



fill level



water level



pressure



temperature



flow



visualization



signal converter



sensoric



Precont S10

Pressure transmitter

Measurement of absolute or relative pressure in gases, vapors, liquids and dust

*Technical manual
01.15*



Main features

Finely graded pressure measuring

- Measuring ranges from -1 to 60bar, gauge
- Measuring ranges from 0 to 60bar, absolute
- Measuring spans from 0,1 to 60bar

Ceramic membrane for various applications

Process temperature range from -40°C to +125°C

ATEX II 1/2 G Ex ia IIC T4 Ga/Gb

ATEX II 1/2 D Ex ia IIIC T60°C/T102°C Da/Db

Certification for the use in explosion hazardous areas

High accuracy $\leq 0,05\%$ - Xcellence / $\leq 0,1\%$ / $\leq 0,2\%$

Integrated evaluation electronic

- 2-wire with current signal 4...20mA
- 3-wire with voltage signal 0...10V
- 2x PNP switch output

LED display for best readability

ACS-CONTROL-SYSTEM
knowledge and systems



Your partner for measuring technology and automation

You have purchased a high-grade and modern measuring device of ACS-CONTROL-SYSTEM GmbH.

We want to give thanks for your purchase and for your confidence to us.

The actual technical manual includes instructions for installation, electrical connection and inauguration, as well as the technical data of the device.

Modifications, that answer the purpose of the technical progress, are reserved by ACS-CONTROL-SYSTEM GmbH without prior notice.

If a question occurs, that can't be answered by the listed informations, please call on our technicians team in Eggenfelden Tel: +49 8721/ 9668-0 or info@acs-controlsystem.de

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Application

The device is an electronic pressure transmitter for continuous measuring of relative or gauge pressures in gases, vapors, liquids and dusts within closed container or pipes.

The device is approved for the use in explosive hazardous areas.

The use of a capacitive measuring sensor with ceramic membrane and the corresponding excellent characteristics, allows the use in nearly all fields of industry.

Function

The device is mounted in the wall of the pressure container or of the pipe.

The system pressure is applied to the ceramic membrane and causes there a variation of the capacity at the back side of the membrane.

The ceramic capacitive membrane offers excellent characteristics like highest pressure and pressure blow strength, vacuum resistance, very high resistance against chemicals, corrosion and abrasion as well as very good insensitiveness against temperature shocks, highest accuracy and reproducibility, good long term stability and a very low temperature influence.

The ceramic capacitive sensor is a dry sensor, that does not need the use of a pressure transmitting liquid.

The pressure signal, that is transmitted by the membrane to the sensor is converted into an electrical signal and processed by the integrated evaluation electronic according to the respective preferences.

The measuring value is diagrammed at the display.

The measuring value can be converted into a continuous current signal 4...20mA resp. voltage signal 0...10V or monitored by two PNP switch outputs for exceedance of limit values.

The switching state of each PNP switching output is indicated by an LED.

Safety notes

Each person that is engaged with inauguration and operation of this device, must have read and understood this technical manual and especially the safety notes.

Installation, electrical connection, inauguration and operation of the device must be made by a qualified employee according to the informations in this technical manual and the relevant standards and rules.

The device may only be used within the permitted operation limits that are listed in this technical manual.

Every use besides these limits as agreed can lead to serious dangers.

The materials of the device must be chosen resp. checked for compatibility with the respective application requirements (contacting materials, process temperature). An unsuitable material can lead to damage, abnormal behavior or destruction of the device and to the resulting dangers.

The sensors may not be used as sole device for prevention of dangerous conditions in machines and plants.

This measuring device meets article 3 (3) of the EC directive 97/23/EC (pressure equipment device directive) and is designed and produced in good engineer practice.

The device meets the legal requirements of all relevant EC directives.  **0158**

Using the device in a manner that does not fall within the scope of its intended use, disregarding this instruction, using under-qualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

Special safety notes

Electrical operating supplies for explosive hazardous areas

If a device is installed and operated in explosive hazardous areas, the general Ex construction standards (EN/IEC 60079-14, VDE 0165), these safety notes and the enclosed EC conformity certificate incl. supplements must be observed.

The installation of explosive hazardous systems must be carried out principally by specialist staff.

The device meets the classification:

	T _a Prozess	T _a Gehäuse
II 1/2 G Ex ia IIC T4 Ga/Gb	T _a = - 20...+60°C	T _a = - 20...+85°C
II 1/2 D Ex ia IIIC T60°C / T102°C Db	T _a = - 20...+60°C	T _a = - 20...+85°C
II 1/2 D Ex ia IIIC T60°C / T57°C Db		T _a = - 20...+40°C
II 2 G Ex ib IIC T4 Gb	T _a = - 20...+85°C	T _a = - 20...+85°C
II 2 D Ex ib IIIC T102°C Db	T _a = - 20...+85°C	T _a = - 20...+85°C
II 2 G Ex ib IIC T4 Gb	T _a = - 20...+125°C	T _a = - 20...+50°C
II 2 D Ex ib IIIC T125°C Db	T _a = - 20...+125°C	T _a = - 20...+50°C

The highest surface temperature is determined inside the housing at complete fill up, that means thermal isolation. The power at the sensor is negligible.

The devices are conceived for measuring of pressures in explosive hazardous areas. The measured medium may also be combustible liquids, gases, fogs, vapors or dusts.

The permitted operating temperatures and pressures are type and variant dependent and can be found in this technical manual.

For applications, which require devices of category 1/2 or category 1, the process pressure and temperature range of the media has to be between 0,8 bar to 1,1 bar and -20 °C to 60 °C.

The permissible maximum values for U_i, I_i and P_i are equal for all variants.

To this there must be paid especially attention in the case of combining more intrinsically safe circuits. The rules for combination of intrinsically safe circuits must be applied.

The PA connection in the terminal enclosure resp. the process connection must be connected with the potential compensation of the explosion hazardous area.

At variants of the devices with chargeable plastic parts, a warning marking points out to the safety measures, that must be applied because of the electrostatic charging in operation and especially in the case of maintenance activities:

- avoid friction
- no dry cleaning
- no assembling in pneumatic conveying stream

Installation

The correct function of the device within the specific technical data can only be guaranteed, if the permitted process and environmental temperatures (see chapter „Technical data“) will not be exceeded.

Installation place

The installation of the device at locations where high pressure blows can occur should be avoided. At a pressure measurement in gases, the device should be installed above the tapping point, so that the condensate can flow into the process. At a pressure measurement in steams, the device should be installed after a siphon and a shut-off device below the tapping point. The siphon reduces the temperature to almost ambient temperature. Fill the siphon with fluid before commissioning. At a pressure measurement in liquids, the device should be installed after a shut-off device below or at the same level as the tapping point. At a filling level measurement in liquids, the device should be installed below the lowest measuring point. Do not mount the device in the fill flow, in the suction area of a pump, in the tank outlet or at a point in the container which could be affected by pressure pulses from an agitator. Calibration and functional test can be carried out more easily if you mount the device after a shut-off device.

The installation position has influence on the measuring result of the kind of a zero value shift because of the deadweight of the measuring membrane. The correction of this deviation at the device is possible.

Process and environmental temperature

The installation of the device should be made if possible at temperature calmed places to get a reliable measuring result. Strong temperature steps, e.g. at filling of a hot liquid into a cold system, can produce a short-time higher measuring signal deviation. Temperature compensation takes effect after several minutes. Internal temperature compensation is faster the smaller the jump in temperature and the longer the time interval involved. At a large amplification of the measuring signal this deviation will be also amplified accordingly.

The deviation will be completely neutralized after the adaptation of the measuring membrane to the temperature. At a step from +20°C ...+80°C this neutralization can wile up to 3 minutes.

The use of a measuring system with process diaphragm seal can cause an essential improvement. At high process temperatures a heat transfer to the terminal housing can be reduced by isolation of the medium carrying part of the plant, by the use of a temperature decoupler or of a measurement system with process diaphragm seal.

Installation notes

Drive the system pressure free prior installation resp. deinstallation of the sensor.

The installation of the device into a closed off completely with process liquid filled connection can lead to destruction of the measuring membrane. The reduction of the volume of the liquid at screw-in leads to a very high pressure boosting, which can exceed the permitted maximum value by a multiple. Thus, before installation, the connection must be sufficiently emptied.

The screw-in of the thread process connection by using the terminal housing, the connection plug resp. the connection cable is not permitted. The tightening of the thread process connection may only be done at the hexagon by a suitable spanner and with the maximum permitted tightening torque (see chapter „Technical data“).

The housing can be rotated every time, also at operation, mechanically by 330°.

Air pressure compensation

Avoid the damaging or pollution of the pressure compensation system.

The hindrance of the pressure compensation can lead to faulty measuring results.

The filter element of the pressure compensation system is positioned at the variant:

Plug M12	bottom of the enclosure
Connected cable	bottom of the enclosure
Terminal box	side of the enclosure

Electrical connection

The electrical connection of the device must be carried out according to the respective country specific standards.

Incorrect installation or adjustment could cause applicationally conditioned risks.

Potential equalization - earthing

The device must be grounded.

The earthing can be carried out by the metallic process connection.

The metallic parts of the version electrical connection type S (plug M12) resp. type K (connected cable) are electrically connected with the earthing connection screw PE/PA.

The metallic parts of the version electrical connection type A (terminal box) are electrically connected with terminal 1 - PE/shield.

Connection cable

Use only shielded signal and measurement wires and install these wires separated from power leading wires.

Connect the cable shield of a connected cable only at one side to earth, ideally at the installation place of the device.

At the version electrical connection type A (terminal box), the terminals for wire cross-section from 0,5...2,5mm², for the connection of a cable are placed below the electronic module. This is plugged and can be pushed easily. After the connection of the cable, the module must be correctly inserted again.

The cable gland is suitable for cable diameter from 4,5 to 10 mm.

After the installation of the cable the cable gland must be firmly screwed to ensure the tightness of the connection housing. The same is valid for the screw cap of the enclosure.

Supply voltage

The voltage applied to the terminal contacts may not exceed the maximum permitted supply voltage (see chapter „Technical data“) to avoid damage of the electronic.

The maximum permitted supply voltage range at the respective version is:

Electronic - output type A/B/E/F/G/H	14,5...45V _{DC}
Electronic - output type A/B/E/F/G/H - ATEX	14,5...30V _{DC}
Electronic - output type C/D	10,5...45V _{DC}
Electronic - output type C/D - ATEX	10,5...30V _{DC}

All connections are reverse polarity protected.

Load resistor

Signal 4...20mA

A load resistor, e.g. the measuring shunt of an evaluation device, requires a minimum supply voltage. Dependent on the connected supply voltage, it results in a maximum value for this resistor, where a correct function is still possible.

This resistor can be calculated by the following term:

$$R_{Lmax} = (U_S - U_{Smin}) / 22mA$$

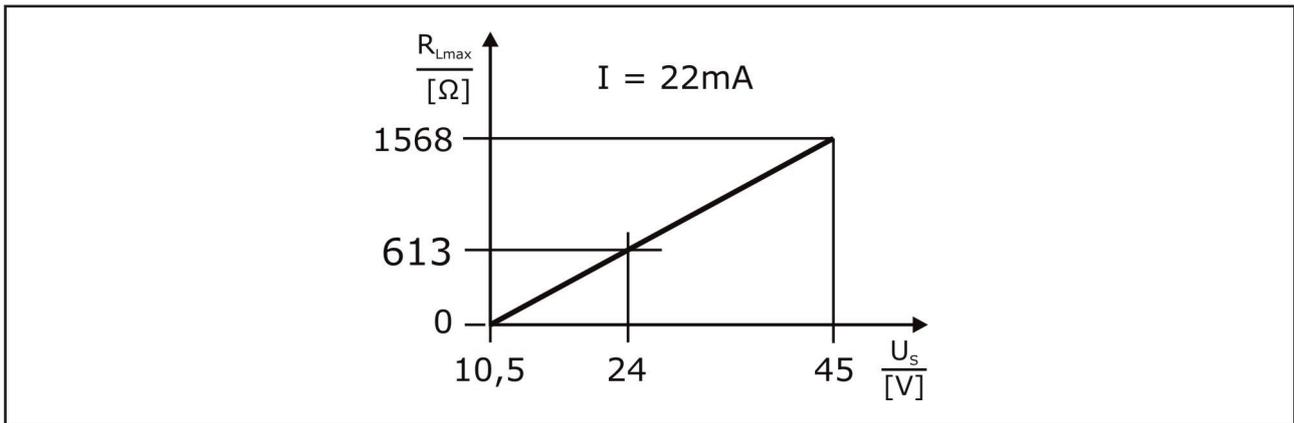
R_{Lmax} = maximum load resistor

U_S = connected supply voltage

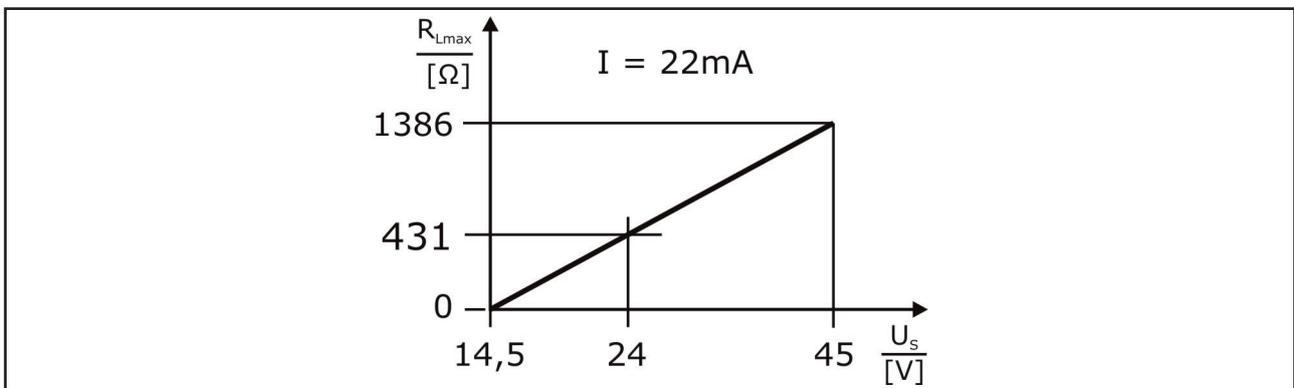
U_{Smin} = minimum supply voltage

Load resistor characteristic

Electronic - output type A/B



Electronic - output type C/D



Signal 0...10V

A load resistor, e.g. the measuring shunt of an evaluation device, requires at a definitive output voltage an output current. Due to the limitation of that output current, it results in a minimum value for this resistor, where a correct function is still possible.

This resistor can be calculated by the following term:

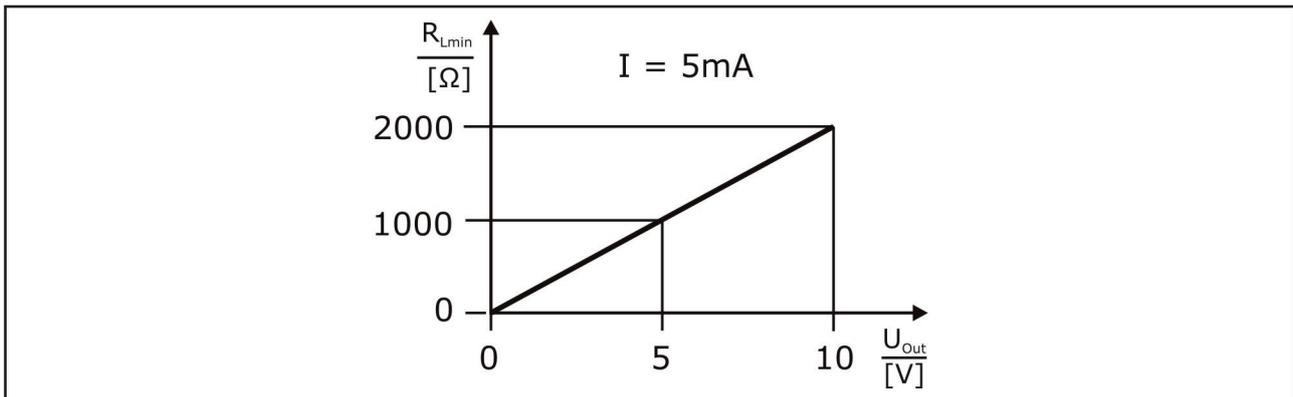
$$R_{Lmin} = U_{Out} / 5mA$$

R_{Lmin} = minimum load resistor

U_{Out} = output voltage

Load resistor characteristic

Electronic - output type E/F/G/H



Switch output

Inductive loads at the pnp switching outputs, e.g. relays or contactors may only be used with a free-wheeling diode or a RC protection circuit to avoid high voltage peaks.

The load at the PNP switching output will be connected to the terminal +terminal of the supply voltage by a semiconductor switch contactless and by this bounce-free.

At an activated switching state a positive signal near supply voltage is feed to the output.

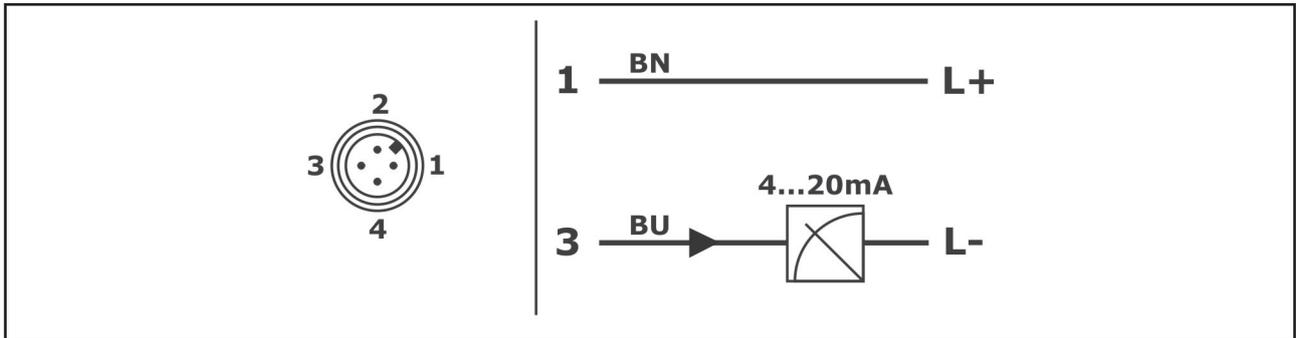
At deactivated switching state and at failure of supply voltage the semiconductor switch is shut off.

The PNP switching output is current limited to 0,2...0,25 A and is overload and short circuit protected.

Connection scheme

Signal 4...20mA

Plug M12

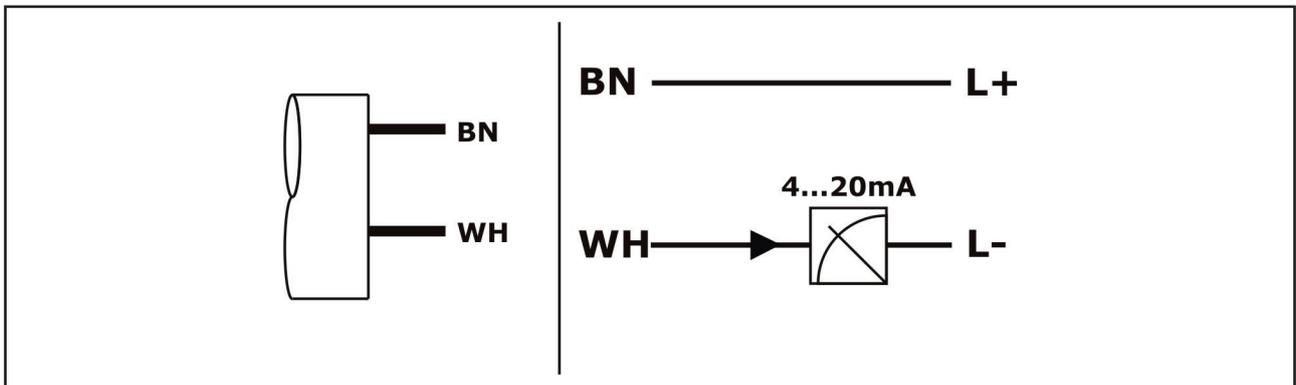


Conductor color standard connection cable M12:

BN = brown, BU = blue

The connection cable is not enclosed in the delivery contents.

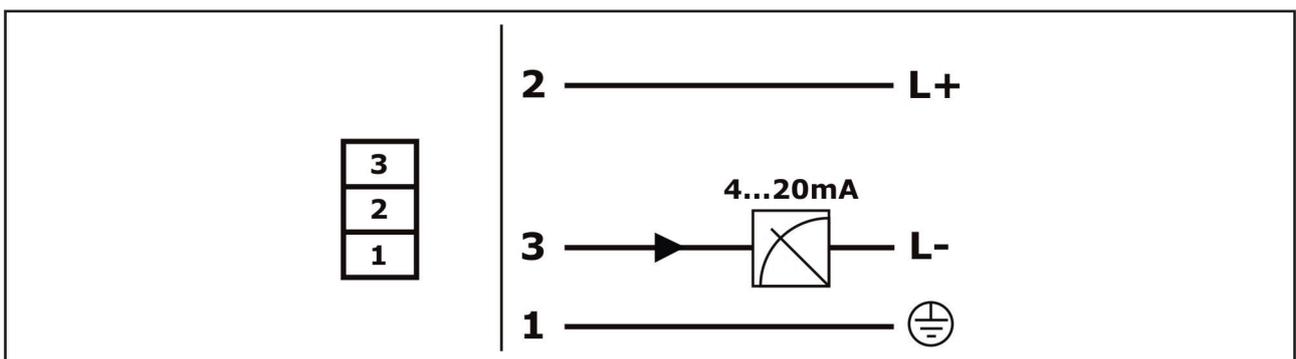
Connected cable



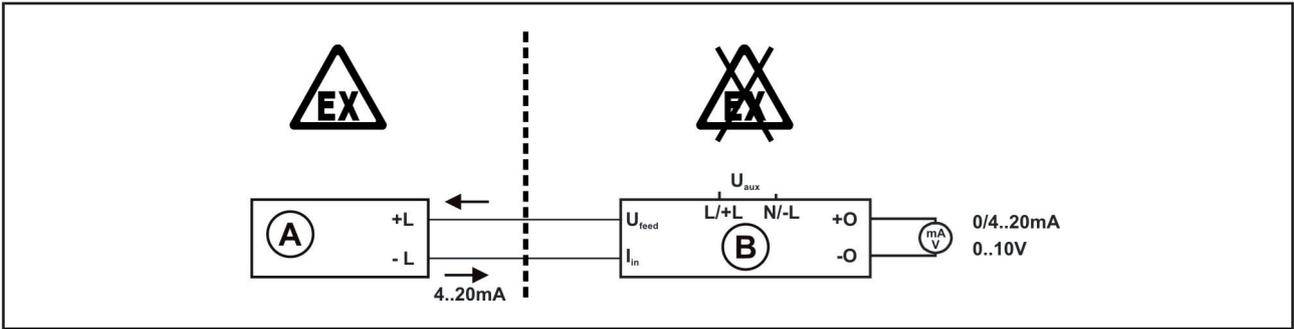
Conductor color cable:

BN = brown, WH = white

Terminal box

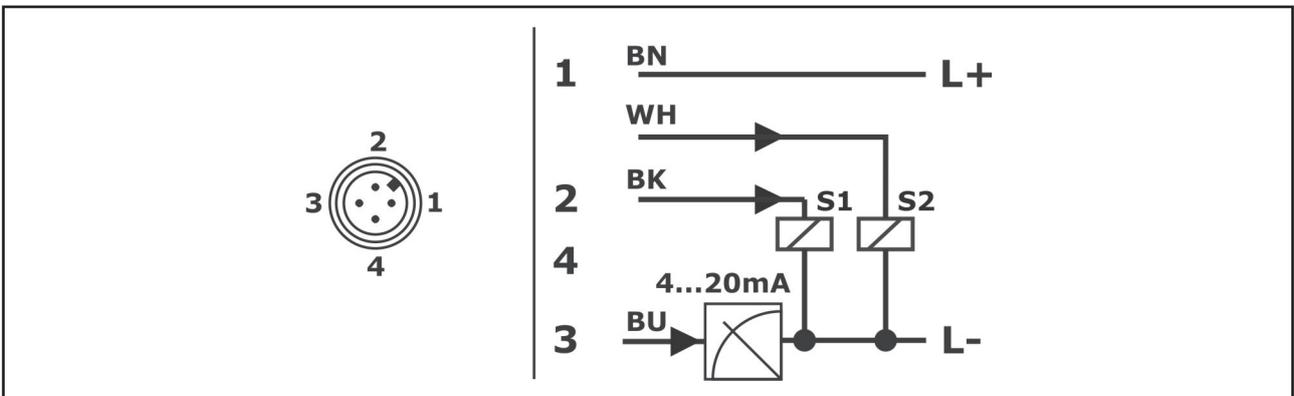


Connection example Ex-version



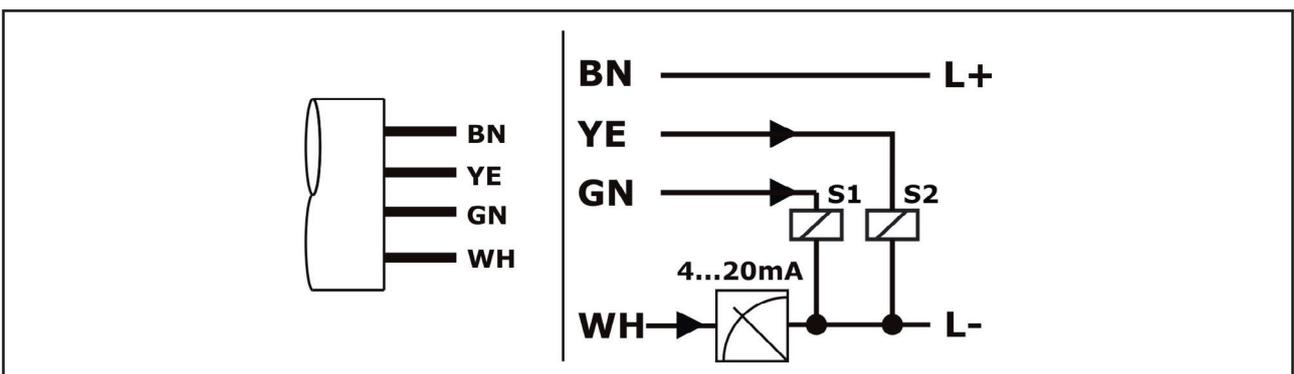
A – Intrinsically safe apparatus / measuring transmitter
 B – Associated apparatus / isolation amplifier active / sensor supply

Signal 4...20mA / 2x PNP switch output Plug M12



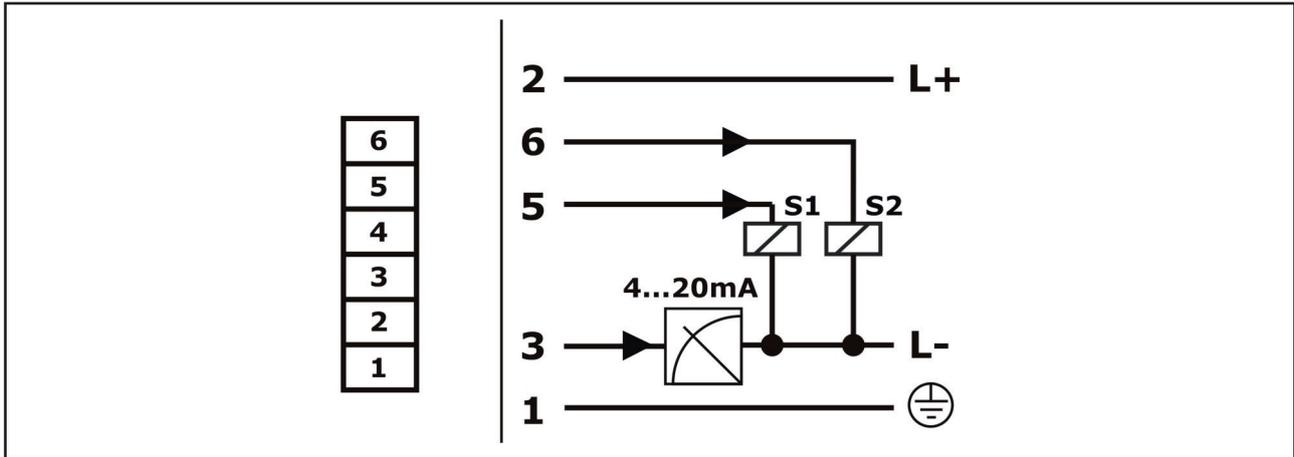
Conductor color standard connection cable M12:
 BN = brown, WH = white, BU = blue, BK = black
 The connection cable is not enclosed in the delivery contents.

Connected cable

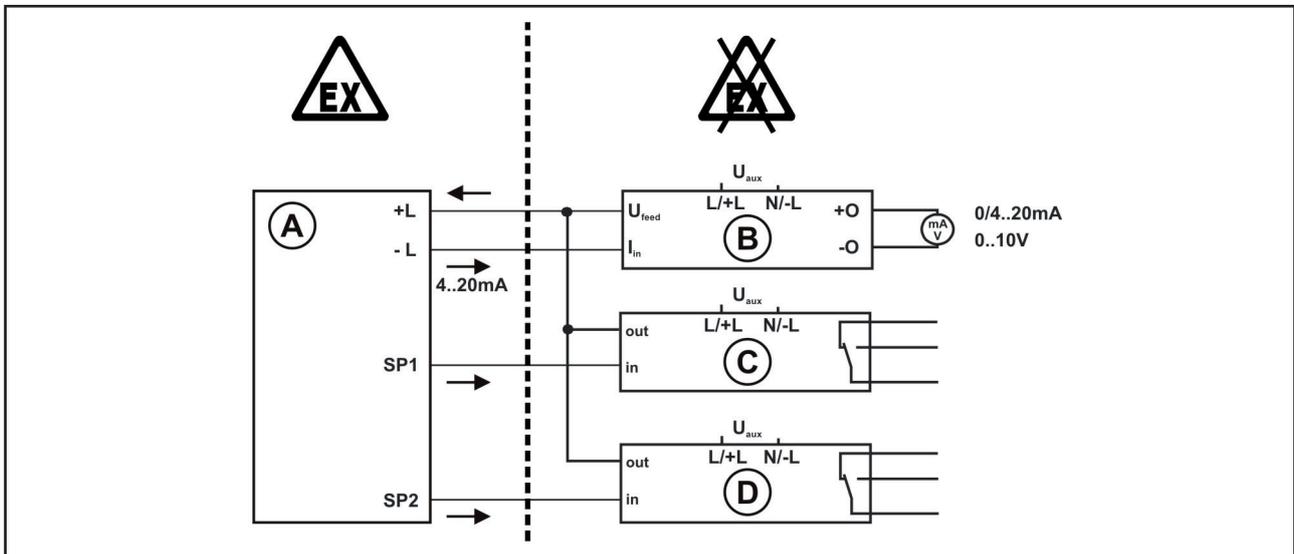


Conductor color cable:
 BN = brown, WH = white, YE = yellow, gn = green

Terminal box

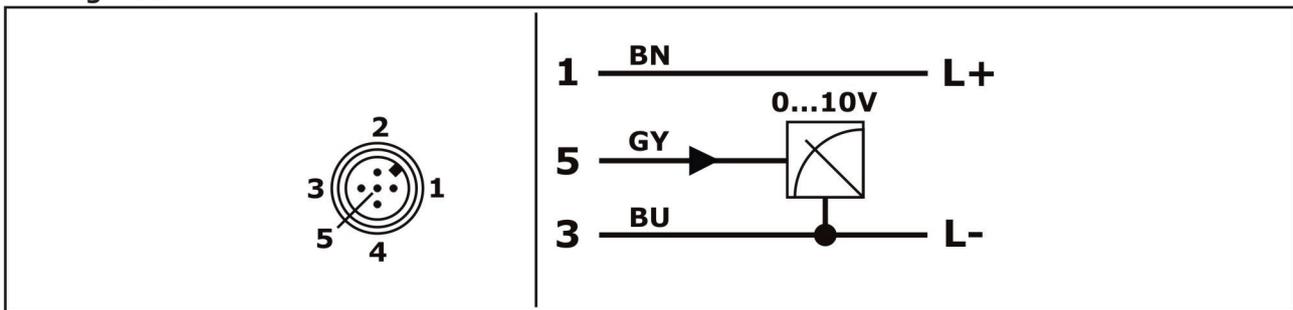


Connection example Ex-version



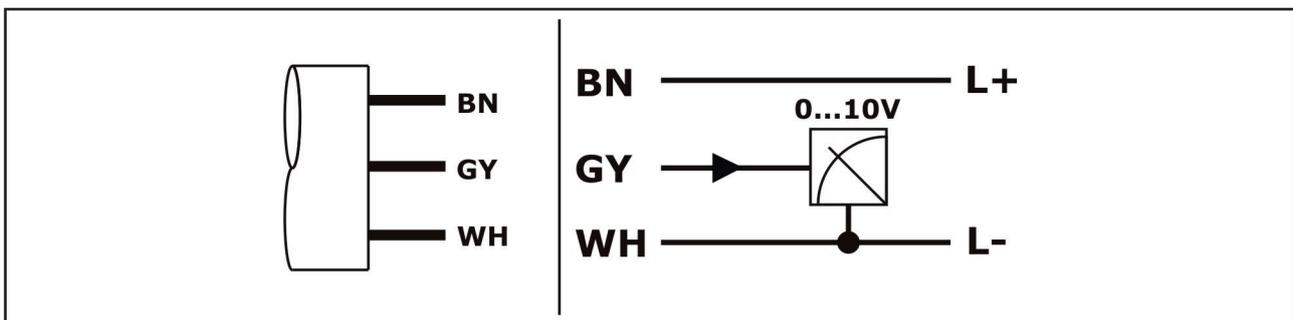
- A – Intrinsically safe apparatus / measuring transmitter
- B – Associated apparatus / isolation amplifier active / sensor supply
- C/D – Associated apparatus / (Namur-) switch amplifier

**Signal 0...10V
Plug M12**



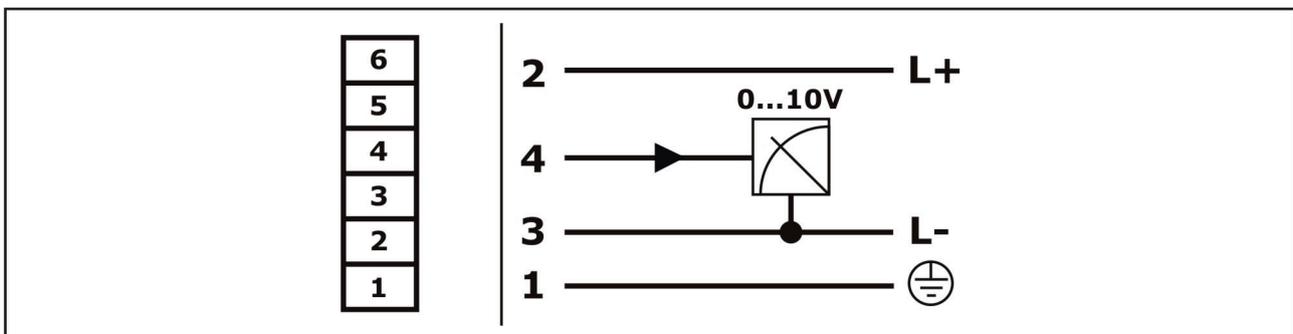
Conductor color standard connection cable M12:
BN = brown, GY = grey, BU = blue
The connection cable is not enclosed in the delivery contents.

Connected cable

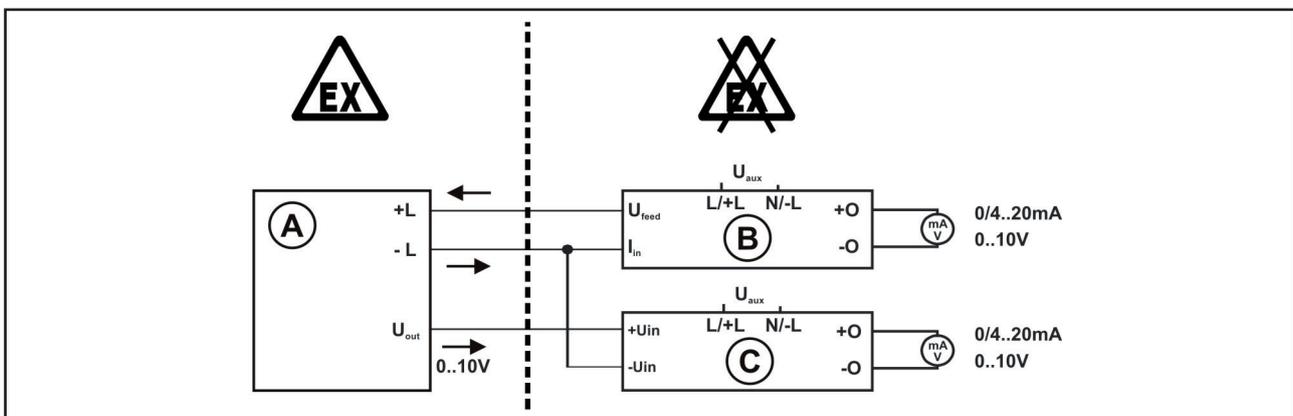


Conductor color cable:
BN = brown, GY = grey, WH = white

Terminal box

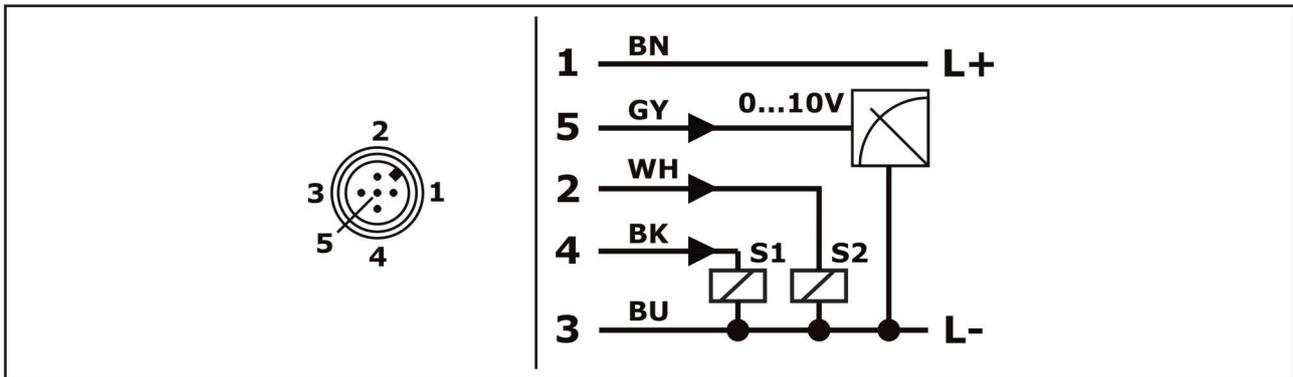


Connection example Ex-version



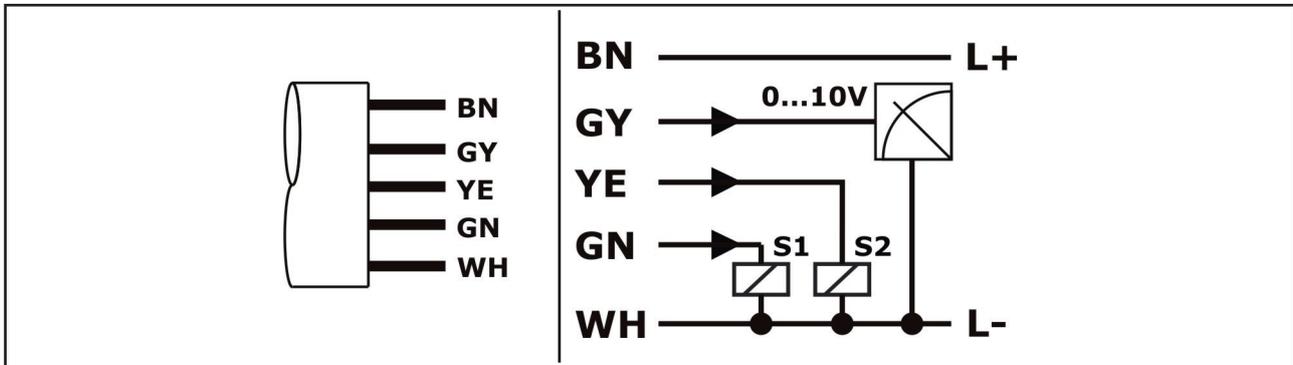
A – Intrinsically safe apparatus / measuring transmitter
B – Associated apparatus / isolation amplifier active / sensor supply
C – Associated apparatus / isolation amplifier active

**Signal 0...10V / 2x PNP switch output
Plug M12**



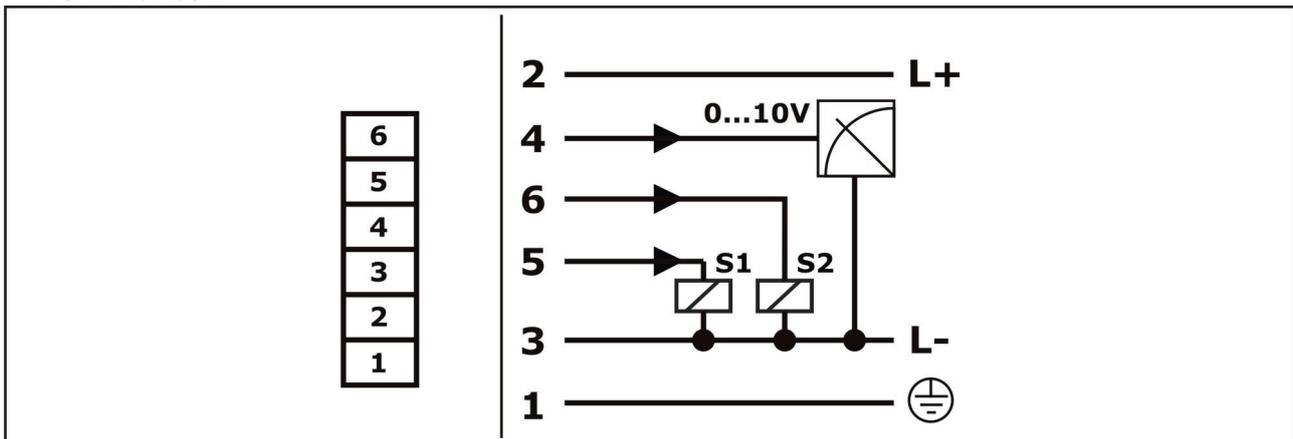
Conductor color standard connection cable M12:
 BN = brown, WH = white, BU = blue, BK = black, GY = grey
 The connection cable is not enclosed in the delivery contents.

Connected cable

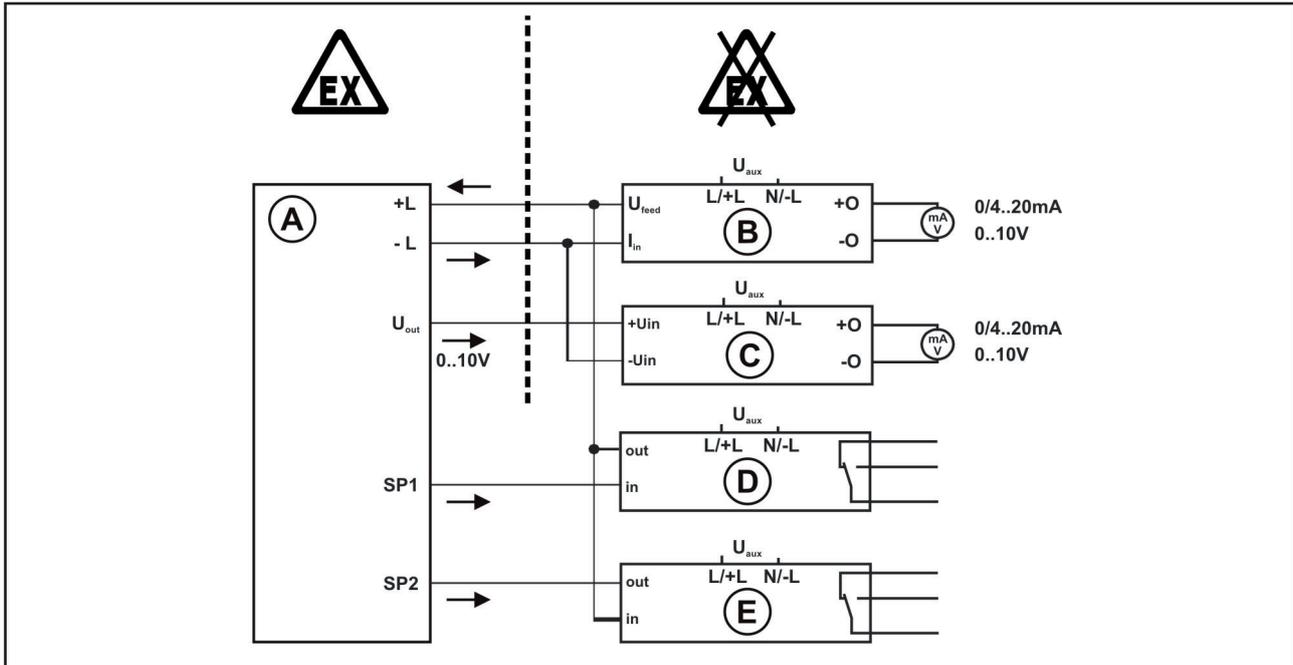


Conductor color cable:
 BN = brown, WH = white, YE = yellow, gn = green, GY = grey

Terminal box



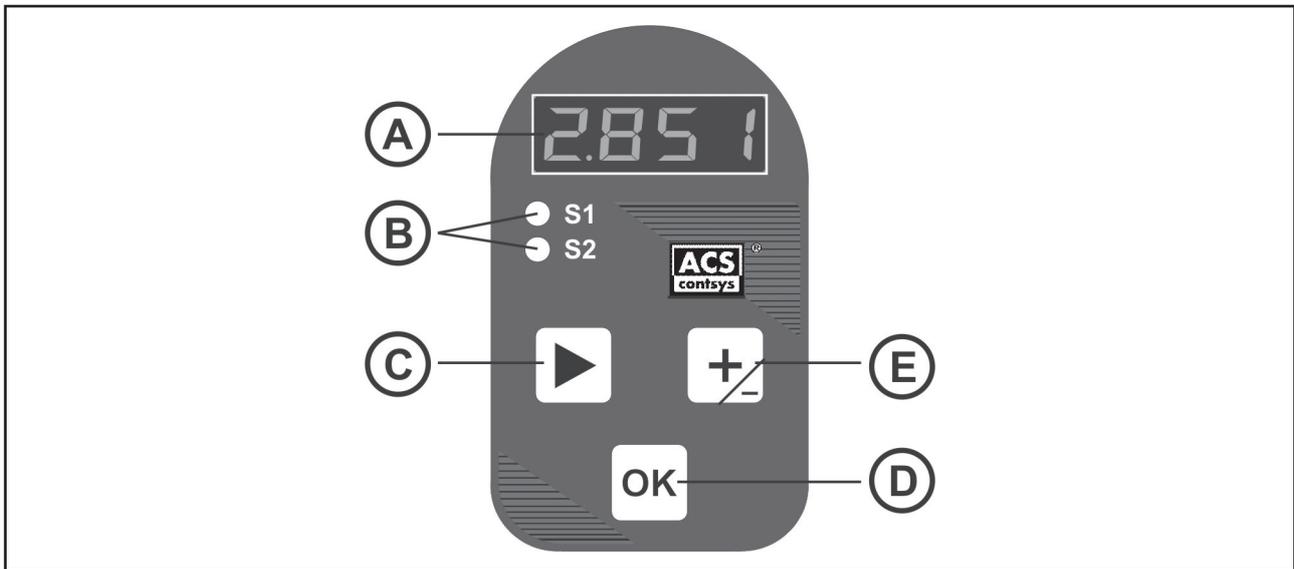
Connection example Ex-version



- A – Intrinsically safe apparatus / measuring transmitter
- B – Associated apparatus / isolation amplifier active / sensor supply
- C – Associated apparatus / isolation amplifier active
- E/F – Associated apparatus / (Namur-) switch amplifier

Operation

Operation and display parts



A - LED display

- Display of measuring value and operation menu

B - Switch condition LED

- Indication of an active switch output by the respective red LED

C - Key Change

- Change between sub menu
- Cancel value input without applying
- Changeover the counter advance sense of the key +/- from + resp. increasing to - resp. decreasing.

D - Key OK

- Access to operation menu
- In the selection menu entering the selected sub menu
- In the set menu applying the new value

E - Key +/-

- Value changing by + resp. increasing or - resp. decreasing. The counter advance sense is at first always + resp. increasing. Changing counter advance sense by the key Change.

Function modes

Run mode

- The device records the applied physical measurand and proceeds the chosen functions according to the set parameter.
- The measuring value is displayed in the display window.
- The analogue output and the switching outputs and are driven.
- A turned on switch output is signaled by the come on of the respective red switch condition LED.
- The exceedance of the frame specifications, abnormal behavior conditions or also device malfunctions are displayed by the display values EEEE resp. -EEE.
- Display of the firmware version by the key +/-.
- Access to operation menus by the key OK and input of the respective password.

Fast adjustment mode

By pushing of key combinations in the run mode the transmitter can be operated without using the adjustment menu.

Zero value adjustment with applied measuring signal

Short pushing the keys Change and OK in succession and hold approx. 6 seconds.

The output signal 4mA/0V is generated.

An adjustment is possible be the keys +/- resp. Change and +/-.

The current sensor value is captured as lower sensor reference value and assigned to the previously adjusted output signal.

By pushing the key OK, the value is captured and stored loss protected (duration approx. 3s).

A jump back to run mode is carried out.

End value adjustment with applied measuring signal

Short pushing the keys +/- and OK in succession and hold approx. 6 seconds.

The output signal 20mA/10V is generated.

An adjustment is possible be the keys +/- resp. Change and +/-.

The current sensor value is captured as upper sensor reference value and assigned to the previously adjusted output signal.

By pushing the key OK, the value is captured and stored loss protected (duration approx. 3s).

A jump back to run mode is carried out.

Damping adjustment

Short pushing the keys Change and +/- in succession and hold approx. 6 seconds.

The signal damping value can be adjusted.

An adjustment is possible be the keys +/- resp. Change and +/-.

The damping value can be varied from 0 to 60 seconds in 100 steps of each 0,6 seconds, at variants C / G from 0 to 6 seconds in 10 steps of each 0,6 seconds.

By pushing the key OK, the value is captured and stored loss protected (duration approx. 3s).

A jump back to run mode is carried out.

Reset to factory values

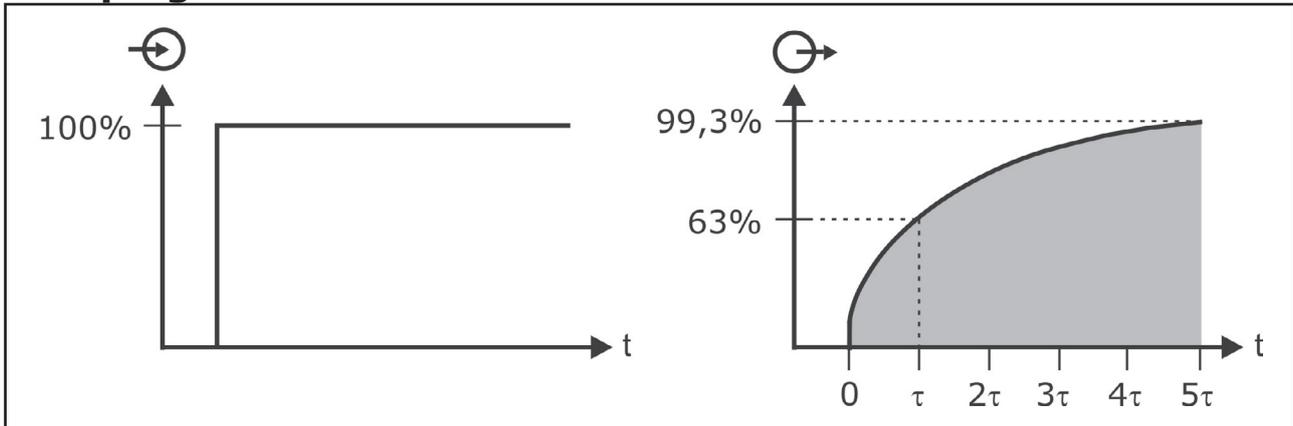
At devices of variant C / G, a reset to factory values will be carried out by pushing the key OK for approx. 5 seconds at a restart after removing the supply voltage. All customer specific adjustment values will be lost.

Attention

If the lower sensor reference value (zero) is adjusted higher than the upper sensor reference value (span), the output signal falls below 3,8mA resp. to 0V. The display shows EEEE as long as the key OK is pushed. A readjustment has to be done correctly (zero < span).

Adjustment

Damping



The damping influences the reaction speed of display, output signal and switch output at a change of the measuring signal.

The behavior of display and output signal follows an exponential characteristic with the damping time constant t .

Within the time period t the output signal increases respectively by 63% of the existing deviation.

With 99,3%, the end value is nearly achieved after $5t$.

At the variants A / B / E / F the damping can be adjusted from 0...60 seconds in 100 steps from 0...100, whereby one step equals 0,6 seconds.

The set time (value \times 0,6 seconds) equals $5t$.

At the variants type C and G the damping can be adjusted from 0...6 seconds in 10 steps from 0...10, whereby one step equals 0,6 seconds.

The set time (value \times 0,6 seconds) equals $5t$.

Offset Adjustment

By the use of the offset adjustment, a constant value can be added to the measuring value, e.g. to suppress overlaid measuring signals in a pressure biased system.

The measured pressure will be shift by the set value.

Upper and lower pressure reference value will be shift by the same value.

To get e.g. a display (desired value) of 0.000 resp. an output signal of 4mA/0V at a shown installation dependent pressure of 0.004, the difference between desired pressure value und shown pressure value (0.000 - 0.004) must be input. Thus the value -0.004 must be input.

Min/Max-Adjustment

Adjustment with applied signal – wet adjustment

At the adjustment with applied signal the adjusted signal zero value equals an output signal of 4mA/0V and the adjusted signal end value equals an output current of 20mA/10V.

Values within the measuring range e.g. 11% and 87% can be also input and the required output signal value can be set, e.g. 5,45mA and 14,44mA. In this case there is an automatic calculation to 4mA/0V and 20mA/10V. The higher the difference between these points, the more precise is the following calculation.

Adjustment without applied signal – dry adjustment

At an adjustment without applying signal the required signal zero resp. signal end value can be assigned to the respective analogue signal end values 4mA/0V und 20mA/10V.

Display scaling

The display value is a freely adjustable numeric value with freely adjustable fractional digits.

The input zero value of the display scaling equals an output signal of 4mA/0V.

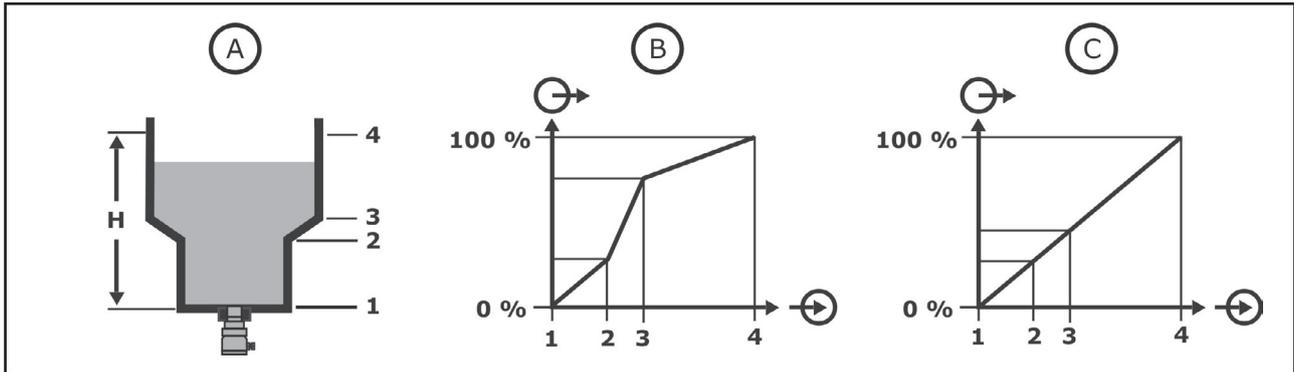
The input end value of the display scaling equals an output signal of 20mA/10V.

If the displayed value falls below -999, -EEE is displayed.

If the displayed value rises above 9999, EEEE is displayed.

Linearization

Due to the integrated linearization function it is possible, to linearize a measuring signal e.g. for volume calculation of conical or horizontal cylindrical vessels or also for flow calculation.



A - Tank with linearization points 1 / 2 / 3 / 4

B - Characteristic pressure - level not linearized

C - Characteristic pressure - level linearized

The linearization can be operated with applied pressure signal as well as without applied pressure signal.

Linearization with applied signal – wet adjustment

At the linearization with applied signal for each linearization point the current pressure value will be measured and assigned to the display value that must be entered.

The entered display value should be set within the range of the display scaling, defined by Zero and Span, but can be set to -999 to 9999.

The first linearization point LP1 should, but must not be assigned to the display value Zero, because this display value is assigned with the output signal 4mA/0V.

The last linearization point should, but must not be assigned to the display value Span, because this display value is assigned with the output signal 20mA/10V.

Linearization without applied signal – dry adjustment

At the linearization without applied signal for each linearization point a needed pressure value can be entered and assigned with the needed display value, which must be entered too.

The pressure value, which must be entered, equals the display value of the device at factory set display adjustment.

If the sensor is set by factory to bar, thus also the pressure must be entered in bar, this is also valid for mbar, psi or other factory settings.

The entered display value should be set within the range of the display scaling, defined by Zero and Span, but can be set to -999 to 9999.

The first linearization point LP1 should, but must not be assigned to the display value Zero, because this display value is assigned with the output signal 4mA/0V.

The last linearization point should, but must not be assigned to the display value Span, because this display value is assigned with the output signal 20mA/10V.

Programming example

The device is mounted into a container like in the scheme above.

Because the container has a conical expansion and the volume should be displayed, the output must be linearized.

The filling level 1 equals the full measuring range of the sensor.

The output (4...20mA) of the sensor is connected to an indication device, which shows the container content in liter.

At the programming with applied signal it can be proceeded like follows:

In the menu item LP_ of the linearization menu the value 4 for 4 linearization points must be entered.

Select the menu item MSig for linearization with applied signal.

Because the minimum level A is at empty container, the factory set minimum value should be set.

Thus at the linearization point LP1 the factory setting will be set by pressing the key OK.

The first real linearization point is set to the position B at the container.

Now the container will be filled up to B and the display value and thus also the output current at the linearization point LP2 will be adjusted as long as the connected indication device shows the correct volume in liter.

This value will be set by OK.

After this the container must be filled up to position C and at the linearization point LP3 the display value resp. the output current must be adjusted, till the indication device shows the correct value.

This value will be set by OK.

Because the position D at the container equals the end pressure of the sensor, once again the factory settings.

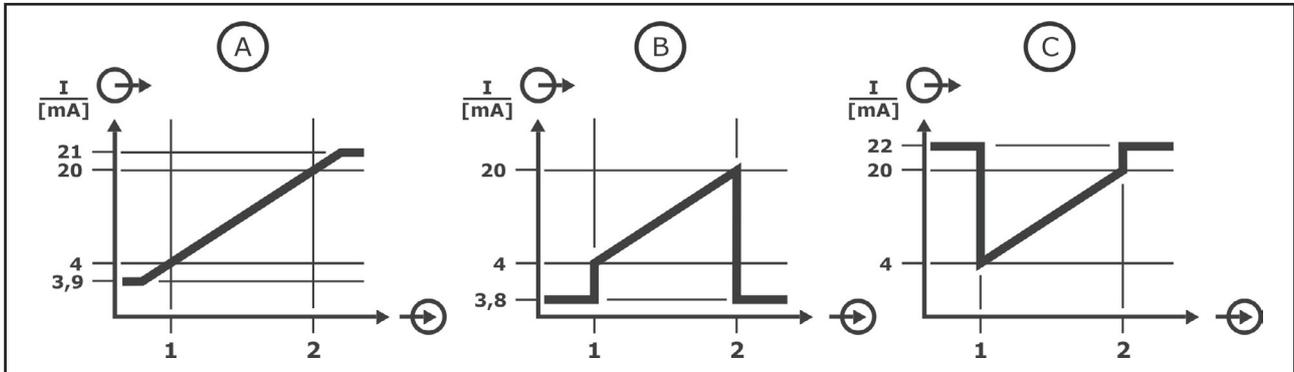
Output

Signal output

Error Signal

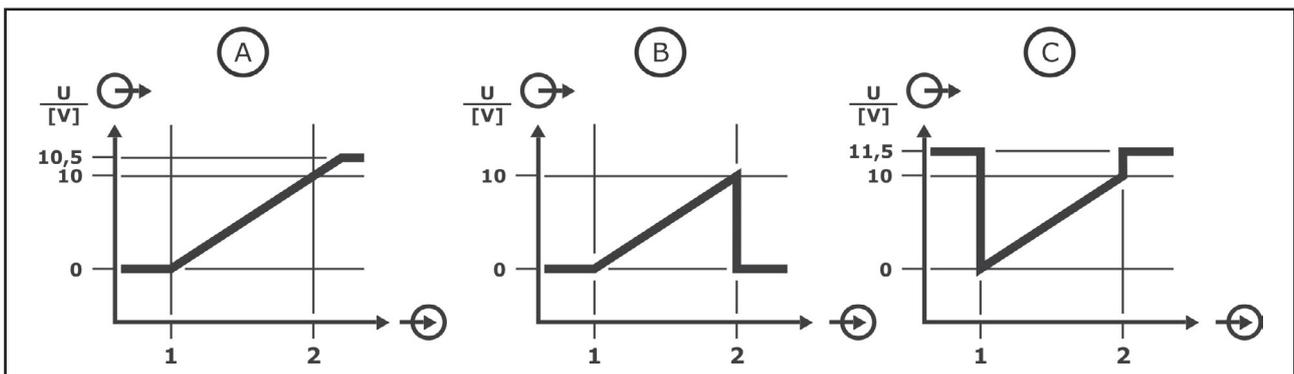
Defines the analogue output signal regarding operating range and if errors are registered.

- Version 4-20mA



A - Off >> 3.9-21mA
 B - 3.8mA
 C - 22mA

- Version 0-10V



A - Off >> 3.9-21mA
 B - 3.8mA
 C - 22mA

Invert Signal

Inverts the analogue output signal, dependent on the version

- 4-20mA >> 20-4mA
- 0-10V >> 10-0V

Simulation

At the signal output an analogue signal is output regardless of the current measuring value. The input range is limited, dependent on the set operating mode.

- 3.800 – 22.00mA (4-20mA)
- 0 – 11.25V (0-10V)

Switch output S1 / S2

Operating Mode

The operating mode defines the function direction of the switch output.

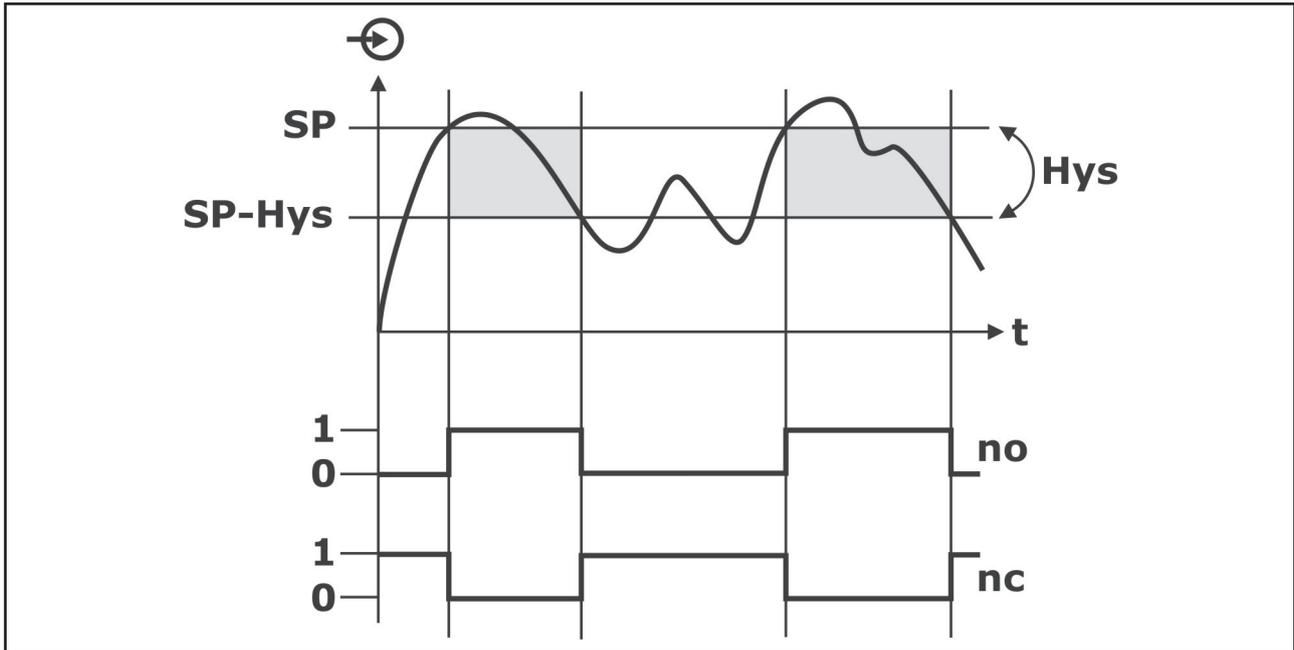
Normal Open / NO

- At the output there is no signal, if the switch condition is not fulfilled.
- At the output there is a signal, if the switch condition is fulfilled.

Normal Close / NC

- At the output there is a signal, if the switch condition is not fulfilled.
- At the output there is no signal, if the switch condition is fulfilled.

Hysteresis function



The hysteresis function realizes a stable switch state, independent from system conditioned signal fluctuations around the adjusted set point.

It can be used for realizing a signal controlled two-position control.

The switch range is determined by the switch point – SP – and hysteresis – HYS – for the respective switch output.

For the switch point as well as for the hysteresis an arbitrary value referring to the display scaling can be input.

There is no default minimum value for hysteresis, that means the distance between switch resp. switch back point.

The switch back point results from switch point deducting hysteresis (SP – HYS).

The switch output is activated, if the current measuring value exceeds the switch point.

The switch output is deactivated, if the current measuring value exceeds the reset switch point (SP – HYS).

Error Indication Function

The switch output S1 can be alternatively used for error indication function. Doing this a switch action happens, if the output signal becomes higher than 20mA/10V resp. lower than 4mA/0V.

Simulation

The switch output is activated resp. deactivated regardless of an already existing activation.

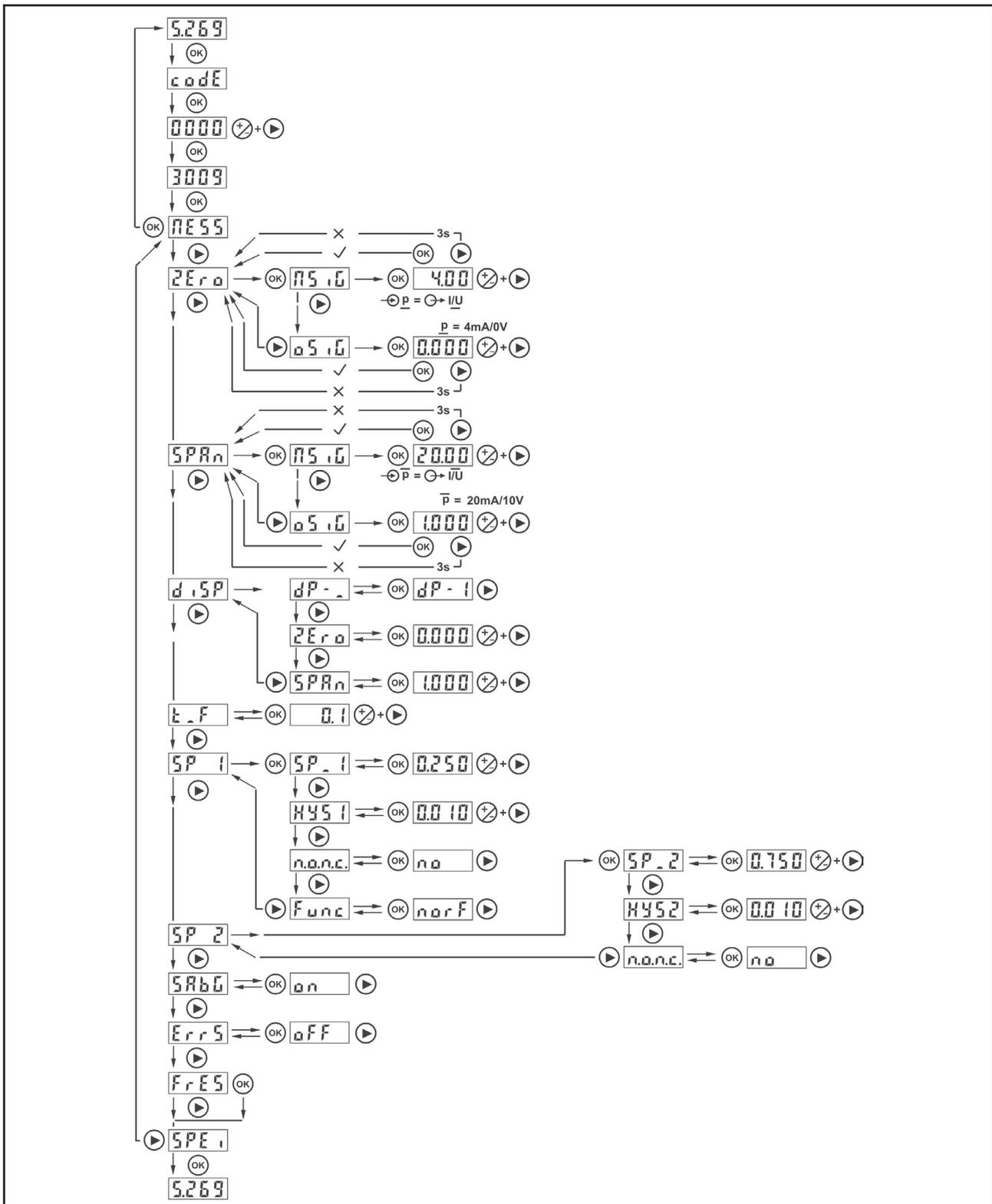
Menu structure

Parameter overview

Menu group	Function	Input	Description
code		3009	Password input for the access to the adjustment menu
		2812	Password input for the access to the extension menu
		2611	Password input for the access to the linearization menu

Adjustment menu - password 3009

Menu structure



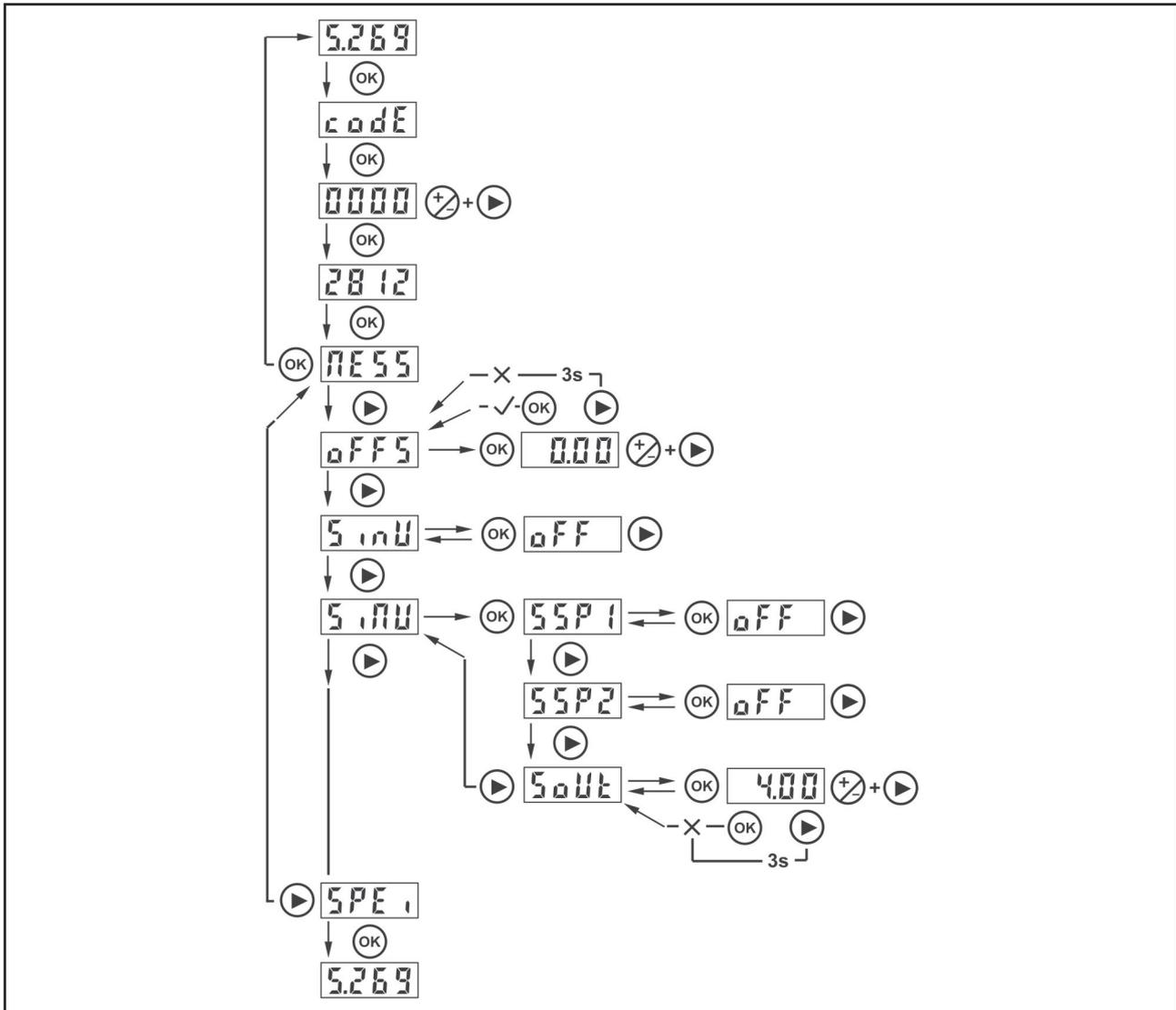
Parameter overview

Menu group	Function	Input	Description
ZEr0			ADJUSTMENT ZERO – Lower pressure reference value
	RSIG	4.00	<u>Adjustment lower pressure reference value with applied signal</u> The actual applied pressure value is captured as lower pressure reference value. The output signal of 4mA/0V, that can adjusted by the control keys +/- and > arbitrarily is assigned to this pressure reference value. Adjustment range 3,9mA to 21mA / 0V to 10,5V. At the signal 0...10V the value of 4.00 equals a voltage of 0V and a value of 20.00 equals a voltage of 10V.
	aSIG	0.000	<u>Adjustment lower pressure reference value without applied signal</u> The freely adjustable pressure value, referring to the nominal sensor measurement range, is captured as lower pressure reference value. The Zero value of the display refers to this pressure reference value. The lower output signal end value, 4mA/0V, refers to this pressure reference value.
SPRn			ADJUSTMENT SPAN – Upper pressure reference value
	RSIG	20.00	<u>Adjustment upper pressure reference value with applied signal</u> The actual applied pressure value is captured as upper pressure reference value. The output signal of 20mA/10V, that can adjusted by the control keys +/- and > arbitrarily is assigned to this pressure reference value. Adjustment range 3,9mA to 21mA / 0V to 10,5V. At the signal 0...10V the value of 4.00 equals a voltage of 0V and a value of 20.00 equals a voltage of 10V.
	aSIG	1.000	<u>Adjustment upper pressure reference value without applied signal</u> The freely adjustable pressure value, referring to the nominal sensor measurement range, is captured as upper pressure reference value. The Span value of the display refers to this pressure reference value. The upper output signal end value, 20mA/10V, refers to this pressure reference value.

<i>d .SP</i>			DISPLAY
	<i>dp -</i>	<i>dp - 0</i>	No decimal point, the measuring value is displayed without decimal place
		<i>dp - 1</i>	One decimal point, the measuring value is displayed with one decimal place
		<i>dp - 2</i>	Two decimal point, the measuring value is displayed with two decimal place
		<i>dp - 3</i>	Three decimal point, the measuring value is displayed with three decimal place
	<i>Zero</i>		Freely adjustable lower display value. This value equals an output signal of 4mA/0V. If the displayed value falls below -999, -EEE is displayed.
<i>SPRn</i>		Freely adjustable upper display value. This value equals an output signal of 20mA/10V. If the displayed value rises above 9999, EEEE is displayed.	
<i>t .F</i>			FILTER TIME CONSTANT
		<i>t</i>	Input of the system damping for extraction of short pressure bursts resp. also for reassuring of cyclic fluctuating pressure signals. The adjustment range is 0...60 seconds, in 100 steps of 0,6 seconds
<i>SP 1</i>			SWITCHING OUTPUT 1
	<i>SP_1</i>	<i>0.250</i>	Display value, when the switching output is activated.
	<i>HYS1</i>	<i>0.005</i>	Switching output hysteresis referring to the display range.
	<i>nonc</i>	<i>no</i>	The switching output 1 operates in open-circuit principle resp. – no normally open
		<i>nc</i>	The switching output 1 operates in closed-circuit principle resp. – nc normally closed
	<i>Func</i>	<i>norF</i>	Normal function – The switching output 1 operates in hysteresis function
<i>ErrF</i>		Error indication function – The switching output 1 operates in error indication function for the analogue output. At underrun of 4mA/0V resp. at exceedance of 20mA/10V, the switching output 1 is activated depending on the settings as closed-circuit or as open-circuit.	
<i>SP 2</i>			SWITCHING OUTPUT 2
	<i>SP_2</i>	<i>0.750</i>	Display value, when the switching output is activated.
	<i>HYS2</i>	<i>0.005</i>	Switching output hysteresis referring to the display range.
	<i>nonc</i>	<i>no</i>	The switching output 1 operates in open-circuit principle resp. – no normally open
		<i>nc</i>	The switching output 1 operates in closed-circuit principle resp. – nc normally closed
<i>SRbG</i>			FAST ADJUSTMENT
		<i>on</i>	Unlock of fast adjustment for the lower and upper pressure reference value with applied signal as well as setting the damping per key combinations.
		<i>oFF</i>	Lock of fast adjustment for the lower and upper pressure reference value with applied signal as well as setting the damping per key combinations.
<i>ErrS</i>			ERROR SIGNAL
		<i>oFF</i>	The output signal operates linear in the range from 3,9mA to 21,0mA/0V to 10,5V. A signal output besides this limits is not possible, the end values are kept at exceedance. An error signal current output at underrun resp. exceedance does not occur.
		<i>FS38</i>	The output signal operates linear in the range from 4,0mA to 20,0mA/0V to 10V. At underrun of 4mA/0V resp. at exceedance of 20mA/10V a constant signal of 3,8mA/0V is generated.
		<i>FS22</i>	The output signal operates linear in the range from 4,0mA to 20,0mA/0V to 10V. At underrun of 4mA/0V resp. at exceedance of 20mA/10V a constant signal of 22mA/11,25V is generated.
<i>FrES</i>			Factory Reset – reset of all parameters to factory values
<i>SPe i</i>			Storage – loss protected storage of all parameters

Extension menu - password 2812

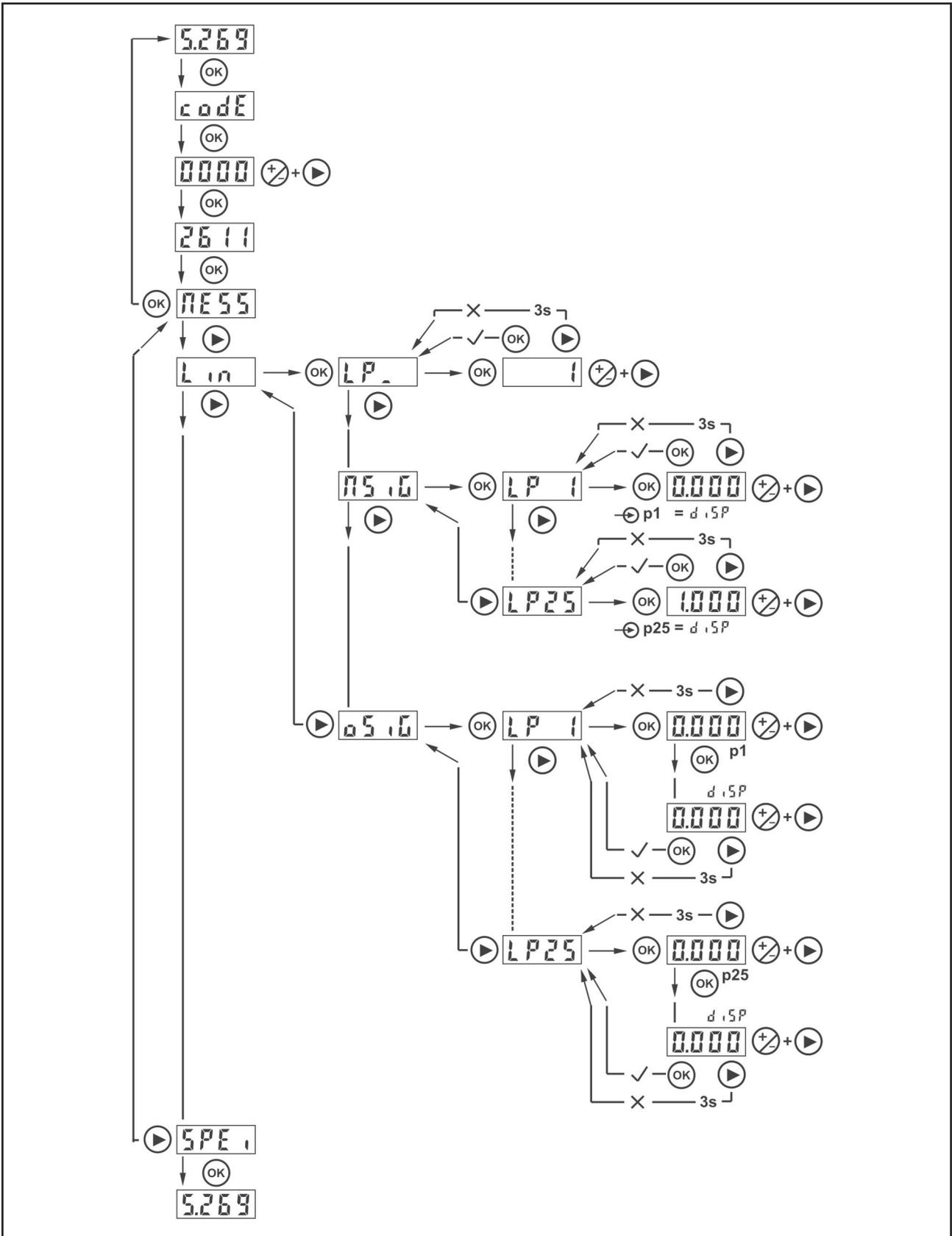
Menu structure



Parameter overview

Menu group	Function	Input	Description
OFFS			OFFSET
		0.000	The measured pressure will be shift by the set value. Upper and lower pressure reference value will be shift by the same value. To get e.g. a display (desired value) of 0.000 resp. an output signal of 4mA/0V at a shown installation dependent pressure of 0.004, the difference between desired pressure value und shown pressure value (0.000 – 0.004) must be input. Thus the value -0.004 must be input.
5 INU			SIGNAL INVERTING
		ON	The output signal corresponds to the assignment of the adjustment >> 4...20mA/0...10V
		OFF	The output signal behaves inverted to the assignment of the adjustment >> 20...4mA/10...0V
5 INU			SIMULATION
	SSP 1	ON	Switching output 1 is activated
		OFF	Switching output 1 is deactivated
	SSP 2	ON	Switching output 2 is activated
		OFF	Switching output 2 is deactivated
5 OUT	4.00	The analogue output signal can be arbitrarily simulated in the whole utilizable range from 3,8mA to 22mA/0 to 11,25V. At the signal 0...10V the value of 4.00 equals a voltage of 0V and a value of 20.00 equals a voltage of 10V.	

Linearization menu - password 2611
Menu structure



Parameter overview

Menu group	Function	Input	Description
L in			LINEARIZATION
	LP_		Between 2 and 25 linearization points can be used.
	ns 1G	0.000	At each linearization point (1 to 25) the current pressure value will be assigned to the displayed adjustable display value. The set range of the display value is set in the display scaling. In the display scaling the value Zero is assigned with the output signal 4 mA / 0 V, resp. the value Span is assigned with the output signal 20 mA / 10 V.
	a5 1G	0.0000	At each linearization point (1 to 25) the display value, which should be displayed at the respective needed pressure value (factory set display scaling) must be input in the first window.
0.0000		In the second window the needed new display value must be input, to which the set pressure value will be assigned. The set range of the display value is set in the display scaling. In the display scaling the value Zero is assigned with the output signal 4mA/0V, resp. the value Span is assigned with the output signal 20mA/10V.	

Maintenance

The device is free of maintenance.

Special substances can lead to solid coatings on the membrane.

Seized depositions can lead to faulty measurement results.

In the case of coat forming liquids the membrane must be regularly cleaned e.g. with clear water.

Don't use sharp tools or aggressive chemicals for cleaning.

Repair

A repair may only be carried out by the manufacturer.

If the device must be sent back for repair, the following informations must be enclosed:

- An exact description of the application.
- The chemical and physical characteristics of the product.
- A short description of the occurred error.

Before returning the device for repair, the following measures must be proceeded:

- All adhesive product residues must be removed. This is especially important, if the product is unhealthy, e.g. caustic, toxic, carcinogenic, radioactive etc.
- A returning must be refrained, if it is not possible by 100% to remove the unhealthy product completely, because e.g. it is penetrate into cracks or is diffused through plastic.

Technical Data

Auxiliary power supply

Supply voltage U_s	<u>2-wire 4...20mA - Electronic output type A / B</u> 14,5V _{DC} ...45V _{DC} , reverse polarity protected
	<u>2-wire 4...20mA - Electronic output type C / D</u> 10,5V _{DC} ...45V _{DC} , reverse polarity protected
	<u>ATEX - 2-wire 4...20mA - Electronic output type A / B</u> 14,5V _{DC} ...30V _{DC} , reverse polarity protected
	<u>ATEX - 2-wire 4...20mA - Electronic output type C / D</u> 10,5V _{DC} ...30V _{DC} , reverse polarity protected
	<u>3-wire 0...10V - Electronic output type E / F / G / H</u> 14,5V _{DC} ...45V _{DC} , reverse polarity protected
	<u>ATEX - 3-wire 0...10V - Electronic output type E / F / G / H</u> 14,5V _{DC} ...30V _{DC} , reverse polarity protected
	Residual ripple U_{pp}
Supply current I_{In}	<u>2-wire 4...20mA - Electronic output type A / B / C / D</u> $\leq 22mA$ (S1/S2 $I_{S-Out}=0mA$)
	<u>3-wire 0...10V - Electronic output type E / F / G / H</u> $\leq 10mA$ (S1/S2 $I_{S-Out}=0mA$)
Isolation	$\geq 10M\Omega$ (100V _{DC}) / $\geq 500V_{AC}$

Output Signal 4...20mA

Operating range I_{Out}	3,9mA...21mA, min. 3,8mA, max. 22mA
Signal resolution	$\leq 1\mu A$
Permitted load R_L	<u>Electronic output type A / B</u> $\leq ((U_s - 14,5V) / 22mA) \Omega$
	<u>Electronic output type C / D</u> $\leq ((U_s - 10,5V) / 22mA) \Omega$
Step response time T_{90}	$\leq 35ms$ ($t_d = 0s$ / typ. $\leq 70ms$)
Start-up time t_{on}	$\leq 1s$

Output Signal 0...10V

Operating range U_{Out}	0V...10,5 V, min. 0V, max. 11,25 V
Signal resolution	$\leq 1mV$
Permitted load R_L	$\geq U_{Out} / 5mA$
Step response time T_{90}	$\leq 35 ms$ ($t_d = 0s$ / typ. $\leq 70 ms$)
Start-up time t_{on}	$\leq 1s$

Output Switch output

Function	PNP switching to +L
Output voltage U_{Out}	$U_{Out} \geq U_s - 2V$
Output current I_l	0... $\leq 250mA$, current limited, short circuit protected
Step response time T_{90}	$\leq 35ms$ ($t_d = 0s$ / typ. $\leq 70ms$)
Rise time T_{90}	$< 700\mu s$ ($R_l < 3kR$ / $I_{Out} > 4,5mA$)
Start-up time t_{on}	$\leq 1s$
Switch cycles	$\geq 100.000.000$

Measuring accuracy

Reference conditions	EN/IEC 60770-1
Temperature T_a/T_p	+25°C ±4°C, constant
Humidity ϕ	50% ±30% rH, constant
Environmental air pressure p_a	960kPa ±100kPa, constant
Calibration position	Membrane bottom side, horizontal ±1%, constant
Supply voltage U_s	24V _{DC} ±3V _{DC} , constant
Warm-up time	≥ 240s

Characteristic deviation ^{3) 5) 6) 12)}	≤ ±0,05% / ±0,1% / ±0,2% FS ²⁾
Nonlinearity ^{6) 12)}	≤ ±0,05% / ±0,1% / ±0,2% FS ²⁾
Hysteresis ^{6) 12)}	negligible
Influence of supply voltage	≤ ±0,02% FS ²⁾ / 10V
Long term drift ^{6) 12)}	≤ ±0,1% FS ²⁾ / year - not cumulative
Temperature deviation ^{6) 12)}	T_k ⁴⁾ <u>Zero</u> ≤ ±0,15% FS ²⁾ / 10K, max. ±0,75% (-20°C...+80°C) ≤ ±0,30% FS ²⁾ / 10K, max. ±1,5% (≤ -20°C / ≥ +80°C)
	T_k ⁴⁾ <u>Span – Measuring span > 0,4bar</u> ≤ ±0,15% FS ²⁾ / 10K, max. ±0,5% (-20°C...+80°C) ≤ ±0,30% FS ²⁾ / 10K, max. ±1% (≤ -20°C / ≥ +80°C)
	T_k ⁴⁾ <u>Span – Measuring span ≤ 0,4bar</u> ≤ ±0,15% FS ²⁾ / 10K, max. ±0,8% (-20°C...+80°C) ≤ ±0,30% FS ²⁾ / 10K, max. ±1,6% (≤ -20°C / ≥ +80°C)

Mounting position

Maximum deviation ¹⁰⁾	≤ 0,18mbar
----------------------------------	------------

²⁾ Referring to nominal measuring span resp. full scale (FS)

³⁾ Nonlinearity + Hysteresis + Reproducibility

⁴⁾ T_k = Temperature coefficient

⁵⁾ Limit value adjustment acc. to EN/IEC 60770-1

⁶⁾ Specification for TD ⁷⁾ = 1 (adjusted measuring range = nominal measuring range).

Specification for TD ⁷⁾ ≥ 1 (adjusted measuring range ≤ nominal measuring range) = specification at nominal measuring range x TD ⁷⁾

⁷⁾ Turn-Down TD = nominal measuring range (FS ²⁾) / adjusted measuring range)

¹⁰⁾ Device rotated by 180°, process connection upside

¹²⁾ Higher values for special measuring range

Process conditions

The permitted process temperature range results from the combination of standard range, expansion and limitation, whereby the range is defined by the narrowest limitation.

Process temperature	-40°C...+100°C
	<u>Expansion</u> Temperature decoupler → -40°C...+125°C
	<u>Limitation</u> Gasket - FPM → -25°C...+200°C Gasket - CR → -40°C...+120°C Gasket - EPDM → -40°C...+140°C Gasket - FFKM / FFKM hd → -15°C...+315°C ATEX – see chapter „Special safety notes“

Process pressure	Pressure range	Over/Burst pressure	Vacuum
[R] Gauge pressure	-0,1...+0,1bar [R]	6bar	0,5bar [A]
[A] Absolute pressure	-0,1...0bar [R]	4bar	0,7bar [A]
	-1...+1bar [R]	18bar	0bar [A]
	-1...0bar [R]	10bar	0bar [A]
	0...0,1bar [R]	4bar	0,7bar [A]
	0...0,1bar [A]	4bar	0bar [A]
	0...0,2bar [R]	6bar	0,5bar [A]
	0...0,2bar [A]	6bar	0bar [A]
	0...0,4bar [R/A]	6bar	0bar [A]
	0...0,6bar [R/A]	10bar	0bar [A]
	0...1bar [R/A]	10bar	0bar [A]
	0...1,6bar [R/A]	18bar	0bar [A]
	0...2,5bar [R/A]	18bar	0bar [A]
	0...4bar [R/A]	25bar	0bar [A]
	0...6bar [R/A]	40bar	0bar [A]
	0...10bar [R/A]	40bar	0bar [A]
	0...16bar [R/A]	40bar	0bar [A]
	0...20bar [R/A]	40bar	0bar [A]
	0...40bar [R/A]	60bar	0bar [A]
	0...60bar [R/A]	105bar	0bar [A]

Environmental conditions

The permitted environmental temperature range results from the combination of standard range and expansion, whereby the range is defined by the narrowest limitation.

Environmental temperature	-40°C...+85°C <i>Limitation</i> Terminal enclosure PBT >> -25°C...+85°C Connected cable PE >> -40°C...+70°C ATEX – see chapter „Special safety notes“
Protection	IP65/IP67 (EN/IEC 60529)
Climatic classification	4K4H [-20...+55°C / 4...100%] (EN/IEC 60721-3-4)
Shock classification	15 g [11ms] (EN/IEC 60068-2-27)
Vibration classification	4 g [10 - 500 Hz] (EN/IEC 60068-2-6)
EM compatibility	Operation device class B / Industrial range (EN/IEC 61326)

Mechanical data

Pressure cycles	≥ 10.000.000 (0%...100% Full scale)
Tightening torque	≤ 50Nm
Weight	Depends on variant

Materials - process wetted

Membrane	Ceramic aluminum oxide 99,9%
Process connection	Steel 1.4404/316L or steel 1.4571/316Ti
Gaskets	FPM – fluorelastomere (Viton®) CR – chloroprene-rubber (Neopren®) EPDM – ethylene-propylene-dienmonomere FFKM – perfluorelastomere (Kalrez®) FFKM hd – perfluorelastomere high density

Materials - not process wetted

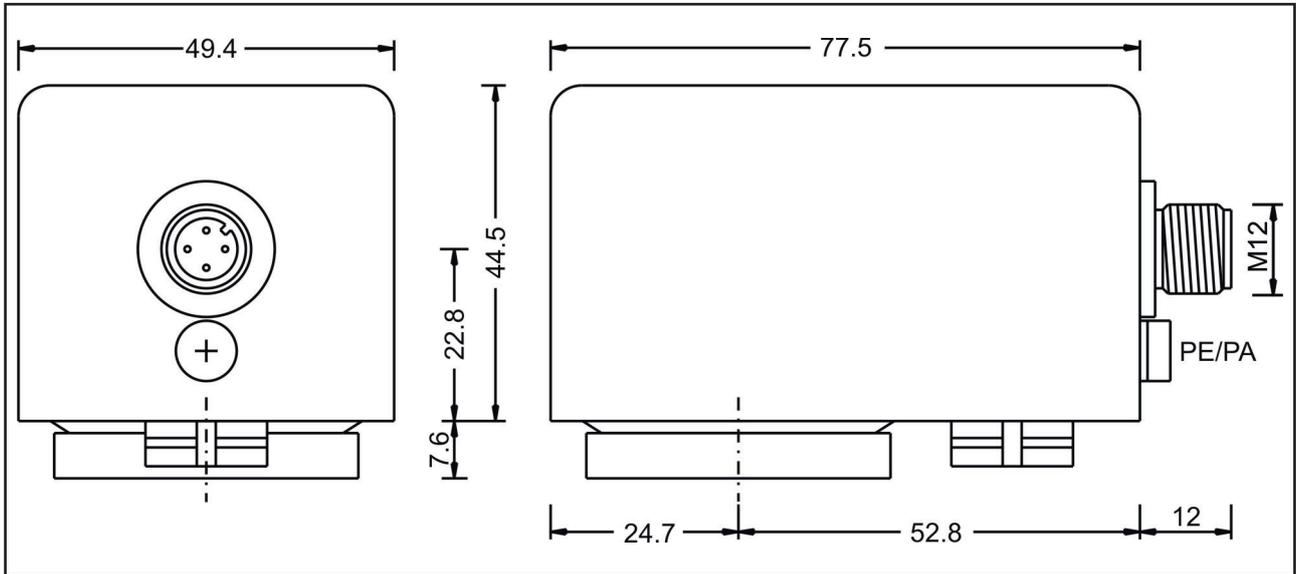
Terminal enclosure	CrNi-steel PBT – polybutyleneterephthalat POM – polyoxymethylene (Delrin®)
	<i>Electrical connection type A – Terminal box</i> Display window PC – polycarbonate
Control panel surface	PES – polyester
Electrical connection part	<i>Electrical connection type S – Plug M12</i> Device plug CrNi-steel / PUR
	<i>Electrical connection type K – Connected cable</i> Cable gland PA Gasket CR / NBR Cable sheath PE
	<i>Electrical connection type A – Terminal box</i> Cable gland PA Gasket CR / NBR
Pressure compensation element	Enclosure PA Membrane ePTFE
Gaskets	FPM – fluorelastomere (Viton®) Silicone
Temperature decoupler	CrNi-steel

Dimension drawings

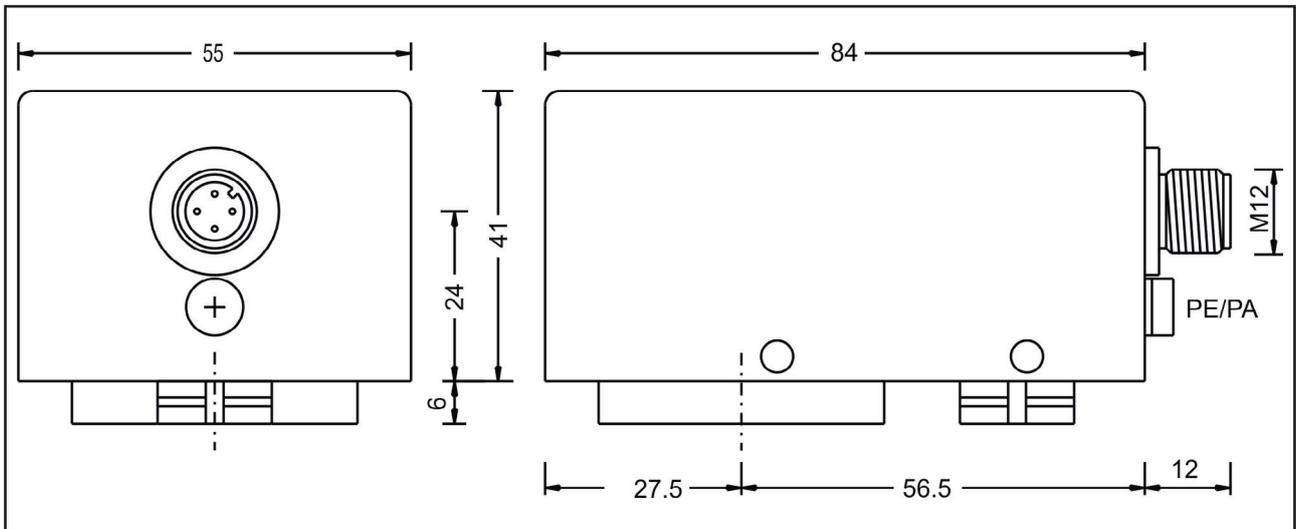
Terminal enclosure

Electrical connection type S - plug M12

Material terminal enclosure type A - PBT

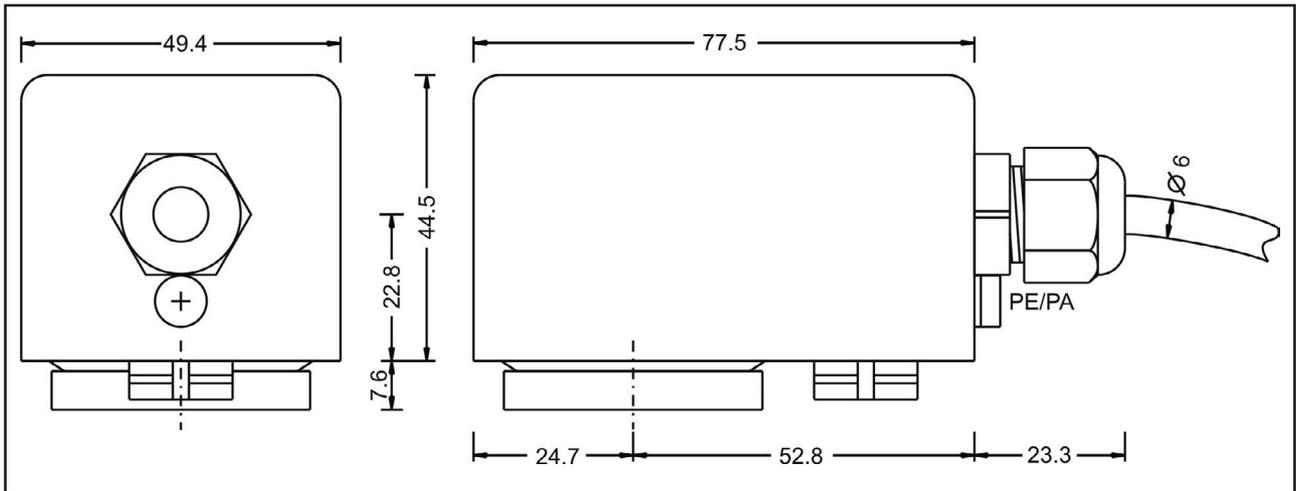


Material terminal enclosure type C - CrNi-steel

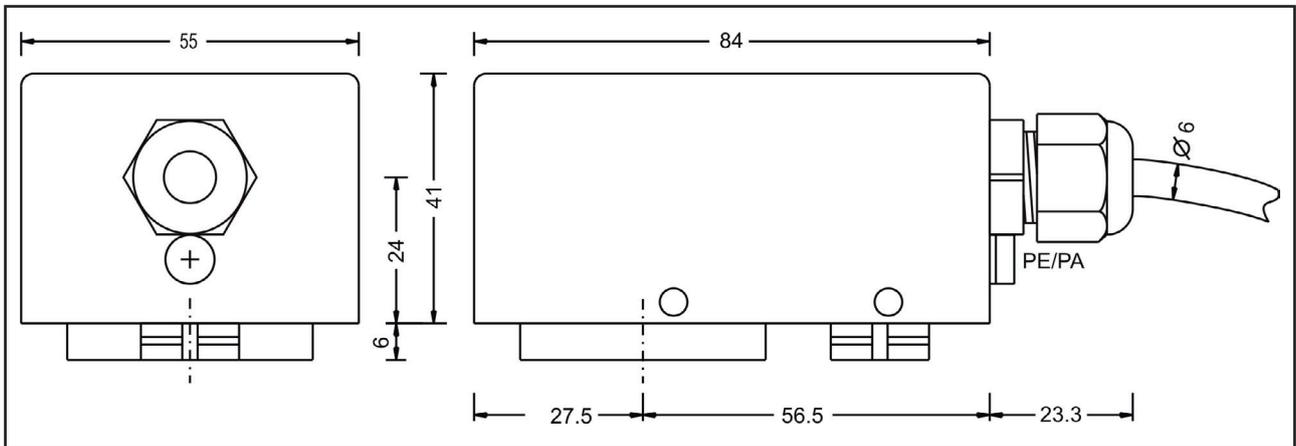


Electrical connection type K - connected cable

Material terminal enclosure type A - PBT

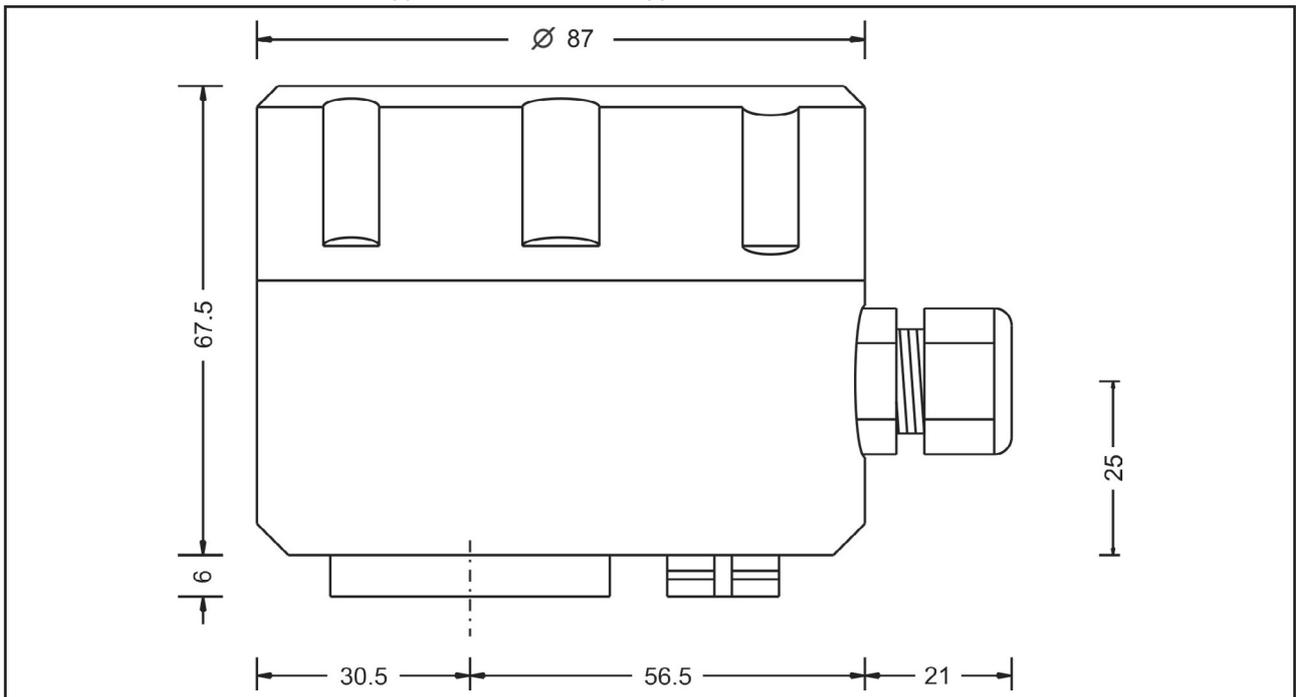


Material terminal enclosure type C - CrNi-steel

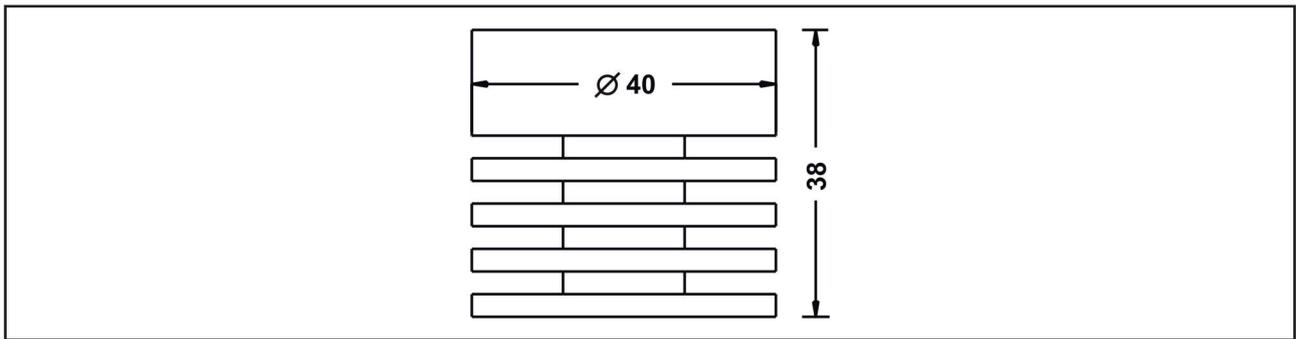


Electrical connection type A - terminal box

Material terminal enclosure type C - CrNi-steel / type D - POM

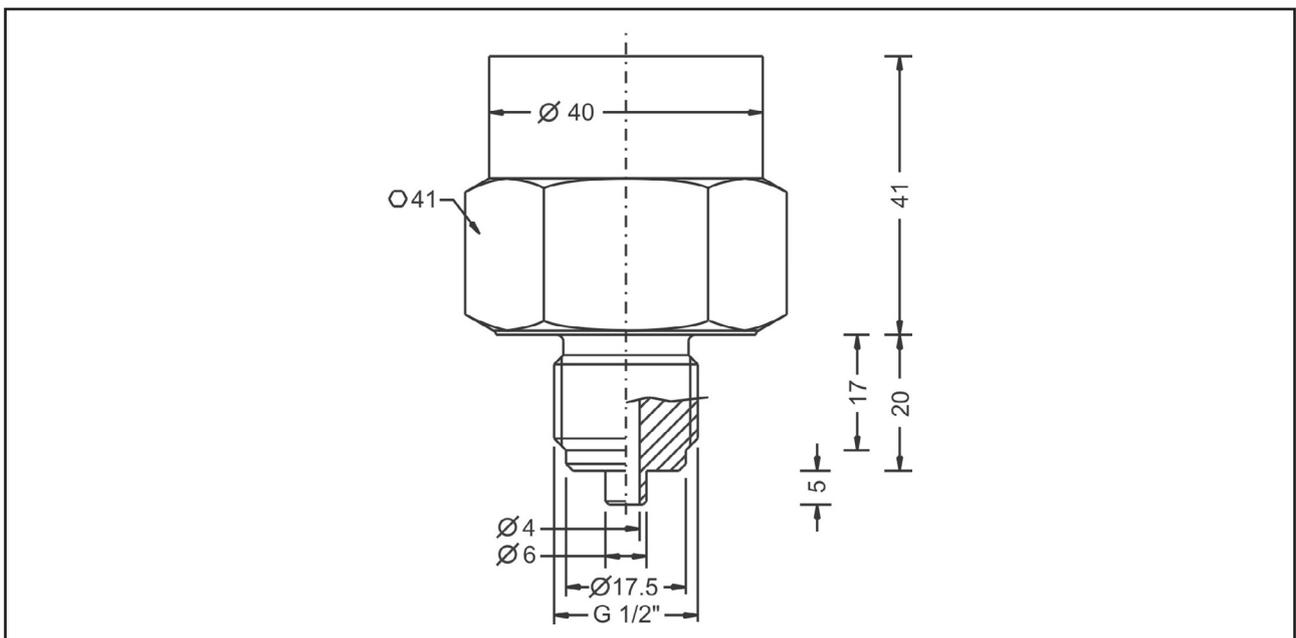


Temperature decoupler

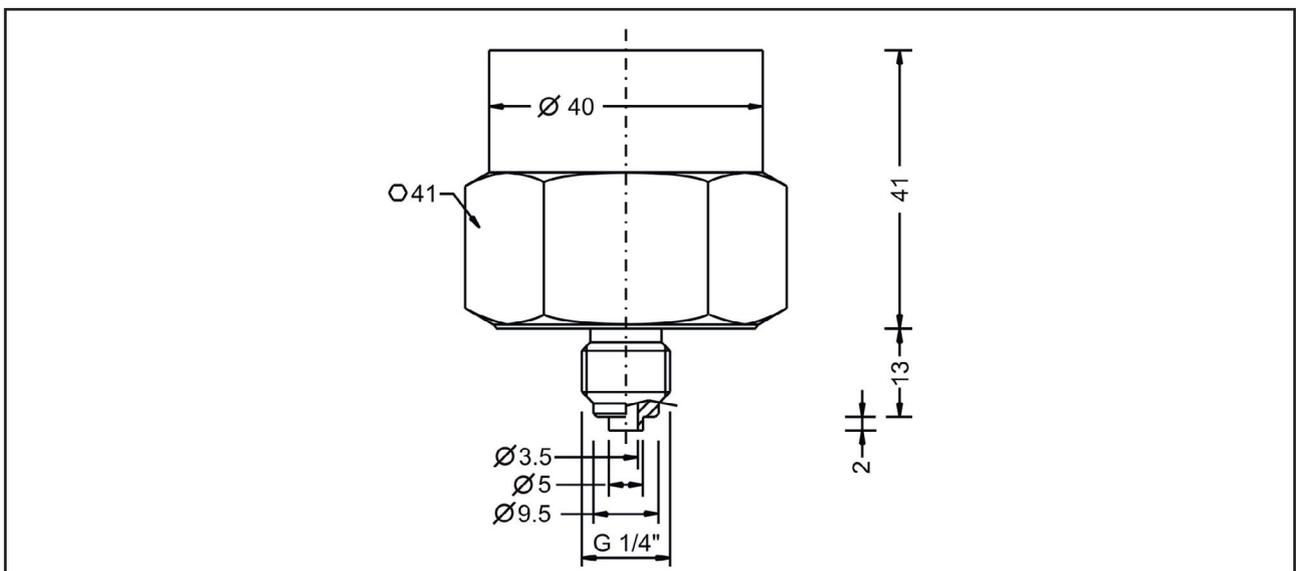


Process connection

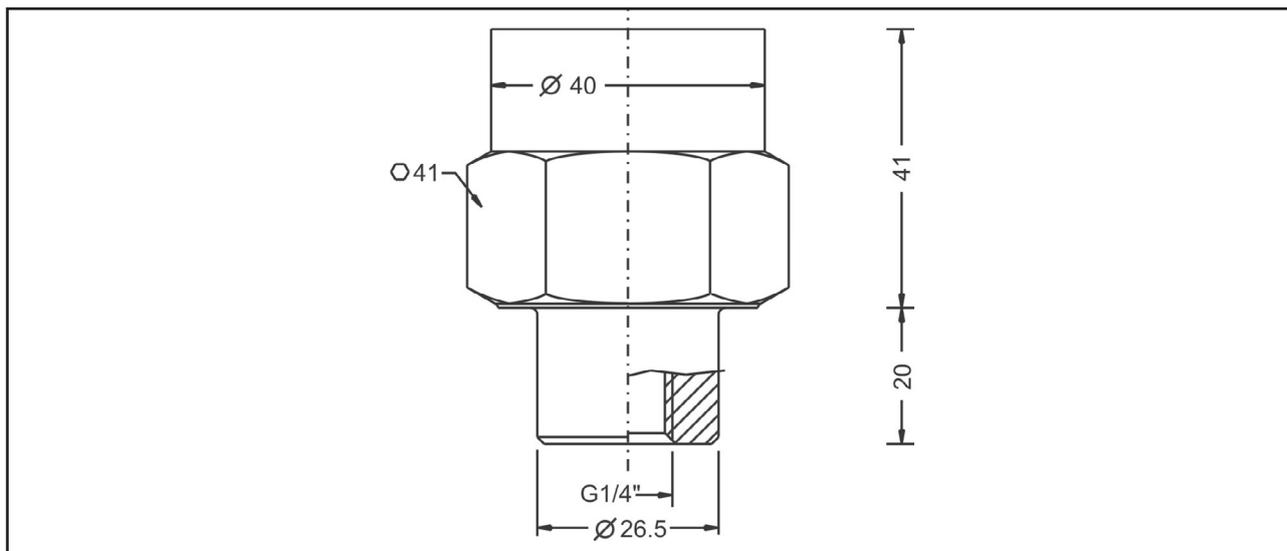
Type 0 - G 1/2" ISO 228-1 - DIN 837-3



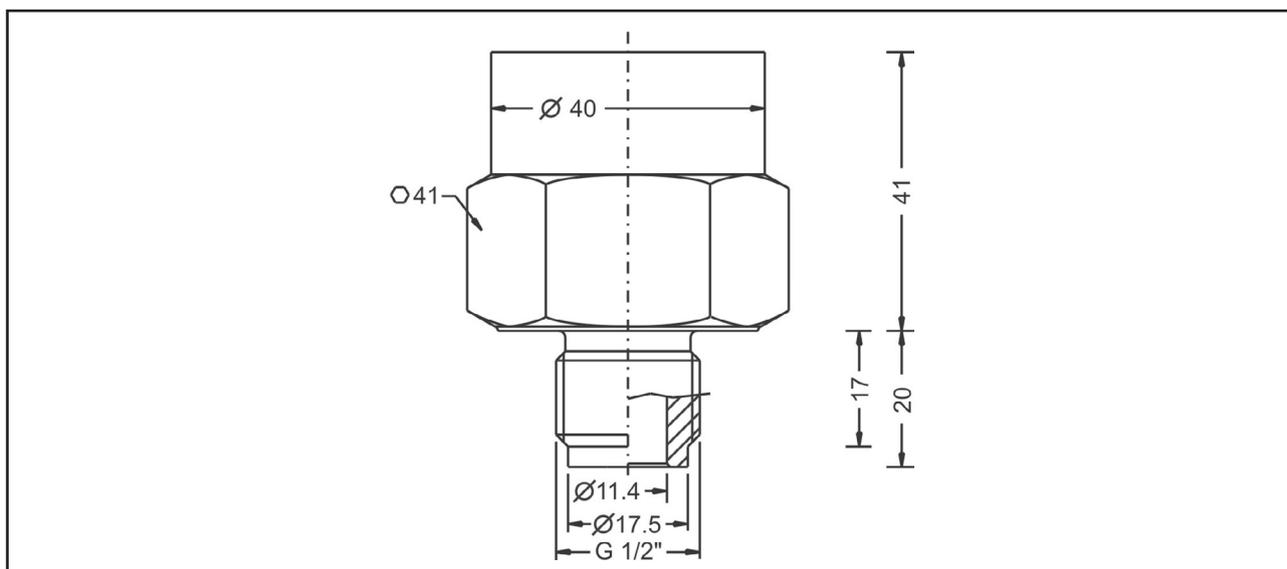
Type 1 - G 1/4" ISO 228-1 - DIN 837-3



Type 4 - G 1/4" ISO 228-1 - internal thread



Type 6 - G 1/2" ISO 228-1 - inside drill 11,4mm



Order Code

Type
 S10 Standard
 ExS10 ATEX II 1/2 G Ex ia IIC T4 Ga/Gb
 XDS10 ATEX II 1/2 D Ex ia IIIC T60°C/T102°C Da/Db + ATEX II 1/2 G Ex ia IIC T4 Ga/Gb
 • only for material terminal enclosure type C - CrNi-steel

Process connection
 0 G½" A, ISO 228-1, DIN EN 837-3 (DIN 16288) manometer
 1 G¼" A, ISO 228-1, DIN EN 837-3 (DIN 16288) manometer
 4 G¼", ISO 228-1, internal thread
 6 G½" A, ISO 228-1, inside drill 11,4 mm

Electronic - output
 A 2-wire, signal 4...20mA, 2x PNP, LED display, keypad
 B 2-wire, signal 4...20mA, LED display, keypad
 C 2-wire, signal 4...20mA, keypad
 D 2-wire, signal 4...20mA
 E 3-wire, signal 0...10V, 2x PNP, LED display, keypad
 F 3-wire, signal 0...10V, LED display, keypad
 G 3-wire, signal 0...10V, keypad
 H 3-wire, signal 0...10V

Material process connection (process wetted)
 V Steel 1.4404/316L - 1.4571/316Ti

Material terminal enclosure
 A PBT - polybutyleneterephthalat, not for electrical connection type A - terminal box
 C CrNi-steel
 D POM - polyoxymethylene (Delrin®), only for electrical connection type A - terminal box

Measuring range

01	0...0,1 bar	10	0...10 bar
02	0...0,2 bar	11	0...16 bar
03	0...0,4 bar	12	0...20 bar
04	0...0,6 bar	13	0...40 bar
05	0...1 bar	14	0...60 bar
06	0...1,6 bar	15	-0,1...0 bar
07	0...2,5 bar	16	-1...0 bar
08	0...4 bar	17	-1...+1 bar
09	0...6 bar	18	-0,1...+0,1 bar
		YY	Special measuring range (poss. higher deviation accuracy)

Material gaskets (process wetted)
 1 FPM - fluorelastomere (Viton®)
 2 CR - chloroprene-rubber (Neopren®)
 3 EPDM - ethylene-propylene-dienmonomere - food applications
 4 FFKM - perfluorelastomere (Kalrez®)
 6 FFKM hd - perfluorelastomere high density - gas applications

Process temperature
 0 Standard, -40°C...+100°C
 1 Extended, -40°C...+125°C, temperature decoupler

Pressure type
 R Gauge pressure
 A Absolute pressure

Measuring membrane - material / accuracy (process wetted)
 1 Ceramic 99,9%, capacitive / 0,2%
 3 Ceramic 99,9%, capacitive / 0,1%, linearization protocol
 6 Xcellence - Ceramic 99,9%, capacitive / 0,05%, linearization protocol
 • Measuring span ≥ 0,2 bar

Electrical connection
 S Plug M12
 K Cable, L = 2m
 A Terminal box

Precont

V

Installation material and connection cable are not enclosed in contents of delivery.

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