JUMO DICON 400/500

Universal process controller

JUMO DICON 401/501

Universal profile controller
Universal profile generator

B 70.3570.2

Interface Description

10.99/00371593

Contents

1.1 Preface

Please read this manual before commissioning the interface. Keep the manual in a place that is accessible to all users at all times.

Please help us to improve this manual.

Your suggestions will be most welcome.

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All the necessary information for operating the interface is contained in this manual. If any difficulties should still arise during start-up, you are asked not to carry out any manipulations which are not permitted. You could endanger your rights under the instrument warranty!

Please contact the nearest JUMO office or the main factory.

When returning chassis, assemblies or components, the rules of EN 100 015 “Protection of electrostatically sensitive devices” have to be observed. Use only the appropriate ESD packaging material for transport.

Please note that we cannot be held liable for damages caused by ESD (electrostatic discharge).

1.2 Typographical conventions

1.2.1 Warning signs

The signs for **Danger** and **Warning** are used in this Manual under the following conditions:

Danger This symbol may be used when there may be **danger to personnel** if the instructions are disregarded or not followed accurately!

Warning This symbol is used when there may be **damage to equipment or data** if the instructions are disregarded or not followed accurately!

Warning This symbol is used where special care is required when handling components liable to damage through electrostatic discharge.

1.2.2 Note signs

Note This symbol is used when your **special attention** is drawn to a remark.

Reference This sign refers to further information in other handbooks, chapters or sections.

abc[1] **Footnote** Footnotes are notes which refer to certain points in the text. Footnotes consist of two parts:

A marking in the text, and the footnote text.

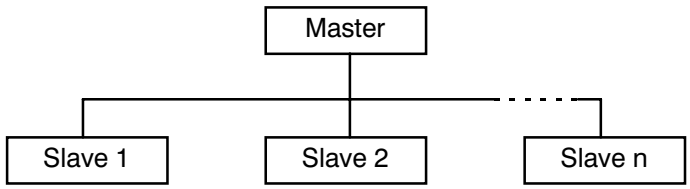
The markings in the text are arranged as continuous raised (superscript) numbers. The footnote text (in a smaller typeface) is placed at the bottom of the text and starts with a number and a full stop.

1.2.3 Presentation

0x0010 **Hexa-decimal no.** A hexadecimal number is identified by being preceded by “0x” (here 16 decimal).

2.1 Master-slave principle

The communication between a PC (master) and an instrument (slave) using MODbus/Jbus takes place according to the master-slave principle in the form of a data request/instruction - response.



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

2.2 Transfer mode (RTU)

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

Data format

The data format describes the arrangement of a transferred byte. The following options are available for the data format:

Data word	Parity bit	Stop bit 1/2 bits	No. of bits
8 bits	—	1	9
8 bits	even	1	10
8 bits	odd	1	10
8 bits	—	2	10
8 bits	even	2	11
8 bits	odd	2	11

2 Protocol description

2.3 Instrument address

The addresses of the slaves can be set from 1 to 31. The instrument address 0 is reserved.

The RS422/485 interface can access a maximum of 254 slaves.

There are two distinct types of data exchange:

Query Data request/instruction from the master to a slave, via the corresponding address. The slave that is accessed will respond.

Broadcast An instruction from the master to all slaves, via address 0. The slaves in the system do not respond. For example, a certain setpoint can be transmitted to all slaves. In this case, the correct acceptance of the value by the slaves should be checked by a subsequent read-out of the setpoint.
A data request using instrument address 0 is meaningless.

2.4 Timing of the communication

The start and end of a data block are identified by transmission pauses. The maximum permitted interval between two consecutive characters is three times the time for transmitting one character.

The character transmission time (time for transmitting a character) depends on the baud rate and the data format that is used (stop bits and parity bit).

If the data format has 8 data bits, no parity bit and one stop bit, then:
character transmission time [msec] = 1000 * 9 bits/(baud rate)

For the other data formats:
character transmission time [msec]
= 1000 * (8 bits+parity bit+stop bit(s))/(baud rate)

Procedure

Data request from master transmission time = n characters * 1000 * x bits/(baud rate)
marker for end of data request 3 characters * 1000 * x bits/(baud rate)
processing the data request by the slave (max. 250msec)
Response of slave transmission time = n characters * 1000 * x bits/(baud rate)
marker for end of response 3 characters * 1000 * x bits/(baud rate)

Example

Marker for end of data request or end of response for 10/9 bits data format.

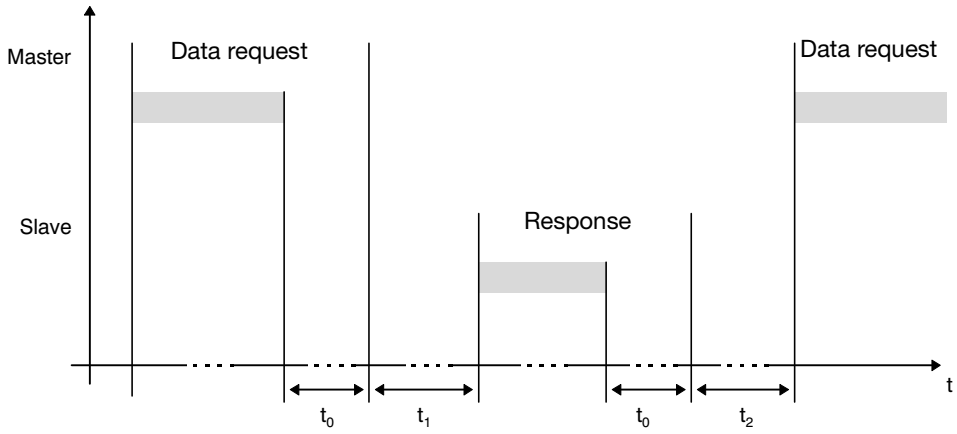
Waiting time = 3 characters * 1000 * 10 bits/(baud rate)

Baud rate [baud]	**Data format** [bit]	**Waiting time** [msec]
19200	11	1.718
	10	1.563
	9	1.406
9600	11	3.4375
	10	3.125
	9	2.813
4800	11	6.875
	10	6.25
	9	5.625
2400	11	13.75
	10	12.5
	9	11.25
1200	11	27.5
	10	25.0
	9	22.5

2.4.1 Timing of a data request

Timing scheme

A data request runs according to the following timing scheme:



t_0 End marker = 3 characters
(the time depends on the baud rate)

t_1 This time depends on the internal processing.
The maximum processing time is 250 msec.

A minimum response time can be set up in the controller, under the menu item “Interface”. At least this preset time (0 — 500 msec) must elapse before a response can be sent. If a smaller value is set, then the response time may be longer than the set value (because the internal processing time is longer) and the controller will then respond as soon as the internal processing is completed. If the time is set to 0 msec, this means that the controller will respond as fast as it can.

The minimum adjustable response time is required by the RS485 interface of the master, to switch the interface driver over from send to receive. This parameter is not needed by the RS422 interface.

t_2 This is the time required by the controller to switch from transmitting back to receiving. The master must wait for this length of time before making a fresh data request. The time must always be maintained, even if the new data request is addressed to a different instrument.

RS422 interface: t_2 = 1msec
RS485 interface: t_2 = 10msec

2.4.2 Communication during the internal processing time of the slave

The master must not make any data requests during the internal processing time of the slave. Any data requests that are made during this time will be ignored by the slave.

2.4.3 Communication during the response time of the slave

The master must not make any data requests during the response time of the slave. Making any data requests during this period will cause all data currently on the bus to become invalid.

2.5 Structure of the data blocks

All data blocks have the same structure:

Data structure

Slave address	Function code	Data field	Checksum CRC16
1 byte	1 byte	x byte(s)	2 bytes

Each data block consists of four fields:

Slave address instrument address of a specific slave

Function code function selection (reading, writing of words)

Data field contains the information:

- word address
- word number
- word value

Checksum for recognition of transmission errors

2.6 Error handling

Error codes There are three error codes:

1 invalid function

2 invalid parameter address

8 write access denied to parameter

2 Protocol description

Response in error situation

Slave address	Function XX OR 80h	Error code	Checksum CRC16
1 byte	1 byte	1 byte	2 bytes

The function code is OR-linked with 0x80, i.e. the most significant bit is set to 1.

Example

Data request:

01	03	00	00	00	04	CRC16

Response:

01	83	02	CRC16

Special cases

The slave will not respond in the event of the following errors:

- the checksum (CRC16) is not correct
- the instruction of the master is incomplete or over-defined
- the number of words or bits to be read is zero

2.7 Checksum (CRC16)

The checksum (CRC16) serves to recognize transmission errors. If an error is identified during processing, the appropriate instrument will not respond.

Calculation method

CRC = 0xFFFF			
	CRC = CRC XOR ByteOfMessage		
	For (1 to 8)		
		CRC = SHR(CRC)	
		if (flag shifted right = 1)	
		then CRC = CRC XOR 0xA001	else
while (not all ByteOfMessage processed);			

Example

Data request: read two words, starting at address 0x1053 (CRC16 = 0x30BC)

07	03	10	53	00	02	30	BC
						CRC16	

Response: (CRC16 = 0xADF5)

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

2 Protocol description

2.8 Interface

C2	Protocol type		MODbus
Interface			MODbus integer
	Data format	Parity	no parity
			odd parity
Symbol explanation:			even parity
			zero parity
* = enter value		Stop bit	1 stop bit
■ =factory-set			2 stop bits
		Baud rate	1200 baud
			2400 baud
			4800 baud
			9600 baud
			19200 baud
	Instrument address		Value *_____
			Value range: 0 — 254
			factory-set: 0
	Minimum response time		Value *_____
			Value range: 0 — 500 msec
			factory-set: 0 msec

The following functions are available to the instrument:

Function number	Function
0x03/0x04	Read n words
0x06	Write 1 word
0x10	Write n words

3.1 Read n words

This function reads n words, starting from a defined address.

Data request

Slave address	Function 0x03 or 0x04	Address of first word	No. 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(s)	2 bytes

Example

Read the 2 setpoints of the controller

Word address = 0x1053 (setpoint W1)

Data request:

07	03	10	53	00	04	B0BE

Response:

07	03	08	0000	41C8	0000	4120	5416
			Setpoint 1 (25.0)		Setpoint 2 (10.0)		

3.2 Write 1 word

In the function *Write 1 word*, 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 limit for limit comparator 1 = 275

Word address = 0x10CC

Instruction: write the first part of the value

07	06	10	CC	80	00	2C93

Response (as instruction):

07	06	10	CC	80	00	2C93

Instruction: write the second part of the value

07	06	10	CD	43	89	EC05

Response (as instruction):

07	06	10	CD	43	89	EC05

3.3 Write n words

Instruction

Slave address	Function 0x10	Address of first word	No. of words max. 127	No. of bytes	Word value(s)	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	1 byte	x bytes	2 bytes

Response

Slave address	Function 0x10	Address of first word	No. of words	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example

Write the reset time for the first parameter set: Tn1 = 20 sec

Word address = 0x1071

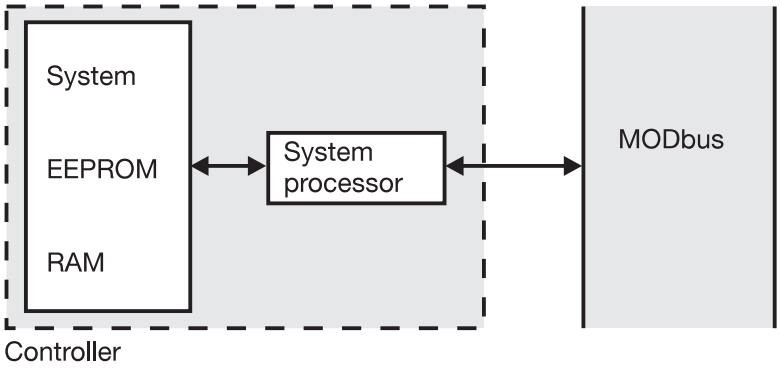
Instruction:

07	10	10	71	00	02	04	00	00	41	A0	D627

Response:

07	10	10	71	00	02	1575

3 Functions



The RS422/485 interface is inactive during communication via the setup interface.

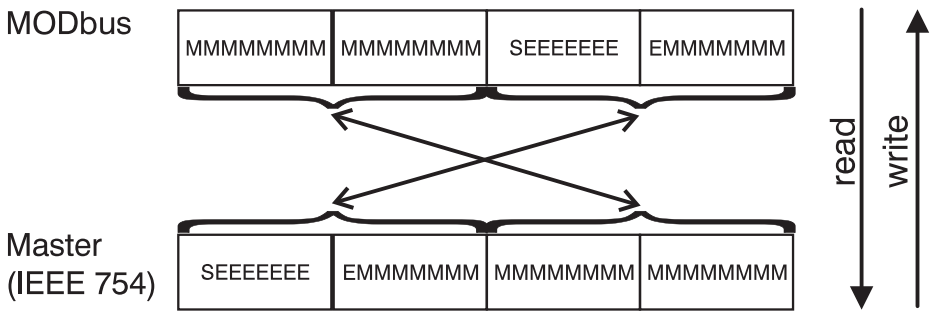
The following describes all the process values (variables) with their addresses, data types, and type of access.

The abbreviations mean:

R/O	read access only
R/W	read and write access
char, byte	byte (8 bits)
int	integer (16 bits)
text	character string, consisting of 10 bytes incl. end-of-string marker 0
Bit x	bit no. x
long	long integer (4 bytes)
float	float value (4 bytes)

The following explanation applies on condition that the master operates with the IEEE-754 format. Before transmitting a value, the bytes have to be rearranged, so that their order corresponds to the representation for MODbus (see diagram).

M = 23 bit normalised mantissa
E = exponent (complement to base 2)
S = sign bit; 1 = negative; 0 = positive



Example:
Transferring the decimal value 550:
MODbus: 0x80, 0x00, 0x44, 0x09

4 Data flow

☞ Memory contents that only affect Type 703570/75 are shown **bold**.
Memory contents that only affect Type 703580/85 are shown in *italics*.

5.1 Process data

Address	Data type/ bit number	Access	Signal designation
0x1000	*INT*	*R/O*	*Generator/source status*
	Bit 0 — 1	R/O	not used
	Bit 2	R/O	Standstill = 1
	Bit 3	R/O	Basic status = 1
	Bit 4	R/O	Operating mode *Manual* / *Automatic-manual* = 1
	Bit 5 — 10	R/O	not used
	Bit 11	R/O	Delay 0 = inactive / 1 = active
	Bit 12	R/O	Program end signal = 1
	Bit 13	R/O	Operating mode *Automatic* = 1
	Bit 14 — 15	R/O	not used
0x1001	INT	R/O	System status
	Bit 0	R/O	Manual operation = 1
	Bit 1	R/O	Self-optimisation active = 1
	Bit 2	R/O	Inhibit Manual operation active = 1
	Bit 3	R/O	Inhibit Self-optimisation active = 1
	Bit 4	R/O	Manual operation on overrange/underrange = 1
	Bit 5	R/O	not used
	Bit 6 — 15	R/O	not used
0x1002	FLOAT	R/O	reserved
0x1004	FLOAT	R/O	reserved
0x1006	FLOAT	R/O	reserved
0x1008	FLOAT	R/O	reserved
0x100A	FLOAT	R/O	reserved
0x100C	INT	R/O	Output 1 — 6 (switching states for switching outputs 0 = off / 1 = on)
	Bit 0 — 1	R/O	not used
	Bit 2	R/O	Output 1
	Bit 3	R/O	Output 2
	Bit 4	R/O	Output 3
	Bit 5	R/O	Output 4
	Bit 6	R/O	Output 5
	Bit 7	R/O	Output 6
	Bit 8 — 15	R/O	not used
0x100D	INT	R/O	Outputs ER8 (switching states 0 = off / 1 = on)
	Bit 0	R/O	Output 1 (K5)
	Bit 1	R/O	Output 2 (K6)
	Bit 2	R/O	Output 3 (K7)
	Bit 3	R/O	Output 4 (K8)

5 Address tables

Address	Data type/ bit number	Access	Signal designation
	Bit 4	R/O	Output 5 (K9)
	Bit 5	R/O	Output 6 (K10)
	Bit 6	R/O	Output 7 (K11)
	Bit 7	R/O	Output 8 (K12)
	Bit 8 —15	R/O	not used
0x100E	INT	R/O	Logic inputs 1 — 8 (switching states 0 = open / 1 = closed)
	Bit 0	R/O	Logic input 1
	…	…	…
	Bit 7	R/O	Logic input 8
	Bit 8 —15	R/O	not used
0x100F	INT	R/O	reserved
0x1010	INT	R/O	reserved
0x1011	INT	R/O	reserved
0x1012	INT	R/O	reserved
0x1013	INT	R/O	reserved
0x1014	INT	R/O	reserved
0x1015	INT	R/O	reserved
0x1016	INT	R/O	Limit comparator (switching states 0 = off / 1 = on)
	Bit 0	R/O	Limit comparator 1
	…	…	…
	Bit 7	R/O	Limit comparator 8
	Bit 8 —15	R/O	not used
0x1017	INT	R/O	Logic module
	Bit 0	R/O	Logic 1
	Bit 1	R/O	Logic 2
	Bit 2 —15	R/O	not used
0x1018	FLOAT	R/O	Analogue input 1
0x101A	FLOAT	R/O	Analogue input 2
0x101C	FLOAT	R/O	Analogue input 3
0x101E	FLOAT	R/O	Analogue input 4
0x1020	FLOAT	R/O	Mathematics 1
0x1022	FLOAT	R/O	Mathematics 2
0x1024	FLOAT	R/O	Ramp value (W)
0x1026	FLOAT	R/O	Process value filtered
0x1028	FLOAT	R/O	Process value unfiltered
0x102A	FLOAT		Setpoint
0x102C	FLOAT	R/O	Output -100 to 100% (display value)
0x102E	FLOAT	R/O	Output heating 0 to +100%
0x1030	FLOAT	R/O	Output cooling -100 to 0%
0x1032	FLOAT	R/O	Control difference
0x1034	FLOAT	R/O	Control deviation
0x1036	INT	R/O	Switch position heating (1 = contact closed/ ON)
0x1037	INT	R/O	Switch position cooling (1 = contact closed/ ON)
0x1038	INT	R/O	Parameter set number (1 — 2)

Address	Data type/ bit number	Access	Signal designation
0x1039	*INT*	*R/O*	*Program number (1 — 10)*
0x103A	*INT*	*R/O*	*Segment number (1 — 99)*
0x103B	*INT*	*R/O*	*Last segment*
0x103C	*INT*	*R/O*	*Tolerance band signal*
0x103D	*INT*	*R/O*	*No. of unused segments*
0x103E	*FLOAT*	*R/O*	*Generator/source setpoint, depending on operating mode*
0x1040	*INT*	*R/O*	*Operating contacts*
0x1041	*INT*	*R/O*	*reserved*
0x1042	*INT*	*R/O*	*Controller/limit comparator function active (1 = active)*
	Bit 0	*R/O*	*Controller (in basic status)*
	Bit 1 — 7	*R/O*	*not used*
	Bit 8	*R/O*	*Limit comparator 1*
	…	*…*	*…*
	Bit 15	*R/O*	*Limit comparator 8*
0x1043	*LONG*	*R/O*	*Program run-time (in seconds)*
0x1045	*LONG*	*R/O*	*Remaining program run-time (in seconds)*
0x1047	*LONG*	*R/O*	*Program time (in seconds)*
0x1049	*LONG*	*R/O*	*Segment run-time (in seconds)*
0x104B	*LONG*	*R/O*	*Remaining segment run-time (in seconds)*
0x104D	*LONG*	*R/O*	*Segment time (in seconds)*
0x104F	FLOAT	R/O	Sampling time
0x1051	FLOAT	R/O	Internal Pt100

5.2 Setpoints

Address	Data type/ bit number	Access	Signal designation
0x1053	FLOAT	R/W	Setpoint W1
0x1055	FLOAT	R/W	Setpoint W2
0x1057	FLOAT	R/W	Setpoint W3
0x1059	FLOAT	R/W	Setpoint W4

When setpoints are altered via the interface, no check is carried out on the setpoint limits.

5.3 Manual output

Address	Data type/ bit number	Access	Signal designation
0x105B	FLOAT	R/W	Manual output

5 Address tables

5.4 Controller parameters

Address	Data type/ bit number	Access	Signal designation
Parameter set 1			
0x1067	INT	R/W	Parameter set 1: Controller structure 1
0x1068	INT	R/W	Parameter set 1: Controller structure 2
0x1069	FLOAT	R/W	Parameter set 1: XP1
0x106B	FLOAT	R/W	Parameter set 1: XP2
0x106D	FLOAT	R/W	Parameter set 1: TV1
0x106F	FLOAT	R/W	Parameter set 1: TV2
0x1071	FLOAT	R/W	Parameter set 1: TN1
0x1073	FLOAT	R/W	Parameter set 1: TN2
0x1075	FLOAT	R/W	Parameter set 1: CY1
0x1077	FLOAT	R/W	Parameter set 1: CY2
0x1079	FLOAT	R/W	Parameter set 1: XSH
0x107B	FLOAT	R/W	Parameter set 1: XD1
0x107D	FLOAT	R/W	Parameter set 1: XD2
0x107F	FLOAT	R/W	Parameter set 1: TT
0x1081	FLOAT	R/W	Parameter set 1: Y0
0x1083	FLOAT	R/W	Parameter set 1: Y1
0x1085	FLOAT	R/W	Parameter set 1: Y2
0x1087	FLOAT	R/W	Parameter set 1: TK1
0x1089	FLOAT	R/W	Parameter set 1: TK2
Parameter set 2			
0x108B	INT	R/W	Parameter set 2: Controller structure 1
0x108C	INT	R/W	Parameter set 2: Controller structure 2
0x108D	FLOAT	R/W	Parameter set 2: XP1
0x108F	FLOAT	R/W	Parameter set 2: XP2
0x1091	FLOAT	R/W	Parameter set 2: TV1
0x1093	FLOAT	R/W	Parameter set 2: TV2
0x1095	FLOAT	R/W	Parameter set 2: TN1
0x1097	FLOAT	R/W	Parameter set 2: TN2
0x1099	FLOAT	R/W	Parameter set 2: CY1
0x109B	FLOAT	R/W	Parameter set 2: CY2
0x109D	FLOAT	R/W	Parameter set 2: XSH
0x109F	FLOAT	R/W	Parameter set 2: XD1
0x10A1	FLOAT	R/W	Parameter set 2: XD2
0x10A3	FLOAT	R/W	Parameter set 2: TT
0x10A5	FLOAT	R/W	Parameter set 2: Y0
0x10A7	FLOAT	R/W	Parameter set 2: Y1
0x10A9	FLOAT	R/W	Parameter set 2: Y2
0x10AB	FLOAT	R/W	Parameter set 2: TK1
0x10AD	FLOAT	R/W	Parameter set 2: TK2

5.5 Configuration

Address	Data type/ bit number	Access	Signal designation
0x10AF	INT	R/W	Controller type
0x10B0	INT	R/W	Control direction
0x10B1	INT	R/W	Output 1 for self-optimisation
0x10B2	INT	R/W	Output 2 for self-optimisation
0x10B3	FLOAT	R/W	Dead band
0x10B5	FLOAT	R/W	FC1
0x10B7	FLOAT	R/W	FC2
0x10B9	INT	R/W	Controller input: Process value
0x10BA	INT	R/W	Controller input: External setpoint
0x10BB	INT	R/W	Controller input: External setpoint with correction
0x10BC	INT	R/W	Controller input: Output retransmission
0x10BD	INT	R/W	Controller input: Additive disturbance
0x10BE	INT	R/W	Controller input: Multiplying disturbance
0x10BF	FLOAT	R/W	Manual output
0x10C1	INT	R/W	Inhibit manual operation (1 = inhibited)
0x10C2	INT	R/W	Inhibit setpoint optimisation (1 = inhibited)
0x10C3	FLOAT	R/W	Setpoint start
0x10C5	FLOAT	R/W	Setpoint end

5.6 Limit comparators

Address	Data type/ bit number	Access	Signal designation
0x10C7	INT	R/W	Action (0 = absolute, 1 = relative)
	Bit 0	R/W	Limit comparator 1
	…	…	…
	Bit 7	R/W	Limit comparator 8
	Bit 8 — 15	R/W	not used
0x10C8	INT	R/W	Function on overrange/underrange (1 = relay energised / ON)
	Bit 0	R/W	Limit comparator 1
	…	…	…
	Bit 7	R/W	Limit comparator 8
	Bit 8 — 15	R/W	not used
0x10C9	INT	R/W	LK1: Function
0x10CA	FLOAT	R/W	LK1: Switching differential
0x10CC	FLOAT	R/W	LK1: Limit value
0x10CE	INT	R/W	LK1: Switch-on delay
0x10CF	INT	R/W	LK1: Pulse function
0x10D0	INT	R/W	LK1: Limit comparator: Process value
0x10D1	INT	R/W	LK1: Limit comparator: Setpoint
0x10D2	INT	R/W	LK2: Function
0x10D3	FLOAT	R/W	LK2: Switching differential

5 Address tables

Address	Data type/ bit number	Access	Signal designation
0x10D5	FLOAT	R/W	LK2: Limit value
0x10D7	INT	R/W	LK2: Switch-on delay
0x10D8	INT	R/W	LK2: Pulse function
0x10D9	INT	R/W	LK2: Limit comparator: Process value
0x10DA	INT	R/W	LK2: Limit comparator: Setpoint
0x10DB	INT	R/W	LK3: Function
0x10DC	FLOAT	R/W	LK3: Switching differential
0x10DE	FLOAT	R/W	LK3: Limit value
0x10E0	INT	R/W	LK3: Switch-on delay
0x10E1	INT	R/W	LK3: Pulse function
0x10E2	INT	R/W	LK3: Limit comparator: Process value
0x10E3	INT	R/W	LK3: Limit comparator: Setpoint
0x10E4	INT	R/W	LK4: Function
0x10E5	FLOAT	R/W	LK4: Switching differential
0x10E7	FLOAT	R/W	LK4: Limit value
0x10E9	INT	R/W	LK4: Switch-on delay
0x10EA	INT	R/W	LK4: Pulse function
0x10EB	INT	R/W	LK4: Limit comparator: Process value
0x10EC	INT	R/W	LK4: Limit comparator: Setpoint
0x10ED	INT	R/W	LK5: Function
0x10EE	FLOAT	R/W	LK5: Switching differential
0x10F0	FLOAT	R/W	LK5: Limit value
0x10F2	INT	R/W	LK5: Switch-on delay
0x10F3	INT	R/W	LK5: Pulse function
0x10F4	INT	R/W	LK5: Limit comparator: Process value
0x10F5	INT	R/W	LK5: Limit comparator: Setpoint
0x10F6	INT	R/W	LK6: Function
0x10F7	FLOAT	R/W	LK6: Switching differential
0x10F9	FLOAT	R/W	LK6: Limit value
0x10FB	INT	R/W	LK6: Switch-on delay
0x10FC	INT	R/W	LK6: Pulse function
0x10FD	INT	R/W	LK6: Limit comparator: Process value
0x10FE	INT	R/W	LK6: Limit comparator: Setpoint
0x10FF	INT	R/W	LK7: Function
0x1100	FLOAT	R/W	LK7: Switching differential
0x1102	FLOAT	R/W	LK7: Limit value
0x1104	INT	R/W	LK7: Switch-on delay
0x1105	INT	R/W	LK7: Pulse function
0x1106	INT	R/W	LK7: Limit comparator: Process value
0x1107	INT	R/W	LK7: Limit comparator: Setpoint
0x1108	INT	R/W	LK8: Function
0x1109	FLOAT	R/W	LK8: Switching differential
0x110B	FLOAT	R/W	LK8: Limit value
0x110D	INT	R/W	LK8: Switch-on delay
0x110E	INT	R/W	LK8: Pulse function

Address	Data type/ bit number	Access	Signal designation
0x110F	INT	R/W	LK8: Limit comparator: Process value
0x1110	INT	R/W	LK8: Limit comparator: Setpoint

5.7 Analogue inputs

Address	Data type/ bit number	Access	Signal designation
0x1111	INT	R/W	E1: Transducer
0x1112	INT	R/W	E1: Linearisation
0x1113	INT	R/W	E1: Constant cold-junction temperature
0x1114	INT	R/W	E1: Heater current monitoring
0x1115	FLOAT	R/W	E1: External cold-junction temperature
0x1117	FLOAT	R/W	E1: Display start
0x1119	FLOAT	R/W	E1: Display end
0x111B	FLOAT	R/W	E1: Range start
0x111D	FLOAT	R/W	E1: Range end
0x111F	FLOAT	R/W	E1: Measurement correction
0x1121	FLOAT	R/W	E1: Filter time constant
0x1123	INT	R/W	E2: Transducer
0x1124	INT	R/W	E2: Linearisation
0x1125	INT	R/W	E2: Constant cold-junction temperature
0x1126	INT	R/W	E2: Heater current monitoring
0x1127	FLOAT	R/W	E2: External cold-junction temperature
0x1129	FLOAT	R/W	E2: Display start
0x112B	FLOAT	R/W	E2: Display end
0x112D	FLOAT	R/W	E2: Range start
0x112F	FLOAT	R/W	E2: Range end
0x1131	FLOAT	R/W	E2: Measurement correction
0x1133	FLOAT	R/W	E2: Filter time constant
0x1135	INT	R/W	E3: Transducer
0x1136	INT	R/W	E3: Linearisation
0x1137	INT	R/W	E3: Constant cold-junction temperature
0x1138	INT	R/W	E3: Heater current monitoring
0x1139	FLOAT	R/W	E3: External cold-junction temperature
0x113B	FLOAT	R/W	E3: Display start
0x113D	FLOAT	R/W	E3: Display end
0x113F	FLOAT	R/W	E3: Range start
0x1141	FLOAT	R/W	E3: Range end
0x1143	FLOAT	R/W	E3: Measurement correction
0x1145	FLOAT	R/W	E3: Filter time constant
0x1147	INT	R/W	E4: Transducer
0x1148	INT	R/W	E4: Linearisation
0x1149	INT	R/W	E4: Constant cold-junction temperature
0x114A	INT	R/W	E4: Heater current monitoring
0x114B	FLOAT	R/W	E4: External cold-junction temperature

5 Address tables

Address	Data type/ bit number	Access	Signal designation
0x114D	FLOAT	R/W	E4: Display start
0x114F	FLOAT	R/W	E4: Display end
0x1151	FLOAT	R/W	E4: Range start
0x1153	FLOAT	R/W	E4: Range end
0x1155	FLOAT	R/W	E4: Measurement correction
0x1157	FLOAT	R/W	E4: Filter time constant
0x1159	INT	R/W	Supply frequency
0x115A	INT	R/W	Unit

5.8 Outputs

Address	Data type/ bit number	Access	Signal designation
0x115B	INT	R/W	A1: Output signal for analogue output
0x115C	FLOAT	R/W	A1: Zero point
0x115E	FLOAT	R/W	A1: End value
0x1160	INT	R/W	A1: Output signal for overrange/underrange (1 = ON / 0 = OFF)
0x1161	INT	R/W	A1: Function
0x1162	INT	R/W	A2: Output signal for analogue output
0x1163	FLOAT	R/W	A2: Zero point
0x1165	FLOAT	R/W	A2: End value
0x1167	INT	R/W	A2: Output signal for overrange/underrange (1 = ON / 0 = OFF)
0x1168	INT	R/W	A2: Function
0x1169	INT	R/W	A3: Output signal for analogue output
0x116A	FLOAT	R/W	A3: Zero point
0x116C	FLOAT	R/W	A3: End value
0x116E	INT	R/W	A3: Output signal for overrange/underrange (1 = ON / 0 = OFF)
0x116F	INT	R/W	A3: Function
0x1170	INT	R/W	A4: Output signal for analogue output
0x1171	FLOAT	R/W	A4: Zero point
0x1173	FLOAT	R/W	A4: End value
0x1175	INT	R/W	A4: Output signal for overrange/underrange (1 = ON / 0 = OFF)
0x1176	INT	R/W	A4: Function
0x1177	INT	R/W	A5: Output signal for analogue output
0x1178	FLOAT	R/W	A5: Zero point
0x117A	FLOAT	R/W	A5: End value
0x117C	INT	R/W	A5: Output signal for overrange/underrange (1 = ON / 0 = OFF)
0x117D	INT	R/W	A5: Function
0x117E	INT	R/W	A6: Output signal for analogue output
0x117F	FLOAT	R/W	A6: Zero point

Address	Data type/ bit number	Access	Signal designation
0x1181	FLOAT	R/W	A6: End value
0x1183	INT	R/W	A6: Output signal for overrange/underrange (1 = ON / 0 = OFF)
0x1184	INT	R/W	A6: Function

5.9 Ramp and profile program function (only Type 703570/75)

Address	Data type/ bit number	Access	Signal designation
0x1185	INT	R/W	Function
0x1186	FLOAT	R/W	Ramp slope
0x1188	INT	R/W	Unit for ramp slope

5.10 Profile controller (only Type 703580/85)

Address	Data type/ bit number	Access	Signal designation
0x1189	INT	R/W	Function
0x118A	INT	R/W	Restart after power failure
0x118B	INT	R/W	Program start
0x118C	INT	R/W	Setpoint provision
0x118D	INT	R/W	Time/gradient programming
0x118E	INT	R/W	Program stop on overrange/underrange
0x118F	INT	R/W	Function control: Controller
0x1190	INT	R/W	Function control: LK1
0x1191	INT	R/W	Function control: LK2
0x1192	INT	R/W	Function control: LK3
0x1193	INT	R/W	Function control: LK4
0x1194	INT	R/W	Function control: LK5
0x1195	INT	R/W	Function control: LK6
0x1196	INT	R/W	Function control: LK7
0x1197	INT	R/W	Function control: LK8
0x1198	INT	R/W	Process value deviation
0x1199	INT	R/W	Program end time

5.11 System states (only Type 703580/85)

Address	Data type/ bit number	Access	Signal designation
Basic status			
0x119A	INT	R/W	reserved
0x119B	INT	R/W	reserved
0x119C	FLOAT	R/W	Setpoint
0x119E	INT	R/W	Operating contacts (1= ON)

5 Address tables

Address	Data type/ bit number	Access	Signal designation
	Bit 0	R/W	Operating contact 1
	…	…	…
	Bit 7	R/W	Operating contact 8
	Bit 8 —15	R/W	not used
0x119F	INT	R/W	Parameter set (0 = Parameter set 1)
0x11A0	INT	R/W	Function Limit comparator/controller (1 = active)
	Bit 0	R/W	Limit comparator 1
	…	…	…
	Bit 7	R/W	Limit comparator 8
	Bit 8	R/W	Controller
	Bit 9 —15	R/W	not used
Operating mode *Manual*			
0x11A1	INT	R/W	reserved
0x11A2	INT	R/W	reserved
0x11A3	FLOAT	R/W	Setpoint
0x11A5	INT	R/W	Operating contacts (1 = ON)
	Bit 0	R/W	Operating contact 1
	…	…	…
	Bit 7	R/W	Operating contact 8
	Bit 8 —15	R/W	not used
0x11A6	INT	R/W	Parameter set (0 = Parameter set 1)
0x11A7	INT	R/W	Function Limit comparator/controller (1= active)
	Bit 0	R/W	Limit comparator 1
	…	…	…
	Bit 7	R/W	Limit comparator 8
	Bit 8	R/W	Controller
	Bit 9 —15	R/W	not used
Overrange/underrange			
0x11A8	INT	R/W	reserved
0x11A9	INT	R/W	reserved
0x11AA	FLOAT	R/W	Setpoint
0x11AC	INT	R/W	Operating contacts (1 = ON)
	Bit 0	R/W	Operating contact 1
	…	…	…
	Bit 7	R/W	Operating contact 8
	Bit 8 —15	R/W	not used
0x11AD	INT	R/W	Parameter set (0 = Parameter set 1)
0x11AE	INT	R/W	Function Limit comparator/controller (1 = active)
	Bit 0	R/W	Limit comparator 1
	…	…	…
	Bit 7	R/W	Limit comparator 8
	Bit 8	R/W	Controller
	Bit 9 —15	R/W	not used

5.12 Mathematics and logic module

Address	Data type/ bit number	Access	Signal designation
0x11AF	INT	R/W	Mathematics1: Function
0x11B0	INT	R/W	Logic 1: Function
0x11B1	INT	R/W	Mathematics 1: Linearisation
0x11B2	FLOAT	R/W	Mathematics 1: Range start
0x11B4	FLOAT	R/W	Mathematics 1: Range end
0x11B6	INT	R/W	Mathematics 1: Variable a
0x11B7	INT	R/W	Mathematics 1: Variable b
0x11B8	INT	R/W	Mathematics 2: Function
0x11B9	INT	R/W	Logic 2: Function
0x11BA	INT	R/W	Mathematics 2: Linearisation
0x11BB	FLOAT	R/W	Mathematics 2: Range start
0x11BD	FLOAT	R/W	Mathematics 2: Range end
0x11BF	INT	R/W	Mathematics 2: Variable a
0x11C0	INT	R/W	Mathematics 2: Variable b

5.13 Displays

Address	Data type/ bit number	Access	Signal designation
0x11C1	INT	R/W	Configuration 1/ display 1: Display value
0x11C2	INT	R/W	Configuration 1/ display 1: Decimal point
0x11C3	INT	R/W	Configuration 1/ display 2: Display value
0x11C4	INT	R/W	Configuration 1/ display 2: Decimal point
0x11C5	INT	R/W	Configuration 1/ display 3: Display value
0x11C6	INT	R/W	Configuration 1/ display 3: Decimal point
0x11C7	INT	R/W	Configuration 2/ display 1: Display value
0x11C8	INT	R/W	Configuration 2/ display 1: Decimal point
0x11C9	INT	R/W	Configuration 2/ display 2: Display value
0x11CA	INT	R/W	Configuration 2/ display 2: Decimal point
0x11CB	INT	R/W	Configuration 2/ display 3: Display value
0x11CC	INT	R/W	Configuration 2/ display 3: Decimal point
0x11CD	INT	R/W	Configuration 1: Text display
0x11CE	INT	R/W	Configuration 2: Text display
0x11CF	INT	R/W	Brightness of matrix display
0x11D0	INT	R/W	Automatic display switching
0x11D1	INT	R/W	Time-out

5.14 Real-time clock (only Type 703580/85)

Address	Data type/ bit number	Access	Signal designation
0x11D2	INT	R/W	Function (1 = active)

5 Address tables

5.15 Binary/logic functions

Address	Data type/ bit number	Access	Signal designation
0x11D3	INT	R/W	Logic input 1
0x11D4	INT	R/W	Logic input 2
0x11D5	INT	R/W	Logic input 3
0x11D6	INT	R/W	Logic input 4
0x11D7	INT	R/W	Logic input 5
0x11D8	INT	R/W	Logic input 6
0x11D9	INT	R/W	Logic input 7
0x11DA	INT	R/W	Logic input 8
0x11DB	INT	R/W	Limit comparator 1
0x11DC	INT	R/W	Limit comparator 2
0x11DD	INT	R/W	Limit comparator 3
0x11DE	INT	R/W	Limit comparator 4
0x11DF	INT	R/W	Limit comparator 5
0x11E0	INT	R/W	Limit comparator 6
0x11E1	INT	R/W	Limit comparator 7
0x11E2	INT	R/W	Limit comparator 8
0x11E3	INT	R/W	Logic 1
0x11E4	INT	R/W	Logic 2
0x11E5	*INT*	*R/W*	*Operating contact 1*
0x11E6	*INT*	*R/W*	*Operating contact 2*
0x11E7	*INT*	*R/W*	*Operating contact 3*
0x11E8	*INT*	*R/W*	*Operating contact 4*
0x11E9	*INT*	*R/W*	*Operating contact 5*
0x11EA	*INT*	*R/W*	*Operating contact 6*
0x11EB	*INT*	*R/W*	*Operating contact 7*
0x11EC	*INT*	*R/W*	*Operating contact 8*
0x11ED	*INT*	*R/W*	*Tolerance band signal*
0x11EE	*INT*	*R/W*	*Program end signal*

5.16 Interface

Address	Data type/ bit number	Access	Signal designation
0x120B	INT	R/W	Protocol type
0x120C	INT	R/W	Parity
0x120D	INT	R/W	Stop bit
0x120E	INT	R/W	Baud rate
0x120F	INT	R/W	Instrument address
0x1210	INT	R/W	Minimum response time

5.17 Program start with start data (only Type 703580/85)

Address	Data type/ bit number	Access	Signal designation
0x121D	INT	R/W	Program buffer (set bit 5 = 1 start the program)
0x121E	INT	R/W	Program number
0x121F	LONG	R/W	Delay time in seconds
0x1221	LONG	R/W	Start time in seconds (-1= 0xFFFFFFFF instant start)
0x1223	INT	R/W	Start day (0 = Sunday)
0x1224	INT	R/W	Start segment (1—100 or 0 = program start)
0x1225	LONG	R/W	Start segment, remaining run-time in seconds

5.18 Operating mode *Manual* with man. data (only Type 703580/85)

Address	Data type/ bit number	Access	Signal designation
0x1227	INT	R/W	Program buffer (set bit 4 = 1 to switch to the *Manual* operating mode)
0x1228	FLOAT	R/W	Setpoint
0x122A	INT	R/W	Operating contacts (1 = ON)
	Bit 0	R/W	Operating contact 1
	…	…	…
	Bit 7	R/W	Operating contact 8
	Bit 8 —15	R/W	not used
0x122B	INT	R/W	Parameter set (0 = Parameter set 1)
0x12CA	INT	R/W	Function Limit comparator/controller (1 = active)
	Bit 0	R/W	Limit comparator 1
	…	…	…
	Bit 7	R/W	Limit comparator 8
	Bit 8	R/W	Controller
	Bit 9—15	R/W	not used

5.19 Transmit program (only Type 703580/85)

Address	Data type/ bit number	Access	Signal designation
0x122F	INT	R/W	Program number
0x1230		R/O	reserved
0x1231	INT	R/W	Segment number (1—100)
0x1232	INT	R/O	Max. no. of segments
0x1233	FLOAT	R/W	Segment setpoint
0x1235	INT	R/W	Operating contacts (1 = ON)
	Bit 0	R/W	Operating contact 1
	…	…	…
	Bit 7	R/W	Operating contact 8
	Bit 8 —15	R/W	not used

5 Address tables

Address	Data type/ bit number	Access	Signal designation
0x1236	FLOAT	R/W	Minimum (lower) limit of the tolerance band
0x1238	FLOAT	R/W	Maximum (upper) limit of the tolerance band
0x123A	LONG	R/W	Segment time
0x123C	INT	R/W	Repeat cycles (0 = no repeat; -1= repeats indefinitely)
0x123D	INT	R/W	Target segment (only for repeat cycles ≠ 0)
0x123E	INT	R/W	Parameter set number (0 = Parameter set 1)

⇨ Chapter 6 “Sample program”

5.20 Commands

Address	Data type/ bit number	Access	Signal designation
0x123F	INT	R/W	Command value 1
	Bit 0 — 1	R/W	not used
	Bit 2	R/W	Ramp/program stop
	Bit 3	R/W	Cancel program
	Bit 4	R/W	Operating mode *Manual*
	Bit 5	R/W	Program start (without data)
	Bit 6	R/W	Change segment
	Bit 7 — 8	R/W	not used
	Bit 9	R/W	Limit comparator acknowledgement
	Bit 10	**R/W**	**Manual operation**
	Bit 11	**R/W**	**Automatic operation**
	Bit 12	R/W	Activate Inhibit manual operation
	Bit 13	R/W	Deactivate operating mode *Manual* or *Automatic-manual*
	Bit 14	R/W	Start self-optimisation
	Bit 15	R/W	Cancel self-optimisation
0x1240	INT	R/W	Command value 2
	Bit 0 — 14	R/W	not used
	Bit 15	R/W	Fast-forward
0x1241	INT	R/W	Command value 3
0x1242	LONG	R/W	Commands for text display
	Bit 0 — 7	R/W	Logic input 1 — 8
	Bit 8 + 9	R/W	Logic 1 + 2
	Bit 10 — 15	R/W	not used
	Bit 16 — 23	R/W	Limit comparator 1 — 8
	Bit 24 — 31	R/W	Operating contact 1 — 8
0x1244	INT	R/W	Setpoint switching -1 = no setpoint switching 0 — 3 = W1 — W4
0x1245	INT	R/W	Parameter set switching -1 = no parameter set switching 0 = P1 1 = P2

Address	Data type/ bit number	Access	Signal designation
0x1246	INT	R/W	Process value switching -1 = no process value switching 0 — 3 = analogue input 1 — 4
0x1247	INT	R/W	Program selection -1 = off 0 — 7 = program 1 — 8

5.21 Frequent setpoint programming

To avoid damaging the EEPROM (max. 10 000 write cycles), you should use the following addresses if frequent setpoint programming is required.

Since the data (setpoints) are stored in a volatile memory (RAM), they will be lost if there is a power interruption.

If the setpoint is altered via the interface, no check is carried out on the setpoint limits.

Address	Data type/ bit number	Access	Signal designation
0x1248	FLOAT	R/W	Setpoint in RAM

5.22 Process value via interface

Address	Data type/ bit number	Access	Signal designation
0x124A	FLOAT	R/W	Process value in RAM

5.23 Instrument identification

Address	Data type/ bit number	Access	Signal designation
0x124C	INT	R/O	Format (case)
0x124D	INT	R/O	Analogue input 3
0x124E	INT	R/O	Analogue input 4
0x124F	INT	R/O	Output 1
0x1250	INT	R/O	Output 2
0x1251	INT	R/O	Output 3
0x1252	INT	R/O	Output 4
0x1253	INT	R/O	Output 5
0x1254	INT	R/O	Output 6
0x1255	INT	R/O	Setup
0x1256	INT	R/O	Interface
0x1257	INT	R/O	reserved

5 Address tables

Address	Data type/ bit number	Access	Signal designation
0x1258	INT	R/O	ER8
0x1259	INT	R/O	Data buffering
0x125A	INT	R/O	Input 1 10V
0x125B	INT	R/O	Input 2 10V
0x125C	INT	R/O	Input 3 10V
0x125D	INT	R/O	Input 4 10V

5.24 External relay module

Address	Data type/ bit number	Access	Signal designation
0x1299	INT	R/W	Relay 1 (K5): Function
0x129A	INT	R/W	Relay 1 (K5): Function for overrange/underrange
0x129B	INT	R/W	Relay 2 (K6): Function
0x129C	INT	R/W	Relay 2 (K6): Function for overrange/underrange
0x129D	INT	R/W	Relay 3 (K7): Function
0x129E	INT	R/W	Relay 3 (K7): Function for overrange/underrange
0x129F	INT	R/W	Relay 4 (K8): Function
0x12A0	INT	R/W	Relay 4 (K8): Function for overrange/underrange
0x12A1	INT	R/W	Relay 5 (K9): Function
0x12A2	INT	R/W	Relay 5 (K9): Function for overrange/underrange
0x12A3	INT	R/W	Relay 6 (K10): Function
0x12A4	INT	R/W	Relay 6 (K10): Function for overrange/underrange
0x12A5	INT	R/W	Relay 7 (K11): Function
0x12A6	INT	R/W	Relay 7 (K11): Function for overrange/underrange
0x12A7	INT	R/W	Relay 8 (K12): Function
0x12A8	INT	R/W	Relay 8 (K12): Function for overrange/underrange

5.25 Setting the clock (only Type 703580/85)

The following steps must be carried out to set the clock:

* Activate the function *Set clock* with 0x0122D = 8
* Set the time and date with 0x2000 — 0x2005
* Perform the function *Set clock* with 0x122C = 1
* De-activate the function *Set clock* with 0x122D = 0

Address	Data type/ bit number	Access	Signal designation
0x122C	INT	R/W	Polling
0x122D	INT	R/W	Fieldbus function
0x122E	INT	R/W	Fieldbus error

Address	Data type/ bit number	Access	Signal designation
0x2000	INT	R/W	Hours (0x0102 = 12 hours)
0x2001	INT	R/W	Minutes (0x304 = 34 minutes)
0x2002	INT	R/W	Seconds (0x509 = 59 seconds)
0x2003	INT	R/W	Day (0x0205 = 25.)
0x2004	INT	R/W	Month (0x0100 = 10.)
0x2005	INT	R/W	Year (0x0906 = 96)
0x2006	INT	R/O	Weekday (0x000—0x600 = Sun—Sat)

5 Address tables

```
Example of program transmission
;------------------------------
;MODBUS parameter addresses
;Function           122D
;ReadyBusy          122C
;Program_number     122F
;Segment_number     1231
;Segment_setpoint   1233
;Operating_contacts 1235
;Tolerance_band MIN 1236
;Tolerance_band MAX 1238
;Segment_time       123A
;------------------------------
;0106122D0007                 ;Function 07: clear program memory
;0106122C0001                 ;ReadyBusy is set
;0103122C0001                 ;ReadyBusy is polled
;#DOWHILE 0103020001
;0103122C0001
;#END
;------------------------------
0106122D0006                  ;Function 06: delete programm
0106122F0008                  ;Program_number 08
0106122C0001                  ;ReadyBusy is set
0103122C0001                  ;ReadyBusy is polled
#DOWHILE 0103020001
0103122C0001
#END
;
;------------------------------
0106122D0002                  ;Function 02: transmit program
0106122F0008                  ;Program_number 08
;
;------------------------------
010612310001                  ;Segment 01
01101233000204000000000       ;Setpoint = 0.0
0110123A0002040E100000        ;Segment_time
0110123E0001020000            ;Parameter_set (Bit7 = gradient programming)
011012350001020000            ;Operating_contacts
                               Bit1 = Operating_contact 1
                               Bit8 = Operating_contact 8
```

```
;Save segment
0106122C0001                    ;ReadyBusy is set
0103122C0001                    ;ReadyBusy is polled
#DOWHILE 0103020001
0103122C0001
#END
;
;------------------------------
010612310002                    ;Segment 02
0110123300020400004270          ;Setpoint = 60.0
0110123A0002040E100000          ;Segment_time = 3600 sec
0110123E0001020000              ;Parameter_set (Bit7 = gradient programming)
011012350001020000              ;Operating_contacts
;Save segment
0106122C0001                    ;ReadyBusy is set
0103122C0001                    ;ReadyBusy is polled
#DOWHILE 0103020001
0103122C0001
#END
;------------------------------
010612310003                    ;Segment 03
01101233000204$60               ;Setpoint
0110123A0002040E100000          ;Segment_time
0110123E0001020000              ;Parameter_set (Bit7 = gradient programming)
011012350001020000              ;Operating_contacts
;Save segment
0106122C0001                    ;ReadyBusy is set
0103122C0001                    ;ReadyBusy is polled
#DOWHILE 0103020001
0103122C0001
#END
;------------------------------
010612310004                    ;Segment 04
01101233000204$0                ;Setpoint
0110123A0002040E100000          ;Segment_time
0110123E0001020000              ;Parameter_set (Bit7 = gradient programming)
011012350001020000              ;Operating_contacts
;Save segment
0106122C0001                    ;ReadyBusy is set
0103122C0001                    ;ReadyBusy is polled
```

```
#DOWHILE 0103020001
0103122C0001
#END
;------------------------------
010612310005                    ;Segment 05
01101233000204000000000         ;Setpoint = 0
0110123A00020400010000          ;Segment_time = 1 sec
0110123E0001020000              ;Parameter_set (Bit7 = gradient programming)
011012350001020000              ;Operating_contacts
;Save segment
0106122C0001                    ;ReadyBusy is set
0103122C0001                    ;ReadyBusy is polled
#DOWHILE 0103020001
; Error_query
0103122C0001
#END
```

6 Sample program

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