JUMO DELOS T

Electronic temperature switch with display and analog output

Operating Manual

90294000T90Z001K000

V1.00/EN/00536581

Contents

Contents

1.1 Safety information

General

This manual contains information that must be observed in the interest of your own safety and to avoid material damage. This information is supported by symbols which are used in this manual as indicated.

Please read this manual before starting up the device. Store this manual in a place that is accessible to all users at all times.

If difficulties occur during startup, please do not intervene in any way that could jeopardize your warranty rights!

Warning symbols

DANGER!

This symbol indicates that **personal injury from electrocution** may occur if the appropriate precautionary measures are not taken.

WARNING!

This symbol in connection with the signal word indicates that **personal injury** may occur if the respective precautionary measures are not carried out.

CAUTION!

This symbol in connection with the signal word indicates that **material damage or data loss** will occur if the respective precautionary measures are not taken.

CAUTION!

This symbol indicates that **components could be destroyed** by electrostatic discharge (ESD = Electro Static Discharge) if the respective cautionary measures are not taken.

Only use the ESD packages intended for this purpose to return device inserts, assembly groups, or assembly components.

Note symbols

NOTE!

This symbol refers to **important information** about the product, its handling, or additional benefits.

REFERENCE!

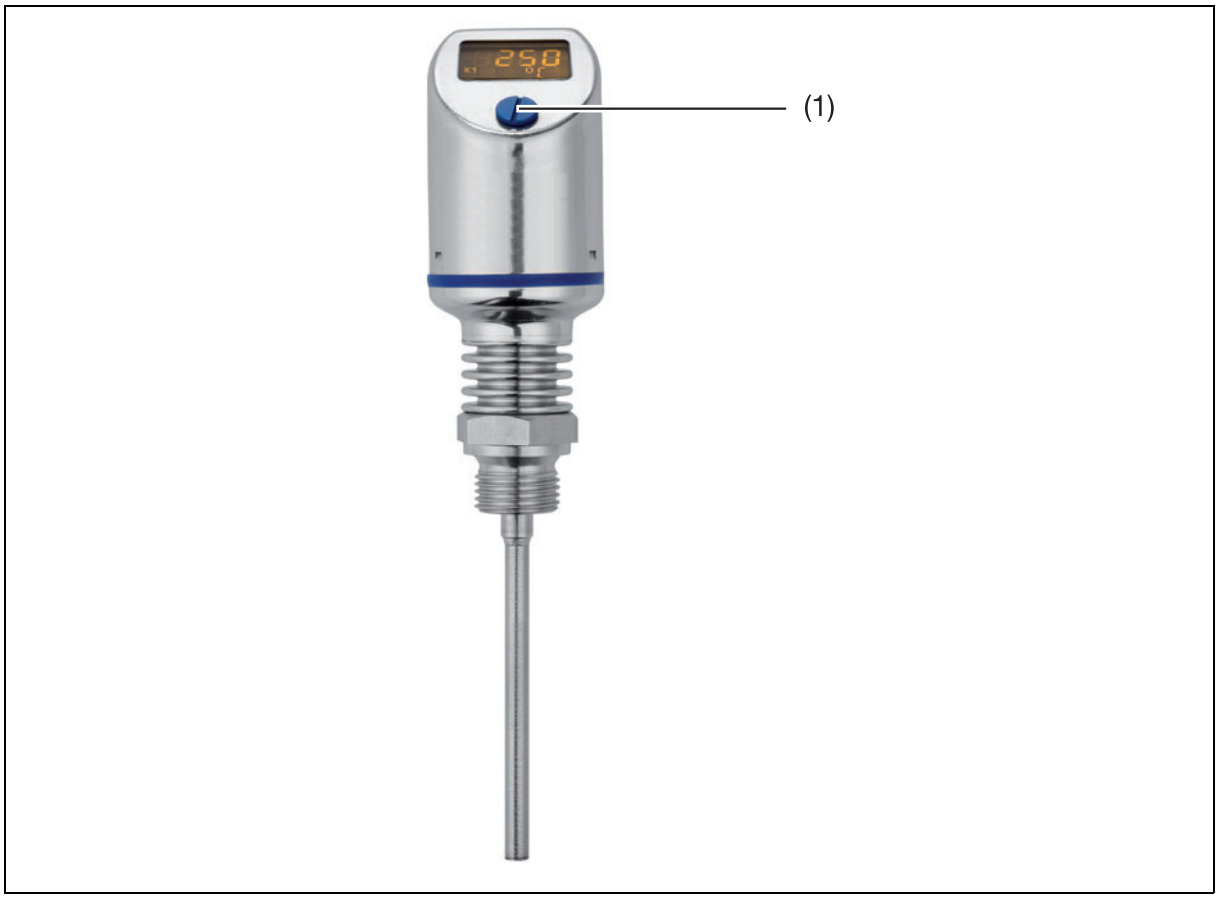
This symbol refers to **additional information** in other sections, chapters, or other manuals.

DISPOSAL!

At the end of its service life, the device and any batteries present do not belong in the trash! Please ensure that they are **disposed of** properly and in an **environmentally friendly** manner.

1 Introduction

1.2 General Information



(1) Sealing screw for operation

- The device measures the temperature in liquids and gases.
- The temperature is displayed digital.
- Depending on the version, the following outputs are available:
  - 1x PNP switching output
  - 2x PNP switching outputs
  - 1x PNP switching output and 1x analog output 0 to 20 mA, configurable
  - 1x PNP switching output and 1x analog output 4 to 20 mA, configurable
  - 1x PNP switching output and 1x analog output 0 to 10 V, configurable
- The device is also available in a version for use in increased medium temperatures.
- The device is additionally available in a version equipped with M12 x 1 plug connection for RTD temperature probes.
- The device can be set directly on-site or configured via the setup program with a notebook/PC.

CAUTION!

The protection type specified for the device is only achieved when the sealing screw is tightened.

1.3 Description

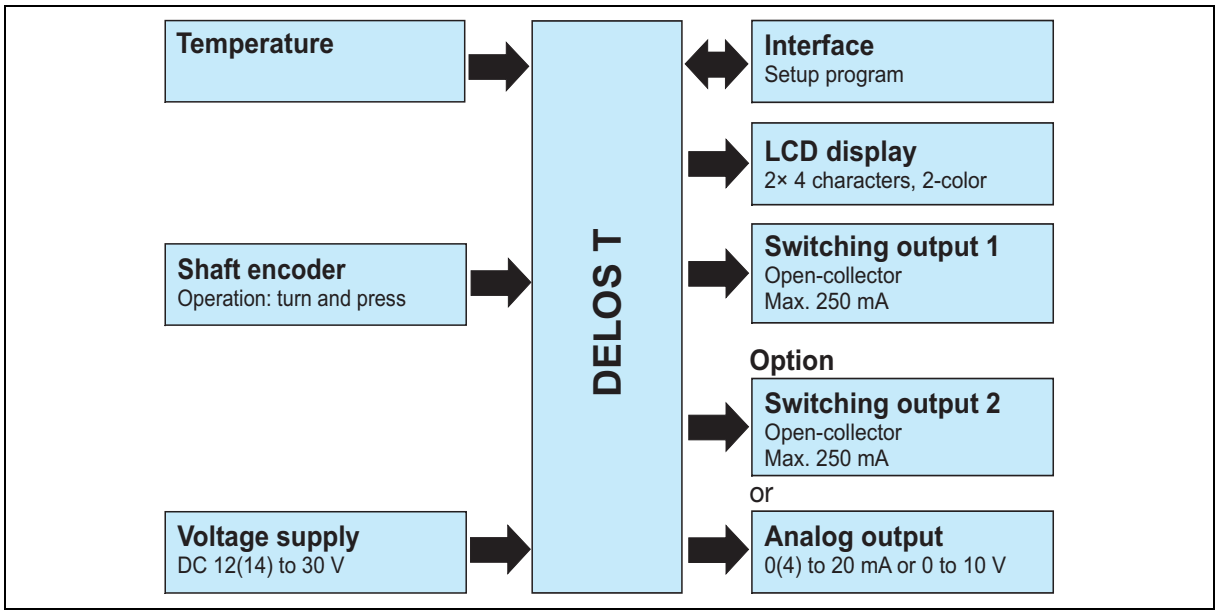
The highly-precise, electronic temperature switch consists of a protection tube with built-in temperature sensor, a process connection, and attached housing with LCD display for the electronics. Depending on the application, the following output variants are available: 1× PNP or 2× PNP switching output (binary output) or 1× PNP switching output and 1× analog output. The configuration of the output signal and the

measuring range can be customized. Depending on the version, the electronic temperature switch can be used in an operating temperature range from -50 to +150 °C, -50 to +260 °C, and -50 to +500 °C. The analog output signal 4 to 20 mA, 0 to 20 mA, 0 to 10 V or reversed 20 to 4 mA, 20 to 0 mA, and 10 to 0 V is available in a linearized fashion (temperature linear). The electronic temperature switch is designed for industrial use and complies with the European standards to guarantee electromagnetic compatibility (EMC).

Note: also available as JUMO DELOS SI and HP – precision pressure transmitter with switching contacts and display, see data sheet 405052 and data sheet 405054.

1 Introduction

1.4 Block diagram



2.1 Type specifications

Position

A laser has been used to label the type specifications on the device display case.

Table of contents

The specifications contain important information. Among others:

Description	Example
Basic type	902940/10
Voltage supply	DC 12 to 30 V
Output signal	4 to 20 mA
Measuring range (MB)	-50 to +150 °C
Switching output	1x PNP 250 mA

Fabrication number (F-no.)

The fabrication number is used by the manufacturer to identify the device.

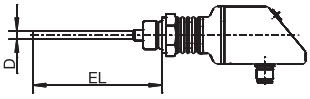
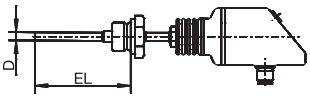
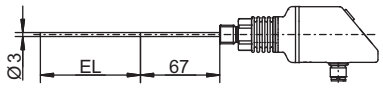
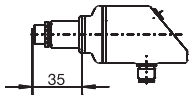
The fabrication number is **not** located on the device but on the package.

The fabrication number contains the production date (year and week) on position 12 to 15, counted from the left.

Example: F-no. = 014967870101**044**0001
The device was produced in the year 2010 and in week 44.

2 Identifying the device version

2.2 Order details

					(1)	**Basic type**[a]
				902940/10		DELOS T – Electronic temperature switch with display and analog output Parts coming into contact with the medium are electrolytically polished, surface roughness ≤ 0.8 µm 
	x			902940/30		DELOS T – Electronic temperature switch with display and analog output with extension tube for higher medium temperatures Parts coming into contact with the medium are electrolytically polished, surface roughness ≤ 0.8 µm 
		x		902940/40		DELOS T – Electronic temperature switch with display, analog output and adaption system for thermowell 902812/10[b] (please select associated thermowells in data sheet 902812) 
			x	902940/50		DELOS T – Electronic temperature switch with display and analog output and M12 × 1 plug connection for RTD temperature probes 
					(2)	**Version**
x	x	x	x	8		Standard with default settings
x	x	x	x	9		Customer-specific configuration (specification in plain text)
					(3)	**Operating temperature in °C**
x				370		-50 to +150 °C
	x	x		386		-50 to +260 °C
			x	408		-50 to +500 °C
					(4)	**Measuring insert**
x	x	x	x	1013		1 × Pt1000 in four-wire circuit
					(5)	**Tolerance class according to DIN EN 60751**
			x	0		Without (not relevant)
x	x	x		2		Class A (standard)
x	x	x		3		Class AA
					(6)	**Output**
x	x	x	x	470		1× PNP switching output
x	x	x	x	471		2× PNP switching output
x	x	x	x	475		1× PNP switching output and 1× analog output, 4 to 20 mA, user configurable
x	x	x	x	476		1× PNP switching output and 1× analog output, 0 to 20 mA, user configurable
x	x	x	x	477		1× PNP switching output and 1× analog output, 0 to 10 V, user configurable
					(7)	**Protection tube diameter D in mm**
			x	0		Without (not relevant)
		x		3		Ø 3 mm
x	x			6		Ø 6 mm
					(8)	**Insertion length EL in mm (50 to 1000 mm)**
			x	0		Without (not relevant)
x	x	x		50		50 mm

x	x	x			100	100 mm
x	x	x			150	150 mm
x	x				...	Specification in plain text (50 mm increments)
					(9)	**Process connection PA**
x	x		x		000	Without (smooth protection tube made out of stainless steel 316 L)
x	x				102	Screw connection G 1/4 (stainless steel 316 Ti)
x	x				103	Screw connection G 3/8 (stainless steel 316 Ti)
x	x				104	Screw connection G 1/2 (stainless steel 316 Ti)
x	x				118	Screw connection M12 × 1.5 (stainless steel 316 Ti)
		x			120	Screw connection M14 × 1 for adapting hygienic thermowells (stainless steel 316 L)
x	x				126	Screw connection M18 × 1.5 (stainless steel 316 Ti)
x	x				128	Screw connection M20 × 1.5 (stainless steel 316 Ti)
x	x				144	Screw connection 1/2-14NPT (stainless steel 316 Ti)
x	x				163	Union nut G 3/8 (stainless steel 316 Ti)
x	x				380	Screw connection G 1/2 with CIP-compliant conical seal (stainless steel 316 L)
x	x				601	Taper socket with union nut DN 10 DIN 11851 (dairy pipe fitting) (stainless steel 316 L)
x	x				604	Taper socket with union nut DN 25 DIN 11851 (dairy pipe fitting) (stainless steel 316 L)
x	x				605	Taper socket with union nut DN 32 DIN 11851 (dairy pipe fitting) (stainless steel 316 L)
	x				611	Clamping socket (clamp) DN 10/20 DIN 32676 (stainless steel 316 L)
x	x				613	Clamping socket (clamp) DN 25/40 (1“/1.5“) DIN 32676 (stainless steel 316 L)
x	x				616	Clamping socket (clamp) DN 50 (2“) DIN 32676 (stainless steel 316 L)
x	x				617	Clamping socket (clamp) 2.5“ similar to DIN 32676 (stainless steel 316 L)
x	x				681	Ball welding socket with threaded fitting (stainless steel 316 L)
x	x				682	Welding socket with CIP-compliant conical seal (stainless steel 316 L)
x	x				684	VARIVENT® connection DN 15/10 (stainless steel 316 L)
x	x				685	VARIVENT® connection DN 32/25 (stainless steel 316 L)
x	x				686	VARIVENT® connection DN 50/40 (stainless steel 316 L)
x	x				840	Ball welding sleeve (stainless steel 316 Ti)
x	x				997	JUMO PEKA hygienic process connection (stainless steel 316 L) (compatible process connection adapter, see data sheet 409711)
					(10)	**Extra codes**
x	x	x	x		000	None
x	x				310	Protection tube ∅ 6 mm stepped down to ∅ 3.8 mm (insertion length EL max. 800 mm)
x	x				810	Welding socket (only for process connection 380)

[a] This JUMO product is licensed under United States and Canadian patents. Purchasers of the JUMO product outside of the United States and Canada should advise JUMO of any planned sales of the product into the United States and Canada.

[b] The insertion length EL in mm must be identical for basic type 902940/40 with the selected hygienic thermowell 902812/10, data sheet 902812.

2 Identifying the device version

2.3 Scope of delivery

1 device in the ordered version
1 combination tool (required for operation on the device and after installation to turn the display case ±160° to the left or right)
1 operating manual

2.4 Accessories for process connection

Designation	**Part no.**
Compression fitting G 1/4 (stainless steel 316 Ti) for protection tube diameter 6 mm (only available for basic type 902940/10 and 902940/30)	00080811
Compression fitting G 1/2 (stainless steel 316 Ti) for protection tube diameter 6 mm (only available for basic type 902940/10 and 902940/30)	00305445

2.5 Accessories

Designation	**Part no.**
Setup program on CD-ROM, multilingual[a]	00550018
Transmitter cable (Y cable)[a]	00507861
PC interface with USB/TTL converter and adapter (USB connecting cable)[a]	00456352
Combination tool (required for operation on the device and after installation to turn the display case ±160° to the left or right)	00526614
Cable box, 4-pole (straight) M12 × 1 with PVC connecting cable length 2000 mm (can be used for assembly)	00404585
Cable box, 4-pole (angled) M12 × 1 with PVC connecting cable length 2000 mm (can be used for assembly)	00409334
Machine connector M12 × 1, 4 pole according to IEC 60947-5-2 (only available for basic type 902940/50)	00404727
Holder for wall mounting for temperature switch with M12 × 1 plug connection (only available for basic type 902940/50)	00555129
Push-in RTD temperature probe with Pt1000 temperature sensor and machine connector M12 × 1	
902150/99-386-1013-2-6-100-56-2500/315 Protection tube diameter 6 mm, insertion length 100 mm, connecting cable length 2500 mm (only available for basic type 902940/50)	00551310
902150/99-386-1013-2-6-200-56-2500/315 Protection tube diameter 6 mm, insertion length 200 mm, connecting cable length 2500 mm (only available for basic type 902940/50)	00551311

Note: for compression fittings and flanges refer to data sheet 909750

[a] The configuration with the setup program can only take place in conjunction with these accessory parts.

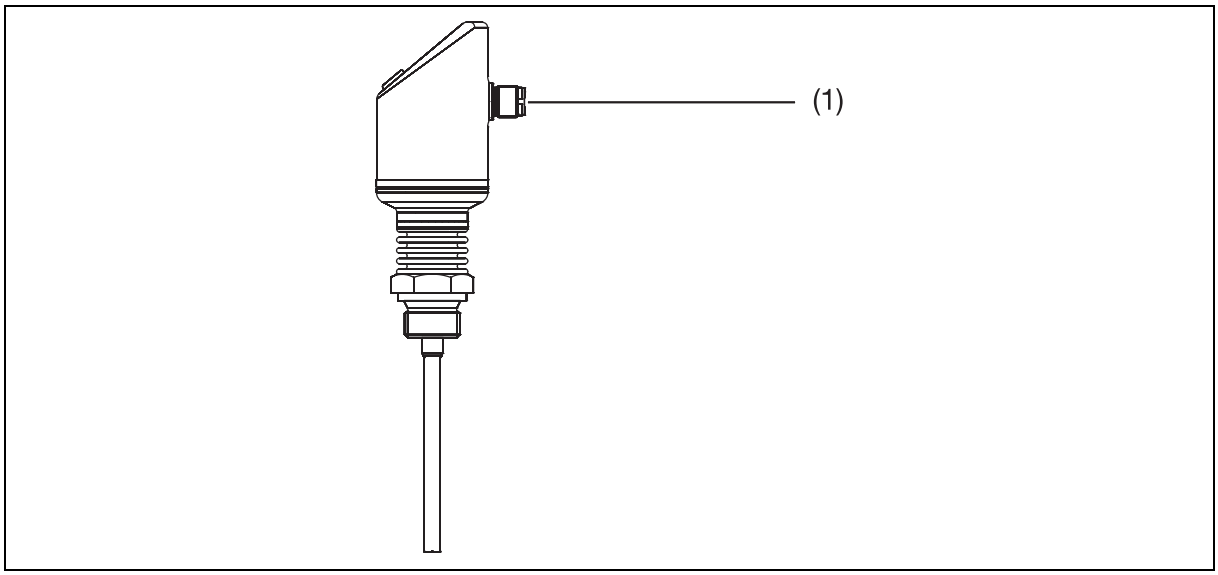
3.1 Installation notes

CAUTION!

The electrical connection must only be carried out by qualified personnel!

- Ensure that the fuses of the load circuits are suitable for the maximum loads to avoid damage to the device.
- The electromagnetic compatibility meets standard EN 61326.
- Do not connect any additional loads to the voltage supply of the device.
- The device is not suitable for installation in potentially explosive areas.
- Besides incorrect installation, incorrectly set values on the device can impair performance of the connected process or cause damage. For this reason, always provide safety devices/guards independent of the device, the setting of which is restricted to expert personnel.

3.2 Device connection



(1) Connection on the device for analog or switching output, voltage supply and interface

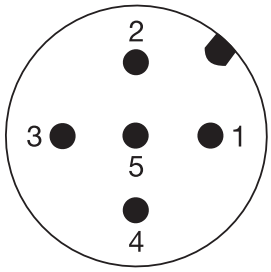
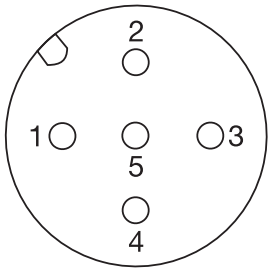
3 Electrical connection

3.3 Device terminal assignment

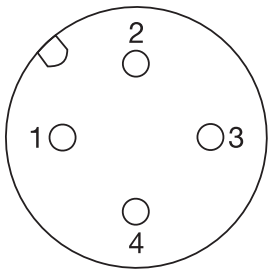
The connection is located on the device rear!

NOTE!

The terminal assignment **only** applies to A-coded standard cables.

M12 circular connector, 5-pole according to IEC 61076-2-101 Top view of the plug-in contacts (pins) for the circular connector on the device.  	Top view of the plug-in contacts (socket) for the transmitter cable (Y cable). Accessories part no. 00507861 

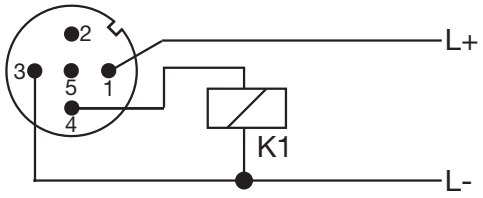
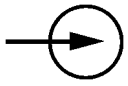
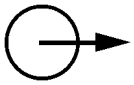
1	Wire color: brown (bn)	2	Wire color: white (wh)
3	Wire color: blue (bu)	4	Wire color: black (bk)
5	Wire color: gray (gy)		

Top view of the plug-in contacts (socket) of the 4-pole cable box (straight or angled) M12 × 1 with PVC connecting cable length 2000 mm Accessories, 4-pole cable box (straight) part no. 00404585 Accessories, 4-pole cable box (angled) part no. 00409334  	

1	Wire color: brown (bn)	2	Wire color: white (wh)
3	Wire color: blue (bu)	4	Wire color: black (bk)

3.4 Terminal assignment for order code 470

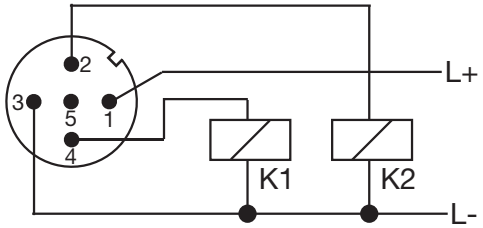
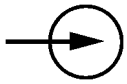
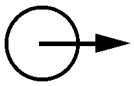
The connection is located on the device rear!

<table>
<tr><td colspan="2">1× PNP switching output
 
</td></tr>
<tr><td>Voltage supply</td><td>  </td></tr>
<tr><td>1 L+ (Wire color: brown (bn))</td><td>DC 12 to 30 V</td></tr>
<tr><td>3 L- (Wire color: blue (bu))</td><td>GND</td></tr>
<tr><td>Output</td><td>  </td></tr>
<tr><td>4 K1 (Wire color: black (bk))</td><td>Highside open collector
max. 0.25 A</td></tr>
<tr><td>2 (Wire color: white (wh))</td><td>nc</td></tr>
<tr><td>5 (Wire color: gray (gy))</td><td>Interface</td></tr>
</table>

3 Electrical connection

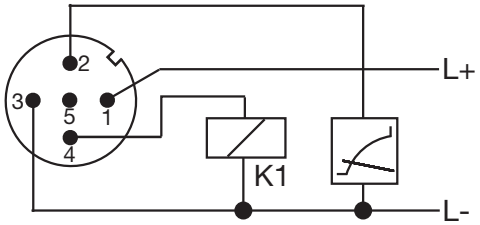
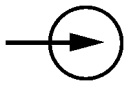
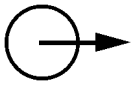
3.5 Terminal assignment for order code 471

The connection is located on the device rear!

<table>
<tr><td colspan="2">2× PNP switching output
 
</td></tr>
<tr><td>Voltage supply</td><td>  </td></tr>
<tr><td>1 L+ (Wire color: brown (bn))</td><td>DC 12 to 30 V</td></tr>
<tr><td>3 L- (Wire color: blue (bu))</td><td>GND</td></tr>
<tr><td>Output</td><td>  </td></tr>
<tr><td>4 K1 (Wire color: black (bk))</td><td rowspan="2">Highside open collector
max. 0.25 A</td></tr>
<tr><td>2 K2 (Wire color: white (wh))</td></tr>
<tr><td>5 (Wire color: gray (gy))</td><td>Interface</td></tr>
</table>

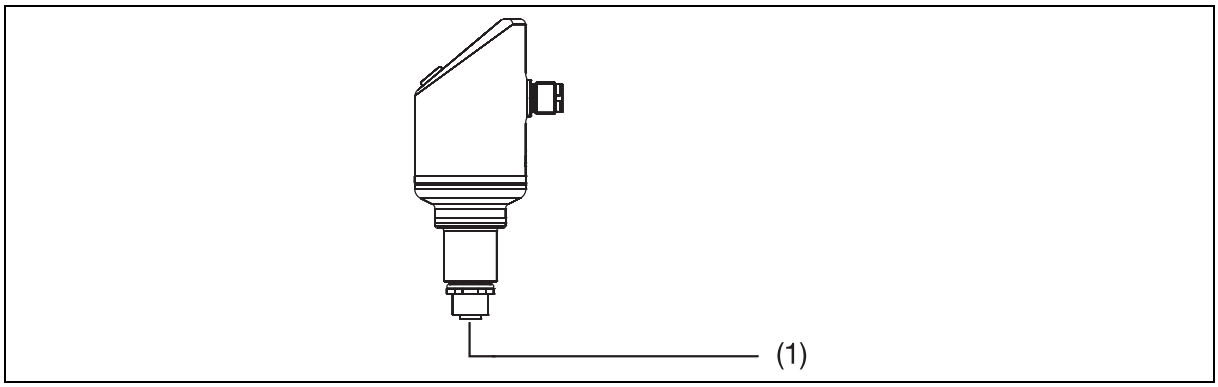
3.6 Terminal assignment for order code 475, 476 and 477

The connection is located on the device rear!

<table>
<tr><td colspan="2">1× PNP switching output and 1× analog output
 
</td></tr>
<tr><td>Voltage supply</td><td>  </td></tr>
<tr><td>1 L+ (Wire color: brown (bn))</td><td>DC 12(14) to 30 V</td></tr>
<tr><td>3 L- (Wire color: blue (bu))</td><td>GND</td></tr>
<tr><td>Output</td><td>  </td></tr>
<tr><td>4 K1 (Wire color: black (bk))</td><td>Highside open collector
max. 0.25 A</td></tr>
<tr><td>2 analog (Wire color: white (wh))</td><td>0(4) to 20 mA/0 to 10 V</td></tr>
<tr><td>5 (Wire color: gray (gy))</td><td>Interface</td></tr>
</table>

3 Electrical connection

3.7 RTD temperature probe connection



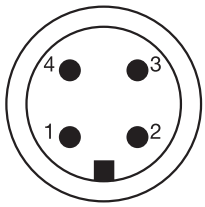
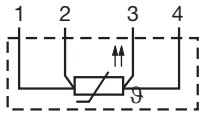
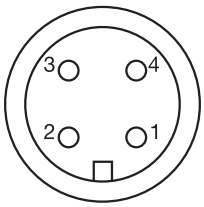
(1) RTD temperature probe connection

3.8 RTD temperature probe terminal assignment for basic type 902940/50

The connection is located on the device underside!

NOTE!

Please do not mix this up with the device connection on the rear of the device (only for analog or switching output, voltage supply and interface)!

Machine connector M12 x 1, 4-pole according to IEC 60947-5-2 Top view of the plug-in contacts (pins) of the machine connector at the corresponding RTD temperature probe! 	**RTD temperature probe terminal assignment in four-wire circuit (input)** 
Top view of the plug-in contacts (socket) of the installed socket on the underside of the device. 	

4.1 General information

CAUTION!

Check that the device is compatible with the measurement medium.

Mounting site

- Ensure that the device is easily accessible for the later operation.
- Ensure that the device is fastened safely and with low vibrations.
- Avoid direct sunlight!
- Ensure an admissible ambient temperature at the installation site.

Installation position

The device can be installed in any position.

We recommend the "vertical" installation position.

4.1.1 Rotating the LCD (display)

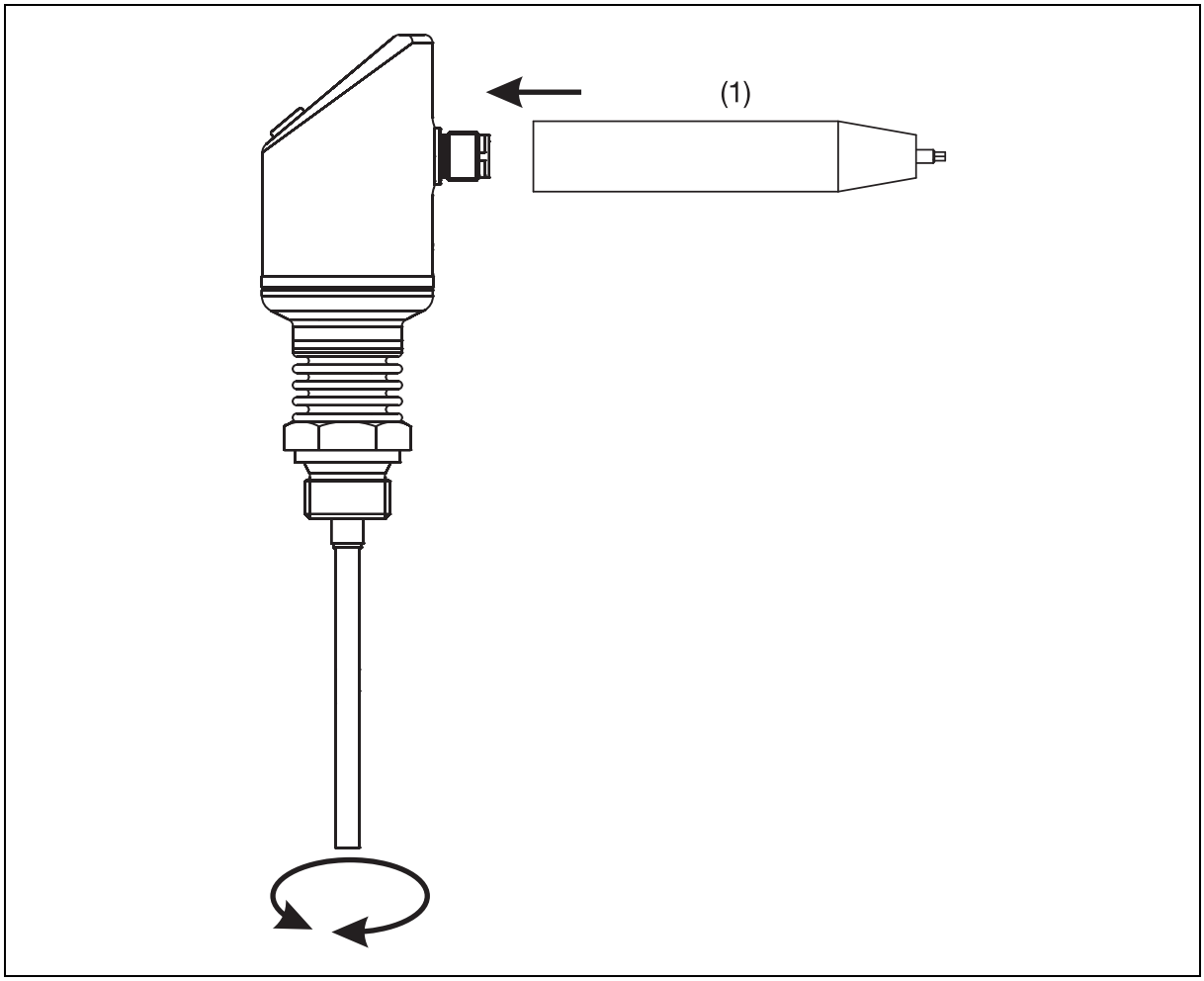
The device LCD display can be turned through 180°. Either via the setting on the device or the optional setup program.

This will facilitate reading when, for example, the device is installed "overhead".

⇨ chapter 6.17 "Setting the display alignment (D.Dir)", page 55

4.1.2 Turning the display case

The display case of the device can be turned to the LH or RH side by ±160° with the supplied combination tool (1).



(1) Combination tool

4.2 Device dimensions

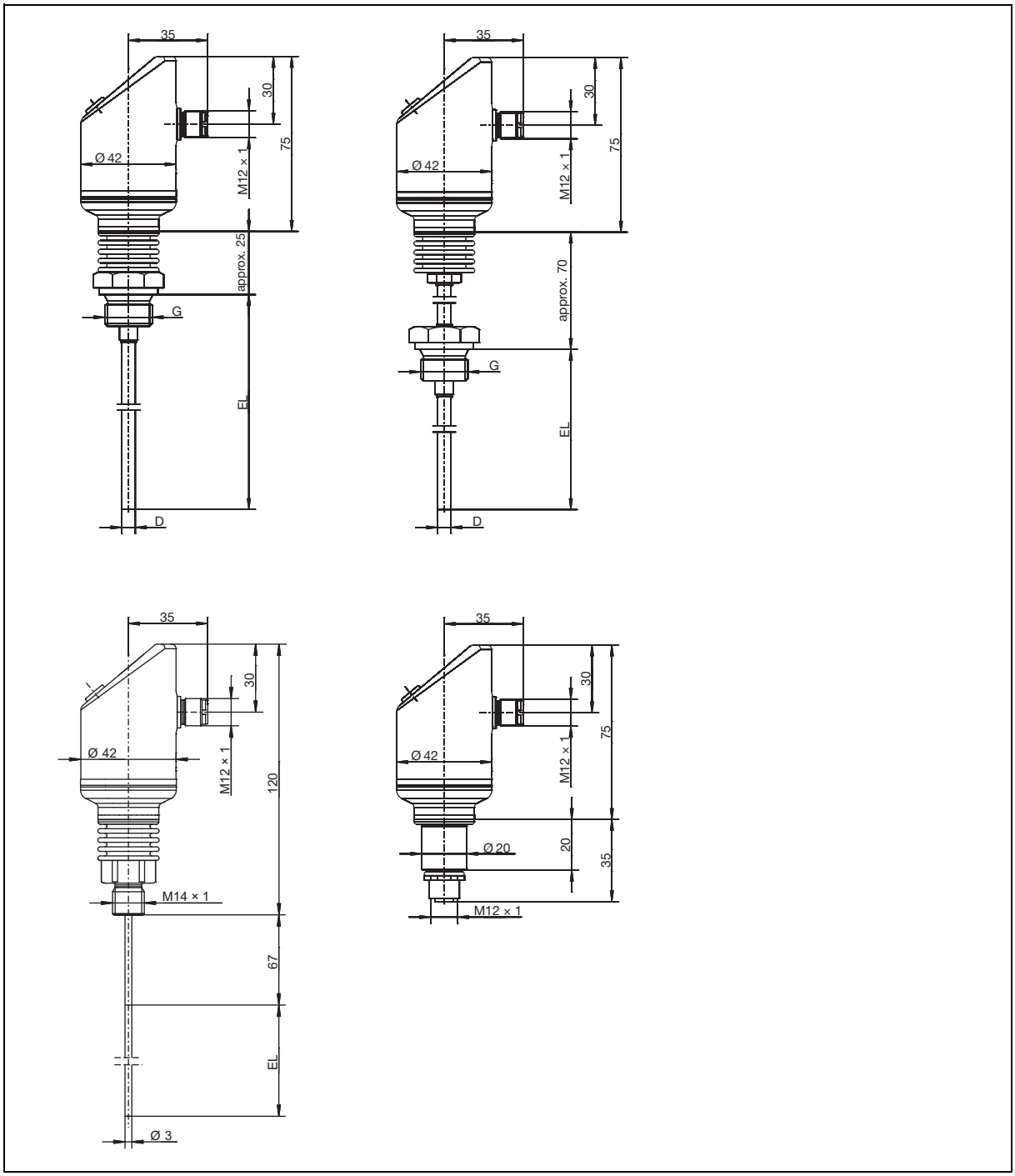
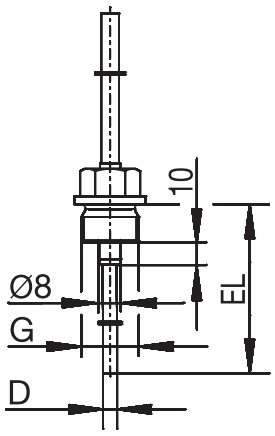


Fig. 4-1 Basic type 902940/10 with process connection (upper left)
Basic type 902940/30 with extension tube and process connection (upper right)
Basic type 902940/40 with adaption system for thermowell 902812/10 (bottom left)
Basic type 902940/50 with M12 x 1 plug connection for RTD temperature probe (bottom right)

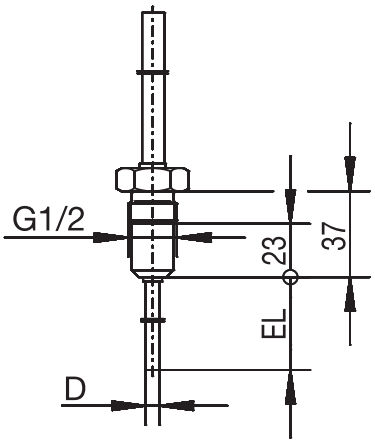
4.3 Process connection dimensions (PA)

Screw connection



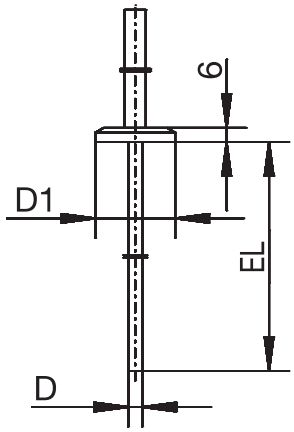
PA	G
103	3/8
104	1/2

Screw connection with CIP-compliant conical seal



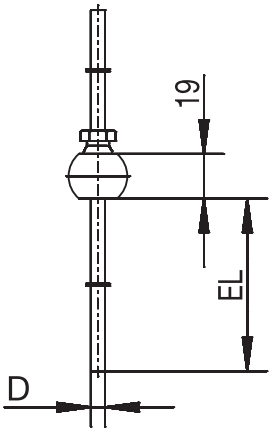
PA	
380	

Clamping socket according to DIN 32676 (clamp)



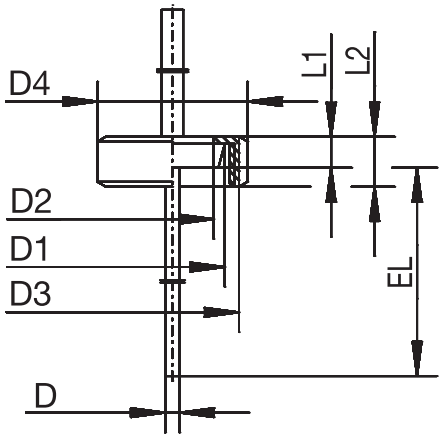
PA	DN	D1
-	-	∅ 25
611	10/20	∅ 34
613	25/1”	∅ 50.5
613	40/1.5”	∅ 50.5
616	50/2”	∅ 64
617	2.5”	∅ 77.5

Ball welding socket with threaded fitting



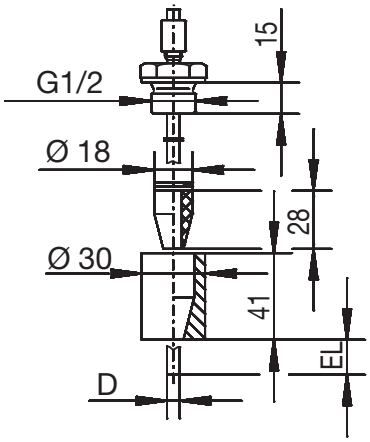
PA		
681		

Clamping socket with union nut acc. to DIN 11851 (dairy pipe fitting)



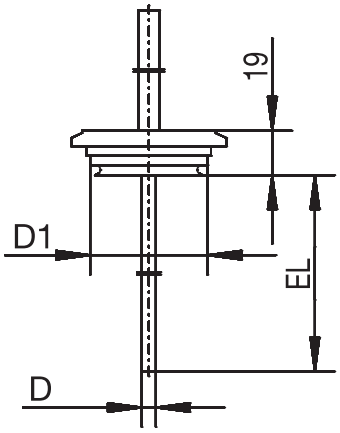
PA	DN	D1	D2	D3	D4	L1	L2
601	10	∅ 22	∅ 18	RD 28 × 1/8	∅ 38	9	18
604	25	∅ 44	∅ 35	RD 52 × 1/6	∅ 63	13	21
605	32	∅ 50	∅ 41	RD 58 × 1/6	∅ 70	13	21

Welding socket with CIP-compliant conical seal

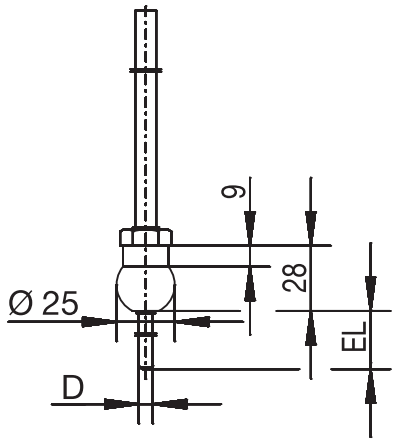
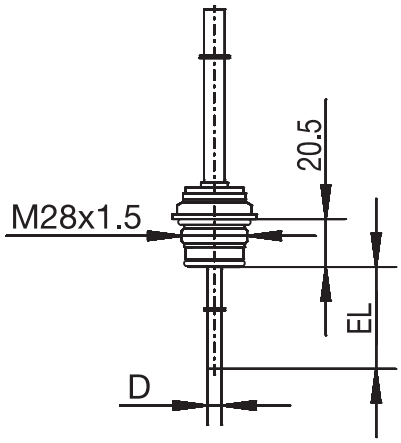


PA		
682		

VARIVENT® connection



PA	DN	D1
684	15/10	∅ 31
685	32/25	∅ 50
686	50/40	∅ 68

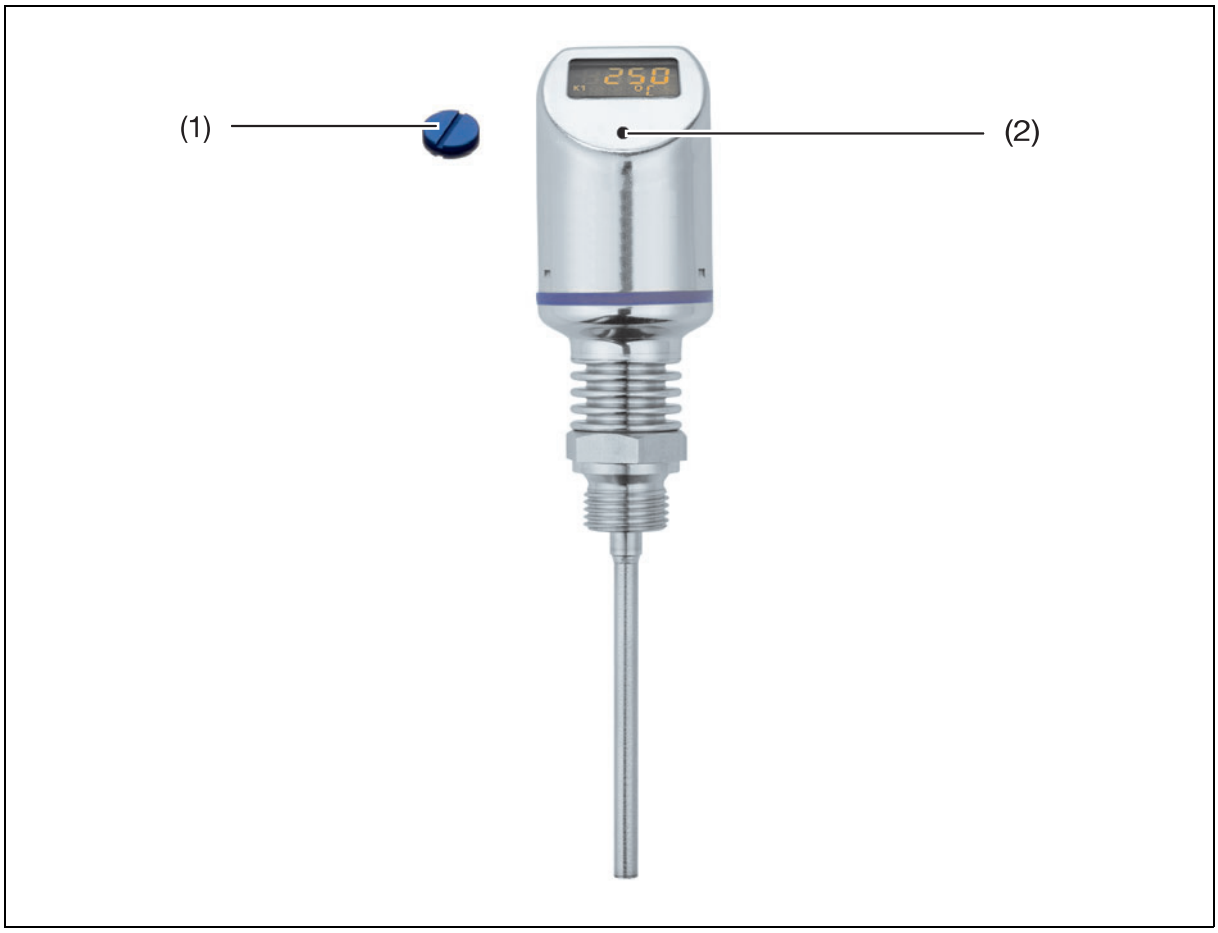
Ball welding sleeve	JUMO PEKA 997 process connection adapter
	

PA			VARIVENT®	Clamp	Aseptic	Welding socket
840			DN 25/32	DN 25/32/40	DN 40	∅ 55 mm
			DN 40-125	DN 50	DN 50	-
			-	-	NKS DN 40	-

NOTE!

The JUMO PEKA 997 process connection adapter is a hygienic process connection.
For detailed information on this process connection adapter, please refer to data sheet 409711.

5.1 Control element



(1) Sealing screw
(2) Control element

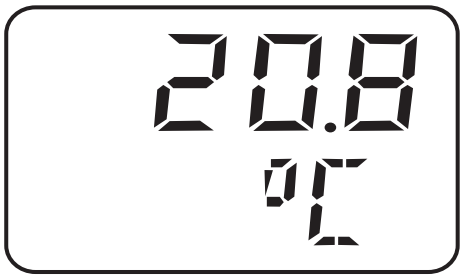
Process:

1. Remove the sealing screw (1) using a suitable screwdriver.
2. Use the supplied combination tool
   (or a 0.5 x 3 mm screwdriver or Allen key, width across flats 2)
   to "turn/press"the operating element (2).

5 Operation

5.2 LCD display

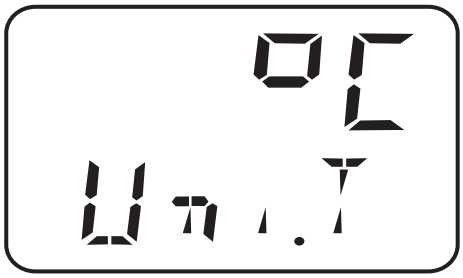
5.2.1 Measuring mode (normal display)



Example:

The LCD display is lit yellow.

5.2.2 Setting mode



Example:

The LCD display is lit red.

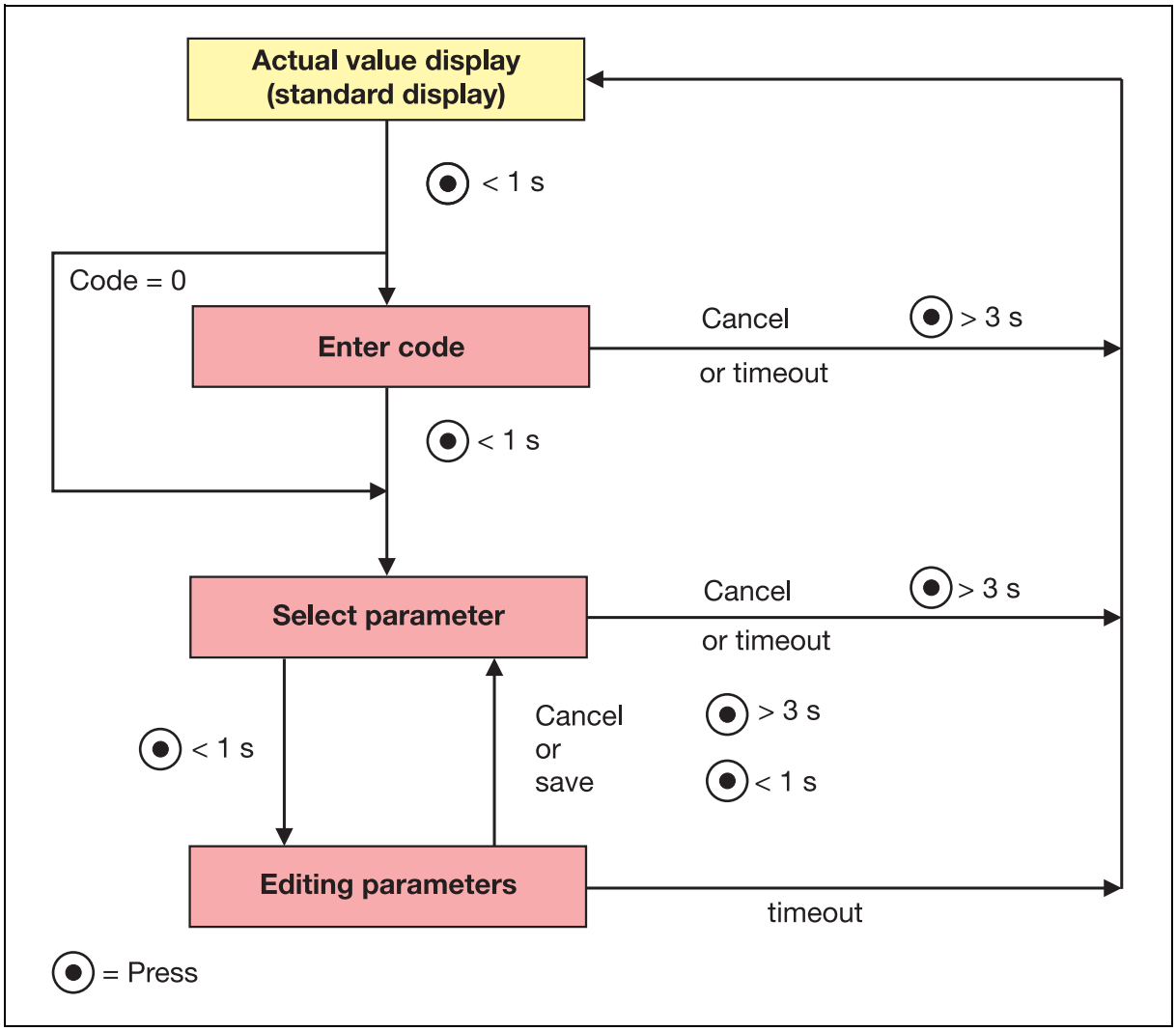
Operation

Next	Press the combination tool for less than 1 second (< 1 s)
Yes (take-over)	Press the combination tool for less than 1 second (< 1 s)
No (cancel)	Press the combination tool for more than 3 seconds (> 3 s)
Timeout	No action for more than 60 seconds (> 60 s)

NOTE!

To change over from the setting mode to the measuring mode:
- "No" (Cancel) or
- Wait for "Timeout" = No actions for 60 seconds.

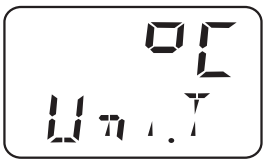
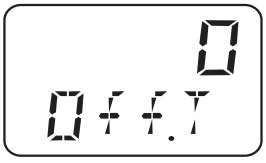
5.3 Levels


Actual value display
(standard display)
< 1 s
Code = 0
Enter code
Cancel
> 3 s
or timeout
< 1 s
Select parameter
Cancel
> 3 s
or timeout
Cancel
or
save
> 3 s
< 1 s
< 1 s
Editing parameters
timeout
= Press

5 Operation

5.4 Parameter

5.4.1 Input

Parameter	Display	Setting range[a]
Temperature unit		**°C** °F
Decimal place temperature values		**0** 1
Offset (zero point correction)		-100.0 to **0** to +100.0 °C
Damping (filter time constant)		0.00 to **0.10** to 99.99 s
Mains frequency (Hz)		**50 H** 60 H

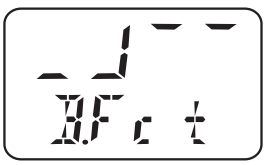
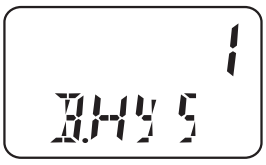
[a] The default setting is displayed bold.

5.4.2 Analog output

Parameter	Display	Setting range[a]
Type of signal (only with analog output)		**4 to 20 mA** 0 to 20 mA 0 to 10 V
Scaling start (only with analog output)		**-50 °C**
Scaling end (only with analog output)		150 °C/260 °C/500 °C **Note:** Depending on the device ordered.
Error signal (only with analog output)		3.4 mA or 22 mA with output signal 4 to 20 mA 0 mA or 22 mA with output signal 0 to 20 mA 0 V or 10.7 V with output signal 0 to 10 V ⇨ chapter 6.10 "Setting the error signal of the analog output (S.Err)", page 45 **Note:** Depending on the configured output signal.

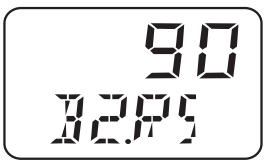
[a] The default setting is displayed bold.

5.4.3 Binary output 1

Parameter	Display	Setting range[a]
Switching function		**= Hysteresis, N/O contact** = Hysteresis, N/C contact = Window, N/O contact = Window, N/C contact ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47
Switching point		100 °C ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47
Release point		90 °C ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47
Hysteresis (only with configured switching point and release point)		0 to **1** to 500 °C ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47 **Note:** Application exclusively with window switching functions.
Switch-on delay		**0.00** to 99.99 s ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47

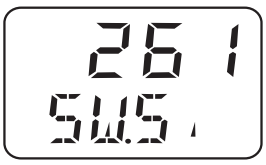
[a] The default setting is displayed bold.

5.4.4 Binary output 2

Parameter	Display	Setting range[a]
Switching function (only with second switching output)		**= Hysteresis, N/O contact** = Hysteresis, N/C contact = Window, N/O contact = Window, N/C contact ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47
Switching point (only with second switching output)		100 °C ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47
Release point (only with second switching output)		90 °C ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47
Hysteresis (only with second switching output and configured switching point and release point)		0 to **1** to 500 °C ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47 **Note:** Application exclusively with window switching functions.
Switch-on delay (only with second switching output)		**0.00** to 99.99 s ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47

[a] The default setting is displayed bold.

5.4.5 Display and operation

Parameter	Display	Setting range[a]
Display alignment		**Std** = standard (for standard operation) turn = turned through 180° (for overhead operation) ⇨ chapter 6.17 "Setting the display alignment (D.Dir)", page 55
Unit of the actual value display (only with analog output)		**Uni.T** = Temperature unit (Uni.T) Perc = % of the scaled range (Sc.Lo and Sc.Hi) ⇨ chapter 6.18 "Setting the digital indicator (D.Uni)", page 56
Software version of the operating unit (cannot be edited)		Display of the software version of the operating unit ⇨ chapter 6.19 "Displaying the software version of the operating unit (SW.Di)", page 57
Software version of the signal unit (cannot be edited)		Display of the software version of the signal unit ⇨ chapter 6.20 "Displaying the software version of the signal unit (SW.Si)", page 58
Code (can only be programmed via the setup program)		0000 to **0072** to 9999 ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34

[a] The default setting is displayed bold.

6.1 Quick introduction

NOTE!

This is a proposal to be able to configure the device reliably within a short time. If you check the setting possibilities specified in this list prior to starting configuration, timeouts can be avoided during configuration.

Process:

1. Mount the device.
   ⇨ chapter 4 "Mounting", page 19
2. Connect the device.
   ⇨ chapter 3 "Electrical connection", page 13
3. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
4. Select the unit of the measured value.
   ⇨ chapter 6.4 "Setting the unit of the measured value (Uni.T)", page 36
5. Set the output signal.
   ⇨ chapter 6.8 "Setting the output signal (S.Type)", page 39
6. Set the output signal scaling.
   ⇨ chapter 6.9 "Setting the output signal scaling", page 40
7. Set the switching function.
   ⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47
8. Set the switching point.
   ⇨ chapter 6.13 "Setting the switching point (B.Sp)", page 51
9. Set the release point.
   ⇨ chapter 6.14 "Setting the release point (B.RSp)", page 52

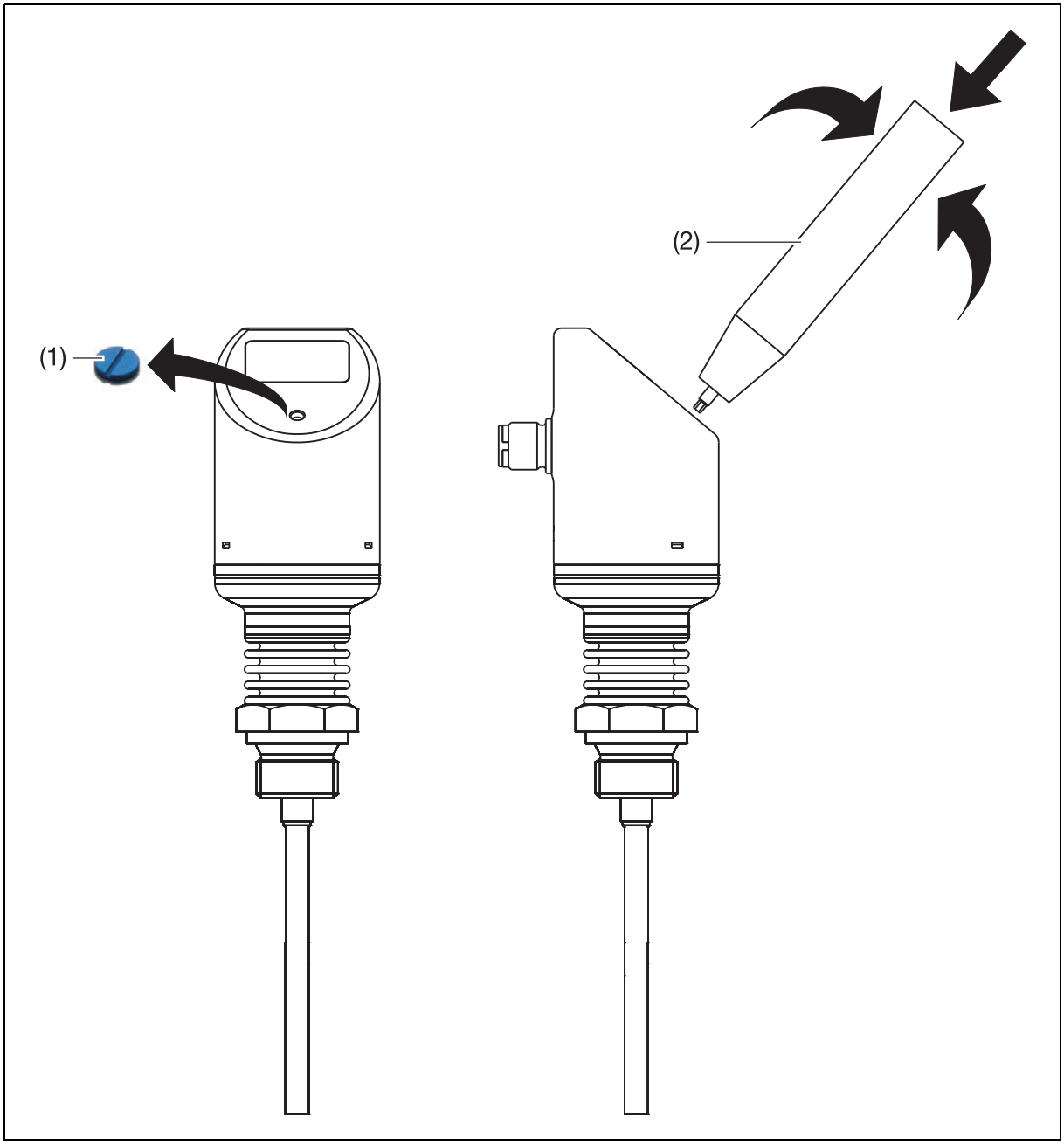
6 Startup

6.2 Unlocking the device (enter the code).

The device is protected against unauthorized operation by a code.

Code is set to 0072 (factory setting). Changes are only possible with the setup program. The device will become unprotected when the setup program is used to set the code to 0000.

Unlocking

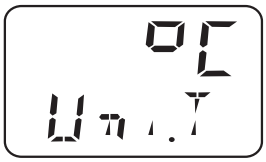


(1) Sealing screw
(2) Combination tool

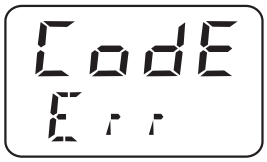
Process:

1. Remove the sealing screw (1) using a suitable screwdriver.
2. Briefly press the combination tool (2) until the third "0" (counted from the left) flashes. Display previously changes to "red".
3. Turn the combination tool until "7" appears. Briefly press the combination tool.
4. Briefly press the combination tool until the fourth "0" (counted from the left) flashes.
5. Turn the combination tool until "2" appears. Briefly press the combination tool.

6. The device automatically changes over to the parameter level.



If an incorrect code was entered:



The display automatically changes over to the code entry after 3 seconds (or briefly press the combination tool). Repeat steps 2 to 5.

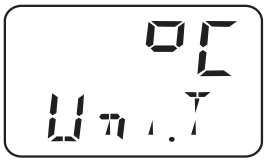
6.3 Cancel operation

1. Press the combination tool for more than 3 seconds or
2. wait for a "timeout" (no actions for more than 60 seconds)

6.4 Setting the unit of the measured value (Uni.T)

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "Uni.T" appears in the bottom line.
3. "Press"

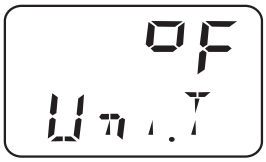


flashing

fixed

The measured temperature is displayed in °C.

4. "Turn"



The measured temperature is displayed in °F.

Setting:

°C = Temperature unit °C (default setting)

°F = Temperature unit °F

5. Confirm the setting: "Press" until the display stops flashing.

6.4.1 Display and setting possibilities of the device

Measuring range	Temperature Unit	Display	
		Start	End
-50 to +150 °C	°C	-50	+150
-50 to +260 °C	°C	-50	+260
-50 to +500 °C	°C	-50	+500
-58 to +302 °F	°F	-58	+302
-58 to +500 °F	°F	-58	+500
-58 to +932 °F	°F	-58	+932

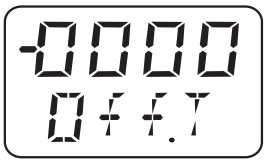
6.5 Setting the offset (zero point) (Off.T)

6.5.1 Edited offset setting

With this setting, the measured temperature can be increased by an adjustable value.

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "Off.T" appears in the bottom line.
3. "Press"



flashing

fixed

NOTE!

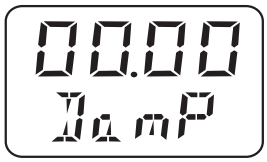
"-" means: the offset is negative - the measured temperature is reduced.
The value is entered "digit-by-digit".

6.6 Setting the filter time constant (damping) (DamP)

The filter time constants (damping) can be used to "damp" the measured value.
Small filter time constant: the measured value is updated faster.
Large filter time constant: the measured value is updated slower.
The value is entered in seconds with two decimal places.

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "DamP" appears in the bottom line.
3. "Press"



6.7 Setting the mains frequency (Freq)

This setting can be used to change the mains frequency from 50 Hz to 60 Hz.

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "Freq" appears in the bottom line.
3. "Press"

Setting:
50H = Mains frequency 50 Hz (default setting)
60H = Mains frequency 60 Hz

6.8 Setting the output signal (S.Type)

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "S.Typ" appears in the bottom line.
3. "Press"

Setting:

4.20 A = Output signal 4 to 20 mA

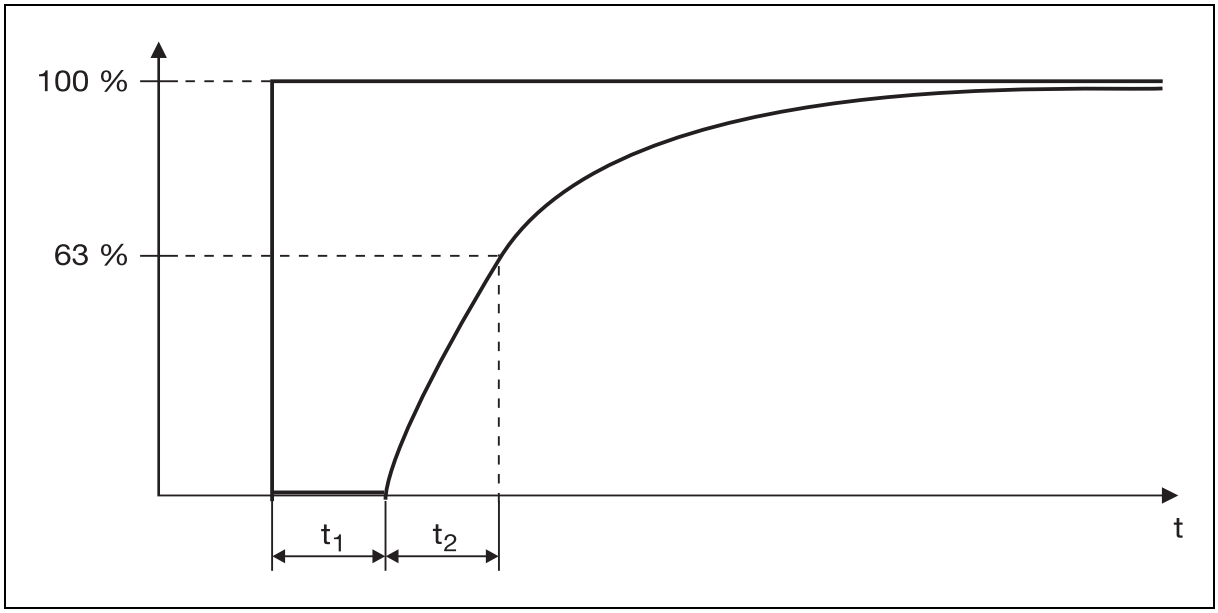
0.20 A = Output signal 0 to 20 mA

0.10 U = Output signal 0 to 10 V

6.8.1 Output behavior

The output signal behavior in the event of an abrupt change of the input signal is specified in the following table and the figure.

Output	Dead time t_1	Time constant t_2
Current output	< 200 ms at 50 Hz mains frequency < 320 ms at 60 Hz mains frequency	70 ms
Voltage output	< 200 ms at 50 Hz mains frequency < 320 ms at 60 Hz mains frequency	80 ms



6.9 Setting the output signal scaling

The output signal scaling describes how the measured temperature is "converted" to an output signal.

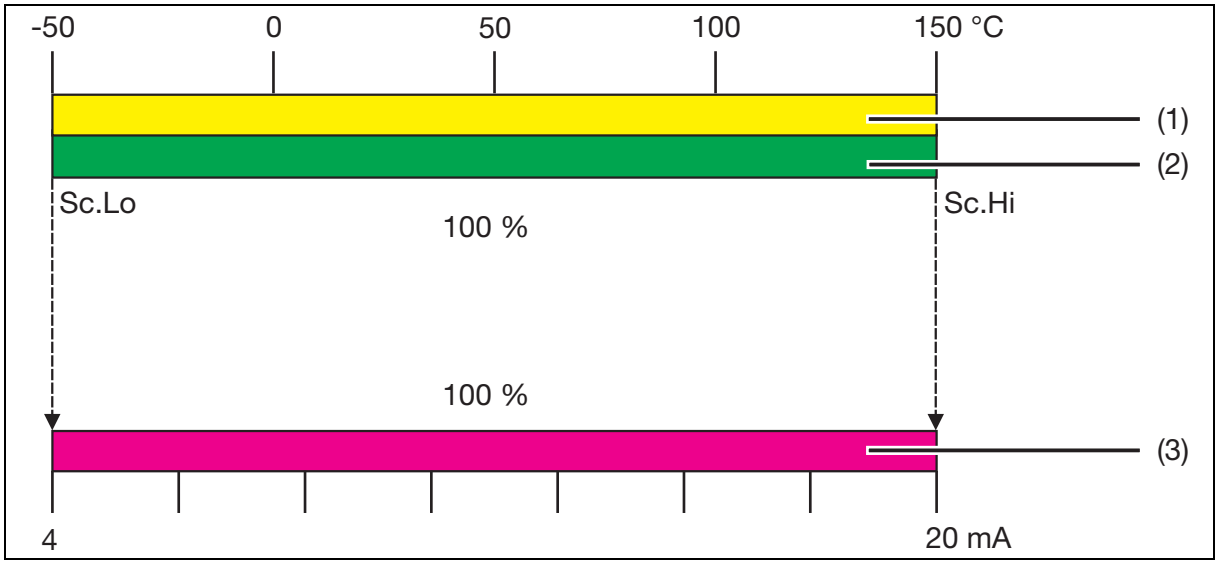
Simple example:

Actual

The device has a measuring range (1) from -50 to+150 °C and the output signal 4 to 20 mA (3).

Set point

Customer requirement: The "customer measuring range" (2) -50 to +150 °C (100 % of the measuring range (1)) must be equivalent to the output signal (3) 4 to 20 mA (100 %).



(1) Measuring range
(2) Customer measuring range
(3) Output signal

Customer specific scaling

It is frequently desired that a part of the measuring range is scaled to the output signal.

Example:

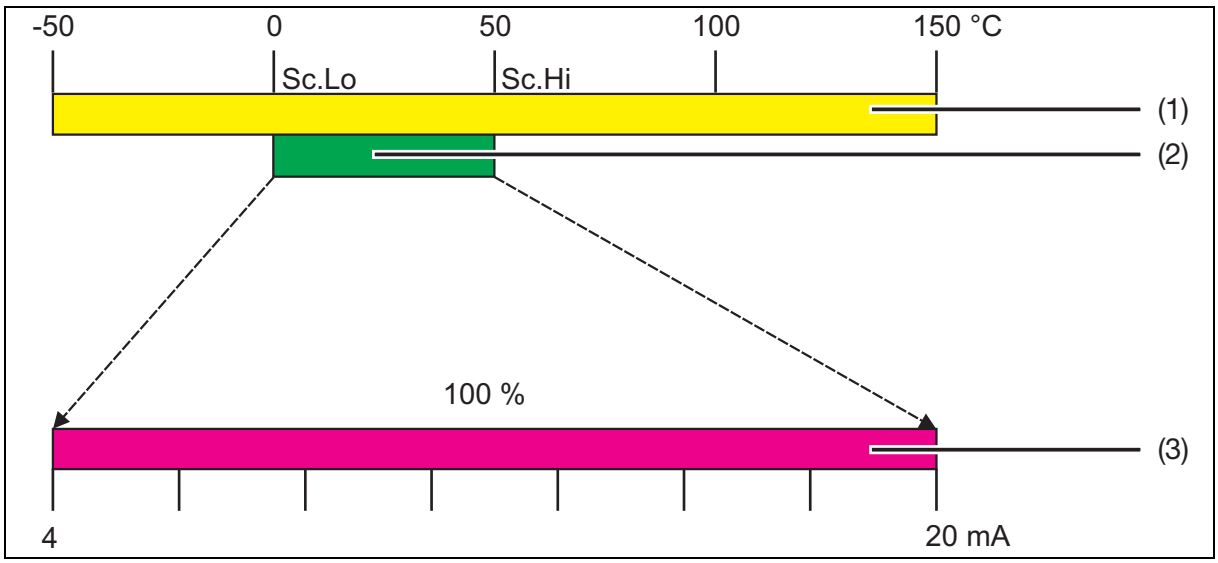
Actual

The device has a measuring range (1) from -50 to+150 °C and the output signal 4 to 20 mA (3).

Set point

Customer requirement: The "customer scaling range" (2) 0 to 50 °C (25 % of the measuring range (1)) must be equivalent to the output signal 4 to 20 mA (100 %).

Scaling is 1 : 4 (25 % to 100 %).



(1) Measuring range
(2) Customer scaling range
(3) Output signal

Inverting the output signal

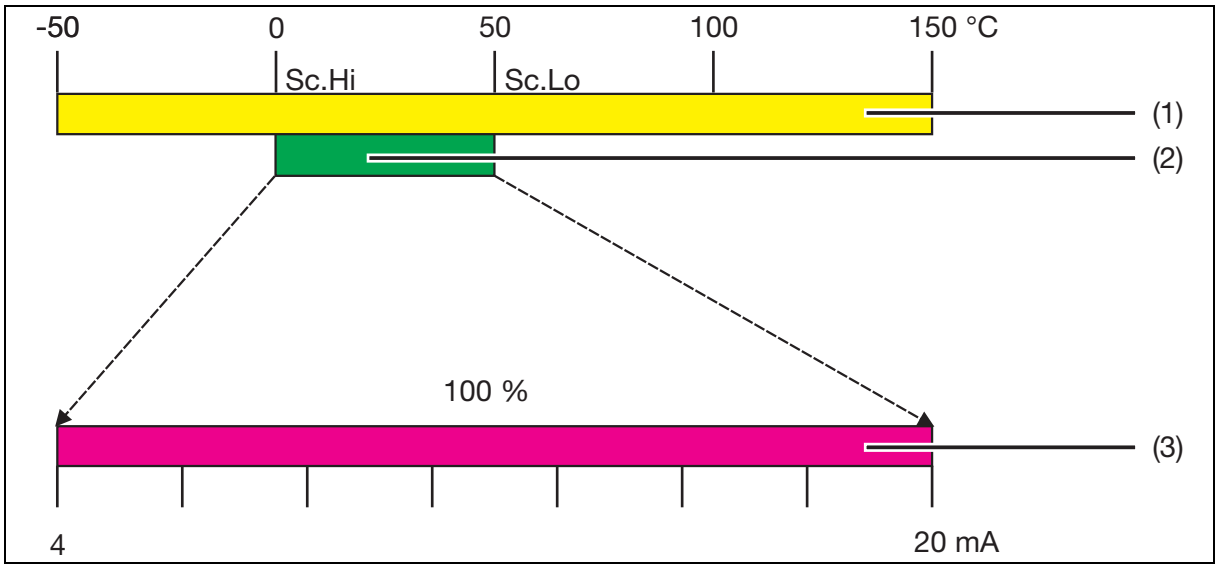
The device offers the possibility to invert the output signal (3).

During this process the output signal

- 0 to 20 mA becomes output signal 20 to 0 mA
- 4 to 20 mA becomes output signal 20 to 4 mA
- 0 to 10 V becomes output signal 10 to 0 V

Example:

20 to 4 mA



(1) Measuring range
(2) Customer scaling range
(3) Output signal

6.9.1 Setting the scaling start value (Sc.Lo)

NOTE!

The output signal can only be scaled on devices with analog output.

Setting range:	Measuring range
Default setting:	Measuring range start

Example:

The device has a measuring range from -50 to +150 °C.

The output signal of the device is 0 to 20 mA.

Objective:	The range from 0 to 100 °C (customer scaling) is to be displayed on the output side by 0 to 20 mA.
Setting:	Scaling start value (Sc.Lo) = 0 Scaling end value (Sc.Hi) = 100
Result:	At a temperature below 0 °C, the device indicates an error (measuring range gone below) and provides the respective error signal (0 mA) on the analog output. At a temperature of 0 °C, the device provides 0 mA on the analog output. At a temperature of 100 °C, the device provides 20 mA on the analog output. At a temperature exceeding 100 °C, the device indicates an error (measuring range exceeded) and provides the respective error signal (22 mA) on the analog output.

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "Sc.Lo" appears in the bottom line.
3. "Press"

"-" flashing

fixed

NOTE!

The value is entered "digit-by-digit"!

6.9.2 Setting the scaling end value (Sc.Hi)

NOTE!

The output signal can only be scaled on devices with analog output.

Setting range:	Measuring range
Default setting:	Measuring range end

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "Sc.Hi" appears in the bottom line.
3. "Press"

"-" flashing

fixed

NOTE!

The value is entered "digit-by-digit"!

6.10 Setting the error signal of the analog output (S.Err)

NOTE!

An error signal for overrange or underrange is only transmitted on devices with analog output.

In the event of errors (e.g. probe break or probe short-circuit), the analog output transmits the signal configured here.

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "S.Err" appears in the bottom line.
3. "Press"

Setting:

Signal type	Setting
4 to 20 mA	3.4mA = 3.4 mA 22mA = 22 mA
0 to 20 mA	0mA = 0 mA 22mA = 22 mA
0 to 10 V	0V = 0 V 10.7V = 10.7 V

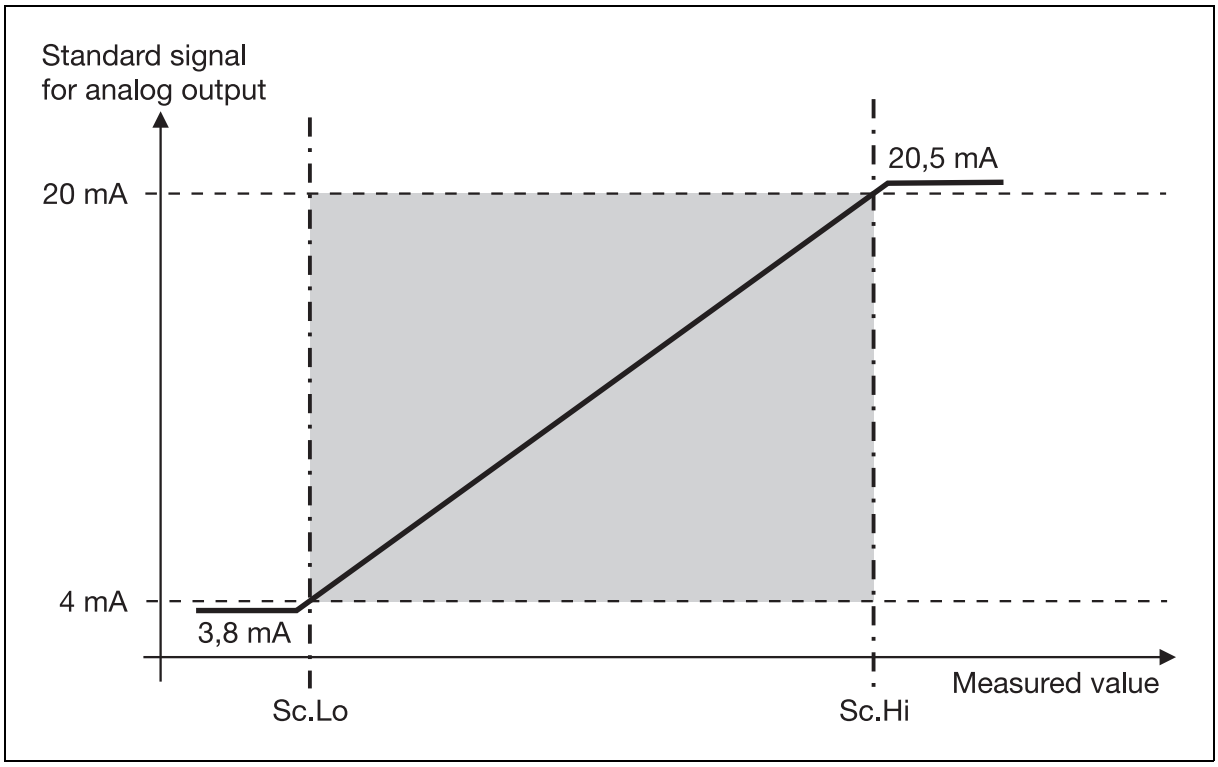
6.11 Behavior when leaving the scaling range

The standard signal range of the analog output is limited according to the recommendation of Namur NE 43.

Signal type	Lower limit	Upper limit
4 to 20 mA	3.8 mA	20.5 mA
0 to 20 mA	0 mA	20.5 mA
0 to 10 V	0 V	10.2 V

Example:

4 to 20 mA (default setting)



6.12 Setting the switching function (B.Fct)

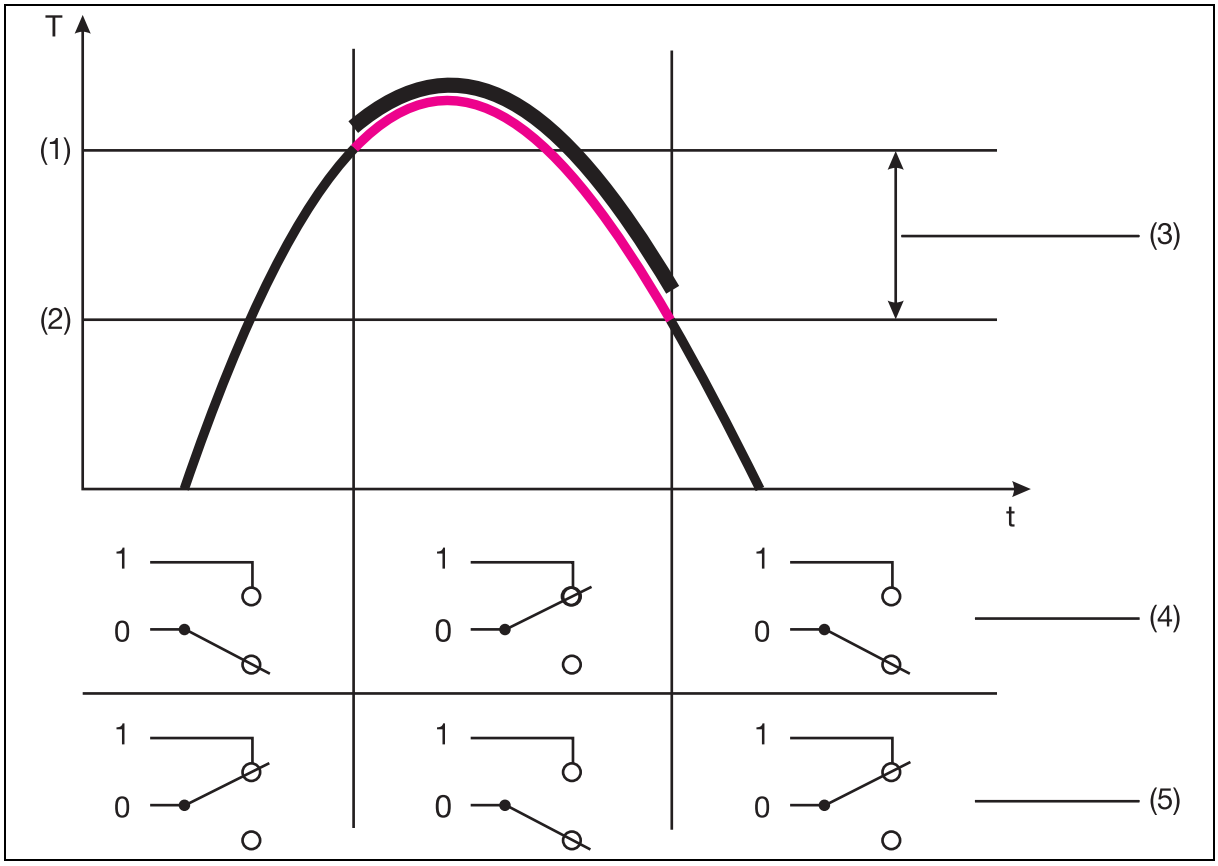
General information

The switching output behavior of the device can be set.

6.12.1 Hysteresis (switching differential)

Relay behavior

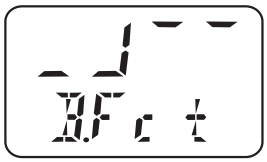
- Hysteresis, N/O contact
- Hysteresis, N/C contact

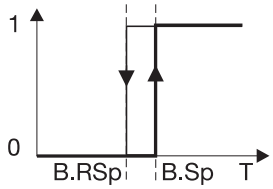


(1) Switching point (Sp)
(2) Release point (RSp)
(3) Hysteresis (switching differential)
(4) N/O contact
(5) N/C contact

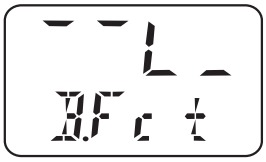
Process:

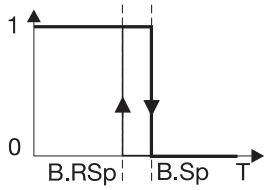
1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "B.Fct" appears in the bottom line.
3. "Press"





Hysteresis N/O contact (switching differential) = Max. contact (default setting)



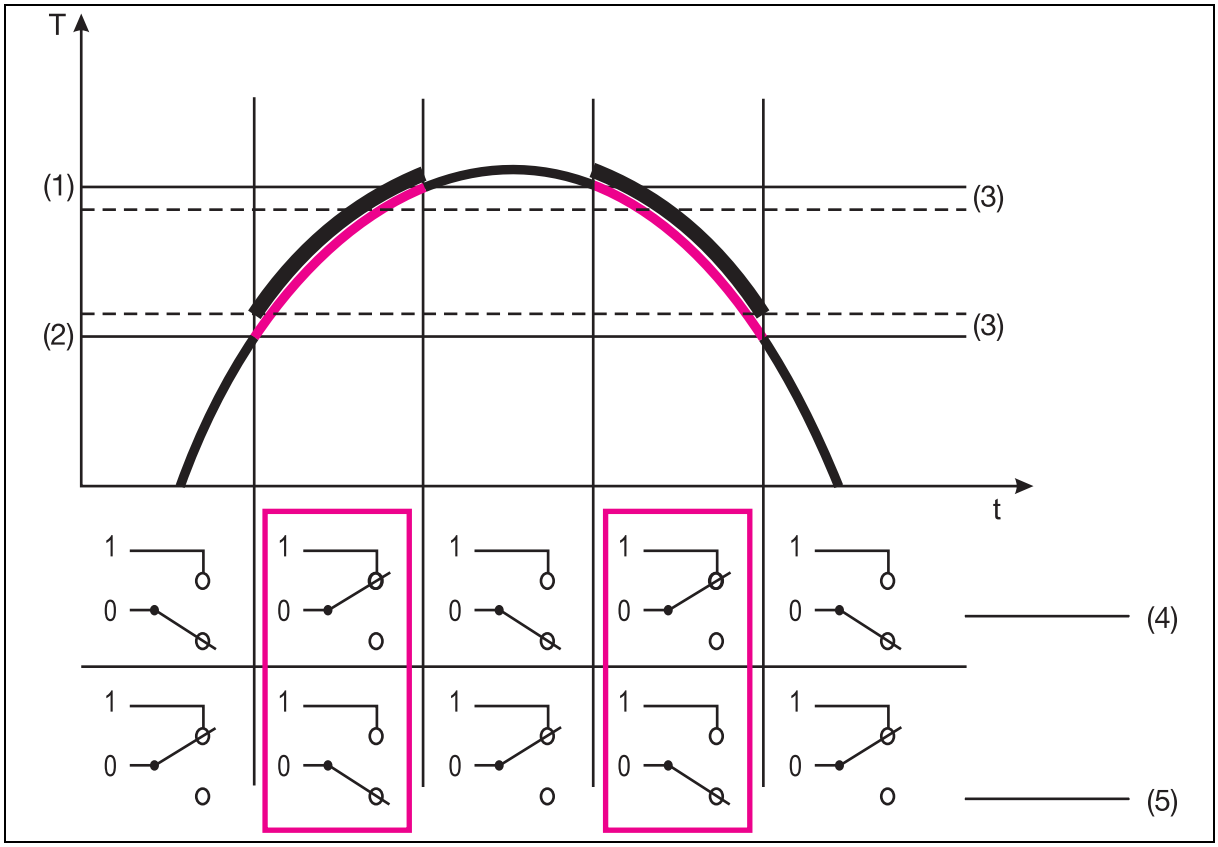


Hysteresis, N/C contact (switching differential) = Min. contact

6.12.2 Window

Relay behavior

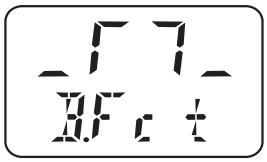
- Window function, N/O Contact
- Window function, N/C Contact

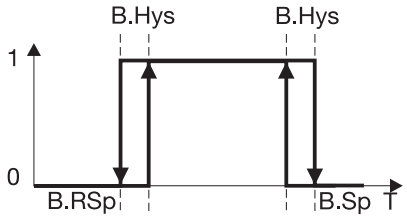


(1) Switching point (Sp)
(2) Release point (RSp)
(3) Hysteresis (switching differential)
(4) N/O contact
(5) N/C contact

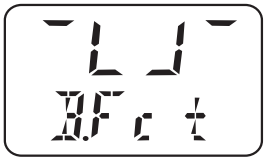
Process:

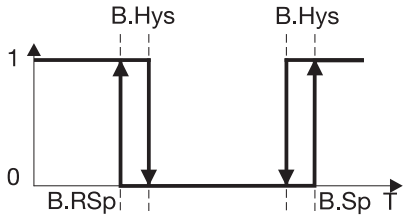
1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "B.Fct" appears in the bottom line.
3. "Press"





Window function, N/O Contact





Window function, N/C Contact

6.13 Setting the switching point (B.Sp)

⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47

Setting range:	Measuring range (> B.RSp)
Default setting:	100 °C

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "B.Sp" appears in the bottom line.
3. "Press"

NOTE!

The value is entered "digit-by-digit“!

6.14 Setting the release point (B.RSp)

⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47

Setting range:	Measuring range (< B.Sp)
Default setting:	90 °C

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "B.RSp" appears in the bottom line.
3. "Press"

NOTE!

The value is entered "digit-by-digit“!

6.15 Setting the hysteresis (switching differential) (B.HyS)

NOTE!

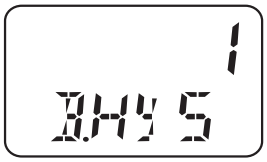
Only with the window switching function.

⇨ chapter 6.12 "Setting the switching function (B.Fct)", page 47

Setting range:	0 to 500 °C
Default setting:	1 °C

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "B.HyS" appears in the bottom line.
3. "Press"



NOTE!

The value is entered "digit-by-digit“!

6.16 Setting the switch-on delay time (B.Dly)

Setting range:	0.00 to 99.99 s
Default setting:	0.00 s

Process:

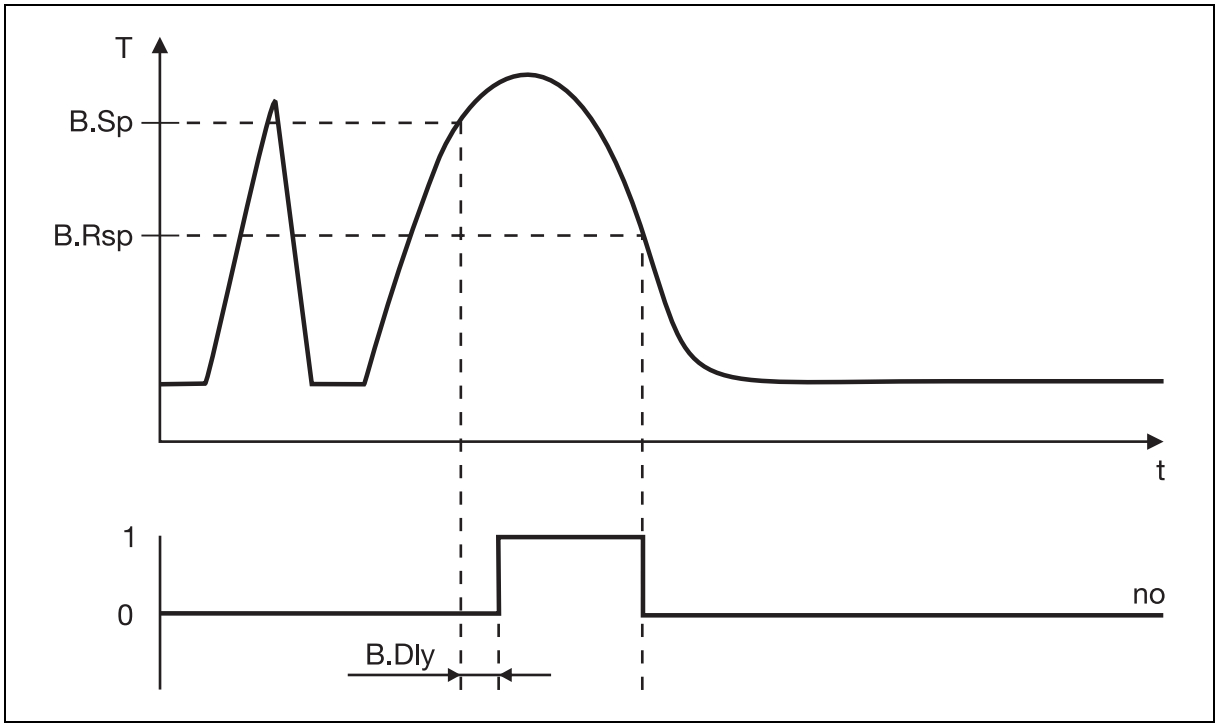
1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "B.Dly" appears in the bottom line.
3. "Press"

"-" flashing

fixed

NOTE!

The value is entered "digit-by-digit"!



6.17 Setting the display alignment (D.Dir)

Setting range:	Std = Standard = Device vertical
	turn = turned = Device turned overhead
Default setting:	Std

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "D.Dir" appears in the bottom line.
3. "Press"

or

6.18 Setting the digital indicator (D.Uni)

Setting range:	Uni.t = Temperature unit set as for "Uni.T" ⇨ chapter 6.4 "Setting the unit of the measured value (Uni.T)", page 36 Pro2 = Percent of the scaled measuring range = "Sc.Hi" minus "Sc.Lo" ⇨ chapter 6.9.1 "Setting the scaling start value (Sc.Lo)", page 43 and ⇨ chapter 6.9.2 "Setting the scaling end value (Sc.Hi)", page 44
Default setting:	Uni.t

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "D.Uni" appears in the bottom line.
3. "Press"

Uni.t = The measured value is displayed in the selected unit.
⇨ chapter 6.4 "Setting the unit of the measured value (Uni.T)", page 36
or

Pro2 = The measured value is displayed in percent of the scaling range.
⇨ chapter 6.9.1 "Setting the scaling start value (Sc.Lo)", page 43
and
⇨ chapter 6.9.2 "Setting the scaling end value (Sc.Hi)", page 44

Example:

The device scaling range was set to 0 to 150 °C.
When the device measures a temperature of 75°°C, 50 % is displayed.

6.19 Displaying the software version of the operating unit (SW.Di)

Setting range:	Read only!
Default setting:	-

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "SW.Di" appears in the bottom line.

“alternating”

6.20 Displaying the software version of the signal unit (SW.Si)

Setting range:	Read only!
Default setting:	-

Process:

1. Unlock the device.
   ⇨ chapter 6.2 "Unlocking the device (enter the code).", page 34
2. "Turn" until "SW.Si" appears in the bottom line.

“alternating”

7.1 General information about the setup program

The setup program optionally available permits a comfortable and clearly structured setting of the large number of device parameters. Settings made once can be saved on a data carrier as a file and transmitted one to one to several devices.

Configurable parameters

Depending on the device, it is possible to set, for example:

- Measuring range and range limits
- Output behavior in the event of an overrange or underrange
- Functions of the K1 and K2 switching outputs

NOTE!

For configuration, the device must be connected to the voltage supply.

⇨ chapter 3 "Electrical connection", page 13

7.2 Required hardware and software

The following hardware and software requirements must be met to operate and install the software:

Hardware requirements

- 512 MB RAM
- 200 MB free hard disk space

Software requirements

- Windows 2000 (as of service pack 4 and higher)
- Windows XP
- Windows VISTA
- Windows 7 - 32-bit

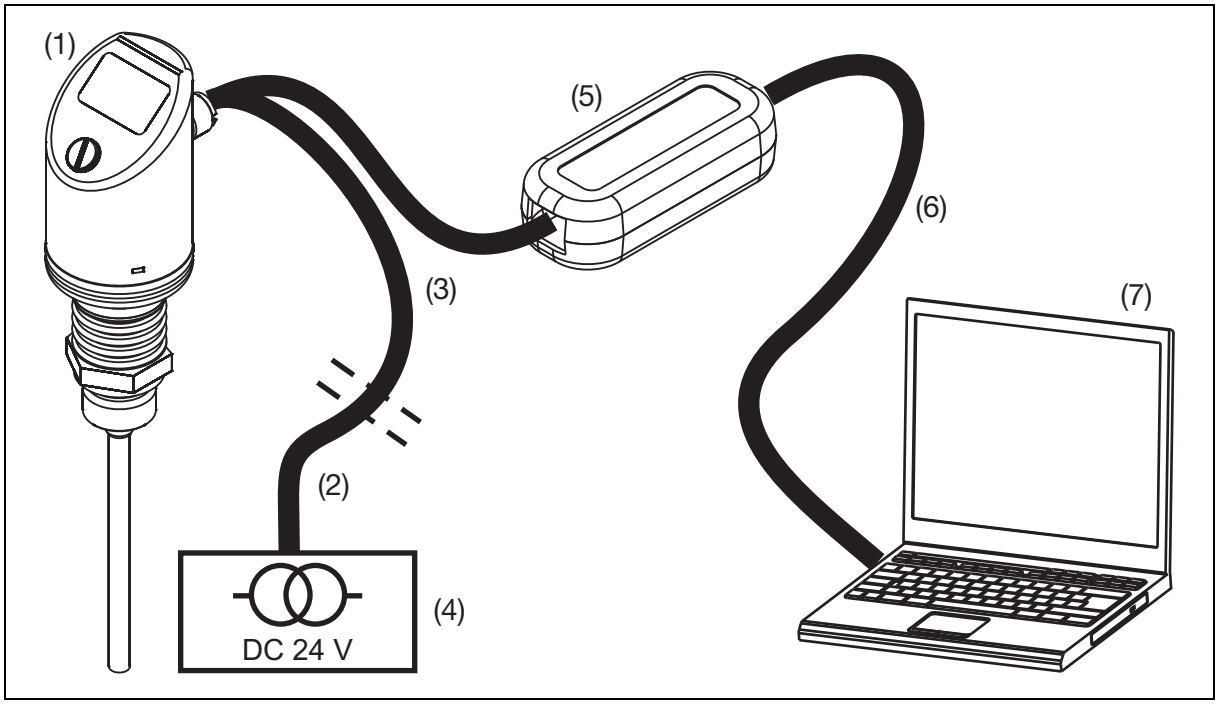
NOTE!

If no connection can be established with the device using the setup program, the setup program must be updated. The latest version of the setup program can be downloaded from the manufacturer's website.

7 Setup program

7.3 Establishing the connection between device and PC

The connection between the device and PC is established via a USB/TTL converter, transmitter cable (Y-cable) and PC interface cable.



(1) Device
(2) Cable box 4-pole (straight) M 12 x 1
with PVC connecting cable length 2000 mm part no. 00404585 or
cable box 4-pole (angled) M12 x 1
with PVC connecting cable length 2000 mm part no. 00409334
(3) Transmitter cable (Y cable)
part no. 00507861
(4) Voltage supply DC 24 V
(5) USB/TTL converter
component of part no. 00456352
(6) PC interface cable (gray)
component of (5)
(7) Notebook/PC

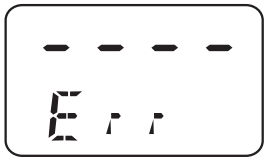
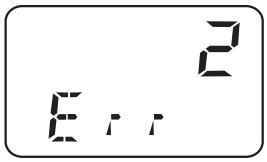
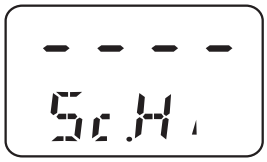
Process:

1. Install the setup program on the notebook/PC.
2. Screw-fit the transmitter cable (3) to the connector of the device (1).
3. Connect the USB/TTL converter (5) to the transmitter cable (3) and PC interface cable (gray) (6).
4. Connect the PC interface cable (gray) (6) to the notebook/PC (7).
5. Connect the cable box to the voltage supply (4) and the transmitter cable (3) using the PVC connecting cable (2).

NOTE!

During installation, the driver for the USB/TTL converter is also installed on the notebook/PC.

8.1 Possible errors

Display	Possible cause	Measure
	Measuring range overrange or underrange Probe break	Check temperature and/or probe.
	Device error: • 1 = Internal communication error • 2 = Error, analog output • 3 = Short circuit, switching output 1 • 3 = Short circuit, switching output 1 • 4 = Short circuit switching output 2 • 5 = VCC 8 V outside the working range • 6 = Internal communication error • 7 = Internal communication error • 8 = Internal communication error • 9 = Invalid configuration	1, 6, 7, 8: Contact the service. 2: Check ambient temperature. Check output for cable break. Output load too high (for current output) or too low (for voltage output). 3, 4: Check the switching output. 5: Check voltage supply. 9: Check the configuration.
	Display overrun: Upper display: "- - - -“ Bottom display: Parameter name Value is smaller than -9999 or exceeds +9999.	Check switching output. Check voltage supply.

8 Overcoming errors and malfunctions

Electrical connection	Machine connector M12 × 1, 4-pole according to IEC 60947-5-2
Process connections	Screw connection G 1/4, G 3/8 and G 1/2 Screw connection M12 × 1.5; M14 × 1; M18 × 1.5 and M20 × 1.5 Screw connection 1/2-14NPT Union nut G 3/8 Compression fitting G 1/4 and G 1/2 Screw connection G 1/2 with CIP-compliant conical seal Taper socket with union nut (dairy pipe fitting) Clamping socket (clamp) Ball welding socket with threaded fitting Welding socket with CIP-compliant conical seal VARIVENT® connection[a] JUMO PEKA hygienic process connection
Protection tube	Stainless steel 316 L, material-no. 1.4404/1.4435 Stainless steel 316 Ti, material-no. 1.4751
Protection type	IP67 acc. to DIN EN 60529 with the pushed in machine connector
Response time	$t_{0.5}$: 3 s in water, flow velocity 0.4 m/s $t_{0.9}$: 8 s in water, flow velocity 0.4 m/s
Measuring insert	Pt1000 temperature sensor, DIN EN 60751, class A or AA, four-wire circuit

[a] VARIVENT® is a registered trademark of GEA Tuchenhagen.

General information

Reference conditions	DIN 16086 and DIN EN 60770
Display	Positively lit LCD display
Alignment	The display can be mirror-imaged by 180° using the setup program After installation, the display case can be swiveled to the left or right by ±160° (use the combination tool)
Size	Display 16 × 26 mm, font size 7 mm, 2× 4-digit
Color	Amber
Switching status display	K1, K2
Temperature unit	°C or °F
Operation	
On the device	With the rotary encoder beneath the sealing screw with combination tool or screwdriver 0.5 × 3 mm or Allen key with width across flats SW 2
With PC	Via the setup program with PC interface

9 Technical data

Input

Measurement input (sensor)	1× Pt1000 temperature sensor, four-wire circuit
Attenuation	0.00 to 99.99 s
Measuring range Basic type 902940/10 Basic type 902940/30 Basic type 902940/40 Basic type 902940/50	 -50 to +150 °C -50 to +260 °C -50 to +260 °C -50 to +500 °C
Limit deviations	0.15 + 0.002 × |t|[a], class A (standard) 0.10 + 0.0017 × |t|[a], class AA

[a] |t| is the numerical value of the temperature in °C regardless of the prefix sign.

Measuring circuit monitoring

Probe short circuit, probe/cable break, underrange, overrange	Analog output 0 to 20 mA, 0 mA or 22 mA user configurable Analog output 4 to 20 mA, 3.4 mA or 22 mA user configurable Analog output 0 to 10 V, 0 V or 10.7 V user configurable Switching outputs, low Additional error message via the LCD display

Outputs

All analog outputs in three-wire circuit, open collector, PNP switching output

Analog output User configurable	 4 to 20 mA and 1× PNP switching output 0 to 20 mA and 1× PNP switching output 0 to 10 V and 1× PNP switching output
Switching output Number Switching type Switching function	 1× PNP switching output 2× PNP switching output N/C contact / N/O contact Window/hysteresis
Contact rating Voltage drop from U_B Switching capacity Switching cycles Response time At 50 Hz At 60 Hz Short-circuit proof	 PNP ≤ 2 V On ≤ 250 mA; off ≤ 1 mA > 10 million ≤ 200 ms ≤ 320 ms Yes
Load check, current Pulse period Periodic protective circuit for overcurrent	 2 s; T_{ON} 40 ms f = 0.5 Hz LCD display: Err3 switching output K1, Err4 switching output K2
Scaling range Analog output	 Scaling can be freely selected within the measuring range

Behavior when leaving the scaling area (underrange)	Analog output 0 to 20 mA, linear drop up to 0 mA Analog output 4 to 20 mA, linear drop up to 3.8 mA Analog output 0 to 10 V, linear drop up to 0 V
Behavior when leaving the scaling area (overrange)	Analog output 0 to 20 mA, linear rise up to 20.5 mA Analog output 4 to 20 mA, linear rise up to 20.5 mA Analog output 0 to 10 V, linear rise up to 10.2 V
Switching output	
Switching point	Measuring range (> release point)
Release point	Measuring range (< switching point)
Switching delay	0.00 to 99.99 s
Burden	
4 to 20 mA	$R_I \geq (U_B - 6.5\ V) \div 0.022\ A$
0 to 20 mA	$R_I \geq (U_B - 6.5\ V) \div 0.022\ A$
0 to 10 V	$R \geq 10\ k\Omega$

Environmental influences

Admissible temperatures	
Ambient temperature, display case	-25 to +75 °C
Ambient temperature	-50 °C; restricted function only stationary use, risk of cable break, LCD display without function
Storage temperature	-40 to +85 °C
Admissible humidity	
During operation	100 % including condensation on the device outer case
In storage	90 % without condensation
Admissible mechanical load	Referring to basic type 902940/10, 902940/30 and 902940/40 with insertion length 100 mm
Vibration resistance	10 g, 10 to 2000 Hz according to IEC 60068-2-6
Shock resistance	50 g for 11 ms / 100 g for 1 ms according to IEC 60068-2-27
Electromagnetic compatibility	(Only with 4-pole connecting cable and grounded housing)
Interference emission	Class A according to EN 61326
Interference immunity	Performance characteristic A according to EN 61326
Protection type	IP67 according to DIN EN 60529
Ambient temperature influence	≤ ±(15 ppm/K × (measuring range end value + 200) + 50 ppm/K × configured measuring range) × $\Delta\vartheta$ $\Delta\vartheta$ = deviation of the ambient temperature from the reference temperature
Calibration/reference conditions	DC 24 V at 25 °C ±5 °C (77 °F ±9 °F)

9 Technical data

Accuracy of entire device

Measured value	Tolerance
100 °C	0.60 K
150 °C	0.75 K
200 °C	1.00 K
450 °C	1.60 K

Auxiliary energy

Voltage supply	DC 12 to 30 V (nominal voltage supply DC 24 V) Residual ripple: ensure that the voltage peaks do **not** exceed or fall below the specified values for the voltage supply
For output 0(4) to 20 mA	DC 12 to 30 V
For output 0 to 10 V	DC 14 to 30 V
Reverse voltage protection	Yes
Power consumption	≤ 45 mA without load, ≤ 545 mA with load 2× PNP switching output
Electrical connection	Machine connector M12 × 1, 4-pole according to IEC 60947-5-2, A-coded
Electrical circuit	SELV
Influence of the voltage supply	≤ ±0.01 % per V deviation from DC 24 V[a]

[a] %-specifications refer to the measuring range end value of 20 mA/10 V.

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