

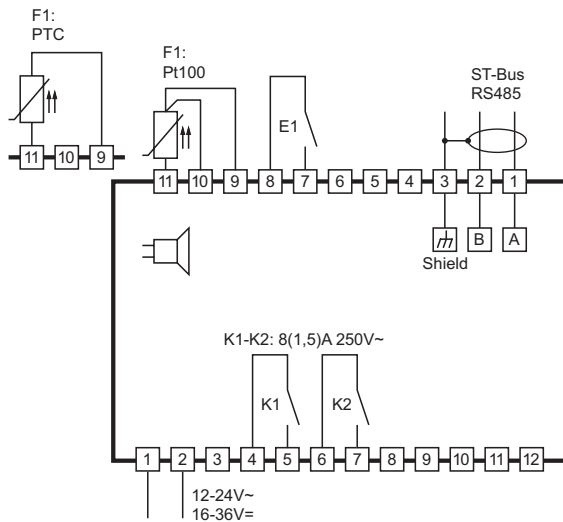
PID controller

Order number: 900310.033

As of: 26.03.2025 V2.31



Wiring diagram



Product description

This microprocessor-controlled controller is used for temperature control with high measurement accuracy. The multi-resistance input can process PTC and Pt100 sensors. PID control and/or thermostat control can be activated via the parameterisation. Two relay contacts are available as outputs.

The controller is networked using an ST-Bus interface. The setpoints and parameters are set using a membrane keypad with five keys.

Range: dependent on type of sensor
Front size: 84mm x 42mm
Panel cut-out: 67.5mm x 31.5mm
Connection: plug and socket

Operating keys



Key UP

- Initiate defrost (after 3 sec.)
- Increasing the setpoint
- In the menu: Selection of the next parameter level (C--, b--, etc.) or the next parameter name (C1, C2, ...)
- In the menu: Increase of the parameter value



Key DOWN

- Switching off the buzzer function (C64)
- Reducing the setpoint
- In the menu: Selection of the previous parameter level (b--, C--, etc.) or the previous parameter name (C2, C1, ...)
- In the menu: Reduction of the parameter value



Function key 2 (if available)

Standard setting: Setpoint changeover (parameterised according to H32)

- Switching the control on or off
- Setpoint changeover
- Autotuning start of the PID control loop (heating circuit only)
- Coupling to an output relay



Key SET

- Displaying the current setpoint
- In the menu: Confirmation of the selected parameter level or parameter name.
- Together with the 'UP' and 'DOWN' keys, a parameter value or the setpoint (if parameter R60 = 0) can be changed.

If the setpoint is specified by the 0-20mA / 0-10V input (R60 > 0), the setpoint cannot be changed via the keys. The measured setpoint from the voltage or current input is displayed.



Function key 1 (if available)

Standard setting: Standby (parameterised according to H31)

- Switching the control on or off
- Setpoint switching
- Autotuning start of the PID control loop (heating circuit only)
- Coupling to an output relay

Control levels:

Parametrisation of the setpoint

The control setpoint C1 is accessible directly with SET key.

Pressing also the UP or DOWN key it can be adjusted.

The activation of the second setpoint of circuit 1 C2 is indicated on the display with a flashing point to the right. It can either be activated via switching entrance or with a function key (depending on parameter).

Menu levels

By pressing the 'UP' and 'DOWN' keys simultaneously for at least 4 seconds, the controller changes to the menu level. This consists of several submenus, which are marked by the respective initial letter followed by 2 dashes (e.g. C-- for the C-level).

	Menu	Function
C--	Controller level	Application parameters
b--	Between level	Linking parameters
H--	Hardware level	Hardware parameters
d--	Defrost level	Defrosting parameters
R--	Analogue level	Parameter for analogue in- and outputs

Adjustment of control parameters

The submenu is selected by pressing the 'UP' or 'DOWN' key. If you press the 'SET' key, the password for the respective level is requested. This must be set accordingly by additionally pressing the 'UP' or 'DOWN' key.

(Default value: 0 = deactivated).

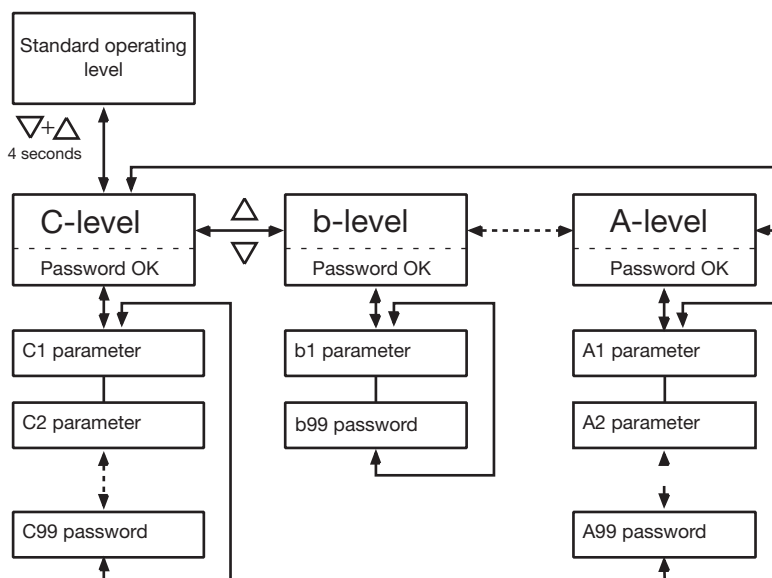
The last parameter of the respective submenu (e.g. C99, b99, ...) corresponds to the current password of this level and can be changed there.

After releasing the 'SET' key, if the password is entered correctly, the display jumps to the submenu and shows the first parameter of the list there. If you press the 'SET' key, the value of the selected parameter is displayed. It can be adjusted by pressing the 'UP' or the 'DOWN' key. After releasing all keys, the new value is permanently stored.

If the 'UP' and 'DOWN' keys are pressed again simultaneously for at least 4 seconds, the display changes back to the menu level. If you press the 'UP' and 'DOWN' keys again for at least 4 seconds or if no key is pressed for more than 60 seconds, the display returns to the basic status.

Software version

The software version number can be called up by pressing the 'SET' + 'UP' + 'DOWN' key simultaneously.



The C-level (controller)

This level contains the application parameters.

Thermostat 1

Parameter	Function	Adjustment range	Standard value	Custom value
C1	Setpoint control circuit 1	C10 ... C11	0.0 °C	
C2	Setpoint control circuit 1 (*)	C10 ... C11	0.0 °C	
C3	Offset for C1/C2	-99.0 ... 99.0 °K	0.0 K	
C4	Switching sense control circuit 1	0: heating function 1: cooling function	0	
C5	Hysteresis control circuit 1	0.1 ... 99.9 °K	1.0 K	
C6	Hysteresis mode control circuit 1	0: symmetrical 1: one-sided	0	
C7	Minimum action time control circuit 1 "ON"	0 ... 400 sec.	0 sec.	
C8	Minimum action time control circuit 1 "OFF"	0 ... 400 sec.	0 sec.	
C9	Function control circuit 1 at sensor error	0: relay off 1: relay on	0	
C10	Max. control range limitation, setpoint 1	-99.0 °C ... C11	-99.0 °C	
C11	Min. control range limitation, setpoint 1	C10 ... 999.0 °C	999 °C	

* The activation of the second setpoint [C2](#) is indicated on the display with a flashing point to the right. It can be activated either via the switching input or via function key 1 or 2. (depending on parameter [H31](#) or [H32](#)).
See also the chapter Notes on setpoint changeover.

Thermostat 2

Parameter	Function	Adjustment range	Standard value	Custom value
C21	Setpoint control circuit 2 (b1 =0)	C30 ... C31	0.0 °C	
C23	Offset for C1/C21 (b1 =1)	-99.0 ... 99.0 °K	0.0 K	
C24	Switching sense control circuit 2	0: heating function 1: cooling function	0	
C25	Hysteresis control circuit 2	0.1 ... 99.9 °K	1.0 K	
C26	Hysteresis mode control circuit 2	0: symmetrical 1: one-sided	0	
C27	Minimum action time control circuit 2 "ON"	0 ... 400 sec.	0 sec.	
C28	Minimum action time control circuit 2 "OFF"	0 ... 400 sec.	0 sec.	
C29	Function control circuit 2 at sensor error	0: relay off 1: relay on	0	
C30	Max. control range limitation, setpoint 2	-99.0 °C ... C31	-99.0 °C	
C31	Min. control range limitation, setpoint 2	C30 ... 999.0 °C	999 °C	

Thermostat 3

C41	Setpoint control circuit 3 (b2 =0)	C50 ... C51	0.0 °C	
C43	Offset for C1/C41 (b2 =1)	-99.0 ... 99.0 °K	0.0 K	
C44	Switching sense control circuit 3	0: heating function 1: cooling function	0	
C45	Hysteresis control circuit 3	0.1 ... 99.9 °K	1.0 K	
C46	Hysteresis mode control circuit 3	0: symmetrical 1: one-sided	0	
C47	Minimum action time control circuit 3 "ON"	0 ... 400 sec.	0 sec.	
C48	Minimum action time control circuit 3 "OFF"	0 ... 400 sec.	0 sec.	
C49	Function control circuit 3 at sensor error	0: relay off 1: relay on	0	
C50	Max. control range limitation, setpoint 3	-99.0 °C ... C51	-99.0 °C	
C51	Min. control range limitation, setpoint 3	C50 ... 999.0 °C	999 °C	

Boundary or range alarm

C61	Lower alarm value	-99.0 ... C62 °C	-10.0 °C	
C62	Upper alarm value	C61 ... 999.0 °C	10.0 °C	

Parameter	Function	Adjustment range	Standard value	Custom value
C63	Alarm functions	0: Boundary alarm, relative boundaries 1: Boundary alarm, absolute boundaries 2: Range alarm, relative boundaries 3: Range alarm, absolute boundaries 4: Boundary alarm, relative boundaries, alarm inverse 5: Boundary alarm, absolute boundaries, alarm inverse 6: Range alarm, relative boundaries, alarm inverse 7: Range alarm, absolute boundaries, alarm inverse	0	
C64	Special function at boundary alarm	0: not active 1: flashing display 2: buzzer 3: buzzer + flashing display 4: like 3, buzzer can be cancelled 5: like 4, restarts after 10 min. 6: like 4, restarts after 30 min	4	
C65	Hysteresis alarm circuit	0.1 ... 99.9 K	1 K	
PID controller				
C82	Proportional area at PID control	0.1 ... 999.0 °K	10 K	
C83	Reset time at PID control (I-portion)	0...999 sec., 0: inactive	600 s	
C84	Lead time at PID control (D-portion)	0...999 sec., 0: inactive	0 s	
C85	Cycle time at PID control	2...100 sec.	8 s	
C86	Control variable dead volume	0.0 ... 100.0%	0,0 %	
C87	Function PID control circuit at sensor error	-100.0% ... 0 ... 100.0%	0,0 %	
C88	PID-mode	0: PID 1: DiffPID (2 relays – heating, cooling) 2: PID with dead volume at analogue exit	0	
C89	Cycle time motor valve (Differential PID)	2...100 sec.	8 s	
C90	Anti-Windup, lower limit for P+I portion	-100 ... 100 %	-100	
C91	Anti-Windup, upper limit for P+I portion	-100 ... 100 %	100	
Password				
C99	Password C level	-99...999	0	

b-level (between)

This level contains the parameters for different combinations.

Parameter	Function	Adjustment range	Standard value	Custom value
b1	Activation setpoint combination for thermostat 1 and 2 (C23 = deltaW2)	0: no combination 1: Setpoint thermostat 2 = C1/C2 + C23	0	
b2	Activation setpoint combination for thermostat 1 and 3 (C43 = deltaW3)	0: no combination 1: setpoint thermostat 3 = C1/C2 + C33	0	
b11	Delay control circuit 1, 2, 3 after "Power-On"	0...400 sec.	0 sec.	
b12	Mutual delay control circuit 1, 2, 3	0...400 sec.	0 sec.	
b13	Alarm suppression after "Power-On", "setpoint"	0...60 min.	20 min.	
b21	Linking analogue exit	0: actuating variable 1: actual value 2: setpoint	0	
b99	Password b-level	-99 ... 999	0	

H level (Hardware)

This level contains the hardware parameters.

Parameter	Function	Adjustment range	Standard value	Custom value
H1	Key-lock	0: no key-lock 1: key-lock	0	
H11	Indication mode display 1	0: integrals 1: decimals in 0.5 °K 2: decimals in 0.1 °K 3: decimals in 0.01 °K	2	

Parameter	Function	Adjustment range	Standard value	Custom value
H 12	Display mode	1: actual value 2: setpoint 3: PID control variable	1	
H 15	Temperature scale	0: Celsius 1: Fahrenheit	0	
H 16	Indication standby	0: no display (point to the right) 1: RUS 2: OFF	1	
H 17	Mode following "Power-On" "	0: Off 1: On 2: Auto	1	
H3 1	Assigning function key 1	0: no function 1: Controller on/off (standby) 2: Setpoint 1 / Setpoint 2 3: Start autotuning 4: Relay (H4 1 ... H44 = 7), off on Standby 5: Relay (H4 1 ... H44 = 7), independent of Standby	1	
H32	Assigning function key 2	0: no function 1: Controller on/off (standby) 2: Setpoint 1 / Setpoint 2 3: Start autotuning 4: Relay (H4 1 ... H44 = 8), off on Standby 5: Relay (H4 1 ... H44 = 8), independent of Standby	2	
H33	Assigning switching input E1	0: no function 1: C 1/C2 2: Setpoint 1 / Setpoint 2 3: Relay (H4 1 ... H44 = 9), off on Standby 4: Relay (H4 1 ... H44 = 9), independent of Standby	2	
H35	Activation of key acknowledgement	0: no key acknowledgement 1: key acknowledgement with buzzer	0	
H4 1	Function output K1	0: no connection 1: thermostat 1 2: thermostat 2 3: thermostat 3 4: alarm function 5: PID heating 6: PID cooling 7: Function key 1 (H3 1 >= 4) 8: Function key 2 (H32 >= 4) 9: Function switching input (H33 >=3)	5	
H42	Function output K2	see H4 1	0	
H43	Function output K3	see H4 1	0	
H44	Function output K4	see H4 1	0	
H5 1	Mains frequency	0: 50Hz 1: 60Hz	0	
L0	ST-Bus address	1 ... 250	5	
H99	Password H level	-99..999	0	

d-level (defrosting functions)

This level contains the parameters for defrosting.

NOTE: Defrosting parameter only affects control circuit 1

Parameter	Function	Adjustment range	Standard value	Custom value
d0	Defrosting interval TH1	1 ... 99h 0: no defrosting	0	
d2	Defrosting temperature TH1	-99.0 ... 999.0°C	10.0 °C	
d3	Defrosting time limit TH1	1 ... 99 min. 0: no time limit	30 min	
d9	Manual defrosting TH1	0...1	0	
d99	Password d-level	-99...999	0	

Die A-level (analogue values)

This level contains the parameters for analogue inputs and outputs

Parameter	Function	Adjustment range	Standard value	Custom value
R1	Actual value	-		
R2	Actual value correction thermocouple/temperature sensor (does not apply to current/voltage input)	-99.0 ... 99.9 °K	0 K	
R3	Weighing factor	0.50 ... 1.50	1.00	
R4	Sensor type	1: Thermocouple type J 2: Thermocouple type K 11: Pt100 two-wire 12: Pt100 three-wire 13: Pt1000 two-wire 14: Pt1000 three-wire 21: KTY81-121 two-wire 31: Voltage input 0 ... 10 V 32: Voltage input 2 ... 10 V 41: Current input 0 ... 20 mA (sink) 42: Current input 4 ... 20 mA (sink) 43: Current input 0 ... 20 mA (source) 44: Current input 4 ... 20 mA (source) 50: Quantity counting	12	
R5	Display value for lower value of U/I analogue input	-99.0 ... 999	0.0	
R6	Display value for upper value of U/I analogue input	-99.0 ... 999	100.0	
R7	Quantity counting scaling	1 ... 9999 pulses/unit of measure	1000	
R8	Display type of the quantity counting	0: Pulses / sec. (= frequency) 1: Quantity / sec. 2: Quantity / min.	0	
R9	Units for measured values, setpoints and parameters	0: without unit 1: counter 2: °C 3: bar 4: Pa 5: %rH 6: % 7: l/min 8: l/h	2	
R40	Time constant of the software filter X = 160 ms (50 Hz, H51 = 0) X = 400 ms (60 Hz, H51 = 1)	0: not active, otherwise average value over 1: 2 measured values (approx. 2*X s) 2: 4 measured values (approx. 4*X s) 3: 8 measured values (approx. 8*X s) 4: 16 measured values (approx. 16*X s) 5: 32 measured values (approx. 32*X s) 6: 64 measured values (approx. 64*X s)	2	
R50	Display of the PID control variable	-		
R51	Display value for lower value at analogue output (0V/0mA)	-99.0 ... (R52 - 0,5) 0 at sensor error (b2 ! = 1)	0.0	
R52	Display value for upper value at analogue output (10V/20mA)	(R51 + 0,5) ... 999	100	
R53	Output value full cooling power (-100.0..0%)	0 ... 10.0 (10 corresponds to 10 V or 20 mA)	0.0	
R54	Output value "0" power	0 ... 10.0 (10 corresponds to 10 V or 20 mA)	0.0	
R55	Output value full heating power (0..100.0%)	0 ... 10.0 (10 corresponds to 10 V or 20 mA)	10.0	
R60	Type of setpoint sensor	0: Fixed value from parameter memory (C1) 31: Voltage input 0 ... 10 V 32: Voltage input 2 ... 10 V 41: Current input 0 ... 20 mA (sink) 42: Current input 4 ... 20 mA (sink) 43: Current input 0 ... 20 mA (source) 44: Current input 4 ... 20 mA (source)	0	
R99	Password A-level	-99 ... 999	0	

Notes on setpoint changeover

Shortcut for setpoint setting via the voltage / current input = „analogue“.

Switching between the two setpoints **C1** (**R60** = 0) or setpoint setting via the analogue input (**R60** > 0) and **C2** can be done via the switching input E1 as well as via the function keys **F1** or **F2**.

The following rules apply:

- A setpoint **C1**/analogue to **C2** switched by a function key can be switched back (**C1**/analogue) by pressing another function key. The function keys must be configured for setpoint switching by the parameters **H31** = 2 (**F1**) or **H32** = 2 (**F2**).
- The switching input can also switch between the setpoints by closing and opening the switching contact.
- By opening the contact, the switching input E1 is able to switch back a setpoint (**C1**/analogue to **C2**) that has been switched by a function key. It acts like an additional function key.
- Conversely, this can also be done by a function key. A setpoint switched by the switching input can be switched back again by **F1** or **F2**.

Important:

In the event of a power failure and standby operation, the last set status is saved.

C-level:

C1: Setpoint control circuit 1

This value corresponds with the setpoint set at the first control level.

Important: For **C1** to be used, parameter **R60** must be = 0. Otherwise, the applied voltage (pins 4/5) or current (pins 4/5 or 5/7) is used as the setpoint.

C2: Setpoint control circuit 1 at closed switching input

Setpoint **C2** can only be called up via the 'SET' key if input E1 is closed or one of the function keys **F1** or **F2** has been pressed (see also the chapter Notes on setpoint switching).

If the quantity counting function (50) was set via the sensor selection (parameter **R4**), then the switchover via input E1 is deactivated.

C3: Offset for C1/C2

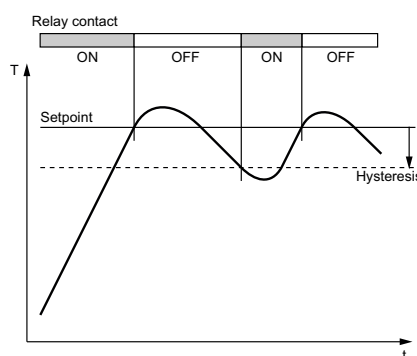
This adjusted value will build the difference to the setpoint for control circuit 1, i.e. there is no regulation according to the pre-set value, but according to the sum of desired value and the value of **C3**.

C4: Switching sense control circuit 1

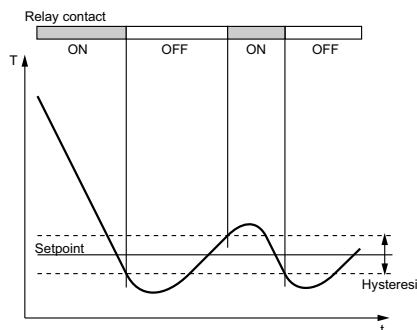
The switching sense for the relays, i.e. cooling or heating function, can be programmed independently. Heating function means that the contact falls as soon as the pre-set setpoint is reached, thus power interruption. At cooling function, the contact only tightens, if the actual value is above the required setpoint.

C5: Hysteresis control circuit 1

The hysteresis can be set symmetrically or one-sided at the desired value (see **C6**). At one-sided setting, the hysteresis works downward with heating contact and upward with cooling contact. At symmetrical hysteresis, half of the hysteresis' value is effective below and half of the value above the switching point.



Heating controller, one-sided hysteresis



Cooling controller, one-sided hysteresis

C6: Hysteresis mode control circuit 1

These parameters allow selection as to whether the hysteresis values which are adjustable with **C5**, are set symmetrically or one-sided at the respective switching point. At symmetrical hysteresis, half of the hysteresis' value is effective below and half of the value above the switching point. The one-sided hysteresis works downward with heating contact and upward with cooling contact.

C7/C8: Minimum action time control circuit 1 "On"/"Off"

These parameters permit a delay in switching on/off the relay in order to reduce the switching frequency. The adjusted time sets the entire minimum time period for a switching-on or switching-off phase

C9: Function circuit 1 at sensor error

At sensor error the selected relay (see **H41** ... **H44**) falls back into the condition pre-set here.

C10: Setpoint limit (min) setpoint 1

C11: Setpoint limit (max) setpoint 1

The adjustment range of the setpoint can be limited in both directions. This is to prevent the end user of a unit from setting inadmissible or dangerous setpoints.

C21: Setpoint control circuit 2 (thermostat) (b1=0)

If **b1** = 1, this value is ineffective.

C23: Value deltaW2 (b1=1)

If **b1** = 1, the setpoints for control circuit 1 and 2 are linked with one another via switching difference deltaW2 (operation with deltaW). The following applies: Setpoint thermostat 2 = setpoint control circuit 1 (**C1/C2**) + deltaW2.

This difference can take positive or negative values. Thus, a leading or following contact can be realised.

C24: Switching sense control circuit 2

The switching sense for the relays, i.e. cooling or heating function, can be programmed independently at works. Heating function means that the contact falls as soon as the pre-set setpoint is reached, thus power interruption. At cooling function, the contact only tightens, when the actual value is above the required setpoint.

C25: Hysteresis control circuit 2

The hysteresis can be set symmetrically or one-sided at the setpoint (see **C26**). At one-sided setting, the hysteresis works downward with heating contact and upward with cooling contact. At symmetrical hysteresis, half of the hysteresis' value is effective below and half of the value above the switching point.

C26: Hysteresis mode control circuit 2

These parameters allow selection as to whether the hysteresis values which are adjustable with **C25**, are set symmetrically or one-sided at the respective switching point. At symmetrical hysteresis, half of the hysteresis' value is effective below and half of the value above the switching point. The one-sided hysteresis works downward with heating contact and upward with cooling contact.

C27: Minimum action time control circuit 2 "On"

C28: Minimum action time control circuit 2 "Off"

These parameters permit a delay in switching on/off the relay, in order to reduce the switching frequency. The adjusted time sets the entire minimum time period for a switching-on or switching-off phase.

¶29: Function control circuit 2 at sensor error

At sensor error the selected relay (see ¶41, ¶42) falls back into the condition pre-set here.

¶30: Setpoint limit (min) setpoint 2 ¶31: Setpoint limit (max) setpoint 2

The adjustment range of the setpoint can be limited in both directions. This is to prevent the end user of a unit from setting inadmissible or dangerous setpoints.

¶41: Setpoint thermostat 3 (b2=0)

If b2=1, this value is ineffective.

¶43: Value deltaW3 (b2=1)

If b2=1, the setpoints for control circuit 1 and 2 are linked with one another via switching difference deltaW3 (operation with deltaW). The following applies: Setpoint thermostat 3 = setpoint control circuit 1 (¶1/¶2) + deltaW3.

This difference can take positive or negative values. Thus, a leading or following contact can be realised.

¶44: Switching sense control circuit 3

The switching sense for the relays, i.e. cooling or heating function, can be programmed independently at works. Heating function means that the contact falls as soon as the pre-set setpoint is reached, thus power interruption. At cooling function, the contact only tightens, when the actual value is above the required setpoint.

¶45: Hysteresis control circuit 3

The hysteresis can be set symmetrical or one-sided at the setpoint (see ¶46). At one-sided setting, the hysteresis works downward with heating contact and upward with cooling contact. At symmetrical hysteresis, half of the hysteresis' value is effective below and half of the value above the switching point.

¶46: Hysteresis mode control circuit 3

These parameters allow selection as to whether the hysteresis values which are adjustable with ¶45, are set symmetrically or one-sided at the respective switching point. At symmetrical hysteresis, half of the hysteresis' value is effective below and half of the value above the switching point. The one-sided hysteresis works downward with heating contact and upward with cooling contact.

¶47: Minimum action time control circuit 2 "On"

¶48: Minimum action time control circuit 2 "Off"

These parameters permit a delay in switching on/off the relay, in order to reduce the switching frequency. The adjusted time sets the entire minimum time period for a switching-on or switching-off phase.

¶49: Function control circuit 3 at sensor error

At sensor error the selected relay (see ¶41, ¶42) falls back into the condition pre-set here.

¶50: Setpoint limit (min) setpoint 3 ¶51: Setpoint limit (max) setpoint 3

The adjustment range of the setpoint can be limited in both directions. This is to prevent the end user of a unit from setting inadmissible or dangerous setpoints.

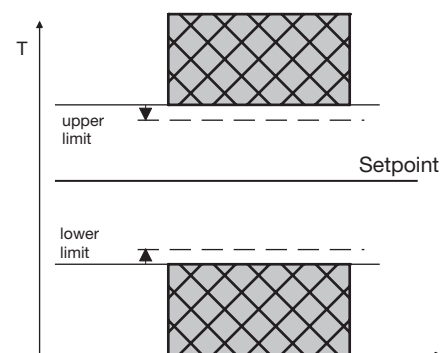
¶61: Lower alarm value

¶62: Upper alarm value

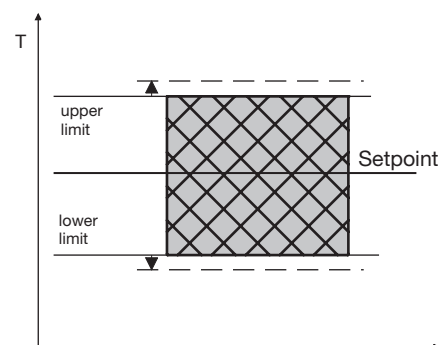
The exit alarm is a boundary alarm or a range alarm with one-sided hysteresis (see parameter ¶65). Both at the boundary alarm and the range alarm, limit values can be relative, i.e. going along with the setpoint ¶1/¶2, or absolute, i.e. independent of the setpoint ¶1/¶2. At boundary alarm the hysteresis works one-sided inwardly, and at range alarm outwardly (see pictures).

¶63: Function exit alarm

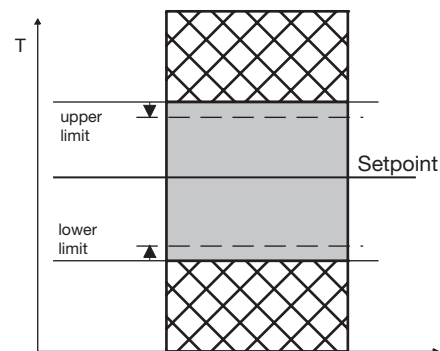
The exit alarm evaluates an upper and a lower limit value (see parameters ¶61 and ¶62), whereas a selection is possible as to whether the alarm is active if the temperature lies within these two limits, or whether the alarm is released if the temperature lies beyond them. In the case of sensor error, the alarm is activated independently of this adjustment. The exit can also be inverted, so that it functions like a release (see pictures).



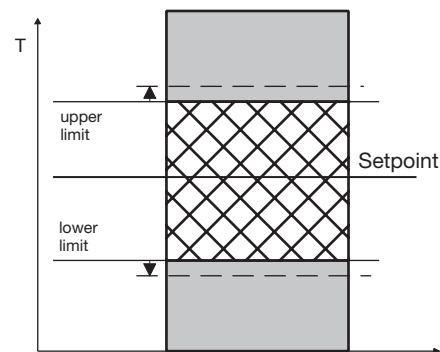
Boundary alarm, alarm contact normal:
¶63=0 limits relative, ¶63=1 limits absolute



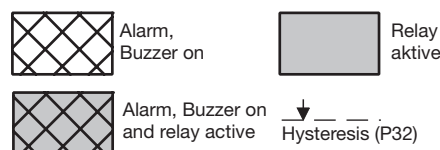
Range alarm, alarm contact normal:
¶63=2 limits relative, ¶63=3 limits absolute



Boundary alarm, alarm contact inverse:
¶63=4 limits relative, ¶63=5 limits absolute



Range alarm, alarm contact inverse:
¶63=6 limits relative, ¶63=7 limits absolute



¶64: Special function at alarm

Here can be selected whether, in the case of emergency, the indication to flash and/or the buzzer is to start. Sensor alarm (display F1L or F1H) is indicated independently thereof by flashing display and the buzzer runs off.

A sensor alarm (display F1L, F1H or FSL, FSH) is indicated independently by a flashing display and the buzzer sounds. The buzzer can be switched off at any time by pressing the 'DOWN' key. The buzzer is switched on again after 10 minutes if the error is still present.

¶65: Hysteresis alarm circuit

Hysteresis is set one-sided at the adjusted limit value. It becomes effective depending on alarm definition.

PID - control

¶82: Proportional band at PID regulation

The proportional band works in such a way that with approximation of the actual value to the setpoint the variable is reduced linearly from +100% to 0%.

▮▮▮ C83: Reset time at PID regulation (I-portion)
▮▮▮ C84: Lead time at PID regulation (D-portion)

The proportional controller as such has a remaining deviation of the actual value from the setpoint. The integral portion provides for a complete compensation of this offset.

The reset time is a measure for the period of time needed to adjust a remaining temperature deviation of the size of the proportional range.

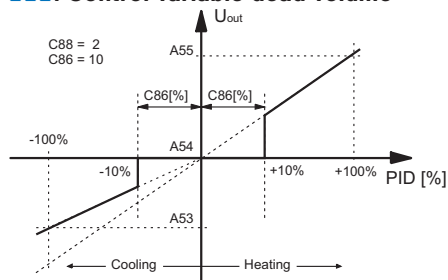
If a small reset time is set, a fast post-adjustment will take place. At a too small reset time, however, the system may tend to vibrate.

The differential portion dampens temperature changes.

If lead time is set for long, damping is strong. At too long lead time, however, the system may tend to vibrate. At setting 0 the values are ineffective. It is therefore possible to realise a pure PI or PD regulation.

▮▮▮ C85: Cycle time at PID regulation

During the cycle time the control exit runs through one switching period, i.e. once switched out and once switched on. The smaller the cycle time, the faster the regulation. By consequence, however, there is also an increased switching frequency of the output, which can lead to rapid wear of relay contacts. For very fast control ways with the respective high switching frequency a voltage output is therefore of advantage.

▮▮▮ C86: Control variable dead volume


With parameter **C86**, the size of the dead volume can be set in % of the PID control value. This function is usually used with clocked PID controllers (relays) to achieve a minimum switch-on time. With **C88** = 1 (differential PID), a pseudo hysteresis can be realised. This leads to a reduction in the switching frequency, provided the actual value is approximately equal to the setpoint. For **C88** = 2, the dead volume is also made available at the analogue output.

▮▮▮ C87: Function PID control circuit at sensor error

In the case a sensor error, the PID variable automatically goes to the condition set here.

▮▮▮ C88: PID-Mode

[C88 = 0] PID standard

[C88 = 1] PID differential (see below)

[C88 = 2] PID standard with dead volume at analogue exit

PID differential: The differential mode is particularly suitable for the use of control valves (e.g. K1=OPEN, K2=CLOSED). As long as the value computed by the PID circuit remains constant, both exits remain inactive, i.e. the valve stops at the current position.

PID Standard (C88 = 0/2)			
	PID	K1: Heating	K2: Cooling
1	20 %	20 %	0 %
2	25 %	25 %	0 %
3	25 %	25 %	0 %
4	10 %	10 %	0 %
5	-20 %	0 %	20 %

PID Differential (C88 = 1)			
	PID	K1: Heating	K2: Cooling
1	+20 %	20 %	0 %
2	+5 %	5 %	0 %
3	±0 %	0 %	0 %
4	-15 %	0 %	15 %
5	-30 %	0 %	30 %

Thus, control valves almost show the same controlling results as analogue valves. The table shows the different behaviour of both modes within the same control system.

▮▮▮ C89: Cycle time control valve (DiffPID)

This parameter sets the time the control valve needs to go from 0% to 100%.

If **C88**=1, the PID variable is converted to this interval. The PID cycle time (**C85**) remains unaffected by this. When this time is defined, indication with a rounded up value in seconds is recommended.

Furthermore **C85** should be $\geq$ **C89**. At $\pm 100\%$ the respective exit remains durably active (synchronisation).

▮▮▮ C99: Password

Password for the **C--** level.

Autotuning of PID heating circuit:

Autotuning is intended to adapt and optimise the control behaviour to the controlled system. The following must be observed:

- Autotuning can be initiated via function key **F1** or **F2**. To do this, set parameters **H31** or **H32** to 3.

- Autotuning only affects one heating circuit. Before the tuning process, at least one output relay (K1 ... K4) must be set to heating (= 5) via parameters **H41** ... **H44**.

- The setpoint must be at least 20 K higher than the actual value. Otherwise "----" is displayed (for 2 sec.) and autotuning is not started.

- After initiating the tuning process until its end, the display alternates between the normal display value (e.g. actual value) and

'Auto' (can take 1 hour or more). Afterwards, the measured value display returns to normal.

- The tuning process changes parameters **C82** ... **C85**.

- After a power failure or switching to standby mode before the end of tuning makes it necessary to restart the tuning process. The above parameters have been changed by its start.

- Changing the setpoint also requires a restart of the tuning process.

- It may be necessary to readjust the above parameters **C82** ... **C85** by hand even after an auto-tuning has been carried out.

b-level
b1: Activation setpoint combination for thermostat 1 and 2 (deltaW2)

This parameter determines whether the setpoints for thermostat 1 and 2 independently adjustable (parameter **C21**) or whether they are tied with one another via a switching off-set deltaW2 (parameter **C23**).

b2: Activation setpoint combination for thermostat 1 and 3 (deltaW3)

This parameter determines whether the setpoints for thermostat 1 and 3 independently adjustable (parameter **C41**) or whether they are tied with one another via a switching off-set deltaW2 (parameter **C43**).

b11: Delay control circuit 1, 2, 3 after "Power-On"

This parameter allows a switching-on delay of relays after switching-on the mains voltage. This delay corresponds with the time set here.

b12: Mutual delay control circuit 1, 2, 3

This parameter makes a mutual switching-on delay of relays possible, depending on whichever contact is switched first.

b13: Alarm suppression after "Power-On", "setpoint"

This parameter allows a switching-on delay of the alarm contact after switching on the mains voltage. This delay corresponds with the time set here.

b21: Analogue output link

b21=0: Output of actuating variable (PID)

b21=1: Output of actual value (measured value)

b21 = 2: Output of setpoint

Important:

The assignment of the output voltage (max. 0..10 V or 0.. 20 mA) to the displayed value is carried out via parameters **A51** and **A52**. Only positive voltages or currents can be output.

b99: Password

Password for the b-level.

H-level

H 1: Key-lock

The key-lock allows blocking of the control keys. In locked condition parameter adjustments with keys is not possible. At the attempt to adjust the parameters despite key-lock the message “---” appears in the display.

H 11: Indication mode display

If the range is exceeded, the system automatically switches to the next lower resolution level (e.g. 99.99 °C → 100.0 °C or -99.9 °C → -100 °C).

Parameter settings and setpoints are always displayed with a resolution of 0.1 °C.

H 12: Display mode

If the setpoint or the PID control value is selected instead of the actual value, the current actual value can only be displayed via parameter **R 1**. Conversely, if the actual value is displayed, the PID control value can only be called up via **R50**.

H 15: Temperature scale

The display can be switched between Fahrenheit and Celsius. This is only a different type of display. Within the controller, the calculation is still done in °C.

(Example: 100 °C is displayed as 212 °F).
ATTENTION: Display limits for °F can be smaller than the actual measuring range!

H 16: Indication standby

In standby mode the here set value appears in the display.

H 17: Mode following “Power-On”

0: OFF, the controller is immediately switched to standby mode.

1: ON, the controller is switched on normally.
2: AUTO, depending on the operating state before disconnection from the mains, the controller is moved to the last set state.

H3 1/H32: Assigning function key 1/2

0: The key is deactivated

1: Standby button. The controller can be switched on or off.

2: Switching between setpoint 1 (**⏮**) and setpoint 2 (**⏭**), see also the chapter Notes on setpoint changeover.

3: Initiate PID autotuning to optimise the PID control behaviour.

See also the chapter Autotuning of the PID heating circuit.

4: Assignment of a relay **H4 1...H44**

After mains interruption, the relay is off.

5: Assignment of a relay **H4 1...H44**

After mains interruption, the state remains stored.

Exceptions:

- Autotuning must be restarted

- A possibly switched on relay must be switched again.

H33: Function switching input E1

0: E1 deactivated

1: Standby, controller can be switched on or off.

2: Toggle setpoint 1 (**⏮**) and 2 (**⏭**).

3: Assignment of a relay (**H4 1...H44** = 9).

After mains interruption, the relay is off.

4: Assignment of a relay (**H4 1...H44** = 9)

After mains interruption, the state remains stored.

H35: Key acknowledgement

This parameter permits to switch the internal buzzer on/off by key confirmation.

H4 1 ... H44: Function output K1 ... K4

H5 1: Mains frequency

This parameter is to select the mains frequency.

L0: Bus address

Setting the ST-Bus address for connection to higher-level control instances.

H99: Password

This parameter is to adjust the password for the H-level

d-level:

d0: Defrosting interval

The “defrosting interval” defines the time, after which a defrosting process is started. After each defrosting start, this time is reset and runs the next interval.

Manual defrosting:

Pressing the key UP for at least 3 sec. the defrosting interval is activated earlier. Alternatively, parameter **d9** can be applied for this function, too. The next automatic defrosting process takes place again after the time **d0** (defrosting synchronisation).

d2: Defrosting temperature

This permits to terminate defrosting when the adjusted desired temperature value is reached. The defrosting time set with “**d3**” nevertheless runs at the same time, i.e. it functions as safety net to terminate the defrosting process in case the defrosting temperature is not reached.

d3: Defrosting time limit

After the here set time the defrosting process is terminated.

d9: Manual defrosting

At change of 0 → 1 the defrosting process is started and the defrosting interval is re-set (defrosting synchronisation).

d99: Password

This parameter is to set the password for the d-level.

A-level:

R 1: Indication of actual value sensor F 1

The here indicated temperature value is the sum of the actual measured value of sensor F1 and the actual value correction according to parameter **R2**.

R2: Actual value correction sensor F 1

With this parameter it is possible to correct actual value deviations caused by sensor tolerances or extremely long sensor lines for example. The control measuring value is increased or decreased by the here set value.

R3: Weighing factor sensor F 1

With this parameter the actual value can be submitted to weighing. The measured value is multiplied by it and both indicated in the display and applied for regulation.

R4: Sensor type F 1

This parameter allows the selection of the sensor type or the type of analogue input as long as the hardware requirements are met.

Note:

There are two types of current inputs

• Sink (41, 42): The power supply for a current source is integrated in the controller (11-pin terminal: + pin 4, - pin 5) (max. 22 mA). The current to be measured is given by a connected load.

• Source (43, 44): The current to be measured must be supplied from outside (11-pin terminal: + pin 5, - pin 7).

The quantity is counted via the switching input E1. In this case, the setpoint switching function via this input is omitted (see also **R7** and **R8**).

Important:

The parameter corresponds to parameter **R60**, i.e. a selected setpoint sensor type by **R60** cannot be additionally set by **R4**. Please note that sensor types between 31 (= voltage input 0...10V) and 44 (= current input 4...20mA (source)) require the same hardware.

It is therefore only possible to select a sensor type from this group once - either as an actual value sensor or as a setpoint sensor. Other sensor types are not affected by this.

Conversely, this rule also applies to parameter **R60**. A current input (**R4**) selected as actual value cannot additionally be selected by **R60**. In such a case, only the value 0 (i.e. parameter **⏮**) is available for **R60**.

R5/R6: Display value for lower/upper value linear analogue input

These parameters are used to scale the linear analogue input. The value to be displayed for the lower and upper value of the input defines the range that is displayed by the controller.

A7: Scaling of the quantity count

Only affects display type = 1 (quantity / sec.) or = 2 (quantity / min.) (see A8). The actual measured value (pulses / sec. = frequency) is converted to a unit of quantity.

The measurable frequency covers the range 2.50 Hz ... 2 kHz (max. resolution 0.01 Hz)

If **A8** = 1: quantity = frequency / A7

(corresponds to the quantity per second)

If **A8** = 2: quantity = (frequency * 60) / A7

(corresponds to the quantity per minute)

A8: Display type of quantity counting

A8 = 0 pulses / second

(= frequency) in the range 2.50 Hz ... 2 kHz (max. resolution 0.01 Hz)

A8 = 1 quantity / second

(max. resolution 0.01 quantity units)

A8 = 2 quantity / minute

(max. resolution 0.01 quantity units)

Important:

The quantity count is always based on the measurement of pulses / sec.

A9: Actual value, setpoint and parameter unit

Depending on the selected sensor, the physical units can be defined via this parameter. units can be defined via this parameter. These are supplied via the ST-Bus in addition to the values.

The following conventions apply:

- If a temperature sensor is selected, °C (abs.) or K (rel.) is always output (independent of **A9**).

- If quantity measurement is selected, **A8** is used to define the units.

(0: Hz, 1: L/sec, 2: L/min)

- If the sensor uses the current or voltage input, **A9** is used to define the units.

Important: The following measured values, setpoints and parameters are affected by the above convention:

Measured values:

A1, C1/C2 (if formed by sensor input)

Setpoints, parameters:

C1/C2, C3, C5, C10, C11, C21, C23, C25, C30, C31, C41, C43, C45, C50, C51, C61, C62, C65, C82, A2

A40: Software filter

Averaging over several measured values can be carried out.

If a sensor is used that reacts very quickly to external influences, averaging ensures a smooth signal curve.

A50: Display of the PID control value

Output of the internally calculated PID control value from -100%...100%.

A51/A52: Display value for lower/upper value at analogue output (0V / 0mA).

When the actual value is output (see **b2**), the following range adjustment is performed:

When the display value reaches the value set in **A51**, 0 V or 0 mA is output.

When the display value reaches the value set in **A52**, 10V or 20mA are output.

A53: Output value full cooling power (-100.0..0%)

A54: Output value "0" power

A55: Output value full heating power (0..100,0%)

When the control value is output (see **b2**), the following range adjustment is carried out:

If cooling is to take place with 100% cooling power, the voltage set in **A53** is output.

If neither heating nor cooling is to take place, the voltage set in **A54** is output.

If heating is to be carried out with 100 % heating power, the voltage set in **A55** is output.

A60 Setpoint sensor type (analogue input)

With this parameter it is possible to specify the setpoint either as a fixed value from the parameter memory (**E**) or variably as an analogue value. The presetting as analogue signal is limited to the voltage (pins 4/5) or current input (pins 4/5 or 5/7). (see also description **A4**).

Important:

Scaling is carried out as with the selection as actual value sensor via A5 and A6.

A99 Password

This parameter is to set the password for the A-level.

Message	Cause	Error elimination
F 1H F 1L	Sensor error at actual value sensor (H: open-circuit or L: short-circuit at sensor F1)	Check sensor
F2H F2L	Sensor error (H: open-circuit or L: short-circuit at 3-wire correction)	Check sensor
F5H F5L	Sensor error at setpoint sensor (H: open-circuit or L: short-circuit at sensor F1)	Check sensor
EP0 EP1	0: Error program memory 1: Error parameter memory => ALL EXITS WILL BE SWITCHED OFF	Repair controller
---	Display overrun or key-lock	
Flashing display	Temperature alarm at too high or too low temperature (if activated)	

If an error is detected in the parameter memory (display **EP**) and therefore the stored settings cannot be used, the control contacts are switched to the de-energised state.

A sensor alarm (display **F 1L/F2L** or **F 1H/F2H** or **F5L** or **F5H**) is indicated independently by a flashing display and the buzzer sounds. The buzzer can be switched off at any time by pressing the 'DOWN' key. The buzzer is switched on again after 10 minutes if the error is still present.

Inputs	E1:	external potential-free contact
Measuring inputs	F1:	Temperature sensor, selection from the following types: Measuring ranges: Pt100-2: -99°C...+690°C Pt100-3: -99°C...+550°C (max. 2x 20R lead resistance) Pt1000-2: -99°C...+500°C Pt1000-3: -99°C...+450°C (max. 2x 20R lead resistance) PTC: -50°C...+150°C 1mA Measuring accuracy related to the entire measuring range +/- 0.5 %.
Outputs	K1: K2:	Relay, normally-open contact, 8(1.5)A 250V~, function defined by parameter U1 Relay, normally-open contact, 8(1.5)A 250V~, function defined by parameter U2 Additional built-in buzzer, 85dB
Display		1 4-digit LED display, height 13mm, colour red, temperature display. 3 LEDs, diameter 3mm, colour red, for status display
Interface		ST-Bus communication interface Interface driver: RS485, galvanically not separated The network has to be installed in lines topology and terminated with a 120 Ohm resistance on each side. In case of networking always connect port "A" with port "A" and port "B" with port "B". Crossing over is not permissible!
Power supply		12-24V~ oder 16-36V=, power consumption max. 3VA
Connectors		Screw/plug-in terminals Terminal A: 12-pole, grid 5.0mm, for cables up to 2.5 mm ² Terminal B: 11-pole, grid 3.5mm, for cable up to 1.5 mm ²
Ambient conditions		Storage temperature: -20...+70°C Operating temperature: 0...+55°C Relative humidity: max. 75% without dew
Weight		ca 150 g, without sensor
Enclosure		Front IP65, IP00 from back
Certificates		



The controller is UL certified with UL File number E219051.

Installation data	Unit is to be installed in an instrument panel. Front size: 84 x 42 mm Panel cut-out: 67.5 x 31.5 mm Installation depth: ca. 90 mm, mounting by fixing strap
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