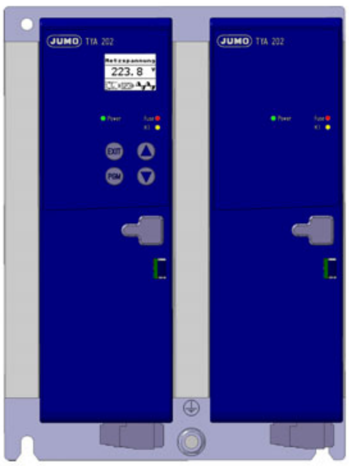
Type 70906X

Thyristor power units TYA 201, 202 and 203

Typ 709061/8-01-020



Typ 709062/8-01-100

Typ 709063/8-01-20

Interface description
for Types 709061,-62, and -63

70906100T92Z001K000

JUMO

V1.00/EN/00566466

Contents

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1.1 Preface

Please read these operating instructions before starting up the instrument. Keep these operating instructions in a place that is accessible to all users at all times.
Please help us to improve this manual. Your suggestions will be welcome.

Warranty

☞ All necessary settings are described in this Operating Manual.
Handling the device in any way that is not described in the Operating Manual or that is expressly forbidden will jeopardize your warranty rights.
Please contact the nearest subsidiary or the head office should you encounter any problems.

Service Service see last page

1.2 Typographical conventions

1.2.1 Warning signs

Danger

This symbol is used when there may be danger to persons if the instructions are ignored or not followed correctly!

Caution

This sign is used where there may be damage to equipment or data if the instructions are ignored or not followed correctly!

ESD

This symbol is used when precautions are to be taken for handling **electrostatic discharge endangered components**.

1.2.2 Note signs

Note

This symbol is used when your attention is drawn to special information.

Reference

This symbol refers to **further information** contained in other manuals, chapters or sections.

Footnote

abc[1]

Footnotes are comments that **refer** to specific text sections. Footnotes consist of two parts:
A marker in the text and the footnote text itself.
The markers in the text are arranged as continuous superscript numbers.

String of commands

Config level ➔ Power controller ➔ Operating mode

Small arrows between words are intended to facilitate faster location of parameters in the configuration level.

1.2.3 Representation

Hexadecimal number	0x0010	A hexadecimal number is identified by "0x“ preceding the actual number (here: 16 decimal).

1.3 Available interfaces

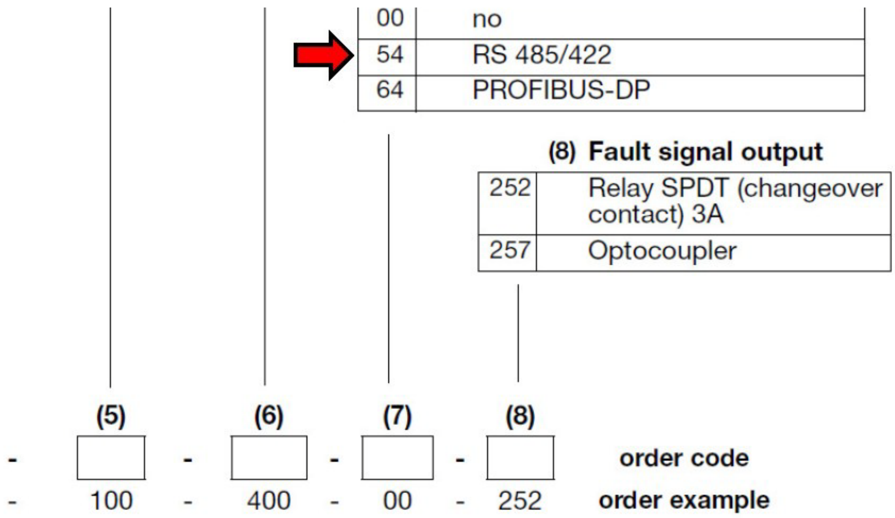
The setup interface on the front (USB connector, type B Mini 5-pole) is fitted in every device.

An RS422 / RS485 (4-pole screw and plug-type connector on the device bottom) or Profibus interface (9-pole D-Sub connector on the front) must be specified in the order.

This operating manual only describes communication via the RS422/485 interface using the Modbus protocol.

1.4 Identifying the device version

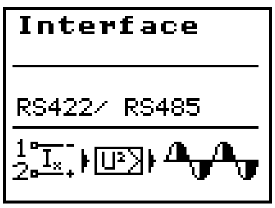
Only devices having 54 in the type code (7) are equipped with the RS422/485 interface.



On the device

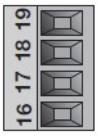
✱ Press PGM

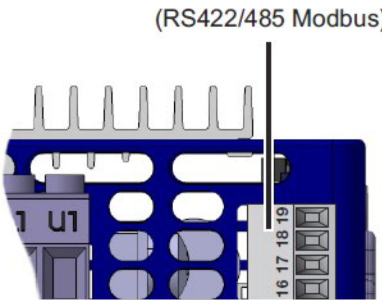
✱ Select the "Device info" menu point and press PGM.



1 Introduction

1.5 Interface connection

Connection	Modbus		RS422	RS485
Plug-in screw terminals on the underside of the case	19		TxD (-)	RxD/TxD B(-)
	18		TxD (+)	RxD/TxD A(+)
	17		RxD (-)	-
	16		RxD (+)	-



1.6 Termination resistor of the serial RS422/485 interface

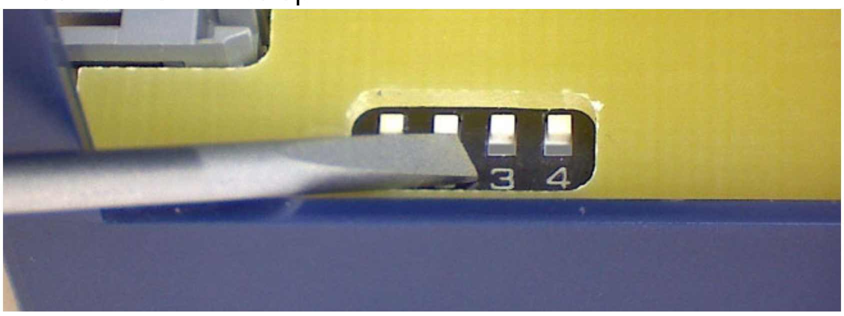
To ensure fault-free operation of several instruments in a line structure, their internal termination resistors must be activated at the start and end.

✱ Isolate the device

✱ Open and turn the case

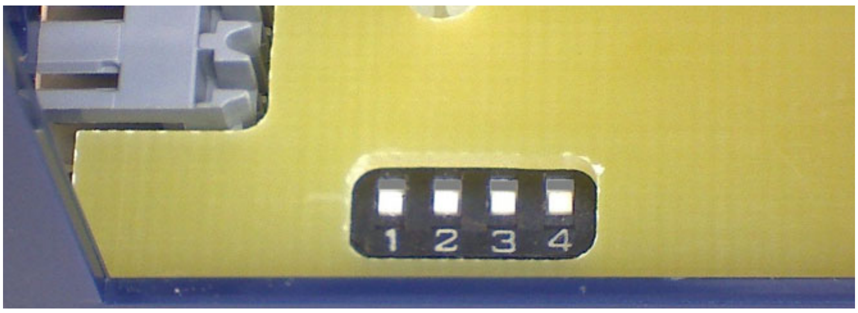
Bus termination resistor active

Push all 4 switches up



no bus termination (by the factory)

Push all 4 switches down



1.7 Configuration

Configuration is either carried out on the device or via the setup program. Here you can find an excerpt from the operating manual.

5.1.9 RS422/485

Interface parameters for RS422/485 (see interface description B70.9061.2)

	Value/settings	Description
Baud rate	9600	
	19200	
	38400	
Data format	8-1-none	Data bits-stop bits-parity check
	8-1-odd	
	8-1-even	
	8-2-none	
Device address	**1** ...255	
Min. response time	**0 ... 500ms**	

■ / **Bold** = factory setting

1.7.1 Baud rate

9 600 baud, 19 200 baud or 38 400 baud

1.7.2 Data format

Number of the data bits - number of the stop bits - parity:

- 8-1-none
- 8-1-even
- 8-1-odd
- 8-2-none

1.7.3 Device address

Ensure that the device address is within the range of 1 to 255.

Address 0 is reserved for broadcast messages, i.e. the instruction is carried out by the TYA 200 but no feedback is given.

If an instruction with the device address 255 is received by the device, it is always processed, even if a different device address is configured.

If the device adress is set to 0, the device doesn’t display a bus error after 10s without an order.

1.7.4 Min. response time

Here you can enter a value within the range of 0 to 500 ms.

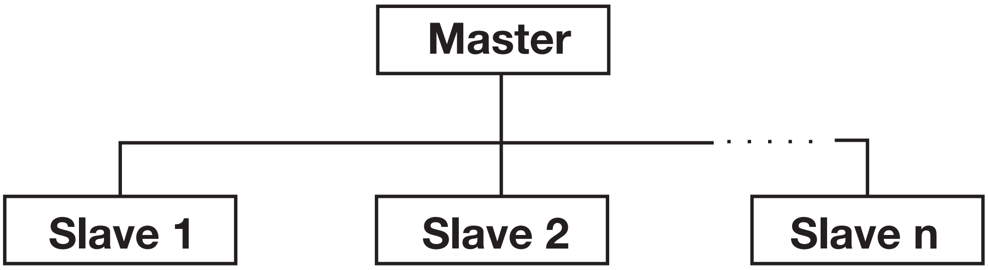
The time entered here must elapse after a Modbus inquiry was received before the response is transmitted to the master. We recommend to use the parameter for the RS485 interface when the counter part (master) or one of the other slaves connected to the bus require a certain time to toggle between sending and receiving.

The set time of 0 ms means that the TYA 200 responds as soon as possible. This setting should be used for the RS422 interface.

⇨ Section 2.4 “Timing of the communication”

2.1 Master-Slave principle

Communication between a PC (master) and a device (slave) using the Modbus takes place according to the master-slave principle, in the form of data request / instruction - response.



The master controls the data exchange, the slaves only have a response function. They are identified by their device address.

2.2 Transmission mode (RTU)

The transmission mode used is the RTU mode (Remote Terminal Unit). Data is transmitted in binary format (hexadecimal) with 8 bits. The LSB (least significant bit) is transmitted first. The ASCII operating mode is not supported.

Data format The data format describes the structure of a character transmitted. The following data format options are available:

Data word	Parity bit	Stop bit 1/2 bit	Number of bits
8 bits	—	1	9
8 bits	even	1	10
8 bits	odd	1	10
8 bits	—	2	10

2.3 Device address

Ensure that the device address is within the range of 1 to 255.

Address 0 is reserved for broadcast messages, i.e. the instruction is carried out by the TYA 200 but no feedback is given.

☞ A maximum of 31 slaves can be addressed via the RS485 interface.

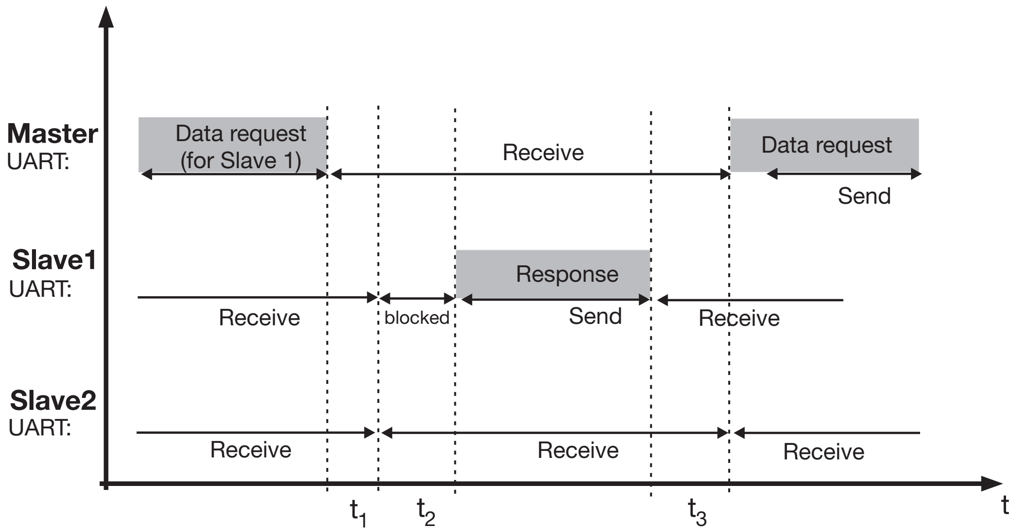
There are two data exchange possibilities:

Query Data request/instruction by the master to a slave via the corresponding device address.
The slave addressed responds.

Broadcast Instruction by the master to all slaves via the device address 0. The connected slaves do not respond. Thus, a specific set point value can be transmitted to all slaves. In such a case, the correct acceptance of the value by the slaves should be checked by subsequently reading out the set point value.
Data request with the device address 0 is meaningless.

2.4 Timing of the communication

Timing scheme Example for the time sequence of a communication with 1 Modbus master (e.g. a SCADA software on a PC or a PLC) and 2 TYA 200 as Modbus slave 1 and Modbus slave 2:



t1 **End marker of the request:**

As per Modbus specification: min. 3.5 times the transmission time required for 1 character depending on the baud rate. In TYA 200 the time is:

- for 9600 bps: 4.1 ms
- for 19200 bps: 2.1 ms
- for 38400 bps: 1.1 ms

t2 **Internal processing time:**

This time is required by the power controller to process the received request and prepare the response. The TYA 200 normally requires 1 to 3 ms and max. 6 ms.

t3 **End marker of the response:**

Identical duration as t1.

Timing

The master transmits a data request for slave 1. After transmitting the last character, all connected TYA 200 slaves wait for the specified time t1 and subsequently evaluate the instruction. Slave 2 discards the instructions due to an incompatible device address. Slave 1, however, starts to process the request and prepare the response within the set time t2. Then, slave 1 transmits the response and immediately switches back to receiving after transmitting the last character. Slave 2, which can also "hear" the response (RS485) must wait for the set time t3 prior to evaluating the received response, ignoring it due to the incompatible device address and switching back to receiving. The master is only now allowed to transmit a new instruction!
No data requests are admissible from the master during t1, t2 and t3, otherwise, the TYA 200 will either ignore the instruction or the data will become invalid on the bus due to data collision.
Time t3 is required by all other slaves on the bus to switch back to receiving. (Due to the fact that every TYA 200 connected to the bus (RS485) also receives the response, the master must wait for this time prior to sending a new instruction. Otherwise, the other power controllers are not ready to receive instructions.)

Min. response time

In the TYA 200, it is also possible to set a mininum response time from 0 to 500 ms in the configuration. The TYA 200 does not transmit any response before this time has elapsed (measured from the time the last character was received), thus, the time period of t1 + t2 is accordingly extended. - This setting is required for RS485 interfaces to:

a) allow the master to switch from "Transmit" to "Receive".
b) allow other devices, which require much more time before the device address of the received protocol is evaluated to process the data.
Configure the **Minimum response time** for the RS485 interface such that even the slowest bus participant has evaluated the data request of the master and has noted that this instruction is not relevant before the TYA 200 starts its response. (In an interface linkage with a LOGOSCREEN 500 cf or LOGOSCREEN es, the minimum response time for the TYA200 should be set to 25 ms.)

2.5 Troubleshooting

In the event of the following errors, the TYA 200 does not respond to the transmitted instruction:

- The baud rate and/or data format of Master and TYA 200 are not compatible
- The device address of the TYA 200 does not comply with that contained in the protocol and is not equal to 255 (for 255, a response is always transmitted).
- The checksum (CRC) is not correct.
- The instruction is incomplete or over-defined
- The number of words to be read is zero.

In these cases, the instruction of the master should be transmitted again after timeout.
If the instruction of the master was received without transmission error but cannot be processed for specific reasons, the TYA 200 will respond as specified in the Modbus protocol: In the response, the received function code is linked to 0x80 OR as error identification and the error code is sent back in the data field.

Error codes

- 01: invalid Modbus function
- 02: invalid data address
- 03: Data value outside the admissible value range
- 04: Error while processing the instruction
  (e.g. Could not write to flash memory)
- 06: Instruction cannot be carried out at this time
  therefore try again
- 08: write-protected

If a number of words exceeding the admissible number is to be read or written (see table of the Modbus functions), the TYA 200 also sends back error code 02.

When reading out float values, the error number is entered into the value itself, if the value is invalid, i.e. the error code is transmitted as float value instead of the measured value.

Errors	Error code for float values
(Un-derrange)	0xFF800000 (Negative Infinity)
(Overrange)	0x7F800000 (Positive Infinity)
other invalid value	0x7FC00000 (Not a Number)

2.6 Recognition of bus errors

If an RS4xx-Interface is used in the TYA 200, the failure of Modbus-Master was not recognized including Software-Version 256.01.10.
From Software-Version 256.01.11 on, the following feature was added:

If an RS4xx-Interface is used in the TYA 200 and at least 10 s no bus-telegram is received, a bus-error is indicated.
In this error-case the TYA 200 can be switch over to configurable replacement value, because the setpoint over Modbus cannot be sent from the Master. If you set the Modbus-device-adress to 0, this behaviour will be deactivated.

2.7 Checksum (CRC16)

The checksum (CRC16) serves to recognize transmission errors. If an error is identified during evaluation, the device concerned does not respond.

Calculation scheme

<table>
<tr><td colspan="4">CRC = 0xFFFF</td></tr>
<tr><td rowspan="5"></td><td colspan="3">CRC = CRC XOR ByteOfMessage</td></tr>
<tr><td colspan="3">For (1 to 8)</td></tr>
<tr><td rowspan="3"></td><td colspan="2">CRC = SHR(CRC)</td></tr>
<tr><td colspan="2">if (flag shifted right = 1)</td></tr>
<tr><td>then
CRC = CRC XOR 0xA001</td><td>else</td></tr>
<tr><td colspan="4">while (not all ByteOfMessage processed);</td></tr>
</table>

Example

Data request: Read two words, starting at address 0x00CE (CRC16 = 0xA592)

07	03	00	CE	00	02	A5	92
						CRC16	

Response: (CRC16 = 0xADF5)

07	03	04	00	00	41	C8	AD	F5
			Word 1		Word 2		CRC16	

The following functions are available for the device:

Function number	Function	Max. number
0x03 or 0x04	Read n words	max. 127 words (= 254 bytes)
0x06	Writing a word	1 word
0x10	Write n words	max. 127 words (= 254 bytes)

If an instruction is received with a different function No. by the device, it will respond with the Modbus error code 1 (ILLEGAL FUNCTION).

3.1 Read n words

This function is used to read n words starting from a specific address.

Data request

Slave address	Function 0x03 or 0x04	Address first word	Number of words (max. 127)	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

response

Slave address	Function 0x03 or 0x04	Number of bytes read	Word value(s)	Checksum CRC16
1 byte	1 byte	1 byte	x byte	2 bytes

Example

Read the load current measured value

Modbus address of the load current = 0x003C

Data request:

01	03	00	3C	00	02	0407

Response:

01	03	04	70	A3	41	45	E172
			Load current = 12.34 A				CRC

3.2 Writing a word

For the Write Word function, the data blocks for instruction and response are identical.

instruction

Slave address	Function 0x06	Word address	Word value	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

response

Slave address	Function 0x06	Word address	Word value	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example

Write external inhibit input = 1

Modbus address = 0x0074

Instruction:

01	06	00	74	00	01	0810

Response (as instruction):

01	06	00	74	00	01	0810

3.3 Write n words

This function is used to write n words starting from a specific address.

instruction

Slave address	Function0x10	Address first word	Number of words (max. 127)	Number of bytes	Word value(s)	Checksum-CRC16
1 byte	1 byte	2 bytes	2 bytes	1 byte	x byte	2 bytes

response

Slave address	Function 0x10	Address first word	Number of words	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example

Write set point value = 12.34

Modbus address = 0x0044

Instruction:

01	10	00	44	00	02	04	70	A3	41	45	ED2D
							Set point value = 12.34				CRC

Response:

01	10	00	44	00	02	01DD

4.1 Transmission formats

4.1.1 Integer values

For the transmission of integer values (and also for the addresses) the arrangement "Big-Endian" (Motorola format) is used.

The high byte first, followed by the low byte.

e.g.: Request of the int value of Modbus address 0x000D, if 45 (= 0x002D) is written beneath this address
Request: `0103000D000115C9`
Response: `010302`**`002D`**`7859`

4.1.2 Float values

For float values, the TYA 200 Modbus operates with the IEEE-754 standard format (32 bits), the only difference being that byte 1 and 2 are changed over with byte 3 and 4.

SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
Byte 1	Byte 2	Byte 3	Byte 4

Single-float-Format (32 bit) nach Standard IEEE 754

S - Vorzeichen-Bit
E - Exponent (2er-Komplement)
M - 23 Bit normalisierte Mantisse

Modbus-Adresse x		Modbus-Adresse x+1	
MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM
Byte 3	Byte 4	Byte 1	Byte 2

Modbus-float-Format

e.g.: Request of the float value of Modbus address 0x0104, if 550.0 (= 0x44098000 in the IEEE-754 format) is written beneath this address
Request: `0103010400028436`
Response: `010304`**`80004409`**`20F5`

Please determine the way float values are saved in your application. Once transmission from the paperless recorder is completed, the bytes of the float value possibly need to be changed over accordingly.

4.1.3 Strings (texts)

Character strings are always terminated with '\0' (ASCII code 0x00) to mark the end. Characters after this mark are without significance.

e.g.:Request of the text of Modbus address 0x000E, to which the "TYA 200" (ASCII code: 0x54, 0x59, 0x41, 0x20, 0x32, 0x30, 0x30, 0x20, 0x00) is written:

Request: `0103000E0005E40A`

Response: `01030A`**`54594120323030200000`**`5E93`

(instead of 0x00 directly in front of CRC, any other value can be written)

The number of characters for the strings specified in the following tables includes the terminating '\0'.

e.g.: "char 10“ means that the text can include 9 characters followed by the ending '\0'.

The addresses of the readable and writable words are specified in the following tables of this chapter. The customer can read and/or write the values with SCADA programs, PLC and similar.

The entries under "Access" have the following meaning:

R Read Only, the value can only be read

R/W Read / Write, the value can be overwritten and read

The number of characters for the strings specified under "Data type" includes the terminating '\0'.

e.g.: "char 10“ means that the text can include 9 characters followed by the suffix '\0'.

5.1 Device data

Address	Access	Data type	Signal designation
0x0000	R	char 11	Software version
0x0006	R	char 13	VdN number
0x000D	R	word	Internal software version
0x000E	R	char 9	Device name ("TYA 200 ")
0x0013	R	char 20	Serial number
0x001D	R	char 9	Inspection ID

5.2 Type codes and options

Address	Access	Data type	Signal designation
0x0023	R	char 31	Type key
0x0033	R	enum	Grundtyp: 0 = 709061 (TYA 201 - Einzelgerät), 1 = 709062 (TYA 202 - Sparschaltung), 2 = 709063 (TYA 203 - Dreiphasen-Leistungssteller)
0x0034	R	enum	Nominal voltage: 0 = 24 V, 1 = 42 V, 2 = 115 V, ... (230, 265, 400, 440 V), 7 = 500 V
0x0035	R	enum	Rated current: 0 = 16 A, 1 = 30 A, 2 = 50 A, 3 = 75 A, ... (100, 150, 200 A), 7 = 250 A
0x0036	R	enum	Current measurement option 0 = no, 1 = yes
0x0037	R	word	Released options
	R	Bit0	Reserve
	R	Bit1	Reserve
	R	Bit2	Reserve
	R	Bit3	Reserve
	R	Bit4	Reserve
	R	Bit5	Reserve
	R	Bit6	P control option

Address	Access	Data type	Signal designation
	R	Bit7	Reserve
	R	Bit8	Device can only be used as slave
	R	Bit9	Reserve
	R	Bit10	Reserve
	R	Bit11	Reserve
	R	Bit12	Reserve
	R	Bit13	Reserve
	R	Bit14	Reserve
	R	Bit15	Reserve
0x0038	R	enum	Equipped binary output: 0=Relay, 1=Optocoupler
0x0039	R	enum	Equipped interface: 0=None, 1=RS422/RS485, 2=Profibus

5.3 Measured values

Address	Access	Data type	Signal designation
0x0100	R	float	Load voltage
0x0102	R	float	Load current
0x0104	R	float	Power
0x0106	R	float	Load resistance
0x0108	R	float	Actual value
0x010A	R, W	float	Input set point value (in %)
0x010C	R	float	Effectice setpoint value
0x010E	R	float	Output level
0x0110	R	float	Alpha (in °) *(current value, read only)*
0x0112	R	float	Mains voltage
0x0114	R	float	Mains frequency
0x0116	R	float	Device temperature
0x0118	R	float	Current input
0x011A	R	float	Voltage input
0x011C	R	float	Load voltage slave/slave1
0x011E	R	float	Load current slave/slave1
0x0120	R	float	Power slave/slave1
0x0122	R	float	Load resistance slave/slave1 (in Ω)
0x0124	R	float	Mains voltage slave/slave1 (in V)
0x0126	R	float	Device temp. slave/slave1 (in °C)
0x0128	R	float	Load voltage slave2 (in V)
0x012A	R	float	Load current slave2 (in A)
0x012C	R	float	Power slave2 (in W
0x012E	R	float	Load resistance slave2 (in Ω)

Address	Access	Data type	Signal designation
0x0130	R	float	Mains voltage slave2 (in V)
0x0132	R	float	Device temp. slave2 (in °C)
0x0134	R	float	Three-phase power (in W)
0x0136	R, W	float	Alpha default value (in °) *(only writable if "via interface" is configured)*
0x0138	R, W	float	Analog output (in %) *(only writable if "via interface" is configured)*
0x013A	R	float	Reserve
0x013C	R	float	Reserve

5.4 Binary signals (bit field)

Address	Access	Data type	Signal designation
0x013E	R	word	Binary signals (bit field) - 1st section
	R	Bit0	Inhibit input
	R	Bit1	Binary input 1
	R	Bit2	Binary input 2
	R	Bit3	External Inhibit input
	R	Bit4	External binary input 1
	R	Bit5	External binary input 2
	R	Bit6	Binary output
	R	Bit7	Inhibit
	R	Bit8	Inhibit by the slave
	R	Bit9	Soft start is still running
	R	Bit10	Current limiting is active
	R	Bit11	The external change-over to phase angle is active.
	R	Bit12	The external current limit value is used.
	R	Bit13	The display PCB is connected.
	R	Bit14	The power controller is currently reconfigured.
	R	Bit15	The power controller operates in the test and calibration mode.

Address	Access	Data type	Signal designation
0x013F	R	word	Binary signals (bit field) - 2nd section
	R	Bit0	The power controller operates in manual mode.
	R	Bit1	The keyboard is locked.
	R	Bit2	The display is switched off
	R	Bit3	The power controller is connected to the supply voltage.
	R	Bit4	The slave/slave1 power controller is connected to the supply voltage.
	R	Bit5	The rotary field detection was successfully completed.
	R	Bit6	Resistance limitation is active.
	R	Bit7	External switching of setpoint value is active
	R	Bit8	Slave2 is connected to the supply voltage
	R	Bit9	Inhibit of Slave2
	R	Bit10	Reserve
	R	Bit11	Reserve
	R	Bit12	Reserve
	R	Bit13	Reserve
	R	Bit14	Reserve
	R	Bit15	Reserve
0x0140	R	word	Malfunction signals (bit field) - 1st section
	R	Bit0	Min-Alarm
	R	Bit1	Max-Alarm
	R	Bit2	Load error
	R	Bit3	Teach-in for load monitoring is still missing.
	R	Bit4	Blown fuse
	R	Bit5	Thyristor breakage
	R	Bit6	Thyristor short circuit
	R	Bit7	Performance limitation due to over-temperature
	R	Bit8	Over-temperature
	R	Bit9	Supply voltage too low
	R	Bit10	Supply voltage too high
	R	Bit11	Temporary supply voltage drop
	R	Bit12	wire breakage on input current
	R	Bit13	wire breakage on input voltage
	R	Bit14	Bus-error
	R	Bit15	Reserve

Address	Access	Data type	Signal designation
0x0141	R	word	Malfunction signals (bit field) - 2nd section
	R	Bit0	Min-Alarm on Slave/Slave1
	R	Bit1	Max-Alarm on Slave/Slave1
	R	Bit2	Load error on Slave/Slave1
	R	Bit3	Blown fuse at the slave or slave1
	R	Bit4	Thyristor breakage at the slave/slave1
	R	Bit5	Thyristor short circuit at the slave/slave1
	R	Bit6	Performance limitation due to over-temperature in slave/slave1
	R	Bit7	Over-temperature in slave/slave1
	R	Bit8	Supply voltage slave/slave1 too low
	R	Bit9	Supply voltage slave/slave1 too high
	R	Bit10	Temporary supply voltage drop at slave/slave1
	R	Bit11	Reserve
	R	Bit12	Reserve
	R	Bit13	Wrong energy counter configuration
	R	Bit14	Reserve
	R	Bit15	Reserve
0x0142	R	word	Malfunction signals (bit field) - 3rd section
	R	Bit0	Master/slave synchronization has failed
	R	Bit1	Error in the master/slave communication
	R	Bit2	Error on the data cable between master and slave
	R	Bit3	The rotary field detection has failed
	R	Bit4	Rotary field error
	R	Bit5	Wiring error
	R	Bit6	The power controller or one of the slaves is incompatible.
	R	Bit7	Regulation not possible
	R	Bit8	Reserve
	R	Bit9	Reserve
	R	Bit10	Reserve
	R	Bit11	Reserve
	R	Bit12	Reserve
	R	Bit13	Reserve
	R	Bit14	Reserve
	R	Bit15	Reserve
0x0143	R	word	Malfunction signals (bit field) - 4th section
	R	Bit0	Min-Alarm on Slave2
	R	Bit1	Max-Alarm on Slave2
	R	Bit2	Load error on Slave2
	R	Bit3	Blown fuse at the slave2

Address	Access	Data type	Signal designation
	R	Bit4	Thyristor breakage at the slave2
	R	Bit5	Thyristor short circuit at the slave2
	R	Bit6	Performance limitation due to over-temperature in slave2
	R	Bit7	Over-temperature in slave2
	R	Bit8	Supply voltage slave2 too low
	R	Bit9	Supply voltage slave2 too high
	R	Bit10	Temporary supply voltage drop at slave2
	R	Bit11	Reserve
	R	Bit12	Reserve
	R	Bit13	Systembus: invalid configuration
	R	Bit14	Systembus: watchdog timeout
	R	Bit15	Systembus: local error

5.5 Digital inputs and -output

Address	Access	Data type	Signal designation
0x0144	R	bool	Inhibit input
0x0145	R	bool	Digital input 1
0x0146	R	bool	Digital input 2
0x0147	R, W	bool	External Inhibit-input
0x0148	R, W	bool	External binary input 1
0x0149	R, W	bool	External binary input 2
0x014A	R, W	bool	Digital output *(only writable if "interface-signal" is configured)*

5.6 Device status

Address	Access	Data type	Signal designation
0x014B	R	bool	Inhibit
0x014C	R	bool	Inhibit slave/slave1
0x014D	R	bool	Soft start phase
0x014E	R	bool	Current limitation active
0x014F	R	bool	Ext. change-over to phase angle active
0x0150	R	bool	Ext. current limit value active
0x0151	R	bool	The Display-socket is connected
0x0152	R	bool	Reconfiguration active
0x0153	R	bool	Power Controller is in Calibrating mode
0x0154	R	bool	Manual mode active
0x0155	R	bool	Keyboard locked
0x0156	R	bool	Display lighting deactivated
0x0157	R	bool	Power Controller is connected on power supply
0x0158	R	bool	Slave/Slave1 is connected on power supply
0x0159	R	bool	Rotating field detected
0x015A	R	bool	Resistance limitation active
0x015B	R	bool	Ext. change-over of setpoint specification active
0x015C	R	bool	Slave2 is connected on power supply
0x015D	R	bool	Inhibit Slave2
0x015E	R	bool	Reserve
0x015F	R	bool	Reserve
0x0160	R	bool	Reserve
0x0161	R	bool	Reserve
0x0162	R	bool	Reserve
0x0163	R	bool	Reserve

5.7 Faults

Address	Access	Data type	Signal designation
0x0164	R	bool	Collective fault
0x0165	R	bool	Low alarm
0x0166	R	bool	High alarm
0x0167	R	bool	Load error
0x0168	R	bool	Missing teach-in
0x0169	R	bool	Blown Fuse
0x016A	R	bool	Thyristor breakage
0x016B	R	bool	Thyristor short-circuit
0x016C	R	bool	Limitation active due to overtemperature
0x016D	R	bool	Over-temperature
0x016E	R	bool	Mains voltage is too low
0x016F	R	bool	Mains voltage is too high
0x0170	R	bool	Short-term mains drop
0x0171	R	bool	Wire break current input
0x0172	R	bool	Wire break voltage input
0x0173	R	bool	System bus error
0x0174	R	bool	Reserve
0x0175	R	bool	Low alarm slave/slave1
0x0176	R	bool	High alarm slave/slave1
0x0177	R	bool	Load error slave/slave1
0x0178	R	bool	Fuse breakage slave/slave1
0x0179	R	bool	Thyristor breakage slave/slave1
0x017A	R	bool	Thyristor short-circuit slave/slave1
0x017B	R	bool	Limitation active due to overtemperature of slave/slave 1
0x017C	R	bool	Over-temperature slave/slave1
0x017D	R	bool	Mains voltage of slave/slave1 is too low
0x017E	R	bool	Mains voltage of slave/slave1 is too high
0x017F	R	bool	Short-term mains drop slave/ slave1
0x0180	R	bool	Reserve
0x0181	R	bool	Reserve
0x0182	R	bool	Wrong energy counter configuration
0x0183	R	bool	Reserve
0x0184	R	bool	Reserve
0x0185	R	bool	Master slave synchronisation failed
0x0186	R	bool	Error in master slave communication
0x0187	R	bool	Data cable faulty
0x0188	R	bool	Rotation field detection failed

Address	Access	Data type	Signal designation
0x0189	R	bool	Rotation field error
0x018A	R	bool	Wiring error
0x018B	R	bool	Der oder einer der Slave-Steller ist inkompatibel
0x018C	R	bool	Sollwert ist nicht erreichbar
0x018D	R	bool	Reserve
0x018E	R	bool	Reserve
0x018F	R	bool	Reserve
0x0190	R	bool	Reserve
0x0191	R	bool	Reserve
0x0192	R	bool	Reserve
0x0193	R	bool	Reserve
0x0194	R	bool	Reserve
0x0195	R	bool	Low alarm slave2
0x0196	R	bool	Max alarm slave2
0x0197	R	bool	Load error slave2
0x0198	R	bool	Fuse breakage slave2
0x0199	R	bool	Thyristor breakage slave2
0x019A	R	bool	Thyristor short-circuit slave2
0x019B	R	bool	Limitation active due to overtemperature of slave2
0x019C	R	bool	Over-temperature slave2
0x019D	R	bool	Mains voltage of slave2 is too low
0x019E	R	bool	Mains voltage of slave2 is too high
0x019F	R	bool	Short-term mains drop slave2
0x01A0	R	bool	Reserve
0x01A1	R	bool	Reserve
0x01A2	R	bool	Systembus: invalid configuration
0x01A3	R	bool	Systembus: watchdog timeout
0x01A4	R	bool	Systembus: local error

5.8 Parameters of the operator level (storage in the RAM)

from Device-software Version 256.01.03 on

The following parameters are taken over into the RAM during writing. For this reason, they can be permanently cyclically rewritten, but get lost, if the device is switched off.

Address	Access	Data type	Signal designation
0x00DC	R, W	word	Switch off display light in (minutes)
0x00DD	R, W	word	Angle alpha start (in °)
0x00DE	R, W	float	Current limit value (in A)
0x00E0	R, W	float	Resistance limit value (in Ω)
0x00E2	R, W	float	Maximum actuating variable (in %. not the same as shown on the device)
0x00E4	R, W	float	Base load (in %. not the same as shown on the device) in V / A / W / kW / Ω / °C / °F)
0x00E6	R, W	float	Min. limit value alarm (in V / A / W / kW / Ω / °C / °F - depending on the monitored value)
0x00E8	R, W	float	Max. limit value alarm (in V / A / W / kW / Ω / °C / °F - depending on the monitored value)
0x00EA	R, W	float	Limit value hysteresis (in V / A / W / kW / Ω / °C / °F - depending on the monitored value)
0x00EC	R, W	float	Limit value load monitoring (10...50 %)
0x00EE	R, W	float	Setpoint in the case of a bus-error/wire break (in %)
0x00EF	R	word	Reserve
0x00F0	R	word	Reserve
0x00F1	R	word	Reserve
0x00F2	R	word	Reserve
0x00F3	R	word	Reserve
0x00F4	R	word	Reserve
0x00F5	R	word	Reserve

6.1 Default set point values via interface

If the set point value for a controller is to be defined via an interface, it must be configured accordingly: Use the keyboard on the device or the setup program to set "*via interface*" under: *Config level* ➔*Set point value config*. ➔*Default set point value*. If this is not set, writing a value to the Modbus address 0x010A is not taken into account.

The set point value must be written as a percent value on the Modbus address 0x010A. The range of the transmitted set point value is not checked. Thus, the power controller never replies with Modbus error code 03 (data value outside the admissible value range). Set point values that are too great or too small are corrected later to 100% or 0 %.

If applicable, other variables, such as basic load, max. setting value and soft start, are also taken into account for the internal set point value calculation. This results in the effective set point value being saved in the cascade control which can be read out from the Modbus address 0x010C as required.

The transmitted set point value is used for SCR control until a new set point value is transmitted via the interface.

Set point values transmitted to the power controller are only saved in the RAM, i.e. they are lost in the event of a power failure.

After power ON the set point value 0 % is started with until the first received set point over interface or a detected bus-errror.

6.2 α-default value via interface

For logic mode (*Config level* ➔*Power controller* ➔*SCR control* to "*Logics (switch)*"), a phase angle α can be additionally configured for all sine waves to limit the maximum performance. This phase angle can also be set cyclically via the interface. For this purpose, set the default α value to "*via interface*" under: *Config level* ➔*Set point value config*. ➔.

α must be written to Modbus address 0x0136 as angle value (0...180°). The transmitted phase angle is not controlled for its range. Thus, the power controller never replies with Modbus error code 03 (data value outside the admissible value range). Angle values that are too great or too small are corrected later to 180° or 0°.

The transmitted angle value is used for SCR control until a new angle value is transmitted via the interface.

After Power-ON 180° are used for α until the first value is received.

Angle values transmitted to the power controller are only saved in the RAM, i.e. they are lost in the event of power failure. After power ON, the default α value of 180° is used for SCR control until a new angle value is transmitted via the interface.

6.3 Controlling the analog output via Interface

From Software-Version 256.02.01 on, the analog output can be set via the interface. Before this could happen, the parameter *Config level* ➔*Analog output* ➔ *Output value* has to be set to*: "From Interface".*

The parameter *Config level* ➔*Analog output* ➔ *Signal range start value* should be set to "0%" and the *Signal range end value* to "100%".

If for instance a float value of 50.0 is written on the modbus adress 0x0138 the analog output set to 4 to 20 mA, will put out 12mA. This value remains unchanged until an other value is received.

After Power-off the value of 0%(4mA) will be put out until a new value is received over interface.
In the case of a bus-error the value of 0%(4mA) will be put out.
The output values are saved in the RAM memory and get lost in the case of an Power-off.

6.4 Controlling the binary output via Interface

From Software-Version 256.02.01 on, the binary outputs (relay and optocoupler) can be set via the interface.

The parameter *Config level* ➔*Binary output* ➔ *Output mode binary out* should be set to "Interf.sign.outp".

The desired state of the output level is written with a "0" for low and "1" for high on the on the modbus adress 0x014A. This value remains unchanged until an other value is received.

After Power-off or a bus -error the output is switched off that means value of "0" will be put out.
The output values are saved in the RAM memory and get lost in the case of an Power-off.

After Power-on the binary output will remain switched off "0" until he is activated again with "1" via interface.

6.5 External Inhibit and external binary input1 and 2

Over the modbus adresses 0x0147 to 0x0149 external inhibit, external binary input1 and external binary input2 can be set.

These binary inputs have got the same behaviour as wired on the device with potental free contacts. They are only switched via interface and can be used in the same way for functions such as current limiting, ext. swiching to phase angle control or keyboard lock.

After Power-on the binary inputs will remain switched off "0" until ther are activated again with "1" via interface.

In case of a bus -error the inputs are switched off "0".

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