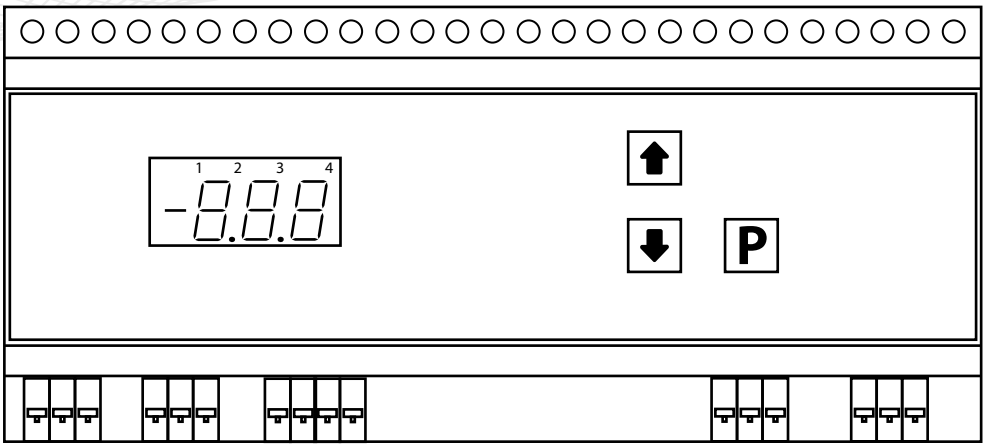
eltherm®

OPERATION-MANUAL



ELTC-MV2

Handling, operation and adjustment
ELTC-MV2 Moduvise

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BU 123

CONTENT

Particularly important points in these instructions are marked by symbols:

DANGER indicates an extremely dangerous situation. If it is not avoided, there is a danger to life or at least a high risk of serious injury.

WARNING indicates a dangerous situation. If it is not avoided, there is a risk of injury or at least a high risk of damage.

CAUTION indicates an potential dangerous situation. If it is not avoided, there is a risk of damage or malefunction.

NOTE important information and instructions for safe, effective and environmentally compatible use.

Reservation
We reserve the right to make technical changes. Changes, errors and misprints do not justify any no claim for compensation. For safety components and systems, the installation instructions and the relevant standards and regulations must be observed.

eltherm GmbH Ernst-Heinkel-Str. 6-10 57299 Burbach T.: +49 2736 4413-0 F.: +49 2736 4413-50 info@eltherm.com	Document: 8643050611135 BU - 123		operation manual temperature controller ELTC-MV2
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	Revision: 1	27.10.2022_je	07.06.2021

DESCRIPTION AND TECHNICAL DATA

DESCRIPTION

Temperature controller for heating applications such as heating cables in industrial plants, with additional alarm relay. Design for DIN rail mounting. Temperature sensor Pt100 in 3- or 2-wire technology, thermocouples type J, thermocouple type K or standard signals (0/2V - 10V, 0/4mA - 20mA). Many different control functions.

Operating status LEDs

LED 1 = operation (heating on)
LED 2 = ramp mode
LED 3 = signaling relay (alarm 2)
LED 4 = alarm relay (alarm 1)

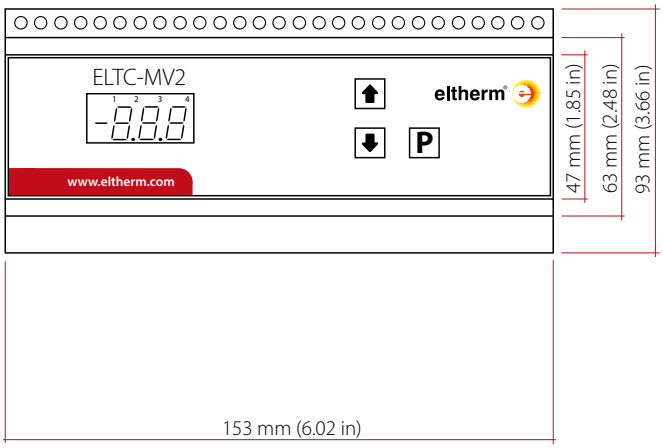
Soft start

When using the internal hybrid relay as a switching output, a soft start phase is initiated for 20 seconds before each cold start of the load relay (with 14% power via triac output) in order to reduce the starting current.

Digital inputs

DigIn1 is used with structure switch position S07 – 2 (external controller release) and serves as an external release of the load output.
DigIn2 is used with the structure switch position S04 - 5 (limiter function) and serves as an external unlocking.
DigIn3 is used with structure switch position S03 – 6 (W1/W2 switchover) and is used to switch between W1 and W2.

Dimensions ELTC-MV2

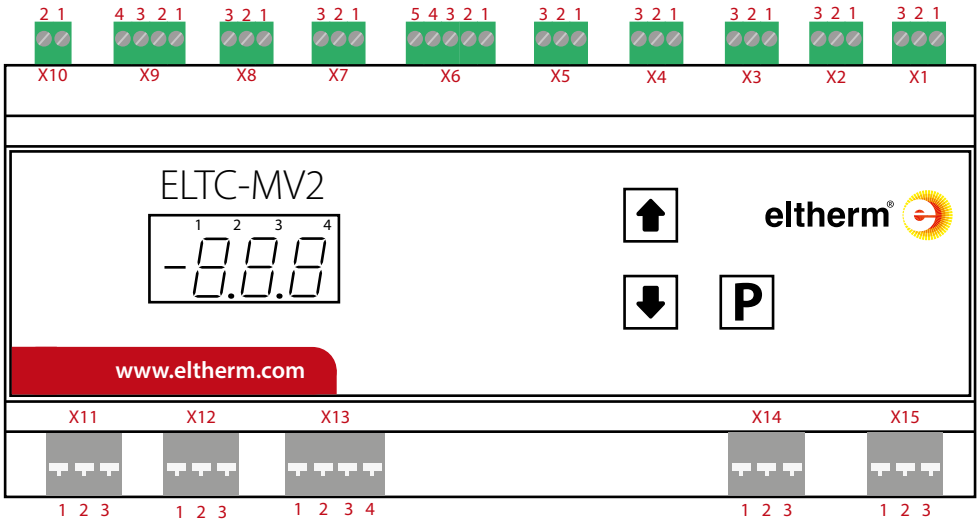


TECHNICAL SPECIFICATIONS

contoller type	ELTC-MV2
operating voltage	100V..277VAC, +/-10%, 50/60Hz, 24VDC, +/-5%
power consumption	max. 5,5 W
Relay K1	20A res./ max 277 VAC
Relay K2 and K3	8A res. / max. 250 VAC 1A res. / 24 VDC
operating temperature	-25...+55°C
storage temperature	-30...+60°C
adjustment range	-50…+950°C, configurable
display range/ resolution	-50...+999°C
Measuring range	Pt100 -60...+410°C Type K 0...999°C Type J 0...700°C
accuracy	± 1K, ± 2 Digits (-50..400°C)
Display / relay indicator	LED, rot, 11mm, three digits
terminals	sensor: 0,2…1,5mm² copper line others: 0,1…2,5mm² solid copper, stripping length 5…6mm
sensor connection	Pt100 2- or 3-wire, thermocouples J or K, standard signal; meets requirements for operation with ELTF PTEx sensors
interface	RS485
attachment	TS35
Protection class	IP20

CONNECTION / CONTROL PANEL

control panel



LEDs in the display

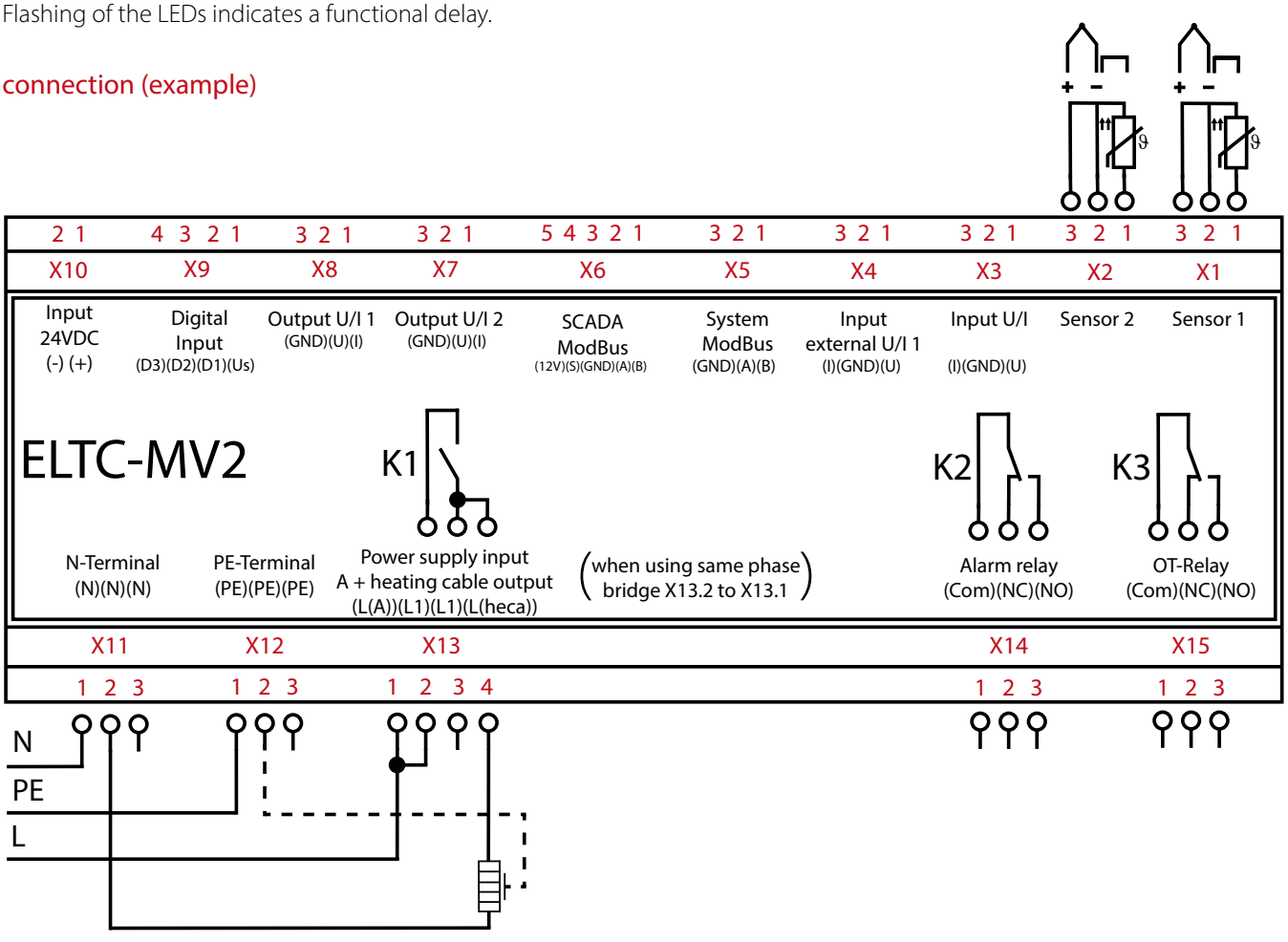
"**1**" = control relay ON
"**2**" = two-point operation
"**3**" = proportional operation
"**4**" = alarm relay activated (=de-energized)

buttons

"**⬆**" = increase values
"**⬇**" = decrease values
"**P**" = programming button

Flashing of the LEDs indicates a functional delay.

connection (example)



SPECIAL CONDITIONS

INSTALLATION AND SAFETY INSTRUCTIONS

CAUTION

•Electrical connection / commissioning must be carried out by a qualified electrician.

•The relevant local safety regulations must be observed.

•Observe the connection values according to the rating plate.

•Avoid tensile stress and torsion of the connected cables

CAUTION The sensor lines must be shielded when extended, the shielding must be grounded on one side close to the controller. The line must not be laid parallel to lines carrying mains voltage. The total line resistance must not exceed 10 ohms.

NOTE After switching on the controller, the display shows the current actual value.

WARNING Before starting work on heating or connection cables or connection terminals is to ensure that the corresponding circuit is switched off and is secured against unintentional restart

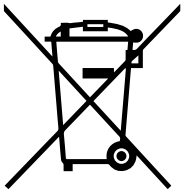
GOODS RECEIPT

Upon receipt of the goods, check the controllers and accessories and compare the data on the nameplate with the data on the delivery note to ensure that the correct material has been supplied.

STORAGE

NOTE Storage should be in a dry place at an ambient temperature of 0°C to 50°C.

DISPOSAL



NOTE The WEEE logo (shown above) indicates that this product should not be disposed of with your household waste.
You can obtain more information on disposal and restoration of electrical and electronic
old devices and collection points from your local waste disposal company or from the manufacturer where you purchased the product.

DECLARATION OF CONFORMITY

CE

We declare that the product described fully complies with the directives 2014/35/EU, 2014/30/EU and 2011/65/EU. If you need a detailed declaration of conformity, please contact us.

OPERATION

GENERAL

After switching on, the type number ("CU2") and software version of the device appear and after approx. three seconds the measured actual value. By pressing the arrow keys ⬆/⬇you can scroll through the parameters P01 – P08 (purely display parameters). After approx. 60 seconds the display jumps back to the actual value. If the „**P**" button is pressed for approx. 3 seconds, you get to the parameter list ("P10" is shown on the display). Holding the „**P**" button down for another 3 seconds will display "C" for degrees Celsius (°C) or "F" for degrees Fahrenheit (°F). If the „**P**" button is pressed longer, the device type, software version and build state are displayed. By pressing „⬆" and „⬇" simultaneously for approx. 3 seconds, you can access the structure switch list via the parameter list.

Call up and change parameters

In order to reach the parameter list, „**P**" must be pressed for approx. 3 seconds until "P10" appears on the display.

Press „P" for 3 seconds
Parameter no. appears

Press „⬆/⬇"
select parameters

Press „P"
parameter value appears

Press „⬆/⬇"
change parameters

Press „P"
New value saved, back to parameter no.

Press „⬆/⬇" until „P01" or T > 1 minute
Exit input mode

Call up and change structure switches

In order to reach the structure switch list, the „⬆" and „⬇" keys must be pressed simultaneously in the parameter list for approx. 3 seconds until "S01" appears on the display.

Press „P" for 3 seconds
Parameter no. appears

Press „⬆" and „⬇" simultaneously for 3 seconds
Structure switch S01 appears

Press „⬆/⬇"
Select structure switch

Press „P"
switch position appears

Press „⬆/⬇"
change switch position

Press „P"
New value saved, back to structure switch.

Press „⬆" and „⬇" simultaneously for 3 seconds
Return to the parameter list

Press „⬆/⬇" until „P01" or T > 1 minute
Exit input mode

Protection against unauthorized operation

In principle, the control setpoints can be set freely, provided they are not limited by "P13/P14" or "P23/P24". All other parameters are protected by a code.
If a code is required, the display shows "C00". The required code number "C42" is set with the arrow keys „⬆/⬇" and confirmed with „**P**".
After about 1 minute without pressing a button, the code is requested again.

Autoscrolling

If you hold down the arrow keys „⬆/⬇" the values continue to run automatically.

Factory reset

To restore the factory settings, you first need to enter the code "C42". To do this, any parameter simply has to be selected and changed. After entering the code, the factory settings can be restored by pressing all buttons simultaneously for approx. 5 seconds.

MESSAGES

Error messages

In the event of an error, the display shows an error code. Sensor errors are displayed with a delay of approx. 10 seconds.

Error codes

- E01 = AE1: Sensor short circuit (Pt100 only)
  or temperature < -60°C
- E02 = AE1: sensor interruption
- E03 = AE1: 3rd wire missing or R ≥ 10Ω (thermocouple only),
- E04 = AE2: Sensor short circuit (only Pt100)
  or temperature < -60°C
- E05 = AE2: sensor interruption
- E06 = AE2: 3rd wire missing or R ≥ 10Ω (thermocouple only)
- E07 = AE3: short circuit current/voltage input, interruption current/voltage input
- E08 = AE4: short circuit current/voltage input, interruption current/voltage input
- E09 = Hybrid relay open error
- E10 = Error hybrid relay short circuit.
- E11 = limiter active
- E12 = no mains supply (heating)
- E19 = internal error

Warning codes

- C00 = Protected parameter Code entry required (Set "C42" with the arrow keys „⬆/⬇" „C42" and confirm with "P".)

- AL1 = over/under temperature input 1
- AL2 = over/under temperature input 2
- AL3 = Alarm current monitoring output, load current < 0.3A

- SP2 = second set value via digital input active
- oFF = external controller release -> device blocked

Ramp status messages

- rF0 = ramp ended correctly
- rF1 = ramp aborted and ramped down in a controlled manner
- rF2 = band alarm occurred during operation
- rF3 = ramp aborted

The ramp status is indicated by a flashing display alternating with parameter "P01" (3 seconds "P01", 1 second "rFx"). You can return to the normal display by pressing the "P" key.

PARAMETERS AND THEIR MEANING

The factory settings are specified in [..].

Parameter	meaning and range
P01 Input variable X1	Display only, resolution: °C
P02 Input variable X2	Display only, resolution: °C
P03 Reference variable	Display only, resolution: °C
P04 Current display	Only display, resolution: 0.1A
P05 Output level on the proportional controller / continuous controller	Only display, resolution: %
P06 Time unit on the proportional controller	Display only, resolution: sec.
P07 Display of the current Ramp phase	Display only, resolution: without unit
P08 Display of the remaining time of the current ramp phase / PWM phase	Display only, resolution: 0.1 min.
P10 Control setpoint W1 [°C]	Range P13...P14, [5°C]
P11 Switching hysteresis	Range 0...10K, [2K]
P12 min standstill time hybrid	Relay range 0...30 min, [0 min], resolution: 0.1 min
P13 Highest settable setpoint 1	Range P14...950°C, [950°C]
P14 Smallest adjustable setpoint 1	Range -50°C...P13, [-50°C]
P15 Sensor correction X1	Range -30...10K, [0K]
P16 Overtemperature alarm 1	Range P17...999°C, [999°C]
P17 Low temperature alarm 1	Range -99°C...P16, [-99°C]
P18 Lower analog scaling value (0/2V, 0/4mA)	Range -50°C...P19, [0°C]

Parameter	meaning and range
P19 Upper analog scaling value (10V, 20mA)	Range P18...999°C, [100°C]
P20 Control setpoint W2 [°C]	Range P23...P24, [5°C]
P23 Highest settable setpoint 2	Range P24...950°C, [950°C]
P24 Smallest adjustable setpoint 2	Range -50°C...P23, [-50°C]
P25 Sensor correction X2	Range -30...10K, [0K]
P26 Over temperature alarm 2	Range P27...999°C, [999°C]
P27 Low temperature alarm 2	Range -99°C...P16, [-99°C]
P28 Current monitoring load output	Range oFF (=0)...1, [oFF]
P32 Low temperature alarm delay during operation	Range 0...99 min., [0 min]
P33 Delay under temperature alarm after switching on	Range 0...500 min., [0 min.]
P40 Power correction	Range 65...130%, [100%]
P41 Minimum ambient temperature	Range -70°C...P10, [-30°C]
P42 Material selection	[1] = metal 2 = plastic
P43 Insulation material range	Range 1...15, [6] see table on page 9
P44 Thickness of insulation material	Range 1...59, [6] see table on page 9
P45 Medium selection	Range 1...5, [2] see table on page 10
P46 Geometry	[0] = pipe 1 = container
P47 Metal pipe outer diameter	Range 1...32, [11] see table on page 10
P48 Plastic pipe outer diameter	Range 1...17, [3] see table on page 10

Parameter	meaning and range
P49 Cooling times	[0] = calculated by parameters P41...P48 1 = TU 30 seconds 2 = TU 60 seconds 3 = TU 120 seconds
P50 Start value setpoint ramp	Range noP (=-1)...950°C, [100°C]
P51 Ramp 1 duration	Range 1...999 min., [30 min.]
P52 Ramp 1 setpoint	Range noP (=-1)...950°C, [100°C]
P53 Ramp 2 duration	Range 1...999 min., [30 min.]
P54 Ramp 2 setpoint	Range noP (=-1)...950°C, [100°C]
P55 Ramp 3 duration	Range 1...999 min., [30 min.]
P56 Ramp 3 setpoint	Range noP (=-1)...950°C, [100°C]
P57 Ramp 4 duration	Range 1...999 min., [30 min.]
P58 Ramp 4 setpoint	Range noP (=-1)...950°C, [100°C]
P59 Ramp 5 duration	Range 1...999 min., [30 min.]
P60 Ramp 5 setpoint	Range noP (=-1)...950°C, [100°C]
P61 Ramp 6 duration	Range 1...999 min., [30 min.]
P62 Ramp 6 setpoint	Range noP (=-1)...950°C, [100°C]
P63 Ramp 7 duration	Range 1...999 min., [30 min.]
P64 Ramp 7 setpoint	Range noP (=-1)...950°C, [100°C]
P65 Ramp 8 duration	Range 1...999 min., [30 min.]
P66 Ramp 9 setpoint	Range noP (=-1)...950°C, [100°C]
P67 Ramp 9 duration	Range 1...999 min., [30 min.]

Parameter	meaning and range
P68 Ramp setpoint 9 (final value)	Range noP (=-1)...950°C, [100°C]
P69 Band alarm hysteresis	Range P11...11K, [5]
P75 Switching 0/4-20mA or 0/2-10V	0 = 0...20mA, 0...10V [1] = 4...20mA, 2...10V
P76 min. output signal analogue output	Range 0%...P77, [0%]
P77 max. output signal analogue output	Range P76...100%, [100%]
P80 Baud rate (SCADA interface)	1 = 9600 baud [2] = 19200 baud 3 = 38400 baud
P81 Device address (SCADA and system interface)	Range 0 (=disabled)...247, [1]
P82 Status network (SCADA interface)	Range 0...999 sec., display of the last telegram
P83 SCADA mode	N / A
P84 SCADA setting	N / A

Parameter content for refined control according to ambient temperature

P43: Insulating material W/(m²*K) at 20°C		
1	Calcium silicate, low density	0,08
2	Calcium silicate moldings	0,21
3	Elastomeric foam	0,033
4	Elastomeric foam high temp.	0,038
5	Foam glass	0,038
6	Foam glass ASTM C552-88	0,052
7	Mineral wool 035	0,035
8	Mineral wool 040	0,04
9	Mineral wool ASTM C547-77	0,035
10	Mineral wool ASTM C553-70	0,04
11	Mineral wool BS3958	0,036
12	Perlite expanded ASTM C610-85	0,067
13	Perlite	0,067
14	PIR-hard foam	0,027
15	PUR-hard foam	0,023

P44: Thickness insulation material					
1	4,76 mm	3/16"	31	45 mm	1 3/4"
2	5 mm	1/5"	32	50 mm	-
3	6,25 mm	1/4"	33	51 mm	2"
4	7 mm	-	34	57 mm	2 1/4"
5	8 mm	5/16"	35	60 mm	-
6	9 mm	5/16"	36	64 mm	2 1/2"
7	9,5 mm	3/8"	37	70 mm	2 3/4"
8	10 mm	2/5"	38	76 mm	3"
9	11 mm	7/16"	39	80 mm	3 1/4"
10	12 mm	-	40	83 mm	-
11	12,7 mm	1/2"	41	89 mm	3 1/2"
12	13 mm	-	42	90 mm	-
13	14 mm	-	43	95 mm	3 3/4"
14	14,3 mm	9/16"	44	100 mm	4"
15	15 mm	3/5"	45	110 mm	-
16	16 mm	5/8"	46	114 mm	4 1/2"
17	17 mm	-	47	120 mm	-
18	17,5 mm	11/16"	48	127 mm	5"
19	18 mm	-	49	130 mm	-
20	19 mm	3/4"	50	140 mm	5 1/2"
21	20 mm	-	51	150 mm	-
22	23,32 mm	4/5"	52	153 mm	6"
23	22 mm	7/8"	53	160 mm	-
24	24 mm	15/16"	54	165 mm	6 1/2"
25	25 mm	1"	55	170 mm	-
26	30 mm	-	56	178 mm	7"
27	32 mm	1 1/4"	57	180 mm	-
28	35 mm	-	58	190 mm	7 1/2"
29	38 mm	1 1/2"	59	200 mm	8"

P45: Medium-selection	
1	Water, brine, caustic soda
2	Water-based liquid, acids, alkalis
3	Liquid hydrocarbons, vegetable oils
4	Gases
5	Other

P47: Metal pipe size					
1	3 mm	1/8"	17	200 mm	8"
2	6 mm	1/4"	18	225 mm	9"
3	10 mm	3/8"	19	250 mm	10"
4	15 mm	1/2"	20	300 mm	12"
5	20 mm	3/4"	21	350 mm	14"
6	25 mm	1"	22	400 mm	16"
7	32 mm	1 1/4"	23	450 mm	18"
8	40 mm	1 1/2"	24	500 mm	20"
9	50 mm	2"	25	550 mm	22"
10	65 mm	2 1/2"	26	600 mm	24"
11	80 mm	3"	27	650 mm	26"
12	90 mm	3 1/2"	28	700 mm	28"
13	100 mm	4"	29	750 mm	30"
14	125 mm	5"	30	800 mm	32"
15	150 mm	6"	31	850 mm	34"
16	175 mm	7"	32	900 mm	36"

P48: Plastic pipe size					
1	10 mm	3/8"	10	75 mm	2 7/8"
2	12 mm	3/8+"	11	100 mm	4"
3	15 mm	1/2"	12	125 mm	5"
4	20 mm	3/4"	13	150 mm	6"
5	25 mm	1"	14	200 mm	8"
6	32 mm	1 1/4"	15	250 mm	10"
7	40 mm	1 1/2"	16	300 mm	12"
8	50 mm	2"	17	400 mm	16"
9	65 mm	2 1/2"			

STRUCTURE SWITCHES AND THEIR MEANING

There are 9 structure switches (S01 to S09) with a different number of switch positions. Each structure switch is assigned a function with at least two or more alternatives, which are selected using only one possible switch position per structure switch.

no.	meaning
S01 Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = Thermocouple type J (AE1) 4 = Thermocouple type K (AE1) 5 = Voltage input (AE3) 6 = Current input (AE3)
S02 Selection actual value X2	[0] = Input disabled 1 = Pt100, 3-wire (AE2) 2 = Pt100, 2-wire (AE2) 3 = Thermocouple type J (AE2) 4 = Thermocouple type K (AE2) 5 = Voltage input (AE4) 6 = Current input (AE4)
S03 Select setpoint W	[1] = Fixed value W1 2 = Fixed value W2 3 = Ramp function 4 = Sliding setpoint (W2+X2) 5 = External setpoint (AE4) 6 = Changeover W1/W2 (DigIn 3)
S04 Selection of output function controller	[1] = two-point control 2 = pulse width modulation (PWM) 3 = proportional control 4 = continuous control 5 = limiter
S05 Selection switching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked
S06 Alarm selection: temperature absolute – relative	[1] = absolute 2 = relative
S07 Select controller release (DigIn1)	[1] = continuously 2 = external
S08 Alarm relay mode	1 = alarm relay on in case of error [2] = alarm relay off on error 3 = enable relay mode 4 = like 0, but heating on 5 = like 1, but heating on 6 = like 2, but heating on
S09 Selection of display format	[1] = °C 2 = °F

MODBUS INTERFACES

System interface

Type: RS485 (Physical Layer)
Baud rate: 19200 Baud
Protocol: N,8,2 / ModBus
number of devices: max. 32

SCADA interface

Type: RS485 (Physical Layer)
Baud rate: max. 38400 Baud
Protocol: N,8,2 / ModBus
number of devices: max. 1

Read discrete inputs

Function = 0x02
Address = 0
QTY = 48

Read device ID

Function = 0x2B
Address = 0x0E
ID Code = 0x01
Object ID = 0x00

Object ID 00: eltherm GmbH
Object ID 01: ELTC-52
Object ID 02: Rev01, Bxxx

ModBus parameters		
Bit 0	Bit 1	Bit 2
Hybrid relay	Alarm relay	OT relay
Bit 3	Bit 4	Bit 5
softstart	U/I output 1	Digit In 1
Bit 6	Bit 7	Bit 8
Digit In 2	Digit In 3	Alarm: X1 High-temp.
Bit 9	Bit 10	Bit 11
Alarm: X1 Low-temp.	Alarm: X2 High-temp.	Alarm: X2 Low-temp.
Bit 12	Bit 13	Bit 14
Alarm: Heating-cable	-	-
Bit 15	Bit 16	Bit 17
-	State: X1 Pre High-temp.	State: X1 Pre Low-temp.
Bit 18	Bit 19	Bit 20
State: X2 Pre High-temp.	State: X2 Pre Low-temp	State: External off mode
Bit 21	Bit 22	Bit 23
State: External SP2 mode	-	-
Bit 24	Bit 25	Bit 26
E01: AE1 short	E02: AE1 open	E03: AE1 3wire
Bit 27	Bit 28	Bit 29
E04: AE2 short	E05: AE2 open	E06: AE2 3wire
Bit 30	Bit 31	Bit 32
E07: AE3 input	E08: AE4 input	E09: Hybrid open
Bit 33	Bit 34	Bit 35
E10: Hybrid short	E11: Limiter active	E12: Mains supply
Bit 36	Bit 37	Bit 38
-	-	-
Bit 39	Bit 40	Bit 41
E19: internal	Ramp: started	Ramp: pause
Bit 42	Bit 43	Bit 44
Ramp: powerdown	-	Ramp: Cycle finalized
Bit 45	Bit 46	Bit 47
Ramp: Controlled stopped	Ramp: Temp. Alarm	Ramp: Uncontrolled stopped

FUNCTIONAL DESCRIPTIONS

SETPOINT CONTROLLER (W1)

Setpoint controller (W1) 2-point

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected.
The corrected actual value is shown on the display.
The setpoint w is set on the controller and shown on the display.
A hysteresis h can be set on the controller.
The control difference $x_d = (w - h) - x$ is formed in the controller.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	[1] = Fixed value W1
S04	Selection of output function controller	[1] = two-point control
S05	Selection swit-ching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory set-ting**	**Own setting**
P01	Input variable X1	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P10	Control setpoint 1 (=W1)	5	
P11	Switching hysteresis	2	
P12	min. standstill time K1	0	
P13	largest adjustable setpo-int 1	950	
P14	smallest adjustable setpoint 1	-50	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value	0	
P19	Upper analog scaling value	100	
P28	power monitoring load output	0	
P75	Low level mode analog inputs/outputs	0	

Hybrid relay K1 (2-point)

If the control difference is $x_d < 0$, the hybrid relay opens.
If the control difference is $x_d \geq 0$, the hybrid relay closes.

Control of an external SSR relay (2-point)

The external SSR relay is switched via a voltage signal from the controller.

If the control difference is $x_d < 0$, a 0/2V signal is sent to the output and the SSR relay switches off.
If the control difference is $x_d \geq 0$, a 10V signal is given to the output and the SSR relay switches on.

Control of an external power contactor (2-point)

The external power contactor is switched via the controller's safety relay.
A hysteresis h can be set on the controller.

If the control difference is $x_d < 0$, the safety relay opens and the external power contactor switches off.
If the control difference is $x_d \geq 0$, the safety relay closes and the external power contactor switches on.

Setpoint controller (W1) PWM

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected.
The corrected actual value is shown on the display.
The setpoint w is set on the controller and shown on the display.
The hysteresis h is set on the controller and indicates the range in which the controller clocks.
The control difference $x_d = w - x$ is formed in the controller.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	[1] = Fixed value W1
S04	Selection of output function controller	2 = PWM
S05	Selection swit-ching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable X1	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P10	Control setpoint 1 (=W1)	5	
P11	Switching hysteresis	2	
P12	min. standstill time K1	0	
P13	largest adjustable setpoint 1	950	
P14	smallest adjustable setpoint 1	-50	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value	0	
P19	Upper analog scaling value	100	

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P28	power monitoring load output	0	
P75	Low level mode analog inputs/ outputs	0	

Hybrid relay K1 (PWM)

If the control difference is $x_d \leq h$, the hybrid relay clocks.
If the control difference is $x_d > h$, the hybrid relay remains permanently closed.
If the control difference is $x_d < 0$, the hybrid relay remains open.

Control of an external SSR relay (PWM)

The external SSR relay is switched via a voltage signal from the controller.

If the control difference is $x_d \leq h$, the analogue output and the SSR relay clocks.
If the control difference is $x_d > h$, a 10V signal is sent to the output and the SSR relay switches on.
If the control difference is $x_d < 0$, a signal with 0/2V is sent to the output and the SSR relay switches off.

Control of an external power contactor (PWM)

The external power contactor is switched via the controller's safety relay.

If the control difference is $x_d \leq h$, the safety relay clocks.
If the control difference is $x_d > h$, the safety relay remains permanently closed.
If the control difference is $x_d < 0$, the safety relay remains open.

Setpoint controller (W1) proportional control according to ambient temperature

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display.

The setpoint w is set on the controller and shown on the display.
At ambient temperatures in between, the controller runs in cycle mode.
The time unit is defined via P49, with the parameters P42 to P48 being included in the calculation in the refined operating mode. During operation, the TU is continuously calculated and adjusted to the current eviromental conditions.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	[1] = Fixed value W1
S04	Selection of output function controller	3 = Proportional control after ambient temperature
S05	Selection switching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable X1	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P05	output level at the proportional controller/ steady controller	Display only	
P06	time unit on the proportional controller	Display only	
P10	Control setpoint 1 (=W1)	5	
P12	min. standstill time K1	0	
P13	largest adjustable setpoint 1	950	
P14	smallest adjustable setpoint 1	-50	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value	0	
P19	Upper analog scaling value	100	
P28	power monitoring load output	0	
P40	power correction [%]	10	
P41	min. ambient temperature	-30	
P42	material selection	1	
P43	insulation material	6	
P44	thickness insulation material	6	
P45	medium selection	2	
P46	geometry	0	
P47	pipe outer diameter metal	11	
P48	pipe outer diameter plastic	3	
P49	cooling times	0	
P75	Low Level mode analog inputs/ outputs	0	

Hybrid relay K1 (proportional control)

The load contact is open at ambient temperatures above the setpoint (P10).
At ambient tempatures below the entered minimum ambient temperature (P41) + 1/6 of the difference between the setpoint (maintaining temperature) and the minimum ambient temperature, the load contact is closed.

Control of an external SSR relay (proportional control)

The external SSR relay is switched via a voltage signal from the controller.
If the ambient temperature is above the set setpoint (P10), the analogue output emits a signal of 0/2V.

At ambient temperature below the entered minimum ambient temperature (P41) + 1/6 of the difference between the setpoint (maintaining temperature) and the minimum ambient temoerature, the analog output emits a signal of 10V.

Control of an external power contactor (proportional control)

The load contact is open at ambient temperatures above the setpoint (P10)
At ambient tempatures below the entered minimum ambient temperature (P41) + 1/6 of the difference between the setpoint (maintaining temperature) and the minimum ambient temperature, the load contact is closed.

Setpoint controller (W1) with continuous output

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected.
The corrected actual value is shown on the display.
The setpoint w is set on the controller and shown on the display.
The size of the output signal can be limited by a minimum and maximum value on the controller.
The hysteresis h is set on the controller. When controlling with a continuous output, the hysteresis indicates the range in which the output signal varies between 0/4mA and 20mA or 0/2V and 10V.
The control difference $x_d = w - x$ is formed in the controller..
If the control difference is $x_d < h$, the output emits a signal up to 20mA or 10V.
If the control difference is $x_d \geq h$, the output emits a signal of 20mA or 10V.
If the control difference is $x_d < 0$, the output emits a signal of 0/4mA or 0/2V.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	[1] = Fixed value W1
S04	Selection of output function controller	4 = continuous control
S05	Selection swit-ching output	3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable X1	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P05	output level at the proportional controller/ steady controller	Display only	
P10	Control setpoint 1 (=W1)	5	
P11	Switching hysteresis	2	
P12	min. standstill time K1	0	
P13	largest adjustable setpoint 1	950	
P14	smallest adjustable setpoint 1	-50	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value	0	
P19	Upper analog scaling value	100	
P28	power monitoring load output	0	
P75	Low Level mode analog in-puts/ outputs	0	
P76	min. output signal analogue output	0	
P77	max. output signal analogue output	100	

RAMP MODE

Ramp start
Press button „⬆“ for >5 seconds, LED „2“ lights up continuously.
If the actual value is below the value stored for P50 (= start value), this value (P50) is initially heated up (in two-point control). After reaching the start value, the stored ramp function (P51 to P68) is started.
If the actual value is abovw the start value stored for P50, the stored ramp function starts immediately.
After reaching the lsat stored ram value, LED "2" goes out and the set temperature setpoint "P10" is approached (in two-point control) and maintained permanently.

Pause
Press button „⬆“ for >5 seconds, LED „2“ flashes at a regular rate. Current temperature is maintained permanently. By pressing the button „⬇“ again for >5 seconds the ramp continues.

Abort the ramp in a controlled manner
Press button „⬆“ and „⬇“ simultaneously for >5 seconds, LED „2“ flashes alternately long / short. Starting from the current temperature, the ramp is ramped down with the next smaller ramp value. After reaching the smallest ramp value, LED "2" goes out. The set temperature setpoint "P10" is then approached and maintained permanently.

Cancel ram immediately
Press button „⬆“ and „⬇“ simultaneously for >5 seconds, LED „2“ flashes alternately long / short. Press button „⬆“ and „⬇“ simultaneously again for >5 seconds, LED „2“ goes out.
The ramp function is now inactive, the set temperature setpoint "P10" is then approached and maintained permanently.

Ramp mode 2-point

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal.
Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display.
The setpoints w1 to w9 and the associated running times t1 to t9 are set on the controller. The current ramp phase, the current setpoint and the remaining run time of the ramp section can be shown on the display.

A hysteresis h can be set on the controller.
In the controller, the control difference is formed with the current setpoint $x_{di} = (w_i - h) - x$

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	3 = ramp function
S04	Selection of output function controller	[1] = two-point control
S05	Selection swit-ching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	description	factory setting	Own setting
P01	input variable 1 (X1)	Display only	
P03	reference variable (W)	Display only	
P04	current display	Display only	
P07	current ramp phase	Display only	
P08	remaining time ramp phase	Display only	
P10	control setpoint 1 (= W1)	5	
P11	switching hysteresis 1	2	
P15	sensor correction 1	0	
P16	over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value	0	
P19	Upper analog scaling value	100	
P28	power monitoring load output	0	
P40	power correction [%]	10	
P41	min. ambient temperature	-30	
P42	material selection	1	
P43	insulation material	6	
P44	thickness insulation material	6	
P45	medium selection	2	
P46	geometry	0	
P47	pipe outer diameter metal	11	
P48	pipe outer diameter plastic	3	
P49	cooling times	0	
P50	start value	100	
P51	Ramp 1 duration	30	
P52	Ramp 1 setpoint	100	
P53	Ramp 2 duration	30	
P54	Ramp 2 setpoint	100	
P55	Ramp 3 duration	30	
P56	Ramp 3 setpoint	100	
P57	Ramp 4 duration	30	
P58	Ramp 4 setpoint	100	
P59	Ramp 5 duration	30	
P60	Ramp 5 setpoint	100	
P61	Ramp 6 duration	30	
P62	Ramp 6 setpoint	100	
P63	Ramp 7 duration	30	
P64	Ramp 7 setpoint	100	
P65	Ramp 8 duration	30	
P66	Ramp 8 setpoint	100	
P67	Ramp 9 duration	30	

Parameters used			
No.	description	factory setting	Own setting
P68	Ramp 9 setpoint	100	
P69	band alarm hysteresis	5	
P75	Low Level mode analog inputs/ outputs	0	

Hybrid relay K1 (2-point)

If the control difference is $x_{di} < 0$, the hybrid relay opens.
If the control difference is $x_{di} \geq 0$, the hybrid relay closes.

Control of an external SSR relay (2-point)

The external SSR relay is switched via a voltage signal from the controller.

If the control difference is $x_{di} < 0$, a 0/2V signal is sent to the output and the SSR relay switches off.
If the control difference is $x_{di} \geq 0$, a 10V signal is given to the output and the SSR relay switches on.

Control of an external power contactor (2-point)

The external power contactor is switched via the controller's safety relay.

If the control difference is $x_{di} < 0$, the safety relay opens and the external power contactor switches off.
If the control difference is $x_{di} \geq 0$, the safety relay closes and the external power contactor switches on.

Ramp mode PWM

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display
The setpoints w1 to w9 and the associated running times t1 to t9 are set on the controller. The current ramp phase, the current setpoint and the remaining run time of the ramp section can be shown on the display.

The hysteresis h is set on the controller and specifies the range in which the controller clocks.
In the controller the control difference is formed with the current setpoint $x_{di} = w_i - x$

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	3 = ramp function
S04	Selection of output function controller	2 = PWM
S05	Selection switching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	input variable 1 (X1)	Display only	
P03	reference variable (W)	Display only	
P04	current display	Display only	
P07	current ramp phase	Display only	
P08	remaining time ramp phase	Display only	
P10	control setpoint 1 (= W1)	5	
P11	switching hysteresis 1	2	
P15	sensor correction 1	0	
P16	over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value	0	
P19	Upper analog scaling value	100	

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P28	power monitoring load output	0	
P40	power correction [%]	10	
P41	min. ambient temperature	-30	
P42	material selection	1	
P43	insulation material	6	
P44	thickness insulation material	6	
P45	medium selection	2	
P46	geometry	0	
P47	pipe outer diameter metal	11	
P48	pipe outer diameter plastic	3	
P49	cooling times	0	
P50	start value	100	
P51	Ramp 1 duration	30	
P52	Ramp 1 setpoint	100	
P53	Ramp 2 duration	30	
P54	Ramp 2 setpoint	100	
P55	Ramp 3 duration	30	
P56	Ramp 3 setpoint	100	
P57	Ramp 4 duration	30	
P58	Ramp 4 setpoint	100	
P59	Ramp 5 duration	30	
P60	Ramp 5 setpoint	100	
P61	Ramp 6 duration	30	
P62	Ramp 6 setpoint	100	
P63	Ramp 7 duration	30	
P64	Ramp 7 setpoint	100	
P65	Ramp 8 duration	30	
P66	Ramp 8 setpoint	100	
P67	Ramp 9 duration	30	
P68	Ramp 9 setpoint	100	
P69	band alarm hysteresis	5	
P75	Low Level mode analog inputs/ outputs	0	

Hybrid relay K1 (PWM)

If the control difference is $x_{di} \leq h$, the hybrid relay clocks.
If the control difference is $x_{di} > h$, he hybrid relay remains permanently closed.
If the control difference is $x_{di} < 0$, the hybrid relay remains open.

Control of an external SSR relay (PWM)

The external SSR relay is switched via a voltage signal from the controller.
If the control difference is $x_{di} \leq h$, the analogue output and the SSR relay clocks.
If the control difference is $x_{di} > h$, a 10V signal is sent to the output and the SSR relay switches on.
If the control difference is $x_{di} < 0$, a signal with 0/2V is sent to the output and the SSR relay switches off.

Control of an external power contactor (PWM)

The external power contactor is switched via the controller's safety relay.

If the control difference is $x_{di} \leq h$, the safety relay clocks.
If the control difference is $x_{di} > h$, he safety relay remains permanently closed.
If the control difference is $x_{di} < 0$, he safety relay remains open.

Ramp mode with continuous output

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display.
The setpoints w1 to w9 and the associated running times t1 to t9 are set on the controller. The current ramp phase, the current setpoint and the remaining run time of the ramp section can be shown on the display.
The size of the output signal can be limited by a minimum and maximum value on the controller.
The hysteresis h is set on the controller. When controlling with a continuous output, the hysteresis indicates the range in which the output signal varies between 0/4mA and 20mA or 0/2V and 10V.

The control difference $x_{di} = w_i - x$ is formed with the current setpoint in the controller.
If the control difference is $x_{di} < h$, he output emits a signal up to 20mA or 10V.
If the control difference is $x_{di} \geq h$, he output emits a signal of 20mA or 10V.
If the actual value is above the set setpoint w, the output emits a signal of 0/4mA or 0/2V.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value X1	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	3 = ramp function
S04	Selection of output function controller	4 = continuous control
S05	Selection swit-ching output	3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	input variable 1 (X1)	Display only	
P03	reference variable (W)	Display only	
P04	current display	Display only	
P07	current ramp phase	Display only	
P08	remaining time ramp phase	Nur Anzeige	

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P10	control setpoint 1 (= W1)	5	
P11	switching hysteresis 1	2	
P15	sensor correction 1	0	
P16	over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value	0	
P19	Upper analog scaling value	100	
P28	power monitoring load output	0	
P50	start value	100	
P51	Ramp 1 duration	30	
P52	Ramp 1 setpoint	100	
P53	Ramp 2 duration	30	
P54	Ramp 2 setpoint	100	
P55	Ramp 3 duration	30	
P56	Ramp 3 setpoint	100	
P57	Ramp 4 duration	30	
P58	Ramp 4 setpoint	100	
P59	Ramp 5 duration	30	
P60	Ramp 5 setpoint	100	
P61	Ramp 6 duration	30	
P62	Ramp 6 setpoint	100	
P63	Ramp 7 duration	30	
P64	Ramp 7 setpoint	100	
P65	Ramp 8 duration	30	
P66	Ramp 8 setpoint	100	
P67	Ramp 9 duration	30	
P68	Ramp 9 setpoint	100	
P69	band alarm hysteresis	5	
P75	Low Level mode analog inputs/ outputs	0	
P76	min. output signal analogue output	0	
P77	max. output signal analogue output	100	

EXTERNAL SETPOINT

External setpoint 2-point

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display.
The setpoint w comes from an external source as a standard signal (0/4 to 20mA or 0/2 to 10V) and is converted into a digital signal. The converted value is shown on the display.

A hysteresis h can be set on the controller.
The control difference $x_d = (w - h) - x$ is formed in the controller.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value 1 (X1)	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S02	Selection actual value 2 (X2)	5 = voltage input (AE4) 6 = current input (AE4)
S03	Select setpoint W	5 = external setpoint (AE4)
S04	Selection of output function controller	[1] = two-point control
S05	Selection switching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	input variable 1 (X1)	Display only	
P03	reference variable (W)	Display only	
P04	current display	Display only	
P05	output level at the proportional controller/ steady controller	Display only	
P06	time unit on the proportional controller	Display only	
P12	min. standstill time K1	0	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value (0/2V, 0/4mA)	0	
P19	Upper analog scaling value (10V, 20mA)	100	
P28	power monitoring load output	0	
P40	power correction [%]	10	
P41	min. ambient temperature	-30	
P42	material selection	1	
P43	insulation material	6	
P44	thickness insulation material	6	
P45	medium selection	2	
P46	geometry	0	
P47	pipe outer diameter metal	11	
P48	pipe outer diameter plastic	3	
P49	cooling times	0	
P75	Low Level mode analog inputs/ outputs	0	

Hybrid relay K1 (2-point)

If the control difference is $x_d < 0$, the hybrid relay opens.
If the control difference is $x_d \geq 0$, the hybrid relay closes

Control of an external SSR relay (2-point)

The external SSR relay is switched via a voltage signal from the controller.

If the control difference is $x_d < 0$, a 0/2V signal is sent to the output and the SSR relay switches off.
If the control difference is $x_d \geq 0$, a 10V signal is given to the output and the SSR relay switches on.

Control of an external power contactor (2-point)

The external power contactor is switched via the controller's safety relay.

If the control difference is $x_d < 0$, the safety relay opens and the external power contactor switches off.
If the control difference is $x_d \geq 0$, the safety relay closes and the external power contactor switches on.

External setpoint proportional control according to ambient temperature

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display.
The setpoint w comes from an external source as a standard signal (0/4 to 20mA or 0/2 to 10V) and is converted into a digital signal. The converted value is shown on the display.

The time unit is defined via P49, with the parameters P42 to P48 being included in the calculation in the refined operating mode. During operation, the TU is continuously calculated and adjusted to the current eviromental conditions.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value 1 (X1)	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S02	Selection actual value 2 (X2)	5 = voltage input (AE4) 6 = current input (AE4)
S03	Select setpoint W	5 = external setpoint (AE4)
S04	Selection of output function controller	3 = Proportional control after ambient temperature
S05	Selection swit-ching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable X1	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P05	output level at the proportional controller/ steady controller	Display only	
P06	time unit on the proportional controller	Display only	
P12	min. standstill time K1	0	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value (0/2V, 0/4mA)	0	
P19	Upper analog scaling value (10V, 20mA)	100	
P28	power monitoring load output	0	
P40	power correction [%]	10	
P41	min. ambient temperature	-30	
P42	material selection	1	
P43	insulation material	6	
P44	thickness insulation material	6	
P45	medium selection	2	
P46	geometry	0	
P47	pipe outer diameter metal	11	
P48	pipe outer diameter plastic	3	
P49	cooling times	0	
P75	Low Level mode analog inputs/ outputs	0	

Hybrid relay K1 (proportional control)

The load contact is open at ambient temperatures above the setpoint (P10).

At ambient tempatures below the entered minimum ambient temperature (P41) + 1/6 of the difference between the set-point (maintaining temperature) and the minimum ambient temperature, the load contact is closed.
At ambient termperatures in between, the controller runs in cycle mode. The output level P05 is used as the basic display.

Control of an external SSR relay (proportional control)

The external SSR relay is switched via a voltage signal from the controller.
The load contact is open at ambient temperatures above the setpoint (P10).
At ambient temperatures below the entered minimum ambient temperature (P41) + 1/6 of the difference between the setpoint (maintaining temperature) and the minimum ambient temperature, the load contact is permanently switched on.
At ambient temperatures in between, the controller runs in cycle mode. The output level P05 is used as the basic display.

Control of an external power contactor (proportional control)

The load contact is open at ambient temperatures above the setpoint (P10)

At ambient tempatures below the entered minimum ambient temperature (P41) + 1/6 of the difference between the setpoint (maintaining temperature) and the minimum ambient temperature, the load contact is closed. At ambient temperatures in between, the controller runs in cycle mode. The output level P05 is used as the basic display.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value 1 (X1)	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S02	Selection actual value 2 (X2)	5 = voltage input (AE4) 6 = current input (AE4)
S03	Select setpoint W	5 = external setpoint (AE4)
S04	Selection of output function controller	4 = continuous control
S05	Selection switching output	3 = analog output clocked

External setpoint with continuous output

The actual value x is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display.
The setpoint w comes from an external source as a standard signal (0/4 to 20mA or 0/2 to 10V) and is converted into a digital signal. The converted value is shown on the display.

The size of the output signal can be limited by a minimum and maximum value on the controller.
The hysteresis h is set on the controller. When controlling with a continuous output, the hysteresis indicates the range in which the output signal varies between 0/4mA and 20mA or 0/2V and 10V.

The control difference $x_d = w - x$ is formed in the controller..
If the control difference is $x_d < h$, the output emits a signal up to 20mA or 10V.
If the control difference is $x_d \geq h$, the output emits a signal of 20mA or 10V.
If the control difference is $x_d < 0$, the output emits a signal of 0/4mA or 0/2V.

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable X1	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P05	output level at the proportional controller/ steady controller	Display only	
P11	Switching hysteresis	2	
P12	min. standstill time K1	0	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value (0/2V, 0/4mA)	0	
P19	Upper analog scaling value (10V, 20mA)	100	
P28	power monitoring load output	0	
P75	Low Level mode analog inputs/ outputs	0	
P76	min. output signal analogue output	0	
P77	max. output signal analogue output	100	

SLIDING SETPOINT

A sliding setpoint is always used when the temperature in control circuit 1 is to be controlled depending on the temperature in control circuit 2. The setpoint of control circuit 1 (w_1) can be greater, less than or equal to the actual value of control circuit 2 (x_2). In order to accomplish this, a temperature deviation w_2 is set on the controller of control circuit 1, which is offset against the actuavl value x_2.

Sliding setpoint 2-point

The actual value x_1 is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected.
The corrected actual value is shown on the display (P01).
The actual value x_2 is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected.
The corrected actual value is shown on the display (P02).
The temperature deviation w_2 is set on the controller and is used to calculate the sliding setpoint w1.
The sliding setpoint $w_1 = x_2 + w_2$, is calculated in the controller and shown on the display.
A hysteresis h can be set on the controller.
The control difference $x_d = (w_1 - h) - x_1$ is formed in the controller.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value 1 (X1)	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S02	Selection actual value 2 (X2)	[1] = Pt100, 3-wire (AE2) 2 = Pt100, 2-wire (AE2) 3 = thermocouple type J (AE2) 4 = thermocouple type K (AE2) 5 = voltage input (AE4) 6 = current input (AE4)
S03	Select setpoint W	4 = Sliding setpoint (W2+X2)
S04	Selection of output function controller	[1] = two-point control
S05	Selection switching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable 1 (X1)	Display only	
P02	Input variable 2 (X2)	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P11	Switching hysteresis 1	2	
P12	min. standstill time K1	0	
P15	Sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	Low temperature alarm 1	-99	
P18	Lower analog scaling value (0/2V, 0/4mA)	0	
P19	Upper analog scaling value (10V, 20mA)	100	
P20	Control setpoint 2 (= W2)	5	
P23	Largest settable setpoint 2	950	
P24	Smallest settable setpoint 2	-50	
P25	Sensor correction 2	0	
P26	Over temperature alarm 2	999	
P27	Low temperature alarm 2	-99	
P28	Power monitoring load output	0	
P75	Low level mode analog inputs/ outputs	0	

Hybrid relay K1 (2-point)

If the control difference is $x_d < 0$, the hybrid relay opens.
If the control difference is $x_d \geq 0$, the hybrid relay closes.

Control of an external SSR relay (2-point)

The external SSR relay is switched via a voltage signal from the controller.

If the control difference is $x_d < 0$, a 0/2V signal is sent to the output and the SSR relay switches off.
If the control difference is $x_d \geq 0$, a 10V signal is given to the output and the SSR relay switches on.

Ansteuerung eines externen Leistungsschützes (2-Punkt)

If the control difference is $x_d < 0$, the safety relay opens and the external power contactor switches off.
If the control difference is $x_d \geq 0$, the safety relay closes and the external power contactor switches on.

Sliding setpoint PWM

The actual value x_1 is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected.
The corrected actual value is shown on the display (P01).
The actual value x_2 is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected.
The corrected actual value is shown on the display (P02).
The temperature deviation w_2 is set on the controller and is used to calculate the sliding setpoint w1.
The sliding setpoint $w_1 = x_2 + w_2$, is calculated in the controller and shown on the display.
A hysteresis h can be set on the controller and specifies the range in which the controller clocks.
The control difference $x_d = w_1 - x_1$ is formed in the controller.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value 1 (X1)	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S02	Selection actual value 2 (X2)	[1] = Pt100, 3-wire (AE2) 2 = Pt100, 2-wire (AE2) 3 = thermocouple type J (AE2) 4 = thermocouple type K (AE2) 5 = voltage input (AE4) 6 = current input (AE4)
S03	Select setpoint W	4 = Sliding setpoint (W2+X2)
S04	Selection of output function controller	2 = PWM
S05	Selection switching output	[1] = internal hybrid relay with soft start 2 = external power contactor 3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable 1 (X1)	Display only	
P02	Input variable 2 (X2)	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P11	Switching hysteresis 1	2	
P12	min. standstill time K1	0	
P15	Sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	Low temperature alarm 1	-99	
P18	Lower analog scaling value (0/2V, 0/4mA)	0	
P19	Upper analog scaling value (10V, 20mA)	100	
P20	Control setpoint 2 (= W2)	5	
P23	Largest settable setpoint 2	950	
P24	Smallest settable setpoint 2	-50	
P25	Sensor correction 2	0	
P26	Over temperature alarm 2	999	
P27	Low temperature alarm 2	-99	
P28	Power monitoring load output	0	
P75	Low level mode analog inputs/ outputs	0	

Hybrid relay K1 (PWM)

If the control difference is $x_d \leq h$, the hybrid relay clocks.
If the control difference is $x_d > h$, he hybrid relay remains permanently closed.
If the control difference is $x_d < 0$, the hybrid relay remains open.

ontrol of an external SSR relay (PWM)

The external SSR relay is switched via a voltage signal from the controller.

If the control difference is $x_d < 0$, a signal with 0/2V is sent to the output and the SSR relay switches off.
If the control difference is $x_d \geq 0$, a 10V signal is sent to the output and the SSR relay switches on.

Control of an external power contactor (PWM)

If the control difference is $x_d \leq h$, the safety relay clocks.
If the control difference is $x_d > h$, the safety relay remains permanently closed.
If the control difference is $x_d < 0$, the safety relay remains open.

Sliding setpoint with continuous output

The actual value x_1 is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display (P01).
The actual value x_2 is recorded via a temperature sensor or a standard signal and converted into a digital signal. Before this signal is sent to the controller, the actual value is corrected. The corrected actual value is shown on the display (P02).
The temperature deviation w_2 is set on the controller and is used to calculate the sliding setpoint w1.
The sliding setpoint $w_1 = x_2 + w_2$, is calculated in the controller and shown on the display.
The size of the output signal can be limited by a minimum and maximum value on the controller.
The hysteresis h is set on the controller. When controlling with a continuous output, the hysteresis indicates the range in which the output signal varies between 0/4mA and 20mA or 0/2V and 10V.
The control difference $x_d = w_1 - x_1$ is formed in the controller.
If the control difference is $x_d < h$, the output emits a signal up to 20mA or 10V.
If the control difference is $x_d \geq h$, the output emits a signal of 20mA or 10V.
If the actual value is above the set setpoint w, the output emits a signal with 0/4mA or 0/2V.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value 1 (X1)	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S02	Selection actual value 2 (X2)	[1] = Pt100, 3-wire (AE2) 2 = Pt100, 2-wire (AE2) 3 = thermocouple type J (AE2) 4 = thermocouple type K (AE2) 5 = voltage input (AE4) 6 = current input (AE4)
S03	Select setpoint W	4 = Sliding setpoint (W2+X2)
S04	Selection of output function controller	4 = continuous control
S05	Selection switching output	3 = analog output clocked

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable 1 (X1)	Display only	
P02	Input variable 2 (X2)	Display only	
P03	Reference variable W	Display only	
P04	Current display	Display only	
P05	output level at the proportional controller/ steady controller	Display only	
P11	Switching hysteresis	2	
P12	min. standstill time K1	0	
P15	sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	low temperature alarm 1	-99	
P18	Lower analog scaling value (0/2V, 0/4mA)	0	
P19	Upper analog scaling value (10V, 20mA)	100	
P20	Control setpoint 2 (= W2)	5	
P23	Largest settable setpoint 2	950	
P24	Smallest settable setpoint 2	-50	
P25	Sensor correction 2	0	
P26	Over temperature alarm 2	999	
P27	Low temperature alarm 2	-99	
P28	Power monitoring load output	0	
P75	Low level mode analog inputs/ outputs	0	
P76	min. output signal analogue output	0	
P77	max. output signal analogue output	100	

LIMITER

The controller can also be used as a limiter. If the actual value of the heating circuit exceeds the set limit value, the limiter switches off the heating circuit (via the safety relay) and locks it. In order for the heating circuit to be unlocked again, the actual value must first fall below the limit value. In addition, the unlocking must be confirmed on the limiter (with DigIn2 or by pressing„⬆" for 5 seconds).
The set limit value may only exist as a fixed setpoint, so the only options are an external setpoint or setpoint W1.

Structure switch settings		
No.	**description**	**selection option**
S01	Selection actual value 1 (X1)	[1] = Pt100, 3-wire (AE1) 2 = Pt100, 2-wire (AE1) 3 = thermocouple type J (AE1) 4 = thermocouple type K (AE1) 5 = voltage input (AE3) 6 = current input (AE3)
S03	Select setpoint W	[1] = fixed value W1
S04	Selection of output function controller	5 = limiter
S06	Alarm: temperature absolute – relative	[1] = absolute 2 = relative
S07	Select controller release (DigIn1)	[1] = continuously 2 = external

Parameters used			
No.	**description**	**factory setting**	**Own setting**
P01	Input variable 1 (X1)	Display only	
P03	Reference variable (W)	Display only	
P04	current display	Display only	
P11	Switching hysteresis 1	2	
P12	min. standstill time K1	0	
P13	Largest settable setpoint 1	950	
P14	Smallest settable setpoint 1	-50	
P15	Sensor correction 1	0	
P16	Over temperature alarm 1	999	
P17	Under temperature alarm 1	-99	
P28	Current monitoring load output	0	

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