JUMO DELOS SI

Precision pressure transmitter with switching contacts and display

Operating Manual

40505200T90Z003K000

V3.00/EN/00526948/2019-10-15

Content

Content

1.1 Warning symbol

DANGER!

This symbol indicates that personal unjury **caused by electrical shock** may occur, if the respective precautionary measures are not carried out.

CAUTION!

This symbol in connection with the signal word indicates that **damage to assets 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.

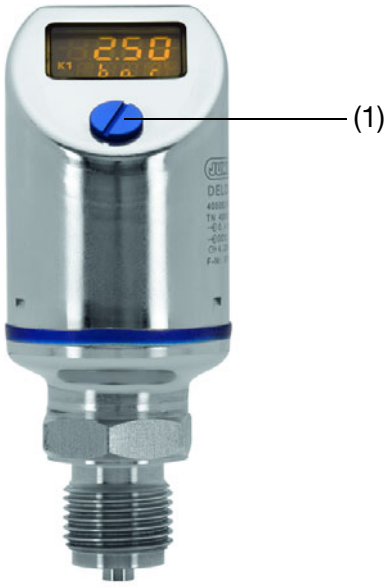
1.2 Note symbols

NOTE!

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

1 Safety information

2.1 General



- Depending on its design, the instrument measures relative or absolute pressure in liquid and gaseous media.
- The pressure is displayed digitally.
- Depending on the design, the following outputs are available:
  - 1 PNP switching output
  - 2 PNP switching outputs
  - 1 PNP switching output + 1 analog output 4 to 20 mA[1]
  - 1 PNP switching output + 1 analog output 0 to 20 mA[1]
  - 1 PNP switching output + 1 analog output 0 to 10 V[1]
- The instrument is also available in a design for use at elevated medium temperatures.
- The instrument can be adjusted directly on site or can be configured via PC with a setup program.

CAUTION!

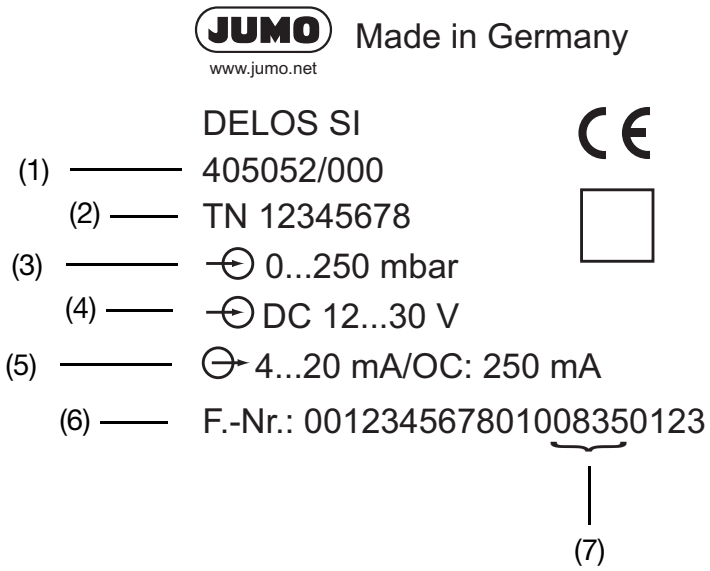
The protection type specified for the device (see chapter 11 „Technical data“, page 57) can only be achieved with the control opening (1) closed.

[1] The output is freely configurable.

2 Description

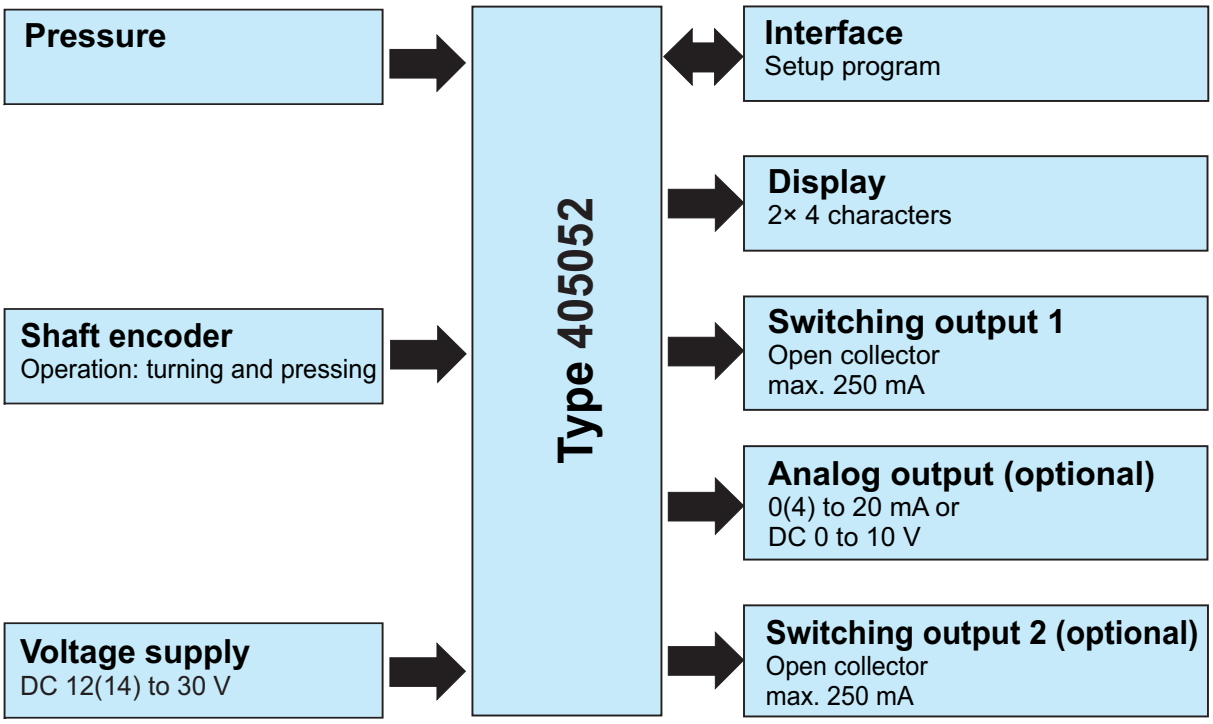
3.1 Nameplate

on the pressure switch



(1) Type
(2) Sales no.
(3) Measuring range
(4) Voltage supply
(5) Output signal
(6) Manufacturing number
(7) Date of manufacture (year and calendar week)

3.2 Block diagram



3 Identifying the instrument version

3.3 Order details

	(1)	**Basic type**
405052/000		JUMO DELOS SI – Precision pressure transmitter with switching contacts and display[a]
405052/004		JUMO DELOS SI – Precision pressure transmitter with switching contacts and display for increased measuring material temperatures upt to 200 °C[b]
405052/999		JUMO DELOS SI – Precision pressure transmitter with switching contacts and display, special version
	(2)	**Input**
447		-400 to +400 mbar relative pressure
449		-1 to +1 bar relative pressure
452		0 to 0,4 bar relative pressure
454		0 to 1 bar relative pressure
457		0 to 4 bar relative pressure
459		0 to 10 bar relative pressure
461		0 to 25 bar relative pressure
463		0 to 60 bar relative pressure
481		-1 to +3 bar relative pressure
483		-1 to +9 bar relative pressure
485		-1 to +24 bar relative pressure
486		0 to 400 mbar absolute pressure
488		0 to 1 bar absolute pressure
491		0 to 4 bar absolute pressure
493		0 to 10 bar absolute pressure
495		0 to 25 bar absolute pressure
506		0 to 60 bar absolute pressure
	(3)	**Output**
470		1× PNP switching output
471		2× PNP switching output
475		1× PNP switching output and 1× analog output 4 to 20 mA[c]
476		1× PNP switching output and 1× analog output 0 to 20 mA[c]
477		1× PNP switching output and 1× analog output 0 to 10 V[c]
	(4)	**Process connection**
504		G 1/2 EN 837
511		1/4-18 NPT EN 837
521		G 1/4 DIN 3852-11
523		G 1/2 DIN 3852-11
571		G 3/4 front-flush EN ISO 228-1
575		G 3/4 front-flush with 2-way seal
576		G 1 front-flush with 2-way seal
603		Taper socket with union nut DN 20 DIN 11851 (dairy screw connection)[d]
604		Taper socket with union nut DN 25 DIN 11851 (dairy screw connection)[d]
606		Taper socket with union nut DN 40 DIN 11851 (dairy screw connection)[d]
607		Taper socket with union nut DN 50 DIN 11851 (dairy screw connection)[d]

612		Clamp DN 10, 15, 20 DIN 32676
613		Clamp DN 25, 32, 40 DIN 32676
616		Clamp DN 50 DIN 32676, 2“ ISO 2852
619		Clamp DN 15 DIN 32676, 3/4“ ISO 2852
623		Small flange DN 25 DIN 28403
652		Tank connection with grooved union nut DN 25[e]
997		JUMO PEKA hygienic process connection[f]
998		Diaphragm seal, version with screw connection
	(5)	**Process connection material**
20		CrNi (stainless steel)
	(6)	**Electrical connection**
36		Round plug M12 × 1
	(7)	**Measuring system filling medium**
01		Silicon oil
12		FDA-compliant oil
	(8)	**Extra codes**
000		None
100		Customized setting (specify required setting in plain text)
452		Parts in contact with the medium are electropolished, surface roughness Ra ≤ 0.8 µm
591		Throttle in pressure channel
624		Free of oil and grease
634		TAG-number
691		Improved humidity/vibration protection
769		Calibration certification

[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 products incorporating the JUMO product into the United States and Canada.

[b] Measuring devices for increased measuring material temperatures can only be delivered with process connection 571, 575, 576, 603, 604, 606, 607, 612, 613, 623, 652, 997.

[c] Factory setting – the analog output can be freely configured.

[d] Union nut is included in delivery.

[e] Welding socket, seal and groove union nut are included in delivery.

[f] For suitable process connection adapters, see data sheet 409711.

	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)
Order code		-		-		-		-		-		-		/	
Order example	405052/000	-	459	-	471	-	504	-	20	-	36	-	01	/	000

3 Identifying the instrument version

3.4 Accessories

Article	Sales no.
PC interface cable including USB/TTL converter[a]	00456352
Y transmitter cable, 5 pole[a]	00507861
Combination tool	00526614
Cable connector, straight, 4 pole, M12 × 1, 2 m PVC cable	00404585
Cable connector, angled, 4 pole, M12 × 1, 2 m PVC cable	00409334
Cable socket, 5 pole, M12 × 1, straight, without connecting cable, assembly by customer	00419130
Measuring device holder for wall and 2" pipe	00597711
CD-setup-program[a]	00522384

[a] The setup program can only be used for configuration in conjunction with these accessories.

4.1 Installation instructions

DANGER!

The electrical connection must only be performed by qualified personnel!

The load circuits must be fused for the maximum load currents in each case to prevent the instrument from being destroyed.

Electromagnetic compatibility meets the requirements of EN 61326.

No other consumers can be connected to the voltage supply of the instrument.

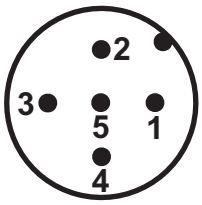
The device is not suitable for installation in areas with an explosion hazard.

Apart from faulty installation, incorrect settings on the instrument may also affect the proper functioning of the subsequent process or lead to damage. You should therefore always provide safety equipment that is independent of the instrument and it should only be possible for qualified personnel to make settings.

4.2 Color assignment of M12 x 1 round plug

CAUTION!

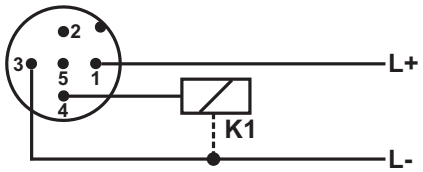
The following color assignment applies only to A-coded standard cables!



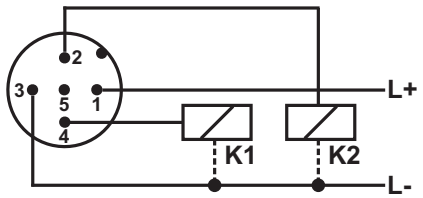
1 Brown
2 White
3 Blue
4 Black
5 Gray

4 Electrical connection

4.3 Terminal assignment for output 470

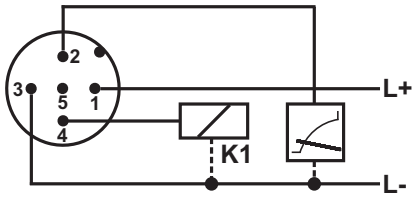
One PNP switching output	
	
Voltage supply	
1 L+	DC 12 to 30 V
3 L-	GND
Output	
4 K1	Highside Open Collector maximum 0.25 A
2	nc
5	Interface

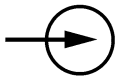
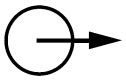
4.4 Terminal assignment for output 471

Two PNP switching outputs	
	
Voltage supply	
1 L+	DC 12 to 30 V
3 L-	GND
Output	
4 K1	Highside Open Collector maximum 0.25 A
2 K2	
5	Interface

4.5 Terminal assignment for outputs 475, 476, and 477

One PNP switching output + one analog output



Voltage supply	
1 L+	DC 12 to 30 V
3 L-	GND
Output	
4 K1	Highside Open Collector maximum 0.25 A
2 Analog	0(4) to 20 mA/0 to 10 V
5	Interface

4 Electrical connection

5.1 General information

CAUTION!

The compatibility of the instrument with the measuring medium must be tested, see chapter 11 „Technical data“, page 57.

Mounting location

- Find a location that ensures easy accessibility for later operation.
- The fastening must be secure and must ensure low vibration for the instrument.
- Avoid direct sunlight!
- Permissible ambient temperature at the installation location chapter 11 „Technical data“, page 57.

Installation position

The instrument can be mounted in any position.

The "vertical" installation position is recommended, see illustration.

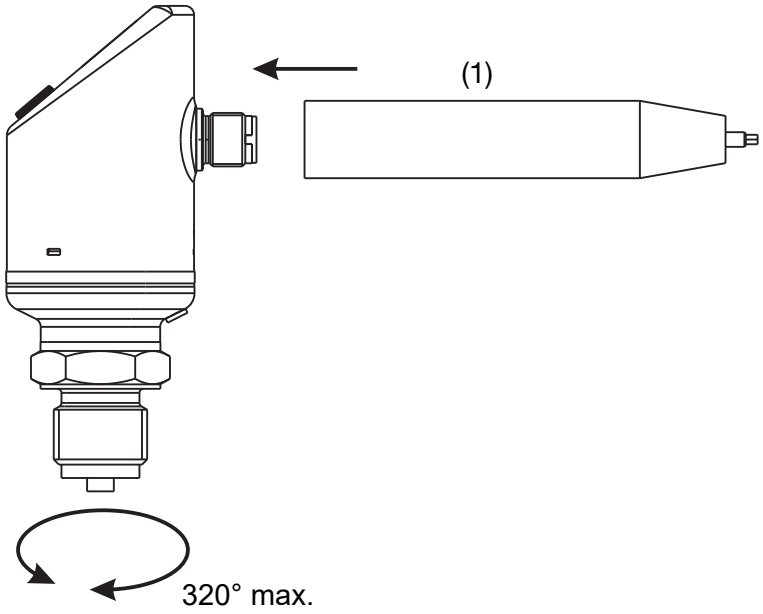
5 Mounting

5.1.1 Rotating the display

The display image can be rotated 180° in the software, siehe „Display position“, page 27. This may make it easier to read when the instrument is installed overhead, for example.

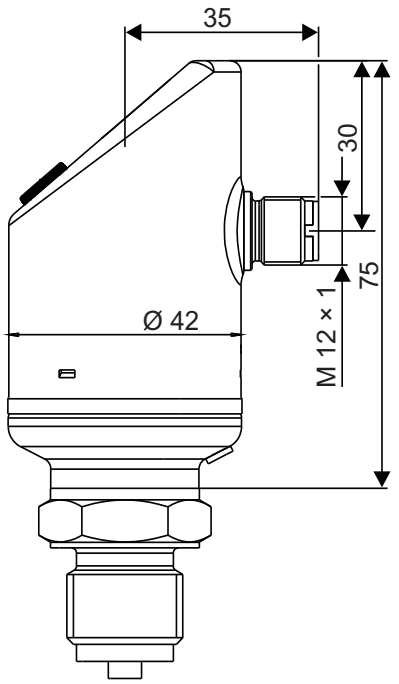
5.1.2 Rotating the housing

The instrument housing can be rotated a maximum of 320° with the combination tool (1).

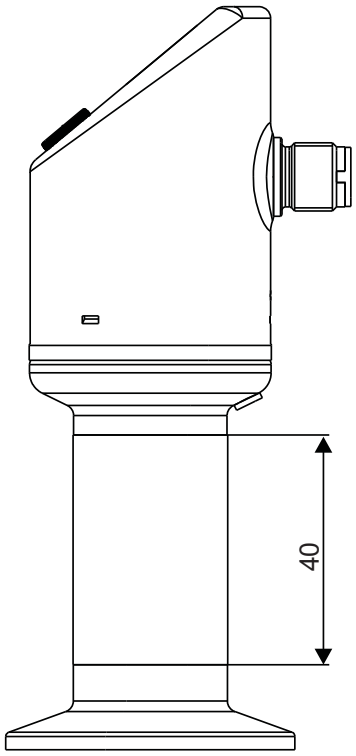


5.2 Dimensions of electronic pressure switches

Type 405052/000-...



Typ 405052/004-...
for increased medium temperature



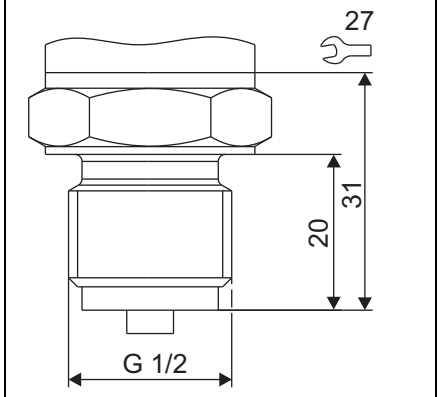
NOTE!

The overall height is 40 mm greater for instruments with basic type extension 004 (for increased medium temperature up to 200 °C). See drawing

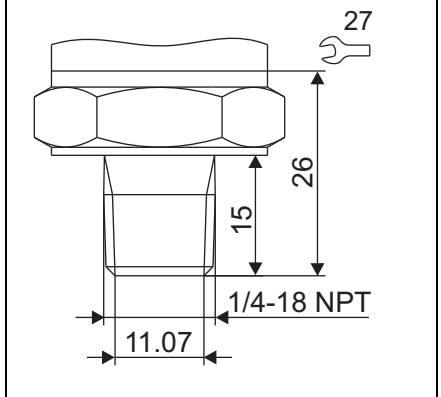
5 Mounting

5.2.1 Process connections, not front-flush

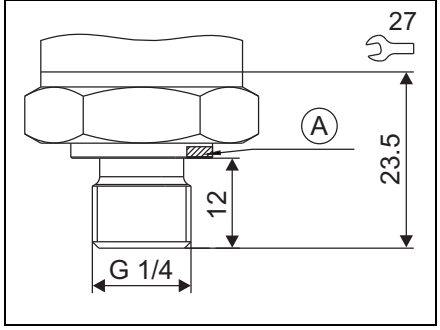
504
G 1/2



511
1/4-18 NPT

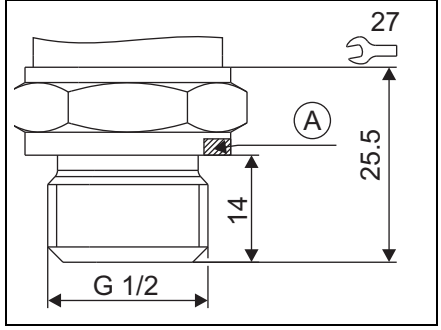


521
G 1/4



A Profile seal DN G 1/4

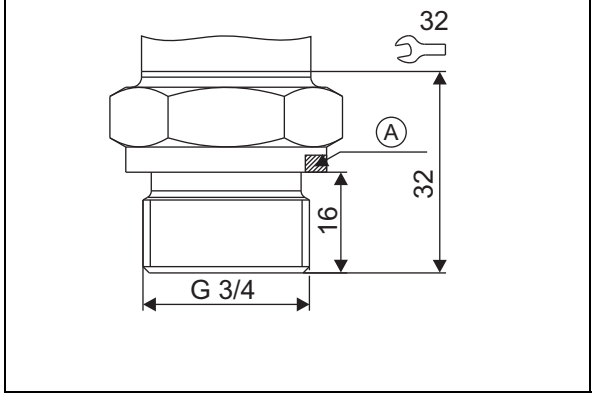
523
G 1/2



A Profile seal DN G 1/2

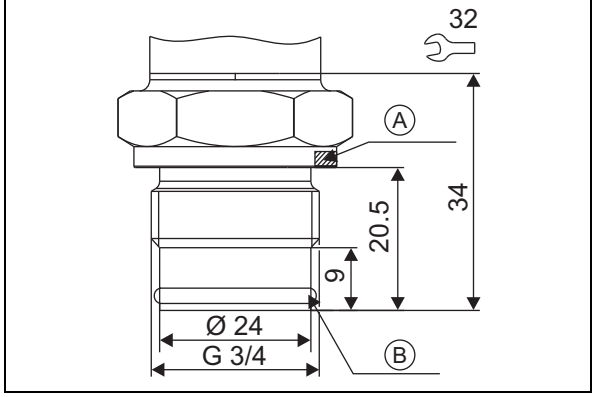
5.2.2 Process connections, front-flush

571
G 3/4



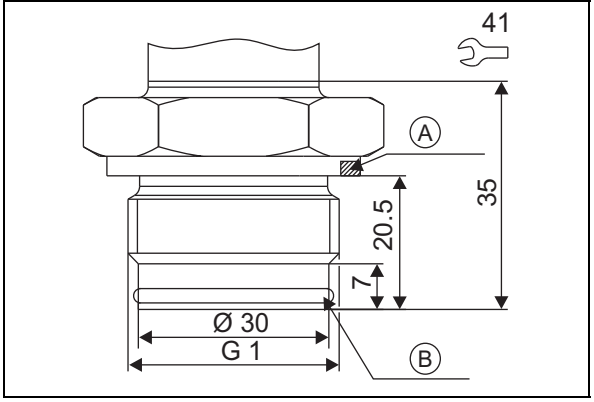
A Profile seal DN G 3/4

575
G 3/4 with 2-way seal



A Profile seal DN G 3/4
B O-ring 20.35 × 1.78

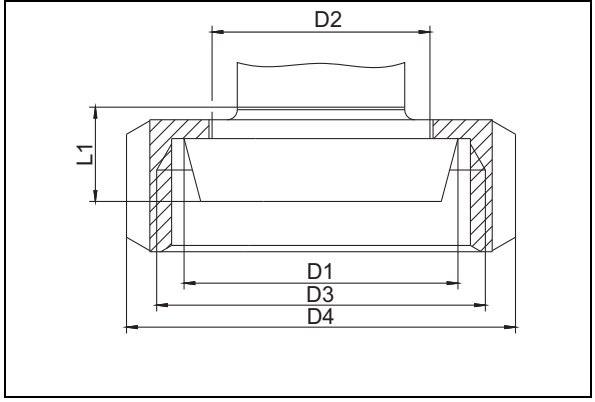
576
G 1 with 2-way seal



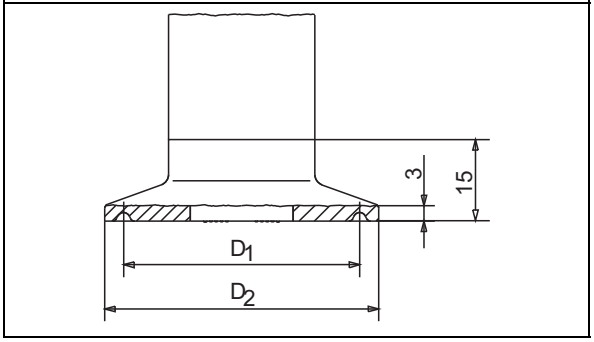
A Profile seal DN G 1

B O-ring 26.7 × 1.78

603 to 607
Taper socket with union nut



612 to 616
Clamp

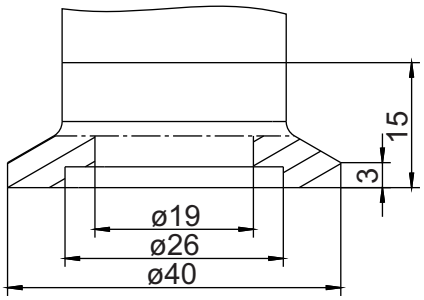


Process connection	DN	Ø D_1	Ø D_2	Ø D_3	Ø D_4	L_1
603	20	36.5	30	RD 44 × 1/6	54	13
604	25	44	35	RD 52 × 1/6	63	15
606	40	56	48	RD 65 × 1/6	78	15
607	50	68.5	61	RD 78 × 1/6	92	16

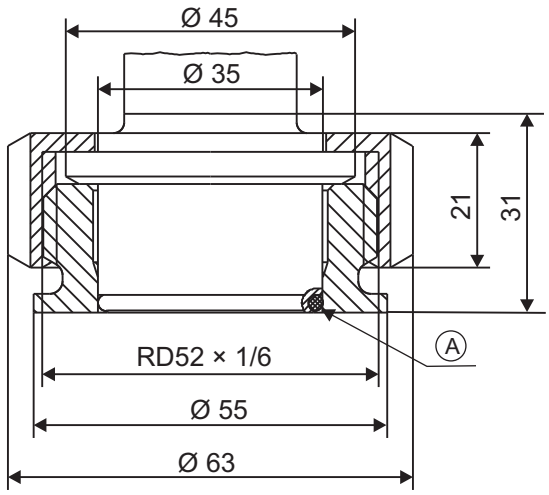
Process connection	DN DIN 32676	DN (Zoll)	DN ISO 2852	Ø D_1	Ø D_2
612	10 15 20		8 10 15	27.5	34
613	25 32 40	1 1.5	20 25 32	43.5	50.5
616	50	2	40	56.5	64

5 Mounting

623
Small flange

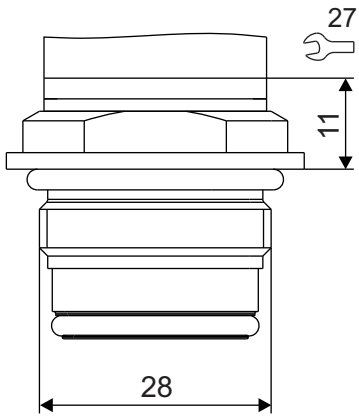


652
Tank connection with grooved union nut



A O-ring 29.82 × 2.62

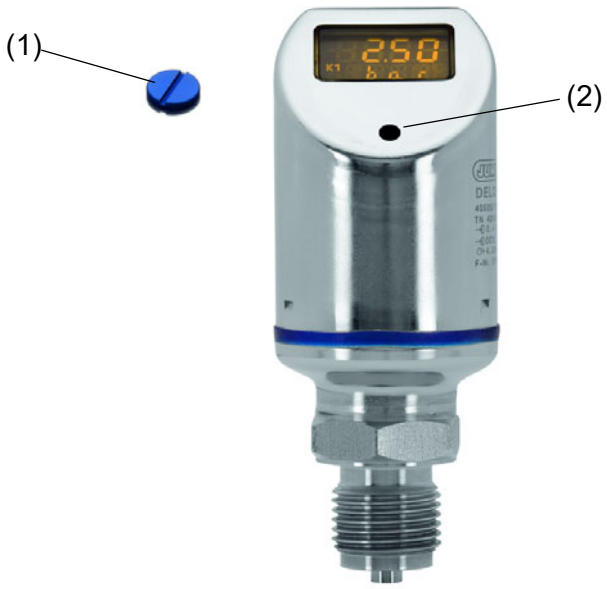
997
JUMO PEKA



NOTE!

For detailed information about this process connection system, see data sheet 409711.

6.1 Controls



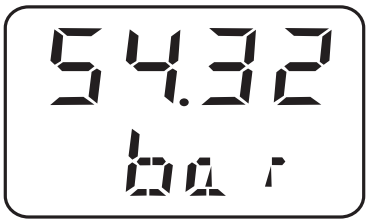
(1) Protective screw
(2) Hexagon socket

- Unscrew the protective screw (1).
- "Turn/push" the control element (2) with the enclosed combination tool (or a 0.5 × 3 screwdriver).

6.2 LC display

6.2.1 Measurement mode

Normal display

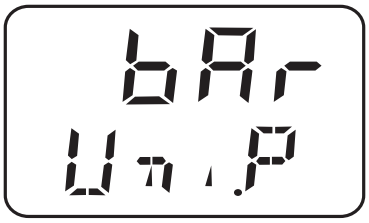


Example:

The display is lit yellow.

6 Operation

6.2.2 Settingmode



Example:

The display is lit red.

Operation

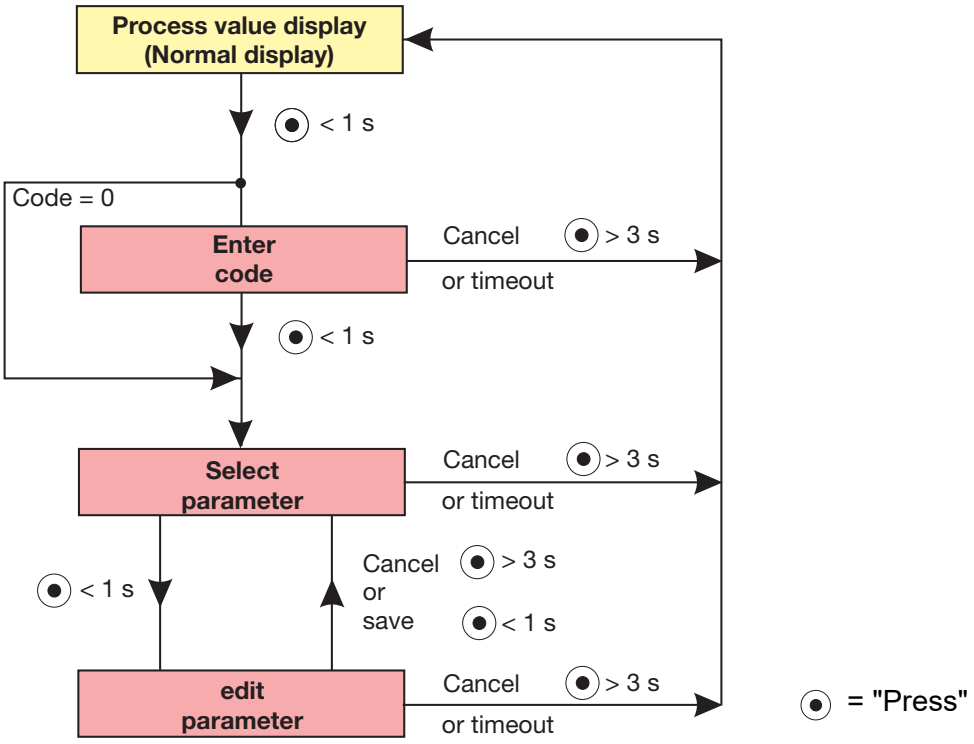
Continue	Press the combination tool less than 1 second (< 1 s)
Yes (accept)	Press the combination tool less than 1 second (< 1 s)
No (Cancel)	Press the combination tool more than 3 seconds (> 3 s)
Timeout	No activity for more than 60 seconds (> 60 s)

NOTE!

To return to measuring mode:

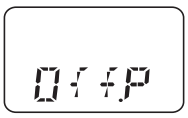
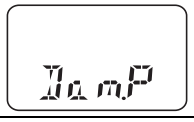
- "No (Cancel)" or
- Wait for timeout = no activity performed for 60 seconds.

6.3 Levels



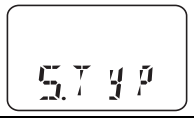
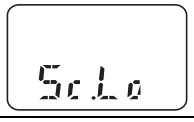
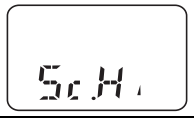
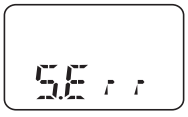
6.4 Parameter

6.4.1 Input

Parameter	Display	Setting range[a]
Pressure unit		bar kPa MPa psi mbar **Note:** The units kPa and mbar cannot be configured for all measuring ranges.
Offset (zero-point correction)		-20.00 to **0.00** to +20.00 % of the measuring range **Note:** Automatic offset correction see chapter 7.5 "Setting the zero point (offset) (Off.P)", page 34.
Damping (filter time constant)		**0.00** to 99.99 s

[a] The default setting is marked in **bold**.

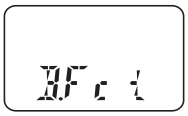
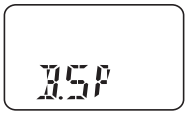
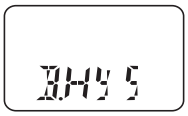
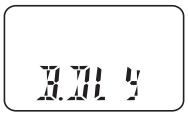
6.4.2 Analog output

Parameter	Display	Setting range[a]
Signal type (for analog output)		**4 to 20 mA** 0 to 20 mA 0 to 10 V
Scaling start (for analog output)		**0.00** to 75.00 **%** of nominal measuring range
Scaling end (for analog output)		25.00 to **100 %** of nominal measuring range
Signal for error (for analog output)		3.4 mA or 22 mA for output signal 4 to 20 mA 0 mA or 22 mA for output signal 0 to 20 mA 0 V or 10.7 V for output signal 0 to 10 V **Note:** Depending on the configured output signal.

[a] The default setting is marked in **bold**.

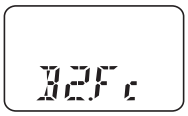
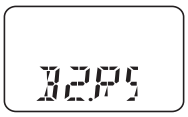
6 Operation

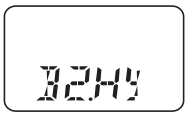
6.4.3 Binary output 1

Parameter	Display	Setting range[a]
Switching function (for switching output only)		**Hysteresis, make contact** Hysteresis, break contact Window, make contact Window, break contact see chapter 7.10 "Setting the switching function (B.Fct)", page 40.
Switching point (for switching output only)		**0.00** to 100.00 % of nominal measuring range see chapter 7.10 "Setting the switching function (B.Fct)", page 40.
Reset point (for switching output only)		**0.00** to 100.00 % of nominal measuring range see chapter 7.10 "Setting the switching function (B.Fct)", page 40.
Hysteresis (for switching output and configured switching point or reset point only)		**0.00** to 100.00 % of nominal measuring range see chapter 7.10 "Setting the switching function (B.Fct)", page 40. **Note:** Used only with window switching functions.
Switching delay (for switching output only)		**0.00** to 99.99 s see chapter 7.10 "Setting the switching function (B.Fct)", page 40.

[a] The default setting is marked in **bold**.

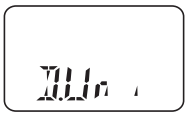
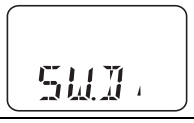
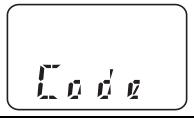
6.4.4 Binary output 2

Parameter	Display	Setting range[a]
Switching function (for second switching output only)		**Hysteresis, make contact** Hysteresis, break contact Window, make contact Window, break contact see chapter 7.10 "Setting the switching function (B.Fct)", page 40.
Switching point (for second switching output only)		**0.00** to 100.00 % of nominal measuring range see chapter 7.10 "Setting the switching function (B.Fct)", page 40.
Reset point (for switching output only)		**0.00** to 100.00% of nominal measuring range see chapter 7.10 "Setting the switching function (B.Fct)", page 40.

Parameter	Display	Setting range[a]
Hysteresis (for second switching output and configured switching point or reset point only)		**0.00** to 100.00 % of nominal measuring range see chapter 7.10 "Setting the switching function (B.Fct)", page 40. **Note:** Used only with window switching functions.
Switching delay (for second switching output only)		**0.00** to 99.99 s see chapter 7.10 "Setting the switching function (B.Fct)", page 40.

[a] The default setting is marked in **bold**.

6.4.5 Display and operation

Parameter	Display	Setting range[a]
Display position		Normal (for normal operation) Rotated (for overhead operation) see chapter 7.15 "Setting the display alignment (D.Dir)", page 45.
Unit of actual value display (for analog output only)		Pressure unit (see parameter "Uni.P") Percentage of the scaled range see chapter 7.16 "Setting the display unit (D.Uni)", page 46.
Version D		Software version of the operating device see chapter 7.17 "Displaying the version of the operating device software (SW.Di)", page 47.
Version S		Software version of the signal stage see chapter 7.18 "Displaying the version of the signal stage software (SW.Si)", page 47.
Code (can only be edited via setup program)		0000 to **0072** to 9999 see chapter 7.2 "Unlocking the instrument (code entry)", page 30.

[a] The default setting is marked in **bold**.

6 Operation

7.1 Getting started

NOTE!

This is a suggestion for configuring the instrument reliably in little time.

By checking the setting options of this list before starting the configuration, you can avoid timeouts during the configuration.

- Mounting the instrument, see chapter 5 "Mounting", page 17.
- Installing the instrument, see chapter 4 "Electrical connection", page 13.
- Unlocking the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- Selecting the unit of the measured value, see chapter 7.4 "Selecting the unit of the measured value (Uni.P)", page 31.
- Adjusting the output signal, see chapter 7.7 "Setting the output signal (S.TyP)", page 35.
- Adjusting the scaling of the output signal (restricting the measuring range), see chapter 7.8 "Setting scaling", page 36.
- Setting the switching function, see chapter 7.10 "Setting the switching function (B.Fct)", page 40.
- Setting the switching point, see chapter 7.11 "Setting the switching point (B.SP)", page 43.

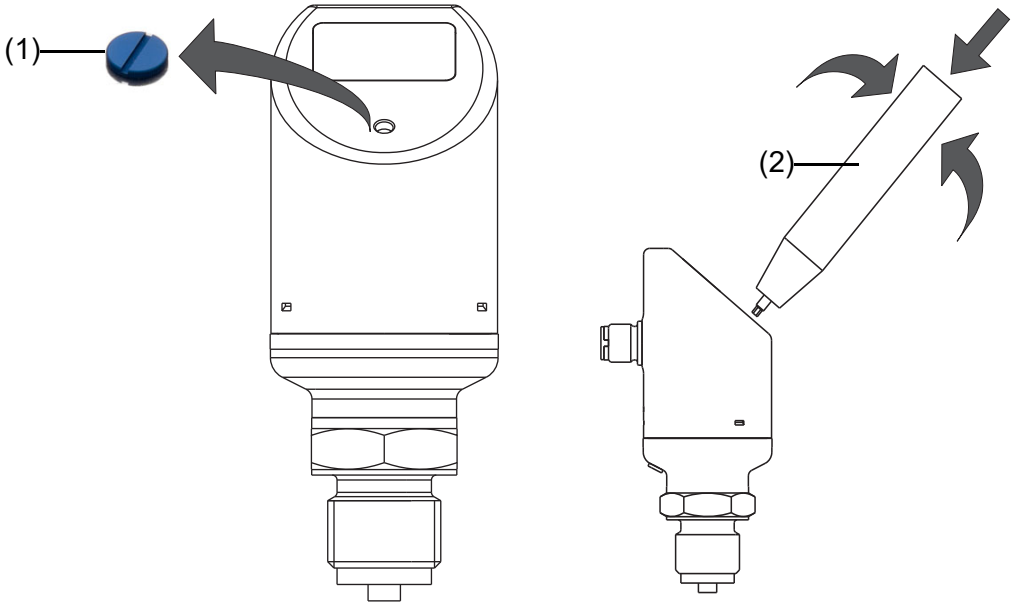
7 Commissioning

7.2 Unlocking the instrument (code entry)

The instrument is protected by a code to prevent unauthorized operation.

The code is set to 0072 in the factory. It can only be changed with the setup program. If the code is set to 0000 with the setup program, the instrument is unprotected.

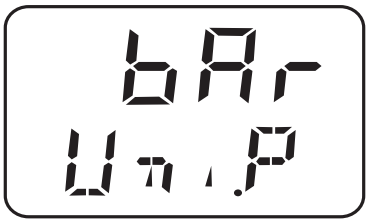
Unlocking



(1) Protective screw
(2) Combination tool

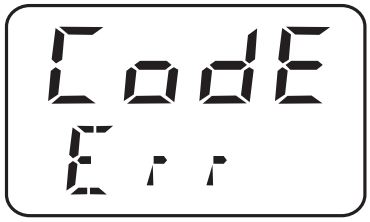
- Unscrew the protective screw (1).
- Continue briefly pressing the combination tool (2) until the third "0" from the left is flashing. The color of the display also changes to "red."
- Turn the combination tool until "7" is displayed.
- Continue briefly pressing the combination tool until the fourth "0" from the left is flashing.
- Turn the combination tool until "2" is displayed.

- Press the combination tool briefly - the instrument switches to the parameter level.



NOTE!

After an incorrect code is entered:

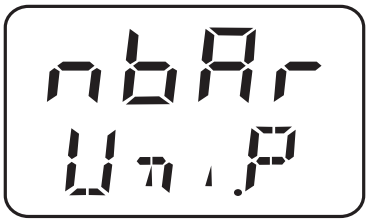


7.3 Cancel operation

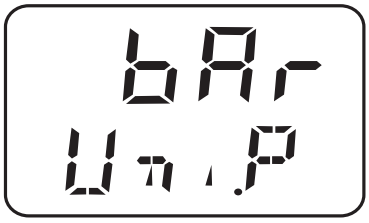
- Press and hold the combination tool (2) longer than 3 seconds or
- wait for timeout (no activity for longer than 60 seconds).

7.4 Selecting the unit of the measured value (Uni.P)

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "Uni.P".
- "Press"



- The measured pressure is shown in millibar.
- "Press"



Flashing

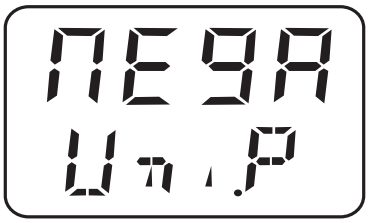
Continuous

The measured pressure is shown in bar.

- "Rotate"

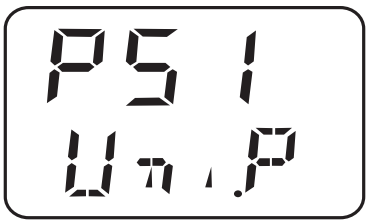
The measured pressure is shown in Kilopascal.

- "Rotate"



The measured pressure is shown in Megapascal (MPa).

- "Rotate"



The measured pressure is shown in psi.

To confirm setting: "Press" until the display is no longer flashing.

7.4.1 Display and setting options of the instrument

Measuring range	Unit	Display	
		Start	End
-0.4 to +0.4 bar	mbar	-400.0	400.0
	bar	-0.400	0.400
	kPa	-40.00	40.00
	MPa	-0.040	0.040
	psi	-5.802	5.802
-1 to +3 bar	mbar	-1000	3000
	bar	-1.000	3.000
	kPa	-100.0	300.0
	MPa	-0.100	0.300
	psi	-14.50	43.51
0 to 60 bar	mbar	0000	9999
	bar	00.00	60.00
	kPa	0000	6000
	MPa	0.000	6.000
	psi	000.0	870.2
-1 to +9 bar	mbar	-1000	9000
	bar	-1.000	9.000
	kPa	-100.0	900.0
	MPa	-0.100	0.900
	psi	-14.5	130.5
-1 to +24 bar	mbar	-1000	9999
	bar	-1.00	24.00
	kPa	-100	2400
	MPa	-0.100	2.400
	psi	-14.5	348.1

NOTE!

Gray cells are units that cannot be configured! Display overflow - values do not appear in operation or in setup!

7 Commissioning

7.5 Setting the zero point (offset) (Off.P)

7.5.1 Automatic offset adjustment

This setting is used to accept the current measured value as the new zero point.

NOTE!

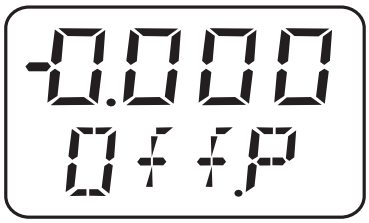
Automatic offset adjustment is only possible for instruments with a relative pressure measuring range!

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "Off.P".
- "Press" twice in quick succession.
  The current measured value is accepted as the zero point.

7.5.2 Edited offset setting

This setting is used to increase or reduce the measured pressure selectively by an adjustable value.

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "Off.P".
- "Press"



"-" Flashing

Continuous

NOTE!

"-" means: the offset is negative - the measured pressure is reduced.

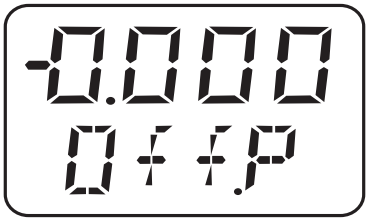
Enter the value "digit by digit."

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

The filter time constant (damping) can be used to smooth the measured value.
Small filter time constant: the display is refreshed quickly.
Large filter time constant: Display refresh is slower.

The value is entered in seconds with two places after the decimal.

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "Dam.P".
- "Press"

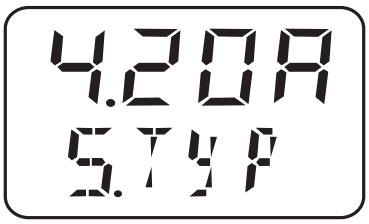


Example:

4.20A = Output signal 4 to 20 mA
0.20A = Output signal 0 to 20 mA
0.10U = Output signal 0 to 10 V

7.7 Setting the output signal (S.TyP)

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "S.TyP".
- "Press"



Example:

4.20A = Output signal 4 to 20 mA
0.20A = Output signal 0 to 20 mA
0.10U = Output signal 0 to 10 V

7 Commissioning

7.8 Setting scaling

Customer-specific measuring range

The customer measuring range (2) is defined by:

- Range start (4)
- Range end (5)
- Span (MSP)

Example

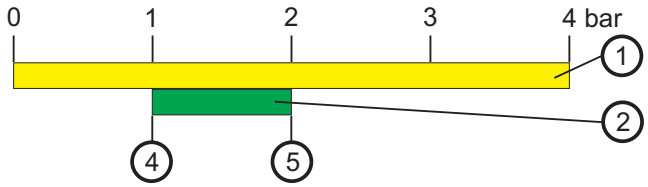
Actual
The instrument has a nominal measuring range (1) from 0 to 4 bar

Target
The customer would like to measure the pressure in the range from 1 to 2 bar (25 % of the nominal measuring range).

Range start (5) is 1 bar

Range end (6) is 2 bar

Span (MSP) is 1 bar



Scaling

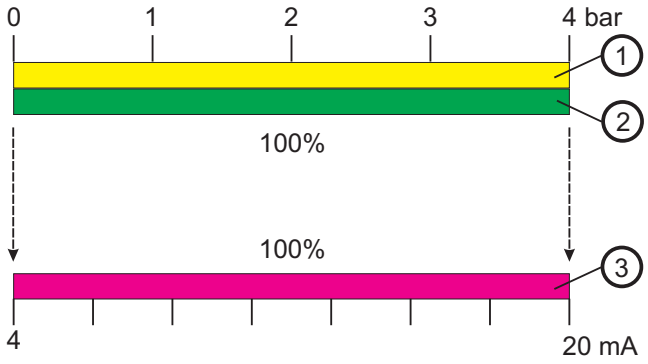
The scaling of the instrument's output signal describes how the measured pressure is converted into an output signal.

Simple example

Actual
The instrument has a nominal measuring range (1) from 0 to 4 bar and the instrument has an output signal from 4 to 20 mA (3).

Target
The customer would like:
the "Customer measuring range" (2) from 0 to 4 bar (100 % of nominal measuring range (1) should correspond to the output signal (3) from 4 to 20 mA (100 %).

The scaling is 1: 1 (100 % to 100 %).



Customer-specific scaling

It is often useful to scale part of the nominal measuring range to the output signal.

Example

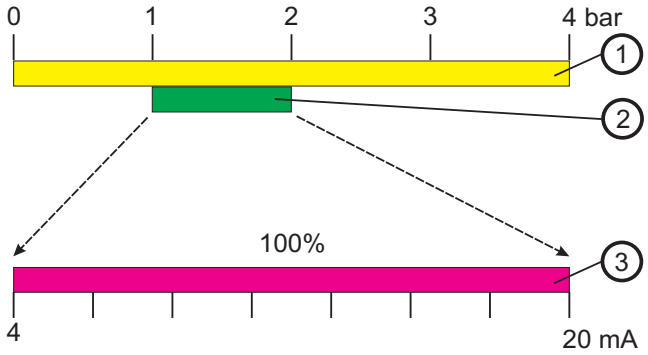
Actual

The instrument has a nominal measuring range (1) from 0 to 4 bar and the instrument has an output signal from 4 to 20 mA (3).

Target

The customer would like:
the "Customer measuring range" (2) from 1 to 2 bar (25 % of nominal measuring range (1) should correspond to the output signal from 4 to 20 mA (100 %).

The scaling is 1: 4 (25 % to 100 %).



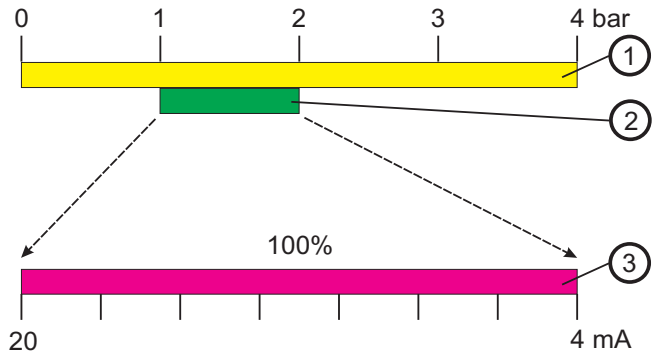
Inversion of the output signal

The instrument provides the option of inverting the output signal (3).

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) Nominal measuring range (NMB)
(2) Customer measuring range (MB)
(3) Output signal
(4) Range start (MA)
(5) Range end (ME)
Span (MSP)

7.8.1 Setting the starting value of scaling (Sc.Lo)

HINWEIS!
The output signal can only be scaled for instruments with analog output!

Setting range: 0 to 75 % of the nominal measuring range
Factory setting: Initial value of measuring range

Example

The instrument has a nominal measuring range -400 to +400 mbar
The output signal of the instrument is 0 to 20 mA

Objective: The range from 0 to 200 mbar (customer's measuring range) will be represented on the output side by 0 to 20 mA.

Setting: The initial value of scaling (Sc.Lo) = 0.000
The final value of scaling (Sc.Hi) = 200.0

Result: At a pressure of less than 0 mbar the instrument reports an error (value below lower measuring range limit) and makes the corresponding error signal (0 mA) available at the output.

At a pressure of 0 mbar the instrument makes 0 mA available at the output.

At a pressure of 200 mbar the instrument makes 20 mA available at the output.

At a pressure greater than 200 mbar the instrument reports an error (measuring range exceeded) and makes the corresponding error signal (22 mA) available at the output.

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "Sc.Lo".
- "Press"

"-" Flashing

Continuous

NOTE!
Enter the value "digit by digit."

7.8.2 Setting the final value of scaling (Sc.Hi)

NOTE!
The output signal can only be scaled for instruments with analog output!
Explanation chapter 7.8.1 "Setting the starting value of scaling (Sc.Lo)", page 38.

Setting range: 25 to 100 % of the nominal measuring range
Factory setting: Final value of measuring range

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "Sc.Hi".
- "Press"

"-" Flashing

Continuous

NOTE!
Enter the value "digit by digit."

7.9 Setting the error signal (S.Err)

NOTE!
Only for instruments with analog output, an error signal is generated for overrange or underrange!

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "S.Err".
- "Press"

Example:

3.40nA =	For **underrange** error signal = 0 mA for measuring range 0 to 20 mA error signal = 3.4 mA for measuring range 4 to 20 mA error signal = 0 V for measuring range 0 to 10 V
22nA =	For **overrange** error signal = 22 mA for measuring range 0 to 20 mA error signal = 22 mA for measuring range 4 to 20 mA error signal = 10.7 V for measuring range 0 to 10 V

7.10 Setting the switching function (B.Fct)

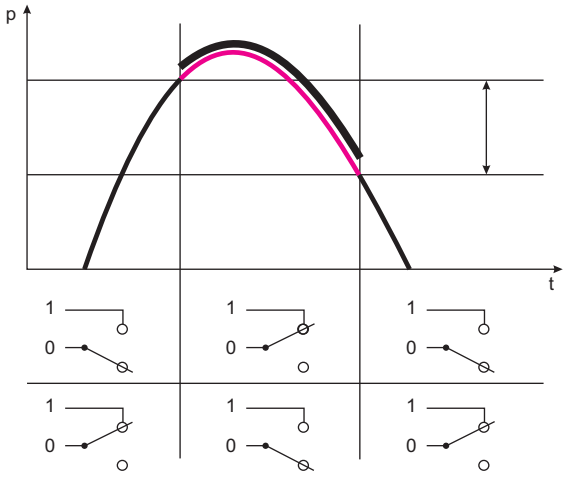
General

The response of the instrument's switching output can be selected:

- Hysteresis make contact
- Hysteresis break contact
- Window function make contact
- Window function break contact

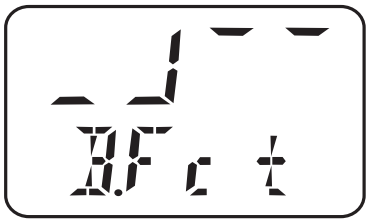
7.10.1 Hysteresis

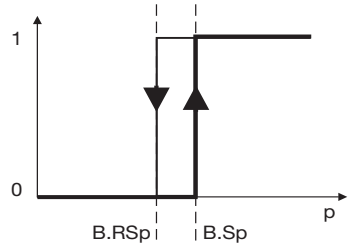
Relay behavior



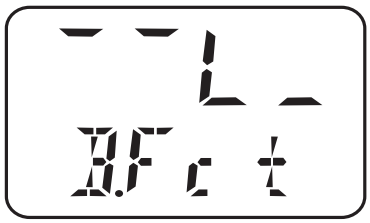
Setting

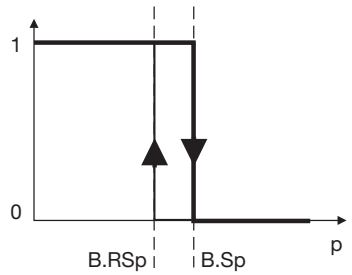
- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "B.Fct".
- "Press"





0 = Hysteresis of make contact (switching difference) (factory setting)

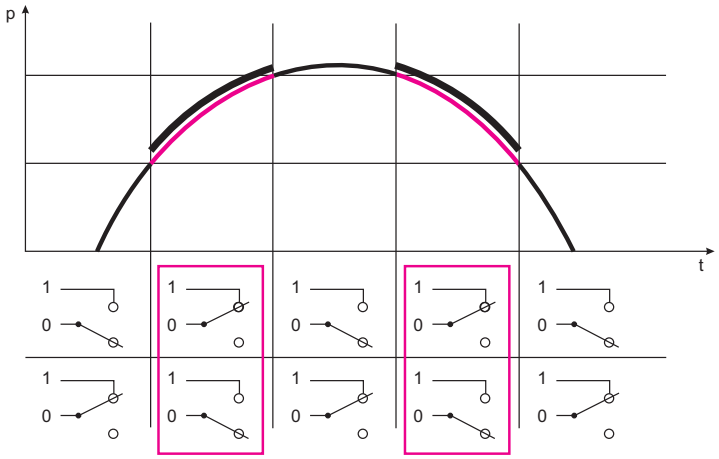




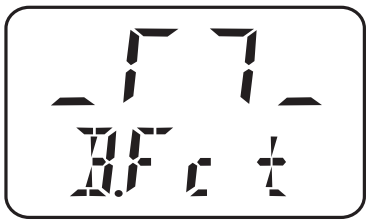
1 = Hysteresis of break contact (switching difference) = min. contact

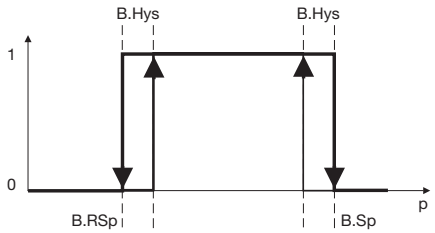
7.10.2 Window

Relay response

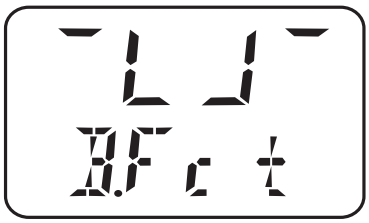


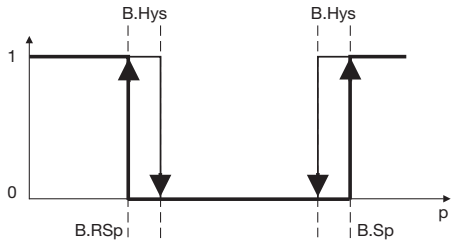
2 = Window function make contact





3 = Window function break contact





7.11 Setting the switching point (B.SP)

See chapter 7.10 "Setting the switching function (B.Fct)", page 40.

Setting range: 0 to 100 % of the nominal measuring range
Factory setting: 50 % of the nominal measuring range

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "B.SP".
- "Press"

"-" Flashing

Continuous

NOTE!
Enter the value "digit by digit."

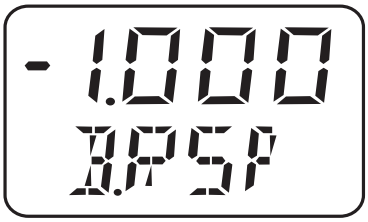
7.12 Setting the reset point (B.RSP)

See chapter 7.10 "Setting the switching function (B.Fct)", page 40.

Setting range: 0 to 100 % of the nominal measuring range
Factory setting: 40 % of the nominal measuring range

Setting

- Unlock the instrument, chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "B.RSP".
- "Press"



"-" Flashing

Continuous

NOTE!
Enter the value "digit by digit."

7 Commissioning

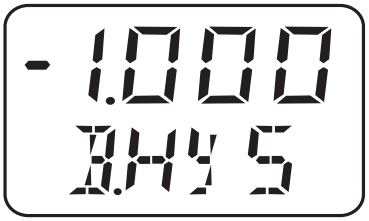
7.13 Setting the switching difference (hysteresis) (B.HYS)

See chapter 7.10 "Setting the switching function (B.Fct)", page 40.

Setting range: 0 to 100 % of the nominal measuring range
Factory setting: 40 % of the nominal measuring range

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "B.HYS".
- "Press"



"-" Flashing

Continuous

NOTE!
Enter the value "digit by digit."

7.14 Setting the switching delay (B.DLY)

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

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "B.DLY".
- "Press"

"0" flashes

Continuous

NOTE!
Enter the value "digit by digit."

7.15 Setting the display alignment (D.Dir)

Setting range: std = standard = instrument upright
turn = turned = instrument overhead

Factory setting: std

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "D.Dir".
- "Press"

or

7 Commissioning

7.16 Setting the display unit (D.Uni)

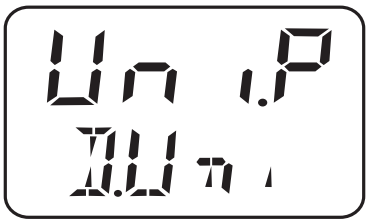
Setting range: Uni.P = pressure unit set as for "Uni.P",
see chapter 7.4 "Selecting the unit of the measured value (Uni.P)", page 31.

Pro2 = percentage of scaled measuring range = "Sc.Hi" minus "Sc.Lo",
see chapter 7.8.1 "Setting the starting value of scaling (Sc.Lo)", page 38 and chapter 7.8.2 "Setting the final value of scaling (Sc.Hi)", page 39.

Factory setting: std

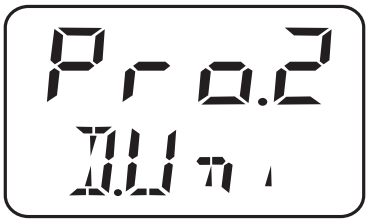
Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "D.Uni".
- "Press"



Uni.P = The measured value is displayed in the unit that was selected,
see chapter 7.4 "Selecting the unit of the measured value (Uni.P)", page 31

or



Pro.2 = The measured value is displayed as a percentage of the scaled measuring range, see chapter 7.8.1 "Setting the starting value of scaling (Sc.Lo)", page 38 and chapter 7.8.2 "Setting the final value of scaling (Sc.Hi)", page 39.

Example

The measuring range of the instrument was set to from -50 to +350 mbar and the scaled measuring range is 300 mbar.
If the instrument measures a pressure of 150 mbar, 50 % is displayed.

7.17 Displaying the version of the operating device software (SW.Di)

Setting range: Read only
Factory setting: -

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "SW.Di".
- "Press"

"Alternating"

7.18 Displaying the version of the signal stage software (SW.Si)

Setting range: Read only
Factory setting: -

Setting

- Unlock the instrument, see chapter 7.2 "Unlocking the instrument (code entry)", page 30.
- "Rotate" until the bottom line shows "SW.Sir".
- "Press"

"Alternating"

7 Commissioning

8.1 Setting the zero point (offset)

8.1.1 Automatic offset adjustment

NOTE!

Automatic offset adjustment is only possible for instruments with a relative pressure measuring range!

On the instrument

See chapter 7.5.1 "Automatic offset adjustment", page 34.

By setup program

Not possible.

8.1.2 Edited offset setting

On the instrument

See chapter 7.5.2 "Edited offset setting", page 34.

By setup program

Connect the instrument with the PC and start the setup program,
see chapter 9 "Setup program", page 51 and following.

Input/offset.

8 Calibration

9.1 Function

Configurable parameters

The optionally available PC setup software (Sales no. 00522384) can be used to operate the instrument conveniently from a PC.

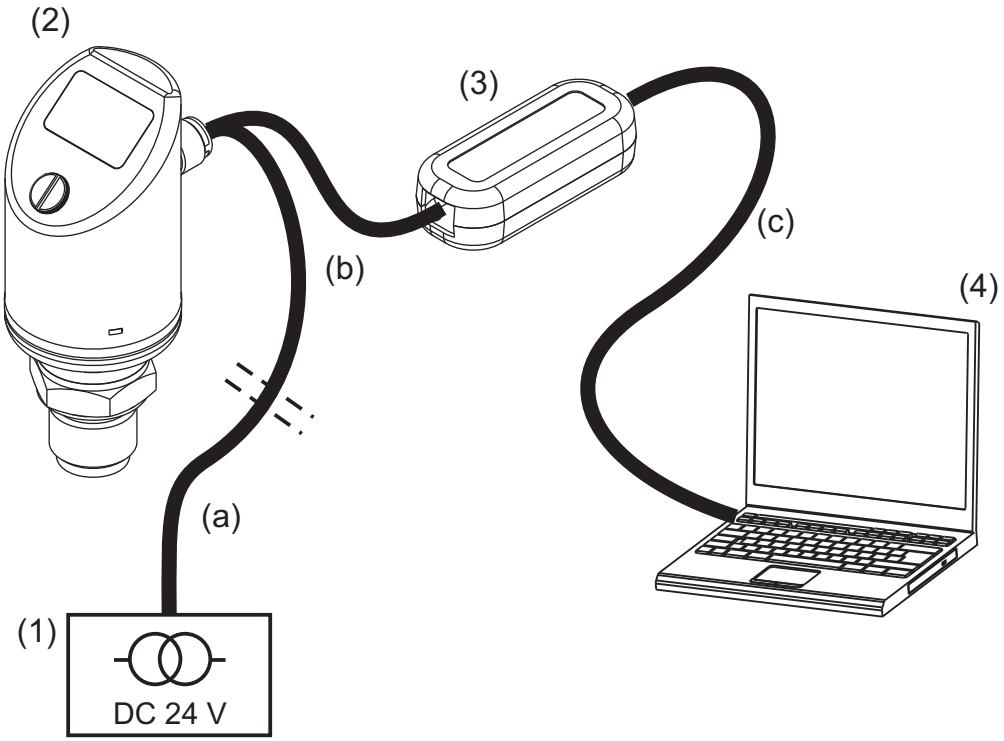
Depending on the device design, the following settings are possible, for example:

- Measuring range and limits of measuring range.
- Response of outputs when the measuring range is exceeded.
- Functions of switching outputs K1 and K2.
- Setting special functions (for example tables for special linearizations).

NOTE!

Data can be transferred from or to the transmitter if it is connected to the power supply;
See chapter 4 "Electrical connection", page 13 and following.

Connection



(1) Voltage supply DC 24 V

(2) Pressure switch type 405052

(3) USB/TTL converter, sales no. 00456352

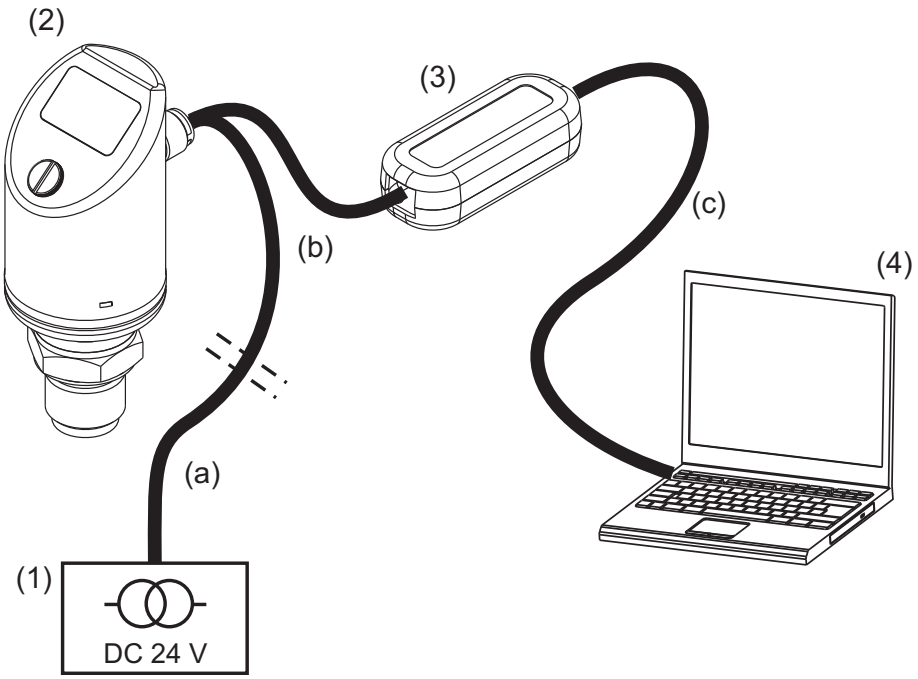
(4) Notebook/PC

(a) 4-pin cable socket (straight) M12 × 1 with 2-m PVC cable, sales no. 00404585 or 4-pin angle box M12 × 1 with 2-m PVC cable, sales no. 00409334

(b) Connecting cable, sales no. 00507861

(c) PC interface line (gray) Part of (3)

9 Setup program



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

Activity	Step
1	Install the setup program software on the notebook/PC.
2	Screw the connecting cable (b) onto the plug of the pressure switch (2).
3	Connect the USB/TTL converter (3) to the connecting cable (b) and PC interface line (gray) (c).
4	Connect the PC interface line (gray) (c) to the notebook (4).
5	Connect the cable (a) to the power supply (1) and connecting cable (b).

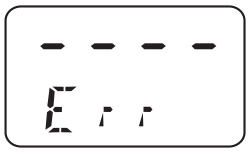
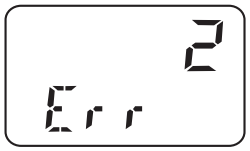
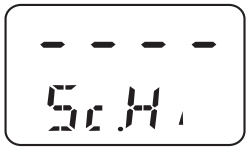
9.2 Start the setup program

Start/Programs/JUMO instruments/Setup program JUMO DELOS K, SI, HP

Display	Possible cause	Measure
	Note at active setup Note: display up: „Set“ display below: „Com“	Display disappears automatically, if the device is no longer connected to the setup.

9 Setup program

10.1 Possible errors

Display	Possible cause	Measure
	• Overrange or underrange • Broken sensor	Configure other measuring range, see chapter 7.4 "Selecting the unit of the measured value (Uni.P)".
	Device error: • 1 = Internal communication error • 2 = Error analog output • 3 = Short circuit Switching output 1 • 4 = Short circuit Switching output 2 • 5 = VCC 8 V outside of working range • 6 to 8 = Internal communication error • 9 = Invalid configuration	1), 6), 7), 8): Call Customer Service; see the back of the Operating Manual. 2): Check the ambient temperature. Check output for broken line. Output burden is too high (for current output) or too low (for voltage output). 3), 4): Check the corresponding switching output. 5): Check the power supply. 9): Check the configuration.
	Display overflow: Upper display: "- - - -" Lower display: Parameter name Value is less than -9999 or greater than 9999.	Check the corresponding switching output. Check the power supply.

10 Eliminating errors and faults

General

Reference conditions	DIN 16086 and EN 60770
Sensor system	Silicon sensor with stainless steel separating diaphragm
Pressure transfer means	Synthetic oil (silicon oil), FDA-compliant oil
Permissible load change	> 10 million
Location	
Mounting position	Any
Position-dependent zero point offset	Device standing upright, process connection on bottom
Basic type 000 standard	≤ 1 mbar
Basic type 004 high-temperature design	≤ 10 mbar
Display	Positively lit display
Alignment	Display can be rotated 180° via software
	Enclosure rotatable ±160° (use the combination tool supplied)
Size	Display field 16 × 26 mm, font size 7 mm, 2× 4-digit
Color	Normal operation: amber-colored
Switching state display	K1, K2
Measuring unit	mbar, bar, kPa, MPa, psi, %
Operation	
Local	Via control element under the screw plug with combination tool or 0.5 × 3 screwdriver or 2AF hex key
Setup interface	Pin 5 of the M12 × 1 round plug

11 Technical data

Measuring range and accuracy

Nominal measuring range bar	Linearity[a] % MSP[e]	Accuracy at 20 °C[c] % MSP	 -20 to +75 °C[d] % MSP	Long-term stability[b] % MSP per year	Overload capacity bar	Burst pressure bar
-1 to +24 bar relative pressure	0,1	0,25	0,5	0,2	100	125
-1 to +9 bar relative pressure	0,1	0,25	0,5		40	50
-1 to +3 bar relative pressure	0,1	0,25	0,5		16	20
-1 to +1 bar relative pressure	0,15	0,3	0,6		4	5
-0,4 to +0,4 bar relative pressure	0,15	0,35	0,7		1,6	2
0 to 0,4 bar relative pressure	0,15	0,35	0,7		1,6	2
0 to 1 bar relative pressure	0,15	0,3	0,6		4	5
0 to 4 bar relative pressure	0,1	0,25	0,5		16	20
0 to 10 bar relative pressure	0,1	0,25	0,5		40	50
0 to 25 bar relative pressure	0,1	0,25	0,5		100	125
0 to 60 bar relative pressure	0,1	0,25	0,5		240	300
0 to 0,4 bar absolute pressure	0,15	0,35	0,7		1,6	2
0 to 1 bar absolute pressure	0,15	0,3	0,6		4	5
0 to 4 bar absolute pressure	0,1	0,25	0,5		16	20
0 to 10 bar absolute pressure	0,1	0,25	0,5		40	50
0 to 25 bar absolute pressure	0,1	0,25	0,5		100	125
0 to 60 bar absolute pressure	0,1	0,25	0,5		240	300

[a] Linearity according to limit point setting
[b] DIN EN 61298-1
[c] Includes: linearity, hysteresis, repeatability, deviation of measuring range initial value and measuring range end value
[d] Includes: linearity, hysteresis, repeatability, deviation of measuring range initial value and measuring range end value, thermal effect on measuring range start and measuring span
[e] MSP = measuring span

Outputs

All analog outputs in 3-wire technology/Switching outputs: open collector, PNP switching

Attenuation	0 to 99.99 s
Analog output	
Current	
Output 475	4 to 20 mA (and 1× PNP switching output)
Output 476	0 to 20 mA (and 1× PNP switching output)
Voltage	
Output 477	0 to 10 V (and 1× PNP switching output)
Setting range	Measurement range scaling (turn down) 1:4
Switching point	Configurable in the nominal measuring range (> release point)
Release point	Configurable in the nominal measuring range (< switching point)
Hysteresis	Configurable in the nominal measuring range
Input delay	0 to 99,99 s
Burden	
Current	
4 to 20 mA, three-wire (output 475)	RL ≤ (U_B-6.5 V) ÷ 0.022 A (Ω)
0 to 20 mA, three-wire (output 476)	RL ≤ (U_B-6.5 V) ÷ 0.022 A (Ω)
Voltage	
DC 0 bis 10 V, three-wire (output 477)	RL ≥ 10 kΩ
Step response time (analog input)	
T_{90}	≤ 100 ms
Switching output	
Output 470, 475, 476 or 477	1× PNP switching output
Output 471	2× PNP switching outputs
Switching type	Break contact/make contact
Switching function	Window/hysteresis
Switching capacity	
Voltage drop from U_B	PNP ≤ 2 V
Contact rating	ON ≤ 250 mA/OFF ≤ 1 mA
Switching cycles	> 10 million
Response time	≤ 20 ms
Short-circuit proof	Yes
Current load check	
Pulse period	2 s; T_{ON}40 ms
Periodic protective circuit with overcurrent	f = 0.5 Hz Display: Err3 switching output K 1, Err4 switching output K 2

11 Technical data

Mechanical features

Process connection	
Material	Stainless steel 316 L
Surface	Ra ≤ 0.8 µm
Process seal	All flange connections are welded and therefore have no seals!
Process connection 521, 523, 571, 576, 652	FPM as standard
Process connection 575	FPM as standard, O-ring at front
Process connection 997 (JUMO PEKA)	FPM, VMQ, silicon EPDM; FDA-compliant, options see data sheet 409711
Measuring diaphragm	
Material	Stainless steel 316 L
Surface	Ra ≤ 0.8 µm
Housing	
Material	Stainless steel 316 L
Surface	Ra ≤ 0.8 µm
Threaded sleeve M12 × 1	Stainless steel 316 L
Housing seal	VMQ silicon; FDA-compliant
Display	PA (polyamide)
Control element screw plug	
Material	Aluminum 3.2315
Surface	Eloxal coating
Seal	VMQ silicon; FDA-compliant
Weight	200 g with G 1/2 (process connection 504)

Environmental influences

Permissible temperatures	
Medium	-25 to +100 °C (135 °C max 1 hour/day; no function here)
For basic type extension 004	-25 to +200 °C
Environment	-25 to +75 °C
Ambient temperature -50 °C	Restricted function: stationary use only, danger of broken cable, display does not function
Storage	-40 to +85 °C
Permissible relative humidity	
In operation	100 % rel. humidity, including condensation of instrument outer sleeve
Storage	90 % rel. humidity, no condensation
Permissible mechanical loading	
Vibration resistance[a]	20 g, 10 to 2000 Hz
Shock resistance[b]	50 g for 11 ms/100 g for 1 ms

Electromagnetic compatibility	With 4-pin connecting cable and grounded enclosure only!
Interference emission[c]	Class B[d]
Interference immunity[c]	Industrial requirements
Protection[e]	IP67

[a] IEC 60068-2-6

[b] IEC 60068-2-27

[c] DIN EN 61326-2-3

[d] The product is suitable for industrial use as well as for households and small businesses.

[e] DIN EN 60529 (with suitable mating piece when connected)

Auxiliary power

Voltage supply U_B[a]	Nominal voltage DC 24 V
0 to 20 mA, three-wire (output 476)	DC 12 to 30 V
4 to 20 mA, three-wire (output 475)	DC 12 to 30 V
0 to 10 V, three-wire (output 477)	DC 14 to 30 V
Less than the permitted voltage supply	Display Err 5
Reverse polarity protection	YES
Power consumption	≤ 45 mA without load, ≤ 545 mA with load 2× PNP
Electrical connection	Round plug M12 × 1, 4-pin, A-coded (for assignment see "Connection diagram")
Circuit	SELV
Requirements	The device must be equipped with an electrical circuit that meets the requirements of EN 61010-1 with regard to "Limited-energy circuits".

[a] Residual ripple: Peak voltages must not exceed or fall below the values specified for the voltage supply!

11 Technical data

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