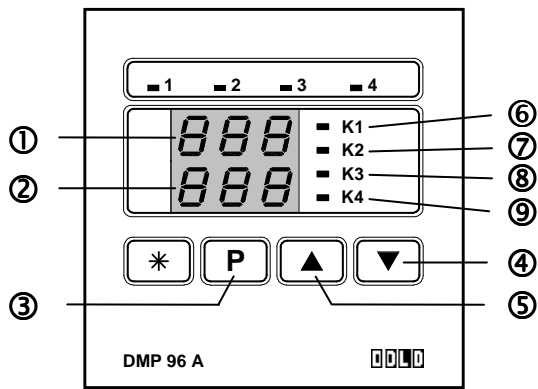




DOLD GmbH
 Blumenstraße 33
 D-70736 Fellbach
 Germany
 Tel. 0049 (0) 711/95152-0
 Fax 0049 (0) 711/95152-19
 info@dold-regler.de
 www.dold-regler.de



DMP 96 A - ... -2P

from program version: 010C3 ... 010C9
 010D0 ... 010D1

Inputs:
 ...: P1...P5: 2xPt 100 -150...600°C
 L1...L2: 2xFe-CuNi 0...850°C
 K1...K2: 2xNiCr-Ni 0...1200°C

as Two-channel controller
2P: Two-point controller with one limit-value contact per channel

Installation and operation of the unit

Operating and display elements

- ① Actual value channel 1 display in operating mode, parameter display in input mode
- ② Actual value channel 2 display in operating mode, parameter value in input mode
- ③ Jump to input level and operating level, confirmation key, keying through the parameters on one level
- ④ Reducing code value, parameter value
- ⑤ Increasing code value, parameter value
- ⑥ LED is lit if output K 1 is active
- ⑦ LED is lit if output K 2 is active
- ⑧ LED is lit if output K 3 is active
- ⑨ LED is lit if output K 4 is active

Safety notes

Please read these notes on safety attentively and note the listed points! They concern the safety of persons and of the equipment!

The unit is conceived mainly as a temperature controller. However, it can also be used for other, slow changing physical dimensions, where one measurement per second is sufficient for accurate function. The logical cohesion of the temperature controller must then be transferred to the appropriate dimensions. Substantial damage to persons and property can be caused through improper use, application, installation, configuration or operation within a plant! Important! The unit must not be used as a safety device, it serves as process controller, process control as well as process monitoring!

The unit must not be installed in the EX-area! If everything with process dimensions from the EX-area and the unit is installed outside the EX-area, all supply lines of the unit, which lead into the EX-area, must be directed over safety barriers!

The satisfactory and safe operation of the unit presupposes, that the unit is transported, stored and installed with due care and that it is properly fitted.

This unit must be installed, configured, commissioned and parameters have been setting by qualified persons only, who are familiar with the installation, commissioning and servicing or comparative units, as well as with the installation, for which the unit is used and must have knowledge of measuring control and regulating methods.

The operating personnel of the plant, in which the unit is to be used, must be instructed in its operation by qualified persons.

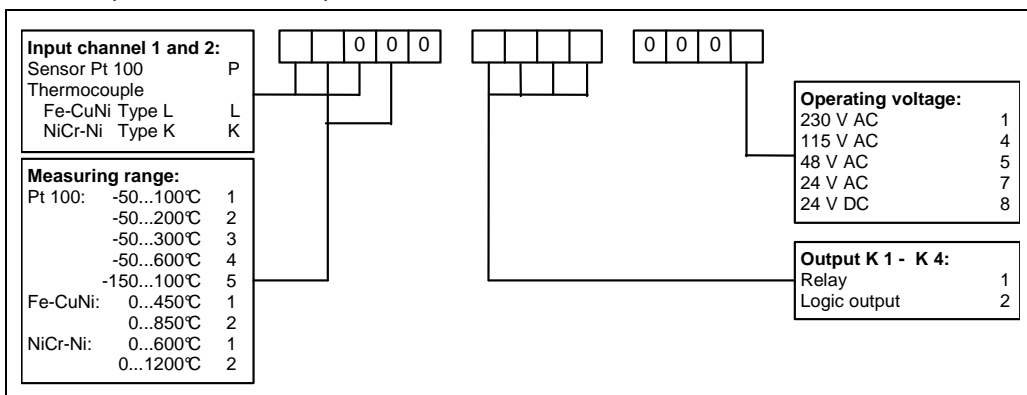
Please note

- the contents of these manual, especially the notes of installation, commissioning and adaptation of the unit to the controlling system,
- the safety regulations affixed to the unit,
- the respective safety regulations for the installation and the operation of electric plant,
- keep these manual for later applications.

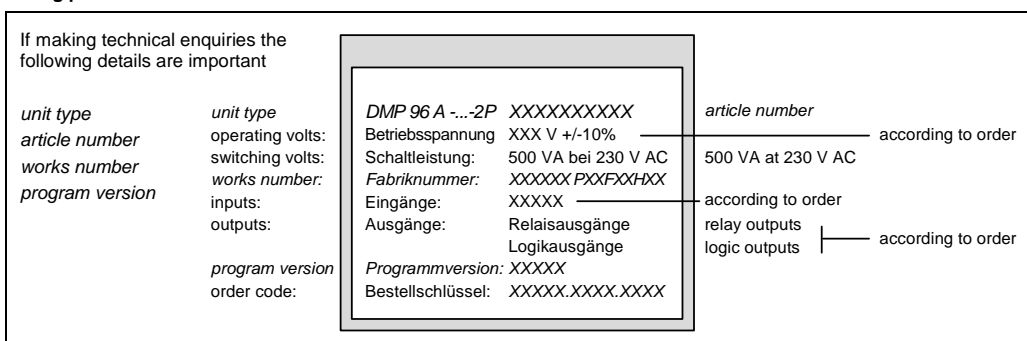
The regulations mentioned in these manual are valid for all EC countries. For application in a country outside the EC, the appropriate national regulations must be observed.

This unit has been manufactured and tested according to DIN EN 61010 part 1 "protection measures for electronic measuring units", and has left our factory in a safety and operational technical satisfactory condition.

Order code (identification of the unit)



Rating plate



Mounting location of the unit

The mounting location must be free from vibrations. The unit must not be mounted in the proximity of motors, transformers, valves and other inductive loads. The ambient temperature at the mounting location can be 0...50°C with a relative humidity of ≤ 75% (without dewing). Aggressive gases and vapours can quickly destroy the unit. Any fitting position is suitable.

Fitting of the unit

- Insert the unit from the front side into the control panel cutout
- Suspending the fastener in the lateral nipple of the grip by the back of the control panel
- Thereby the flat sides of the fastener must border of the housing
- The fastener must be tighten against the back of the control panel symmetrical with a screwdriver
- Any fitting position is suitable.

Please note: **Don't resort to force !**

Installation notes

Please read the installation notes attentively and observe all listed points when installing the unit. If these notes are ignored, function interferences can occur, the required EMV guide lines are not complied with, and CE-conformity is no longer fulfilled. Ensure before connecting and commissioning of the unit, that the operating voltage and the required operating voltage ratio of the unit comply with those at the location (see rating plate and technical data). If necessary, carry out the appropriate measures.



Ensure that the control voltage and load voltage at the location is switched off and secured against switch on for the period of installing the unit. The electrical connections are to be carried out in accordance with the connection diagram and the appropriate national regulations. Use multi core cable end at wiring with flexible jumper wire. Arrange the supply lines to the unit in such a way, that they are free from tensile load under all conditions and that they are not in any possible danger of being cut-off or crushed.

Shielded cables must be used for sensor leads, for thermocouples shielded compensatory leads. The sensor leads must be arranged spatially separated from the load leads and control leads (power lines).

Compensatory leads for thermocouples must not be intermediately clamped with normal clamps, as otherwise additional thermocouples are created, which could falsify the measuring result!

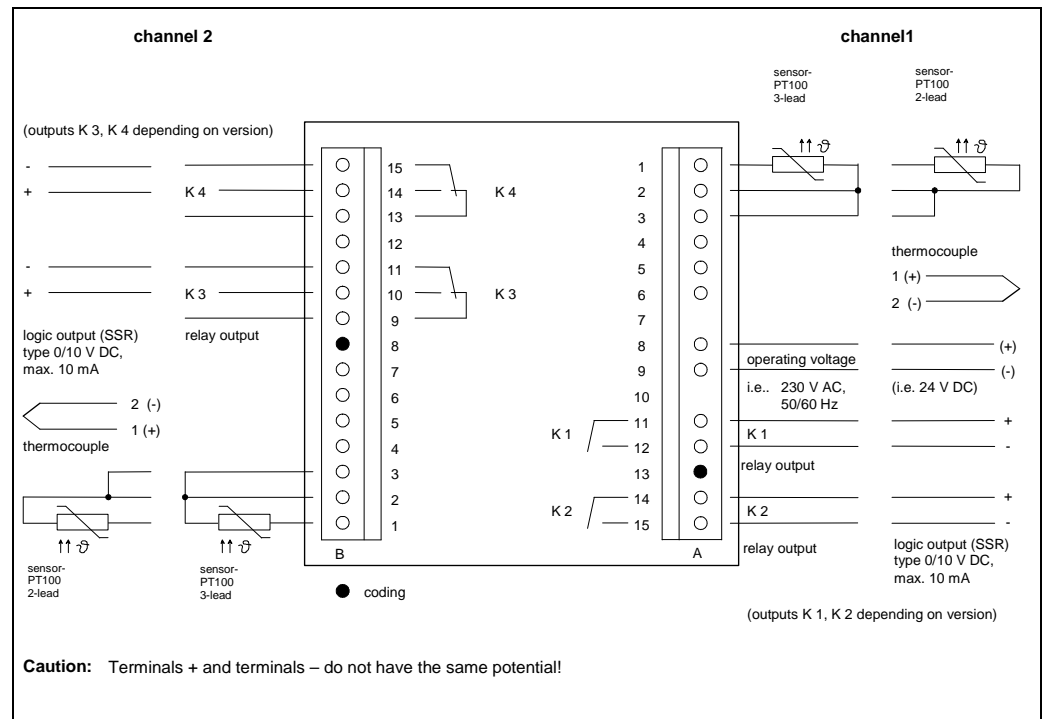
Connect the shield of the sensor lead with the unit as close as possible to the fitting board and lay the lead with a minimum of 1.5 mm² cross-section from this point to the earthed collecting bar.

Inductive loads, such as contactors, valves, motors, transformers etc., switched from the unit, as well as inductive loads installed in the same control cabinet or in the same plant, must be suppressed with unit-specific interference suppressers!

The load circuits and control circuits of the unit relays must be fused against overload.

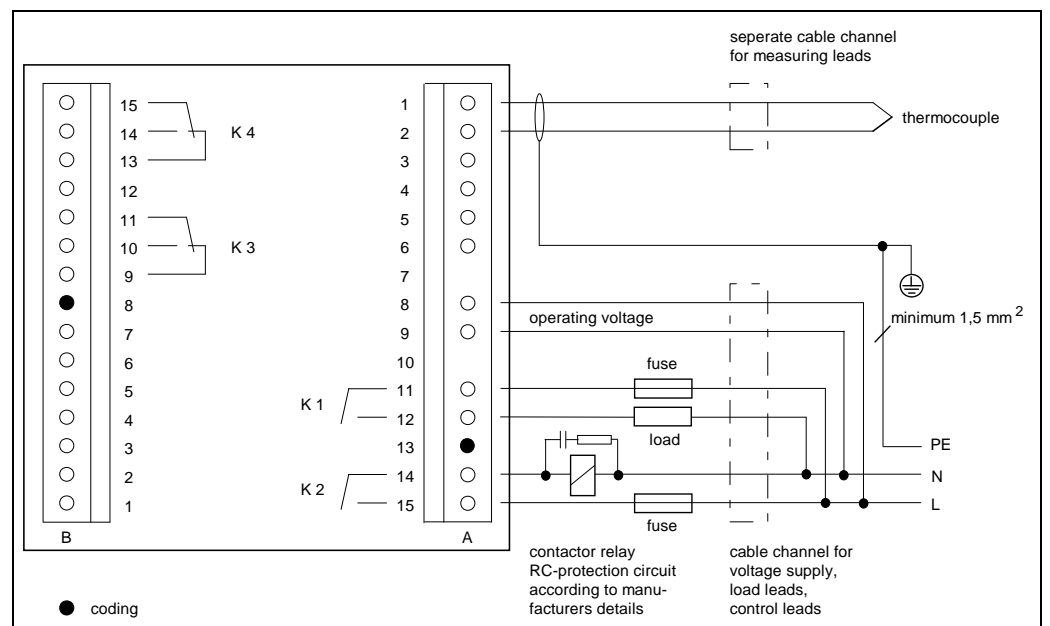
These manual do not contain all notes on the regulations, standards etc., which must be observed and followed when working with the unit in connection with plants. These regulations, standards etc. must be compiled and observed by the operator of the unit, application-specific.

Terminal connection diagram (in dependence on version)



Wiring diagram (Wiring example)

To enable effective discharge of interferences the shielding of the sensor leads and signal leads must be connected to earth at the side of the unit.



Commissioning and adaptation of the unit

The unit is supplied pre-configured to an application, so by switching on some function is present. This pre-configuration is suitable for the given requirements in only a few cases, it means, the unit must be adapted to the controller system of the plant, in which it is to be used.

Switch on



Check the wiring again carefully! Incorrect wiring of the unit can lead to serious damage to the unit and the plant! Ensure that the load voltage of the plant is switched off at the initial switch on of the unit, because the unit is not yet adapted to the plant and can therefore possibly cause error functions.

Now switch on the operating voltage of the unit.

Lead balancing or zero point correction

In operation with a resistance thermometer with the two wire method, the lead resistance, as well as a safety barrier, is noticeable through a constant temperature measuring error. This temperature measuring error can be corrected on the configuration level (code 155) with parameter "Ln.1" for channel 1 and "Ln.2" for channel 2. Furthermore, the temperature difference between the temperature of the measuring point, the temperature sensors, the unit and the temperature of the process can be equalised with this parameter.



Temperature differences between measuring point and process should be kept to a minimum by selecting the measuring point! This substantially improves the controller result! When the temperature sensor is fitted improperly, overheating or under cooling can occur, and therefore, damage to personnel or material!

Setting the operating nominal value

The nominal value 1 for channel 1 and the nominal value 2 for channel 2 can be set on the operating level.

Please note:

If the nominal value is taken out of adjustment during the operation of the plant, then the plant must first build-up to the new value! It means, there will be some instability in the regulation, until the actual value has set itself to the new nominal value. During operation as PID controller with relay output, it can be some time after switch on before the controller relay responds and the unit is seen to carry out its task, due to the PID typical time character!

Configuration and programming of the unit

Parameter setting at the various levels

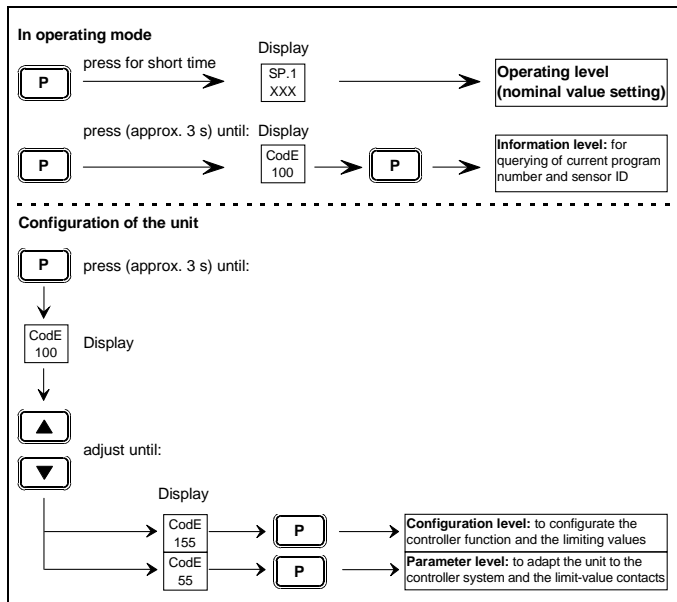
	current value: +1 after approx. 3 s after approx. 6 s +100
	current value: -1 after approx. 3 s after approx. 6 s -100
	enter

After accepting the last parameter, jump back into operating mode.

If within approx. 20 seconds (timeout) no key is activated, automatic jump back to operating mode. The possibly altered value is not accepted. With the star key the timeout can be restarted (extended).

If an incorrect code number is accepted for jumping to a level, you have to wait for timeout and for the jump back to operating mode before you can input a new code number (approx. 20 seconds). After this a new code input can be carried out.

The operating structure



Parameters of the configuration level (code 155)	Display / Works setting
After changing configuration or re-configuration the controller character and the switching function of the limit contacts, the appropriate parameters must be set at the parameter level (code 55) or be adapted to the controlled system. After any change of configuration or re-configuration of the setpoint range (parameters "rH.1", "rL.1", "rH.2" and "rL.2") the setpoint settings at the operating level must be checked and adapted to the setpoint range.	"Con"
Lead balancing or zero point correction channel 1	"Ln.1" / 0.0°C
Lead balancing or zero point correction channel 2	"Ln.2" / 0.0°C
Nominal value range end channel 1 Adjustment range: Maximum setpoint range according to sensor ID	"rH.1" / maximum setpoint range
Nominal value range start channel 1 Adjustment range: Maximum setpoint range according to sensor ID. With configuration "rH.1" = rL.1 nominal value setting at the operating level is not possible. With configuration "rH.1" < "rL.1" switching between the set values at the operating level is possible with the buttons or .	"rL.1" / 0.0°C
Nominal value range end channel 2 Adjustment range: Maximum setpoint range according to sensor ID	"rH.2" / maximum setpoint range
Nominal value range start channel 2 Adjustment range: Maximum setpoint range according to sensor ID. With configuration "rH.2" = rL.2 nominal value setting at the operating level is not possible. With configuration "rH.2" < "rL.2" switching between the set values at the operating level is possible with the buttons or .	"rL.2" / 0.0°C
Configuration control output or limit comparator K 1, channel 1 00: output no function 01: cooling controller with hysteresis setting to higher temp. 02: cooling controller with PID-character 03: limit comparator closed in goodband 04: heating controller with hysteresis setting to lower temp. 05: heating controller with PID-character 06: limit comparator open in goodband	"Co.1" / 05
Configuration limit-value contact K 2, channel 1 00: output no function 01: limit contact absolute, make contact referenced to increasing temperature 02: limit contact following to the nominal value, make contact referenced to increasing temperature 03: limiting comparator in the approval range closed 04: limit contact absolute, break contact referenced to increasing temperature 05: limit contact following to the nominal value, break contact referenced to increasing temperature 06: limiting comparator in the approval range open	"Co.2" / 00
Configuration control output or limit comparator K 3, channel 2 00: output no function 01: cooling controller with hysteresis setting to higher temp. 02: cooling controller with PID-character 03: limit comparator closed in goodband 04: heating controller with hysteresis setting to lower temp. 05: heating controller with PID-character 06: limit comparator open in goodband	"Co.3" / 05
Configuration limit-value contact K 4, channel 2 00: output no function 01: limit contact absolute, make contact referenced to increasing temperature 02: limit contact following to the nominal value, make contact referenced to increasing temperature 03: limiting comparator in the approval range closed 04: limit contact absolute, break contact referenced to increasing temperature 05: limit contact following to the nominal value, break contact referenced to increasing temperature 06: limiting comparator in the approval range open	"Co.4" / 00
Error allocation output K 1 - K 4 output K 1 output K 2 output K 3 output K 4 on: output active in event of an error OFF: output inactive in event of an error	"Fd.1" / OFF "Fd.2" / OFF "Fd.3" / OFF "Fd.4" / OFF

Incorrect error allocation at the outputs can, in the event of an error, cause substantial damage to persons and property!

Parameters of the configuration level (code 155)	Display / Works setting
Display resolution 00: resolution 0.1°C 01: resolution 1°C	"rES" / 00
Parameters of the parameter level (code 55)	Display / Works setting
In dependence of configuration only those parameters become accessible, which are required for the appertaining function.	"PAI"
K 1 Output with hysteresis, channel 1 ("Co.1" = 01, 04) hysteresis	"HY.1" / 1.0°C
K 1 Output with PID-character, channel 1 ("Co.1" = 02, 05) proportional band (refer to max. setpoint range by sensor ID) integral time (0...999 s, setting 0 = portion 0) derivative time (0...500 s, setting 0 = portion 0) cycle time (1...200 s)	"Pb.1" / 5.0% "ti.1" / 250 s "td.1" / 50 s "CY.1" / 30 s
K 1 Limiting comparator, channel 1 ("Co.1" = 03, 06) symmetric spreading (hysteresis 0.5 fix)	"bd.1" / 5.0°C
K 1 Output, channel 1 ("Co.1" = 00); output K 1 no function	"noP"
K 2 Limit contact absolute, channel 1 ("Co.2" = 01, 04) limit absolute hysteresis	"LA.2" / 0.0°C "HY.2" / 1.0°C
K 2 Limit contact following to the nominal value, channel 1 ("Co.2" = 02, 05) limit relative hysteresis	"Lr.2" / 0.0°C "HY.2" / 1.0°C
K 2 Limiting comparator, channel 1 ("Co.2" = 03, 06) symmetric spreading (hysteresis 0.5°C fix)	"bd.2" / 5.0°C
K 2 Limit contact, channel 1 ("Co.2" = 00); K 2 no function	"noP"
K 3 Output with hysteresis, channel 2 ("Co.3" = 01, 04) hysteresis	"HY.3" / 1.0°C
K 3 Output with PID-character, channel 2 ("Co.3" = 02, 05) proportional band (refer to max. setpoint range by sensor ID) integral time (0...999 s, setting 0 = portion 0) derivative time (0...500 s, setting 0 = portion 0) cycle time (1...200 s)	"Pb.3" / 5.0% "ti.3" / 250 s "td.3" / 50 s "CY.3" / 30 s
K 3 Limiting comparator, channel 2 ("Co.3" = 03, 06) symmetric spreading (hysteresis 0.5°C fix)	"bd.3" / 5.0°C
K 3 Output, channel 2 ("Co.3" = 00); output K 3 no function	"noP"
K 4 Limit contact absolute, channel 2 ("Co.4" = 01, 04) limit absolute hysteresis	"LA.4" / 0.0°C "HY.4" / 1.0°C
K 4 Limit contact following to the nominal value, channel 2 ("Co.4" = 02, 05) limit relative hysteresis	"Lr.4" / 0.0°C "HY.4" / 1.0°C
K 4 Limiting comparator, channel 2 ("Co.4" = 03, 06) symmetric spreading (hysteresis 0.5°C fix)	"bd.4" / 5.0°C
K 4 Limit contact, channel 2 ("Co.4" = 00); K 4 no function	"noP"

Nominal value setting (operating level)	Display / Works setting
Nominal value 1, channel 1 Adjustment range: "rL.1"..."rH.1"	"SP.1" / 0.0°C
Nominal value 2, channel 2 Adjustment range: "rL.2"..."rH.2"	"SP.2" / 0.0°C

Information level	Display
Querying of current program number and sensor-ID in the information level.	"inF"
Current program number	"Pnr"
Sensor ID as in table	"SEn"

Sensor-ID

Sensor-ID	ID by ordering key	Sensor (Channel 1 and 2)	Max. display range	Max. setpoint range
P 1	P 1	Pt 100	-69...149°C	-50...100°C
P 2	P 2	Pt 100	-69...249°C	-50...200°C
P 3	P 3	Pt 100	-69...349°C	-50...300°C
P 4	P 4	Pt 100	-69...699°C	-50...600°C
P 5	P 5	Pt 100	-169...149°C	-150...100°C
tl1	L 1	Fe-CuNi Type L	-24...499°C	0...450°C
tl2	L 2	Fe-CuNi Type L	-24...899°C	0...850°C
tn1	K 1	Ni Cr-Ni Type K	-24...649°C	0...600°C
tn2	K 2	Ni Cr-Ni Type K	-24...1299°C	0...1200°C

Adapting the PID controller to the controlled system - Rule of thumb for adjusting the controller

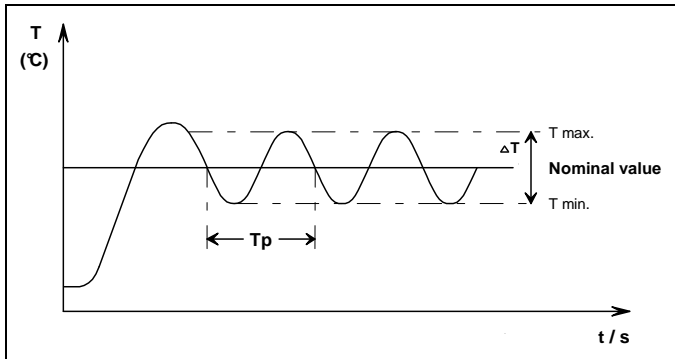
Ascertainment of the characteristic data in a closed-loop control circuit
A controlling system with unknown PID parameters have to be tuned by an oscillation test in a closed-loop control circuit. The following characteristic data are necessary to calculate the PID parameters.

- Amplitude of oscillation ΔT
- Duration of period of oscillation T_p

These characteristic data can be carried out by observation of the actual value, or by recording the controller curve with a measuring recorder.

Condition

Setting the parameter at the parameter level (code 55):
Proportional band Pb (parameter "Pb.X") 0.1%
Integral time Ti (parameter "ti.X") 0 s
Derivative time Td (parameter "td.X") 0 s
Cycle time Cy (parameter "Cy.X") 1 s



Oscillation test

Calculating the PID return parameter by the ascertained values

T_p = Duration of period of oscillation
 ΔT = Amplitude of oscillation
 $\Delta T = T_{max} - T_{min}$ (°C)
(Setpoint range according to sensor ID)

$$Pb = \frac{3 \cdot \Delta T (\text{°C}) \cdot 100\%}{\text{Setpoint range (°C)}}$$

$$Ti = 0,65 \cdot T_p$$

$$Td = 0,16 \cdot T_p$$

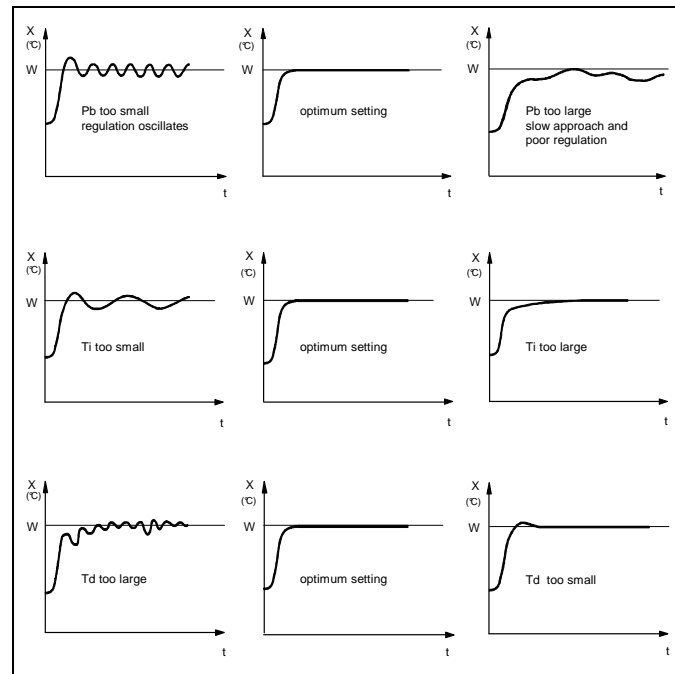
$$\text{Cycle time } Cy = \frac{T_d}{4}$$

Now the calculated PID return parameter can be set on the parameter level (code 55).

Please note: Lifetime of the relays

Inspection of the return parameters

The diagrams show possible incorrect settings, and give hints for their correction.



Incorrect settings of the return parameters

Caution!



During oscillation test extreme conditions can occur in the plant. The oscillation test have to be monitored continuously. Lifetime of the relays!

Lifetime of the relays

Period per switching cycle	Period, after which the 10 ⁶ switching cycles are reached (8 hour/day operation with 500 VA load)
2 minutes	approx. 11.4 years
60 seconds	approx. 5.7 years
30 seconds	approx. 2.8 years

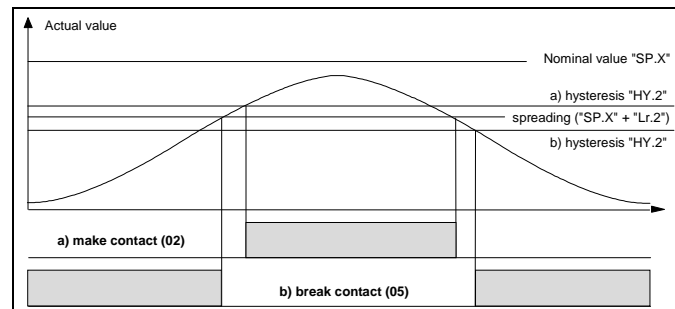
This table is not valid for SSR relays (solid state relays)

Error messages

Display	Error (channel 1 or channel 2)
Er.1	Pt 100: falling below range, exceeding range, sensor faulty (interruption or short circuit), thermocouple: falling below range, exceeding range, sensor faulty (interruption), sensor lead (balancing lead) cross-polarity, ambient temperature of the unit > 70°C or < -10°C
Er.9	System error (switch unit off/on)

The switching character of the limit contacts

Switching functions in reference to rising actual value. The shaded areas identify those areas, in which the output relay is active, it means, if it is closed.



Example: Limit contact K 2 following to the nominal value

Technical data

Inputs (channel 1 and channel 2)
Pt 100 two-wire lead, three-wire lead range according to sensor ID
two-wire lead switching: circuit balancing maximum 9 Ω
three-wire lead switching: wire resistance compensation maximum 50 Ω each lead

Thermocouple type and range according to sensor ID
Common data
measuring cycle 1 s
resolution ≥ 12 Bit

Outputs
2 Relay outputs K 1 and K 2, make contact
2 Relay outputs K 3 and K 4, change over

contact load ≤ 250 V AC, ≤ 8 A resistive load, type 500 VA with 10⁶ switching cycles or **Logic outputs** for SSR instead of K 1 or K 3 (type 0/10 V DC, max. 10 mA)

Energy supply
Operating voltage 230 V AC ± 10%, 48...62 Hz
Rate of power input ≤ 4 VA

Special voltages: 115 V AC, 48 V AC, 24 V AC, 24 V DC, other special voltages ask the producer, protection: the unit has a built-in thermal protection

Climatic requirements according to 75% relative humidity without dewing
working temperature range 0...+50°C
storage temperature range -30...+70°C

Electric safety according to DIN EN 61 010
excess voltage category III
degree of contamination 2 according to DIN EN 60 335
protection class II
isolation group C according to DIN VDE 0110 b
type of protection DIN EN 60 529
front panel IP 50
(optionally: IP 54 with the proper mounting and a suitable sealing ring)

housing IP 30
connections IP 20

Terminal connections: screwed socket strips nominal cross section 2.5 mm²

Housing, mounting
Pull-out housing for mounting control panel as per DIN 43 700 with a B fastener as per DIN 43 835 (M 4 screw clamp)

Material: PPO, glass-fibre reinforced (Noryl GFN2SE1), self-extinguishing, non-dripping, fire protection class UL 94 V1

Front panel dimensions 96 x 96 mm
Control panel cutout 92+0.8 x 92+0.8 mm
Recess depth 91 mm

CE-conformity
Interference emission trade, industry EN 50 081-1, EN 50 081-2
Interference immunity trade, industry EN 50 082-1, EN 50 082-2
IEC 801-2, IEC 801-3, IEC 801-4

Subject to technical and functional change.