

## Introduction

The microprocessor-based controller MTR 2000 is used for thermostatic temperature control. For this purpose, it has an input for a Pt 100 temperature sensor.

The supply voltage for the controller is 230 V AC. The controller has two changeover contacts as its output.



## Description

By setting the appropriate parameters, the controller can be programmed to execute many different functions.

The controller is programmed in three levels with the aid of the buttons on its front panel. Access to parameters which affect the safety of the system is deliberately made difficult.

The first level permits access only to the setpoint and the alarm acknowledgement.

All regulation parameters (P2 - P32) can be set in the second level.

The third level permits programming of the basic functions (A1 – A92) of the controller.



UP button (red arrow)



Down button (blue arrow)

This button is used to acknowledge an alarm.



SET 1 button

Pressing this button displays setpoint value S1.  
If the button is not depressed, the actual value is displayed.  
This button is also used for setting the parameters.



SET 2 button

Pressing this button displays setpoint value S2.  
For details of changing the button assignments, see parameter A82 (standby mode, direct switching of a contact).

## Settings

### First operating level

#### Displaying and adjusting the setpoints

The setpoint 1 (regulation contact 1) can be displayed by simply pressing the SET 1 button.

The setpoint 2 (regulation contact 2) can be displayed by simply pressing the SET 2 button.

With the Set button held down, the setpoint can be adjusted with the UP and DOWN buttons.



## General note

All values are stored in the non-volatile memory and are retained there even in the case of a power failure. When setting any value, always release the UP or DOWN button before releasing the SET button. This applies to the setpoint and all other parameters.

Parameter/button	Function	Setting range	Default value	Your setting
S1 / SET1	Setpoint for regulation contact K1	P4...P5	0.0 °C	
S2 / SET 2	Setpoint for regulation contact K2	P4...P5	0.0 °C	

## Second operating level

### Setting the regulation parameters

Pressing and holding the UP and DOWN buttons together for at least four seconds displays a list of regulation parameters (starting with P0). This list can be rolled up and down with the UP and DOWN buttons.

To display the value for a selected parameter, press the SET 1 button. With the SET 1 button depressed, the value can be adjusted with the UP and DOWN buttons. When all buttons are released, the new value is saved permanently. If no button is pressed within 60 seconds, the controller reverts to its normal state.

Parameter	Function	Setting range	Default value	Your setting
P0	Actual value	-		
P1	Setpoint S2 / regulation contact 2 DeltaW regulation contact 2	P4...P5 if A5=0 (factory setting) -99...+99.9K if A5=1	10,0 °C/K	
P2	Hysteresis, contact 1	0.1...99.0 K	1.0 K	
P3	Hysteresis, contact 2	0.1...99.0 K	1.0 K	
P4	Lower setpoint limit	-99°C...P5	-99 °C	
P5	Upper setpoint limit	P4...999°C	999 °C	
P6	Actual value correction	-20.0...+20.0 K	0.0 K	
P19	Disable setpoint adjustment	0: not disabled 1: disabled	0	
P30	Lower limit for alarm	-99...999°C/K	-10°C	
P31	Upper limit for alarm	-99...999°C/K	120°C	
P32	Hysteresis for alarm, asymmetrical	0.1...99.9 K	1.0 K	

## Parameter descriptions

### P0 Actual value

Display of the current actual value. If parameter A32 is set to 1 to display the setpoint, the actual value can be displayed only with this parameter.

### P1 Setpoint / DeltaW for regulation contact 2

Adjustment of the setpoint S2 for regulation contact 2 at the parameter level.

If parameter A5 is set to 1 (operation with DeltaW), the DeltaW value of the regulation circuit is displayed and can be adjusted.

### P2/P3 Hysteresis for regulation contact 1/2

The hysteresis is symmetrical with respect to the setpoint (see Figs. 2 and 4).

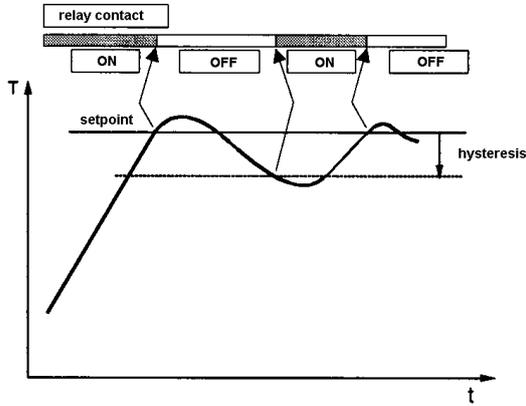


Fig. 1: Heating controller, asymmetrical hysteresis

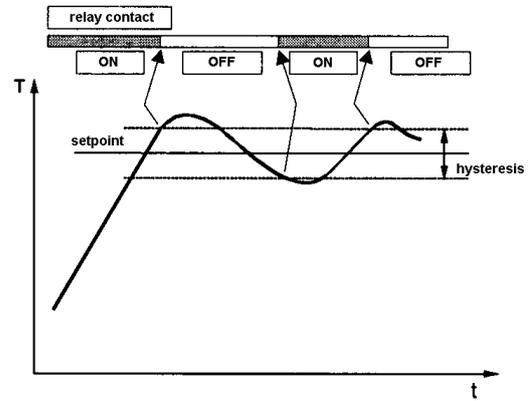


Fig. 2: Heating controller, symmetrical hysteresis

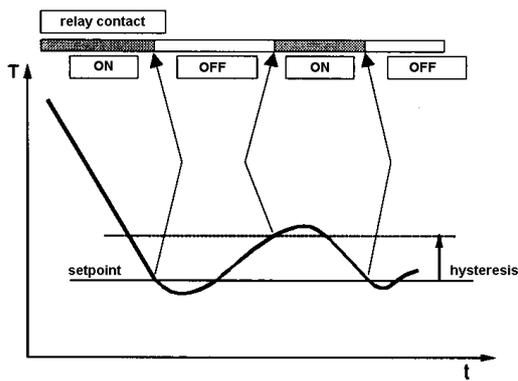


Fig. 3: Cooling controller, asymmetrical hysteresis

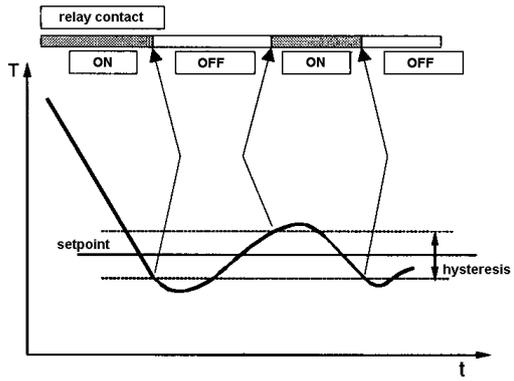


Fig. 4: Cooling controller, symmetrical hysteresis

**P4/P5 Lower/upper setpoint limit**

The setpoints S1/S2 (and P1) can be set only within the limits defined here.

**P6 Actual value correction**

The value set here is added to the measured value from the sensor. The resulting value is displayed and acts as the basis for regulation.

**P19 Disable setpoint adjustment**

If this parameter is active, the buttons on the front panel are disabled.

We recommend that this be done after all adjustments.

In the disabled state, the setpoint cannot be adjusted with the buttons on the front panel. Any attempt to adjust the setpoint then results in the message "---" on the display.

**P30 Lower limit value for alarm**

**P31 Upper limit value for alarm**

The alarm output can be used as a limit-value or bandwidth alarm. It has an asymmetrical hysteresis (see parameter P32). In both cases, the limit values may be relative to setpoint S1 or absolute, i.e. independent of setpoint S1.

For a limit-value alarm, the hysteresis is asymmetrical inwards; for a bandwidth alarm, it is asymmetrical outwards (see Figs. 5 to 8)

**P32 Alarm hysteresis, asymmetrical**

The hysteresis is asymmetrical with reference to the selected limit value. Its function depends on the alarm definition.



## Third operating level

The third operating level can be accessed from the second level by scrolling through the parameter list until the last parameter (P32) is displayed and pressing the UP button for at least 10 seconds. The message "PA" then appears on the display. Release the button.

Pressing the UP and DOWN keys together for at least four seconds then displays the parameter list for the third operating level (starting with A1).

The parameter values are displayed and adjusted exactly as in the second level.

The list can be rolled up and down with the UP and DOWN buttons.

To display the value for a selected parameter, press the SET button. With the SET button depressed, the value can be adjusted with the UP and DOWN buttons. When all buttons are released, the new value is saved permanently. If no button is pressed within 60 seconds, the controller reverts to its normal state.

### Note:

If you want to adjust any A parameters, parameter A19 must first be set to "0" (=parameters not locked).

Parameter	Function	Setting range	Default value	Your setting
A1	Function of regulation contact 1	<b>0: Heating contact</b> 1: Cooling contact	0	
A2	Function of regulation contact 2	<b>0: Heating contact</b> 1: Cooling contact	0	
A3	Function of regulation contact 1 in case of (sensor) fault	<b>0: Off on fault</b> 1: On on fault	0	
A4	Function of regulation contact 2 in case of (sensor) fault	<b>0: Off on fault</b> 1: On on fault	0	
A5	Operation with setpoint or DeltaW for regulation contact 2	<b>0: Operation with setpoint</b> 1: Operation with DeltaW	0	
A8	Actual-value display mode (all parameter values are displayed with a resolution of 0.1K)	<b>0: Integer</b> 1: Resolution 0.5K 2: Resolution 0.1K	0	
A9	Weighting factor	0.50 ... 1.50	1.00	
A19	Parameter locking	0: Parameters not locked <b>1: A parameters locked</b> 2: A and P parameters locked	1	
A20	Button click	0: No button click <b>1: Button click on</b>	1	
A30	<b>Function of alarm output</b>	0: Limit-values alarm, relative <b>1: Limit-value alarm, absolute</b> 2: Bandwidth alarm, relative 3: Bandwidth alarm, absolute 4: Limit-value alarm, relative, alarm contact inverted 5: Limit-value alarm, absolute, alarm contact inverted 6: Bandwidth alarm, relative, alarm contact inverted 7: Bandwidth alarm, absolute, alarm contact inverted	1	
A31	<b>Special function on alarm</b>	0: Inactive 1: Display blinks 2: Buzzer sounds <b>3: Display blinks and buzzer sounds</b> 4: As for 3, buzzer can be acknowledged 5: As for 4, buzzer sounds again after 10 minutes 6: As for 4, buzzer sounds again after 30 minutes	3	
A32	Type of display	<b>0: Actual value</b> 1: Setpoint S1	0	



Parameter	Function	Setting range	Default value	Your setting
A33	Not used	<b>0: Disabled</b>	0	0
A40	Hysteresis mode, regulation contact 1	<b>0: Symmetrical</b> 1: Asymmetrical	0	
A41	Hysteresis mode, regulation contact 2	<b>0: Symmetrical</b> 1: Asymmetrical	0	
A50	Minimum "On" time, contact 1	0...600 s	0 s	
A51	Minimum "Off" time, contact 1	0...600 s	0 s	
A52	Minimum "On" time, contact 2	0...600 s	0 s	
A53	Minimum "Off" time, contact 2	0...600 s	0 s	
A54	Delay after power on	0...600 s	0 s	
A55	Mutual delay, regulation contacts 1 and 2	0...600 s	0 s	
A56	Alarm suppression after power on	0...60 min	20 min	
A60	Temperature sensor	11: <b>12: PT100, three-wire connection</b>	12	
A70	<b>Software filter</b>	1: Disabled <b>Average over:</b> 2: 2 measured values (approx. 0.6s) <b>4: 4 measured values (approx. 1.2s)</b> 8: 8 measured values (approx. 2.4s) 16: 16 measured values (approx. 4.8s) 32: 32 measured values (approx. 9.6s) 64: 64 measured values (approx. 19.2s) 128: 128 measured values (approx. 38.4s)	4	
A80	Temperature scale and display in standby mode	0: Fahrenheit (AUS) <b>1: Celsius (AUS)</b> 2: Fahrenheit (OFF) 3: Celsius (OFF)	1	
A81	Not used	<b>0:</b>	0	0
A82	<b>Function of button SET 2</b>	0: Disabled 1: Regulator On/Off (standby) <b>2: Setpoint S2 (parameter P1)</b> 3: Switch relay directly, off on standby 4: Switch relay directly, unaffected by standby	2	
A83	Function of unlabelled button	<b>0:</b>	0	0
A90	Output connection, K1	0: No connection <b>1: Connect to regulation contact 1</b> 2: Connect to regulation contact 2 3: Connect to alarm contact 4: Connect to buzzer function 5: Connect to button 3 or 5	1	
A91	Output connection, K2	0: No connection 1: Connect to regulation contact 1 <b>2: Connect to regulation contact 2</b> 3: Connect to alarm contact 4: Connect to buzzer function 5: Connect to button SET 2	2	



Parameter	Function	Setting range	Default value	Your setting
A92	Output connection, K3	0: No connection 1: Connect to regulation contact 1 2: Connect to regulation contact 2 <b>3: Connect to alarm contact</b> 4: Connect to buzzer function 5: Connect to button SET 2	0	0
Pro	Program version	-	-	

#### A1/A2 Function of regulation contacts 1/2

Regulation contacts 1 and 2 can be set separately to act as a heating contact or a cooling contact. If set as a heating contact, the contact closes if the actual temperature is less than the setpoint. For use as a cooling contact, the function is inverted. See also Figs. 1 - 4.

#### A3/A4 Function of regulation contacts 1/2 in the case of a sensor fault

Regulation contacts 1 and 2 switch to the position specified here in the case of a sensor fault. If a fault is detected in the parameter memory (display: EP), which means that the saved settings cannot be used, regulation contacts 1 and 2 are switched to a state where no current flows.

#### A5 Operation with setpoint or DeltaW for regulation contact 2

This parameter determines whether the controller operates with two independently adjustable contacts (A5=0, operation with setpoint, factory setting) or with two mutually linked contacts (A5=1, operation with Delta W).

This parameter always affects regulation contact 2.

#### A8 Display mode

The actual value can be displayed as an integer or with one digit after the decimal point (resolution 0.5 °C or 0.1 °C). If a resolution of 0.5 °C is selected, the actual value is rounded up or down. All parameter settings and setpoints are always displayed with a resolution of 0.1 °C.

#### A9 Weighting factor

The actual value can be weighted with the aid of this parameter. The measured value is multiplied by this factor and the resulting value is displayed and used for regulation.

#### A19 Parameter locking

With the setting A19=0, all parameters are accessible.

With the setting A19=1, all A parameters are locked except for A19 itself (factory setting).

With the setting A19=2, all A parameters and all P parameters are locked.

When parameters are locked, they cannot be changed with the buttons on the front panel. Any attempt to do this results in the message "----" on the display.

#### A30 Function of alarm output

The state of the alarm output depends on actual values with respect to the upper and lower limit values (see parameters P30 and P31). With this parameter, you can select whether the alarm is activated when the actual temperature lies between the two limit values or when the temperature lies outside the limit values. In the case of a sensor fault, the alarm is activated regardless of this setting. The output can also be inverted. See Figs. 5 to 8.

#### A31 Special function for limit-value or bandwidth alarm

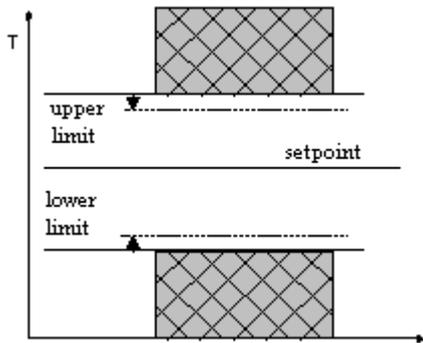
Here, you can select whether or not the display blinks and the buzzer sounds in the case of a limit-value or bandwidth alarm. The factory setting is with this function active.

A sensor alarm (display: F1L or F1H) is always signalled by a blinking display and the buzzer.

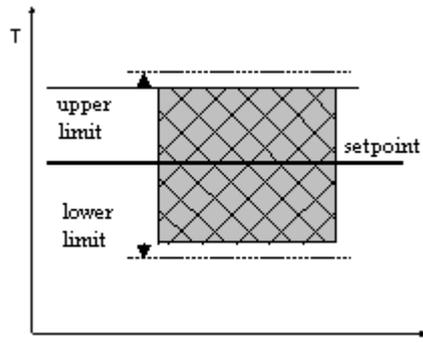
#### A32 Type of display

If A32=0 is set, the actual value is displayed. If A32=1 is set, setpoint S1 is always displayed and the actual value can then be displayed only with the aid of parameter P0 (second operating level).

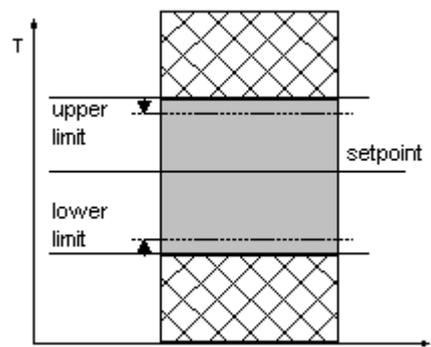
#### A33 Not used



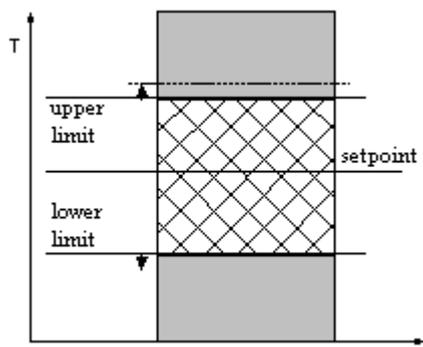
**Fig. 5:** Limit-value alarm, alarm contact normal  
 A30=0: relative limits  
 A30=1: absolute limits



**Fig. 6:** Bandwidth alarm, alarm contact normal  
 A30=2: relative limits  
 A30=3: absolute limits



**Fig. 7:** Limit-value alarm, alarm contact inverted  
 A30=4: relative limits  
 A30=5: absolute limits



**Fig. 8:** Bandwidth alarm, alarm contact inverted  
 A30=6: relative limits  
 A30=7: absolute limits



**A40 Hysteresis mode, regulation contact 1**

**A41 Hysteresis mode, regulation contact 2**

This parameter permits selection of a symmetrical or asymmetrical hysteresis at the switching point. An asymmetrical hysteresis lies below the setpoint for the heating function and above the setpoint for the cooling function. A symmetrical hysteresis (factory setting) is effective on both sides of the setpoint, regardless of the selected switching function. See also Figs. 1 - 4.

**A50 Minimum "On" time, regulation contact 1**

**A51 Minimum "Off" time, regulation contact 1**

**A52 Minimum "On" time, regulation contact 2**

**A53 Minimum "Off" time, regulation contact 2**

These parameters make it possible to ensure that the output contact remains on or off for a specified time in order to reduce the switching frequency. The time specified here is the total minimum time for the on or off state of the contact (factory setting: 0 s).

**A54 Delay after power on**

With this parameter, activation of regulation contacts 1 and 2 can be delayed by a specified period after the mains voltage is switched on.





**A55 Mutual delay, regulation contacts 1 and 2**

This parameter permits the activation of regulation contact 1 to be delayed by a specified period with respect to activation of regulation contact 2 or vice versa, depending on which contact is activated first.

**A56 Alarm suppression after power on**

This parameter permits the activation of the alarm contact to be delayed by a specified period after the mains voltage is switched on (factory setting: 20 minutes).

**A60 Temperature sensor**

This parameter permits selection of the type of PT100 temperature sensor connection (factory setting: three-wire connection).

**A70 Software filter**

The measured value is averaged over the number of measuring cycles specified here. This average value is displayed and used for regulation. A70=1 deactivates the software filter.

**A80 Temperature scale**

The temperatures can be displayed in Fahrenheit or Celsius (factory setting). Note that the values and setting ranges for the parameters and setpoints remain unchanged when the scale is changed. If, for example, a controller whose setpoint is set to 0°C is modified to display the temperatures in Fahrenheit, the setpoint is then interpreted as 0 °F, corresponding to a temperature of -32° C. In addition, you can specify whether the controller displays the word AUS (German) or OFF (English) when it is in standby mode.

**A81 Not used**

**A82 Function of button SET 2**

Setpoint S2 (parameter P1)

**A83 Function of unlabelled button**

The button is disabled.

**A90 Output connection, relay K1**

**A91 Output connection, relay K2**

**(A92 No connection)**

Depending on the hardware, the relays can be connected to various signals from the regulator:

Regulator outputs

Regulation contact 1 Regulation circuit set with the parameters S1, P2, A1

Regulation contact 2 Regulation circuit set with the parameters P1, P3, A2

Alarm Alarm circuit set with the parameters P30, P31, P32, A30

Buzzer function As for internal horn, intermittent, can be acknowledged with the DOWN button (affected by parameter A31)

**Status messages**

Display	Fault	Action
F1L	Sensor fault (short circuit)	Check the sensor
F1H	Sensor fault (open circuit)	Check the sensor
-- --	Parameters are locked	See parameter P19 or A19
Blinking display	Temperature alarm (see A31)	
EP	Loss of data in parameter memory	Have the controller repaired (regulation contacts 1 and 2 are set to no-current position)



## Technical Data

<b>Measuring inputs:</b>	<b>F1:</b> Temperature sensor Pt100 (DIN IEC 751, three-wire connection), measuring range Pt100 (Class B): -60.0 °C...400 °C (with suitable sensor and < 1 Ohm wire resistance), accuracy: +/- 0.5 K +/- 0.5% at 25 °C (not including any sensor errors), +/- 1K +/- 0.5% over the entire temperature range 0 to 55 °C (not including any sensor errors)
<b>Display and indicators:</b>	Three-digit red LED display, 13 mm high, for temperatures Three LEDs, diameter 3 mm, for status indication LED 1: regulation contact 1 LED 2: regulation contact 2 LED 3: Alarm
<b>Outputs:</b>	<b>K1:</b> Relay, 250 V~, maximum switched current 8 A, (cosφ=1), maximum continuous current 5 A, changeover contact, suitable for electric motors up to 0.5 HP. Function: see parameter A90 <b>K2:</b> Relay, 250 V~, maximum switched current 8 A, (cosφ=1), maximum continuous current 5 A, changeover contact, suitable for electric motors up to 0.5 HP. Function: see parameter A91
<b>Supply voltage:</b>	230 V~ 50/60 Hz, maximum power consumption 4 VA
<b>Terminals:</b>	12-pole screw-terminal plug strip, spacing 5.0 mm, for cables up to 2.5 mm <sup>2</sup>
<b>Temperature range:</b>	-99 to 999 °C, factory setting: alarm if actual value is below -10 °C or above 120 °C
<b>Ambient conditions:</b>	Storage temperature -20 °C...+70 °C Operating temperature 0...55 °C Maximum relative humidity 75%, no condensation
<b>Degree of protection:</b>	IP65 from front, IP00 from rear
<b>Installation:</b>	Designed for panel mounting Front-panel dimensions 84 x 42 mm Panel aperture 67.5 x 31.5 mm Installation depth approx. 85 mm Secured with screw-on bow Install flat gasket between panel and front frame of controller
<b>Weight:</b>	approx. 140 g (without sensor)

## Terminal assignments:

