



fill level



water level



pressure



temperature



flow



visualization



signal converter



sensoric



Precont MAC

Pressure transmitter

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

Technical manual
01.14



Main features

Finely graded pressure measuring

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

Ceramic membrane for various applications

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

Accuracy $\leq 0,2\%$

Integrated evaluation electronic

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

Enclosure and display rotatable for optimal operability in each installation position

Viewing angle optimized TFT-LCD display for best readability

Easy handling by clear menu navigation

Extensive diagnostic functions for system analysis

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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Index

Application	4
Function	4
Safety notes	5
Installation	6
Installation place	6
Process and environmental temperature	6
Installation notes	6
Air pressure compensation	6
Electrical connection	7
Potential equalization - earthing	7
Connection cable	7
Supply voltage	7
Load resistor	8
Switch output	9
Connection scheme	9
Operation	10
Operation and display parts	10
Function scheme	11
Menu structure	13
Navigation	13
Output	14
Basic Setting	18
Display	21
Diagnose	23
Start-up procedure	24
Maintenance	26
Repair	26
Technical Data	27
Auxiliary power supply	27
Output Signal 4...20mA	27
Output Signal 0...10V	27
Output Switch output	27
Measuring accuracy	28
Mounting position	28
Process conditions	29
Environmental conditions	29
Materials - process wetted	30
Materials - not process wetted	30
Dimension drawings	31
Terminal enclosure	31
Temperature decoupler	31
Process connection	32
Order Code	33

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 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, whereby it can be selected between different display styles (digital value / manometer / bar graph).

In the internal ring memory up to 1 million measuring values can be recorded durable.

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

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. 

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.

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, that 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 torque strength.

The maximum permitted torque strength is 50 Nm.

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

The display can be rotated every time electrically by 180°.

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 in the bottom 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 device are electrically connected with the socket of the plug M12.

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.

Supply voltage

The voltage applied to the terminal contacts may not exceed the maximum permitted supply voltage to avoid damage of the electronic.

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

Signal 4...20mA	9...33V _{DC}
Signal 0...10V	14...35V _{DC}

All connections are reverse polarity protected.

Load resistor

Signal 4...20 mA

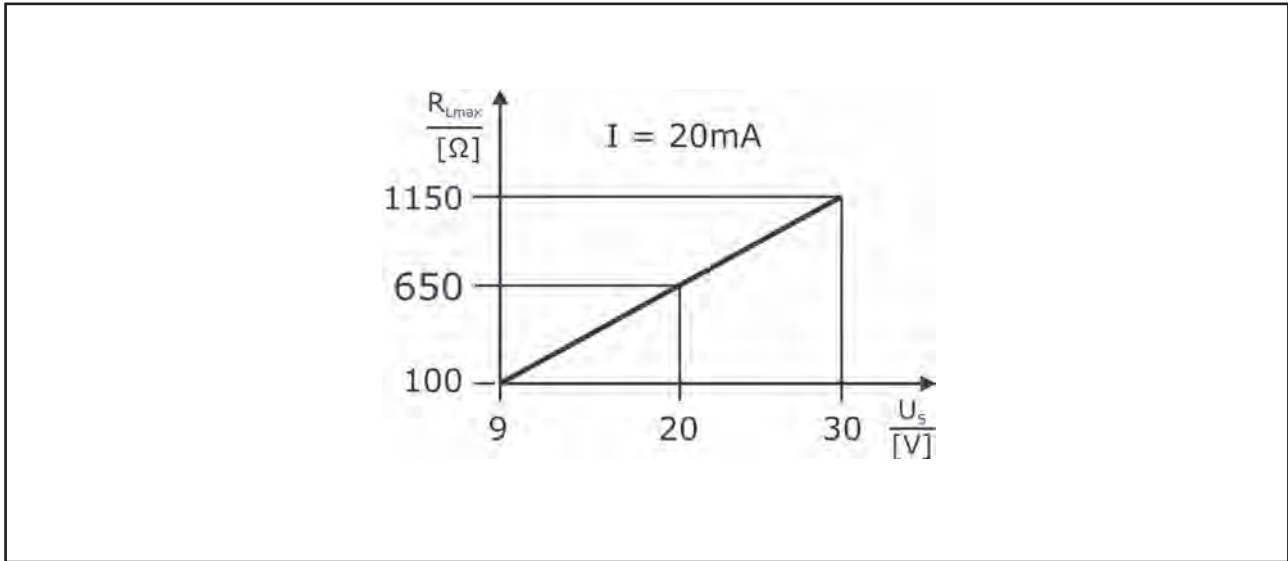
A load resistor, e.g. the measuring shunt of an evaluation device, requires a minimum supply voltage. Dependent on the connected supply voltage, it results in a maximum value for this resistor, where a correct function is still possible.

This resistor can be calculated by the following term:

$$R_{Lmax} = (U_s - 7 \text{ V}) / 20\text{mA}$$

R_{Lmax} = maximum load resistor
 U_s = connected supply voltage

Load resistor characteristic



Signal 0...10 V

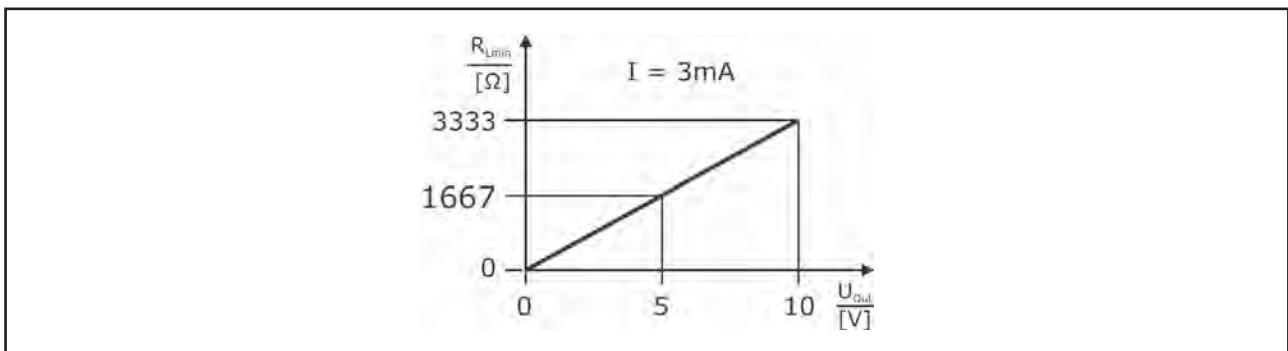
A load resistor, e.g. the measuring shunt of an evaluation device, requires at a definitive output voltage an output current. Due to the limitation of that output current, it results in a minimum value for this resistor, where a correct function is still possible.

This resistor can be calculated by the following term:

$$R_{Lmin} = U_{Out} / 3\text{mA}$$

R_{Lmin} = minimum load resistor
 U_{Out} = output voltage

Load resistor characteristic



Switch output

Inductive loads at the pnp switch output, 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.

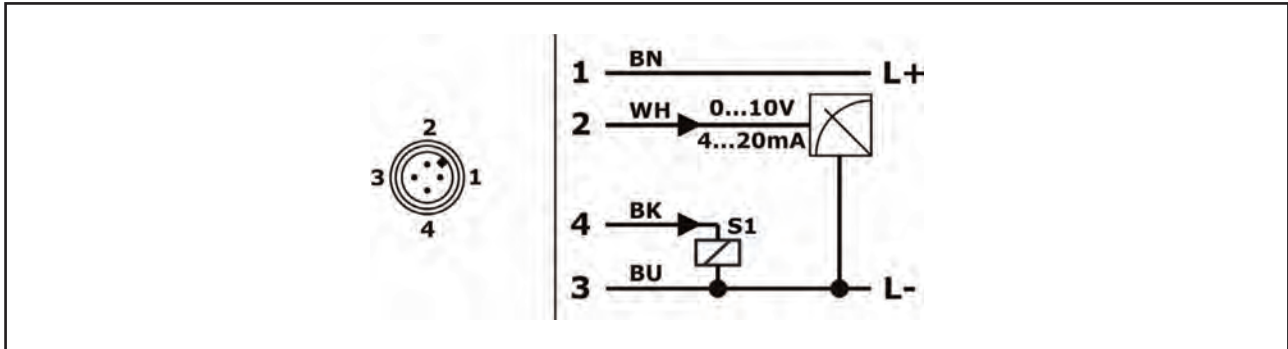
At an activated switching state a positive signal near supply voltage is feed to the output.

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...20 mA / 0...10 V / 1x PNP switch output



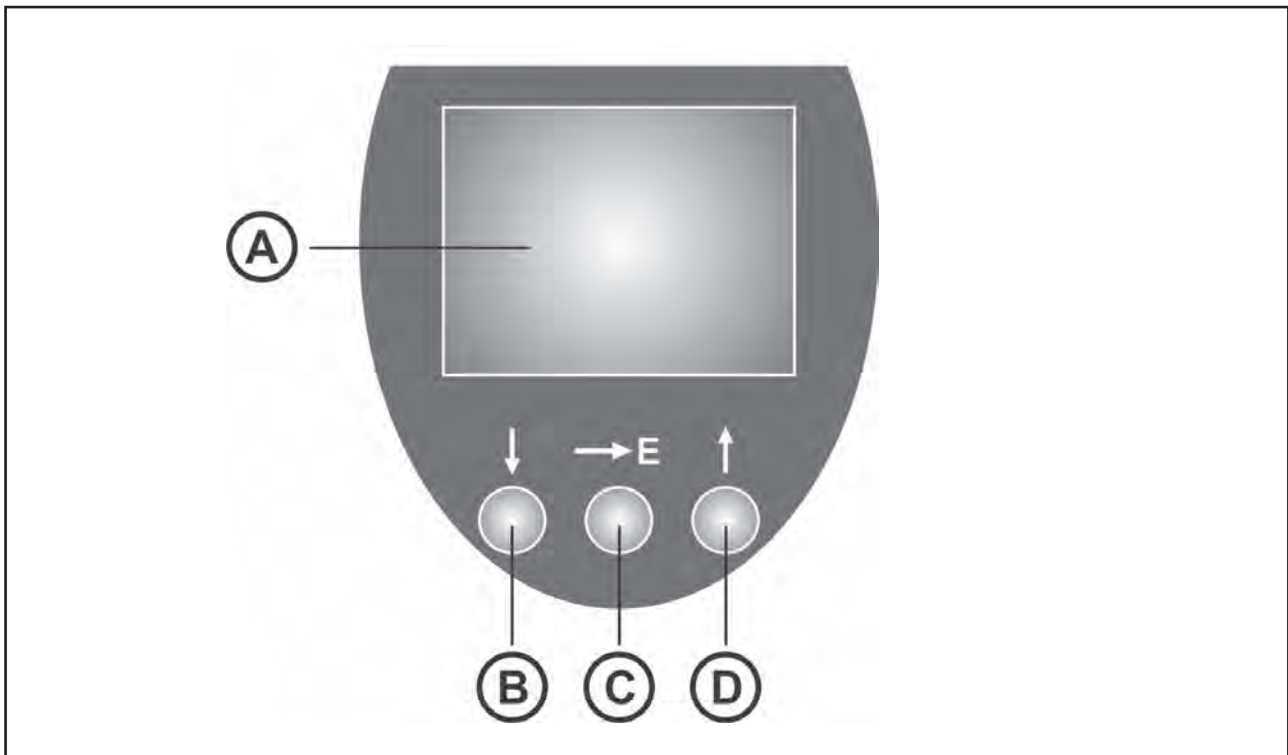
Conductor color standard connection cable M12:

BN = brown, WH = white, BU = blue, BK = black

The connection cable is not enclosed in the delivery contents.

Operation

Operation and display parts



A - LCD display

- Display of measuring value, device state and operation menu

B - Key Down

- In the selection menu navigation downwards
- In the set menu decreasing of value
- Used, in combination with the key up, for leaving selection and set menu without applying changings
- Used, in combination with the key up, for a step backwards one menu item

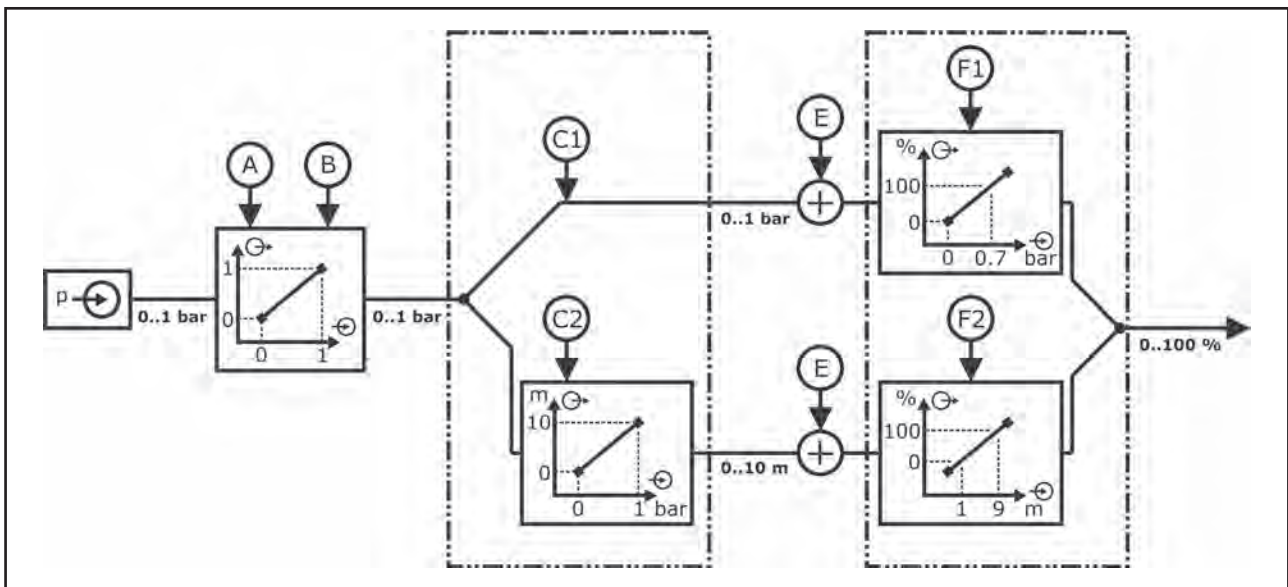
C - Key Enter/Shift right

- Access to operation menu
- In the selection menu entering the selected sub menu
- In the set menu applying the new value and digit shift right

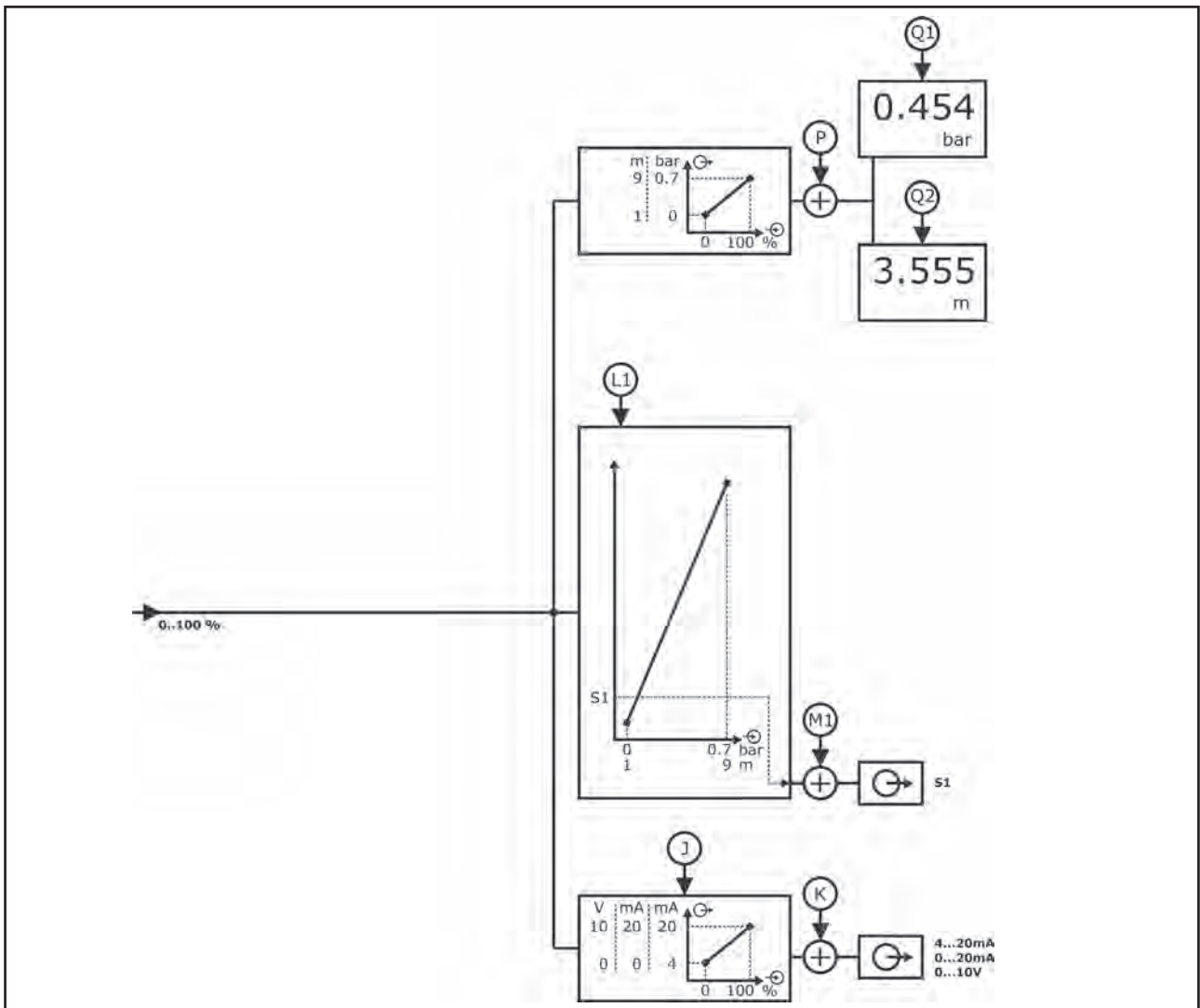
D - Key Up

- In the selection menu navigation upwards
- In the set menu increasing of value
- Used, in combination with the key down, for leaving selection and set menu without applying changings
- Used, in combination with the key down, for a step backwards one menu item

Function scheme



- A - Damping
- B - Position adjustment
- C1 - Primary unit > e.g. bar
- C2 - Primary unit > m
- E - Offset adjustment > e.g. no offset
- F1 - Min/Max adjustment > e.g. 0..0,7 bar = 0..100 %
- F2 - Min/Max adjustment > e.g. 1..9 m = 0..100 %



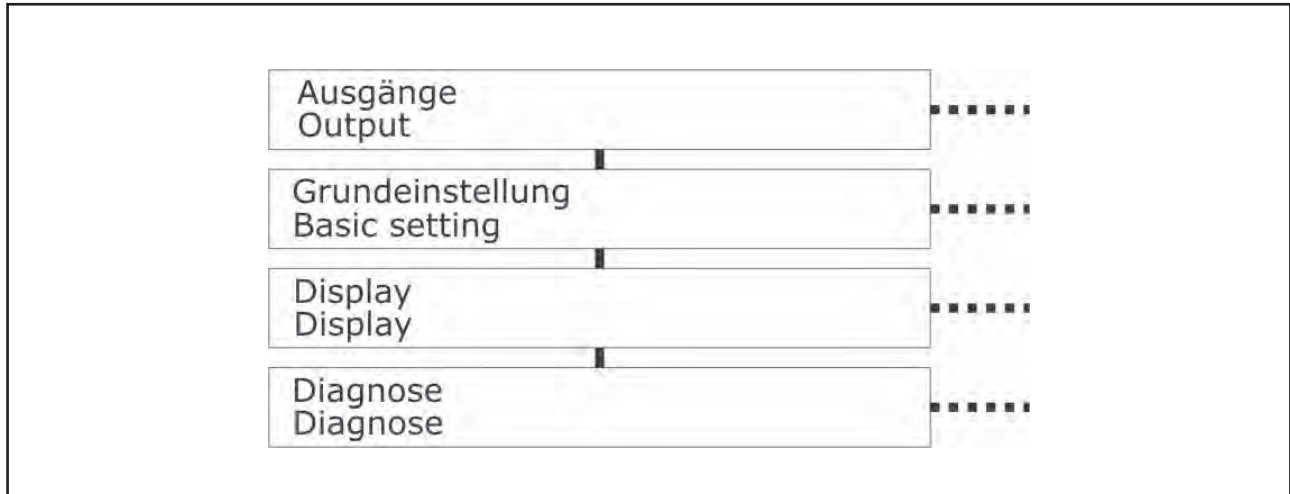
- J - Signal output > e.g. 0..100 % = 4..20 mA resp. 0..20 mA resp. 0..10V
- K - Error signal evaluation
- L1 - Switch / reset switch point S1
- M1 - Error indication function S1
- P - Error indication display
- Q1 - Display - 0..0,7 bar
- Q2 - Display - 1..9 m

Menu structure

The entrance to the different function areas of the selection and set menu layer is done by the main menu (push the key Enter/Shift right for 3 seconds).

If failures are registered (see chapter diagnose/failure), these are indicated prior the jump into the main menu.

By the key Enter/Shift right the failure indication will be canceled.



Submenu output

Settings for the function of the switch output and the signal output.

Submenu basic setting

Settings for the basic adaption of the device to the measuring task, e.g. adjustment and damping.

Submenu display

Settings for the adaption of the measuring value indication to the measuring task, e.g. display type and also menu language.

Submenu diagnose

Multiple information to the historical measuring activity and the device, that can be useful for system surveillance or also for failure analysis.

Navigation

The navigation in a submenu and in a selection window is done by the keys Up and Down.

The selection of a submenu and the selection of a setting in a selection menu is done by the key Enter/Shift right.

The jump backward from a submenu to the higher-level menu is done by the menu item back or by the simultaneous pushing the keys Up and Down.

The leaving of a selection menu without applying the changings is done by the simultaneous pushing the keys Up and Down.

The input of a value or text in a set menu is done digit by digit.

For the changing of the selected digit the keys Up and Down are used.

For the changing of the digit the key Enter/Shift right is used.

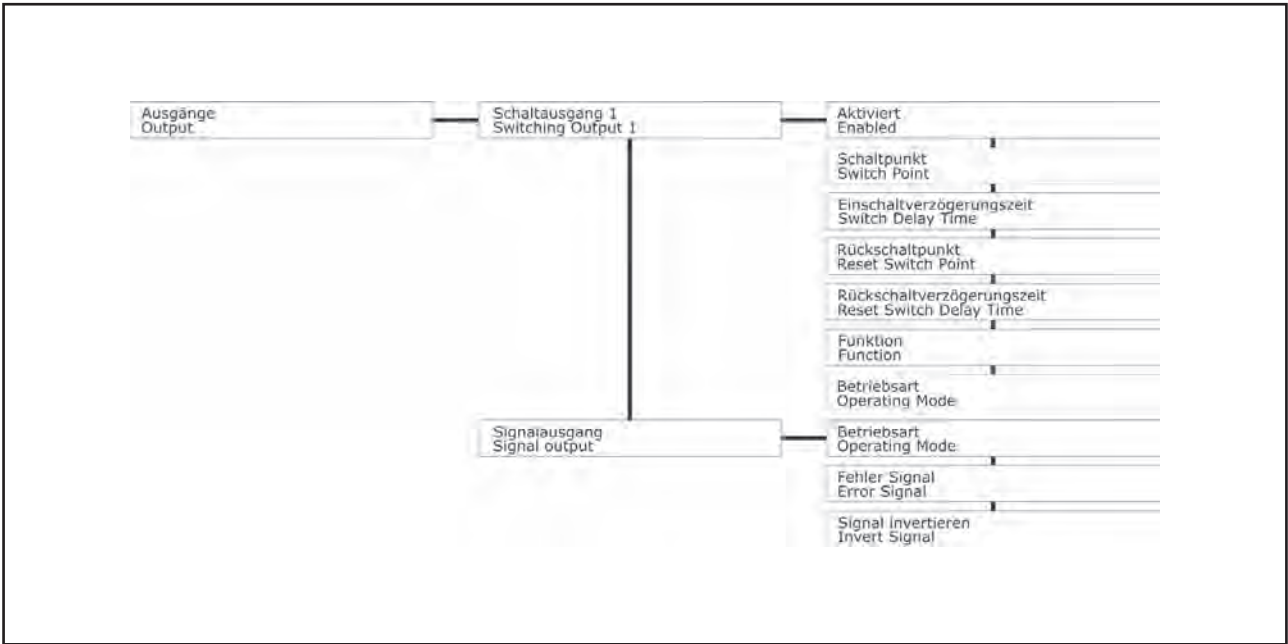
The applying of a set value resp. text is done by pushing the key Enter/Shift right for 3 seconds.

The leaving of an set menu without applying a value resp. text is done by the simultaneous pushing the keys Up and Down.

After 5 minutes of inactivity the active submenu resp. selection menu will automatically be left and a change to the measuring value indication is executed.

A jump backward is not executed from an active set menu.

Output



Switch output S1

Enabled

The switch output can be activated resp. deactivated.

- Yes
- No

Default > Yes

Switch Point / Reset Switch Point

The input values refers to the set display value, in the set primary unit or acc. to display scaling.

The current measuring value is indicated on the display.

The reset switch point must be lower or equal to the switch point.

The input range is limited to the measuring range.

Default > S1 = 20%

Switch Delay Time / Reset Switch Delay Time

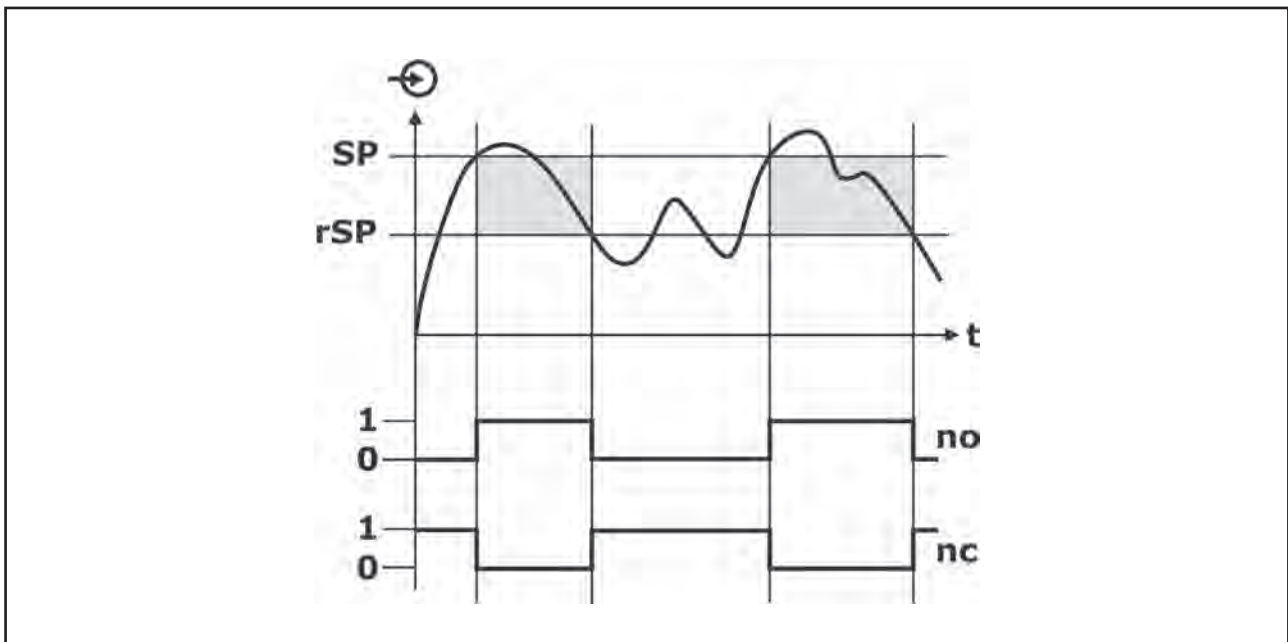
The activation resp. deactivation of the switch output can be biased with a delay time (resolution 0,01s), to realize simple sequence control system.

The input range is indefinite.

Default > 0s

Function

Hysteresis function



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

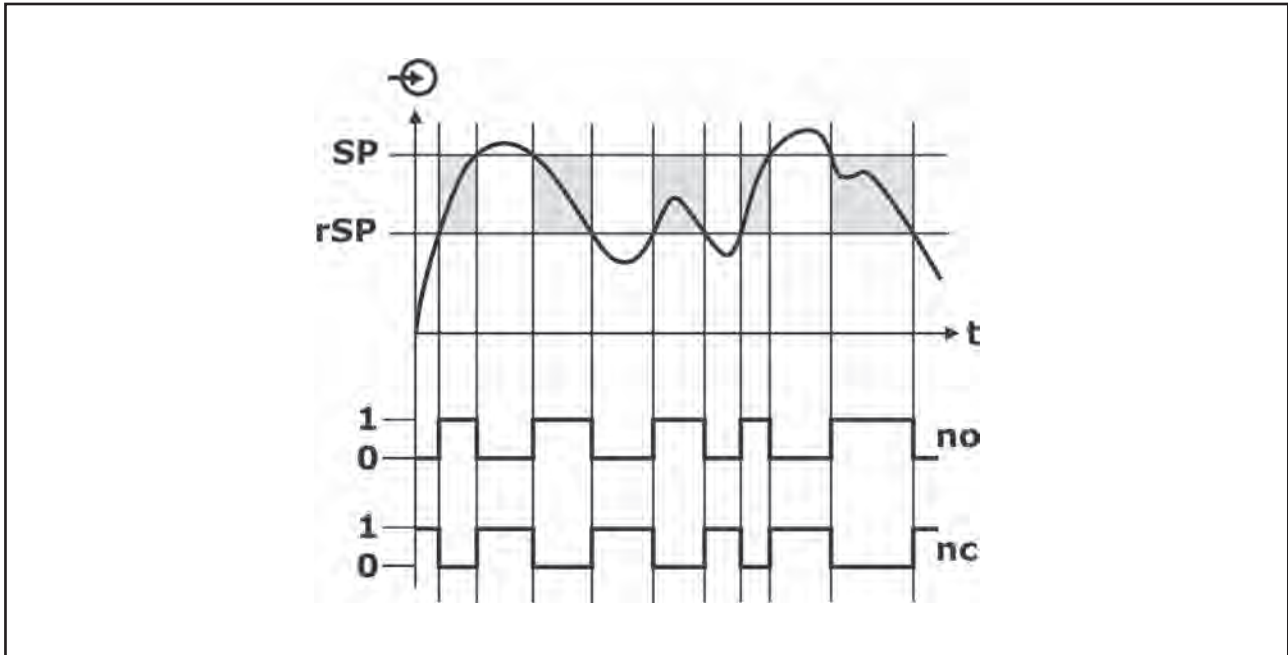
It can be used for realizing a signal controlled two-position control.

The switch range is determined by definition of switch point and reset switch point.

The switch output is activated, if the current measuring value exceeds the switch point and if the set switch point delay time has been expired.

The switch output is deactivated, if the current measuring value exceeds the reset switch point and if the set reset switch point delay time has been expired.

Window function



The window function realizes a signal range – acceptance region –, where the switch output is set to a definitive switch state.

The switch range is determined by definition of switch point and reset switch point.

The switch output is activated, if the current measuring value is inside the area that is defined by the switch point and the reset switch point and if the set switch point delay time has been expired.

The switch output is deactivated, if the current measuring value is outside the area that is defined by the switch point and the reset switch point and if the set reset switch point delay time has been expired.

Error Indication Function

The switch output is activated, if the device has detected a failure behavior (see chapter diagnose/ failures).

Default > Hysteresis Function

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.

Default > Normal Open / NO

Signal output

The nominal values of the analogue signal (4/20 mA resp. 0/10mA resp. 0/10 V) refers to the set display nominal values 0% and 100%

Operating Mode

Defines the type of the analogue output signal

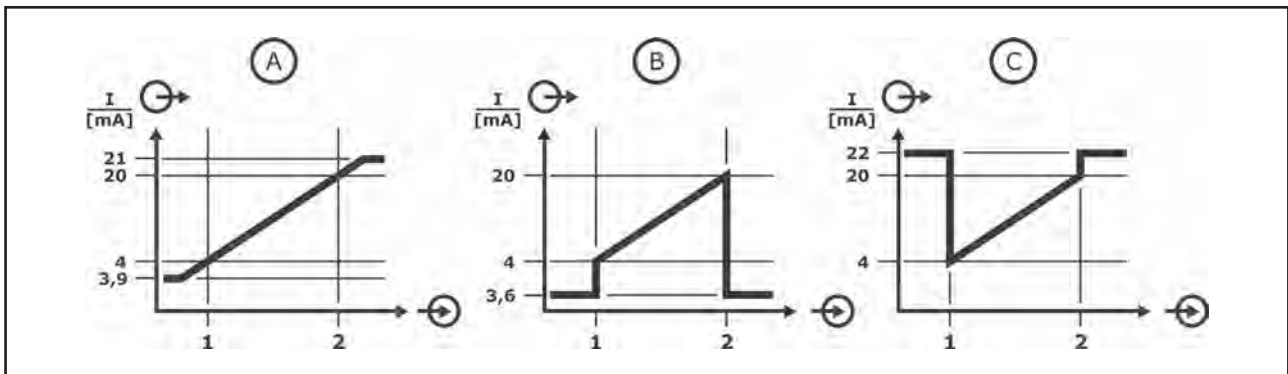
- 4-20 mA
- 0-20 mA
- 0-10V

Default > 4-20 mA

Error Signal

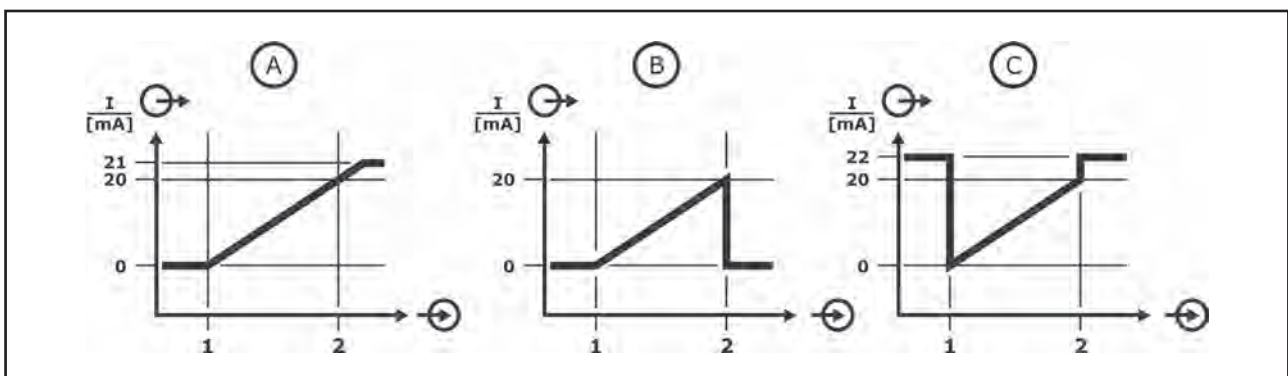
Defines, dependent on the operating mode, the analogue output signal regarding operating range and if errors (see chapter diagnose/failures) are registered.

- Operating mode 4-20mA



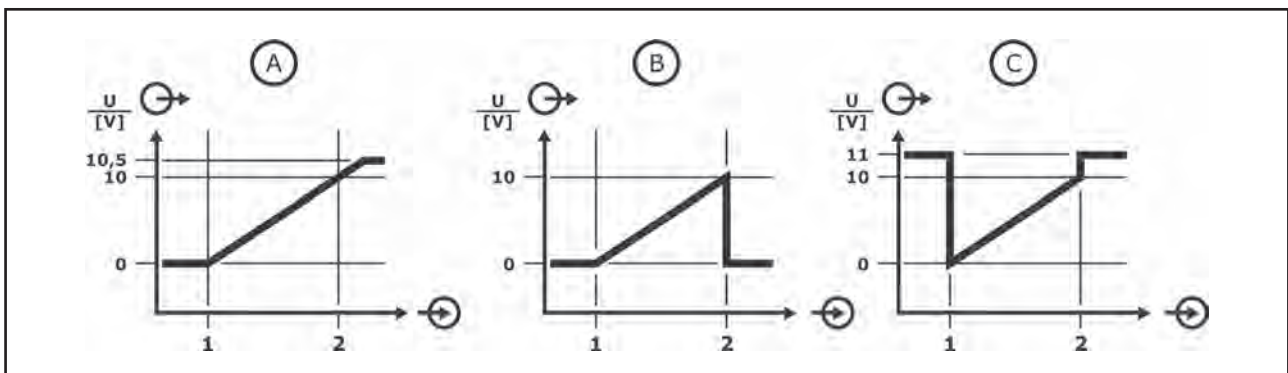
A - Off >> 3.9-21mA
 B - 3.6mA
 C - 22mA

- Operating mode 0-20mA



A - Off >> 0-21mA
 B - 0mA
 C - 22mA

- Operating mode 0-10V



A - Off >> 0-10,5V
 B - 0V
 C - 11V

Default > Off

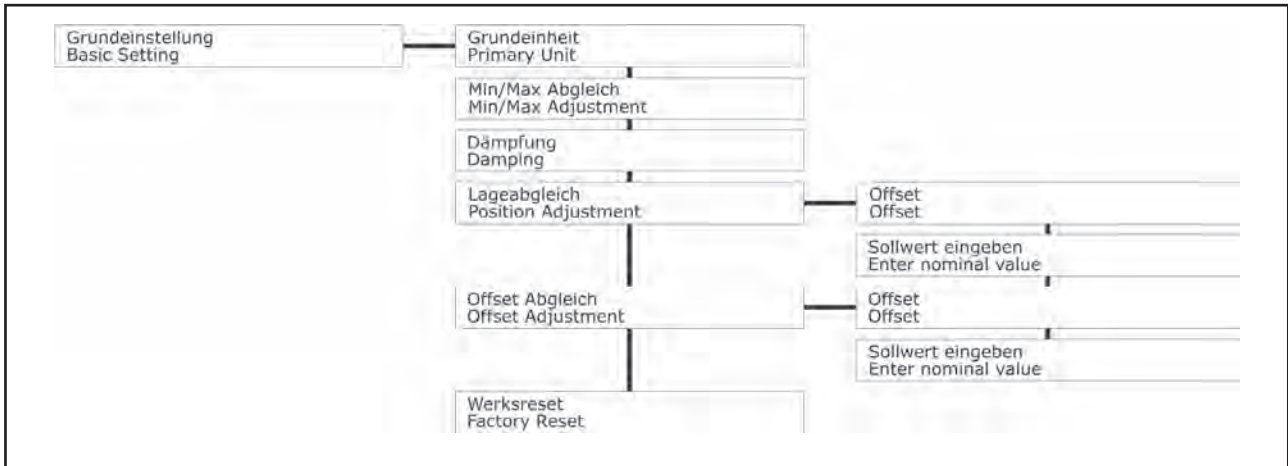
Invert Signal

Inverts, dependent on the operating mode, the analogue output signal.

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

Default > No

Basic Setting



Primary Unit

The primary unit defines the internal reference unit of the measuring signal.

At the change of the primary unit an automatic conversion is calculated.

At the change of the primary unit from a pressure unit to a height unit the gravitational acceleration mean value 9,81 m/s² is used.

For special applications another value can be stored by factory.

- bar / mbar / m / cm / mm / feet / inch

Default > bar

Min/Max-Adjustment

The min/max-adjustment set the measuring range limits.

2 points are defined, that set the ratio of the measured pressure/level and the measuring range of the device.

The current measuring value is indicated in the display.

The input of the measuring range limits 0% and 100% are not mandatory. Values within the measuring range e.g. 11% and 87% can be also input. In this case there is an automatic calculation to 0% resp. 100%. The higher the difference between these points, the more precise is the following calculation.

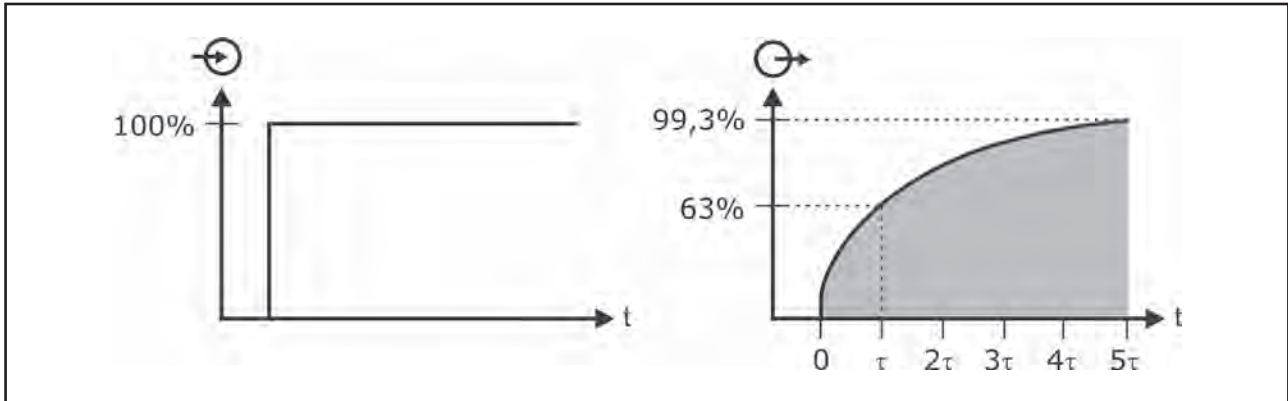
The min/max-adjustment is relevant for the signal output and display view.

- Lower adjustment value
- Upper adjustment value

The input range is indefinite.

Default > Lower calibrated measuring value = 0% / Upper calibrated measuring value = 100%

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 5 t .

The set time equals 5 t .

The measuring rate depends directly on the set damping.

- Damping 0s >> Measuring rate 100x/s >> Resolution 12 bit
- Damping 0,02s >> Measuring rate 50x/s >> Resolution 16 bit
- Damping 0,05s >> Measuring rate 20x/s >> Resolution 18 bit
- Damping 0,15s >> Measuring rate 7,5x/s >> Resolution 20 bit
- At damping values $\geq 0,15$ s the resolution remains at 20 bit constantly.

The input range is indefinite.

Default > 1 sec

Position Adjustment

By the use of the position adjustment measuring errors caused by the installation position can be corrected.

This errors can be caused e.g. by the dead weight of the measuring membrane, by the filling fluid of a process diaphragm seal or by a higher process temperature.

The position adjustment must be done in installed position at conditions, that are representative for the measuring task and should only be done in an absolutely pressure less condition, cause the set primary unit is not regarded in this function.

For the suppression of a measuring signal, that is caused by the process material, the function offset adjustment is available.

In the sub menu offset, a value can be input, that is added to the current measuring value or in the sub menu enter nominal value, a value can be input, that equals the current measuring signal.

- Offset
Current measuring value -0.090 bar > Offset 0.090 bar > resulting measuring value 0.000 bar
The input range is indefinite.
- Enter nominal value
Current measuring value -0.090 bar > Nominal Value 0.000 bar > resulting measuring value 0.000 bar
The input range is indefinite.

Default > Offset = 0

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. For the suppressing of measuring deviations, caused by the installation position, the function position adjustment ist available. Position adjustment and offset adjustment are identical, if the primary unit is not altered compared to the default value.

In the sub menu offset, a value can be input, that is added to the current measuring value or in the sub menu enter nominal value, a value can be input, that equals the current measuring signal.

- Offset
Current measuring value -0.090 bar > Offset 0.090 bar > resulting measuring value 0.000 bar
The input range is indefinite.
- Enter nominal value
Current measuring value -0.090 bar > Nominal Value 0.000 bar > resulting measuring value 0.000 bar
The input range is indefinite.

Default > Offset = 0

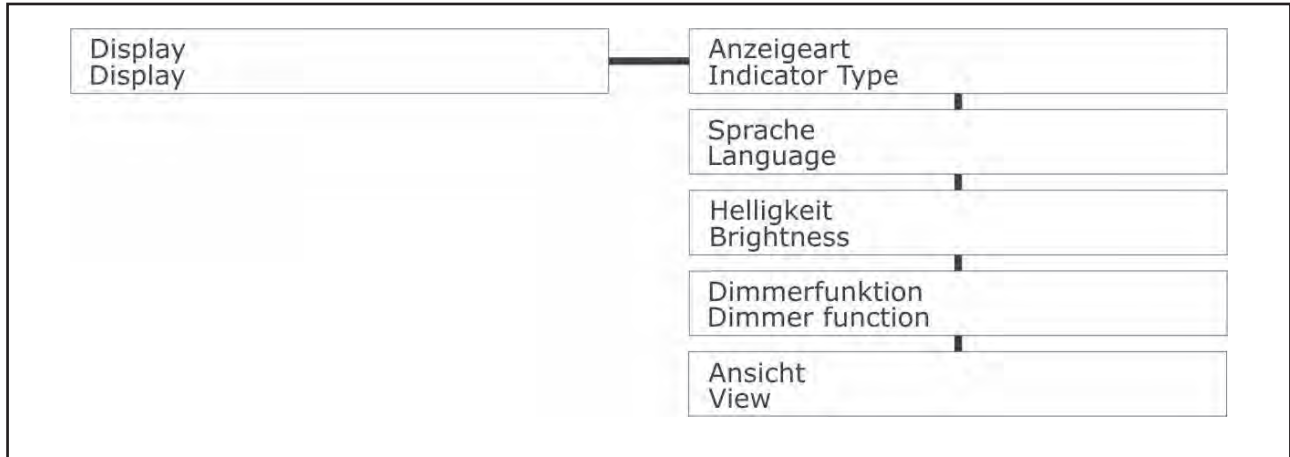
Factory Reset

The factory reset changes all settings to default values.

The factory reset does not concern:

- Diagnose data

Display



Indicator Type

Dependent on the requirements the measuring values can be indicated in different types.

- Digital

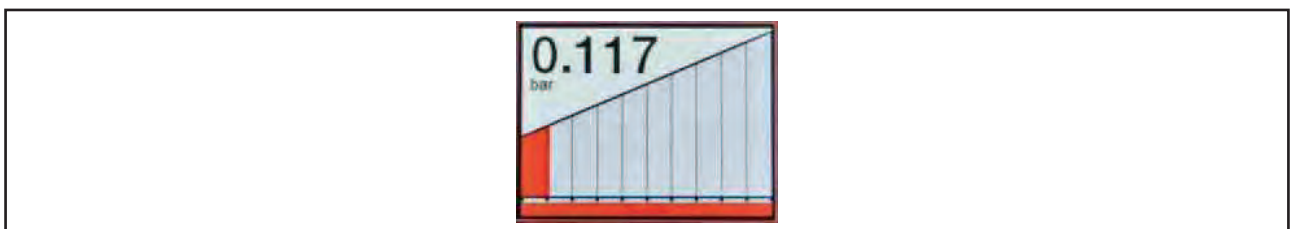


- Switch point, active or deactive
- Sensor TAG
- Digital measuring value
- Unit
- Horizontal scaled bargraph
- Mark of the switch point at the bargraph

- Manometer

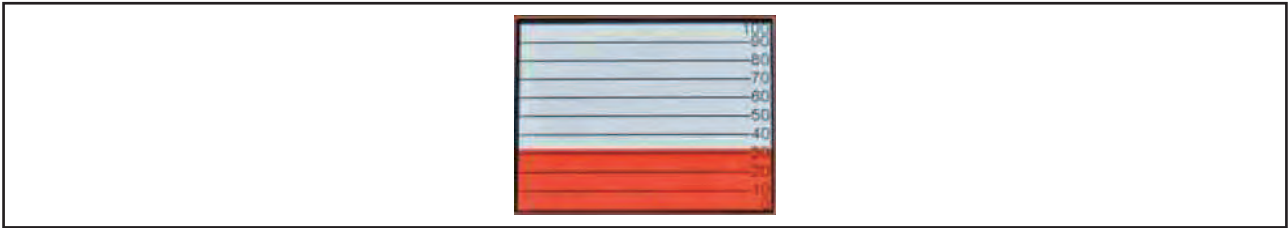


- Round pointer scale
- Mark of the switch point at the pointer scale
- Unit
- Digital measuring value
- Bargraph



- Digital measuring value
- Unit
- Horizontal scaled bargraph

- Vertical Bargraph



Vertical percentual scaled bargraph

Default > Digital

Language

The menu navigation can be done in the following different languages.

- Deutsch
- English

Default > Deutsch

Brightness

For the adaption of the display to the requirements the brightness of the backlight can be varied in a wide range.

At a brightness higher than 60 a limitation of the permitted environmental temperature must be obeyed At an input value of 0 a minimum residual brightness is already present.

The input range is limited to values from 0 to 100.

Default > 75

Dimmer Function

To reduce the supply current and also to minimize the system typical aging influences on the brightness of the backlight an automatic dim after 5 minutes of inactivity (no key touch) can be activated.

- 0% / 10% / 20% / 30% / 40% / 50% / Off

Default > Off

View

For the adaption of the display to the requirements of the installation situation the view of the display can be rotated by 180°. In combination with the mechanical rotatability of app. 330° a readability from all directions in all installation positions is possible.

- Normal
- 180°

Default > Normal

Diagnose

Diagnose Diagnose	Schaltspiele Operation Cycles
	Störungen Failures
	Min. Schleppzeiger Min. Drag Indicator
	Max. Schleppzeiger Max. Drag Indicator
	Betriebsstunden Operating Hours
	Betriebsstunden ges. Operating Hours total
	System Starts System Starts
	Max. Gerätetemp. Max. Device Temp.
	Min. Gerätetemp. Min. Device Temp.
	Kalibrierdatum Calibration Date
	Seriennummer Serial Number
	Info Info

Operation Cycles

The number of operation cycles of the switch output is indicated.

An operation cycle is a complete change of the switch state till back to the start state, thus deactive - active - deactive.

Failure

The device registrates multiple of short time or also continuous existing functional failures in type and frequency of occurrence.

- Overpressure - exceeding the nominal measuring range by 3%
- Underpressure - exceeding the nominal measuring range by 3%
- Over Range - exceeding the signal output range (dependent on Operating Mode)
20.5 mA (4-20 mA)
20.5 mA (0-20 mA)
10.5 V (0-10 V)
- Under Range - exceeding the signal output range (dependent on Operating Mode)
3.8 mA (4-20 mA)
-0.4 mA (0-20 mA) – theoretical value
-0.5 V (0-10 V) – theoretical value
- S1 Error – functional failure at the switch output
Output signal present, although switch output is deactive (an external voltage is applied or device failure)
Output signal not present, although switch output is active (device failure)
Short circuit at switch output, although switch output is deactive (device failure)
- S1 Short Circuit - short circuit at switch output
Sig. out break - wire break at signal output on signal output not connected at Operating Mode
4-20 mA resp. 0-20 mA

Min./Max. Drag Indicator

The drag indicator is used for detection and indication of the minimum and maximum registered measuring values.

The drag indicator can be separately reset by pushing the key Shift right/Enter.

Operating Hours

The operating hours of the device since the last device start-up are detected.

The indication is done in hours.

Operating Hours total

The operating hours of the device since the first device start-up are detected.

The indication is done in hours.

System Starts

The number of the occurred system starts resp. device restarts is registered.

Min./Max. Device Temperature

The minimum and maximum temperature of the electronic in the area of the terminal enclosure (not the process temperature) is registered.

Calibration Date

Indication of the date (format DDMMJJ), the calibration by factory is done.

Serial Number

Indication of the serial number of the device.

Info

Indication of manufacturer data and firmware version

Start-up procedure

Pressure measurement

The sensor is preconfigured to pressure measurement dependent on the pressure range alternatively in unit mbar or bar by factory.

Only a few changings must be optionally made.

Sub menu Basic Setting

- Position Adjustment
- Primary Unit
- Min/Max Adjustment (when using the signal output)

Level measurement

The filling level is calculated by the device with entering the gravitational acceleration mean value $9,81\text{m/s}^2$ and the density 1kg/m^3 of the process material into the equation.

Sub menu Basic Setting

- Position Adjustment
- Primary Unit
- Offset Adjustment
- Min/Max Adjustment (when using the signal output)

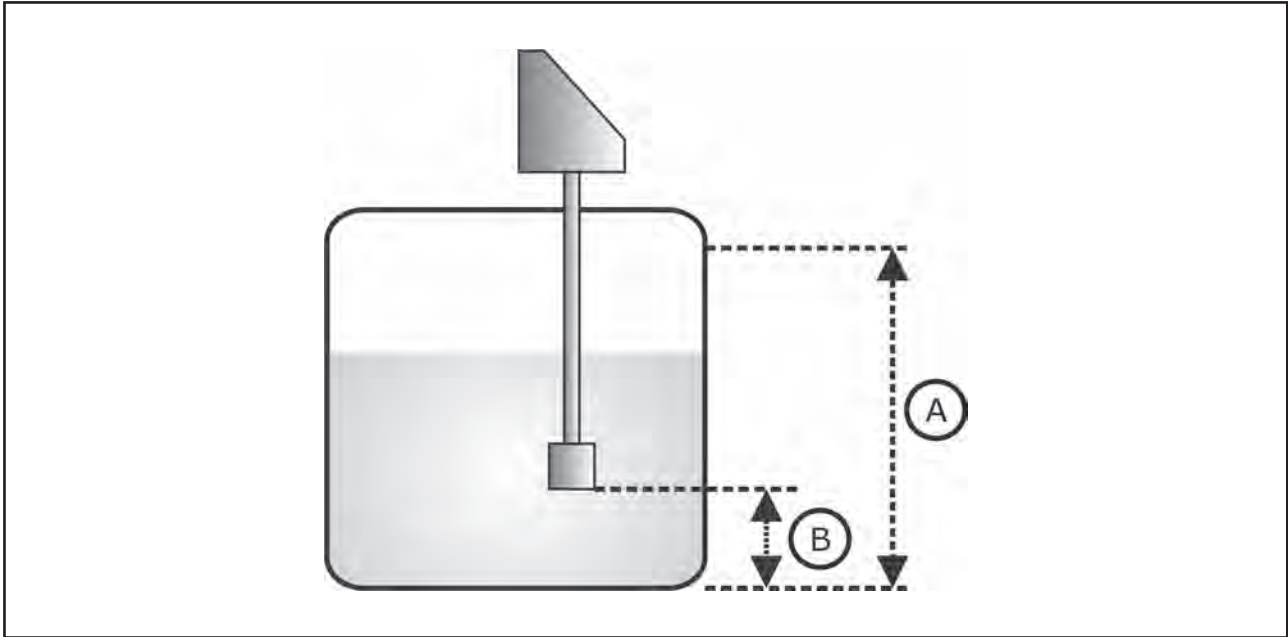
Example

Measurement task

- Process material: Water
- Not measurable level: 0,1m

Settings

- Primary Unit: m
- Offset: 0.1m



A - Maximum Level

B - Offset / not measurable level range

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

Technical Data

Auxiliary power supply

Supply voltage U_s	<i>Preference output 4...20 mA</i> 9..30 V _{DC} , reverse polarity protected <i>Preference output 0...10 V</i> 14..30 V _{DC} , reverse polarity protected
Residual ripple U_{pp}	$\leq 2 V_{pp} / U_{Smin} \leq U_s \leq U_{Smax}$
Supply current I_{In}	<i>Preference output 4...20 mA</i> $\leq 110 \text{ mA}$ ($U_s = 9 \text{ V} / S1 = 0\text{mA}$) $\leq 70 \text{ mA}$ ($U_s = 30 \text{ V} / S1 = 0\text{mA}$) <i>Preference output 0...10 V</i> $\leq 65 \text{ mA}$ ($U_s = 14 \text{ V} / S1 = 0\text{mA}$) $\leq 50 \text{ mA}$ ($U_s = 30 \text{ V} / S1 = 0\text{mA}$)

Output Signal 4...20mA

Operating range I_{Out}	3,9 mA ... 21 mA, min. 3,6mA, max. 22 mA
Permitted load R_l	$\leq (U_s - 7 \text{ V}) / 20\text{mA}$
Step response time T_{90}	$\leq 15 \text{ ms}$ ($t_d = 0\text{s}$)
Start-up time t_{On}	$\leq 1\text{s}$

Output Signal 0...10V

Operating range U_{Out}	0 ... 10,5 V, max. 11 V
Permitted load R_l	$\geq U_{Out} / 3\text{mA}$
Step response time T_{90}	$\leq 15 \text{ ms}$ ($t_d = 0\text{s} / R_l = 10\text{kR}$)
Start-up time t_{On}	$\leq 1\text{s}$

Output Switch output

Function	PNP switching to +L
Output voltage U_{Out}	$U_{Out} \geq U_s - 2 \text{ V}$
Output current I_l	0... $\leq 250 \text{ mA}$, current limited, short circuit protected
Step response time T_{90}	$\leq 25 \text{ ms}$ ($t_d = 0\text{s}$)
Rise time T_{90}	$< 30 \mu\text{s}$ ($R_l < 3 \text{ kR} / I_{Out} > 4,5 \text{ mA}$)
Start-up time t_{On}	$\leq 1\text{s}$
Switch cycles	$\geq 100.000.000$

Measuring accuracy

Reference conditions	EN/IEC 60770-1 resp. EN/IEC 61003-1
	T = 25 °C, relative humidity 45...75 %, environmental air pressure 860..1060 kPa
Calibration position	Vertical, process connection bottom side
Warm-up time	≤ 240 s
Characteristic deviation ^{3) 5) 6) 12)}	≤ ±0,2% FS ²⁾
Nonlinearity ^{6) 12)}	≤ ±0,2% FS ²⁾
Hysteresis ^{6) 12)}	negligible
Influence of supply voltage	<i>Preference output 4...20 mA</i> ≤ ±0,01% FS ²⁾ / 10V <i>Preference output 0...10 V</i> ≤ ±0,06% FS ²⁾ / 10V
Load influence	<i>Preference output 4...20 mA</i> ≤ ±0,01% FS ²⁾ / 100R <i>Preference output 0...10 V</i> ≤ ±0,05% FS ²⁾ / 1mA
Long term drift ^{6) 12)}	≤ ±0,1% FS ²⁾ / year - not cumulative
Temperature deviation ^{6) 12)}	T _k ⁴⁾ Zero ≤ ±0,15% FS ²⁾ / 10 K, max. ±0,75 % (-20°C...+80°C)
	T _k ⁴⁾ Span ≤ ±0,15% FS ²⁾ / 10 K, max. ±0,5 % (-20°C...+80°C / > 0,4 bar), max. ±0,8 % (-20°C...+80°C / ≤ 0,4 bar)

Mounting position

Maximum deviation ¹⁰⁾	≤ 0,18 mbar
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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 <i>Expansion</i> Temperature decoupler -40°C...+125°C <i>Limitation</i> Gasket - FPM -25°C...+200°C Gasket - EPDM -40°C...+140°C
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Process pressure	Pressure range	Over/Burst pressure	Vacuum
[R] Gauge pressure	-0,1...+0,1 bar [R]	6 bar	0,5 bar [A]
[A] Absolute pressure	-0,1...0 bar [R]	4 bar	0,7 bar [A]
	-1...+1 bar [R]	18 bar	0 bar [A]
	-1...0 bar [R]	10 bar	0 bar [A]
	0...0,1 bar [R]	4 bar	0,7 bar [A]
	0...0,1 bar [A]	4 bar	0 bar [A]
	0...0,2 bar [R]	6 bar	0,5 bar [A]
	0...0,2 bar [A]	6 bar	0 bar [A]
	0...0,4 bar [R/A]	6 bar	0 bar [A]
	0...0,6 bar [R/A]	10 bar	0 bar [A]
	0...1 bar [R/A]	10 bar	0 bar [A]
	0...1,6 bar [R/A]	18 bar	0 bar [A]
	0...2,5 bar [R/A]	25 bar	0 bar [A]
	0...4 bar [R/A]	25 bar	0 bar [A]
	0...6 bar [R/A]	40 bar	0 bar [A]
	0...10 bar [R/A]	40 bar	0 bar [A]
	0...16 bar [R/A]	40 bar	0 bar [A]
	0...20 bar [R/A]	40 bar	0 bar [A]
	0...40 bar [R/A]	60 bar	0 bar [A]
	0...60 bar [R/A]	105 bar	0 bar [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	-20°C...+50°C <i>Expansion</i> Backlight LCD ≤ 80% >> -20°C...+60°C Backlight LCD ≤ 60% >> -20°C...+70°C
Protection	IP68 [≤ 1 mWs-1h] (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)
Weight	0,7 kg

Materials - process wetted

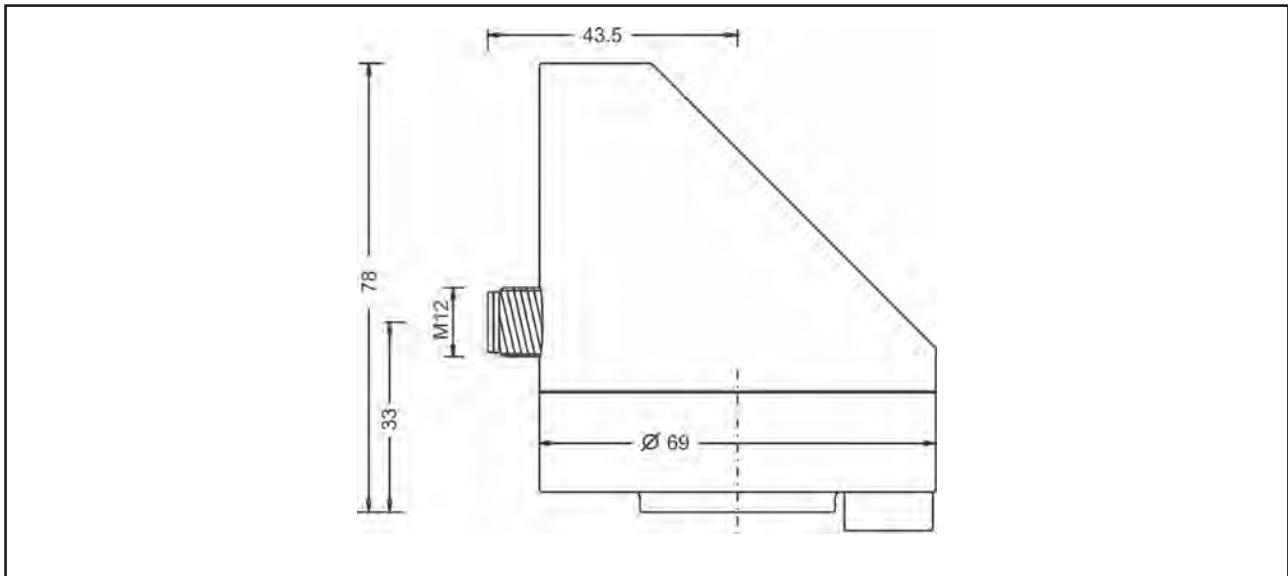
Membrane	Ceramic aluminum oxide 99,9%
Process connection	Steel 1.4404 (316L) / 1.4571 (316Ti)
Gaskets	FPM – fluorelastomere (Viton®) EPDM – ethylene-propylene-dienmonomere

Materials - not process wetted

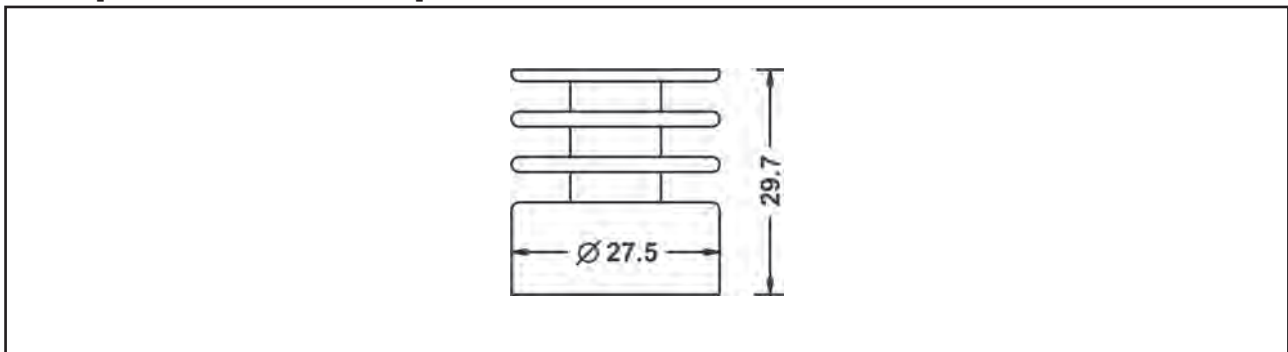
Terminal enclosure	CrNi-steel
Control panel surface	PC / PES
Electrical connection part	Device plug PUR
Pressure compensation element	Enclosure PBT Membrane PES
Gaskets	FPM – fluorelastomere (Viton®)

Dimension drawings

Terminal enclosure

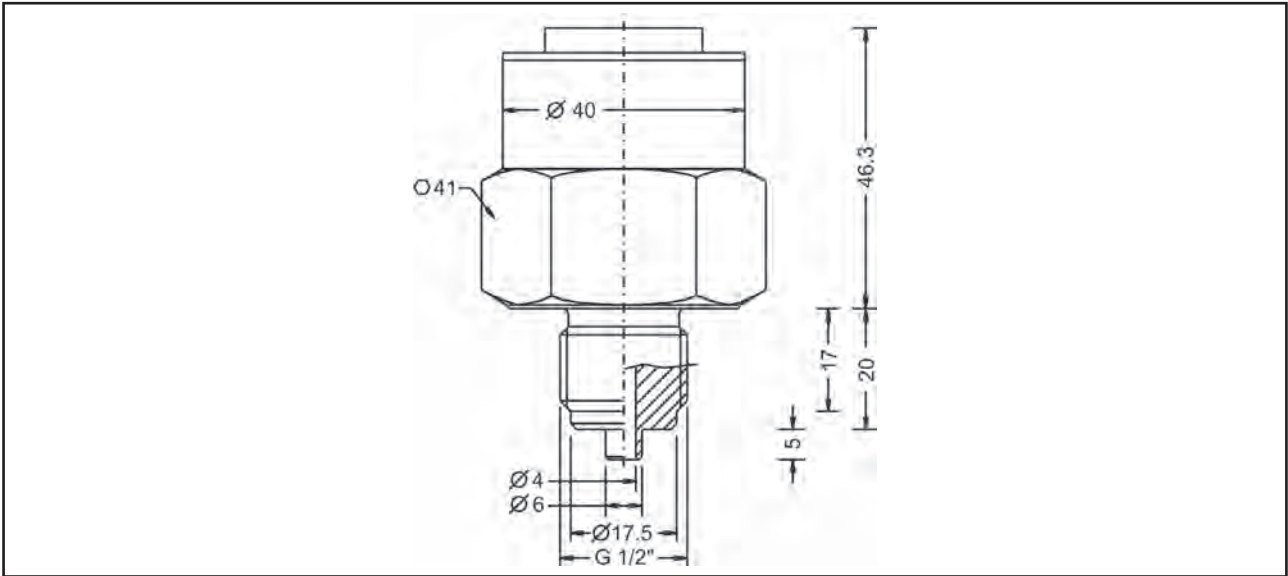


Temperature decoupler

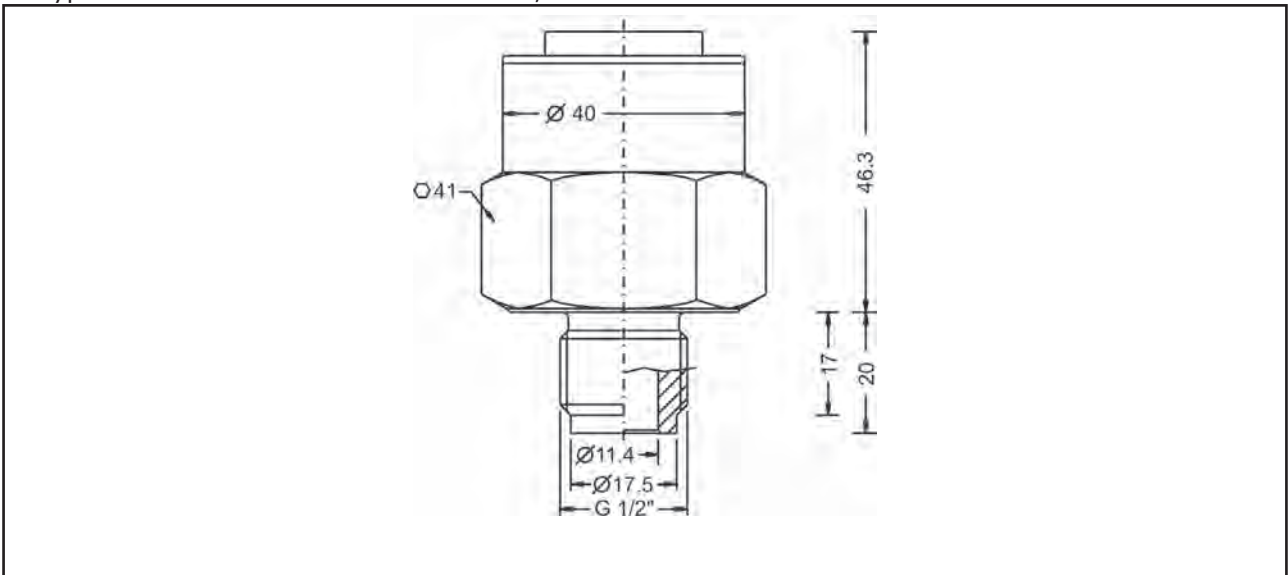


Process connection

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



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



Order Code

<p>MAC</p> <p>0</p> <p>6</p> <p>0</p> <p>V</p> <p>C</p> <p>01</p> <p>1</p> <p>0</p> <p>1</p> <p>R</p> <p>A</p> <p>1</p> <p>S</p>	<p>Type Standard</p> <p>Process connection G½" A, ISO 228-1, DIN EN 837-3 (DIN 16288) manometer G½" A, ISO 228-1, inside drill 11,4 mm</p> <p>Electronic - output L 0/4...20mA/0...10V (3-wire), 1x PNP</p> <p>Material process connection (process wetted) Steel 1.4404/316L or 1.4571/316Ti</p> <p>Material terminal enclosure CrNi-steel</p> <p>Measuring range</p> <p>01 0..0,1 bar 02 0..0,2 bar 03 0..0,4 bar 04 0..0,6 bar 05 0..1 bar 06 0..1,6 bar 07 0..2,5 bar 08 0..4 bar 09 0..6 bar 10 0..10 bar 11 0..16 bar 12 0..20 bar 13 0..40 bar 14 0..60 bar 15 -0,1..0 bar 16 -1..0 bar 17 -1..+1 bar 18 -0,1..+0,1 bar YY Special measuring range (poss. higher deviation accuracy)</p> <p>Material gaskets (process wetted) 1 FPM – fluorelastomere (Viton®) 3 EPDM – ethylene-propylene-dienmonomere – food applications</p> <p>Process temperature 0 Standard, -40°C...+100°C 1 Extended, -40°C...+125°C, temperature decoupler</p> <p>Pressure type R Gauge pressure A Absolute pressure</p> <p>Measuring membrane - material / accuracy (process wetted) 1 Ceramic 99,9%, capacitive / 0,2%</p> <p>Electrical connection S Plug M12</p>
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Precont

MAC	L	0	V	C	01	1	S
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Installation material and connection cable are not enclosed in contents of delivery.

ACS-CONTROL-SYSTEM
knowledge and systems

Your partner for measuring technology and automation



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