JUMO diraTRON/diraVIEW 104/108/116/132

Compact controller/digital indicator

Interface Description

70211000T92Z001K000

V2.00/EN/00688816

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1.1 Safety information

General

This manual contains information that must be observed in the interest of your own safety and to avoid material damage. This information is supported by symbols which are used in this manual as indicated.

Please read this manual before starting up the device. Store this manual in a place that is accessible to all users at all times.

If difficulties occur during startup, please do not intervene in any way that could jeopardize your warranty rights!

Warning symbols

CAUTION!

This symbol in connection with the signal word indicates that **material damage or data loss** will occur if the respective precautionary measures are not taken.

Note symbols

NOTE!

This symbol refers to **important information** about the product, its handling, or additional benefits.

REFERENCE!

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

1.2 Intended use

The device is designed for use in an industrial environment as specified in the technical data. Other uses beyond those defined are not viewed as intended uses.

The device has been manufactured in compliance with applicable standards and directives as well as the applicable safety regulations. Nevertheless, improper use may lead to personal injury or material damage.

To avoid danger, only use the device:

- For the intended use
- When in good order and condition
- When taking the technical documentation provided into account

Risks resulting from the application may arise, e.g. as the result of missing safety provisions or wrong settings, even when the device is used properly and as intended.

1.3 Qualification of personnel

This document contains the necessary information for the intended use of the device to which it relates.

It is intended for staff with technical qualifications who have been specially trained and have the appropriate knowledge in the field of automation technology.

The appropriate level of knowledge and the technically fault-free implementation of the safety information and warnings contained in the technical documentation provided are prerequisites for risk-free mounting, installation, and startup as well as for ensuring safety when operating the described modules. Only qualified personnel have the required specialist knowledge to correctly interpret and implement the safety information and warnings contained in this document in specific situations.

1 Introduction

1.4 Content of this document

NOTE!

This document applies to devices from the device series 70211x (compact controllers) as well as to devices from the device series 70151x (digital indicators).

This document describes the use of the RS485 interface as a Modbus slave using Modbus RTU operating mode. After a short introduction to the Modbus protocol, the addresses of all the configuration data, commands, and process values accessible via Modbus will be listed.

In addition to this document, the operating manual of the respective device series must be observed:

- Types 701510, 701511, 701512, 701513, 701514 (digital indicators):
  Document 70151000T90Z...K...
- Types 702110, 702111, 702112, 702113, 702114 (compact controllers):
  Document 70211000T90Z...K...

There is an option to equip the device with an RS485 interface.

Electrical connection

Version for type 701510 (format 132)	Symbol and terminal designation
Option 1: RS485 interface	RxD/TxD+ —○ 11 RxD/TxD- —○ 12

Version for types 701511 to 701514	Symbol and terminal designation
Option 1 (alternative to digital output 4): RS485 interface	RxD/TxD+ —○ 11 RxD/TxD- —○ 12

Version for type 702110 (format 132)	Symbol and terminal designation
Option 1: RS485 interface	RxD/TxD+ —○ 11 RxD/TxD- —○ 12

Version for types 702111 to 702114	Symbol and terminal designation
Option 1 (alternative to digital output 4): RS485 interface	RxD/TxD+ —○ 11 RxD/TxD- —○ 12

NOTE!

A twisted connecting cable with shielding must be used to connect the RS485 interface.
To avoid transmission errors, only the signals listed above and, if necessary, GND may be routed in the connecting cable.

NOTE!

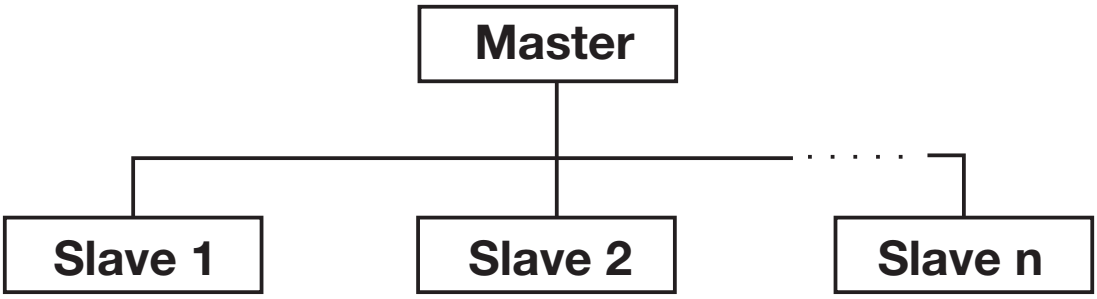
To ensure fault-free operation, terminating resistors are required at the beginning and end of an RS485 transmission path.

For further information on electrical connection and configuration of the interface, please refer to the operating manual of the device.

2 Interface

3.1 Master-slave principle

Communication between a master and a slave device with 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.

NOTE!

This device can only be operated as a Modbus slave.

The Modbus master can read and write different device data, configuration parameters, and device process values. Refer to the Modbus address tables for details.

⇨ chapter 4 "Modbus addresses", page 21

3.2 RTU transmission mode

RTU mode (Remote Terminal Unit) is used as the transmission mode. The transmission of a character is therefore performed in binary format with 8 data bits, 1 start bit, 1 or 2 stop bits, and, if necessary, 1 parity bit. The highest value bit (MSB, most significant bit) is transmitted first.

The ASCII operating mode is not supported.

Data format

The data format describes the structure of a transmitted character.

Data format (configuration)	Start bit	Data bits	Parity bit	Stop bit	Number of bits
8 - 1 - no parity	1	8	0	1	10
8 - 1 - odd parity	1	8	1	1	11
8 - 1 - even parity	1	8	1	1	11
8 - 2 - no parity	1	8	0	2	11

3.3 Chronological sequence of communication

Character transmission time

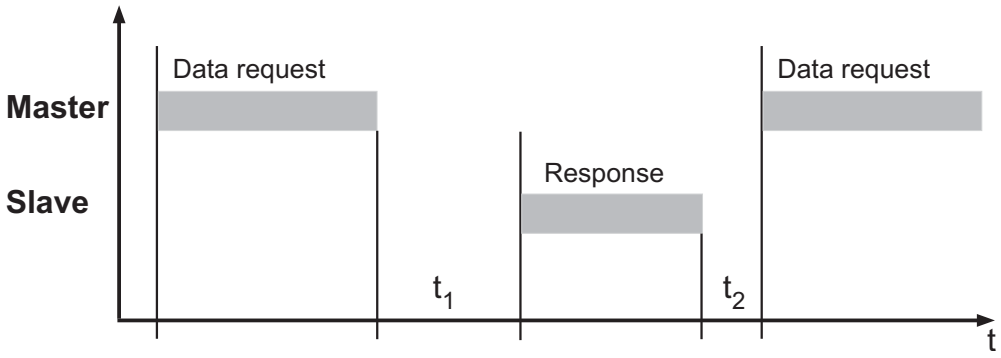
The character transmission time (time taken to transmit one character with 8 data bits) depends on the baud rate and the number of bits of the character (see table for data format):

Character transmission time [ms] = 1000 × number of bits/baud rate

Baud rate[Bd]	**Number of bits**	**Character transmission time**[ms]
115200	11	0.095
	10	0.087
38400	11	0.286
	10	0.260
19200	11	0.573
	10	0.521
9600	11	1.146
	10	1.042

Time diagram of a data request

A data request runs according to the following time diagram:



The data request and response consist of several characters (each with a start bit, 8 data bits, a parity bit if necessary, and a stop bit) which are transmitted coherently.

t_1	The slave has to observe this waiting period before sending the response. min.: 5 ms typically: 5 to 35 ms max.: 35 ms or the minimum response time set in the configuration
t_2	The master has to observe this waiting period before starting a new data request. 35 ms

NOTE!

The waiting periods t_1 and t_2 also contain the end identifier (3.5 × character transmission time), which follows after each data request or response.

NOTE!

In the configuration of the serial interface of the device, a minimum response time can be set (0 to 500 ms). This set time is the minimum waiting period before a response is transmitted. If a smaller value is set, then the response time may be longer than the preset value (internal processing takes longer); the controller responds as soon as internal processing is completed. The preset time of 0 ms

means that the device responds at the maximum possible speed.
The minimum response time is required by the master in order to switch the interface drivers from transmitting to receiving.

NOTE!

During t_1 and t_2 and during the response time of the slave, no data requests may be generated by the master. Requests during t_1 and t_2 are ignored by the slave. Requests during the response time invalidate all the data currently on the bus.

3.4 Structure of a Modbus telegram

Data structure

All telegrams have the same structure:

Slave address	Function code	Data field	Checksum CRC
1 byte	1 byte	x bytes	2 bytes

Each telegram has four fields:

Slave address Device address of a specific slave

Function code Function selection (read/write words)

Data field Contains information (according to the function code)

- Word address
- Number of words
- Word value(s)

Checksum Detection of transmission errors

3.5 Device address

The device address can be set to between 1_{DEC} and 254_{DEC}. Each Modbus station must have a unique device address.

The following data exchange variants are available for accessing the connected stations:

Query

This is a data request/instruction from the master to a slave via the corresponding device address (1 to 254). The addressed slave responds.

Broadcast

The broadcast is an instruction from the master to all slaves via the device address 0 (for example, to transmit a certain value to all slaves).
The connected slaves do not respond. In such a case, the correct acceptance of the value by the slaves should be checked by a subsequent readout at each individual slave. A data request using the device address 0 is meaningless.

NOTE!

A maximum of 31 slaves can be accessed via the RS485 interface.
The device address 0 is reserved as a Modbus broadcast address:
an instruction from the master to address 0 is executed by all slaves, however, none of the slaves respond (since it would otherwise lead to a data collision).
The address is given in binary format in the transmission protocol.

3 Modbus protocol description

3.6 Function codes

Function overview

The functions described in the following are available for the readout of measured values, device data, and process data, as well as for writing specific data.

Function code	Function	Limit
0x03 or 0x04	Reading n words	Max. 127 words (254 bytes)
0x06	Writing one word	Max. 1 word (2 bytes)
0x10	Writing n words	Max. 127 words (254 bytes)

NOTE!

A hexadecimal number is marked by a preceding "0x".
Example: 0x0010 (= 16_{DEC})

NOTE!

If the device does not respond to these functions or generates an error code, these can be evaluated.

⇨ 3.9 "Error messages", page 18

3.6.1 Reading n words

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

Data request

Slave address	Function 0x03 or 0x04	Address of first word	Number of words	Checksum CRC
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 CRC
1 byte	1 byte	1 byte	x bytes	2 bytes

Example

Read measured value (here: 25.0) from the analog input (from word address 0x7000, 4 bytes = 2 words):

Data request:

01	03	70 00	00 02	DE CB
Slave	Function	Address of 1st word	Number of words	CRC

Response (measured value in Modbus floating-point format):

01	03	04	00 00 41 C8	CB F5
Slave	Function	Bytes read	Measured value	CRC

⇨ 3.7.2 "Float values", page 15

⇨ 3.8 "Checksum (CRC16)", page 17

3.6.2 Writing one word

This function is used to write one word to a specific address.

The data blocks are identical for the instruction and response.

Instruction

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

Response

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

Example

Write binary value 1 to the external digital input 1 (word address 0x37A1):

Instruction:

01	06	37 A1	00 01	17 9C
Slave	Function	Word address	Value	CRC

Response:

01	06	37 A1	00 01	17 9C
Slave	Function	Word address	Value	CRC

⇨ 3.8 "Checksum (CRC16)", page 17

3.6.3 Writing n words

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

Instruction

Slave address	Function 0x10	Address of first word	Number of words	Number of bytes	Word val-ue(s)	Checksum CRC
1 byte	1 byte	2 bytes	2 bytes	1 byte	x bytes	2 bytes

Response

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

Example

Write value 25.0 to the external analog input 1 (from word address 0x3700, 4 bytes = 2 words):

Instruction (value in Modbus floating-point format):

01	10	37 00	00 02	04	00 00 41 C8	B0 58
Slave	Function	Address of first word	Number of words	Number of bytes	Value	CRC

Response:

01	10	37 00	00 02	4F BC
Slave	Function	Address of first word	Number of words	CRC

⇨ 3.7.2 "Float values", page 15

⇨ 3.8 "Checksum (CRC16)", page 17

3.7 Transmission formats

3.7.1 Integer values

Integer values are transmitted via Modbus in the following sequence:
First the high byte, then the low byte.

Example

In this example, the integer value at address 0x5208 is to be extracted. The value here is to be "4" (word value 0x0004).

Data request:

01	03	52 08	00 01	15 70
Slave	Function	Address of first word	Number of words	CRC

Response:

01	03	02	00 04	B9 87
Slave	Function	Bytes read	Integer value	CRC

3.7.2 Float values

For floating-point values, Modbus functions with the IEEE 754 standard format (32-bit), but with the difference that bytes 1 and 2 are interchanged with bytes 3 and 4.

Single floating-point format (32-bit) according to standard IEEE 754

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

S - Prefix sign bit

E - Exponent (two's complement)

M - 23-bit normalized mantissa

Modbus floating-point format

Modbus address x		**Modbus address x+1**	
MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM
Byte 3	Byte 4	Byte 1	Byte 2

Example

In this example, the measured value of the analog input (from word address 0x7000) is to be extracted. The value here should be 25.0 (0x41C80000 in IEEE 754 format).

Data request:

01	03	70 00	00 02	DE CB
Slave	Function	Address of 1st word	Number of words	CRC

Response:

01	03	04	00 00 41 C8	CB F5
Slave	Function	Bytes read	Measured value as floating-point value	CRC

After extracting from the device, the bytes for the floating-point value must be interchanged accordingly.

Many compilers (for example, Microsoft Visual C++) store the floating-point values in the following sequence:

Floating-point value

Address x	**Address x+1**	**Address x+2**	**Address x+3**
MMMMMMMM	MMMMMMMM	EMMMMMMM	SEEEEEEE
Byte 4	Byte 3	Byte 2	Byte 1

NOTE!

The sequence of the bytes depends on how floating-point values are saved in the application concerned. It may be necessary for the bytes to be interchanged in the interface program accordingly.

3.8 Checksum (CRC16)

Transmission errors are detected with the aid of the checksum (CRC16). If an error is detected during evaluation, the device concerned does not respond.

Calculation principle

CRC = 0xFFFF			
	CRC = CRC XOR BytesOfMessage		
	For (1 to 8)		
		CRC = SHR(CRC)	
		if (flag shifted to the right = 1	
		then CRC = CRC XOR 0xA0001	else
while (not all BytesOfMessage processed);			

NOTE!

The low byte of the checksum is transmitted first!
Example: The CRC16 checksum 0x1234 is transmitted and represented in the sequence 0x3412.

Example

Write binary value 1 to the external digital input 1 (word address 0x37A1):

Instruction (CRC16 = 9C17):

01	06	37 A1	00 01	17 9C
Slave	Function	Word address	Value	CRC

Response:

01	06	37 A1	00 01	17 9C
Slave	Function	Word address	Value	CRC

3 Modbus protocol description

3.9 Error messages

3.9.1 Modbus error codes

The slave device does not respond

The slave will not respond in the following cases:

- The baud rate and/or data format of the master and slave do not match
- The used device address does not match the slave address contained in the protocol
- The checksum (CRC) is not correct
- The instruction from the master is defined incompletely or excessively
- The number of words to read is zero

In these cases, the data request should be sent again after a timeout time of approx. 1 s has elapsed.

Error codes

If the data request from the master has been received by the slave without transmission errors but cannot be processed, the slave responds with an error code. The following error codes may occur:

- 01 = Invalid function
- 02 = Invalid address or too many words need to be read or written
- 08 = Value is write-protected

Response in case of error

Slave address	Function XX OR 80h	Error code	Checksum CRC
1 byte	1 byte	1 byte	2 bytes

The function code is "OR"-linked with 0x80. As a result, the highest value bit (MSB) is set to 1.

Example

Data request:

01	06	48 02	00 01	FE 6A
Slave	Write word	Word address	Word value	CRC

Response:

01	86	08	43 A6
Slave	OR function	Error	CRC

The response contains the error code 08 because the address 0x4802 is write-protected.

3.9.2 Error messages for invalid values

For measured values in the floating-point format, the error is displayed in the value itself, i.e. it contains the error code instead of the measured value.

Error code for floating-point values	Error
1.0×10^{37}	Measuring range underflow
2.0×10^{37}	Measuring range overflow
3.0×10^{37}	Value invalid
4.0×10^{37}	Division by zero
5.0×10^{37}	Math error
6.0×10^{37}	Error: terminal temperature/compensation signal
7.0×10^{37}	Probe short circuit
8.0×10^{37}	Probe break

Example

Read measured value of analog input (from word address 0x7000):

Data request:

01	03	70 00	00 02	DE CB
Slave	Function	Word address	Number of words	CRC

Response:

01	03	04	8E 52 7D B4	51 ED
Slave	Function	Bytes read	Error code	CRC

The error code 0x7DB48E52 (= 3.0×10^{37}) means that this is an invalid input value.

3 Modbus protocol description

4.1 Data types and access types

The following data types and access types must be used by the Modbus master when accessing the device (Modbus slave).

Data types

BOOL16	The least significant bit of a word (16-bit) as a Boolean value (1 = TRUE; 0 = FALSE); the remaining bits are not used.
ENUM16	Word (16-bit) as a list (sequence) of elements (starting with 0)
BIT16	Word as bit field (bit 0 to 15)
BIT32	Double word as bit field (bit 0 to 31)
UINT32	Double word (32-bit) as an unsigned integer value (unsigned integer, value range 0 to 4,294,967,295)
UINT16	Word (16-bit) as an unsigned integer value (unsigned integer, value range 0 to 65535)
INT16	Word (16-bit) as a signed integer value (signed integer, value range -32768 to 0 to 32767)
FLOAT	Double word (32-bit) as floating-point value according to IEEE 754

Access types

R/O	Read only
W/O	Write only
R/W	Read/write

CAUTION!

Write operations to some R/W parameters result in them being saved to the EEPROM.

The storage components only have a limited number of writing cycles (approx. 10,000), which is why no fast cyclical writing operations should be performed, otherwise there is a risk of a storage error in the event of a power failure.

CAUTION!

Configuration changes are not automatically stored in the EEPROM.

It is possible to start storing the complete configuration via the Modbus address 0x6D00 (BOOL16).

4 Modbus addresses

4.2 Addresses

The following tables contain configuration parameters, commands, and process values for the device including its address, data type, and type of access.

In principle, the specifications apply to devices of type 70211x (compact controllers) and type 70151x (digital indicators). Exceptions are indicated in the relevant sections.

4.2.1 Configuration data

Analog input

Address		Data type	Access	Designation
Hex.	Dec.			
0x17C0	6080	FLOAT	R/W	Measured value offset
0x17C2	6082	FLOAT	R/W	Filter time constant

Flags

Address		Data type	Access	Designation
Hex.	Dec.			
0x1B00	6912	FLOAT	R/W	1. analog flag
0x1B0B	6923	FLOAT	R/W	2. analog flag
0x1B16	6934	BOOL16	R/W	1. digital flag
0x1B17	6935	BOOL16	R/W	2. digital flag

Timer

Address		Data type	Access	Designation
Hex.	Dec.			
0x1B24	6948	UINT32	R/W	Timer time (timer value)

Limit value monitoring functions

Address		Data type	Access	Designation
Hex.	Dec.			
Limit value monitoring 1				
0x1B7B	7035	FLOAT	R/W	Limit value
0x1B7D	7037	FLOAT	R/W	Limit value 2
Limit value monitoring 2				
0x1BCB	7115	FLOAT	R/W	Limit value
0x1BCD	7117	FLOAT	R/W	Limit value 2
Limit value monitoring 3				
0x1C1B	7195	FLOAT	R/W	Limit value
0x1C1D	7197	FLOAT	R/W	Limit value 2
Limit value monitoring 4				
0x1C6B	7275	FLOAT	R/W	Limit value
0x1C6D	7277	FLOAT	R/W	Limit value 2

Parameter blocks (only for type 70211x)

Address Hex.	Address Dec.	Data type	Access	Designation
Parameter block 1				
0x1F00	7936	ENUM16	R/W	1. control structure 0 = P 1 = I 2 = PD 3 = PI 4 = PID
0x1F01	7937	ENUM16	R/W	2. control structure (see 1. control structure)
0x1F02	7938	FLOAT	R/W	Xp1 proportional band
0x1F04	7940	FLOAT	R/W	Xp2 proportional band
0x1F06	7942	FLOAT	R/W	Tv1 derivative time
0x1F08	7944	FLOAT	R/W	Tv2 derivative time
0x1F0A	7946	FLOAT	R/W	Tn1 reset time
0x1F0C	7948	FLOAT	R/W	Tn2 reset time
0x1F0E	7950	FLOAT	R/W	Cy1 cycle time
0x1F10	7952	FLOAT	R/W	Cy2 cycle time
0x1F12	7954	FLOAT	R/W	Xsh contact spacing
0x1F14	7956	FLOAT	R/W	Xd1 switching differential
0x1F16	7958	FLOAT	R/W	Xd2 switching differential
0x1F18	7960	INT16	R/W	TT actuator time
0x1F19	7961	INT16	R/W	Y0 working point
0x1F1A	7962	INT16	R/W	Y1 max. output value limit
0x1F1B	7963	INT16	R/W	Y1 min. output value limit
0x1F1C	7964	FLOAT	R/W	Tk1 min. relay-on time
0x1F1E	7966	FLOAT	R/W	Tk2 min. relay-on time
Parameter block 2				
0x1F20	7968	ENUM16	R/W	1. control structure 0 = P 1 = I 2 = PD 3 = PI 4 = PID
0x1F21	7969	ENUM16	R/W	2. control structure (see 1. control structure)
0x1F22	7970	FLOAT	R/W	Xp1 proportional band
0x1F24	7972	FLOAT	R/W	Xp2 proportional band
0x1F26	7974	FLOAT	R/W	Tv1 derivative time
0x1F28	7976	FLOAT	R/W	Tv2 derivative time
0x1F2A	7978	FLOAT	R/W	Tn1 reset time
0x1F2C	7980	FLOAT	R/W	Tn2 reset time
0x1F2E	7982	FLOAT	R/W	Cy1 cycle time
0x1F30	7984	FLOAT	R/W	Cy2 cycle time
0x1F32	7986	FLOAT	R/W	Xsh contact spacing

4 Modbus addresses

Address		Data type	Access	Designation
Hex.	Dec.			
0x1F34	7988	FLOAT	R/W	Xd1 switching differential
0x1F36	7990	FLOAT	R/W	Xd2 switching differential
0x1F38	7992	INT16	R/W	TT actuator time
0x1F39	7993	INT16	R/W	Y0 working point
0x1F3A	7994	INT16	R/W	Y1 max. output value limit
0x1F3B	7995	INT16	R/W	Y1 min. output value limit
0x1F3C	7996	FLOAT	R/W	Tk1 min. relay-on time
0x1F3E	7998	FLOAT	R/W	Tk2 min. relay-on time

Program memory (only for type 70211x)

Address		Data type	Access	Designation
Hex.	Dec.			
0x2000	8192	UINT16	R/W	Number of program sections
0x2001	8193	INT16	R/W	Program time
Section 1				
0x2002	8194	FLOAT	R/W	Setpoint value This value must be read or written together with the following reserved value!
0x2004	8196	FLOAT	R/W	(reserved)
0x2006	8198	UINT32	R/W	Duration
0x2008	8200	BIT16	R/W	Operating contacts 0000 0000 0000 0001 = Contact 1 active 0000 0000 0000 0010 = Contact 2 active 0000 0000 0000 0100 = Contact 3 active 0000 0000 0000 1000 = Contact 4 active
Section 2				
0x2009	8201	FLOAT	R/W	Setpoint value (see section 1)
0x200B	8203	FLOAT	R/W	(reserved)
0x200D	8205	UINT32	R/W	Duration
0x200F	8207	BIT16	R/W	Operating contacts (see section 1)
Section 3				
0x2010	8208	FLOAT	R/W	Setpoint value (see section 1)
0x2012	8210	FLOAT	R/W	(reserved)
0x2014	8212	UINT32	R/W	Duration
0x2016	8214	BIT16	R/W	Operating contacts (see section 1)
Section 4				
0x2017	8215	FLOAT	R/W	Setpoint value (see section 1)
0x2019	8217	FLOAT	R/W	(reserved)
0x201B	8219	UINT32	R/W	Duration
0x201D	8221	BIT16	R/W	Operating contacts (see section 1)
Section 5				
0x201E	8222	FLOAT	R/W	Setpoint value (see section 1)
0x2020	8224	FLOAT	R/W	(reserved)
0x2022	8226	UINT32	R/W	Duration
0x2024	8228	BIT16	R/W	Operating contacts (see section 1)

Address		Data type	Access	Designation
Hex.	Dec.			
Section 6				
0x2025	8229	FLOAT	R/W	Setpoint value (see section 1)
0x2027	8231	FLOAT	R/W	(reserved)
0x2029	8233	UINT32	R/W	Duration
0x202B	8235	BIT16	R/W	Operating contacts (see section 1)
Section 7				
0x202C	8236	FLOAT	R/W	Setpoint value (see section 1)
0x202E	8238	FLOAT	R/W	(reserved)
0x2030	8240	UINT32	R/W	Duration
0x2032	8242	BIT16	R/W	Operating contacts (see section 1)
Section 8				
0x2033	8243	FLOAT	R/W	Setpoint value (see section 1)
0x2035	8245	FLOAT	R/W	(reserved)
0x2037	8247	UINT32	R/W	Duration
0x2039	8249	BIT16	R/W	Operating contacts (see section 1)
Section 9				
0x203A	8250	FLOAT	R/W	Setpoint value (see section 1)
0x203C	8252	FLOAT	R/W	(reserved)
0x203E	8254	UINT32	R/W	Duration
0x2040	8256	BIT16	R/W	Operating contacts (see section 1)
Section 10				
0x2041	8257	FLOAT	R/W	Setpoint value (see section 1)
0x2043	8259	FLOAT	R/W	(reserved)
0x2045	8261	UINT32	R/W	Duration
0x2047	8263	BIT16	R/W	Operating contacts (see section 1)
Section 11				
0x2048	8264	FLOAT	R/W	Setpoint value (see section 1)
0x204A	8266	FLOAT	R/W	(reserved)
0x204C	8268	UINT32	R/W	Duration
0x204E	8270	BIT16	R/W	Operating contacts (see section 1)
Section 12				
0x204F	8271	FLOAT	R/W	Setpoint value (see section 1)
0x2051	8273	FLOAT	R/W	(reserved)
0x2053	8275	UINT32	R/W	Duration
0x2055	8277	BIT16	R/W	Operating contacts (see section 1)
Section 13				
0x2056	8278	FLOAT	R/W	Setpoint value (see section 1)
0x2058	8280	FLOAT	R/W	(reserved)
0x205A	8282	UINT32	R/W	Duration
0x205C	8284	BIT16	R/W	Operating contacts (see section 1)
Section 14				
0x205D	8285	FLOAT	R/W	Setpoint value (see section 1)
0x205F	8287	FLOAT	R/W	(reserved)
0x2061	8289	UINT32	R/W	Duration

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Address		Data type	Access	Designation
Hex.	Dec.			
0x2063	8291	BIT16	R/W	Operating contacts (see section 1)
Section 15				
0x2064	8292	FLOAT	R/W	Setpoint value (see section 1)
0x2066	8294	FLOAT	R/W	(reserved)
0x2068	8296	UINT32	R/W	Duration
0x206A	8298	BIT16	R/W	Operating contacts (see section 1)
Section 16				
0x206B	8299	FLOAT	R/W	Setpoint value (see section 1)
0x206D	8301	FLOAT	R/W	(reserved)
0x206F	8303	UINT32	R/W	Duration
0x2071	8305	BIT16	R/W	Operating contacts (see section 1)
Section 17				
0x2072	8306	FLOAT	R/W	Setpoint value (see section 1)
0x2074	8308	FLOAT	R/W	(reserved)
0x2076	8310	UINT32	R/W	Duration
0x2078	8312	BIT16	R/W	Operating contacts (see section 1)
Section 18				
0x2079	8313	FLOAT	R/W	Setpoint value (see section 1)
0x207B	8315	FLOAT	R/W	(reserved)
0x207D	8317	UINT32	R/W	Duration
0x207F	8319	BIT16	R/W	Operating contacts (see section 1)
Section 19				
0x2080	8320	FLOAT	R/W	Setpoint value (see section 1)
0x2082	8322	FLOAT	R/W	(reserved)
0x2084	8324	UINT32	R/W	Duration
0x2086	8326	BIT16	R/W	Operating contacts (see section 1)
Section 20				
0x2087	8327	FLOAT	R/W	Setpoint value (see section 1)
0x2089	8329	FLOAT	R/W	(reserved)
0x208B	8331	UINT32	R/W	Duration
0x208D	8333	BIT16	R/W	Operating contacts (see section 1)
Section 21				
0x208E	8334	FLOAT	R/W	Setpoint value (see section 1)
0x2090	8336	FLOAT	R/W	(reserved)
0x2092	8338	UINT32	R/W	Duration
0x2094	8340	BIT16	R/W	Operating contacts (see section 1)
Section 22				
0x2095	8341	FLOAT	R/W	Setpoint value (see section 1)
0x2097	8343	FLOAT	R/W	(reserved)
0x2099	8345	UINT32	R/W	Duration
0x209B	8347	BIT16	R/W	Operating contacts (see section 1)
Section 23				
0x209C	8348	FLOAT	R/W	Setpoint value (see section 1)
0x209E	8350	FLOAT	R/W	(reserved)

Address		Data type	Access	Designation
Hex.	Dec.			
0x20A0	8352	UINT32	R/W	Duration
0x20A2	8354	BIT16	R/W	Operating contacts (see section 1)
Section 24				
0x20A3	8355	FLOAT	R/W	Setpoint value (see section 1)
0x20A5	8357	FLOAT	R/W	(reserved)
0x20A7	8359	UINT32	R/W	Duration
0x20A9	8361	BIT16	R/W	Operating contacts (see section 1)

Setpoint values (only for type 70211x)

Address		Data type	Access	Designation
Hex.	Dec.			
0x2114	8468	FLOAT	R/W	Setpoint value 1
0x212A	8490	FLOAT	R/W	Setpoint value 2
0x2140	8512	FLOAT	R/W	Setpoint value 3
0x2156	8534	FLOAT	R/W	Setpoint value 4

Ramp (only for type 70211x)

Address		Data type	Access	Designation
Hex.	Dec.			
0x2201	8705	FLOAT	R/W	Positive gradient
0x2203	8707	FLOAT	R/W	Negative gradient
0x2205	8709	FLOAT	R/W	Tolerance band

4.2.2 Commands

External analog inputs (via an interface)

Address		Data type	Access	Designation
Hex.	Dec.			
External analog input 1				
0x3700	14080	FLOAT	R/W	Value of the analog input
External analog input 2				
0x370A	14090	FLOAT	R/W	Value of the analog input

External digital inputs (via an interface)

Address		Data type	Access	Designation
Hex.	Dec.			
External digital input 1				
0x37A1	14241	BOOL16	R/W	Value of the digital input
External digital input 2				
0x37AB	14251	BOOL16	R/W	Value of the digital input

4 Modbus addresses

Operation

Address		Data type	Access	Designation	Type[a]	
Hex.	Dec.				70211x	70151x
0x5350	21328	BOOL16	R/W	Start of autotuning	X	---
0x5351	21329	BOOL16	R/W	Canceling autotuning	X	---
0x5352	21330	BOOL16	R/W	Change to manual mode	X	---
0x5353	21331	BOOL16	R/W	Change to automatic mode	X	---
0x5354	21332	FLOAT	R/W	Manual output level	X	---
0x5356	21334	BOOL16	R/W	Open actuator	X	---
0x5357	21335	BOOL16	R/W	Close actuator	X	---
0x5358	21336	BOOL16	R/W	Program start	X	---
0x5359	21337	BOOL16	R/W	Program abort	X	---
0x535A	21338	BOOL16	R/W	Program stop	X	---
0x535D	21341	BOOL16	R/W	Change to next section	X	---
0x535E	21342	BOOL16	R/W	Change to previous section	X	---
0x5360	21344	BOOL16	R/W	Timer start	X	X
0x5361	21345	BOOL16	R/W	Timer abort	X	X
0x5362	21346	BOOL16	R/W	Timer stop	X	X
0x5363	21347	BOOL16	R/W	Timer acknowledgement	X	X
0x5364	21348	BOOL16	R/W	Timer restart	X	X
0x5365	21349	BOOL16	R/W	Ramp restart	X	---
0x5366	21350	BOOL16	R/W	Ramp abort	X	---
0x5367	21351	BOOL16	R/W	Ramp stop	X	---
0x5368	21352	BOOL16	R/W	Acknowledgement of all limit value monitoring functions	X	X
0x5369	21353	BOOL16	R/W	Service signal acknowledgement	X	X
0x536A	21354	BOOL16	R/W	Function key, short	X	X
0x536B	21355	BOOL16	R/W	Function key, long	X	X

[a] X = Function exists; --- = Function does not exist

Serial interface

Address		Data type	Access	Designation
Hex.	Dec.			
0x6D00	27904	BOOL16	R/W	Adoption of the configuration values

4.2.3 Process values

Analog process values

In this section, different analog process values are listed under consecutive addresses so that they can be extracted using a read operation.

Some of these process values are also listed in the section of the respective function – under a different address.

Address		Data type	Access	Designation	Type[a]	
Hex.	Dec.				70211x	70151x
0x7000	28672	FLOAT	R/O	Analog input (measured value)	X	X
0x7002	28674	FLOAT	R/O	Min. value	---	X
0x7004	28676	FLOAT	R/O	Max. value	---	X
0x7006	28678	FLOAT	R/O	Tara value	---	X
0x7008	28680	FLOAT	R/O	1. math result	X	X
0x700A	28682	FLOAT	R/O	2. math result	X	X
0x700C	28684	FLOAT	R/O	3. math result	X	X
0x700E	28686	FLOAT	R/O	4. math result	X	X
0x7010	28688	FLOAT	R/O	Controller setpoint value	X	---
0x7012	28690	FLOAT	R/O	Controller actual value	X	---
0x7014	28692	FLOAT	R/O	Control deviation	X	---
0x7016	28694	FLOAT	R/O	Output level display	X	---
0x7018	28696	FLOAT	R/O	1. setpoint value	X	---
0x701A	28698	FLOAT	R/O	2. setpoint value	X	---
0x701C	28700	FLOAT	R/O	3. setpoint value	X	---
0x701E	28702	FLOAT	R/O	4. setpoint value	X	---
0x7020	28704	FLOAT	R/O	Ramp end value	X	---
0x7022	28706	FLOAT	R/O	Current ramp setpoint value	X	---
0x7024	28708	FLOAT	R/O	1. ext. analog input	X	X
0x7026	28710	FLOAT	R/O	2. ext. analog input	X	X
0x7028	28712	FLOAT	R/O	1. analog flag	X	X
0x702A	28714	FLOAT	R/O	2. analog flag	X	X
0x702C	28716	FLOAT	R/O	Timer run time	X	X
0x702E	28718	FLOAT	R/O	Timer remaining running time	X	X
0x7030	28720	FLOAT	R/O	Timer value	X	X
0x7032	28722	FLOAT	R/O	Current section	X	---
0x7034	28724	FLOAT	R/O	Section end value	X	---
0x7036	28726	FLOAT	R/O	(reserved)	---	---
0x7038	28728	FLOAT	R/O	Remaining section time	X	---
0x703A	28730	FLOAT	R/O	Remaining program time	X	---
0x703C	28732	FLOAT	R/O	Section run time	X	---
0x703E	28734	FLOAT	R/O	Program run time	X	---
0x7040	28736	FLOAT	R/O	Current program setpoint value	X	---
0x7042	28738	FLOAT	R/O	(reserved)	---	---
0x7044	28740	FLOAT	R/O	1. ST analog output	X	X
0x7046	28742	FLOAT	R/O	2. ST analog output	X	X
0x7048	28744	FLOAT	R/O	3. ST analog output	X	X
0x704A	28746	FLOAT	R/O	4. ST analog output	X	X

Address		Data type	Access	Designation	Type[a]	
Hex.	Dec.				70211x	70151x
0x704C	28748	FLOAT	R/O	5. ST analog output	X	X
0x704E	28750	FLOAT	R/O	6. ST analog output	X	X
0x7050	28752	FLOAT	R/O	Analog output	X	X
0x7052	28754	FLOAT	R/O	Service counter	X	X
0x7054	28756	FLOAT	R/O	Operating time	X	X

[a] X = Process value exists; --- = Process value does not exist (undefined value)

Digital signals

In this section, different digital signals are listed under consecutive addresses so that they can be extracted using a read operation.

Some of these signals are also listed in the section of the respective function – under a different address.

Address		Data type	Access	Designation	Type[a]	
Hex.	Dec.				70211x	70151x
0x6D50	27984	BIT16	R/O	Limit value monitoring functions	X	X
		0000 0000 0000 0001 = Limit value monitoring 1 active 0000 0000 0000 0010 = Limit value monitoring 2 active 0000 0000 0000 0100 = Limit value monitoring 3 active 0000 0000 0000 1000 = Limit value monitoring 4 active				
0x6D51	27985	BIT16	R/O	Timer	X	X
		0000 0000 0000 0001 = Timer output active 0000 0000 0000 0010 = End signal active 0000 0000 0000 0100 = Tolerance band signal active 0000 0000 0000 1000 = Stop signal active				
0x6D52	27986	BIT16	R/O	Digital outputs	X	X
		0000 0000 0000 0001 = Digital output 1 active 0000 0000 0000 0010 = Digital output 2 active 0000 0000 0000 0100 = Digital output 3 active 0000 0000 0000 1000 = Digital output 4 active 0000 0000 0001 0000 = Digital output 5 active 0000 0000 0010 0000 = Digital output 6 active 0000 0000 0100 0000 = Digital output 7 active				
0x6D53	27987	BIT16	R/O	Digital control signals	X	X
		0000 0000 0000 0001 = Control signal 1 active 0000 0000 0000 0010 = Control signal 2 active 0000 0000 0000 0100 = Control signal 3 active 0000 0000 0000 1000 = Control signal 4 active				
0x6D54	27988	BIT16	R/O	Digital inputs	X	X
		0000 0000 0000 0001 = Digital input 1 active 0000 0000 0000 0010 = Digital input 2 active				
0x6D55	27989	BIT16	R/O	External digital inputs	X	X
		0000 0000 0000 0001 = Ext. digital input 1 active 0000 0000 0000 0010 = Ext. digital input 2 active				

Address		Data type	Access	Designation	Type[a]	
Hex.	Dec.				70211x	70151x
0x6D56	27990	BIT16	R/O	Controller outputs	X	---
		0000 0000 0000 0001 = Output 1 active (heating) 0000 0000 0000 0010 = Output 2 active (cooling) 0000 0000 0000 0100 = Manual mode active 0000 0000 0000 1000 = Autotuning active 0000 0000 0001 0000 = Regler aus 0000 0000 0010 0000 = Controller cycle alarm active 0000 0000 0100 0000 = Output level alarm active				
0x6D57	27991	BIT16	R/O	Operating contacts	X	---
		0000 0000 0000 0001 = Operating contact 1 active 0000 0000 0000 0010 = Operating contact 2 active 0000 0000 0000 0100 = Operating contact 3 active 0000 0000 0000 1000 = Operating contact 4 active				
0x6D58	27992	BIT16	R/O	Logic results	X	X
		0000 0000 0000 0001 = Result formula 1 (= TRUE) 0000 0000 0000 0010 = Result formula 2 (= TRUE) 0000 0000 0000 0100 = Result formula 3 (= TRUE) 0000 0000 0000 1000 = Result formula 3 (= TRUE)				

[a] X = Signal exists; --- = Signal does not exist (undefined value)

Digital flag

Address		Data type	Access	Designation
Hex.	Dec.			
Digital flag 1				
0x4802	18434	BOOL16	R/O	Value of the digital flag
Digital flag 2				
0x4834	18484	BOOL16	R/O	Value of the digital flag

Timer

Address		Data type	Access	Designation
Hex.	Dec.			
0x4908	18696	BOOL16	R/O	Prerun signal (active during lead time)
0x4909	18697	BOOL16	R/O	Timer output (active while timer is running; high or low, configurable)
0x490A	18698	BOOL16	R/O	Tolerance band signal
0x490B	18699	BOOL16	R/O	Timer status 0 = Timer not active 1 = Timer active
0x490C	18700	BOOL16	R/O	End signal
0x490D	18701	BOOL16	R/O	Stop signal

Controller (only for type 70211x)

Address		Data type	Access	Designation
Hex.	Dec.			
0x4B0E	19214	BOOL16	R/O	Controller status 0 = on 1 = off

Address		Data type	Access	Designation
Hex.	Dec.			
0x4B2A	19242	BOOL16	R/O	Autotuning active 0 = not active 1 = active
0x4B2B	19243	BOOL16	R/O	Manual mode active 0 = not active 1 = active
0x4B2C	19244	BOOL16	R/O	Manual mode active due to measuring range overflow or underflow 0 = not active 1 = active
0x4B2D	19245	BOOL16	R/O	Controller cycle alarm 0 = not active 1 = active
0x4B2E	19246	BOOL16	R/O	Output level alarm 0 = not active 1 = active
0x4B38	19256	ENUM16	R/O	Controller mode 0 = Controller disabled 1 = Automatic mode 2 = Autotuning active 3 = Manual mode
0x4B39	19257	BOOL16	R/O	Manual mode inhibited 0 = not inhibited 1 = inhibited
0x4B3A	19258	BOOL16	R/O	Autotuning inhibited 0 = not inhibited 1 = inhibited

Program generator (only for type 70211x)

Address		Data type	Access	Designation
Hex.	Dec.			
0x5208	21000	INT16	R/O	Current section
0x5209	21001	INT32	R/O	Remaining section time
0x520B	21003	INT32	R/O	Remaining program time
0x5211	21009	UINT32	R/O	Section run time
0x5213	21011	UINT32	R/O	Program run time
0x5225	21029	BIT16	R/O	Operating contacts 0000 0000 0000 0001 = Contact 1 active 0000 0000 0000 0010 = Contact 2 active 0000 0000 0000 0100 = Contact 3 active 0000 0000 0000 1000 = Contact 4 active
0x5226	21030	ENUM16	R/O	Status (operating mode) of the program generator 0 = Stop 2 = Prerun 3 = Start 4 = Auto

Address		Data type	Access	Designation
Hex.	Dec.			
0x5227	21031	BOOL16	R/O	Automatic mode signal
0x5228	21032	BOOL16	R/O	Tolerance band signal
0x5229	21033	BOOL16	R/O	Fixed-setpoint controller signal
0x522A	21034	BOOL16	R/O	Program end signal
0x522B	21035	BOOL16	R/O	Program prerun signal (active during lead time)

Setpoint values (only for type 70211x)

Address		Data type	Access	Designation
Hex.	Dec.			
0x52D0	21200	BOOL16	R/O	Ramp end
0x52D1	21201	BOOL16	R/O	Ramp tolerance band active
0x52E9	21225	UINT16	R/O	Setpoint no. (1 to 4)

ST code

Address		Data type	Access	Designation
Hex.	Dec.			
0x5700	22272	BOOL16	R/O	1. ST digital output
0x5701	22273	BOOL16	R/O	2. ST digital output
0x5702	22274	BOOL16	R/O	3. ST digital output
0x5703	22275	BOOL16	R/O	4. ST digital output
0x5704	22276	FLOAT	R/O	1. ST analog output
0x5706	22278	FLOAT	R/O	2. ST analog output
0x5708	22280	FLOAT	R/O	3. ST analog output
0x570A	22282	FLOAT	R/O	4. ST analog output
0x570C	22284	FLOAT	R/O	5. ST analog output
0x570E	22286	FLOAT	R/O	6. ST analog output

4 Modbus addresses

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