

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

All names identified by ® are registered trademarks of the Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

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

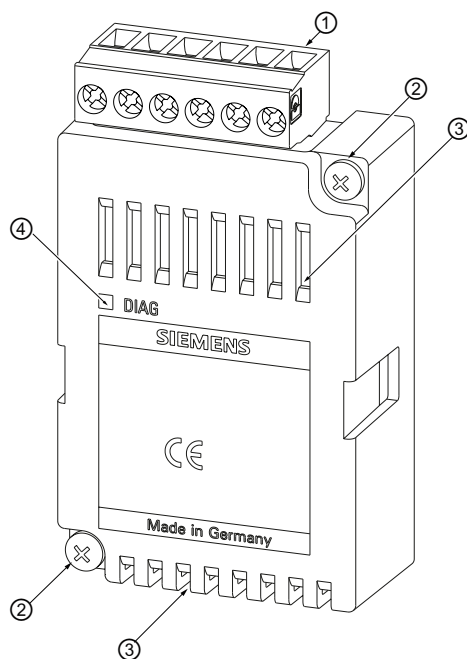


Figure 3-1 Schematic view of the side and front of the PAC RS485 expansion module

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

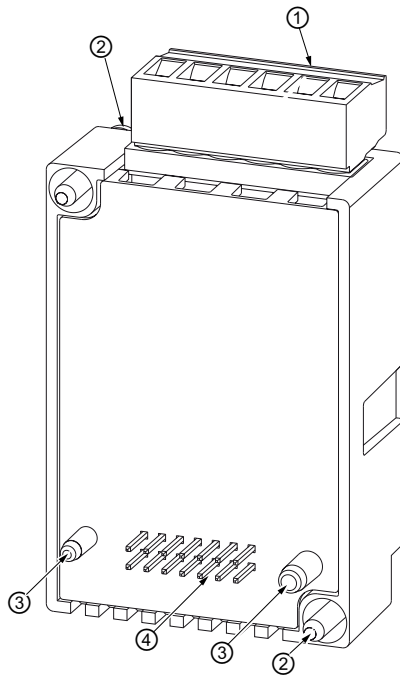


Figure 3-2 Schematic view of the rear of the PAC RS485 expansion module

- (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 *SETRON 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.

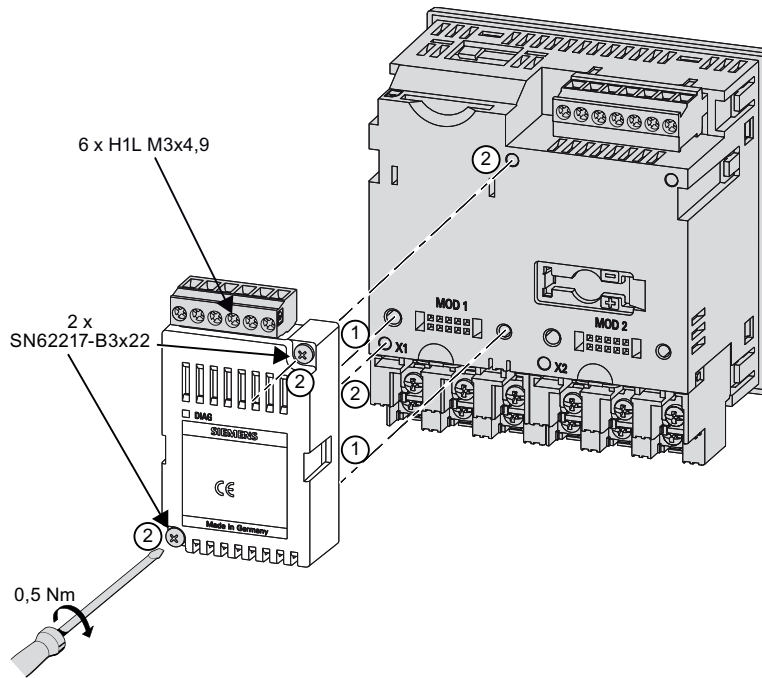


Figure 4-1 Schematic view of assembling the PAC RS485 expansion module

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.

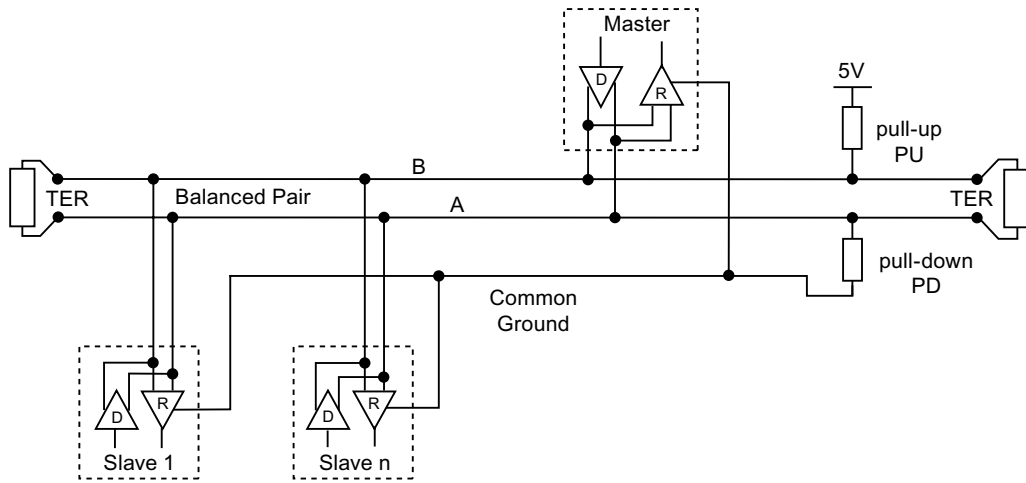


Figure 4-2 Block diagram: General topology of the twisted-pair cable

- +/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

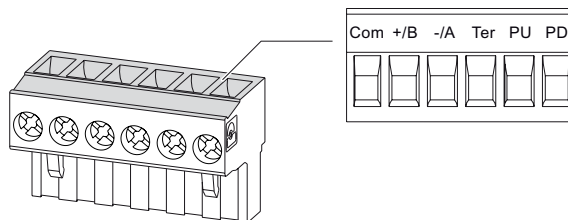


Figure 4-3 Terminal assignment

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.

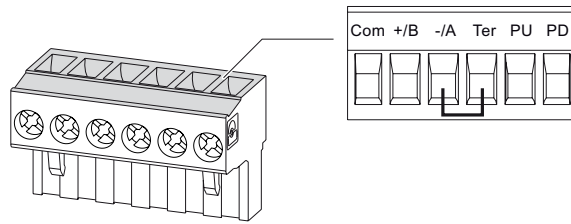


Figure 4-4 Terminal assignment with terminating resistor

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.

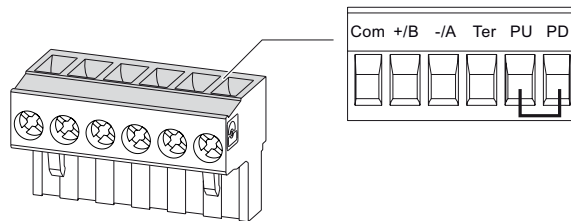


Figure 4-5 Terminal assignment with line polarization

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)

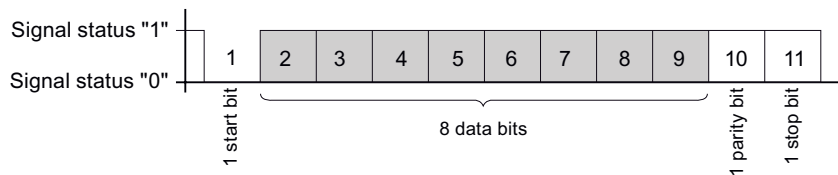
5.1.2 Character frame

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

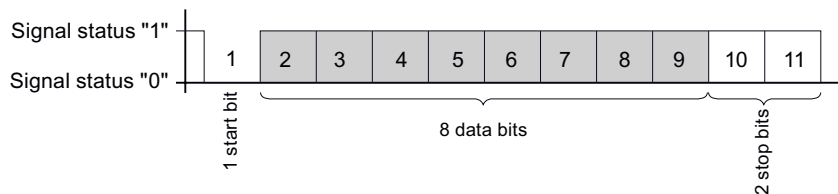


Figure 5-1 11-bit character frame

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						

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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	

5.1 MODBUS RTU

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="0"> <tr> <td>0 =</td> <td>MODBUS TCP</td> </tr> <tr> <td>1 =</td> <td>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="0"> <tr> <td>0 =</td> <td>MODBUS RTU</td> </tr> <tr> <td>1 =</td> <td>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	SETRON 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 SETRON 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

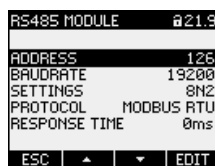


Figure 6-1 Configuring the PAC RS485 expansion module using buttons

"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
 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.

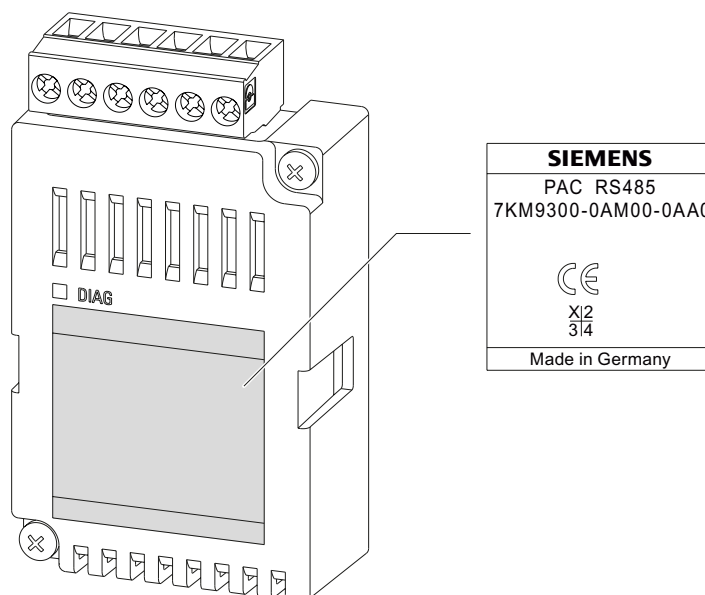


Figure 10-1 PAC RS485 expansion module with type plate

- (1) Type plate

Dimension drawings

11.1 Dimension drawings

PAC RS485 expansion module

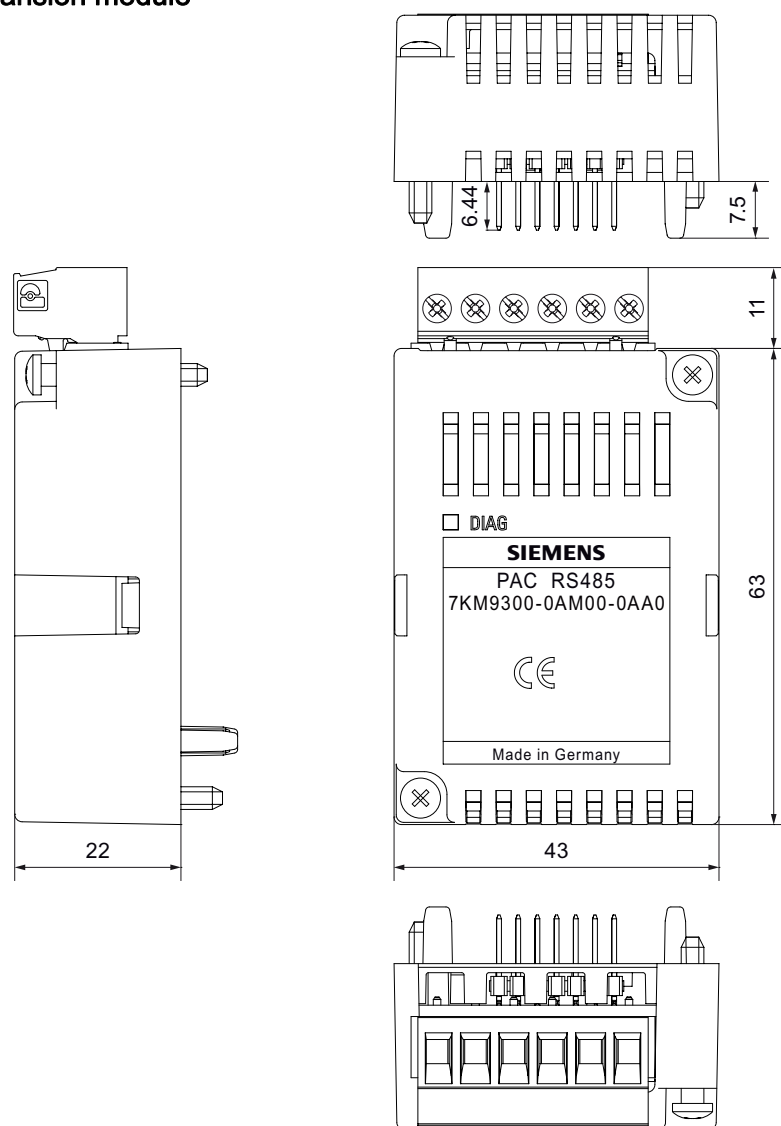


Figure 11-1 View from above, side view, front view and view from underneath with terminal block

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.

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.

<p>CAUTION</p>
<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.

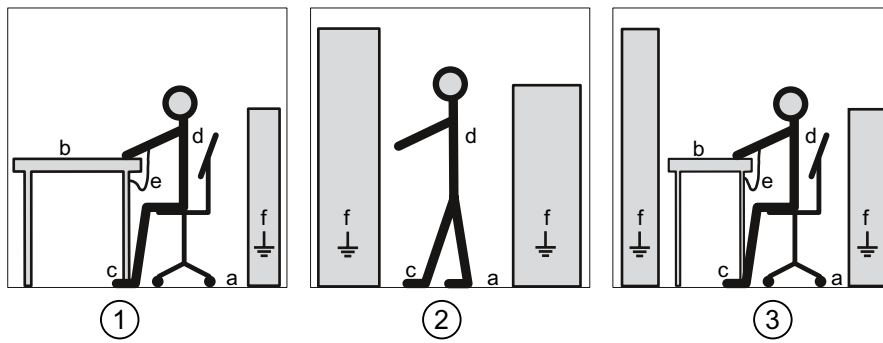


Figure B-1 ESD work center

- (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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