power Monitoring Device. 2. Switch on the supply voltage to the SENTRON PAC Power Monitoring Device. |
| Green | Continuous | <ul style="list-style-type: none">Voltage applied to the PAC RS485 expansion moduleThe bus is not active. | - |
| Green | Flashing | Communication is active on the bus. | - |
| Yellow | Flashing | The PAC RS485 expansion module is sending data. | - |

8.3 Initializing the module

Starting communication between the PAC RS485 expansion module and the SENTRON PAC Power Monitoring Device

1. Power up
2. Initialization phase
3. Starting communication

The PAC RS485 expansion module is initialized. The SENTRON PAC Power Monitoring Device is ready for communication.

The green LED lights continuously.

4. The master is sending data to the SENTRON PAC Power Monitoring Device.

The green LED flashes.

5. The SENTRON PAC Power Monitoring Device is forwarding data to the master.

The yellow LED flashes.

Troubleshooting/FAQs

9.1 Power failure

Settings

The settings of the PAC RS485 expansion module are not lost in the event of a power failure. They are saved in the SENTRON PAC Power Monitoring Device.

Technical data

10.1 Cable

Requirements

Use a serial, shielded, 3-core interface cable:

- Two twisted cores are required for the signals -A and +B
- The third core is required for the Common signal.

The maximum length of the bus cable depends on the following:

- The baud rate
- The properties of the cable used:
 - Thickness
 - Capacitance
 - Characteristic surge impedance
- Number of stations
- The network configuration, e.g. 2-wire cable with shield

Additional information

You can find more information about the cables in the standard ANSI TIA/EIA-485-A-98 and in the "MODBUS over Serial Line Specification and Implementation Guide".

10.2 Standards

Description

Table 10-1 The device meets the following standards

| Standard | Title |
|--|---|
| ANSI TIA/EIA-485-A-98 (R2003) (RS 485) | "Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems" |

Note

Other standards

In addition to the above-mentioned standards, those listed in the manual of the SENTRON PAC Power Monitoring Device also apply.

10.3 Technical data

Mechanical data

Table 10-2 Mechanical data for the PAC RS485 expansion module

| | Values |
|--|---|
| Device type | Slave |
| Dimensions of housing (height x width x depth) | 63 mm x 43 mm x 22 mm |
| Dimensions of housing with terminal block (height x width x depth) | 74 mm x 43 mm x 22 mm |
| Overall depth of SENTRON PAC Power Monitoring Device with mounted PAC RS485 expansion module | 73 mm with a maximum plate thickness of 4 mm |
| Mounting position | Vertical on the SENTRON PAC Power Monitoring Device |
| Housing design | VDT 3400 structure 36 |
| Tolerances | According to DIN 16901:1982-11 |
| Weight | 41 g |
| Connector to SENTRON PAC Power Monitoring Device | 14-pin connector |
| Non-volatile memory | Vertical on the SENTRON PAC Power Monitoring Device |
| Power supply | Power supplied by SENTRON PAC |
| Cooling | Passive air cooling in form of ventilation slots |
| Class of inflammability | V-0 |

Electrical data

Table 10-3 Electrical data for the PAC RS485 expansion module

| | Values |
|---|---------------------------------|
| ANSI TIA/EIA-485-A ¹⁾ wiring for RS 485 interface, galvanically isolated from the device | 5 V ± 5 % |
| Galvanic isolation between the SENTRON PAC Power Monitoring Device and the RS 485 interface | 500 V |
| Galvanic isolation of the supply voltage | Via an isolated DC-DC converter |
| Maximum insulating voltage between the RS 485 bus and the SENTRON PAC | 500 V |
| 1) Formerly RS 485 | |

Ambient and environmental conditions

Table 10-4 Ambient and environmental conditions

| Ambient and environmental conditions | Values |
|--------------------------------------|---------------------------------------|
| Degree of protection | IP20 |
| Permissible degree of pollution | 2 in accordance with IEC 61010-1:2001 |
| Recycling symbol | > PC / ABC < |

Note

Other technical data

The other mechanical and electrical data and ambient and environmental conditions are identical to those for the SENTRON PAC Power Monitoring Device. You can find more information in the operating instructions and manual for the SENTRON PAC Power Monitoring Device.

See also

Standards (Page 67)

10.4 Communication interface

Technical data

Table 10-5 Technical data for the communication interface

| | Values |
|--|--|
| Electrical interface | RS 485, twisted-pair cable + 1 cable for Common |
| Connection type | Terminal block with screw terminals |
| RS 485 data transfer: supported baud rates in bps | 4800 / 9600 / 19200 / 38400 / 57600 / 115200 Standard: 19200 The following is supported in conjunction with the SENTRON PAC3200: max. 38,400 bps |
| Supported address range | 1 to 247 ¹⁾ |
| Supported communication protocols ²⁾ | <ul style="list-style-type: none"> • MODBUS RTU • SEAbus |
| Bus cycle | The bus cycle depends on: <ol style="list-style-type: none"> 1. The number of nodes 2. The data volume 3. The baud rate |
| Supported modes | <ul style="list-style-type: none"> • Unicast • Broadcast |
| Stations | Max. 32 including master |
| Integral bus terminator | 120 Ohms resistance |
| Integral line polarization | <ul style="list-style-type: none"> • 560-Ohm pull-up resistor for 5 V voltage³⁾ • 560-Ohm pull-down resistor³⁾ |

1) Each device on the bus must have a unique address.

2) The communication protocols supported depend on the SENTRON PAC in each case.

3) If necessary, you can switch on line polarization.

Table 10-6 Connection types with associated conductor cross-sections






| Connection type | Conductor cross-sections |
|---|--|
|  Solid | 1 x 0.2 ... 2.5 mm ² 2 x 0.2 ... 1 mm ² |
|  Finely-stranded | 1 x 0.2 ... 2.5 mm ² 2 x 0.2 ... 1.5 mm ² |
|  Finely-stranded with end sleeve, without plastic sleeve | 1 x 0.25 ... 2.5 mm ² 2 x 0.25 ... 1 mm ² |
|  Finely-stranded with end sleeve, with plastic sleeve | 1 x 0.25 ... 2.5 mm ² |
| - AWG / kcmil | 24 ... 12 |
|  Finely-stranded with TWIN end sleeve, with plastic sleeve | 2 x 0.5 ... 1.5 mm ² |

Table 10-7 Technical data of the terminal block

| | Values |
|------------|--------|
| H1L screws | M3x4.9 |

10.5 Labeling

Description

The graphic below shows the positioning of the label on the housing of the PAC RS485 expansion module.

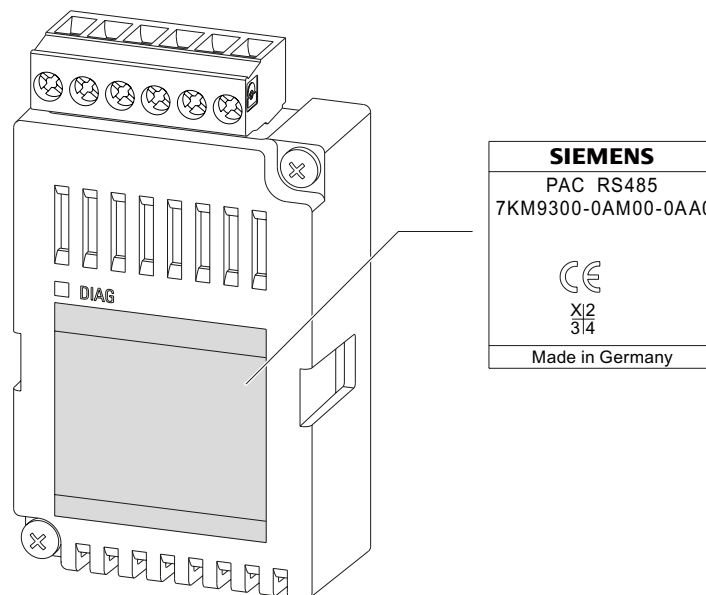


Figure 10-1 PAC RS485 expansion module with type plate

- (1) Type plate

Dimension drawings

11.1 Dimension drawings

PAC RS485 expansion module

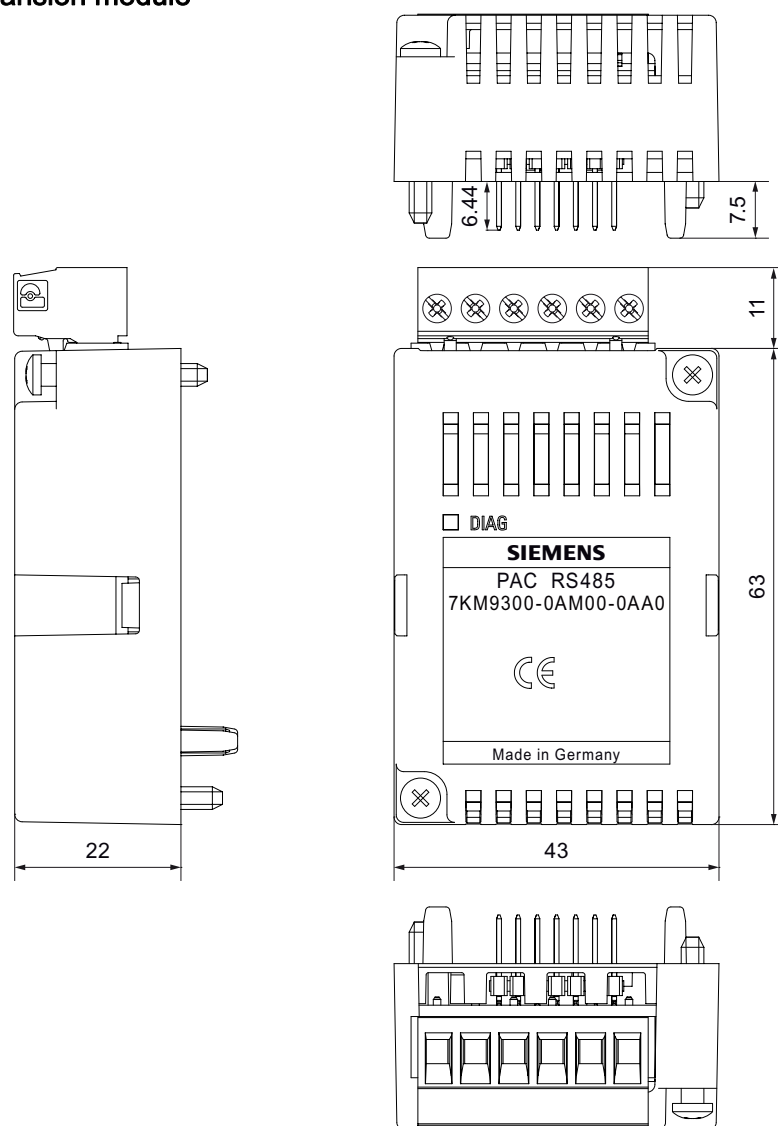


Figure 11-1 View from above, side view, front view and view from underneath with terminal block

Application examples

12.1 Examples of MODBUS communication

General information

The master makes a request to the slave, the SENTRON PAC Power Monitoring Device. This replies to the master and confirms that it has executed the request.

Below is a representation of communication between the master and the slave using some application examples from the "Application Log-File" of the bus master. The values are specified in hexadecimal form.

Read measured values

Table 12-1 Request of the master

| Address | FC | From register | Number of registers to be read | CRC |
|--------------|----|-----------------------------------|--------------------------------|-------|
| 01 | 04 | 00 01 | 00 06 | 21 C8 |
| Explanation: | | | | |
| | | From offset 0001: voltage Va-n | | |

Table 12-2 Response - confirmation of the slave

| Address | FC | Number of read bytes | Bytes | CRC |
|--------------|----|----------------------|---|-------|
| 01 | 04 | 0C | 43 68 70 22 43 67 60 DC 43 67 9C A5 | 41 D7 |
| Explanation: | | | | |
| | | 12 | 232.4 231.4 231.6 | |

Reading a parameter

Table 12-3 Requirement

| Address | FC | From register | Number of registers to be read | CRC |
|--------------|----|---------------------------------------|--------------------------------|-------|
| 01 | 04 | C3 51 | 00 10 | 9C 53 |
| Explanation: | | | | |
| | | From offset 50001: connection type | Read 16 registers | |

Table 12-4 Response - confirmation of the slave

| Address | FC | Number of read bytes | Bytes to be read | CRC |
|---------|----|----------------------|------------------|-------|
| 01 | 04 | 32 | 00 00 00 00 | 00 6D |
| | | | 00 00 00 00 | |
| | | | 00 00 01 90 | |
| | | | 00 00 01 90 | |
| | | | 00 00 00 00 | |
| | | | 00 00 00 05 | |
| | | | 00 00 00 05 | |
| | | | 00 00 00 00 | |

Execute command: Switch to low tariff

Table 12-5 Requirement

| Address | FC | Register | Content of the register | CRC |
|--------------|----|-------------------------------------|-------------------------|-------|
| 01 | 06 | EA 66 | 00 01 | 9C 0D |
| Explanation: | | | | |
| | | From offset 60006: Switch tariff | | |

Table 12-6 Response - confirmation of the slave

| Address | FC | Register | Content of the register | CRC |
|---------|----|----------|-------------------------|-------|
| 01 | 06 | EA 66 | 00 01 | 9C 0D |

Saving parameters

Table 12-7 Requirement

| Address | FC | From register | Bytes to be written | CRC |
|--------------|----|---------------------------------------|--|-------|
| 01 | 10 | C3 51 | 00 10 20 00 00 00 00 00 00 00 00 00 00 01 90 00 00 01 90 00 00 00 00 00 00 00 05 00 00 00 05 00 00 00 00 | 6F E0 |
| Explanation: | | | | |
| | | From offset 50001: connection type | | |

Table 12-8 Response - confirmation of the slave

| Address | FC | From register | Number of written registers | CRC |
|--------------|----|---------------------------------------|-----------------------------|-------|
| 01 | 10 | C3 51 | 00 10 | AC 50 |
| Explanation: | | | | |
| | | From offset 50001: connection type | 16 registers | |

Read Device Identification

Table 12-9 Requirement

| Address | FC | MEI type | ReadDevID code and object ID to be read | CRC |
|--------------|----|----------|---|-------|
| 01 | 2B | 0E | 01 00 | 70 77 |
| Explanation: | | | | |
| | | 14 | ReadDevID Code: 01 Object ID: OID0 | |

Table 12-10 Response - confirmation of the slave

| Address | FC | MEI type | Bytes read | CRC |
|---------|----|----------|---|-------|
| 01 | 2B | 0E | 01 01 00 00 03 00 0A 53 49 45 4D 45 4E 53 20 41 47 01 07 50 41 43 33 32 30 30 02 11 46 57 20 56 02 00 04 20 2F 20 42 4C 20 56 01 00 00 | 41 E8 |

See also

Function codes (Page 31)

Modbus measured variables with the function codes 0x03 and 0x04 (Page 33)

Modbus settings with the function codes 0x03, 0x04 and 0x10 (Page 40)

Modbus command parameters (Page 51)

MODBUS standard device identification with the function code 0x2B (Page 55)

A

Appendix

A.1 Correction sheet

Correction sheet

Have you noticed any errors while reading this manual? If so, please use this form to tell us about them. We welcome comments and suggestions for improvement.

Fax response

To
SIEMENS AG
A&D CD MM3
P.O. Box 1954

92220 Amberg / Germany

From (please complete):

Name

Company/Department

Address

Fax: +49 (0)96-21-80-33-37

Manual title:


Table A-1 Errors, comments, and suggestions for improvements

ESD guidelines

B.1 Electrostatic sensitive devices (ESD)

ESD components are destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged. ESD components which have been subject to such voltage are usually not recognized immediately as being defective, because the malfunction does not occur until after a longer period of operation.

ESD Guidelines

| |
|---|
|  CAUTION |
| <p>Electrostatic sensitive devices</p> <p>Electronic modules contain components that can be destroyed by electrostatic discharge. These modules can be easily destroyed or damaged by improper handling.</p> <ul style="list-style-type: none"> • You must discharge your body electrostatically immediately before touching an electronic component. To do this, touch a conductive, grounded object, e.g., a bare metal part of a switch cabinet or the water pipe. • Always hold the component by the plastic enclosure. • Electronic modules should not be brought into contact with electrically insulating materials such as plastic film, plastic parts, insulating table supports or clothing made of synthetic fibers. • Always place electrostatic sensitive devices on conductive bases. • Always store and transport electronic modules or components in ESD-safe conductive packaging, e.g. metallized plastic or metal containers. Leave the component in its packaging until installation. |

| |
|--|
| CAUTION |
| <p>Storage and transport</p> <p>If you have to store or transport the component in non-conductive packaging, you must first pack the component in ESD-safe, conductive material, e.g., conductive foam rubber, ESD bag.</p> |

The diagrams below illustrate the required ESD protective measures for electrostatic sensitive devices.

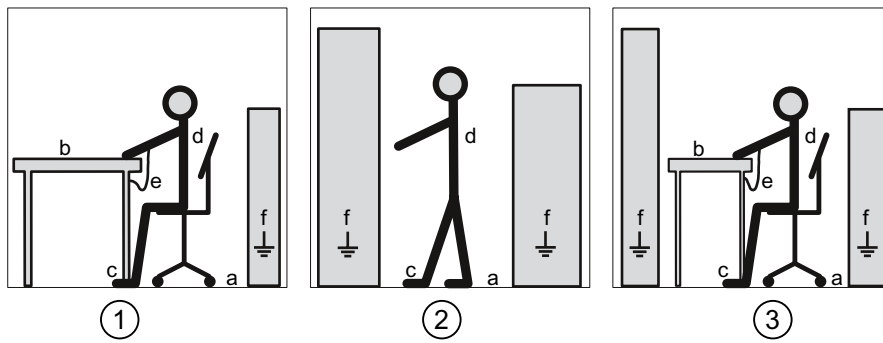


Figure B-1 ESD work center

- (1) ESD seat
- (2) ESD standing position
- (3) ESD seat and ESD standing position

Table B-1 Protective measures

- a Conductive floor
- b ESD table
- c ESD footwear
- d ESD smock
- e ESD bracelet
- f Cubicle ground connection

List of abbreviations

C.1 Abbreviations

Overview

Table C-1 Meaning of abbreviations

| Abbreviation | Meaning |
|--------------------------|--|
| ANSI | American National Standards Institute |
| Old: CCITT New: ITU-T | Old: Comité Consultatif International Télégraphique et Téléphonique (English: International Consultative Committee for Telegraphy and Telephony); New: Telecommunication Standardization Sector |
| AWG | American Wire Gauge |
| CD | Compact Disk |
| CRC | Cyclic redundancy check |
| DIN | Deutsches Institut für Normierung e. V. (English: German Institute for Standardization) |
| ESD | Electrostatic sensitive devices |
| EIA | Electronic Industries Alliance |
| EMC | Electromagnetic compatibility |
| FC | Function codes |
| MODBUS-IDA | Organization for MODBUS |
| IEC | International Electrotechnical Commission |
| IP | International Protection, e.g. IP20 |
| ISO | International Standardization Organization |
| LC display | Liquid Crystal Display |
| LED | Light Emitting Diode |
| LSB | Least Significant Bit |
| MEI | MODBUS Encapsulated Interface |
| MSB | Most Significant Bit |
| PAC | Power Analysis & Control |
| RS | Formerly: Radio Selector; now usually: Recommended Standard |
| RTU | Remote Terminal Unit |
| TIA | Totally Integrated Automation |

Glossary

American Wire Gauge

American Wire Gauge is a number assigned to a specific conductor or wire cross-section. Each AWG number represents a jump of 26% in the cross-sectional area. The thicker the wire, the smaller the AWG number. A copper wire with AWG 10 has a diameter of 2.54 mm, a cross-sectional area of 5 mm² and a resistance of 1 Ohm over a length of 304.8 m. With a reduction of 3 AWG, e.g. AWG 10 to AWG 7, the cross-sectional area and the mass (weight) are doubled. The DC resistance is halved. With a reduction by 6 AWG the diameter is doubled. For conductor cross-sections to 107.2 mm² = AWG 4 / 0, also AWG 0000.

Baud rate

The baud rate is the rate of data transmission. It indicates the number of bits transferred in one second.

Broadcast

Multicasting. With the broadcast procedure, the master sends a request to address "0". This directs the information to all slave devices on the network. Slave devices do not respond to broadcast frames.

Bus

Shared transmission path over which all bus nodes are connected. It has two defined ends.

Bus system

All stations physically connected to a bus line form a bus system.

Data bit

The number of data bits describes how many bits a character is mapped to for transmission purposes.

Diagnostics

The detection, localization, visualization and further evaluation of errors, disturbances and messages.

Provides monitoring functions which are executed automatically when the system is in RUN mode. This reduces startup times and standstill times. Plant availability increases.

Function code

The function code defines the meaning of the message frame. The function code defines the structure of the message frame.

Half-duplex mode

Bidirectional data traffic. Data is exchanged between the communication partners but only in one direction at a time. In half-duplex mode, the driver switches the twisted-pair cable R(A),R(B) of the interface between send mode and receive mode. Individual data flow control characters (e.g. XON/XOFF) can be an exception to this. These can also be received and sent during send/receive mode.

The following are ignored in this mode:

- All detected transmission errors before and after the receive message frames
- The BREAK level during the message frame breaks

Master

The master sends requests to a certain slave in unicast frames. In broadcast frames it sends requests to all slaves in the network.

MODBUS RTU

MODBUS RTU is a master/slave protocol which runs on a serial channel. There is only one master on a MODBUS RTU bus.

Parity bit

Depending on the setting, the parity bit supplements the number of data bits to be transmitted to form an even or odd number. This is for the purpose of data security.

Report

All communication partners involved in data transmission must follow fixed rules for handling and implementing the data traffic. Such rules are called protocols.

Response monitoring time

The response monitoring time is the time the master spends waiting for a response message frame from the slave once a request message frame has been output.

Slave

A slave may only exchange data with a master after being requested to by the master.

Start bit and stop bit

One start bit and up to two stop bits are used with asynchronous serial data transmission in order to enable synchronization to every transmitted character for the receiver.

Unicast

In unicast frames, the master sends a request to a certain slave.

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