

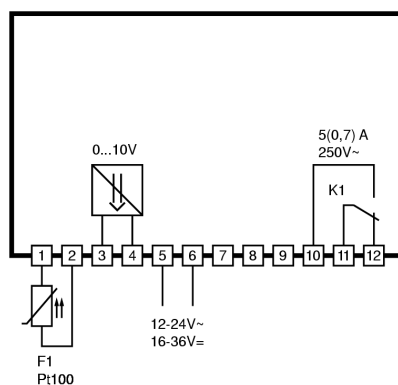
## ST70-31.02

PID controller

Order number 206144



## Wiring diagram



## Product description

The compact execution of the PID controller with 3-digit LED seven segment display, 3 keys, 1 analogue output and 1 relay perfectly qualifies it for space-saving mountings. The analogue output permits the access to control valves and invertors.

**Please note that the analogue output is not galvanically separated from the supply voltage. To avoid any problems operate the controller with a separate transformer.**

The relay K1 can be programmed as switching output.

**Sensor:** Pt100

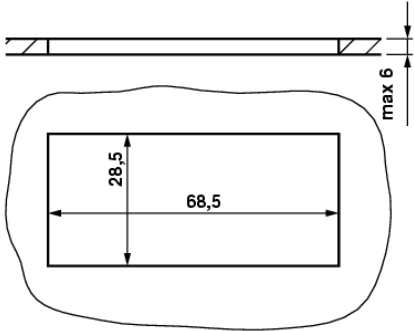
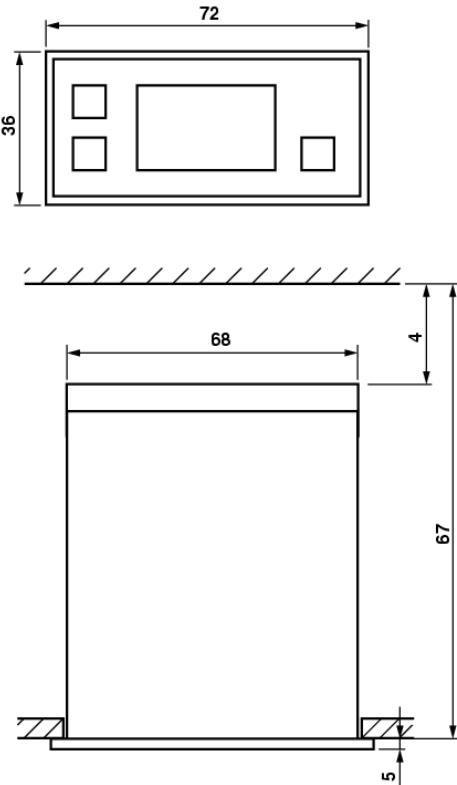
**Range:** -99...850°C

**Front size:** 72mm x 36mm

**Panel cutout:** 68,5mm x 28,5mm

**Connector:** screw terminal

ST 70 ...



## SOFTWARE .02

### Adjustment options



#### **Key UP**

Pressing this key you can increase the parameter or parameter value or scroll the parameter list.



#### **Key DOWN**

Pressing this key you can decrease the parameter or parameter value or scroll the parameter list. At alarm the buzzer function can be switched off with this key.



#### **Key 4: SET**

While SET key is pressed, the setpoint is indicated.  
In addition, the SET key is used for setting parameters

### First control level:

#### **Parameter setting of the control setpoint**

If none of the keys is pressed, the display indicates the actual value of the temperature. Pressing the SET key, the setpoint shows on the display.

If the setpoint is to be changed, the SET key is to be kept pressed while adjusting the setpoint with the keys UP and DOWN.

Please note that the setpoint can only be changed within the set setpoint limits.

The setpoint S1' (if available) can be adjusted in the same way. If setpoint S1' is activated it is indicated and relevant for the control in case of closed switching input.

<b>Parameter</b>	<b>Function description</b>	<b>Adjustment range</b>	<b>Standard setting</b>	<b>Custom setting</b>
<b>S1</b>	Setpoint	P4...P5	0.0°C	
<b>S1'</b>	Setpoint at closed switching input E1	-99...+99.9 K if A33=1 P4...P5, if A33=0	0.0°C/K	

### Second control level (P parameters):

#### Setting of control parameters

Simultaneously pressing the UP and DOWN key for at least 4 seconds opens a parameter list containing control parameters.

With the UP and DOWN keys the list can be scrolled in both directions.

Pressing the SET key will give you the value of the respective parameter. Pressing also the UP or DOWN key at the same time the value can be adjusted.

Return to the initial position takes place automatically, if no key is pressed for 60 seconds.

Parameter	Function description	Adjustment range	Standard setting	Custom setting
<b>P1**</b>	Setpoint 2 or DeltaW	P4...P5 -99.9...+99.9 K	0,0°C +10.0K	
<b>P2*</b>	Hysteresis contact K1	0.1... 99.0 K	1.0 K	
<b>P3**</b>	Hysteresis contact K2	0.1... 99.0 K	1.0 K	
<b>P4</b>	Control range limitation – minimum setpoint	-99°C...P5	-99°C	
<b>P5</b>	Control range limitation – maximum setpoint	P4...999°C	999°C	
<b>P6</b>	Actual value correction	-10.0...+10.0 K	0.0 K	
<b>P7***</b>	Proportional band	0.1 ... 99.9 K	20 K	
<b>P8***</b>	I-factor	0 ... 15	8	
<b>P9***</b>	D-factor	0 ... 15	8	
<b>P10***</b>	Cycle time Tp	2 ... 100 sec.	20 sec.	
<b>P19</b>	Key-lock	0: no key-lock 1: key-lock	0	
<b>P30</b>	Lower alarm value	-99 ... P31 °C/K	-10°C	
<b>P31</b>	Upper alarm value	P30 ... 999°C/K	+10°C	
Parameters P40...P45 are only available if there is an analogue output!				
<b>P40</b>	Analogue output	0: control output PID 1: actual value	0	
<b>P41</b>	Indication value for 0V at analogue output	-99.9 ... 999.9°C	0.0 °C	
<b>P42</b>	Indication value for 10V at analogue output	-99.9 ... 999.9°C	100 °C	
<b>P43</b>	Indication value full heating performance (+100 %)	-10.0 ... 10.0 V	+10.0 V	
<b>P44</b>	Indication value "0" performance (0 %)	-10.0 ... 10.0 V	0.0 V	
<b>P45</b>	Indication value full cooling performance (-100 %)	-10.0 ... 10.0 V	- 10.0 V	

\* Parameter only available if K1 operates as thermostat.

\*\* Parameter only available if K2 operates as thermostat.

\*\*\* Parameter only available if K1 or K2 operates in PID mode.

### Parameter description:

#### P1: Setpoint / DeltaW for control circuit 2

Adjusting the setpoint of control circuit 2.

If A5=1, the setpoints for control circuit 1 and 2 are linked with one another via switching difference DeltaW, which can be adjusted with P1. (operation with DeltaW)

The following applies: setpoint thermostat 2 = setpoint control circuit 1 + delta W2.

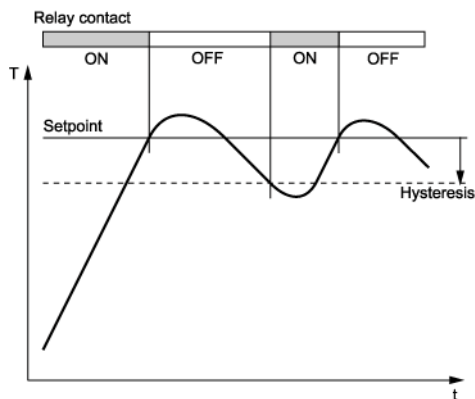
This difference can take positive or negative values. Thus, a leading or following contact can be realised.

#### P2: Hysteresis contact K1

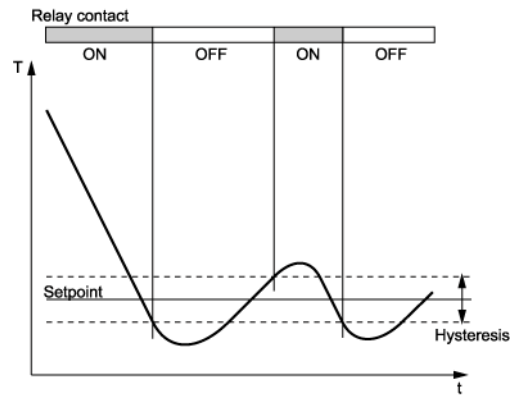
#### P3: Hysteresis contact K2

The hysteresis can be set symmetrically or one-sided at the setpoint (see A40, A41).

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 (see fig. 1 and 2).



**Fig. 1:** Heating controller, one-sided hysteresis



**Fig. 2:** Cooling controller, symmetrical

#### P4: Control range limitation – minimum setpoint

#### P5: Control range limitation – maximum setpoint

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.

#### P6: Actual value correction

This parameter allows the correction of actual value deviations caused for example by sensor tolerances or extremely long sensor lines. The regulation measure value is increased or decreased by the here adjusted value.

#### Parameters P7...P10 are only available if either K1 or K2 operates in PID mode (A6=1 or A7=1)

#### P7: Proportional band at PID regulation

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

#### P8: Integral-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.

#### P9: Differential-portion

The differential portion dampens temperature changes.

### P10: Cycle time $T_p$

The cycle time is the time, in which the control output 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 exit, 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.

### P19: 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.

### P30: Lower alarm value

### P31: Upper alarm value

The exit alarm is a boundary alarm or a range alarm with a hysteresis of 0,1K. Both at the boundary alarm and the range alarm, limit values can be relative, i.e. going along with the setpoint, or absolute, i.e. independent of the setpoint. The operation mode is set with parameter A30. If, in case of boundary alarm and only one switching point is required the not used second switching point should be adjusted to a value above or below the operating range of the controller.

Boundary alarm function (see fig. 5):

The alarm contact is closed if the process temperature is above the upper or below the lower boundary value.

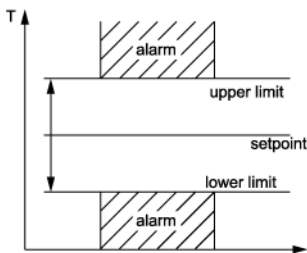


Fig. 5: Boundary alarm, rel. boundaries

Range alarm function (see fig. 6):

Opposite switching behaviour to the boundary value alarm. The alarm contact is closed if the actual value remains between the boundary values.

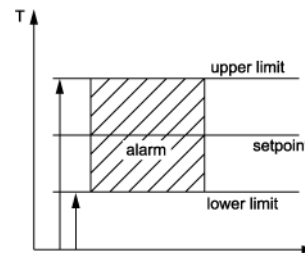


Fig 6: Range alarm, abs. boundaries

### P40: Analogue output

If the controller has an analogue output this parameter is to define whether the analogue output carries the control output of the PID regulation or the actual value. In case of control output display, the sign can change, depending on whether heating or cooling is required. The actual values, however, are always indicated with positive sign.

### P41: Indication value for 0V at analogue output

### P42: Indication value for 10V at analogue output

Indication of the actual value (see P40) is subject to the following range adjustment:

If the indication value reaches the value set in P41, voltage is 0 V.

If the indication value reaches the value set in P42, voltage is 10 V.

### P43: Indication value full heating performance (100%)

### P44: Indication value "0" performance

### P45: Indication value full cooling performance (-100,0%)

Indication of the PID control output (see P40) is subject to the following range adjustment:

If heating is to be performed with 100 % heating performance, voltage is as set in P43.

If neither heating nor cooling is required, voltage is as set in P44.

If cooling is to be performed with 100% cooling performance, voltage is as set in P45.

### Third control level, (A parameters):

#### Setting of control parameters

Access to the third control level is granted when selecting the last P-parameter on the second control level. Continue to press the UP key for approximately 10 seconds until "PA" appears. Continue to press the UP key and additionally press the DOWN key for about 4 seconds and the first A-parameter of the third control level is indicated. With the keys UP and DOWN you can scroll the list in both directions. Pressing the SET key will give you the value of the respective parameter. By pressing the UP or DOWN key at the same time the value can be adjusted. Return to the initial position takes place automatically, if no key is pressed for 60 seconds, or by simultaneously pressing the UP and DOWN key for approx. 4 seconds.

Parameter	Function description	Adjustment range	Standard setting	Custom setting
A1	Switch mode contact K1	0: heating contact 1: cooling contact	0	
A2	Switch mode contact K2	0: heating contact 1: cooling contact	1	
A3	Function of contact K1 at sensor error	0: relay off 1: relay on	0	
A4	Function of contact K2 at sensor error	0: relay off 1: relay on	0	
A5*	Selection setpoint 2 or DeltaW	0: operation with setpoint 2 1: operation with DeltaW	1	
A6	Control characteristics contact K1	0: thermostatic 1: PID	1	
A7	Control characteristics contact K2	0: thermostatic 1: PID	0	
A8	Display mode	0: integrals, without leading zero 1: with decimals without leading zero 2: integrals, with leading zero 3: with decimals and leading zero	1	
A9	Weighing factor	0.50 ... 1.50	1.00	
A10	Indication value for lower value linear analogue input	-99 ... 999°C	0°C	
A11	Indication value for upper value linear analogue input	-99 ... 999°C	100°C	
A19	Parameter lock	0: no lock 1: A-parameter locked 2: A- and P-parameter locked	0	
A30	Function alarm exit	0: Boundary alarm, relative 1: Boundary alarm, absolute 2: Range alarm, relative 3: Range alarm, absolute	0	
A31	Special function at boundary or range alarm	0: no special function 1: flashing display 2+3: not effective	0	
A32	Setpoint display	0: display shows actual value 1: display shows setpoint S1 (S1')	0	
A33**	Type of setpoint S1'	0: can not be activated 1: relative to setpoint S1 2: absolute (freely adjustable)	0	

\* Parameter only available if K1 operates as thermostat

\*\* Only available, if switching input exists.

## Parameter description:

*The following values can change the equipment characteristics and are therefore to be set with utmost care.*

### **A1: Switch mode contact K1**

### **A2: Switch mode contact K2**

The switch mode for the relays, i.e. cooling or heating function, can be programmed independently at works. Heating function means that the contact opens as soon as the setpoint is reached, thus power interruption. At cooling function the contact closes, if the actual value is above the required setpoint. (see fig. 1 + 2)

### **A3: Function of contact K1 at sensor error**

### **A4: Function of contact K2 at sensor error**

At sensor error the selected relay falls back into the condition pre-set here. If there is a data-loss in parameter memory (display indicates "EP") both contacts K1 and K2 are switched off.

### **A5: Selection setpoint 2 or DeltaW**

This parameter determines whether the setpoints for thermostat 1 and 2 independently adjustable (A5=0) or whether they are tied with one another via a switching offset DeltaW (A5=1). This parameter applies only to contact K2 (see parameter P1).

### **A6: Control characteristics contact K1**

### **A7: Control characteristics contact K2**

Independent choice of either PID or thermostatic characteristics for each contact.

If both A6 and A7 are set to "1" both outputs have the same setpoint. This setting is used i.e. to control a motor valve.

### **A8: Display mode**

The value can be indicated in integrals or with decimals and if there is a leading zero. In general, all parameter indications are presented with decimals.

### **A9: Weighing factor**

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.

### **A10: Indication value for lower value linear analogue input**

### **A11: Indication value for upper value linear analogue input**

Only relevant, if the controller is programmed for a voltage input (0...10V linear) or a current input (4...20mA linear). These parameters allow scaling of the linear analogue input. The value to be indicated for the lower and upper entrance value then defines the range the controller will indicate. For input range 4...20mA the display will show sensor error if the input signal drops below 4mA.

### **A19: Parameter lock**

This parameter enables locking of each parameter level. If third level is locked, only parameter A19 may be changed.

### **A30: Function alarm exit**

The alarm exit evaluates an upper and a lower limit value (see parameters P30 and P31), 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.

### **A31: Special function at boundary alarm**

Here can be selected whether, in the case of a boundary alarm, the indication is to flash.

### A32: Setpoint display

A32=0 indicates the actual value, A32=1 statically indicates the setpoint S1 or S1' in the display. Therefore, the current actual value can only be indicated with parameter P0.

### A33: Adjustment of setpoint S1' (not available on all types of controllers)

By closing switching input E1, setpoint S1 can be switched to a setpoint S1'. Setpoint S1' can be either relative to setpoint S1 or an independent, freely adjustable, control setting. The setpoint S1' can only be accessed if input E1 is closed.

### Status messages

Message	Cause	Error elimination
<b>F0</b>	Error at actual value measuring	
<b>F1</b>	Sensor error, open- or short-circuit at sensor	Check sensor
<b>- - -</b>	Key-lock activated	See parameter P19 and A19
<b>flashing display</b>	Temperature alarm (A31)	
<b>EP</b>	Data loss in parameter memory	If error cannot be eliminated by switching on/off, the controller must be repaired

## Technical data of ST70-31.02

### Measuring input

**F1:** Resistance thermometer Pt100-2L  
Measuring range: -99°C...850°C (with appropriate sensor)  
Measuring accuracy: 0.5K +/- 0.5 % of scale range, without sensor

### Outputs

**S1:** Analogue output 0-10V, galvanically not separated  
**K1:** Relay, change-over contact, 5A 250V

### Display

One 3-digit LED-display, height 13mm, for temperature display, colour red  
One LED-Lampe, for status display of output K1

### Power supply

12...24V AC (50/60 Hz) or 16...36V DC  
Power supply is not galvanically separated!

### Connectors

Screw terminal for cable up to 1.5 mm<sup>2</sup>

### Ambient conditions:

Storage temperature: -20°C...+70°C  
Operating temperature: 0...55°C  
Relative humidity: max. 75%, without dew

### Weight

ca. 130g, without sensor

### Enclosure

IP50

### Installation data

Unit is to be installed in an instrument panel.  
Front size: 72 x 36 mm  
Panel cut-out: 8.5 x 28.5 mm  
Installation depth: ca. 67mm