Modbus Description

1. General

1.1 Format:

Serial connections: MODBUS RTU.
Ethernet connection: MODBUS TCP

1.2 Used MODBUS services:

0x03 Read Holding Registers (maximum 125 words).
0x06 Write Single Register. (stored in non volatile memory)
0x08 Diagnosis: Only Sub-Function Code 0x0000 (Loopback) available.
0x10 Write Multiple Registers (maximum 123 words). (stored in non volatile memory)
0x17 Read/Write Multiple Registers. (stored in non-volatile memory)

WARINING! The non-volatile memory allows only approx. 1.000.000 write cycles!
In systems with frequently changed setpoints (e.g. ramps) Control Sequence 1 must be used!

1.3 Response times (Response Time-Out)

The response time depends on the number of transferred words.
E.g. 16-zones controller: typical 5-40ms. When changing the configuration parameters: up to 400ms.

1.4 Transmission format of the numerical values

It is transferred a pure numerical value as an integer16 number.

Decimal points used in this document, are specified as follows:

Indication	Dec.point
<empty>	no dec. point, value is correct.
1	one dec. point (eg transmitted value: 1234 > interpretation: 123.4)
2	two dec. points (eg transmitted value: 1234 > interpretation: 12.34)
Var	Dec. point is dependent of the selected measuring range. The decimal point is acc. the adjustment of the parameter "decimal point".
Var + 1	Dec. point is dependent on the selected measuring range. The actual decimal point of this zone can be read from the address 0x1DLL "decimal point". It must be increased by 1. (Example: Var (parameter "decimal point") = 1 add 1 transmitted value: 1234 > Interpretation: 12.34)

1.5 Dependency of this documentation from the controller type

In dependency of the controller type not all parameters or control-bits are available.
See operation manual of the controller.

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1.6 Description of the bits in the status / control word:

Bit	Device status / alarm status (read only)		Control word (write only)
0	Zone on/off 0 = on, 1 = off		Zone on/off 0 = on, 1 = off
1	Selftuning action: 0 = OFF 1 = ON		Selftuning action: 0 = OFF 1 = ON Changing this bit from 0 to 1 causes a one-time selftuning action. To start a new selftuning action this bit must be set one time to “0”
2	0 = Remote operation 1 = Manual operation		0
3	Actual Setpoint: 0 = setpoint 1 1 = setpoint 2		Temperature setpoint selection: 0 = setpoint 1 1 = setpoint 2
4	1 = Error: Self tuning		1 = clear the message "Tuning error"
5	1 = Setpoint ramp active		0
6	1 = Sensor error		0
7	1 = System error		1 = clear the message "System Error"
8	1 = Alarm 1 has triggered		1 = clear self retaining of alarm 1 (if active)
9	1 = Alarm 2 has triggered		1 = clear self retaining of alarm 2 (if active)
10	0		0
11	0		0
12	0		0
13	Restart lock-out active		1 = clear Restart lock-out
14	Heater current alarm		0
15	Heater current detection: Short circuit		0

2 0x00 -> 0xBF Direct access to individual parameters for all zones

Depending on the controller type and the current configuration some parameters are not accessible.

Access rules: R = Read only
W = Write only
RW = Read and write

Parameter	Access	Decimal-point	Address															
			High byte	Low byte (LL)														
Zone:				**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Temperature: Process value	R	Var	0x10LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heater current: Process value	R	1	0x11LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Temperature: Monitoring value	R	1	0x14LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Temperature: Offset value	RW	Var	0x18LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Temperature: Filter time	RW		0x19LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Sensor configuration: selection	RW		0x1ALL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Sensor type monitoring selection	RW		0x1BLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Dec. point (linear)	R		0x1DLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Measuring range: lower value (linear)	R	Var	0x1ELL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Measuring range: higher value (linear)	R	Var	0x1FLL	00	01	2	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Actual Setpoint	R	Var	0x20LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Setpoint 1	RW	Var	0x21LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F

Parameter	Access	Decimal-point	Address																
			High byte	Low byte (LL)															
Setpoint 2	RW	Var	0x22LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Setpoint 3	RW	Var	0x23LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Lower setpoint limit	RW	Var	0x2BLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Higher reference limit	RW	Var	0x2CLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Setpoint ramp function: falling	RW	Var+1	0x2DLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Setpoint ramp function: rising	RW	Var+1	0x2FLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Alarm 1 Alarm value under temperature	RW	Var o. 0	0x36LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Alarm 2 Alarmvalue under temperature	RW	Var o. 0	0x37LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Alarm 1: Alarm value (over temperature)	RW	Var o. 0	0x38LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Alarm 2: Alarm value (over temperature	RW	Var o. 0	0x39LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heater current alarm value	RW	1	0x3ALL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heating: Proportional band	RW	1	0x40LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heating: D part, rate	RW		0x41LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heating: I part, reset	RW		0x42LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heating: Cycle time	RW	1	0x43LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Dead Band	RW	Var+1	0x46LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heating: Control sensitivity	RW	Var+1	0x47LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Cooling: Proportional band	RW	1	0x50LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Cooling: D part, rate	RW		0x51LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Cooling: I part, reset	RW		0x52LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Cooling: Cycle time	RW	1	0x53LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
C: Control sensitivity	RW	Var+1	0x57LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Actual output ratio	R		0x60LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Manual action: output ratio	RW		0x62LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Heating: output ratio limit	RW		0x64LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Cooling: output ratio limit	RW		0x69LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Softstart: output ratio	RW		0x6ALL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Softstart: setpoint	RW	Var	0x6BLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Soft: duration time	RW		0x6CLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Softstart: on/off	RW		0x6DLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Device/Alarm status	R		0x78LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Control word	W		0x78LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Controller mode	RW		0x80LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Conf. Logic output	RW		0x81LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Conf. relay output	RW		0x82LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Conf. contin. output	RW		0x83LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Zone number	RW	0	0x84LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
contin. output min.	RW	Var	0x86LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
contin. output max.	RW	Var	0x87LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Self tuning	RW		0x88LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Behav.sensor break	RW		0x8ALL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
Select. Controller mode/Manual mode	RW		0x8BLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F

Parameter	Access	Decimal-point	Address															
			High byte	Low byte (LL)														
Zone On / Off	RW		0x8FLL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
			0x__LL	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F

3 0xC0 Process image 1 (read only)

Parameter Code / Name	Decimal-place	Address 0x C0 LL (LL = low byte, see below)															
Zone:		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Address of the last write error (0x0000 = OK). Automatically set to 0 after a read operation.		00															
Actual process value	1	01	05	09	0D	11	15	19	1D	21	25	29	2D	31	35	39	3D
Actual output ratio		02	06	0A	0E	12	16	1A	1E	22	26	2A	2E	32	36	3A	3E
Device status / Alarm status		03	07	0B	0F	13	17	1B	1F	23	27	2B	2F	33	37	3B	3F
Actual heater current value	1	04	08	0C	10	14	18	1C	20	24	28	2C	30	34	38	3C	40

Process value will be transmitted with one decimal place, independent of measurement range.

3.1 0xC1 Control Sequence 1:

The setpoints are stored in RAM only.
After powerfail the old values will be valid again.

Parameter Code / Name	Decimal-place	Address 0x C1 LL (LL = low byte, see below)															
Zone:		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Write: Setpoint 1 Read: Actual Setpoint	1	00	02	04	06	08	0A	0C	0E	10	12	14	16	18	1A	1C	1E
Write: Controlword Read: Device / Alarmstatus		01	03	05	07	09	0B	0D	0F	11	13	15	17	19	1B	1D	1F

3.2 0xC2 Control Sequence 2:

Identically with Control Sequence 1, but the setpoints will be stored powerfailsafe.

WARINING! The nonvolatile memory allows only app. 1.000.000 write cycles!
In systems with frequently changing setpoints (e.g. ramps) Control Sequence 1 must be used!

Parameter Code / Name	Decimal-place	Address 0x C2 LL (LL = low byte, see below)															
Zone:		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Write: Setpoint 1 Read: Actual Setpoint	1	00	02	04	06	08	0A	0C	0E	10	12	14	16	18	1A	1C	1E
Write: Control word Read: Device / Alarm status		01	03	05	07	09	0B	0D	0F	11	13	15	17	19	1B	1D	1F

The Control Sequences transmits the process value and the setpoints with one decimal point, also if the controller is programmed to a measuring range without decimal point. So a transmitted decimal place may be cut.
Example: Range 0...400°C. Setpoint read by Modbus: 120,0°C. Set new setpoint by Modbus: 210,7°C. Accepted and displayed value: 210,0°C

4 0xCF Device configuration sequence (read / write)

Depending on the controller type some parameters are not all available. If in the selected memory range parameters are not present: Read operation: The value"0" is returned.
Write operation: The value will be ignored. No error message will be send.

Address	Access	Name	Note
0xCF00	RO	Device Type	
0xCF01	RW	Sensor configuration (P-tc; selection: PT100 or thermocouple)	
0xCF02	RW	Alarm 1 configuration	
0xCF03	RW	Alarm1-switching behaviour	
0xCF04	RW	Alarm 2 configuration	
0xCF05	RW	Alarm 2-switching behaviour	
0xCF06	RW	Alarm 1 Delay	
0xCF07	RW	Alarm 2 Delay	
0xCF08	RW	Current sampling rate	
0xCF09	RW	Leakage current: limit value	
0xCF0A	RO	Leakage current: actual value	
0xCF0B	RW	Operating lock (LOC)	
0xCF0C	RW	Zone Offset	
0xCF0D	RW	F1-key: configuration	
0xCF0E	RW	Sample time	
0xCF0F	RW	Language	
0xCF10	RW	Remote	
0xCF11	RW	Address of serial interface	
0xCF12	RW	Baud rate	
0xCF13	RW	Transmission data format	
0xCF14	RW	Transmission protocol selection	
0xCF15	RW	Setpoint switch (Setpoint 1 / Setpoint 2)	0 = SP1 1=SP2 2=SP3
0xCF16	RW	Current transformer: Turns ratio	
0xCF17	Reserved	Verk.	
0xCF18	Reserved	Sync	
0xCF19	Reserved	Sens Pt.	
0xCF1A	Reserved	OptAlle	
0xCF1B	Reserved	OptTimeout	
0xCF1C	RW	Restart Lock-out	
0xCF1D	RW	Alarm 1 Start suppression	
0xCF1E	RW	Alarm 2 Start suppression	
0xCF1F	RW	Alarm 1 Colour	
0xCF20	RW	Alarm 2 Colour	
0xCF21	RW	Alarm 1 Self-retaining	
0xCF22	RW	Alarm 2 Self-retaining	
0xCF23	RW	Configuration Monitoring 1 Selection Alarm 1	
0xCF24	RW	Config. Monitoring 1 Selection Alarm 2	
0xCF25	RW	Config. Monitoring 1 Selection Sensor error	
0xCF26	RW	Config. Monitoring 1 Selection Restart Lock-out	
0xCF27	RW	Config. Monitoring 1 Selection System error	
0xCF28	RW	Config. Monitoring 1 Selection Heater current alarm	
0xCF29	RW	Config. Monitoring 2 Selection Alarm 1	
0xCF2A	RW	Config. Monitoring 2 Selection Alarm 2	
0xCF2B	RW	Config. Monitoring 2 Selection Sensor error	
0xCF2C	RW	Config. Monitoring 2 Selection Restart Lock-out	
0xCF2D	RW	Config. Monitoring 2 Selection System error	
0xCF2E	RW	Config. Monitoring 2 Selection Heater current alarm	
0xCF2F	RW	Delay heater current alarm	
0xCF30	RW	Configuration external contact	
0xCF31	RW	Monitoring 1 program completed	
0xCF32	RW	Monitoring 2 program completed	
0xCF33	RW	Wizard at startup off/on = 0/1	
0xCF34	RW	Unit (Temperature unit) 0=°C ; 1=°F	
0xCF35	RW	Password	

0xCF36	RW	Hardware configuration Fieldbus	
0xCF37	RW	IP-Address Part 1	192
0xCF38	RW	IP-Address Part 2	168
0xCF39	RW	IP-Address Part 3	100
0xCF3A	RW	IP-Address Part 4	100
0xCF3B	RW	Subnet mask Part 1	255
0xCF3C	RW	Subnet mask Part 2	255
0xCF3D	RW	Subnet mask Part 3	255
0xCF3E	RW	Subnet mask Part 4	0
0xCF3F	RW	Default gateway Part 1	192
0xCF40	RW	Default gateway Part 2	168
0xCF41	RW	Default gateway Part 3	100
0xCF42	RW	Default gateway Part 4	1
0xCF43	RW	Clock: hour	
0xCF44	RW	Clock: minute	
0xCF45	RW	Clock: day	
0xCF46	RW	Clock: month	
0xCF47	RW	Clock: Year	
0xCF48	R	Firmware version of the controller	1120 means V2020_11
0xCF49	RW	Program controller Start/Stop	1=run 0=stop

5 0xD0 - 0xD3 Zone configuration sequence (read / write)

Before writing the zone configuration parameters, the device configuration parameters must have been written.
Depending on the controller type some parameters are not all available.
If in the selected memory range parameters are not present:
Read operation: The value"0" is returned.
Write operation: The value will be ignored. No error message will be send.

The address in HEX consists of high byte (HH) and low byte (LL) of: 0xHHLL

Zone 1	Zone 2	Zone 3	Zone 4		
Highbyte(HH) = 0xD0LL					
Zone 5	Zone 6	Zone 7	Zone 8		
Highbyte(HH) = 0xD1LL					
Zone 9	Zone 10	Zone 11	Zone 12		
Highbyte(HH) = 0xD2LL					
Zone 13	Zone 14	Zone 15	Zone 15		
Highbyte(HH) = 0xD3LL					
Low byte (LL):				**Parameter Code / Name**	**Dec.point**
0xHH00	0xHH40	0xHH80	0xHHC0	Sensor	
01	41	81	C1	Measuring range: lower value	
02	42	82	C2	Measuring range: higher value	
03	43	83	C3	Dec.point	Var read here
04	44	84	C4	Higher setpoint limit	Var
05	45	85	C5	Lower setpoint limit	Var
06	46	86	C6	Controller mode	
07	47	87	C7	Manual output level configuration (PID)	
08	48	88	C8	Heating: Output ratio limitation	
09	49	89	C9	Cooling: Output ratio limitation	
0A	4A	8A	CA	Setpoint 1	Var
0B	4B	8B	CB	Setpoint 2	Var
0C	4C	8C	CC	Manual output ratio	
0D	4D	8D	CD	Setpoint ramp function: rising	Var + 1
0E	4E	8E	CE	Setpoint ramp function: falling	Var + 1
0F	4F	8F	CF	Alarm value 1 (Over temperature)	Var or 0
10	50	90	D0	Alarm value 2 (Over temperature)	Var or 0
11	51	91	D1	Heating: Proportional band	1
12	52	92	D2	Heating: D part	
13	53	93	D3	Heating: I part	
14	54	94	D4	Heating: Cycle time	1
15	55	95	D5	Heating: Hysteresis	Var + 1
16	56	96	D6	Dead Band	Var + 1
17	57	97	D7	Cooling: Proportional band	1
18	58	98	D8	Cooling: D part	
19	59	99	D9	Cooling: I part	
1A	5A	9A	DA	Cooling: Cycle time	1
1B	5B	9B	DB	Cooling: Switching point difference	Var + 1
1C	5C	9C	DC	Temperature process value: Offset	Var
1D	5D	9D	DD	Soft start: on/off	
1E	5E	9E	DE	Soft start: output ratio	
1F	5F	9F	DF	Soft Start: setpoint	Var
20	60	A0	E0	Soft start: time	
21	61	A1	E1	Zone: on/off	
22	62	A2	E2	Self tuning	
23	63	A3	E3	Alarm value 1 Under temperature	Var oder 0
24	64	A4	E4	Alarm value 2 Under temperature	Var oder 0
25	65	A5	E5		

The address space 0xD400 to 0xDFFF is reserved for extensions.

6. Program controller - parameter 0xC3..

Parameter	Acc.	Pr.	St	Index	P	S	Index	P	S	Index	P	S	Index	P	S	Index	P	S	Index	P	S	Index	P	S	Index
Count of Programs	R	alle		0xC3 00																					
Count of max. steps	R	alle		0xC3 01																					
Act. Program number	R/W	alle		0xC3 02																					
Reserve		alle		0xC3 03																					
For zone	R/W	1		0xC3 04	2		0xC3 22	3		0xC3 40	4		0xC3 5E	5		0xC3 7C	6		0xC3 9A	7		0xC3 B8	8		0xC3 D6
Continue if	R/W	1		0xC3 05	2		0xC3 23	3		0xC3 41	4		0xC3 5F	5		0xC3 7D	6		0xC3 9B	7		0xC3 B9	8		0xC3 D7
Program end	R/W	1		0xC3 06	2		0xC3 24	3		0xC3 42	4		0xC3 60	5		0xC3 7E	6		0xC3 9C	7		0xC3 BA	8		0xC3 D8
Number of steps	R/W	1		0xC3 07	2		0xC3 25	3		0xC3 43	4		0xC3 61	5		0xC3 7F	6		0xC3 9D	7		0xC3 BB	8		0xC3 D9
Res 1		1		0xC3 08	2		0xC3 26	3		0xC3 44	4		0xC3 62	5		0xC3 80	6		0xC3 9E	7		0xC3 BC	8		0xC3 DA
Res 2		1		0xC3 09	2		0xC3 27	3		0xC3 45	4		0xC3 63	5		0xC3 81	6		0xC3 9F	7		0xC3 BD	8		0xC3 DB
Ramp duration	R/W	1	1	0xC3 0A	2	1	0xC3 28	3	1	0xC3 46	4	1	0xC3 64	5	1	0xC3 82	6	1	0xC3 A0	7	1	0xC3 BE	8	1	0xC3 DC
Temperature	R/W	1	1	0xC3 0B	2	1	0xC3 29	3	1	0xC3 47	4	1	0xC3 65	5	1	0xC3 83	6	1	0xC3 A1	7	1	0xC3 BF	8	1	0xC3 DD
Dwell time	R/W	1	1	0xC3 0C	2	1	0xC3 2A	3	1	0xC3 48	4	1	0xC3 66	5	1	0xC3 84	6	1	0xC3 A2	7	1	0xC3 C0	8	1	0xC3 DE
Ramp duration	R/W	1	2	0xC3 0D	2	2	0xC3 2B	3	2	0xC3 49	4	2	0xC3 67	5	2	0xC3 85	6	2	0xC3 A3	7	2	0xC3 C1	8	2	0xC3 DF
Temperature	R/W	1	2	0xC3 0E	2	2	0xC3 2C	3	2	0xC3 4A	4	2	0xC3 68	5	2	0xC3 86	6	2	0xC3 A4	7	2	0xC3 C2	8	2	0xC3 E0
Dwell time	R/W	1	2	0xC3 0F	2	2	0xC3 2D	3	2	0xC3 4B	4	2	0xC3 69	5	2	0xC3 87	6	2	0xC3 A5	7	2	0xC3 C3	8	2	0xC3 E1
Ramp duration	R/W	1	3	0xC3 10	2	3	0xC3 2E	3	3	0xC3 4C	4	3	0xC3 6A	5	3	0xC3 88	6	3	0xC3 A6	7	3	0xC3 C4	8	3	0xC3 E2
Temperature	R/W	1	3	0xC3 11	2	3	0xC3 2F	3	3	0xC3 4D	4	3	0xC3 6B	5	3	0xC3 89	6	3	0xC3 A7	7	3	0xC3 C5	8	3	0xC3 E3
Dwell time	R/W	1	3	0xC3 12	2	3	0xC3 30	3	3	0xC3 4E	4	3	0xC3 6C	5	3	0xC3 8A	6	3	0xC3 A8	7	3	0xC3 C6	8	3	0xC3 E4
Ramp duration	R/W	1	4	0xC3 13	2	4	0xC3 31	3	4	0xC3 4F	4	4	0xC3 6D	5	4	0xC3 8B	6	4	0xC3 A9	7	4	0xC3 C7	8	4	0xC3 E5
Temperature	R/W	1	4	0xC3 14	2	4	0xC3 32	3	4	0xC3 50	4	4	0xC3 6E	5	4	0xC3 8C	6	4	0xC3 AA	7	4	0xC3 C8	8	4	0xC3 E6
Dwell time	R/W	1	4	0xC3 15	2	4	0xC3 33	3	4	0xC3 51	4	4	0xC3 6F	5	4	0xC3 8D	6	4	0xC3 AB	7	4	0xC3 C9	8	4	0xC3 E7
Ramp duration	R/W	1	5	0xC3 16	2	5	0xC3 34	3	5	0xC3 52	4	5	0xC3 70	5	5	0xC3 8E	6	5	0xC3 AC	7	5	0xC3 CA	8	5	0xC3 E8
Temperature	R/W	1	5	0xC3 17	2	5	0xC3 35	3	5	0xC3 53	4	5	0xC3 71	5	5	0xC3 8F	6	5	0xC3 AD	7	5	0xC3 CB	8	5	0xC3 E9
Dwell time	R/W	1	5	0xC3 18	2	5	0xC3 36	3	5	0xC3 54	4	5	0xC3 72	5	5	0xC3 90	6	5	0xC3 AE	7	5	0xC3 CC	8	5	0xC3 EA
Ramp duration	R/W	1	6	0xC3 19	2	6	0xC3 37	3	6	0xC3 55	4	6	0xC3 73	5	6	0xC3 91	6	6	0xC3 AF	7	6	0xC3 CD	8	6	0xC3 EB
Temperature	R/W	1	6	0xC3 1A	2	6	0xC3 38	3	6	0xC3 56	4	6	0xC3 74	5	6	0xC3 92	6	6	0xC3 B0	7	6	0xC3 CE	8	6	0xC3 EC
Dwell time	R/W	1	6	0xC3 1B	2	6	0xC3 39	3	6	0xC3 57	4	6	0xC3 75	5	6	0xC3 93	6	6	0xC3 B1	7	6	0xC3 CF	8	6	0xC3 ED
Ramp duration	R/W	1	7	0xC3 1C	2	7	0xC3 3A	3	7	0xC3 58	4	7	0xC3 76	5	7	0xC3 94	6	7	0xC3 B2	7	7	0xC3 D0	8	7	0xC3 EE
Temperature	R/W	1	7	0xC3 1D	2	7	0xC3 3B	3	7	0xC3 59	4	7	0xC3 77	5	7	0xC3 95	6	7	0xC3 B3	7	7	0xC3 D1	8	7	0xC3 EF
Dwell time	R/W	1	7	0xC3 1E	2	7	0xC3 3C	3	7	0xC3 5A	4	7	0xC3 78	5	7	0xC3 96	6	7	0xC3 B4	7	7	0xC3 D2	8	7	0xC3 F0
Ramp duration	R/W	1	8	0xC3 1F	2	8	0xC3 3D	3	8	0xC3 5B	4	8	0xC3 79	5	8	0xC3 97	6	8	0xC3 B5	7	8	0xC3 D3	8	8	0xC3 F1
Temperature	R/W	1	8	0xC3 20	2	8	0xC3 3E	3	8	0xC3 5C	4	8	0xC3 7A	5	8	0xC3 98	6	8	0xC3 B6	7	8	0xC3 D4	8	8	0xC3 F2
Dwell time	R/W	1	8	0xC3 21	2	8	0xC3 3F	3	8	0xC3 5D	4	8	0xC3 7B	5	8	0xC3 99	6	8	0xC3 B7	7	8	0xC3 D5	8	8	0xC3 F3

6.1 Legend:

- Acc. -> Access (read or write)
- Pr. or P -> Abbreviation for Program
- St or S -> Abbreviation for Step
- Index -> Modbus-address Both columns together
  E.g. 0xC30A for Ramp Duration program 1, Step 1

6.1 Program controller - parameter description:

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>Count of Programs</td><td>Programs available in the controller (R4000 current 8)</td></tr>
<tr><td>Count of max. steps</td><td>Steps per program (R4000 current 8)</td></tr>
<tr><td>Act. Program number.</td><td>Selected program [1 ... number of programs]</td></tr>
<tr><td>For zone</td><td>Assignment Bit coded: Bit_0 = 1 -> Zone1 takes part in program controller,
BIT_0 = 0 Zone 1 regulates normally, etc.
<table>
<tr><td>Bit</td><td>BIT_7</td><td>BIT_6</td><td>BIT_5</td><td>BIT_4</td><td>BIT_3</td><td>BIT_2</td><td>BIT_1</td><td>BIT_0</td></tr>
<tr><td>Zone</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
</table></td></tr>
<tr><td>Continue if</td><td>Configuration: (end of steps)
0 = "Time expired"
1 = "Temperature reached"</td></tr>
<tr><td>Program end</td><td>Configuration:
0 = "Continue to setpoint 1"
1 = "Last program setpoint"
2 = "Repeat Program"</td></tr>
<tr><td>Number of steps</td><td>Number of program steps for the respective program. [1 ... Count of max. steps]</td></tr>
<tr><td>Res 1</td><td>For possible additions.</td></tr>
<tr><td>Ramp duration</td><td>Time in minutes in which the step setpoint is continuously changed from the current actual value or the previous setpoint value to the current setpoint value.</td></tr>
<tr><td>Temperature</td><td>Die step temperature in °C.</td></tr>
<tr><td>Dwell time</td><td>Duration in minutes, how long the step temperature should be maintained.
Also holding time.</td></tr>
</table>

7 Examples

To illustrate the address ranges in the tables, here are some examples below:

7.1 8-zones controller: all actual values should be read out
Modbus service: 0x03; Select addresses 0x1000 to 0x1007 (8 words)

7.2 8-zones controller: the alarm value 1 of zone 5 should be set to “77”
Modbus service: 0x06; Select address 0x3804
Memory area, in which a parameter for all zones can be reached
or
Modbus service: 0x06; Select address 0xD10F
Memory area, where all parameters of a zone are reachable together.

7.3 16-zones controller: the most important process-relevant values should be read out
Modbus service: 0x03, Select addresses 0xC000 to 0xC040 (65 words, process image 1)

7.4 The device configuration parameters of the controller should be written / read
Depending on the controller design parameters are not all available.
Read: Modbus service: 0x03; Select addresses 0xCF00 to CF0C (13 words)
Write: Modbus service: 0x10; Select addresses 0xCF01 to CF0C (12 words)
Note: Address 0xCF00 (identifies type of device) is read-only!

7.5 16-zones controller: all parameters of zone 3 should be read out
Modbus service: 0x03, Select addresses 0xD080 to 0xD0A2 (35 words)

7.6 16-zones controller: all PID control parameters of zone 3 should be read out
Modbus service: 0x03, Select addresses 0xD091 to 0xD09B (11 words)

7.7 10-zone controller: the process-relevant parameter values of all the zones should be read out. Furthermore, the setpoints and control functions should be written
Modbus service: 0x17
Read: Select addresses 0xC000 to 0xC028 (41 words; process image 1)
Write: Select addresses 0xC100 to 0xC113 (20 words; control sequence 1)

7.8 How can it be determined whether the range of values has been incorrect while writing ?
Via address 0xC000 can be read out, if a written value was out of range.
It will return the address at which the last write error has occurred.
The value is stored as long, until the address 0xC000 was read out once.
After reading, the entry will be set to 0x0000 (no error) automatically.
Modbus service: 0x03
Read: Select Address 0xC000 (1 word)

For example:
Measuring range of the controller: 0....400 °C
The setpoint values 100, *700* and 255 are written in the zones 1-3.
Value *700 (zone 2)* is out of range
Address 0xC000 shows the value 0x2101.
Reading 0xC000 again will return the value 0x0000.

Range errors will not reported by the Modbus exception codes.

8. Error messages (Exception code)

Code	Name	Possible Causes
01	ILLEGAL FUNCTION	- The selected function code is invalid. - There was a write command to a Read-Only-Parameter. - The self tuning action should be started, but the conditions to start the self tuning are not met.
02	ILLEGAL DATA ADDRESS	- The selected address is invalid.
03	ILLEGAL DATA VALUE	- Checksum wrong - Data length wrong

9. Disclaimer of liability

We have checked the contents of the document for conformity with the hardware and software described. Nevertheless, we are unable to preclude the possibility of deviations so that we are unable to assume warranty for full compliance.
The information given in the publication is, however, reviewed regularly. Necessary amendments are incorporated in the following editions.
We would be pleased to receive any improvement proposals which you may have.
The information contained herein is subject to change without notice.