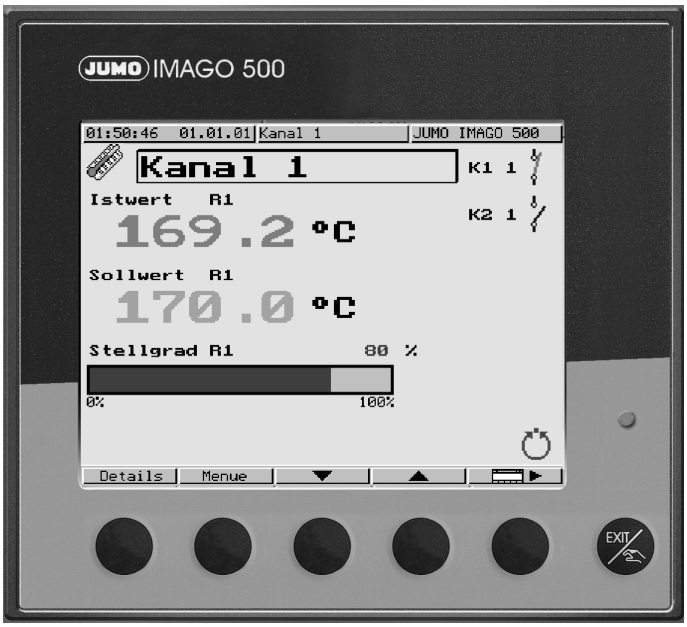

JUMO IMAGO 500

Multi-channel process and program controller

B 70.3590.2

Interface Description

05.02/00403594

Contents

1.1 Preface

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

Please assist us to improve these operating instructions, where necessary.

Your suggestions will be appreciated.

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All the necessary information for operating the interface is contained in these operating instructions. However, if any difficulties should still arise during start-up, please do not carry out any unauthorized manipulations. You could endanger your rights under the instrument warranty!

Please contact the nearest subsidiary or the main factory in such a case.

When returning modules, assemblies or components, the regulations of EN 100 015 “Protection of electrostatically sensitive components” must be observed. Use only the appropriate **ESD** packaging for transport.

Please note that we cannot accept any liability for damage caused by ESD (electrostatic discharge).

1.2 Typographical conventions

1.2.1 Warning signs

The symbols for **Danger** and **Caution** are used in these operating instructions under the following conditions:

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

Caution This symbol is used when there may be **damage to equipment or data** if the instructions are ignored or not followed correctly!

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

1.2.2 Note signs

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

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

abc[1] **Footnote** Footnotes are remarks that refer to specific points in the text. Footnotes consist of two parts:

A marker in the text, and the footnote text.

The markers in the text are arranged as continuous superscript numbers.

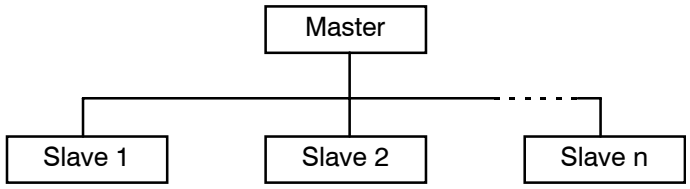
The footnote text (in smaller typeface) is placed at the bottom of the page and starts with a number and a full stop.

1.2.3 Representation

0x0010 **Hexadecimal number** A hexadecimal number is identified by being preceded by an “0x” (here: 16 decimal).

2.1 Master-slave principle

The communication between a PC (master) and a device (slave) using MODbus 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 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 are 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 format options are available:

Data word	**Parity bit**	**Stop bit 1/2 bit**	**Bit number**
8 bit	—	1	9
8 bit	even	1	10
8 bit	odd	1	10
8 bit	—	2	10

2 Protocol description

2.3 Device address

The device address of the slave can be set between 0 and 254. Address 0 is reserved.

A maximum of 31 slaves can be addressed via the RS422/485 interface.

Two forms of data exchange can be distinguished:

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. A specific setpoint can, for example, be transmitted to all slaves. In such a case, the correct acceptance of the values by the slaves should be checked by a subsequent readout of the setpoint.
A data request with device address 0 is not meaningful.

2.4 Timing of the communication

Start and end of a data block are marked by transmission pauses. The maximum permitted interval between two consecutive characters is three times the transmission time of a single character.

The character transmission time (the time taken to transmit one character) depends on the baud rate and the data format that is used (stop bits and parity bit).

For a data format with 8 data bits, no parity bit and one stop bit, this is:

character transmission time [msec] = 1000 * 9 bits/(baud rate)

For the other data formats it is:

character transmission time [msec]
= 1000 * (8 bits+parity bit+stop bit(s)) bits/(baud rate)

Sequence

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 of 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

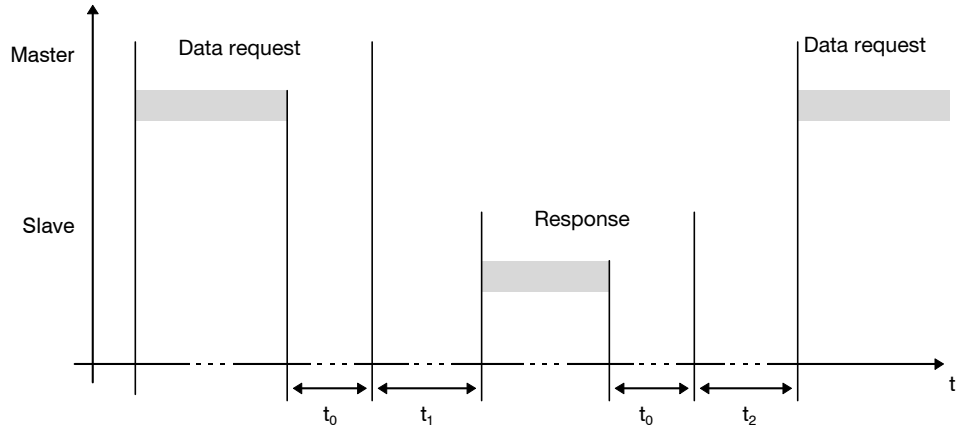
Marker for end of data request or end of response for 10/9 bit data format

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

Baud rate [baud]	**Data format** [bit]	**Waiting time** [msec] (3 characters)
38400	10	0.79
	9	0.71
19200	10	1.57
	9	1.41
9600	10	3.13
	9	2.82

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 in the controller, under the menu item “Interface”. This preset time is the minimum time which will be waited before an answer is transmitted (0 — 500 msec). If a smaller value is set, then the response time may be longer than the preset value (because the internal processing time is longer), the controller answers as soon as the internal processing is completed. A preset time of 0 msec means that the controller answers with the maximum possible speed.

The minimum response time which can be set is required by the RS485 interface in the master, in order to switch over the interface driver from transmit to receive. This parameter is not required for the RS422 interface.

t_2 This time is needed by the controller, to switch over from transmit back to receive. This is the waiting time which the master has to observe before presenting a new data request. This time must always be observed, even when the new data request is directed to a different device.

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

2.4.2 Communication during the internal processing time of the slave

No data requests from the master are permitted during the internal processing time. Any data requests that are made during this period will be ignored by the slave.

2.4.3 Communication during the response time of the slave

No data requests from the master are permitted during the response time of the slave. Any data requests that are made during this period will result in the invalidation of all the data currently on the bus.

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 contains four fields:

Slave address device address of a specific slave

Function code Function selection (read, write words)

Data field contains the information:

- word address
- word number
- word value

Checksum detection of transmission errors

2.6 Error handling

Error codes There are three error codes:

1 invalid function

2 invalid parameter address

8 write access to parameter denied

Response in the event of an error

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

The function code is ORed with 0x80, which means that the MSB (most significant bit) is set to 1.

Example

Data request:

01	03	40	00	00	04	CRC16

Response:

01	83	02	CRC16

Special cases

The slave will not respond in the following error situations:

- the checksum (CRC16) is not correct
- the instruction from 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 evaluation, the corresponding device does not respond.

Calculation scheme

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 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	

2 Protocol description

2.8 Interface

MODbus →

	Value/selection	Description
Protocol	**MODBUS** MODBUS int.	MODbus integer: All values are transmitted in the integer format
Baud rate	**9600** 19200 38400	
Data format	**8-1-none** 8-1-odd 8-1-even 8-2-none	(Data bits)-(stop bits)-(parity)
Device address	0 — **1** — 254	Address in data network
Minimum response time	**0** — 500msec	Minimum time that elapses between the request of a device in the data network and the response of the controller.

Factory settings are shown **bold**.

The following functions are available for the device:

Function number	Function
0x03/0x04	read n words
0x06	write one 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 first word	Word number (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 two setpoints of controller 1

Word address = 0x083C (setpoint W1)

Data request:

07	03	08	3C	00	04	8603

Response:

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

3.2 Write one 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 limit value for limit comparator 1 = 275

Word address = 0x026F

Instruction: Write first part of the value

07	06	02	6F	80	00	D9C9

Response (as instruction):

07	06	02	6F	80	00	D9C9

Instruction: Write second part of the value

07	06	02	70	43	89	7959

Response (as instruction):

07	06	02	70	43	89	7959

3.3 Write n words

Instruction

Slave address	Function 0x10	Address of first word	Word number (max. 127)	Byte number	Word value(s)	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	1 byte	x byte(s)	2 bytes

Response

Slave address	Function 0x10	Address of first word	Word number	Checksum CRC16
1 byte	1 byte	2 bytes	2 bytes	2 bytes

Example

Write reset time Tn1 = 20sec of the first parameter set

Word address = 0x0866

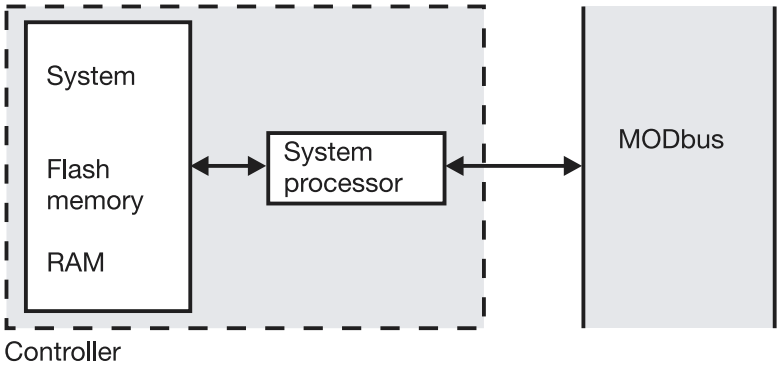
Instruction:

07	10	08	66	00	02	04	00	00	41	A0	3CCD

Response:

07	10	08	66	00	02	A3D1

3 Functions



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

All process values (variables) together with their addresses, data type and access mode are described below.

References are as follows:

R/O read access only

R/W read and write access

char, byte byte (8 bits)

int integer (16 bits)

Bit x bit No. x

long long integer (4 bytes)

float float value (4 bytes) according to IEEE 754

Byte sequence

Because of the platform-dependent representation of floating-point numbers and long values, the bytes must be arranged in the sequence that is appropriate for MODbus.

Please find out in which sequence float values are stored in your system (PC, PLC etc.).

Single-float format (32bit) according to the IEEE 754 standard

SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM

S - sign bit
E - exponent (complement to base 2)
M - 23bit normalized mantissa

MODbus-float format

MODbus address x		MODbus address x+1	
MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM

Example: Transmission of the floating-point number 3000

PC (master):	00	80	3B	45
MODbus:	80	00	45	3B
Byte	1	2	3	4

Long values

Example: Transmission of the number 66051

PC (master):	03	02	01	00
MODbus:	00	01	02	03
Byte	1	2	3	4

5.1 Process data

Address	Data type/ bit number	Access	Signal designation
0x008B	INT	R/O	Generator status
	Bit 0 — 1	R/O	not used
	Bit 2	R/O	Delay 0 = not active / 1 = active
	Bit 3	R/O	Overrange / underrange
	Bit 4	R/O	Program end signal = 1
	Bit 5 — 7	R/O	not used
	Bit 8	R/O	Operating mode “Automatic” = 1
	Bit 9	R/O	Operating mode “Manual”/ “Automatic-Manual” = 1
	Bit 10	R/O	not used
	Bit 11	R/O	Basic status = 1
	Bit 12	R/O	not used
	Bit 13	R/O	Standstill = 1
	Bit 14 — 15	R/O	not used
0x008C	INT	R/O	Controller status
	Bit 0	R/O	C4: Manual mode = 1
	Bit 1	R/O	C4: Self-optimization active = 1
	Bit 2 — 3	R/O	not used
	Bit 4	R/O	C3: Manual mode = 1
	Bit 5	R/O	C3: Self-optimization active = 1
	Bit 6 — 7	R/O	not used
	Bit 8	R/O	C2: Manual mode = 1
	Bit 9	R/O	C2: Self-optimization active = 1
	Bit 10 — 11	R/O	not used
	Bit 12	R/O	C1: Manual mode = 1
	Bit 13	R/O	C1: Self-optimization active = 1
	Bit 14 — 15	R/O	not used
0x008D	INT	R/O	Logic outputs 1 — 12 (switching states 0 = off/1 = on)
	Bit 0	R/O	Logic output 1
	Bit 1	R/O	Logic output 7
	Bit 2	R/O	Logic output 2
	Bit 3	R/O	Logic output 8
	Bit 4	R/O	Logic output 3
	Bit 5	R/O	Logic output 9
	Bit 6	R/O	Logic output 4
	Bit 7	R/O	Logic output 10
	Bit 8	R/O	Logic output 5
	Bit 9	R/O	Logic output 11
	Bit 10	R/O	Logic output 6
	Bit 11	R/O	Logic output 12
	Bit 12 — 15	R/O	not used
0x008E	INT	R/O	Outputs ER8 (switching states 0 = off/1 = on)
	Bit 0	R/O	Output 1
	Bit 1	R/O	Output 2

5 Address tables

Address	Data type/ bit number	Access	Signal designation
	Bit 2	R/O	Output 3
	Bit 3	R/O	Output 4
	Bit 4	R/O	Output 5
	Bit 5	R/O	Output 6
	Bit 6	R/O	Output 7
	Bit 7	R/O	Output 8
	Bit 8 — 15	R/O	not used
0x008F	INT	R/O	Logic inputs 1 — 6 (switching states 0 = open/1 = closed)
	Bit 0	R/O	Logic input 1
	…	…	…
	Bit 5	R/O	Logic input 6
	Bit 6 — 7	R/O	not used
0x0090	INT	R/O	Limit comparator (switching states 0 = off/1 = on)
	Bit 0	R/O	Limit comparator 1
	…	…	…
	Bit 15	R/O	Limit comparator 16
0x0091	INT	R/O	Logic module
	Bit 0	R/O	Logic 1
	…	…	…
	Bit 7	R/O	Logic 8
	Bit 8 — 15	R/O	not used
0x0092	FLOAT	R/O	reserved
0x0094	FLOAT	R/O	reserved
0x0096	FLOAT	R/O	reserved
0x0098	FLOAT	R/O	reserved
0x009A	FLOAT	R/O	reserved
0x009C	FLOAT	R/O	reserved
0x009E	FLOAT	R/O	reserved
0x00A0	FLOAT	R/O	reserved
0x00A2	FLOAT	R/O	reserved
0x00A4	FLOAT	R/O	Sampling time
0x00A6	FLOAT	R/O	Internal Pt100 (in degrees)
0x00A8	FLOAT	R/O	Analog input 1
0x00AA	FLOAT	R/O	Analog input 2
0x00AC	FLOAT	R/O	Analog input 3
0x00AE	FLOAT	R/O	Analog input 4
0x00B0	FLOAT	R/O	Analog input 5
0x00B2	FLOAT	R/O	Analog input 6
0x00B4	FLOAT	R/O	Analog input 7
0x00B6	FLOAT	R/O	Analog input 8
0x00B8	FLOAT	R/O	Math 1
0x00BA	FLOAT	R/O	Math 2
0x00BC	FLOAT	R/O	Math 3
0x00BE	FLOAT	R/O	Math 4

Address	Data type/ bit number	Access	Signal designation
0x00C0	FLOAT	R/O	Math 5
0x00C2	FLOAT	R/O	Math 6
0x00C4	FLOAT	R/O	Math 7
0x00C6	FLOAT	R/O	Math 8
0x00C8	FLOAT	R/O	C1: ramp end value (W)
0x00CA	FLOAT	R/O	C1: filtered process value
0x00CC	FLOAT	R/O	C1: unfiltered process value
0x00CE	FLOAT		C1: setpoint
0x00D0	FLOAT	R/O	C1: output -100 to 100% (displayed value)
0x00D2	FLOAT	R/O	C1: output heating 0 to 100%
0x00D4	FLOAT	R/O	C1: output cooling -100 to 0%
0x00D6	FLOAT	R/O	C1: control difference
0x00D8	FLOAT	R/O	C1: control deviation
0x00DA	INT	R/O	C1: switching status heating (1 = contact closed/ON)
0x00DB	INT	R/O	C1: switching status cooling (1 = contact closed/ON)
0x00DC	FLOAT	R/O	C2: ramp end value (W)
0x00DE	FLOAT	R/O	C2: filtered process value
0x00E0	FLOAT	R/O	C2: unfiltered process value
0x00E2	FLOAT		C2: setpoint
0x00E4	FLOAT	R/O	C2: output -100 to 100% (displayed value)
0x00E6	FLOAT	R/O	C2: output heating 0 to 100%
0x00E8	FLOAT	R/O	C2: output cooling -100 to 0%
0x00EA	FLOAT	R/O	C2: control difference
0x00EC	FLOAT	R/O	C2: control deviation
0x00EE	INT	R/O	C2: switching status heating (1 = contact closed/ON)
0x00EF	INT	R/O	C2: switching status cooling (1 = contact closed/ON)
0x00F0	FLOAT	R/O	C3: ramp end value (W)
0x00F2	FLOAT	R/O	C3: filtered process value
0x00F4	FLOAT	R/O	C3: unfiltered process value
0x00F6	FLOAT		C3: setpoint
0x00F8	FLOAT	R/O	C3: output -100 to 100% (displayed value)
0x00FA	FLOAT	R/O	C3: output heating 0 to 100%
0x00FC	FLOAT	R/O	C3: output cooling -100 to 0%
0x00FE	FLOAT	R/O	C3: control difference
0x0100	FLOAT	R/O	C3: control deviation
0x0102	INT	R/O	C3: switching status heating (1 = contact closed/ON)
0x0103	INT	R/O	C3: switching status cooling (1 = contact closed/ON)
0x0104	FLOAT	R/O	C4: ramp end value (W)
0x0106	FLOAT	R/O	C4: filtered process value
0x0108	FLOAT	R/O	C4: unfiltered process value
0x010A	FLOAT		C4: setpoint
0x010C	FLOAT	R/O	C4: output -100 to 100% (displayed value)
0x010E	FLOAT	R/O	C4: output heating 0 to 100%
0x0110	FLOAT	R/O	C4: output cooling -100 to 0%

5 Address tables

Address	Data type/ bit number	Access	Signal designation
0x0112	FLOAT	R/O	C4: control difference
0x0114	FLOAT	R/O	C4: control deviation
0x0116	INT	R/O	C4: switching status heating (1 = contact closed/ON)
0x0117	INT	R/O	C4: switching status cooling (1 = contact closed/ON)
0x0118	INT	R/O	C1: parameter set number (1 — 2)
0x0119	INT	R/O	C2: parameter set number (1 — 2)
0x011A	INT	R/O	C3: parameter set number (1 — 2)
0x011B	INT	R/O	C4: parameter set number (1 — 2)
0x011C	INT	R/O	Program number (1 — 99)
0x011D	INT	R/O	PCh1: segment number (1 — 99)
0x011E	INT	R/O	PCh2: segment number (1 — 99)
0x011F	INT	R/O	PCh3: segment number (1 — 99)
0x0120	INT	R/O	PCh4: segment number (1 — 99)
0x0121	INT	R/O	PCh1: last segment
0x0122	INT	R/O	PCh2: last segment
0x0123	INT	R/O	PCh3: last segment
0x0124	INT	R/O	PCh4: last segment
0x0125	INT	R/O	Tolerance band signal
0x0126	INT	R/O	Number of free segments
0x0127	FLOAT	R/O	PCh1: generator setpoint according to operating mode
0x0129	FLOAT	R/O	PCh2: generator setpoint according to operating mode
0x012B	FLOAT	R/O	PCh3: generator setpoint according to operating mode
0x012D	FLOAT	R/O	PCh4: generator setpoint according to operating mode
0x012F	INT	R/O	Control contacts
0x0130	INT	R/O	PCh1: parameter set number (1 — 2)
0x0131	INT	R/O	PCh2: parameter set number (1 — 2)
0x0132	INT	R/O	PCh3: parameter set number (1 — 2)
0x0133	INT	R/O	PCh4: parameter set number (1 — 2)
0x0134	INT	R/O	reserved
0x0135	INT	R/O	reserved
0x0136	LONG	R/O	Program run time (in seconds)
0x0138	LONG	R/O	Remaining program run time (in seconds)
0x013A	LONG	R/O	PCh1: program time (in seconds)
0x013C	LONG	R/O	PCh2: program time (in seconds)
0x013E	LONG	R/O	PCh3: program time (in seconds)
0x0140	LONG	R/O	PCh4: program time (in seconds)
0x0142	LONG	R/O	PCh1: segment run time (in seconds)
0x0144	LONG	R/O	PCh1: remaining segment run time (in seconds)
0x0146	LONG	R/O	PCh1: segment time (in seconds)
0x0148	LONG	R/O	PCh2: segment run time (in seconds)
0x014A	LONG	R/O	PCh2: remaining segment run time (in seconds)
0x014C	LONG	R/O	PCh2: segment time (in seconds)
0x014E	LONG	R/O	PCh3: segment run time (in seconds)
0x0150	LONG	R/O	PCh3: remaining segment run time (in seconds)

Address	Data type/ bit number	Access	Signal designation
0x0152	LONG	R/O	PCh3: segment time (in seconds)
0x0154	LONG	R/O	PCh4: segment run time (in seconds)
0x0156	LONG	R/O	PCh4: remaining segment run time (in seconds)
0x0158	LONG	R/O	PCh4: segment time (in seconds)

5.2 Setpoints

Address	Data type/ bit number	Access	Signal designation
0x083C	FLOAT	R/W	C1: setpoint W1
0x083E	FLOAT	R/W	C1: setpoint W2
0x0840	FLOAT	R/W	C1: setpoint W3
0x0842	FLOAT	R/W	C1: setpoint W4
0x0844	FLOAT	R/W	C2: setpoint W1
0x0846	FLOAT	R/W	C2: setpoint W2
0x0848	FLOAT	R/W	C2: setpoint W3
0x084A	FLOAT	R/W	C2: setpoint W4
0x084C	FLOAT	R/W	C3: setpoint W1
0x084E	FLOAT	R/W	C3: setpoint W2
0x0850	FLOAT	R/W	C3: setpoint W3
0x0852	FLOAT	R/W	C3: setpoint W4
0x0854	FLOAT	R/W	C4: setpoint W1
0x0856	FLOAT	R/W	C4: setpoint W2
0x0858	FLOAT	R/W	C4: setpoint W3
0x085A	FLOAT	R/W	C4: setpoint W4

The setpoint limits will not be checked when setpoints are altered via the interface.

5.3 Manual output

Address	Data type/ bit number	Access	Signal designation
0x016A	FLOAT	R/W	C1: manual output
0x016C	FLOAT	R/W	C2: manual output
0x016E	FLOAT	R/W	C3: manual output
0x0170	FLOAT	R/W	C4: manual output

5 Address tables

5.4 Controller parameter

Address	Data type/ bit number	Access	Signal designation
0x085C	INT	R/W	C1: parameter set 1: controller structure 1
0x085D	INT	R/W	C1: parameter set 1: controller structure 2
0x085E	FLOAT	R/W	C1: parameter set 1: XP1
0x0860	FLOAT	R/W	C1: parameter set 1: XP2
0x0862	FLOAT	R/W	C1: parameter set 1: TV1
0x0864	FLOAT	R/W	C1: parameter set 1: TV2
0x0866	FLOAT	R/W	C1: parameter set 1: TN1
0x0868	FLOAT	R/W	C1: parameter set 1: TN2
0x086A	FLOAT	R/W	C1: parameter set 1: CY1
0x086C	FLOAT	R/W	C1: parameter set 1: CY2
0x086E	FLOAT	R/W	C1: parameter set 1: XSH
0x0870	FLOAT	R/W	C1: parameter set 1: XD1
0x0872	FLOAT	R/W	C1: parameter set 1: XD2
0x0874	FLOAT	R/W	C1: parameter set 1: TT
0x0876	FLOAT	R/W	C1: parameter set 1: Y0
0x0878	FLOAT	R/W	C1: parameter set 1: Y1
0x087A	FLOAT	R/W	C1: parameter set 1: Y2
0x087C	FLOAT	R/W	C1: parameter set 1: TK1
0x087E	FLOAT	R/W	C1: parameter set 1: TK2
0x0880	INT	R/W	C1: parameter set 2: controller structure 1
0x0881	INT	R/W	C1: parameter set 2: controller structure 2
0x0882	FLOAT	R/W	C1: parameter set 2: XP1
0x0884	FLOAT	R/W	C1: parameter set 2: XP2
0x0886	FLOAT	R/W	C1: parameter set 2: TV1
0x0888	FLOAT	R/W	C1: parameter set 2: TV2
0x088A	FLOAT	R/W	C1: parameter set 2: TN1
0x088C	FLOAT	R/W	C1: parameter set 2: TN2
0x088E	FLOAT	R/W	C1: parameter set 2: CY1
0x0890	FLOAT	R/W	C1: parameter set 2: CY2
0x0892	FLOAT	R/W	C1: parameter set 2: XSH
0x0894	FLOAT	R/W	C1: parameter set 2: XD1
0x0896	FLOAT	R/W	C1: parameter set 2: XD2
0x0898	FLOAT	R/W	C1: parameter set 2: TT
0x089A	FLOAT	R/W	C1: parameter set 2: Y0
0x089C	FLOAT	R/W	C1: parameter set 2: Y1
0x089E	FLOAT	R/W	C1: parameter set 2: Y2
0x08A0	FLOAT	R/W	C1: parameter set 2: TK1
0x08A2	FLOAT	R/W	C1: parameter set 2: TK2
0x08A4	INT	R/W	C2: parameter set 1: controller structure 1
0x08A5	INT	R/W	C2: parameter set 1: controller structure 2
0x08A6	FLOAT	R/W	C2: parameter set 1: XP1
0x08A8	FLOAT	R/W	C2: parameter set 1: XP2
0x08AA	FLOAT	R/W	C2: parameter set 1: TV1

Address	Data type/ bit number	Access	Signal designation
0x08AC	FLOAT	R/W	C2: parameter set 1: TV2
0x08AE	FLOAT	R/W	C2: parameter set 1: TN1
0x08B0	FLOAT	R/W	C2: parameter set 1: TN2
0x08B2	FLOAT	R/W	C2: parameter set 1: CY1
0x08B4	FLOAT	R/W	C2: parameter set 1: CY2
0x08B6	FLOAT	R/W	C2: parameter set 1: XSH
0x08B8	FLOAT	R/W	C2: parameter set 1: XD1
0x08BA	FLOAT	R/W	C2: parameter set 1: XD2
0x08BC	FLOAT	R/W	C2: parameter set 1: TT
0x08BE	FLOAT	R/W	C2: parameter set 1: Y0
0x08C0	FLOAT	R/W	C2: parameter set 1: Y1
0x08C2	FLOAT	R/W	C2: parameter set 1: Y2
0x08C4	FLOAT	R/W	C2: parameter set 1: TK1
0x08C6	FLOAT	R/W	C2: parameter set 1: TK2
0x08C8	INT	R/W	C2: parameter set 2: controller structure 1
0x08C9	INT	R/W	C2: parameter set 2: controller structure 2
0x08CA	FLOAT	R/W	C2: parameter set 2: XP1
0x08CC	FLOAT	R/W	C2: parameter set 2: XP2
0x08CE	FLOAT	R/W	C2: parameter set 2: TV1
0x08D0	FLOAT	R/W	C2: parameter set 2: TV2
0x08D2	FLOAT	R/W	C2: parameter set 2: TN1
0x08D4	FLOAT	R/W	C2: parameter set 2: TN2
0x08D6	FLOAT	R/W	C2: parameter set 2: CY1
0x08D8	FLOAT	R/W	C2: parameter set 2: CY2
0x08DA	FLOAT	R/W	C2: parameter set 2: XSH
0x08DC	FLOAT	R/W	C2: parameter set 2: XD1
0x08DE	FLOAT	R/W	C2: parameter set 2: XD2
0x08E0	FLOAT	R/W	C2: parameter set 2: TT
0x08E2	FLOAT	R/W	C2: parameter set 2: Y0
0x08E4	FLOAT	R/W	C2: parameter set 2: Y1
0x08E6	FLOAT	R/W	C2: parameter set 2: Y2
0x08E8	FLOAT	R/W	C2: parameter set 2: TK1
0x08EA	FLOAT	R/W	C2: parameter set 2: TK2
0x08EC	INT	R/W	C3: parameter set 1: controller structure 1
0x08ED	INT	R/W	C3: parameter set 1: controller structure 2
0x08EE	FLOAT	R/W	C3: parameter set 1: XP1
0x08F0	FLOAT	R/W	C3: parameter set 1: XP2
0x08F2	FLOAT	R/W	C3: parameter set 1: TV1
0x08F4	FLOAT	R/W	C3: parameter set 1: TV2
0x08F6	FLOAT	R/W	C3: parameter set 1: TN1
0x08F8	FLOAT	R/W	C3: parameter set 1: TN2
0x08FA	FLOAT	R/W	C3: parameter set 1: CY1
0x08FC	FLOAT	R/W	C3: parameter set 1: CY2
0x08FE	FLOAT	R/W	C3: parameter set 1: XSH

5 Address tables

Address	Data type/ bit number	Access	Signal designation
0x0900	FLOAT	R/W	C3: parameter set 1: XD1
0x0902	FLOAT	R/W	C3: parameter set 1: XD2
0x0904	FLOAT	R/W	C3: parameter set 1: TT
0x0906	FLOAT	R/W	C3: parameter set 1: Y0
0x0908	FLOAT	R/W	C3: parameter set 1: Y1
0x090A	FLOAT	R/W	C3: parameter set 1: Y2
0x090C	FLOAT	R/W	C3: parameter set 1: TK1
0x090E	FLOAT	R/W	C3: parameter set 1: TK2
0x0910	INT	R/W	C3: parameter set 2: controller structure 1
0x0911	INT	R/W	C3: parameter set 2: controller structure 2
0x0912	FLOAT	R/W	C3: parameter set 2: XP1
0x0914	FLOAT	R/W	C3: parameter set 2: XP2
0x0916	FLOAT	R/W	C3: parameter set 2: TV1
0x0918	FLOAT	R/W	C3: parameter set 2: TV2
0x091A	FLOAT	R/W	C3: parameter set 2: TN1
0x091C	FLOAT	R/W	C3: parameter set 2: TN2
0x091E	FLOAT	R/W	C3: parameter set 2: CY1
0x0920	FLOAT	R/W	C3: parameter set 2: CY2
0x0922	FLOAT	R/W	C3: parameter set 2: XSH
0x0924	FLOAT	R/W	C3: parameter set 2: XD1
0x0926	FLOAT	R/W	C3: parameter set 2: XD2
0x0928	FLOAT	R/W	C3: parameter set 2: TT
0x092A	FLOAT	R/W	C3: parameter set 2: Y0
0x092C	FLOAT	R/W	C3: parameter set 2: Y1
0x092E	FLOAT	R/W	C3: parameter set 2: Y2
0x0930	FLOAT	R/W	C3: parameter set 2: TK1
0x0932	FLOAT	R/W	C3: parameter set 2: TK2
0x0934	INT	R/W	C4: parameter set 1: controller structure 1
0x0935	INT	R/W	C4: parameter set 1: controller structure 2
0x0936	FLOAT	R/W	C4: parameter set 1: XP1
0x0938	FLOAT	R/W	C4: parameter set 1: XP2
0x093A	FLOAT	R/W	C4: parameter set 1: TV1
0x093C	FLOAT	R/W	C4: parameter set 1: TV2
0x093E	FLOAT	R/W	C4: parameter set 1: TN1
0x0940	FLOAT	R/W	C4: parameter set 1: TN2
0x0942	FLOAT	R/W	C4: parameter set 1: CY1
0x0944	FLOAT	R/W	C4: parameter set 1: CY2
0x0946	FLOAT	R/W	C4: parameter set 1: XSH
0x0948	FLOAT	R/W	C4: parameter set 1: XD1
0x094A	FLOAT	R/W	C4: parameter set 1: XD2
0x094C	FLOAT	R/W	C4: parameter set 1: TT
0x094E	FLOAT	R/W	C4: parameter set 1: Y0
0x0950	FLOAT	R/W	C4: parameter set 1: Y1
0x0952	FLOAT	R/W	C4: parameter set 1: Y2

Address	Data type/ bit number	Access	Signal designation
0x0954	FLOAT	R/W	C4: parameter set 1: TK1
0x0956	FLOAT	R/W	C4: parameter set 1: TK2
0x0958	INT	R/W	C4: parameter set 2: controller structure 1
0x0959	INT	R/W	C4: parameter set 2: controller structure 2
0x095A	FLOAT	R/W	C4: parameter set 2: XP1
0x095C	FLOAT	R/W	C4: parameter set 2: XP2
0x095E	FLOAT	R/W	C4: parameter set 2: TV1
0x0960	FLOAT	R/W	C4: parameter set 2: TV2
0x0962	FLOAT	R/W	C4: parameter set 2: TN1
0x0964	FLOAT	R/W	C4: parameter set 2: TN2
0x0966	FLOAT	R/W	C4: parameter set 2: CY1
0x0968	FLOAT	R/W	C4: parameter set 2: CY2
0x096A	FLOAT	R/W	C4: parameter set 2: XSH
0x096C	FLOAT	R/W	C4: parameter set 2: XD1
0x096E	FLOAT	R/W	C4: parameter set 2: XD2
0x0970	FLOAT	R/W	C4: parameter set 2: TT
0x0972	FLOAT	R/W	C4: parameter set 2: Y0
0x0974	FLOAT	R/W	C4: parameter set 2: Y1
0x0976	FLOAT	R/W	C4: parameter set 2: Y2
0x0978	FLOAT	R/W	C4: parameter set 2: TK1
0x097A	FLOAT	R/W	C4: parameter set 2: TK2

5.5 Program start with start data

Address	Data type/ bit number	Access	Signal designation
0x01B4	INT	R/W	Program buffer (setting bit 8=1 will start the program)
0x01B5	INT	R/W	Program number
0x01B6	LONG	R/W	Delay time in seconds
0x01B8	INT	R/W	Date (year)
0x01B9	INT	R/W	Date (month)
0x01BA	INT	R/W	Date (day)
0x01BB	INT	R/W	Start time (seconds) (-1=0xFFFF instant start)
0x01BC	INT	R/W	Start time (minutes)
0x01BD	INT	R/W	Start time (hours)
0x01BE	INT	R/W	Start segment (1 — 99 or 0=program start)
0x01BF	LONG	R/W	Remaining start segment run-time in seconds

5 Address tables

5.6 Manual operating mode with manual data

Address	Data type/ bit number	Access	Signal designation
0x01C1	INT	R/W	Program buffer (setting bit 9=1 will switch over to the “Manual” mode)
0x01C2	FLOAT	R/W	PCh1: setpoint
0x01C4	FLOAT	R/W	PCh2: setpoint
0x01C6	FLOAT	R/W	PCh3: setpoint
0x01C8	FLOAT	R/W	PCh4: setpoint
0x01CA	INT	R/W	Control contacts (1=ON)
	Bit 0	R/W	Control contact 1
	…	…	…
	Bit 7	R/W	Control contact 8
	Bit 8 — 15	R/W	not used
0x01CB	INT	R/W	PCh1: parameter set (0=parameter set 1)
0x01CC	INT	R/W	PCh2: parameter set (0=parameter set 1)
0x01CD	INT	R/W	PCh3: parameter set (0=parameter set 1)
0x01CE	INT	R/W	PCh4: parameter set (0=parameter set 1)
0x01CF	INT	R/W	Control function, controller (1=active)
	Bit 0	R/W	Controller 1
	Bit 1	R/W	Controller 2
	Bit 2	R/W	Controller 3
	Bit 3	R/W	Controller 4
	Bit 4 — 15	R/W	not used
0x01D0	INT	R/W	Control function, limit comparators (1=active)
	Bit 0	R/W	Limit comparator 1
	…	…	…
	Bit 15	R/W	Limit comparator 16

5.7 Program transmission

Address	Data type/ bit number	Access	Signal designation
0x01D1	INT	R/W	Activation of function
0x01D2	INT	R/W	Function (2=transmit segment)
0x01D3	INT	R/O	Error feedback
0x01D4	INT	R/W	Program number
0x01D5	INT	R/W	Program channel number
0x01D6	INT	R/W	Segment number (1 — 100)
0x01D7	INT	R/O	Max. number of segments
0x01D8	FLOAT	R/W	Segment setpoint
0x01DA	FLOAT	R/W	Segment setpoint, trace 2
0x01DC	INT	R/W	Control contacts (1=ON)
	Bit 0	R/W	Control contact 1
	…	…	…
	Bit 7	R/W	Control contact 8

Address	Data type/ bit number	Access	Signal designation
	Bit 8 — 15	R/W	not used
0x01DD	FLOAT	R/W	Minimum limit of tolerance band
0x01DF	FLOAT	R/W	Maximum limit of tolerance band
0x01E1	LONG	R/W	Segment time
0x01E3	INT	R/W	Repeat cycles (0=no repeat; -1=endless repeat)
0x01E4	INT	R/W	Target segment (only for repeat cycles ≠ 0)
0x01E5	INT	R/W	Parameter set number (0=parameter set 1)

⇨ Chapter 6 “Program example”

5.8 Commands

Address	Data type/ bit number	Access	Signal designation
0x0172	INT	R/W	Command value “program controller”
	Bit 0	R/W	Fast forward
	Bit 1	R/W	Temporary alteration
	Bit 2	R/W	Segment change
	Bit 3 — 4	R/W	not used
	Bit 5	R/W	Acknowledgement of limit comparators
	Bit 6 — 7	R/W	not used
	Bit 8	R/W	Automatic mode
	Bit 9	R/W	Manual mode
	Bit 10	R/W	not used
	Bit 11	R/W	Program/ramp canceled
	Bit 12	R/W	Program start of the last program activated
	Bit 13	R/W	Program/ramp pause
	Bit 14 — 15	R/W	not used
0x0173	INT	R/W	Command value “controller 1”
	Bit 0 — 5	R/W	not used
	Bit 6	R/W	C1: activate inhibit for manual mode
	Bit 7	R/W	C1: start self-optimization
	Bit 8	R/W	C1: automatic mode
	Bit 9	R/W	C1: manual mode
	Bit 10	R/W	C1: cancel self-optimization
	Bit 11 — 15	R/W	not used
0x0174	INT	R/W	Command value “controller 2”
	Bit 0 — 5	R/W	not used
	Bit 6	R/W	C2: activate inhibit for manual mode
	Bit 7	R/W	C2: start self-optimization
	Bit 8	R/W	C2: automatic mode
	Bit 9	R/W	C2: manual mode
	Bit 10	R/W	C2: cancel self-optimization
	Bit 11 — 15	R/W	not used
0x0175	INT	R/W	Command value “controller 3”

5 Address tables

Address	Data type/ bit number	Access	Signal designation
	Bit 0 — 5	R/W	not used
	Bit 6	R/W	C3: activate inhibit for manual mode
	Bit 7	R/W	C3: start self-optimization
	Bit 8	R/W	C3: automatic mode
	Bit 9	R/W	C3: manual mode
	Bit 10	R/W	C3: cancel self-optimization
	Bit 11 — 15	R/W	not used
0x0176	INT	R/W	Command value “controller 4”
	Bit 0 — 5	R/W	not used
	Bit 6	R/W	C4: activate inhibit for manual mode
	Bit 7	R/W	C4: start self-optimization
	Bit 8	R/W	C4: automatic mode
	Bit 9	R/W	C4: manual mode
	Bit 10	R/W	C4: cancel self-optimization
	Bit 11 — 15	R/W	not used
0x0177	INT	R/W	Command value “operation”
	Bit 1 — 9	R/W	not used
	Bit 10	R/W	Display switching (edge-triggered)
	Bit 11	R/W	Inhibit program start
	Bit 12	R/W	Display off
	Bit 13	R/W	Inhibit program editor
	Bit 14	R/W	Inhibit configuration level
	Bit 15	R/W	Key inhibit
0x0178	LONG	R/W	reserved
0x017A	INT	R/W	C1: setpoint changeover 0=switched off 1 — 4=W1 — W4
0x017B	INT	R/W	C1: parameter set switching 0=switched off 1=P1 2=P2
0x017C	INT	R/W	C1: process value changeover 0=switched off 2 — 4=analog input 2 — 4
0x017D	INT	R/W	C2: setpoint changeover 0=switched off 1 — 4=W1 — W4
0x017E	INT	R/W	C2: parameter set switching 0=switched off 1=P1 2=P2
0x017F	INT	R/W	C2: process value changeover 0=switched off 2 — 4=analog input 2 — 4
0x0180	INT	R/W	C3: setpoint changeover 0=switched off 1 — 4=W1 — W4

Address	Data type/ bit number	Access	Signal designation
0x0181	INT	R/W	C3: parameter set switching 0=switched off 1=P1 2=P2
0x0182	INT	R/W	C3: process value changeover 0=switched off 2 — 4=analog input 2 — 4
0x0183	INT	R/W	C4: setpoint changeover 0=switched off 1 — 4=W1 — W4
0x0184	INT	R/W	C4: parameter set switching 0=switched off 1=P1 2=P2
0x0185	INT	R/W	C4: process value changeover 0=switched off 2 — 4=analog input 2 — 4
0x0186	INT	R/W	Program selection -1=off 1 — 16=program 1 — 16
...			
0x01B3	INT	R/W	Relay output
	Bit 0	R/W	Output 1
	Bit 1	R/W	Output 7
	Bit 2	R/W	Output 2
	Bit 3	R/W	Output 8
	Bit 4	R/W	Output 3
	Bit 5	R/W	Output 9
	Bit 6	R/W	Output 4
	Bit 7	R/W	Output 10
	Bit 8	R/W	Output 5
	Bit 9	R/W	Output 11
	Bit 10	R/W	Output 6
	Bit 11	R/W	Output 12
	Bit 12 — 14	R/W	not used
	Bit 15	R/W	Activation

5.9 Frequent setpoint programming

In order to avoid damaging the EEPROM (max. 10,000 write cycles), the following addresses should be used for frequent setpoint programming.

Since the data (setpoints) are stored in a volatile memory (RAM), they will be lost after a supply failure.

The setpoint limits will not be checked when setpoints are altered via the interface.

5 Address tables

Address	Data type/ bit number	Access	Signal designation
0x015A	FLOAT	R/W	C1: setpoint in the RAM
0x015E	FLOAT	R/W	C2: setpoint in the RAM
0x0162	FLOAT	R/W	C3: setpoint in the RAM
0x0166	FLOAT	R/W	C4: setpoint in the RAM

5.10 Process value via interface

Address	Data type/ bit number	Access	Signal designation
0x015C	FLOAT	R/W	C1: process value in the RAM
0x0160	FLOAT	R/W	C2: process value in the RAM
0x0164	FLOAT	R/W	C3: process value in the RAM
0x0168	FLOAT	R/W	C4: process value in the RAM

5.11 Device identification

Address	Data type/ bit number	Access	Signal designation
0x019F	INT	R/O	Output board, output 1
0x01A0	INT	R/O	Output board, output 2
0x01A1	INT	R/O	Output board, output 3
0x01A2	INT	R/O	Output board, output 4
0x01A3	INT	R/O	Output board, output 5
0x01A4	INT	R/O	Output board, output 6
0x01A5	INT	R/O	Analog input 1
0x01A6	INT	R/O	Analog input 2
0x01A7	INT	R/O	Analog input 3
0x01A8	INT	R/O	Analog input 4
0x01A9	INT	R/O	Setup
0x01AA	INT	R/O	Interface
0x01AB	INT	R/O	Profibus-DP
0x01AC	INT	R/O	ER8
0x01AD	INT	R/O	Data buffering

5.12 Setting the clock

Address	Data type/ bit number	Access	Signal designation
0x007E	INT	R/W	Year (without century, e.g. 0x0002=2002)
0x007F	INT	R/W	Month (1 — 12)
0x0080	INT	R/W	Day (1 — 31)
0x0081	INT	R/W	Hours (0 — 24)
0x0082	INT	R/W	Minutes (0 — 59)
0x0083	INT	R/W	Seconds (0 — 59)
0x0084	INT	R/W	Set clock command (1=set clock)

5 Address tables

```
Example for program transmission
;----------------------------------
;MODbus parameter addresses
;
;Function activation  0x01D1
;Function             0x01D2
;Program number       0x01D4
;Program channel      0x01D5
;Segment number       0x01D6
;Segment setpoint     0x01D8
;Segment setpoint     0x01DA (trace2)
;Control contacts     0x01DC
;Tolerance band MIN   0x01DD
;Tolerance band MAX   0x01DF
;Segment time         0x01E1
;Parameter set        0x01E5

;------------------------------
;010601D20007                  ;Function 07: Delete program memory
;010601D10001                  ;Function activation is set
;010301D10001                  ;Function activation is polled
;#DOWHILE FF03020001
;010301D10001
;#END

;------------------------------
;010601D20001                  ;Function 01: Read program segment
;010601D40008                  ;Program number   08
;010601D50001                  ;Program channel  02
;010601D60001                  ;Segment          01
;010601D10001                  ;Function activation is set
;010301D10001                  ;Function activation is polled
;#DOWHILE FF03020001
;010301D10001
;#END
;010301D7000C                  ;Read out segment data
;
;------------------------------

;010601D2000A                   ;Function 10: Delete program channel
;010601D40008                   ;Program number 08
;010601D10001                   ;Function activation is set
;010301D10001                   ;Function activation is polled
;#DOWHILE FF03020001
;010301D10001
;#END
;

;------------------------------
;010601D20006                   ;Function 06: Delete program
;010601D40008                   ;Program number 08
;010601D10001                   ;Function activation is set
;010301D10001                   ;Function activation is polled
;#DOWHILE FF03020001
;010301D10001
;#END
```

```
;

;------------------------------
;010601D20002                   ;Function 02: Transmit segment
;010601D40008                   ;Program number  08
;010601D50000                   ;Program channel 01
;
;------------------------------
;010601D60001                   ;Segment 01
;011001D8000204$0               ;Setpoint
;011001E10002040E100000         ;Segment time
;011001E50001020000             ;Parameter set
;011001DC0001020000             ;Control contacts

;Store segment
;010601D10001                   ;Function activation is set
;010301D10001                   ;Function activation is polled
;#DOWHILE FF03020001
;010301D10001
;#END
;
;------------------------------
;010601D60002                   ;Segment 02
;011001D8000204$60              ;Setpoint
;011001E10002040E100000         ;Segment time
;011001E50001020000             ;Parameter set
;011001DC0001020000             ;Control contacts

;Store segment
;010601D10001                   ;Function activation is set
;010301D10001                   ;Function activation is polled
;#DOWHILE FF03020001
;010301D10001
;#END
;------------------------------
;010601D60003                   ;Segment 03
;011001D8000204$60              ;Setpoint
;011001E10002040E100000         ;Segment time
;011001E50001020000             ;Parameter set
;011001DC0001020000             ;Control contacts

;Store segment
;010601D10001                   ;Function activation is set
;010301D10001                   ;Function activation is polled
;#DOWHILE FF03020001
;010301D10001
;#END

;------------------------------
;Error polling
;010301D30001
```

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