SIPROTEC4

Multifunction protection with control 7SJ62 / 7SJ63

Communication module

Modbus

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Non-liability clause

Although we have checked the contents of this publication for conformance with the hardware and software described we cannot guarantee complete conformance since differences cannot be ruled out.

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Preface

Contents of this manual

The manual is devided into the following topics:

- Bus specific parameters
- Supported Modbus functions
- Exception responses of the Modbus slave
- Annunciations to the Modbus master
- Data type definitions
- Modbus register map
- Technical data

Additional literature

This manual describes the operation the register map organization and the hardware interface of the Modbus slave for the SIPROTEC devices 7SJ61, 7SJ62, 7SJ63 and 6MD63.

The following additional manuals inform you about the function, operation, assembly and commissioning of the SIPROTEC devices:

Manual	*Contents*	*Order number*
Overcurrent, overload and motor protection with control SIPROTEC 7SJ61	Function, operation, assembly and commissioning of the SIPROTEC device 7SJ61	C53000-G1140-C118-2
Multifunction protection with control SIPROTEC 7SJ62	Function, operation, assembly and commissioning of the SIPROTEC device 7SJ62	C53000-G1140-C121-2
Multifunction protection with control SIPROTEC 7SJ63	Function, operation, assembly and commissioning of the SIPROTEC device 7SJ63	C53000-G1140-C120-2
Input/output unit with local control SIPROTEC 6MD63	Function, operation, assembly and commissioning of the SIPROTEC device 6MD63	C53000-C1840-C101-2

The Modbus specification with a detailed explanation of the Modbus protocol is contained in:

➢ Modicon
Modbus Protocol
Reference Guide
PI-MBUS-300 Rev. J
June 1996, Modicon, Inc

Notes to this manual

This manual provides you with the following aids to make it easier to locate the information you are looking for:

- At the beginning of this manual you will find a complete table of contents plus separate lists of figures and tables contained in this manual.
- In the individual chapters, you will find information in the left margin of each page which will give you an overview of the contents of that particular paragraph.
- Following the last chapter of this manual, you will find a glossary containing definitions of technical terms and abbreviations used in this manual.
- At the end of this manual, you will find a comprehensive index for fast access to the information you need.

Validity

This manual is valid for

- SIPROTEC devices 7SJ61, 7SJ62, 7SJ63 and 6MD63 with firmware version 4.2 and Modbus communication module.

Training courses

See our catalog of courses for a list of available courses or contact our training center in Nuremberg.

Questions

If you have questions to the SIPROTEC devices, contact your Siemens representative.

Revision index

Modified chapters / pages	*Edition*	*Reasons of modification*
	1.0	First edition Apr 12th, 2000

Table of contents

List of figures

List of tables

1 Bus specific parameters

The following settings for the serial communication between the Modbus master and the Modbus slave of the SIPROTEC device have to be defined when programming the device using the parameterization system DIGSI.

Slave address

Permissible slave addresses are in the range between 1 and 247.

Modbus mode

The Modbus slave of the SIPROTEC device supports the two serial transmission modes ASCII and RTU:

- In *ASCII mode* each byte in a Modbus message is sent as two ASCII characters. For error checking a Longitudinal Redundancy Check (LRC) is used.
- When the Modbus slave is setup to communicate on a Modbus network using *RTU mode* each byte in a Modbus message contains two hexadecimal characters. In *RTU mode* a Cyclical Redundancy Check (CRC) is applied for frame checking.

Baud rate

The following baud rates are available:

- 300, 600, 1200, 2400, 4800, 9600, 19200 Bit/s.

Parity

The parity is adjustably to:

- even or odd parity bit (EVEN, ODD) in *ASCII mode*,
- none, even or odd paritiy bit (NONE, EVEN, ODD) in *RTU mode*.

Maximum slave response time

The maximum response time determines the time interval within which the Modbus slave may respond to enquiries from the master.

This value is indicated into milliseconds unities and must be coordinated with the time-out of the Modbus master.

The following formula is valid:

$$T_{bus} < (T_{max} + T_{bus}) < T_{master}$$

T_{bus} - Transmission time of the slave response on the bus line,
T_{master} - Time-out of the Modbus master,
T_{max} - Maximum slave response time.

Processing of broadcast messages

If one of the Modbus messages "Force Single Coil", "Preset Single Register", "Force Multiple Coil" or "Preset Single Regs" (ref. to chap. 2) is transmitted from the Modbus master to the Modbus slaves using slave address 0 all Modbus slaves recognize this message as a broadcast message and process it.

For every Modbus slave of a SIPROTEC device can be decided whether broadcast messages are accepted for coil status registers and/or holding registers.

Per default this option is enabled and all broadcast messages are processed.

Note

Modbus Plus is not supported by the Modbus slave of the SIPROTEC devices 7SJ61, 7SJ62, 7SJ63 and 6MD63.

2 Supported Modbus functions

The following Modbus functions are supported by the Modbus slave of the SIPROTEC device:

Function code	*Function name*	*Description*	*Broadcast supported?*[1]
1	Read Coil Status (0x-Register)	Reading one or several coil status registers of the Modbus slave. A maximum of 1970 registers can be read with one message. The coil status registers reflect the ON/OFF status of discrete outputs of the SIPROTEC device.	no
2	Read Input Status (1X-Register)	Reading one or several input status registers of the Modbus slave. A maximum of 1970 registers can be read with one message. The input status registers reflect the ON/OFF status of discrete inputs and the status of the protection function of the SIPROTEC device.	no
3	Read Holding Registers (4X-Register)	Reading one or several holding registers of the Modbus slave. A maximum of 125 registers can be read with one message. The holding registers contain device status annunciations, measured values – mean values and metered measurands.	no
4	Read Input Registers (3X-Register)	Reading one or several input registers of the Modbus slave. A maximum of 125 registers can be read with one message. The input registers contain recorded measured values.	no
5	Force Single Coil (0x-Register)	Writing (force to ON or OFF) one coil status register (and binary output of the SIPROTEC device assigned with that). Use function code 15 to force multiple coil status registers.	yes
6	Preset Single Register (4X-Register)	Function presets a value into a single holding register. Use function code 16 to preset multiple holding registers. There are none writable holding registers for the SIPROTEC devices at present.	yes
7	Read Exception Status	This function responses the value of the eight exception status coils to the Modbus master. The Modbus slave of the SIPROTEC device uses coil status register 257..264 as exception coils.	no
8	Diagnostics	This function provides diagnostic values to the Modbus master. Subfunctions 0 and 2 are implemented. • Funktion 0: The data passed in the query data field of the message to the slave is to be returned (looped-back) in the response. • Funktion 2: The contents of the diagnostic register is returned in the response to the master. For this the contents of the holding register 129 is used.	no

[1] Broadcast messages from Modbus master to the Modbus slaves using slave address 0 in the modbus message (ref. to paragraph "Processing of broadcast messages" in chap. 1).

Function code	Function name	Description	Broadcast supported?
15	Force Multiple Coils (0X-Register)	Writing (force to ON or OFF) one or several coil status registers (and binary outputs of the SIPROTEC device assigned with these). A maximum of 1970 registers can be written with one message.	yes
16	Preset Multiple Regs (4X-Register)	Function presets one or several holding registers register. A maximum of 125 registers can be written with one message. There are none writable holding registers for the SIPROTEC devices at present.	yes

Table 2-1 Supported Modbus functions

Exception responses of the Modbus slave

3

If the Modbus slave receives a query from the Modbus master which cannot be processed (e.g. a request to read a non-existent register), then the slave answers with an exception response message.

The following exception codes are signaled in a exception response message to the Modbus master by the Modbus slave of the SIPROTEC device:

Exception code 01 ILLEGAL_FUNCTION

The function code used in the query by the Modbus master is not supported by the Modbus slave of the SIPROTEC device.

Ref to chap. 2 for a list of supported Modbus functions.

Exception code 02 ILLEGAL_DATA_ADDRESS

The Modbus master addresses in the query a register for which:

- no mapping entry exist (i.e. a non-existent register),
- the access is not enabled since the addressed register is part of a complex bus object which uses more than one registers and can be read only completely.

Exception code 03 ILLEGAL_DATA_VALUE

The Modbus master tried to write to a register for which only read access is permitted.

Exception code 06 SLAVE_DEVICE_BUSY

The Modbus slave has no valid mapping data or the Modbus registers still have not been initialized and enabled by the SIPROTEC device (after initial start or restart of the device).

Exception code 08 NEGATIVE_ACKNOWLEDGE

If at the diagnostic query (Modbus function code 8) another subfunction than 00 or 02 is requested, then this is rejected with NEGATIVE_ACKNOWLEDGE.

Annunciations to the Modbus master

4

Note

When analysing the annunciations of the SIPROTEC device in the Modbus master, it should be noted that due to the cycle period of the Modbus system (period between two following queries of the same data of the Modbus slave) temporary changes of an annunciation's value (ON and OFF within one cycle) may eventually not be recognized.

This applies in the first place for protection annunciations.

Protection pickup

Protection annunciations which indicate the status protection pickup are active only for the period of time of the protection pickup.

Protection TRIP

The parameter **MINIMUM DURATION OF TRIP COMMAND** (parameter address = 210) allows setting of the minimum duration of the TRIP command.

This time setting applies to all protection functions which may cause a TRIP signal. After a protection TRIP, the corresponding protection annunciations transmit the value ON for the programmed minimum time duration.

5 Data type definitions

Following data types are used for storage of variables in Modbus registers:

- Single-point indications
- Single commands
- Double-point indications
- Double commands
- Measured values (signed integer)
- Metered measurands (unsigned long)

Note

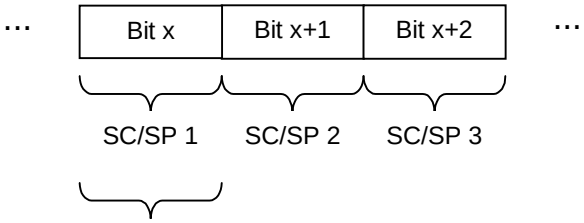
The storage of variables of more complex data types in the Modbus holding registers (i.e. variables greater than one holding register, e.g. metered measurands) is processed according to the following convention:

The register which has the lower address contains the most significant byte (MSB) of the variable and the register with the higher address contains the least significant byte (LSB).

5.1 Single command (SC) / Single-point indiation (SP)

Range of values:

0 – OFF
1 – ON



Coil / input status register or one bit of a holding register

Figure 5-1 Data typ single command / single-point indication

5.2 Double command (DC) / Double-point indication (DP)

Range of values:

0 (bit 1 = 0 and bit 0 = 0) - „Not applicable“ for DP, not permissible for DC
1 (bit 1 = 0 and bit 0 = 1) - OFF
2 (bit 1 = 1 and bit 0 = 0) - ON
3 (bit 1 = 1 and bit 0 = 1) - Error status/Intermediate position for DP, not permissible for DC

Note

- „Not applicable“: double-point indication is not configured (not assigned to a binary input).
- The value „11“ ist transmitted for intermediate position „00“ too.

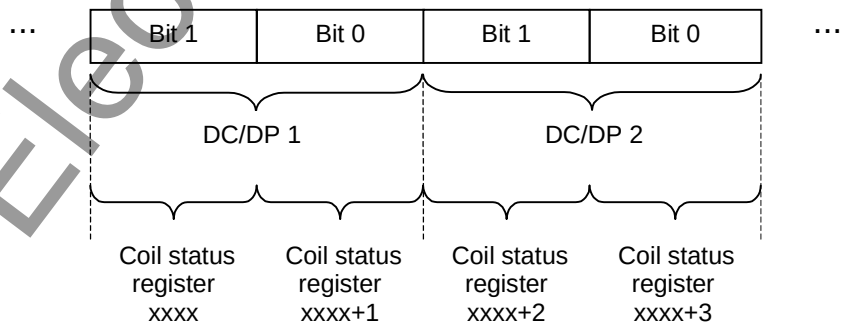


Figure 5-2 Data type double command / double-point indication

Double commands are exclusively controled using Modbus function „Force Multiple Coils“ (ref. to chap. 2).

5.3 Measured value (signed integer)

Range of values:

-32768 to +32767
(**-32768 = overflow or invalid**)

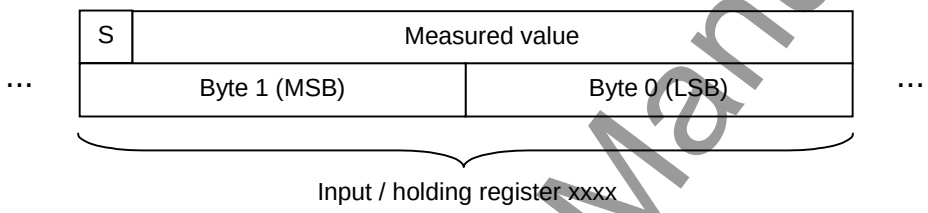


Figure 5-3 Data type measured value (signed integer)

Meaning of the status bits:
S - Sign bit, active: negative measured value (two’s complement)

5.4 Metered measurand (unsigned long)

Range of values:

0 to +4294967295

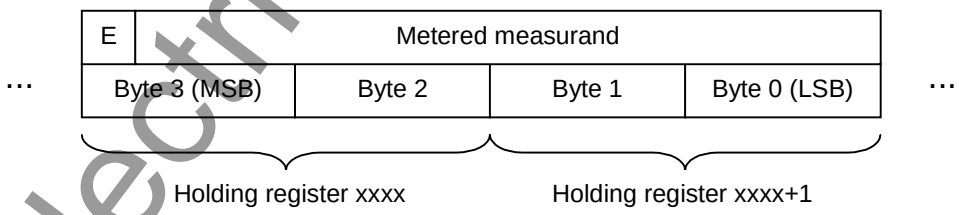


Figure 5-4 Data type metered measurand (unsigned integer)

Meaning of the status bits:
E - Error bit, active: invalid metered measurand

6 Modbus register map

6.1 Explanation

Note

The examples shown in this chapter 6.1 do not necessarily correspond to the real allocation of the objects in the register mapping.

Chapters 6.3 to 6.6 define the mapping of the data objects of the SIPROTEC devices 7SJ61, 7SJ62, 7SJ63 and 6MD63 to the associated Modbus registers.

There are three standard mappings (standard mapping 1 to standard mapping 3) available, which have an identical data size and differ in the scaling of the measured values (ref. to chap. 6.5).

The listed SIPROTEC data objects are sorted by register addresses (starting with 1), e.g.:

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Scaling (32767 corresponds to ...)*	*Internal object no.*
30001	IA	Current in phase A	1: 3276,7 A 2: 32,767 kA 3: 3276,7 A	601

The measured value “IA“ (ref. to chap. 5.3 for measured value data type definition) is assigned to register 30001 (input register).

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Internal object no.*
00001	Q0 ON/OFF ON	Circuit breaker	–
00002	Q0 ON/OFF OFF		

The double command "Q0 ON/OFF" and simultaneous the checkback indication of the circuit breaker Q0 as an double-point indication (ref. to chap. 5.2 for data type definitions) are assigned to the coil status registers 00001 (ON) and 00002 (OFF).

6.2 Notes for parametrization in DIGSI

Only those SIPROTEC objects can be transmitted or controlled by Modbus which are listed in the column “Designation of the SIPROTEC objects“.

All these objects are already contained in the standard parameter set and they can be identified by their name or their "Internal object no." (not all SIPROTEC objects have an internal object number).

For transmission of installation-specific commands and annunciations user-definable objects are available.
Binary outputs and binary inputs of the SIPROTEC device can be assigned to these objects using the DIGSI parameterization software (ref. to chap. 6.3.2 and 6.4.1).

CFC-Incoming annunciations and CFC-Output indications can be used to allocate protection annunciations, which are not containd in the standard mapping to positions in Modbus registers (ref. to chap. 6.3.4 and 6.4.2).

6.3 Coil status registers (0X references)

The coil status register block allows the Modbus master:

- command outputs through the output relays of the SIPROTEC device (external commands),
- manipulation of taggings (internal commands), which can be changed by Modbus,
- reading the checkback indication and/or the status of output relays as well as taggings.

Note

The allocation of the output relays to the switching devices and to the output channels is defined during parametrization of the SIPROTEC devices.

Depending on the device composition there may be less than indicated output relays (and corresponding Modbus registers) available in the SIPROTEC device.

6.3.1 Register addresses 00001 to 00018: Double commands

- Data type definition ref. to chap. 5.2.

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Internal object no.*
00001	Q0 ON/OFF ON	Impulse output, 3 relays (2-pole ON, 1-pole OFF)	–
00002	Q0 ON/OFF OFF		
00003	Q1 ON/OFF ON	Impulse output, 2 relays, 1-pole	–
00004	Q1 ON/OFF OFF		
00005	Q8 ON/OFF ON	Impulse output, 2 relays, 1-pole	–
00006	Q8 ON/OFF OFF		
00007	Q2 ON/OFF ON	Impulse output, 2 relays, 1-pole	–
00008	Q2 ON/OFF OFF		
00009	Q9 ON/OFF ON	Impulse output, 2 relays, 1-pole	–
00010	Q9 ON/OFF OFF		
00011	Switching device D1 (UsrDC1) ON	Impulse output, 4 relays (2-pole)	–
00012	Switching device D1 (UsrDC1) OFF		
00013	Switching device D2 (UsrDC2) ON	Impulse output, 2 relays, 1-pole	–
00014	Switching device D2 (UsrDC2) OFF		
00015	Switching device D3 (UsrDC3) ON	Impulse output, 2 relays, 1-pole	–
00016	Switching device D3 (UsrDC3) OFF		

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
00017	Switching device D4 (UsrDC4) ON	Impulse output, 2 relays, 1-pole	–
00018	Switching device D4 (UsrDC4) OFF		
00019 – 00032	reserved[2]		–

6.3.2 Register addresses 00033 to 00054: Single commands

- Data type definition ref. to chap. 5.1.

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
00033	Output channel E1 (UsrSC1)	Impulse output, single command with checkback indiation, 1 relay, 1-pole	–
00034	Output channel E2 (UsrSC2)	Impulse output, single command with checkback indiation, 1 relay, 1-pole	–
00035	Output channel E3 (UsrSC3)	Impulse output, single command with checkback indiation, 1 relay, 1-pole	–
00036	Output channel E4 (UsrSC4)	Impulse output, single command with checkback indiation, 1 relay, 1-pole	–
00037	Output channel E5 (UsrSC5)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00038	Output channel E6 (UsrSC6)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00039	Output channel E7 (UsrSC7)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00040	Output channel E8 (UsrSC8)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00041	Output channel E9 (UsrSC9)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00042	Output channel E10 (UsrSC10)	Continuous output without restauration after reset, SC without checkback indiation	–
00043	Output channel E11 (UsrSC11)	Continuous output without restauration after reset, SC without checkback indiation	–
00044	Output channel E12 (UsrSC12)	Continuous output with restauration after reset, SC without checkback indiation	–
00045	Output channel E13 (UsrSC13)	Continuous output with restauration after reset, SC without checkback indiation	–
00046	Output channel E14 (UsrSC14)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00047	Output channel E15 (UsrSC15)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00048	Output channel E16 (UsrSC16)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00049	Output channel E17 (UsrSC17)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00050	Output channel E18 (UsrSC18)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00051	Output channel E19 (UsrSC19)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00052	Output channel E20 (UsrSC20)	Impulse output, single command without checkback indiation, 1 relay, 1-pole	–
00053	Output channel E21 (UsrSC21)	Continuous output without restauration after reset, SC without checkback indiation	–
00054	Output channel E22 (UsrSC22)	Continuous output without restauration after reset, SC without checkback indiation	–
00055 – 00064	reserved[2]		–

[2] For an as "reserved" labeled coil status register the value 0 is always returned if reading.
A write access is rejected in the SIPROTEC device.

Note

- The command output mode (pulse output, continuous output) is changeable for the single commands using parametrization software DIGSI. The command output modes indicated in above table are predefined.
- The switching direction OFF for single commands with pulse output is not permitted and is rejected in the SIPROTEC device.
- It is presupposed at single commands with pulse output and checkback indication that a switchgear with monostable time element is externally connected. This monoflop is activated by the pulse command and drops out after a predefined time. Now a repeated activation is possible. The command output is rejected in the SIPROTEC device during the time in which the checkback indication has the value ON.

6.3.3 Register addresses 00065 to 00071: Internal commands

- Data type definition ref. to chap. 5.1.

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Internal object no.*
00065	Command: Auto recl. ON/OFF	0 = Deactivation of “Autoreclosing“ 1 = Activation of “Autoreclosing“	127
	Annunciation: 79AR ON	1 = AR is switched ON	2782
00066	Command: Protection ON/OFF	0 = Deactivation of protection functions 1 = Activation of protection functions	126
	Annunciation: Prot.Active	1 = At least one protection function is active	52
00067	Command: Setting group A	0 = not permissible 1 = Activation of setting group A	53
	Annunciation: Setting group A	0 = Setting group A is not active 1 = Setting group A is active	
00068	Command: Setting group B	0 = not permissible 1 = Activation of setting group B	54
	Annunciation: Setting group B	0 = Setting group B is not active 1 = Setting group B is active	
00069	Command: Setting group C	0 = not permissible 1 = Activation of setting group C	55
	Annunciation: Setting group C	0 = Setting group C is not active 1 = Setting group C is active	
00070	Command: Setting group D	0 = not permissible 1 = Activation of setting group A	56
	Annunciation: Setting group D	0 = Setting group D is not active 1 = Setting group D is active	
00071	Command: Mode REMOTE	Change control mode REMOTE to 0 = Control mode REMOTE = LOCKED 1 = Control mode REMOTE = UNLOCKED	–
	Annunciation: SchModFern	Status of control mode REMOTE 0 = LOCKED 1 = UNLOCKED	
00072 – 00080	reserved[2]		–

Control mode REMOTE

Control mode with control authority is REMOTE, option of unlocked control with Modbus.

- Changing the “Control mode REMOTE“ to UNLOCKED permits one unlocked control operation via Modbus. After execution of the command, the tagging “Control mode REMOTE“ in the SIPROTEC device will automatically be reset to LOCKED.
- A programmed test “Switch in position“ for unlocked control operations will always be executed.
- If, after changing the “Control mode REMOTE“ to UNLOCKED, no command is received via Modbus for a period of 5 minutes, then the tagging “Control mode REMOTE“ is automatically reset to LOCKED.

Changing the setting group

In order to change the setting group, the value “1“ = ON must be transmitted to the corresponding register. Switching on one setting group automatically switches off the current active setting group. Transmission of the value “0“ = OFF is insignificant for the change of the setting group and is refused by the device.

A change of the setting group is only possible via Modbus if the parameter **CHANGE TO ANOTHER SETTING GROUP** (parameter address = 302) has the value "Protocol".

6.3.4 Register addresses 00081 to 0096: Application logic CFC

- Data type definitions ref. to chap. 5.1.

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Internal object no.*
00081	CFC-Incoming annunciation 1 (UsCfcSpI1)	Tagging ON/OFF, released as CFC input	–
00082	CFC-Incoming annunciation 2 (UsCfcSpI2)	Tagging ON/OFF, released as CFC input	–
00083	CFC-Incoming annunciation 3 (UsCfcSpI3)	Tagging ON/OFF, released as CFC input	–
00084	CFC-Incoming annunciation 4 (UsCfcSpI4)	Tagging ON/OFF, released as CFC input	–
00085	CFC-Incoming annunciation 5 (UsCfcSpI5)	Tagging ON/OFF, released as CFC input	–
00086	CFC-Incoming annunciation 6 (UsCfcSpI6)	Tagging ON/OFF, released as CFC input	–
00087	CFC-Incoming annunciation 7 (UsCfcSpI7)	Tagging ON/OFF, released as CFC input	–
00088	CFC-Incoming annunciation 8 (UsCfcSpI8)	Tagging ON/OFF, released as CFC input	–
00089	CFC-Incoming annunciation 9 (UsCfcSpI9)	Tagging ON/OFF, released as CFC input	–
00090	CFC-Incoming annunciation 10 (UsCfcSpI10)	Tagging ON/OFF, released as CFC input	–
00091	CFC-Incoming annunciation 11 (UsCfcSpI11)	Tagging ON/OFF, released as CFC input	–

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
00092	CFC-Incoming annunciation 12 (UsCfcSpI12)	Tagging ON/OFF, released as CFC input	–
00093	CFC-Incoming annunciation 13 (UsCfcSpI13)	Tagging ON/OFF, released as CFC input	–
00094	CFC-Incoming annunciation 14 (UsCfcSpI14)	Tagging ON/OFF, released as CFC input	–
00095	CFC-Incoming annunciation 15 (UsCfcSpI15)	Tagging ON/OFF, released as CFC input	–
00096	CFC-Incoming annunciation 16 (UsCfcSpI16)	Tagging ON/OFF, released as CFC input	–

Note

The CFC-Incoming annunciations allow routing of further protection annunciations on Modbus registers, which are not contained in the standard mapping (e.g. ">BLK 50/51", internal object number = 1704 or ">BLK 50N/51N", internal object number = 1714).

Example

Control of object ">BLK 50/51" using "CFC-Incoming annunciation 1 (UsCfcSpI1)" via Modbus:

- In the DIGSI configuration matrix set the source for ">BLK 50/51" to CFC output.
- All CFC-Incoming annunciations are released as CFC input by default, therefore no further actions in the DIGSI configuration matrix are nessesary.
- Open a CFC working page and insert a CONNECT module.
- Connect the input („BO X“) of the CONNECT module with the operand "UsCfcSpI1“ (group „Protocol“).
- Connect the output („Y BO“) of the CONNECT module with the operand ">BLK 50/51" (Gruppe: "50/51 Overcur.“).
- Save and translate the CFC working page.

The object ">BLK 50/51" (and with that the associated protective function) can be influenced by changing the value of the "CFC-Incoming annunciation 1" via Modbus now.

6.3.5 Register addresses 00257 to 00264: Exception flags

- Registers are write-protected[3].
- The contents of these registers are also readable using function "Read Exception Status" (function code 7).

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Internal object no.*
00257	reserved	not used at present	–
00258	reserved	not used at present	–
00259	reserved	not used at present	–
00260	reserved	not used at present	–
00261	reserved	not used at present	–
00262	reserved	not used at present	–
00263	reserved	not used at present	–
00264	reserved	not used at present	–

[3] A write access is rejected with exception code 03 (ILLEGAL_DATA_VALUE).

6.4 Input status registers (1X references)

The input status register block allows the Modbus master to scan the current status of the input channels as well as the annunciations generated in the SIPROTEC device (e.g. protection annunciations, status annunciations).

Note

The allocation of the input channels to the binary inputs is defined during parameterization of the devices.

Depending on the device composition and the existing protection packages not all of the indicated binary inputs or protection annunciations (and corresponding Modbus registers) may be available in the SIPROTEC device.

Ref. to chap. 5.1 for data type definition of the input status registers.

6.4.1 Register addresses 10001 to 10037: Input channels with allocation to the binary inputs

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Internal object no.*
10001	Input channel 1 (UsrSpO/C1)	Single-point indication OPEN/CLOSE	–
10002	Input channel 2 (UsrSpO/C2)	Single-point indication OPEN/CLOSE	–
10003	Input channel 3 (UsrSpO/C3)	Single-point indication OPEN/CLOSE	–
10004	Input channel 4 (UsrSpO/C4)	Single-point indication OPEN/CLOSE	–
10005	Input channel 5 (UsrSpO/C5)	Single-point indication OPEN/CLOSE	–
10006	Input channel 6 (UsrSpO/C6)	Single-point indication OPEN/CLOSE	–
10007	Input channel 7 (UsrSpO/C7)	Single-point indication OPEN/CLOSE	–
10008	Input channel 8 (UsrSpO/C8)	Single-point indication OPEN/CLOSE	–
10009	Input channel 9 (UsrSpO/C9)	Tagging / internal single-point indication OPEN/CLOSE	–
10010	Input channel 10 (UsrSpO/C10)	Tagging / internal single-point indication OPEN/CLOSE	–
10011	Input channel 11 (UsrSpO/O11)	Single-point indication ON/OFF	–
10012	Input channel 12 (UsrSpO/O12)	Single-point indication ON/OFF	–
10013	Input channel 13 (UsrSpO/O13)	Single-point indication ON/OFF	–
10014	Input channel 14 (UsrSpO/O14)	Single-point indication ON/OFF	–
10015	Input channel 15 (UsrSpO/O15)	Single-point indication ON/OFF	–
10016	Input channel 16 (UsrSpO/O16)	Single-point indication ON/OFF	–
10017	Input channel 17 (UsrSpO/O17)	Single-point indication ON/OFF	–
10018	Input channel 18 (UsrSpO/O18)	Single-point indication ON/OFF	–

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10019	Input channel 19 (UsrSpO/O19)	Single-point indication ON/OFF	–
10020	Input channel 20 (UsrSpO/O20)	Single-point indication ON/OFF	–
10021	Input channel 21 (UsrSpO/O21)	Single-point indication ON/OFF	–
10022	Input channel 22 (UsrSpO/O22)	Single-point indication ON/OFF	–
10023	Input channel 23 (UsrSpO/O23)	Single-point indication ON/OFF	–
10024	Input channel 24 (UsrSpO/O24)	Single-point indication ON/OFF	–
10025	Input channel 25 (UsrSpO/O25)	Single-point indication ON/OFF	–
10026	Input channel 26 (UsrSpO/O26)	Single-point indication ON/OFF	–
10027	Input channel 27 (UsrSpO/O27)	Single-point indication ON/OFF	–
10028	Input channel 28 (UsrSpO/O28)	Single-point indication ON/OFF	–
10029	Input channel 29 (UsrSpO/O29)	Single-point indication ON/OFF	–
10030	Input channel 30 (UsrSpO/O30)	Single-point indication ON/OFF	–
10031	Input channel 31 (UsrSpO/O31)	Single-point indication ON/OFF	–
10032	Input channel 32 (UsrSpO/O32)	Tagging / internal single-point indication ON/OFF	–
10033	Input channel 33 (UsrSpO/O33)	Tagging / internal single-point indication ON/OFF	–
10034	Input channel 34 (UsrSpO/O34)	Tagging / internal single-point indication ON/OFF	–
10035	Input channel 35 (UsrSpO/O35)	Tagging / internal single-point indication ON/OFF	–
10036	Input channel 36 (UsrSpO/O36)	Tagging / internal single-point indication ON/OFF	–
10037	Input channel 37 (UsrSpO/O37)	Tagging / internal single-point indication ON/OFF	–
10038 – 10048	reserved[4]		–

6.4.2 Register addresses 10049 to 10064: Application logic CFC

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10049	CFC-Output indication 1 (UsCfcSpO1)	Single-point indication ON/OFF, released as CFC output	–
10050	CFC-Output indication 2 (UsCfcSpO2)	Single-point indication ON/OFF, released as CFC output	–
10051	CFC-Output indication 3 (UsCfcSpO3)	Single-point indication ON/OFF, released as CFC output	–
10052	CFC-Output indication 4 (UsCfcSpO4)	Single-point indication ON/OFF, released as CFC output	–
10052	CFC-Output indication 5 (UsCfcSpO5)	Single-point indication ON/OFF, released as CFC output	–
10054	CFC-Output indication 6 (UsCfcSpO6)	Single-point indication ON/OFF, released as CFC output	–
10055	CFC-Output indication 7 (UsCfcSpO7)	Single-point indication ON/OFF, released as CFC output	–
10056	CFC-Output indication 8 (UsCfcSpO8)	Single-point indication ON/OFF, released as CFC output	–

[4] For an as "reserved" labeled input status register the value 0 is always returned if reading.

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10057	CFC-Output indication 9 (UsCfcSpO9)	Single-point indication ON/OFF, released as CFC output	–
10058	CFC-Output indication 10 (UsCfcSpO10)	Single-point indication ON/OFF, released as CFC output	–
10059	CFC-Output indication 11 (UsCfcSpO11)	Single-point indication ON/OFF, released as CFC output	–
10060	CFC-Output indication 12 (UsCfcSpO12)	Single-point indication ON/OFF, released as CFC output	–
10061	CFC-Output indication 13 (UsCfcSpO13)	Single-point indication ON/OFF, released as CFC output	–
10062	CFC-Output indication 14 (UsCfcSpO14)	Single-point indication ON/OFF, released as CFC output	–
10063	CFC-Output indication 15 (UsCfcSpO15)	Single-point indication ON/OFF, released as CFC output	–
10064	CFC-Output indication 16 (UsCfcSpO16)	Single-point indication ON/OFF, released as CFC output	–

Note

The CFC-Output indications allow configuration of further protection annunciations on Modbus registers, which are not contained in the standard mapping.

6.4.3 Register addresses 10065 to 10089: Automatic recloser status

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10065	>79 ON	1 = >79 ON	2701
10066	>79 OFF	1 = >79 OFF	2702
10067	>BLOCK 79	1 = >BLOCK 79	2703
10068	>79 T WAIT	1 = >79 T Wait (coordination control)	2705
10069	> 79 TRIP 1p	1 = >79 Ext. 1pole TRIP for internal A/R	2715
10070	> 79 TRIP 3p	1 = >79 Ext. 3pole TRIP for internal A/R	2716
10071	>Enable ANSI#-2	1 = >Enable 50/67-(N)-2 (override 79 blk)	2720
10072	>CB Ready	1 = >Circuit breaker READY for reclosing	2730
10073	79AR OFF	1 = 79 Auto recloser is switched OFF	2781
10074	reserved[4]		–
10075	CB is NOT ready	1 = Circuit breaker is NOT ready	2784
10076	79 DynBlock	1 = 79 - Auto-reclose is dynamically BLOCKED	2785
10077	79 in progress	1 = 79 - in progress	2801
10078	79 Close	1 = 79 - Close command	2851
10079	79 Successful	1 = 79 - cycle successful	2862
10080	79 Lockout	1 = 79 - Lockout	2863
10081	79 L-N Sequence	1 = 79-A/R single phase reclosing sequence	2878

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10082	79 L-L Sequence	1 = 79-A/R multi-phase reclosing sequence	2879
10083	>ZSC ON	1 = >Switch zone sequence coordination ON	2722
10084	>ZSC OFF	1 = >Switch zone sequence coordination OFF	2723
10085	TRIP Gnd Fault	1 = TRIP Ground Fault	2869
10086	TRIP Ph Fault	1 = TRIP Phase Fault	2870
10087	ZSC active	1 = Zone Sequencing is active	2883
10088	ZSC ON	1 = Zone sequence coordination switched ON	2884
10089	ZSC OFF	1 = Zone sequence coordination switched OFF	2885
10090 – 10096	reserved[4]		–

6.4.4 Register addresses 10097 to 10137: Time overcurrent protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10097	>BLOCK 50-2	1 = >BLOCK 50-2	1721
10098	>BLOCK 50-1	1 = >BLOCK 50-1	1722
10099	>BLOCK 51	1 = >BLOCK 51	1723
10100	>BLOCK 50N-2	1 = >BLOCK 50N-2	1724
10101	>BLOCK 50N-1	1 = >BLOCK 50N-1	1725
10102	>BLOCK 51N	1 = >BLOCK 51N	1726
10103	>BLK CLP stpTim	1 = >BLOCK Cold-Load-Pickup stop timer	1731
10104	50/51 PH OFF	1 = 50/51 O/C is switched OFF	1751
10105	50/51 PH BLK	1 = 50/51 O/C is BLOCKED	1752
10106	50/51 PH ACT	1 = 50/51 O/C is ACTIVE	1753
10107	50N/51N OFF	1 = 50N/51N is switched OFF	1756
10108	50N/51N BLK	1 = 50N/51N is BLOCKED	1757
10109	50N/51N ACT	1 = 50N/51N is ACTIVE	1758
10110	50(N)/51(N) PU	1 = 50(N)/51(N) O/C PICKUP	1761
10111	50/51 Ph A PU	1 = 50/51 Phase A picked up	1762
10112	50/51 Ph B PU	1 = 50/51 Phase B picked up	1763
10113	50/51 Ph C PU	1 = 50/51 Phase C picked up	1764
10114	50N/51NPickedup	1 = 50N/51N picked up	1765
10115	50(N)/51(N)TRIP	1 = 50(N)/51(N) TRIP	1791

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10116	50-2 picked up	1 = 50-2 picked up	1800
10117	50-2 TimeOut	1 = 50-2 Time Out	1804
10118	50-2 TRIP	1 = 50-2 TRIP	1805
10119	50-1 picked up	1 = 50-1 picked up	1810
10120	50-1 TimeOut	1 = 50-1 Time Out	1814
10121	50-1 TRIP	1 = 50-1 TRIP	1815
10122	51 picked up	1 = 51 picked up	1820
10123	51 TimeOut	1 = 51 Time Out	1824
10124	51 TRIP	1 = 51 TRIP	1825
10125	50N-2 picked up	1 = 50N-2 picked up	1831
10126	50N-2 TimeOut	1 = 50N-2 Time Out	1832
10127	50N-2 TRIP	1 = 50N-2 TRIP	1833
10128	50N-1 picked up	1 = 50N-1 picked up	1834
10129	50N-1 TimeOut	1 = 50N-1 Time Out	1835
10130	50N-1 TRIP	1 = 50N-1 TRIP	1836
10131	51N picked up	1 = 51N picked up	1837
10132	51N TimeOut	1 = 51N TimeOut	1838
10133	51N TRIP	1 = 51N TRIP	1839
10134	PhA InrushBlk	1 = Phase A trip blocked by inrush detection	1840
10135	PhB InrushBlk	1 = Phase B trip blocked by inrush detection	1841
10136	PhC InrushBlk	1 = Phase C trip blocked by inrush detection	1842
10137	INRUSH X-BLK	1 = Cross blk: PhX blocked PhY	1843
10138 – 10144	reserved[4]		–

6.4.5 Register addresses 10145 to 10188: Directional time overcurrent protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10145	>BLOCK 67-2	1 = >BLOCK 67-2	2615
10146	>BLOCK 67N-2	1 = >BLOCK 67N-2	2616
10147	>BLOCK 67-1	1 = >BLOCK 67-1	2621
10148	>BLOCK 67-TOC	1 = >BLOCK 67-TOC	2622
10149	>BLOCK 67N-1	1 = >BLOCK 67N-1	2623

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10150	>BLOCK 67N-TOC	1 = >BLOCK 67N-TOC	2624
10151	Phase A forward	1 = Phase A forward	2628
10152	Phase B forward	1 = Phase B forward	2629
10153	Phase C forward	1 = Phase C forward	2630
10154	Phase A reverse	1 = Phase A reverse	2632
10155	Phase B reverse	1 = Phase B reverse	2633
10156	Phase C reverse	1 = Phase C reverse	2634
10157	Ground forward	1 = Ground forward	2635
10158	Ground reverse	1 = Ground reverse	2636
10159	67-2 picked up	1 = 67-2 picked up	2642
10160	67N-2 picked up	1 = 67N-2 picked up	2646
10161	67-2 Time Out	1 = 67-2 Time Out	2647
10162	67N-2 Time Out	1 = 67N-2 Time Out	2648
10163	67-2 TRIP	1 = 67-2 TRIP	2649
10164	67/67-TOC OFF	1 = 67/67-TOC is switched OFF	2651
10165	67 BLOCKED	1 = 67/67-TOC is BLOCKED	2652
10166	67 ACTIVE	1 = 67/67-TOC is ACTIVE	2653
10167	67N OFF	1 = 67N/67N-TOC is switched OFF	2656
10168	67N BLOCKED	1 = 67N/67N-TOC is BLOCKED	2657
10169	67N ACTIVE	1 = 67N/67N-TOC is ACTIVE	2658
10170	67-1 picked up	1 = 67-1 picked up	2660
10171	67-1 Time Out	1 = 67-1 Time Out	2664
10172	67-1 TRIP	1 = 67-1 TRIP	2665
10173	67-TOC pickedup	1 = 67-TOC picked up	2670
10174	67-TOC Time Out	1 = 67-TOC Time Out	2674
10175	67-TOC TRIP	1 = 67-TOC TRIP	2675
10176	67N-2 TRIP	1 = 67N-2 TRIP	2679
10177	67N-1 picked up	1 = 67N-1 picked up	2681
10178	67N-1 Time Out	1 = 67N-1 Time Out	2682
10179	67N-1 TRIP	1 = 67N-1 TRIP	2683
10180	67N-TOCPickedup	1 = 67N-TOC picked up	2684
10181	67N-TOC TimeOut	1 = 67N-TOC Time Out	2685
10182	67N-TOC TRIP	1 = 67N-TOC TRIP	2686

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10183	67/67N pickedup	1 = 67/67N picked up	2691
10184	67 A picked up	1 = 67/67-TOC Phase A picked up	2692
10185	67 B picked up	1 = 67/67-TOC Phase B picked up	2693
10186	67 C picked up	1 = 67/67-TOC Phase C picked up	2694
10187	67N picked up	1 = 67N/67N-TOC picked up	2695
10188	67/67N TRIP	1 = 67/67N TRIP	2696
10189 – 10192	reserved[4]		–

6.4.6 Register addresses 10193 to 10200: Unbalanced load protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10193	>BLOCK 46	1 = >BLOCK 46	5143
10194	46 OFF	1 = 46 is switched OFF	5151
10195	46 BLOCKED	1 = 46 is BLOCKED	5152
10196	46 ACTIVE	1 = 46 is ACTIVE	5153
10197	46-2 picked up	1 = 46-2 picked up	5159
10198	46-1 picked up	1 = 46-1 picked up	5165
10199	46-TOC pickedup	1 = 46-TOC picked up	5166
10200	46 TRIP	1 = 46 TRIP	5170
10201 – 10208	reserved[4]		–

6.4.7 Register addresses 10209 to 10224: Frequency protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10209	>BLOCK 81O/U	1 = >BLOCK 81O/U	5203
10210	>BLOCK 81-1	1 = >BLOCK 81-1	5206
10211	>BLOCK 81-2	1 = >BLOCK 81-2	5207
10212	>BLOCK 81-3	1 = >BLOCK 81-3	5208
10213	>BLOCK 81-4	1 = >BLOCK 81-4	5209
10214	81 OFF	1 = 81 is switched OFF	5211
10215	81 BLOCKED	1 = 81 is BLOCKED	5212
10216	81 ACTIVE	1 = 81 is ACTIVE	5213
10217	81-1 picked up	1 = 81-1 picked up	5232

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10218	81-2 picked up	1 = 81-2 picked up	5233
10219	81-3 picked up	1 = 81-3 picked up	5234
10220	81-4 picked up	1 = 81-4 picked up	5235
10221	81-1 TRIP	1 = 81-1 TRIP	5236
10222	81-2 TRIP	1 = 81-2 TRIP	5237
10223	81-3 TRIP	1 = 81-3 TRIP	5238
10224	81-4 TRIP	1 = 81-4 TRIP	5239

6.4.8 Register addresses 10225 to 10247: Undervoltage and overvoltage protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10225	>BLOCK 27	1 = >BLOCK 27 undervoltage protection	6503
10226	>27 I SUPRVSN	1 = >27-Switch current supervision ON	6505
10227	>BLOCK 27-1	1 = >BLOCK 27-1 Undervoltage protection	6506
10228	>BLOCK 27-2	1 = >BLOCK 27-2 Undervoltage protection	6508
10229	>FAIL:FEEDER VT	1 = >Failure: Feeder VT	6509
10230	>FAIL: BUS VT	1 = >Failure: Busbar VT	6510
10231	>BLOCK 59-1	1 = >BLOCK 59-1 overvoltage protection	6513
10232	>59 I SUPRVSN	1 = >59 Switch current supervision ON	6515
10233	27 OFF	1 = 27 Undervoltage protection switched OFF	6530
10234	27 BLOCKED	1 = 27 Undervoltage protection is BLOCKED	6531
10235	27 ACTIVE	1 = 27 Undervoltage protection is ACTIVE	6532
10236	27-2 picked up	1 = 27-2 Undervoltage picked up	6533
10237	27-1 PU CS	1 = 27-1 Undervoltage PICKUP w/curr. supervision	6534
10238	27-2 picked up	1 = 27-2 Undervoltage picked up	6537
10239	27-2 PU CS	1 = 27-2 Undervoltage PICKUP w/curr. supervision	6538
10240	27-1 TRIP	1 = 27-1 Undervoltage TRIP	6539
10241	27-2 TRIP	1 = 27-2 Undervoltage TRIP	6540
10242	59 OFF	1 = 59-Overvoltage protection is switched OFF	6565
10243	59 BLOCKED	1 = 59-Overvoltage protection is BLOCKED	6566
10244	59 ACTIVE	1 = 59-Overvoltage protection is ACTIVE	6567
10245	59-1 picked up	1 = 59 picked up	6568
10246	59-1 PU CS	1 = 59 picked up w/curr. supervision	6569

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10247	59-1 TRIP	1 = 59 TRIP	6570
10248 - 10256	reserved[4]		–

6.4.9 Register addresses 10257 to 10278: Sensitive ground fault protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10257	>BLOCK 64	1 = >BLOCK 64	1201
10258	>BLOCK 50Ns-2	1 = >BLOCK 50Ns-2	1202
10259	>BLOCK 50Ns-1	1 = >BLOCK 50Ns-1	1203
10260	>BLOCK 51Ns	1 = >BLOCK 51Ns	1204
10261	>BLK 50Ns/67Ns	1 = >BLK 50Ns/67Ns	1207
10262	50Ns/67Ns OFF	1 = 50Ns/67Ns is switched OFF	1211
10263	50Ns/67Ns ACT	1 = 50Ns/67Ns is ACTIVE	1212
10264	64 Pickup	1 = 64 displacement voltage pick up	1215
10265	64 TRIP	1 = 64 displacement voltage element TRIP	1217
10266	50Ns-2 Pickup	1 = 50Ns-2 Pickup	1221
10267	50Ns-2 TRIP	1 = 50Ns-2 TRIP	1223
10268	50Ns-1 Pickup	1 = 50Ns-1 Pickup	1224
10269	50Ns-1 TRIP	1 = 50Ns-1 TRIP	1226
10270	51Ns Pickup	1 = 51Ns picked up	1227
10271	51Ns TRIP	1 = 51Ns TRIP	1229
10272	Sens. Gnd block	1 = Sensitive Ground fault detection BLOCKED	1230
10273	Sens.Gnd Pickup	1 = Sensitive Ground fault pick up	1271
10274	Sens. Gnd Ph A	1 = Sensitive Ground fault picked up in Ph A	1272
10275	Sens. Gnd Ph B	1 = Sensitive Ground fault picked up in Ph B	1273
10276	Sens. Gnd Ph C	1 = Sensitive Ground fault picked up in Ph C	1274
10277	SensGnd Forward	1 = Sensitive Gnd fault in forward direction	1276
10278	SensGnd Reverse	1 = Sensitive Gnd fault in reverse direction	1277
10279	SensGnd undef.	1 = Sensitive Gnd fault direction undefined	1278
10280 - 10288	reserved[4]		–

6.4.10 Register addresses 10289 to 10298: Circuit breaker failure protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10289	>BLOCK 50BF	1 = >BLOCK 50BF	1403
10290	>50BF ext SRC	1 = >50BF initiated externally	1431
10291	50BF OFF	1 = 50BF is switched OFF	1451
10292	50BF BLOCK	1 = 50BF is BLOCKED	1452
10293	50BF ACTIVE	1 = 50BF is ACTIVE	1453
10294	50BF int Pickup	1 = 50BF (internal) PICKUP	1456
10295	50BF ext Pickup	1 = 50BF (external) PICKUP	1457
10296	50BF TRIP	1 = 50BF TRIP	1471
10297	50BF int TRIP	1 = 50BF (internal) TRIP	1480
10298	50BF ext TRIP	1 = 50BF (external) TRIP	1481
10299 - 103004	reserved[4]		–

6.4.11 Register addresses 10305 to 10313: Thermal overload protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10305	BLOCK 49 O/L	1 = >BLOCK 49 Overload Protection	1503
10306	49 EmergencyStart	1 = >Emergency start of motors	1507
10307	49 O/L OFF	1 = 49 Overload Protection is switched OFF	1511
10308	49 O/L BLOCK	1 = 49 Overload Protection is BLOCKED	1512
10309	49 O/L ACTIVE	1 = 49 Overload Protection is ACTIVE	1513
10310	49 O/L I Alarm	1 = 49 Overload Current Alarm (I alarm)	1515
10311	49 O/L <Theta> Alarm	1 = 49 Overload Alarm! Near Thermal Trip	1516
10312	49 Winding O/L	1 = 49 Winding Overload	1517
10313	49 Th O/L TRIP	1 = 49 Thermal Overload TRIP	1521
10314 - 10320	reserved[4]		–

6.4.12 Register addresses 10321 to 10325: Motor start protection

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10321	>66 emerg.start	1 = >Emergency start	4823
10322	66 OFF	1 = 66 Motor start protection is switched OFF	4824
10323	66 BLOCKED	1 = 66 Motor start protection is BLOCKED	4825

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10324	66 ACTIVE	1 = 66 Motor start protection is ACTIVE	4826
10325	66 TRIP	1 = 66 Motor start protection TRIP	4827
10326 - 10336	reserved[4]		–

6.4.13 Register addresses 10337 to 10342: Startup supervision

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10337	START-SUP OFF	1 = Startup supervision is switched OFF	6811
10338	START-SUP BLK	1 = Startup supervision is BLOCKED	6812
10339	START-SUP ACT	1 = Startup supervision is ACTIVE	6813
10340	START-SUP TRIP	1 = Startup supervision TRIP	6821
10341	Rotor locked	1 = Rotor locked	6822
10342	START-SUP pu	1 = Startup supervision Pickup	6823
10343 – 10352	reserved[4]		–

6.4.14 Register addresses 10353 to 10359: Trip coil monitor

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10353	>74TC trip rel.	1 = >74TC Trip circuit superv.: trip relay	6852
10354	>74TC brk rel.	1 = >74TC Trip circuit superv.: bkr relay	6853
10355	74TC OFF	1 = 74TC Trip circuit supervision is switched OFF	6861
10356	74TC BLOCKED	1 = 74TC Trip circuit supervision is BLOCKED	6862
10357	74TC ACTIVE	1 = 74TC Trip circuit supervision is ACTIVE	6863
10358	74TC ProgFail	1 = 74TC blocked. Binary input is not set.	6864
10359	FAIL: Trip cir.	1 = 74TC Failure Trip Circuit	6865
10360 – 10368	reserved[4]		–

6.4.15 Register addresses 10369 to 10383: Inrush stabilization

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10369	50-1 InRushPU	1 = 50-1 InRush picked up	7551
10370	50N-1 InRushPU	1 = 50N-1 InRush picked up	7552
10371	51 InRushPU	1 = 51 InRush picked up	7553

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10372	51N InRushPU	1 = 51N InRush picked up	7554
10373	InRush OFF	1 = InRush is switched OFF	7556
10374	InRushPhBLOCKED	1 = InRush Phase is BLOCKED	7557
10375	InRush Gnd BLK	1 = InRush Ground is BLOCKED	7558
10376	67-1 InRushPU	1 = 67-1 InRush picked up	7559
10377	67N-1 InRushPU	1 = 67N-1 InRush picked up	7560
10378	67-TOC InRushPU	1 = 67-TOC InRush picked up	7561
10379	67N-TOCInRushPU	1 = 67N-TOC InRush picked up	7562
10380	Gnd InRush PU	1 = Ground InRush picked up	7564
10381	Ia InRush PU	1 = Phase A InRush picked up	7565
10382	Ib InRush PU	1 = Phase B InRush picked up	7566
10383	Ic InRush PU	1 = Phase C InRush picked up	7567
10384	reserved[4]		–

6.4.16 Register address 10385: Fault locator

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10385	>Start Flt. Loc	1 = >Start Fault Locator	1106
10386 – 10392	reserved[4]		–

6.4.17 Register addresses 10393 to 10396: Cold load pickup

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10393	CLP OFF	1 = Cold-Load-Pickup is switched OFF	1994
10394	CLP BLOCKED	1 = Cold-Load-Pickup is BLOCKED	1995
10395	CLP running	1 = Cold-Load-Pickup is RUNNING	1996
10396	Dyn set ACTIVE	1 = Dynamic settings are ACTIVE	1997
10397 – 10400	reserved[4]		–

6.4.18 Register addresses 10401 to 10408: Measurement supervision

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10401	Fail I Superv.	1 = Failure: general Current Supervision	161
10402	Failure <sum> I	1 = Failure: Current Summation	162
10403	Fail I balance	1 = Failure: Current Balance	163
10404	Fail V balance	1 = Failure: Voltage Balance	167
10405	Fail Ph. Seq.	1 = Failure: Phase Sequence	171
10406	Fail Ph. Seq. I	1 = Failure: Phase Sequence Current	175
10407	Fail Ph. Seq. V	1 = Failure: Phase Sequence Voltage	176
10408	MeasSup OFF	1 = Measurement Supervision is switched OFF	197
10409 – 10416	reserved[4]		–

6.4.19 Register addresses 10417 to 10426: Set point alarms

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10417	SP. Op Hours>	1 = Set Point Operating Hours	272
10418	SP. I A dmd>	1 = Set Point Phase A dmd>	273
10418	SP. I B dmd>	1 = Set Point Phase B dmd>	274
10420	SP. I C dmd>	1 = Set Point Phase C dmd>	275
10421	SP. I1dmd>	1 = Set Point positive sequence I1dmd>	276
10422	SP. |Pdmd|>	1 = Set Point |Pdmd|>	277
10423	SP. |Qdmd|>	1 = Set Point |Qdmd|>	278
10424	SP. |Sdmd|>	1 = Set Point |Sdmd|>	279
10425	SP. 37-1 alarm	1 = Set Point 37-1 Undercurrent alarm	284
10426	SP. PF(55)alarm	1 = Set Point 55 Power factor alarm	285
10427 – 10432	reserved[4]		–

6.4.20 Register addresses 10433 to 10446: Status annunciations

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10433	>Trig.Wave.Cap.	1 = >Trigger Waveform Capture	4
10434	>Reset LED	1 = >Reset LED	5
10435	>Set Group Bit0	1 = >Setting Group Select Bit 0	7
10436	>Set Group Bit1	1 = >Setting Group Select Bit 1	8

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
10437	>Manual Close	1 = >Manual close signal	356
10438	>DataStop	1 = >Stop data transmission	16
10439	>Test mode	1 = >Test mode	15
10440	>Door open	1 = >Cabinet door open	–
10441	>CB wait	1 = >CB waiting for Spring charged	–
10442	>No Volt.	1 = >No Voltage (Fuse blown)	–
10443	>SF6-Loss	1 = >SF6-Loss	–
10444	Cntrl Auth (device 7SJ63/6MD63)[5]	Control authority (0 = REMOTE, 1 = LOCAL)	–
10445	ModeLOCAL (device 7SJ63/6MD63)[5]	Control mode LOCAL (0 = LOCKED, 1 = UNLOCKED)	–
10446	Cntrl Auth (device 7SJ61/7SJ62)[6]	Control authority (0 = REMOTE, 1 = LOCAL)	–
10447	ModeLOCAL (device 7SJ61/7SJ62)[6]	Control mode LOCAL (0 = LOCKED, 1 = UNLOCKED)	–

[5] Not used in the 7SJ61 and 7SJ62.
[6] Not used in the 7SJ63 and 6MD63.

6.5 Input registers (3X references)

The input register block allows the Modbus master to read the values of the the analog inputs of the SIPROTEC device (recorded measured values).

Note

Depending on the device composition not all of the indicated analog inputs (and corresponding Modbus registers) may be available in the SIPROTEC device.

Ref. to chap. 5.3 for data type definition of measured values.

Standard mapping

By selecting the standard mappings (standard mapping 1 to standard mapping 3) the measured values can be scaled in accordance with the operational values of the primary equipment.

For each measured value the table in chap. 6.5.2 shows in the column “Scaling“ the scaling values defined in standard mappings 1 to 3, e.g. (for "IA =“):

1: 3276.7 A - applies to standard mapping 1

2: 3276.7 A - applies to standard mapping 2

3: 32.767 kA - applies to standard mapping 3

6.5.1 Reference values for selecting a standard mapping in accordance with the operating values of the primary equipment

Note

All conditions in the table below to the selected standard mapping must be fulfilled so that the measured values are transferred correctly via Modbus.

Dependent on the SIPROTEC device either parameter address 207 or parameter address 208 is adjustably.

Standard mapping no.	Parameter address 1101 Primary operating voltage V_{prim}	Parameter address 1102 Primary operating current I_{prim}	 Energy values of the primary equipment
1	1,0 kV ... 327.67 kV	10 A ... 999 A	$I_{prim} * V_{prim} * \sqrt{3}$ >= 1 MW
2	1,0 kV ... 32.76 kV	1 kA ... 32 kA	1 MW <= $I_{prim} * V_{prim} * \sqrt{3}$ < 1 GW
3	1,0 kV ... 32.76 kV	10 A ... 999 A	$I_{prim} * V_{prim} * \sqrt{3}$ < 1 MW

Standard mapping no.	Parameter address 206 Ratio factor V_{ph} / V_{delta}	Parameter address 207 Ratio factor I_N / I_{ph}	Parameter address 208 Ratio factor I_{Ns} / I_{ph}
1	$V_{prim} * V_{ph} / V_{delta}$ < 327.67 kV	$I_{prim} * I_N / I_{ph}$ < 1 kA	$I_{prim} * I_{Ns} / I_{ph}$ < 1 kA
2	$V_{prim} * V_{ph} / V_{delta}$ < 32.76 kV	$I_{prim} * I_N / I_{ph}$ >= 1 kA	$I_{prim} * I_{Ns} / I_{ph}$ < 1 kA
3	$V_{prim} * V_{ph} / V_{delta}$ < 32.76 kV	$I_{prim} * I_N / I_{ph}$ < 1 kA	$I_{prim} * I_{Ns} / I_{ph}$ < 1 kA

6.5.2 Recorded measured values

Register address	Designation of the SIPROTEC objects	Comments	Scaling (32767 corresponds to ...)	Internal object no.
30001	Ia =	Ia	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	601
30002	Ib =	Ib	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	602
30003	Ic =	Ic	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	603
30004	In =	In	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	604
30005	Va =	Va	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	621
30006	Vb =	Vb	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	622
30007	Vc =	Vc	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	623
30008	Va-b =	Va-b	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	624
30009	Vb-c =	Vb-c	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	625
30010	Vc-a =	Vc-a	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	626
30011	VN =	VN	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	627
30012	P =	P (active power)	1: 327.67 MW 2: 327.67 MW 3: 3276.7 kW	641
30013	Q =	Q (reactive power)	1: 327.67 MVAR 2: 327.67 MVAR 3: 3276.7 kVAR	642
30014	S =	S (apparent power)	1: 327.67 MVAR 2: 327.67 MVAR 3: 3276.7 kVAR	645
30015	Freq =	Frequency	327.67 Hz	644
30016	INs Real =	Resistive ground current in isol. systems	3276.7 A	701
30017	INs Reac =	Reactive ground current in isol. systems	3276.7 A	702
30018	PF =	Power Factor	3.2767	901
30019	I1 =	I1 (positive sequence)	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	605
30020	I2 =	I2 (negative sequence)	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	606
30021	3Io =	3Io (zero sequence)	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	831
30022	V1 =	V1 (positive sequence)	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	629

Register address	Designation of the SIPROTEC objects	Comments	Scaling (32767 corresponds to ...)	Internal object no.
30023	V2 =	V2 (negative sequence)	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	630
30024	3Vo =	3Vo (zero sequence)	1: 327.67 kV 2: 32.767 kV 3: 32.767 kV	832
30025	<Theta> Rotor	Temperature of rotor	327.67 %	805
30026	<Theta> Stator	Temperature of stator	327.67 %	806
30027	Td1=	Transducer 1	32.767 mA	996
30028	Td2=	Transducer 2	32.767 mA	997

6.6 Holding registers (4X references)

The holding register block allows the Modbus master to read system information, measured values – mean values, metered measurands as well as fault locations.

Note

Depending on the device composition not all of the indicated measured values/metered measurands (and corresponding Modbus registers) may be available in the SIPROTEC device.

6.6.1 Register addresses 40001 to 40048: System information

- Registers are write-protected[7].

Register address	*Designation*	*Comments*
40001 – 40008	Hardware designation of the communication module (string, max. 16 characters)	"AME-GEN“ for AME module, "AMO-GEN“ for AMO module
40009 – 40010	Communication module software revision	Example: Register 40009 = 0001H, Register 40010 = 0205H -> Revision 1.2.5
40011 – 40026	MLFB (order number) of the SIPROTEC device (string, max. 32 characters)	Example: "7SJ63254EA903HG3----0D----------"
40027 – 40034	Date and time of mapping data generation (string, max. 16 characters)	Example: "140100095747330" corresponds to Date: 14th Jan 2000, Time: 09 hours 57 min. 47 seconds and 330 milliseconds
40035 – 40036	Number of selected standard mapping , Revision of mapping data	MSB of register 40035: Number of selected standard mapping, LSB of register 40035 and value of register 40036: Revision of mapping data. Example: Register 40035 = 0102H, Register 40036 = 0304H -> Standard mapping 1, Revision 2.3.4

6.6.2 Register address 40129: Diagnosis

- Registers are write-protected[7],
- The contents of these registers are also readable using function "Diagnostics" (function code 7), subfunction "Return Diagnostic Register" (subfunction code 2).

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Internal object no.*
40129 / 2^0	Device OK	1 = Update of the device replica in the SIPROTEC device completed after initial start or restart	51
40129 / 2^1	reserved	= 0	–
40129 / 2^2	Settings Calc.	1 = Setting calculation is running	70
40129 / 2^3	Chatter ON	1 = Chatter ON	125
40129 / 2^4	Error Sum Alarm	1 = Error with a summary alarm ON	140

[7] A write access is rejected with exception code 03 (ILLEGAL_DATA_VALUE).

Register address	Designation of the SIPROTEC objects	Comments	Internal object no.
40129 / 2^5	Alarm Sum Event	1 = Alarm Summary Event ON	160
40129 / 2^6	Relay PICKUP	1 = Relay PICKUP (protection, summary alarm)	501
40129 / 2^7	Relay TRIP	1 = Relay GENERAL TRIP command (common, summary alarm)	511
40129 / 2^8	DataStop	1 = "Stop data transmssion" is active	–
40129 / 2^9	Test mode	1 = Test mode is active	–
40129 / 2^{10}	reserved	= 0	–
40129 / 2^{11}	reserved	= 0	–
40129 / 2^{12}	reserved	= 0	–
40129 / 2^{13}	reserved	= 0	–
40129 / 2^{14}	reserved	= 0	–
40129 / 2^{15}	reserved	= 0	–

Error with a summary alarm

- 7SJ61 and 7SJ62:
  - The "Error with a summary alarm" corresponds to the internal alarm “I/O-Board error".
- 7SJ63 and 6MD63:
  - The "Error with a summary alarm" is ON if at least one of the following internal alarms assumes the value ON:
    “Error Board 1“, “Error Board 2“, "Error Board 3“, "Error Board 4“, "Error Board 5“, “Error Board 6“, "Error Board 7“, “I/O-Board error“,
  - additionally for the 7SJ631, 7SJ632, 7SJ633, 7SJ635, 7SJ636 and 6MD63 except 6MD63x0: “Error 5V“, “Error 0V“, “Error -5V“.

Alarm summary event

The "Alarm summary event" is indicated, if at least one of the following internal alarms assumes the ON status:

"Failure: Current summation“, "Failure: Current balance“, "Failure: Voltage balance“, "Failure: Phase sequence current“, "Failure: Phase sequence voltage“.

Stop data transmission

The functionality "Stop data transmission" is not supported via Modbus communication. If "Stop data transmission" is active nevertheless data via Modbus will be transmitted furthermore. The annunciation "DataStop" signals the activation of "Stop data transmission" however and can be evaluated correspondingly in the Modbus master.

6.6.3 Register addresses 40201 to 40215: Metered measurands

- Data type definition ref. to chap. 5.4,
- Registers are write-protected[7].

Scaling

The scaling of the metered measurands, which are derived from measured values, refers to**:**

60000 impulses per hour for V = V_{prim} and I = I_{prim}

V_{prim} = **PRIMARY OPERATING VOLTAGE**
(parameter address = 1101)

I_{prim} = **PRIMARY OPERATING CURRENT**
(parameter address = 1102)

Example

In the parameter set is configured:

I_{prim} = 100 A und V_{prim} = 12 kV,

60000 impulses correspond so that:

1 h * 100 A * 12 kV * $\sqrt{3}$ = 2078.46 kWh

Note

The type of the update (cyclic, with or without deletion) and the update interval must be programmed for the metered measurands (except for the operating hours meter) with the parameterization software DIGSI.

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Scaling (2^{31}-1 of the unsigned long value corresponds to...)*	*Internal object no.*
40201 – 40202	Wp(puls) =	Pulsed Energy Wp (active) (metering impulses at binary input)	2^{31}-1 impulses	888
40203 – 40204	Wq(puls) =	Pulsed Energy Wq (reactive) (metering impulses at binary input)	2^{31}-1 impulses	889
40205 – 40206	WpForward=	Wp Forward (*metered measurand derived from measured value*)	2^{31}-1 impulses	924
40207 – 40208	WqForward=	Wq Forward (*metered measurand derived from measured value*)	2^{31}-1 impulses	925
40209 – 40210	WpReverse =	Wp Reverse (*metered measurand derived from measured value*)	2^{31}-1 impulses	928
40211 – 40212	WqReverse =	Wq Reverse (*metered measurand derived fom measured value*)	2^{31}-1 impulses	929
40213 – 40214	Op.Hours=	Counter of operating hours of the primary equipment	2^{31}-1 hours	1020

Note

- The scaling of the metered measurands at binary inputs ("Wp(puls)" and "Wq(puls)") depends on the externally connected pulse generator.
- The error status bit of the metered measurands (except of the operating hours meter) is set after a initial start or restart of the SIPROTEC device until the second update cycle of the metered measurands after the reset. This indicates the metered measurands as "invalid by reset".
- The error status bit of the metered measurand also signals the condition of the external fault input of the metered measurands at binary input (as far as this is parameterized).

6.6.4 Register addresses 40251 to 40257: Measured values – mean values

- Data type definition ref. to chap. 5.3,
- Registers are write-protected[7],
- Explanations for selecting a standard mapping ref. to chap. Kap. 6.5.1.

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Scaling (32767 corresponds to ...)*	*Internal object no.*
40251	Ia dmd=	I A demand	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	963
40252	Ib dmd=	I B demand	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	964
40253	Ic dmd=	I C demand	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	965
40254	I1dmd =	I1 (positive sequence) Demand	1: 3276.7 A 2: 32.767 kA 3: 3276.7 A	833
40255	Pdmd =	Active Power Demand	1: 327.67 MW 2: 327.67 MW 3: 3276.7 kW	834
40256	Qdmd =	Reactive Power Demand	1: 327.67 MVAR 2: 327.67 MVAR 3: 3276.7 kVAR	835
40257	Sdmd =	Apparent Power Demand	1: 327.67 MVAR 2: 327.67 MVAR 3: 3276.7 kVAR	836

6.6.5 Register addresses 40301 to 40305: Fault locator and fault currents

- Data type definitions ref. to chap. 5.3,
- Registers are write-protected[7].

Note

Always the latest fault location and fault currents are stored in the Modbus registers.

In the event of a fault, reading out of the fault record protocol from the SIPROTEC device is necessary for an exact diagnosis.

Register address	*Designation of the SIPROTEC objects*	*Comments*	*Scaling (32767 corresponds to ...)*	*Internal object no.*
40301	Ia =	Primary fault current Ia	327,67 kA	533
40302	Ib =	Primary fault current Ib	327,67 kA	534
40303	Ic =	Primary fault current Ic	327,67 kA	535
40304	Xsec =	Fault locator: secondary REACTANCE	327,76 Ohm	1118
40305	dist =	Fault Locator: Distance to fault	3276,7 km/miles	1119

7 Technical data

7.1 Modbus slave for the SIPROTEC devices

Modbus slave	
Slave addresses	1 – 247
Modbus modes	RTU, ASCII
Modbus functions	• Read Coil Status • Read Input Status • Read Holding Register • Read Input Register • Force Single Coil • Preset Single Register • Read Exception Status • Diagnostics Subfunktion 0 (Return Query Data) Subfunktion 2 (Return Diagnostic Register) • Force Multiple Coils • Preset Multiple Regs
Data transmission	
Baud rates (Bit/s)	300, 600, 1200, 2400, 4800, 9600, 19200
Parity bit	RTU mode: NONE, EVEN, ODD ASCII mode: EVEN, ODD

7.2 Hardware interface

Two communication modules are available for the connection of Modbus to the devices 7SJ61, 7SJ62, 7SJ63 and 6MD63:

AME module Universal asynchronous communication module with isolated RS485 interface.

AMO module Universal asynchronous communication module with fibre-optical interface.

7.2.1 Connection via the AME module

Connections	9pole D-SUB outlet (ref. to Table 7-2)
Protocol	semi-duplex
Max. line length	1000 m / 3300 ft
Insulation level	500 V_{AC}
Bus termination	Integrated, connectable terminating resistors 221 Ohm between A and B 392 Ohm between B and VCC1 as well as A and GND1 Input resistor not terminated ≥ 10 kOhm, then bus termination via bus plug with integrated terminating resistors.
Level	Transmitter: Low: -5 V ≤ U_{A-B} ≤ -1.5 V High: +5 V ≥ U_{A-B} ≥ +1.5 V Receiver: Low: U_{A-B} ≤ -0.2 V High: U_{A-B} ≥ +0.2 V Transmitter and receiver are surge-proof for voltages between A and GND1 as well as B and GND1 in the range of –7 V...+12 V.
Max. number of modules at the bus	32 [8]

Table 7-1 Technical data of the connection via the AME module

Pin	*RS485 signal*	*Meaning*
1	Shield	Shield / operational ground
2		-
3	A	RS485 connection pin A
4	RTS	Directions control RTS (TTL level)
5	GND1	Ground to VCC1
6	VCC1	Supply voltage +5V DC (max. 100 mA, supply voltage for terminating resistors)
7		-
8	B	RS485 connection pin B
9		-

Table 7-2 Assignment of the bus connection at the device (D-SUB outlet)

7.2.2 Connection via the AMO module

Connections	fibre-optical interface, Rx and Tx, 820 nm, BFOC/2.5
Protocol	semi-duplex
Max. line length	• 2000 m / 1.25 miles for glass fibre 62.5/125 µm • approx. 2 m for plastic fibre
Optical budget	min. 8 dB for glass fibre 62.5/125 µm
Status for “no signal“	light OFF

Table 7-3 Technical data of the connection via the AMO module

[8] For exclusive utilisation of ***AME*** modules at the bus.
This value could be smaller depending on the used Modbus master and further modules at the bus.
If more then 32 devices at the bus are needed, RS485 repeaters which support bit retiming have to be used.

Glossary

AME	Universal **a**synchronous communication **m**odule with (**e**lectrical) isolated RS485 interface for the SIPROTEC devices from Siemens.
AMO	Universal **a**synchronous communication **m**odule with fibre-**o**ptical interface for the SIPROTEC devices from Siemens.
AR	**A**utomatic **R**ecloser
CFC	**C**ontinuous **F**unction **C**hart
CRC	**C**yclical **R**edundancy **C**heck
DC	**D**ouble **C**ommand
DIGSI	Parameterization system for SIPROTEC devices
DP	**D**ouble-**p**oint Indication
Input data/ input direction	Data from the Modbus **slave to the** Modbus **master**.
LRC	**L**ongitudinal **R**edundancy **C**heck
LSB	**L**east **S**ignificant **B**yte
Mapping	Allocation of the SIPROTEC data objects to the positions in the Modbus register map.
MSB	**M**ost **S**ignificant **B**yte
Output data/ output direction	Data from the Modbus **master to the** Modbus **slave**.
SC	**S**ingle **C**ommand
SP	**S**ingle-**p**oint Indication

Index