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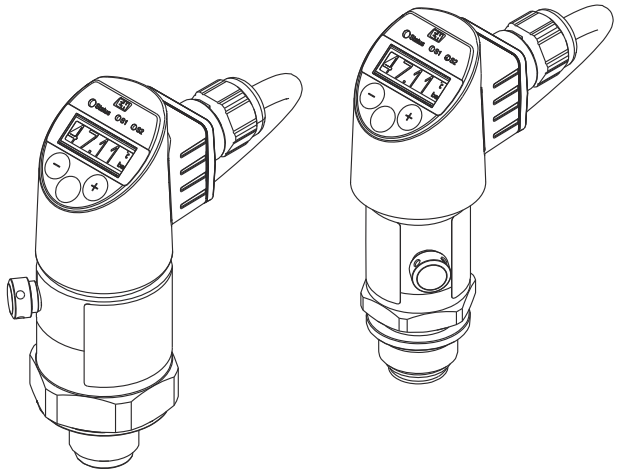
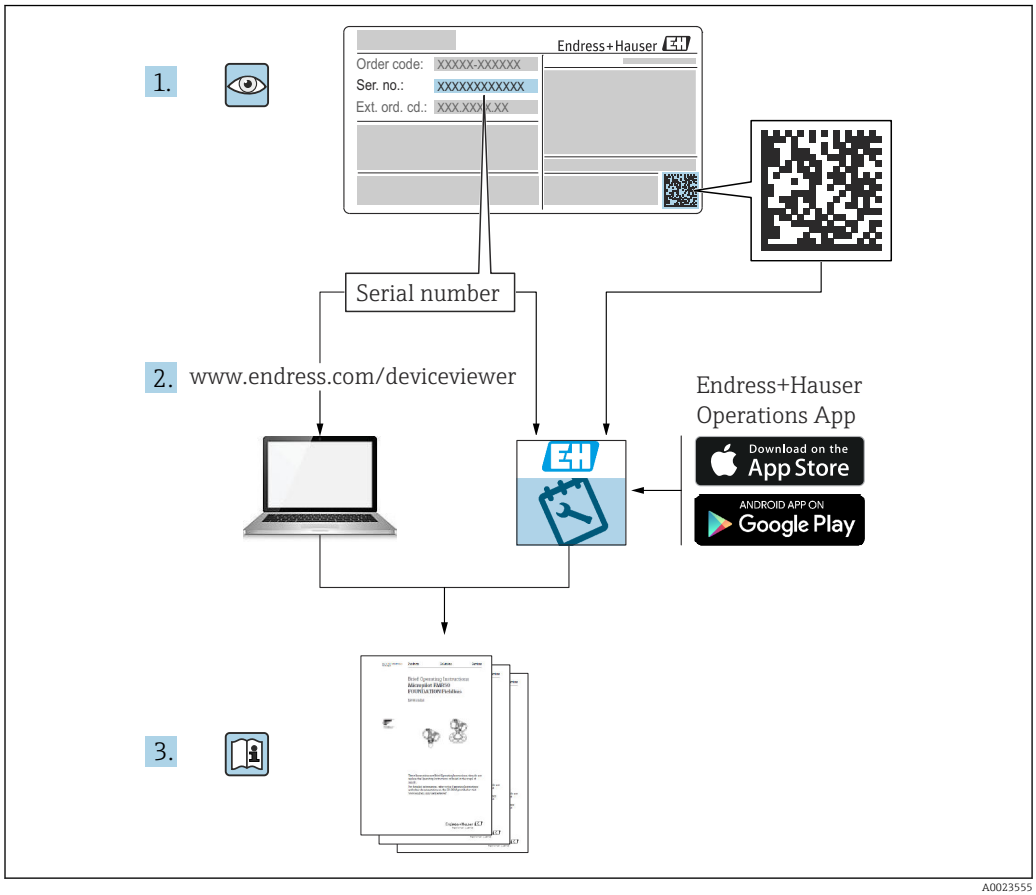
Operating Instructions
Ceraphant PTC31B, PTP31B, PTP33B

Process pressure measurement
Pressure switch for safe measurement and monitoring of absolute and gauge pressure



Endress+Hauser
People for Process Automation



- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid hazards for individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to this manual.

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1 About this document

1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.

1.2 Symbols

1.2.1 Warning symbols

⚠ DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.2.2 Electrical symbols

⊜ Protective earth (PE)
Ground terminals, which must be grounded prior to establishing any other connections. The ground terminals are located on the inside and outside of the device.

⏚ Ground connection
Grounded clamp, which is grounded via a grounding system.

1.2.3 Tool symbols

Open-ended wrench

1.2.4 Symbols for certain types of Information

✓ Permitted
Procedures, processes or actions that are permitted.

✗ Forbidden
Procedures, processes or actions that are forbidden.

ℹ Tip
Indicates additional information

Reference to documentation

1., 2., 3. Series of steps

Reference to page:

Result of an individual step:

1.2.5 Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers

1., 2., 3. Series of steps

1.3 Documentation

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads):

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

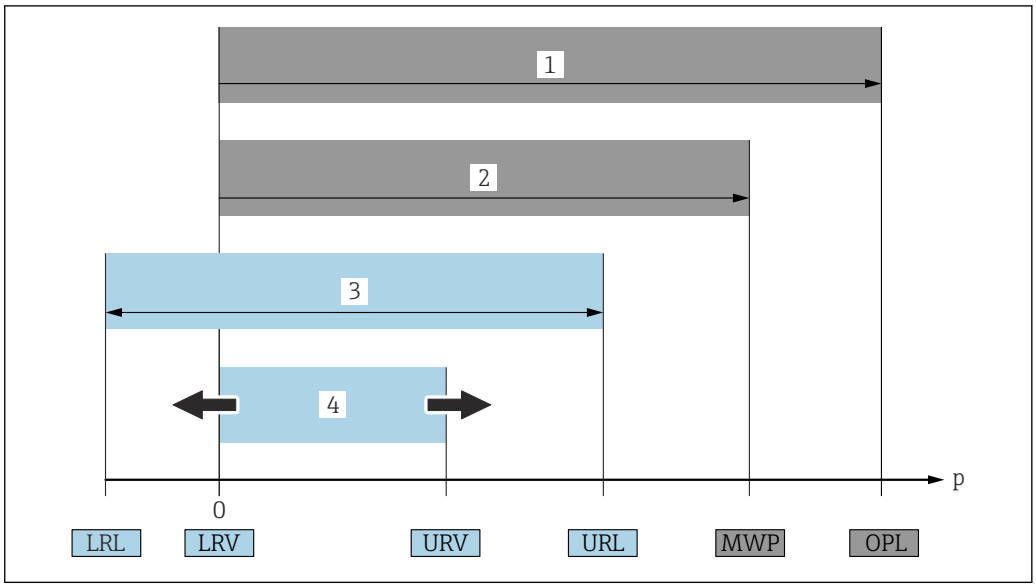
1.3.1 Technical Information (TI)

Planning aid
The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

1.3.2 Brief Operating Instructions (KA)

Guide that takes you quickly to the 1st measured value
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.4 Terms and abbreviations



1 OPL: The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Observe pressure-temperature dependency. The OPL may only be applied for a short period of time.

2 MWP: The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Observe pressure-temperature dependency. The maximum working pressure may be applied at the device for an unlimited period. The MWP can be found on the nameplate.

3 The maximum sensor measuring range corresponds to the span between the LRL and URL. This sensor measuring range is equivalent to the maximum calibratable/adjustable span.

4 The calibrated/adjusted span corresponds to the span between the LRV and URV. Factory setting: 0 to URL. Other calibrated spans can be ordered as customized spans.

p Pressure

LRL Lower range limit

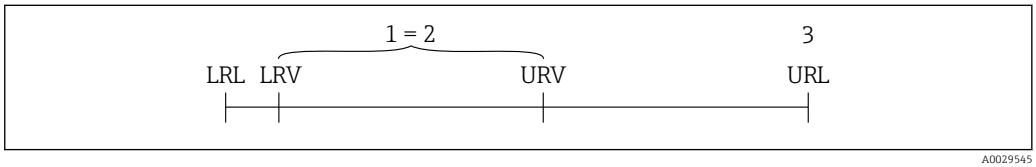
URL Upper range limit

LRV Lower range value

URV Upper range value

TD Turn down. Example - see the following section.

1.5 Turn down calculation



1 Calibrated/adjusted span

2 Zero point-based span

3 Upper range limit

Example:

- Measuring cell: 10 bar (150 psi)
- Upper range limit (URL) = 10 bar (150 psi)
- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

$$TD = \frac{URL}{|URV - LRV|}$$

In this example, the TD is 2:1. This span is based on the zero point.

2 Basic safety instructions

2.1 Requirements concerning the staff

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists: must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:
- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

2.2 Intended use

2.2.1 Application and media

The Ceraphant is a pressure switch for measuring and monitoring absolute and gauge pressure in industrial systems. The process-wetted materials of the measuring device must have an adequate level of resistance to the media.

The measuring device may be used for the following measurements (process variables)
- in compliance with the limit values specified under "Technical data"
- in compliance with the conditions that are listed in this manual.

Measured process variable

- Gauge and absolute pressure and hygienic applications
- Gauge pressure and absolute pressure

Calculated process variable

Pressure

2.2.2 Incorrect use

The manufacturer is not liable for damage caused by using the device incorrectly or for purposes for which it was not intended.

Clarification of borderline cases:
- With regard to special fluids and media used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials but gives no guarantee or warranty as to the suitability of the materials.

2.2.3 Residual risks

When in operation, the housing may reach a temperature close to the process temperature.

Danger of burns from contact with surfaces!
- For elevated process temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

When working on and with the device:
- ▶ Wear the required personal protective equipment as per national regulations.
- ▶ Switch off the supply voltage before connecting the device.

2.4 Operational safety

Risk of injury!
- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.
- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

Hazardous area

To eliminate the risk of danger to persons or the facility when the device is used in the approval-related area (e.g. pressure equipment safety):
- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area.

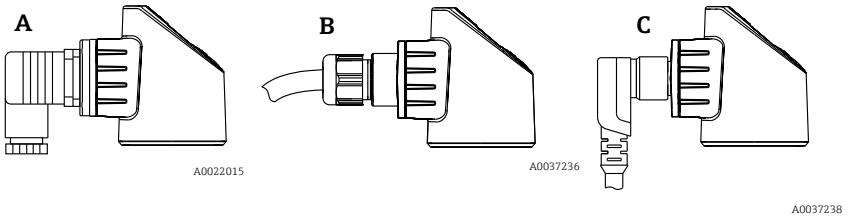
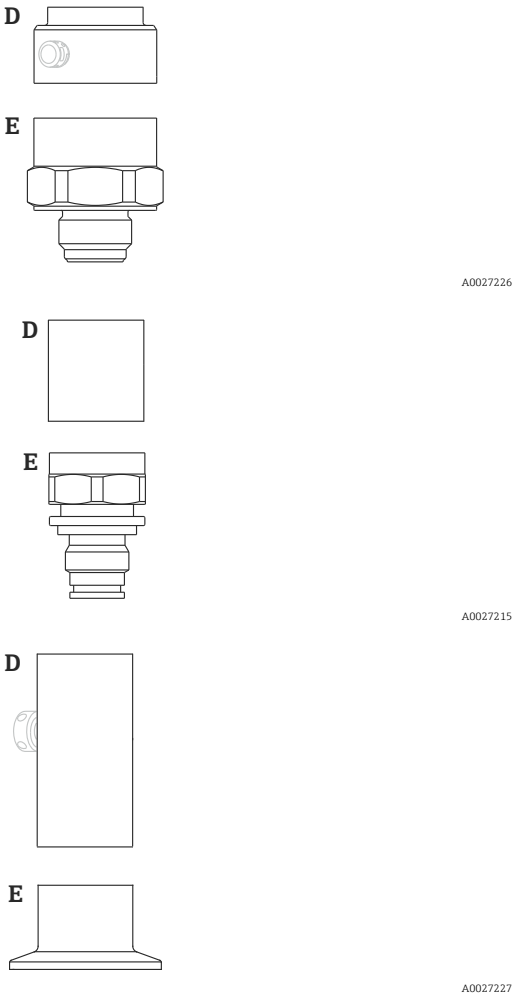
2.5 Product safety

This device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

It meets the general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

3 Product description

3.1 Product design

Overview of product design for analog communication version	Item	Description
 A0022015 A0037236 A0037238	A	Valve plug
	B	Cable
	C	M12 plug Housing cap made of plastic
 A0027226 A0027215 A0027227	D E	Housing Process connection (sample illustration)

3.2 Operating principle

3.2.1 Calculating the pressure

Devices with ceramic process membrane (Ceraphire®)

The ceramic sensor is an oil-free sensor, i.e. the process pressure acts directly on the robust ceramic process membrane and causes it to deflect. A pressure-dependent change in capacitance is measured at the electrodes of the ceramic substrate and the process

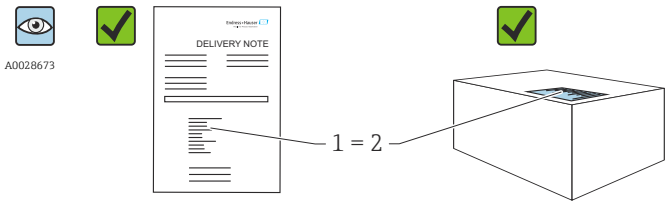
membrane. The measuring range is determined by the thickness of the ceramic process membrane.

Devices with metallic process membrane

The process pressure deflects the metal process isolating diaphragm of the sensor and a fill fluid transfers the pressure to a Wheatstone bridge (semiconductor technology). The pressure-dependent change in the bridge output voltage is measured and evaluated.

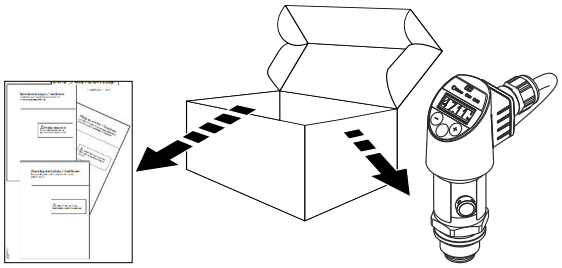
4 Incoming acceptance and product identification

4.1 Incoming acceptance

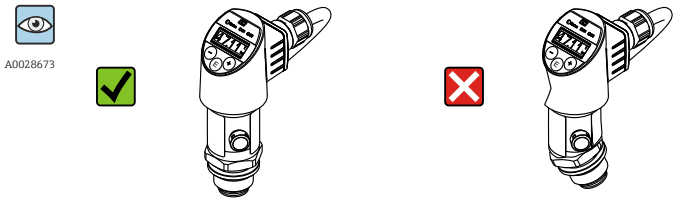


A0016870

Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?

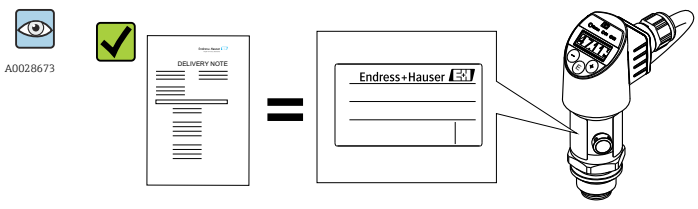


A0022099



A0022101

Are the goods undamaged?



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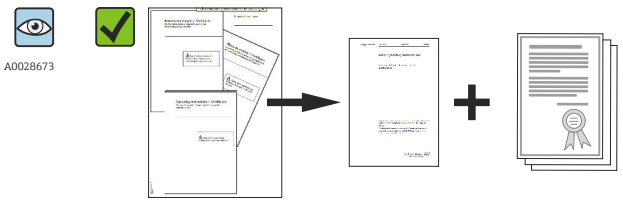
Do the data on the nameplate correspond to the order specifications and the delivery note?



A0022106

Is the documentation provided?
If required (see nameplate), have the Safety Instructions (XA) been provided?

If one of these conditions does not apply, please contact your Endress+Hauser sales office.

4.2 Product identification

The following options are available for identification of the measuring device:
- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial number from nameplates in *Device Viewer* (www.endress.com/deviceviewer): all the information about the measuring instrument is displayed.

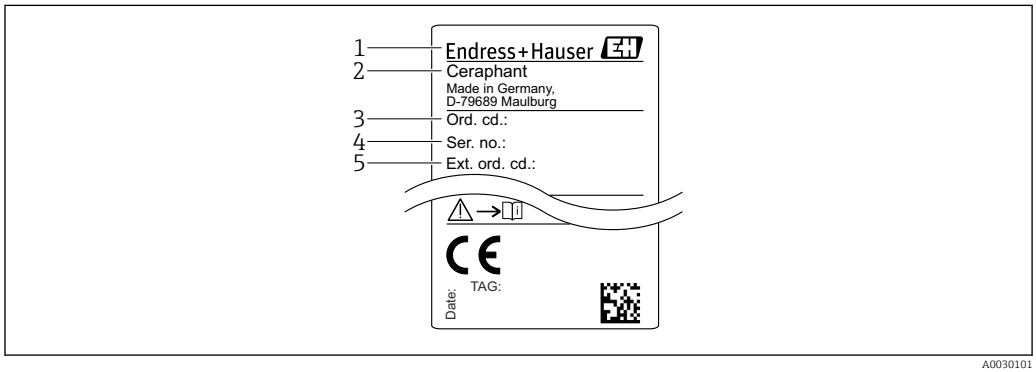
For an overview of the technical documentation provided, enter the serial number from the nameplate in the *Device Viewer* (www.endress.com/deviceviewer).

4.2.1 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

Place of manufacture: See nameplate.

4.2.2 Nameplate



A0030101

1 *Manufacturer address*
2 *Device name*
3 *Order code*
4 *Serial number*
5 *Extended order number*

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

Store the measuring device in clean and dry conditions and protect from damage caused by shocks (EN 837-2).

Storage temperature range

–40 to +85 °C (–40 to +185 °F)

4.3.2 Transporting the product to the measuring point

⚠ WARNING

Incorrect transport!

Housing and diaphragm may become damaged, and there is a risk of injury!

- ▶ Transport the measuring device to the measuring point in its original packaging or by the process connection.

5 Mounting

5.1 Installation conditions

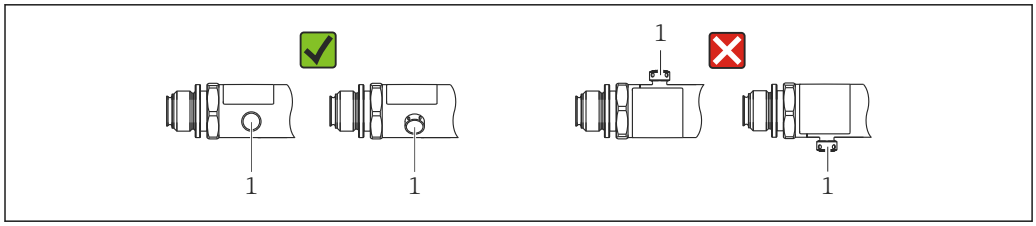
- Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.
- Do not clean or touch process isolating diaphragms with hard and/or pointed objects.
- Do not remove process isolating diaphragm protection until shortly before installation.
- Always tighten the cable entry firmly.
- Point the cable and connector downwards where possible to prevent moisture from entering (e.g. rain or condensation water).
- Protect housing against impact.
- For devices with gauge pressure sensor and M12 or valve plug, the following applies:

NOTICE

If a heated device is cooled in the course of a cleaning process (by cold water, for example), a vacuum develops for a short time causing moisture to penetrate the sensor via the pressure compensation element (1).

Device could be destroyed!

▶ In the event of this happening, mount the device in such a way that the pressure compensation element (1) is pointing downwards at an angle or to the side, if possible.



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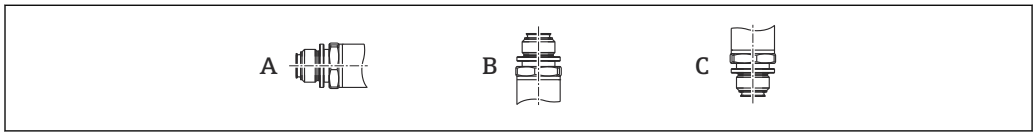
5.2 Influence of orientation

Any orientation is possible. However, the orientation may cause a zero point shift, i.e. the measured value does not show zero when the vessel is empty or partially full.



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PTP31B PTP33B

Process membrane axis is horizontal (A)	Process membrane pointing upwards (B)	Process membrane pointing downwards (C)
Calibration position, no effect	Up to +4 mbar (+0.058 psi)	Up to −4 mbar (−0.058 psi)

PTC31B

Type	Process membrane axis is horizontal (A)	Process membrane pointing upwards (B)	Process membrane pointing downwards (C)
< 1 bar (15 psi)	Calibration position, no effect	Up to +0.3 mbar (+0.0044 psi)	Up to −0.3 mbar (−0.0044 psi)
≥ 1 bar (15 psi)	Calibration position, no effect	Up to +3 mbar (+0.0435 psi)	Up to −3 mbar (−0.0435 psi)

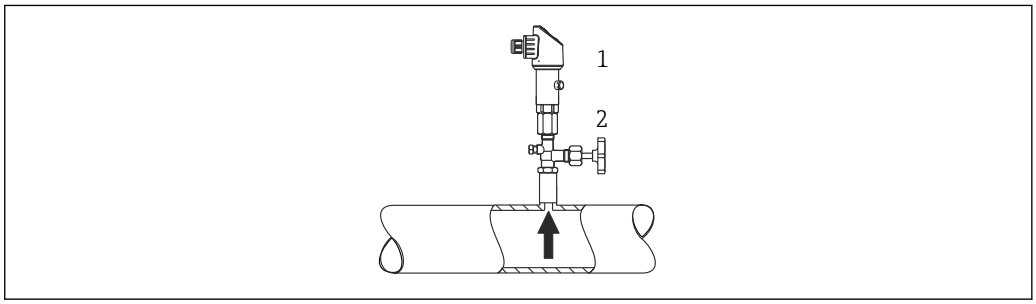
A position-dependent zero point shift can be corrected on the device.

5.3 Mounting location

5.3.1 Pressure measurement

Pressure measurement in gases

Mount the device with shutoff device above the tapping point so that any condensate can flow into the process.



A0025920

1 Device
2 Shutoff device

Pressure measurement in vapors

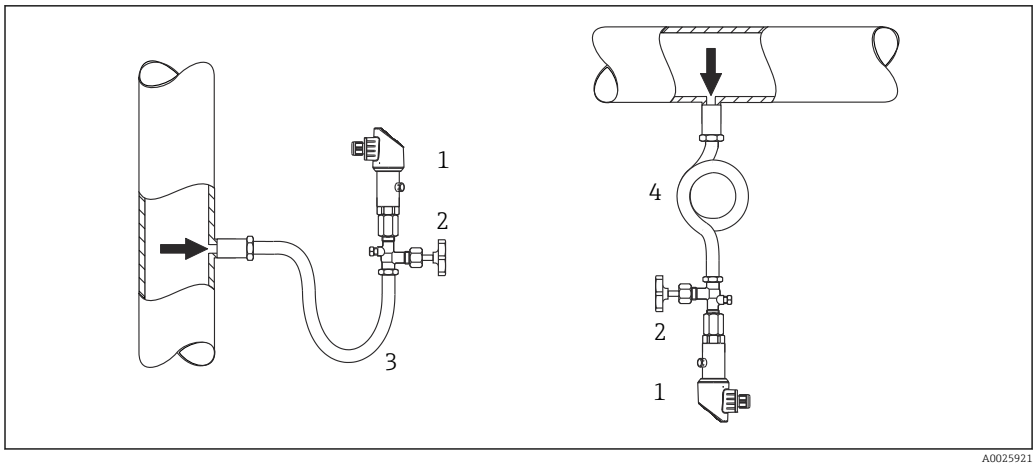
For pressure measurement in vapors, use a siphon. The siphon reduces the temperature to almost ambient temperature. Preferably mount the device with the shutoff device and siphon below the tapping point.

Advantage:
- defined water column causes only minor/negligible measuring errors and
- only minor/negligible heat effects on the device.

Mounting above the tapping point is also permitted.

Note the max. permitted ambient temperature of the transmitter!

Take the influence of the hydrostatic water column into consideration.



A0025921

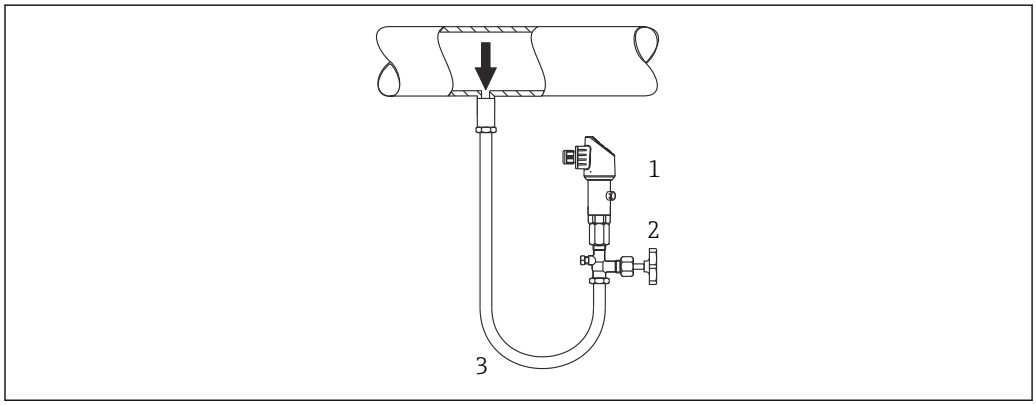
1 Device
2 Shutoff device
3 Siphon
4 Siphon

Pressure measurement in liquids

Mount the device with a shutoff device and siphon below or at the same height as the tapping point.

Advantage:
- defined water column causes only minor/negligible measuring errors and
- air bubbles can be released to the process.

Take the influence of the hydrostatic water column into consideration.

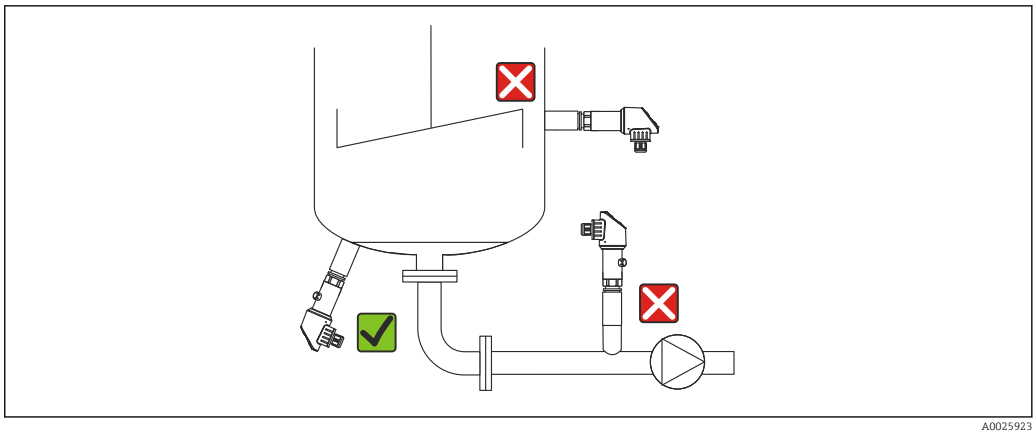


A0025922

1 Device
2 Shutoff device
3 Siphon

5.3.2 Level measurement

- Always install the device below the lowest measuring point.
- Do not install the device at the following positions:
  - in the filling curtain
  - in the tank outlet
  - in the suction area of a pump
  - at a point in the tank which could be affected by pressure pulses from the agitator.
- A functional test can be carried out more easily if you mount the device downstream from a shutoff device.



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5.4 Mounting instructions for oxygen applications

Oxygen and other gases can react explosively to oils, grease and plastics, such that, among other things, the following precautions must be taken:

- All components of the system, such as measuring devices, must be cleaned in accordance with the BAM requirements.
- Depending on the materials used, a certain maximum temperature and a maximum pressure must not be exceeded for oxygen applications.
- The following table lists devices (devices only, not accessories or enclosed accessories), which are suitable for gaseous oxygen applications.

PTC31B

p_{max} for oxygen applications	T_{max} for oxygen applications	Option [1]
40 bar (600 psi)	−10 to +60 °C (+14 to +140 °F)	HB

1) Product Configurator, order code for "Service"

5.5 Post-mounting check

- Is the device undamaged (visual inspection)?
- Does the device comply with the measuring point specifications?
  - Process temperature
  - Process pressure
  - Ambient temperature
  - Measuring range
- Are the measuring point identification and labeling correct (visual inspection)?
- Is the device adequately protected against precipitation and direct sunlight?
- Are the securing screws firmly tightened?
- Is the pressure compensation element pointing downwards at an angle or to the side?
- To prevent the penetration of moisture: are the connecting cables/plugs pointing downwards?

6 Electrical connection

6.1 Connecting the measuring unit

6.1.1 Terminal assignment

⚠ WARNING

Risk of injury from the uncontrolled activation of processes!

- Switch off the supply voltage before connecting the device.
- Make sure that downstream processes are not started unintentionally.

⚠ WARNING

Reduced electrical safety due to incorrect connection!

- A suitable circuit breaker must be provided for the device in accordance with IEC/EN 61010.
- **Non-hazardous area:** To meet device safety specifications according to the IEC/EN61010 standard, the installation must ensure that the maximum current is limited to 630 mA.
- **Hazardous area:** The maximum current is restricted to Ii = 100 mA by the transmitter power supply unit when the measuring instrument is used in an intrinsically safe circuit (Ex ia).
- Protective circuits against reverse polarity are integrated.

NOTICE

Damage to analog input of PLC resulting from incorrect connection

- Do not connect the active PNP switch output of the device to the 4 to 20 mAinput of a PLC.

NOTICE

Damage to analog input of PLC resulting from incorrect connection

- Do not connect the active PNP switch output of the device to the 4 to 20 mA input of a PLC.

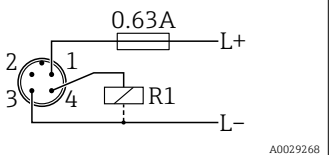
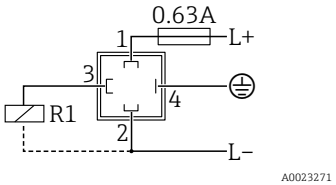
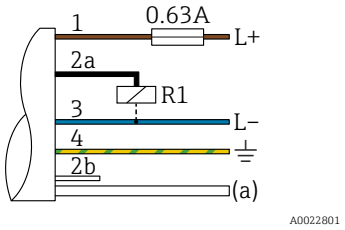
Connect the device in the following order:

1. Check that the supply voltage corresponds to the supply voltage indicated on the nameplate.
2. Connect the device as indicated in the following diagram.

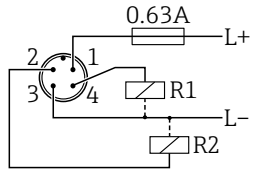
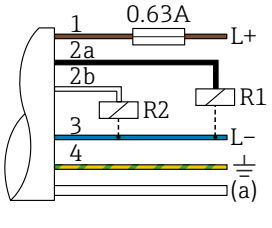
Switch on the supply voltage.

For devices with a cable connection: do not close reference air hose (see (a) in the following drawings)! Protect reference air hose against penetration by water/condensate.

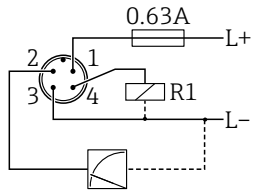
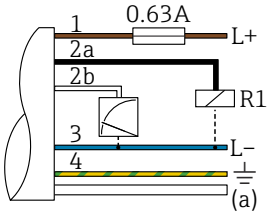
1 x PNP switch output R1 (not with IO-Link functionality)

M12 plug	Valve plug	Cables
		 *1 brown = L+* *2a black = switch output 1* *2b white = not used* *3 blue = L-* *4 green/yellow = ground* *(a) reference air hose*

2 x PNP switch output R1 and R2

M12 plug	Valve plug	Cables
	-	 *1 brown = L+* *2a black = switch output 1* *2b white = switch output 2* *3 blue = L-* *4 green/yellow = ground* *(a) reference air hose*

1 x PNP switch output R1 with additional analog output 4 to 20 mA (active)

M12 plug	Valve plug	Cables
	-	 *1 brown = L+* *2a black = switch output 1* *2b white = analog output 4 to 20 mA* *3 blue = L-* *4 green/yellow = ground* *(a) reference air hose*

6.1.2 Supply voltage

Supply voltage: 10 to 30 V DC at a DC power unit

6.1.3 Current consumption and alarm signal

Intrinsic power consumption	Alarm current (for devices with analog output) [1]
≤ 60 mA	≥21 mA (factory setting)

1) Setting min. alarm current ≤3.6mA can be ordered via the product order structure. Min. alarm current ≤3.6mA can be configured at the device or via IO-Link.

6.2 Connection data

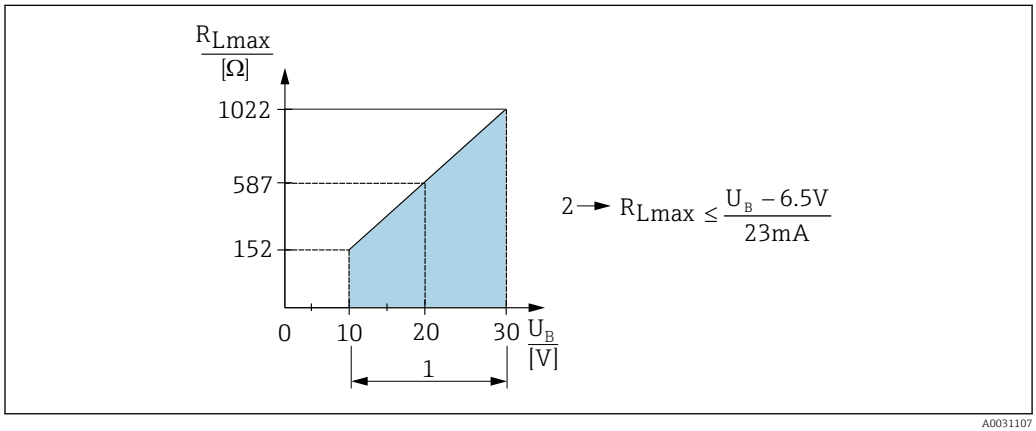
6.2.1 Relay switching capacity

- Switch state ON: I_a ≤ 250 mA; switch state OFF: I_a ≤1 mA
- Switch cycles: >10,000,000
- Voltage drop PNP: ≤2 V
- Overload protection: Automatic load testing of switching current;
  - Max. capacitance load: 14 µF at max. supply voltage (without resistive load)
  - Max. cycle duration: 0.5 s; min. t_{on}: 4 ms
  - Periodic disconnection from protective circuit in the event of overcurrent (f = 2 Hz) and "F804" displayed

6.2.2 Load (for devices with analog output)

In order to guarantee sufficient terminal voltage, a maximum load resistance R_L (including line resistance) must not be exceeded depending on the supply voltage U_B of the supply unit.

The maximum load resistance depends on the terminal voltage and is calculated according to the following formula:



1 Power supply 10 to 30 V DC
2 R_{Lmax} maximum load resistance
U_B Supply voltage

If load is too great:
- failure current is output and "S803" displayed (output: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state
- In order to guarantee sufficient terminal voltage, a maximum load resistance RL (including line resistance) must not be exceeded depending on the supply voltage UB of the supply unit.

6.3 Connection requirements

6.3.1 Cable specification (analog)

For valve plug: < 1.5 mm^2 (16 AWG) and Ø 4.5 to 10 mm (0.18 to 0.39 in)

6.4 Post-connection check

- Are the device or cables undamaged (visual check)?
- Do the cables used comply with the requirements?
- Are the mounted cables strain-relieved?
- Are all cable glands installed, securely tightened and leak-tight?
- Does the supply voltage match the specifications on the nameplate?
- Is the terminal assignment correct ?
- If required: has protective ground connection been established?
- If supply voltage is present: is the device ready for operation and do values appear on the display module or is the green status LED lit?

7 Operation options

7.1 Operation with an operating menu

7.1.1 Operating concept

Operation with an operating menu is based on an operation concept with "user roles" .

User role	Meaning
Operator (display level)	Operators are responsible for the devices during normal "operation". This is usually limited to reading process values either directly at the device or in a control room. Should an error occur, these users simply forward the information on the errors but do not intervene themselves.
Maintenance (user level)	Service engineers usually work with the devices in the phases following device commissioning. They are primarily involved in maintenance and troubleshooting activities for which simple settings have to be made at the device. Technicians work with the devices over the entire life cycle of the product. Thus, commissioning and advanced settings and configurations are some of the tasks they have to carry out.

7.2 Structure of the operating menu

The menu structure has been implemented according to VDMA 24574-1 and complemented by Endress+Hauser-specific menu items.

User role	Submenu	Meaning/use
Operator (display level)	Display/operat.	Display of measured values, fault and information messages
Maintenance (user level)	Parameters on the topmost menu level.	Contains all the parameters that are needed to commission measuring operations. A wide range of parameters, which can be used to configure a typical application, is available at the start. After making settings for all these parameters, the measuring operation should be completely configured in the majority of cases.
	EF	The submenu "EF" (Extended Functions) contains additional parameters which allow more accurate configuration of the measurement, conversion of the measured value and scaling of the output signal.
	DIAG	Contains all the parameters that are needed to detect and analyze operating errors.

For an overview of the entire operating menu, see the → 49

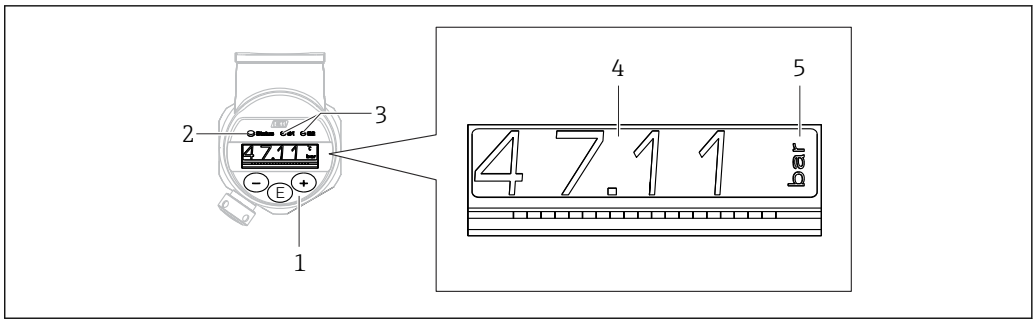
7.3 Operation with local display

7.3.1 Overview

A 1-line liquid crystal display (LCD) is used for display and operation. The local display shows measured values, fault messages and information messages and therefore supports the user through each operating step.

The display is fixed to the housing and can be electronically rotated 180° (see parameter description for "DRO"). This ensures optimum readability of the local display and allows the device to be mounted upside down also.

During measuring operation, the display shows measured values, fault messages and notice messages. In addition, it is possible to switch to menu mode via the operating keys.



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1 *Operating keys*
2 *Status LED*
3 *Switch output LEDs*
4 *Measured value*
5 *Unit*

The second switch output is not used for the device version with current output.

7.3.2 Information on the operational states

Operational states	Function of status-LED and onsite display
Operation	▪ Status LED is lit green ▪ LEDs of switch output 1 and switch output 2 signal the status of each switch output ▪ No activity of LED for switch output 2 if current output is active ▪ White background lighting
Problem	▪ Status LED lit steady red ▪ Red display background ▪ LED of switch output 1 and switch output 2 off (switch output is deactivated)
Warning	▪ Status LED flashing red ▪ White display background ▪ LEDs of switch output 1 and switch output 2 signal the status of each switch output
For Device Search	▪ The green LED is lit (= operational) on the device and starts to flash with increased luminosity. Flash frequency ⎍⎍⎍⎍ ⎍⎍⎍⎍ ▪ LEDs of switch output 1 and switch output 2 signal the status of each switch output ▪ Display background depending on the device status
IO-Link communication	▪ Status LED flashes green as per IO-Link specification (regardless of measuring operation, error or warning). Flash frequency ⎍⎍⎍⎍ ▪ Display background depending on the device status ▪ The state of switch output 1 is also indicated via the LED of switch output 1 at the same time as the process data are displayed

7.4 General value adjustment and rejection of illegal entries

Parameter (not numerical value) is flashing: parameter can be adjusted or selected.

When adjusting a numerical value: the numerical value does not flash. The first digit of the numerical value starts to flash only when the E key is pressed by way of confirmation. Enter the desired value with the − or + key and press the E key to confirm. Following confirmation, the data are recorded directly and are active.

- Entry is OK: value is accepted and shown for one second on the display against a white background.
- Entry is not OK: the message "FAIL" appears for one second on the display against a red background. The value entered is rejected. In the event of an incorrect setting which affects the TD, a diagnostic message is displayed.

7.5 Navigation and selection from list

The capacitive operating keys are used for navigation in the operating menu and to select an option from a picklist.

Key(s)	Meaning
 A0017879	▪ Navigate downwards in the picklist ▪ Edit the numerical values or characters within a function
 A0017880	▪ Navigate upwards in the picklist ▪ Edit the numerical values or characters within a function
 A0017881	▪ Confirm entry ▪ Jump to the next item ▪ Select a menu item and activate the edit mode ▪ The key lock function (KYL) is accessed by pressing the key for longer than 2 seconds
Simultaneously  A0017879 and  A0017880	**ESC functions:** ▪ Exit edit mode for a parameter without saving the changed value ▪ You are in a menu at a selection level. Each time you press the keys simultaneously, you go up a level in the menu. ▪ Long ESC: press the keys for longer than 2 seconds

7.6 Locking and unlocking operation

The device features
- Automatic key locking
- Parameter settings lock.

Key locking is indicated on the local display by "E > 2".

Locking of the parameter settings is indicated as soon as an attempt is made to change a parameter.

7.6.1 Disabling the key lock

The keys are locked automatically if the device remains at the topmost menu level (display of pressure measurement value) for 60 seconds.

Call up the key lock function (KYL)

1. Press the E key for at least 2 seconds and then release it
2. By confirming with E "ON" is displayed
3. Use + and − to toggle between "ON" and "OFF"
4. Key locking is disabled as soon as E is pressed to confirm "OFF"

The display changes to the main value level (topmost menu level) if the E key is pressed briefly. The display changes to the key locking if the E key is pressed for at least 2 seconds.

If in the case of "KYL", "ON" or "OFF", more than 10 seconds elapse without a key being pressed, you return to the topmost menu level with active key locking.

The function can be accessed anytime outside the main measured value display and within the operating menu, i.e. if the E key is pressed for at least 2 seconds key locking can be performed anytime at any menu item. Locking is effective immediately. If you quit the context menu, you will return to the same point from which key locking was selected.

7.6.2 Locking parameter settings

COD locking code

Navigation	Display: EF → ADM → COD IO-Link: EF → ADM → COD
Description	A code can be entered to protect parameter settings against unauthorized and unwanted access.
Input range	0000: Device is permanently unlocked 0001-9999: Device is locked
Factory setting	0000
Note	Locking is enabled after 60 seconds in the measured value display and following a device restart.

7.6.3 Unlocking parameter settings

If parameters are locked, the word "LCK" appears on the local display as soon as an attempt is made to change a parameter.

LCK unlocking code

Navigation
Display: EF → ADM → LCK
IO-Link: EF → ADM → LCK

Description
The device is unlocked by entering the code defined in COD.

Input range
0000-9999

Note
If parameters are locked, the word "LCK" appears on the local display as soon as an attempt is made to change a parameter. Locking is enabled again after 60 seconds in the measured value display and following a device restart.

7.7 Navigation examples

7.7.1 Parameters with a picklist

Example: Display measured value rotated by 180°

Menu path: EF → DIS → DRO

Press ⊞ or ⊟ key until "DRO" is displayed.	D R O
The default setting is "NO" (display is not rotated).	N O
Press ⊞ or ⊟ until "YES" appears (display is rotated by 180°).	Y E S
Press Ⓔ to confirm the setting.	D R O

7.7.2 User-definable parameters

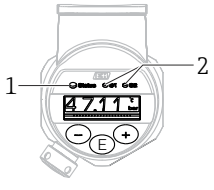
Example: setting the "TAU" damping parameter.

Menu path: EF → TAU

Press ⊞ or ⊟ key until "TAU" is displayed.	T A U
Press Ⓔ to set the damping (min. = 0.0 s; max.= 999.9 s).	**0. 3** 0
Press ⊞ or ⊟ to go up or down. Press Ⓔ to confirm the entry and to go to the next position.	**1. 5**
Press Ⓔ to quit the setting function and to go to the "TAU" menu item.	T A U

7.8 Status LEDs

The Ceraphant also uses LEDs to signal the status:
- Two LEDs indicate the status of the switch outputs (switch output 2 can optionally be used as a current output)
- One LED indicates if the device is switched on or if an error or fault has occurred



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1 Status LED
2 Switch output LEDs

7.9 Resetting to factory settings (reset)

See parameter description for RES → 🖹 56

8 Commissioning

If an existing configuration is changed, measuring operation continues! The new or modified entries are only accepted once the setting has been made.

⚠ WARNING

Risk of injury from the uncontrolled activation of processes!

▶ Make sure that downstream processes are not started unintentionally.

⚠ WARNING

If a pressure smaller than the minimum permitted pressure or greater than the maximum permitted pressure is present at the device, the following messages are output in succession:

▶ S971 (displayed only in the case of devices with current output)
▶ S140
▶ F270

8.1 Function check

Before commissioning your measuring point, ensure that the post-installation and post-connection check have been performed:

- "Post-installation check" checklist → 🖹 19
- "Post-connection check" checklist → 🖹 23

8.2 Enabling configuration/operation

The device features
- Automatic key locking → 🖹 27
- Parameter locking → 🖹 27.

8.3 Commissioning with an operating menu

Commissioning comprises the following steps:
- Configuration of pressure measurement → 🖹 30
- If necessary, perform position adjustment → 🖹 32
- If necessary, Configuration of process monitoring if necessary → 🖹 35
- If necessary, Configuration of the local display if necessary → 🖹 40
- If necessary, Protection of settings from unauthorized access if necessary → 🖹 41

8.4 Configuring pressure measurement (only for devices with a current output)

8.4.1 Calibration without reference pressure (dry calibration = calibration without medium)

Example:

In this example, a device with a 400 mbar (6 psi) sensor is configured for the measuring range 0 to 300 mbar (0 to 4.4 psi).

The following values should be assigned:
- 0 mbar = 4 mA value
- 300 mbar (4.4 psi) = 20 mA value

Prerequisite:

This is a theoretical calibration, i.e. the pressure values for the lower and upper range are known. It is not necessary to apply pressure.

Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. the measured value is not zero in a pressureless condition. For information on how to perform position adjustment, see the "Performing position adjustment" section → 32.

For a description of the parameters mentioned and possible error messages, see the "Description of device parameters" section → 51 and → 44.

Performing the calibration

1. Select a pressure engineering unit via the "UNI" parameter, here "BAR" for example. Menu path: EF → UNI
2. Select the "STL" parameter. Menu path: STL. Enter the value (0 bar (0 psi)) and confirm.
   ↳ This pressure value is assigned to the lower current value (4 mA).
3. Select the "STU" parameter. Menu path: STU. Enter the value (300 mbar (4.4 psi)) and confirm.
   ↳ This pressure value is assigned to the upper current value (20 mA).

The measuring range is configured for 0 to 300 mbar (0 to 4.4 psi).

8.4.2 Calibration with reference pressure (wet calibration = calibration with medium)

Example:

In this example, a device with a 400 mbar (6 psi) sensor is configured for the measuring range 0 to 300 mbar (0 to 4.4 psi).

The following values should be assigned:
- 0 mbar = 4 mA value
- 300 mbar (4.4 psi) = 20 mA value

Prerequisite:

The pressure values 0 mbar and 300 mbar (4.4 psi) can be specified. For example, the device is already installed.

Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. the measured value is not zero in a pressureless condition. For information on how to perform position adjustment, see the "Performing position adjustment" section → 32.

For a description of the parameters mentioned and possible error messages, see the "Description of device parameters" section → 51 and → 44.

Performing the calibration

1. Select a pressure engineering unit via the "UNI" parameter, here "BAR" for example. Menu path: EF → UNI
2. The pressure for the LRV (4 mA value) is present at the device, here 0 bar (0 psi) for example. Select the "GTL" parameter. Menu path: EF → I → GTL. Confirm the present value by selecting "YES".
   ↳ The present pressure value is assigned to the lower current value (4 mA).
3. The pressure for the URV (20 mA value) is present at the device, here 300 mbar (4.4 psi)for example. Select the "GTU" parameter. Menu path: EF → I → GTU. Confirm the present value by selecting "YES".
   ↳ The present pressure value is assigned to the upper current value (20 mA).

The measuring range is configured for 0 to 300 mbar (0 to 4.4 psi).

8.5 Performing position adjustment

ZRO manual position adjustment (typically for absolute pressure sensor)

Navigation	EF → ZRO
Description	The pressure resulting from the orientation of the device can be corrected here. The pressure difference between zero (set point) and the measured pressure must be known.

Prerequisite

An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The set value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function.
Maximum offset value = ± 20 % of the sensor nominal range.
If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and shown on the display. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration.

The sensor can
- be operated in a physically unfavorable range, i.e. outside its specifications, or
- be operated by making appropriate corrections to the offset or span.

Raw measured value − (manual offset) = display value (measured value)

Example

- Measured value = 2.2 mbar (0.033 psi)
- Set the measured value in the parameter to 2.2.
- Measured value (after position adjustment) = 0.0 mbar
- The current value is also corrected.

Note

Setting in increments of 0.1. As the value is entered numerically, the increment depends on the measuring range

Options

No selection. The user is free to edit the values.

Factory setting

0

GTZ automatic position adjustment (typically for gauge pressure sensor)

Navigation

EF → GTZ

Description

The pressure resulting from the orientation of the device can be corrected here.
The pressure difference between zero (set point) and the measured pressure need not be known.

Prerequisite

An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The set value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function.
Maximum offset value = ± 20 % of the sensor nominal range.
If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and shown on the display. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration.

The sensor can
- be operated in a physically unfavorable range, i.e. outside its specifications, or
- be operated by making appropriate corrections to the offset or span.

Raw measured value − (manual offset) = display value (measured value)

Example 1

- Measured value = 2.2 mbar (0.033 psi)
- You use the "GTZ" parameter to correct the measured value with the value, e.g. 2.2 mbar (0.033 psi). This means that you are assigning the value 0 mbar (0 psi) to the pressure present.
- Measured value (after pos. zero adjust) = 0 mbar (0 psi)
- The current value is also corrected.
- If necessary, check and correct switch points and span settings.

Example 2

Sensor measuring range: −0.4 to +0.4 bar (−6 to +6 psi) (SP1 = 0.4 bar (6 psi); STU = 0.4 bar (6 psi))

- Measured value = 0.08 bar (1.2 psi)
- You use the "GTZ" parameter to correct the measured value with the value, e.g. 0.08 bar (1.2 psi). This means that you are assigning the value 0 mbar (0 psi) to the pressure present.
- Measured value (after pos. zero adjust) = 0 mbar (0 psi)
- The current value is also corrected.
- Warnings C431 or C432 appear because the value 0 bar (0 psi) was assigned to the real value of 0.08 bar (1.2 psi) present and the sensor measuring range was thus exceeded by ± 20%.
  SP1 and STU values must be readjusted downwards by 0.08 bar (1.2 psi).

Factory setting

0.0

8.6 Configuring process monitoring

To monitor the process, it is possible to specify a pressure range which is monitored by the limit switch. Depending on the device version, the process can be monitored using one PNP switch output, and optionally using a second PNP switch output or an analog 4 to 20 mA output. Both monitoring versions are described below. The monitoring function allows the user to define optimum ranges for the process (with high yields etc.) and deploy limit switches to monitor the ranges.

8.6.1 Digital process monitoring (switch output)

It is possible to select defined switch points and switchback points which act as NO or NC contacts depending on whether a window function or hysteresis function is configured → 🖹 35.

Function	Output	Abbreviation for operation
Hysteresis	Closing	HNO
Hysteresis	NC contact	HNC
Window	Closing	FNO
Window	NC contact	FNC

If the device is restarted within the specified hysteresis, both switch outputs are open (0 V present at the output).

8.6.2 Analog process monitoring (4 to 20 mA output)

- The 3.8 to 20.5 mA signal range is controlled according to NAMUR NE 43.
- The alarm current and current simulation are exceptions:
  - If the defined limit is exceeded, the device continues measuring in a linear fashion. The output current increases linearly up to 20.5 mA and holds the value until the measured value drops below 20.5 mA again or the device detects an error → 🖹 45.
  - If the defined limit is undershot, the device continues measuring in a linear fashion. The output current decreases linearly to 3.8 mA and holds the value until the measured value rises above 3.8 mA again or the device detects an error → 🖹 45.

8.7 Functions of switch output

The switch output can be used for two-point control (hysteresis) or for monitoring a process pressure range (window function).

8.7.1 Hysteresis

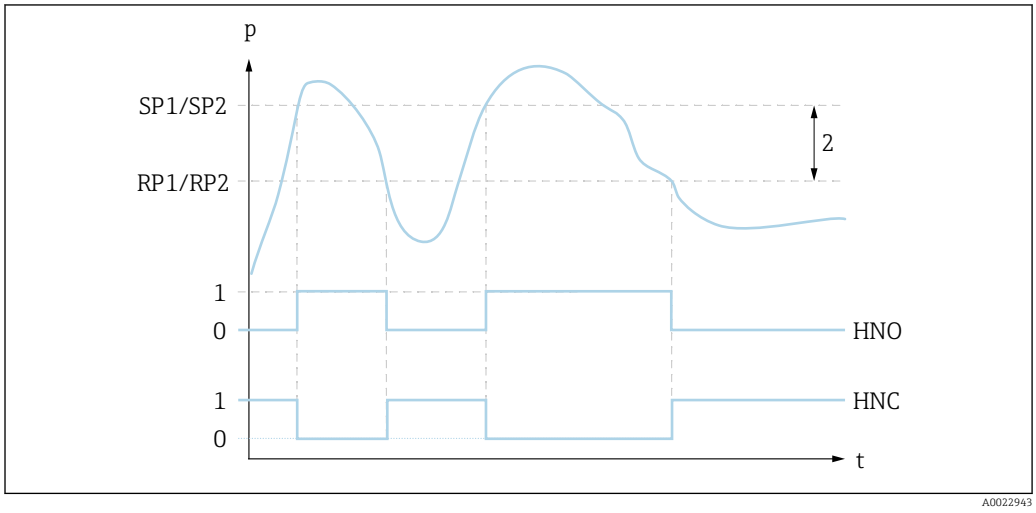
SP1/SP2 switch point value, output 1/2
RP1/RP2 switchback point value, output 1/2

Navigation SP1/SP2
RP1/RP2

Note

The hysteresis is implemented using the "SP1/SP2" and "RP1/RP2" parameters. Since the parameter settings depend on one another, the parameters are described all together.

- SP1 = switch output 1
- SP2 = switch output 2 (optional)
- RP1 = switchback point 1
- RP2 = switchback point 2 (optional)



1 SP1/SP2: switch point 1/2; RP1/RP2: switch-back point 1/2

0 0-signal. Output open in quiescent state.
1 1-signal. Output closed in quiescent state.
2 Hysteresis
HNO Closing
HNC NC contact

Description

The switch point "SP1/SP2" and the switchback point "RP1/RP2" can be defined with these functions (e.g. for pump control).
When the set switch point "SP1/SP2" is reached (with increasing pressure), an electrical signal change takes place at the switch output.

When the set switchback point "RP1/RP2" is reached (with decreasing pressure), an electrical signal change takes place at the switch output.
The difference between the value of the switch point "SP1/SP2" and the switchback point "RP1/RP2" is known as the hysteresis.

Prerequisite

- These functions are only available if the hysteresis function has been defined for the switch output.
- The configured value for the switch point "SP1/SP2" must be greater than the switchback point "RP1/RP2"!
  A diagnostic message is displayed if a switch point "SP1/SP2" is entered that is ≤ the switchback point "RP1/RP2". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!

Note

To prevent constant switch-on and switch-off if values are around the switch point "SP1/SP2" and switchback point "RP1/RP2", a delay can be set for the relevant points. See the parameter description for "dS1/dS2" and "dR1/dR2" for this purpose.

Options

No selection. The user is free to edit the values.

Factory setting

Factory setting (if no customer-specific setting is ordered):
Switch point SP1: 90%; switchback point RP1: 10%
Switch point SP2: 95 %; switchback point RP2: 15 %

8.7.2 Window function

- SP1 = switch output 1
- SP2 = switch output 2 (optional)

FH1/FH2 Upper value for pressure window, output 1/2
FL1/FL2 Lower value for pressure window, output 1/2

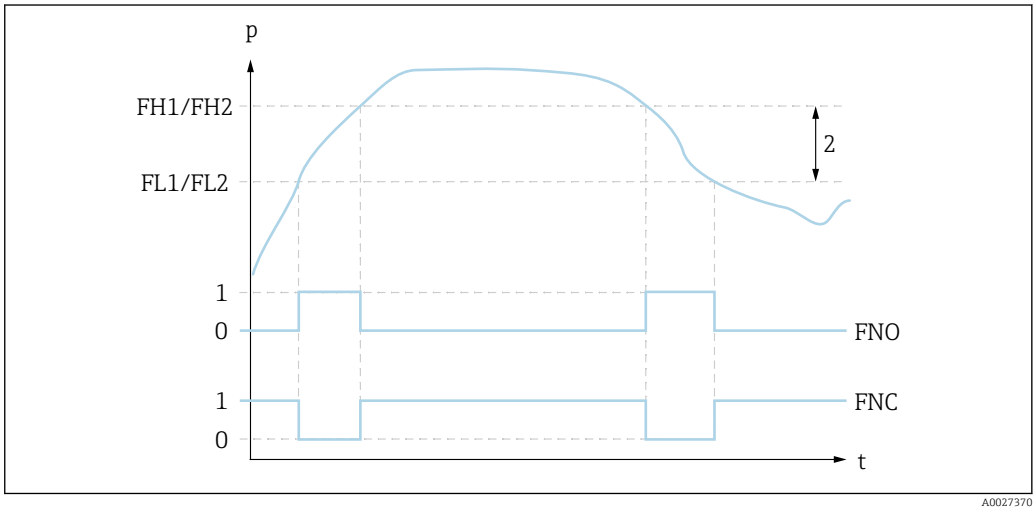
Navigation

FH1/FH2
FL1/FL2

Note

The window function is implemented using the "FH1/FH2" and "FL1/FL2" parameters. Since the parameter settings depend on one another, the parameters are described all together.

- FH1 = Upper value of pressure window 1
- FH2 = Upper value of pressure window 2 (optional)
- FL1 = Lower value of pressure window 1
- FL2 = Lower value of pressure window 2 (optional)



2 *FH1/FH2: upper value of pressure window; FL1/FL2: lower value of pressure window*

0 0-signal. Output open in quiescent state.
1 1-signal. Output closed in quiescent state.
2 Pressure window (difference between the value of the high window "FH1/FH2" and the low window "FL1/FL2")
FNO Closing
FNC NC contact

Description

The upper value of the pressure window "FH1/FH2" and the lower value of the pressure window "FL1/FL2" can be defined with these functions (e.g. for monitoring a certain pressure range).
When the lower value of the pressure window "FL1/FL2" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output.

When the upper value of the pressure window "FH1/FH2" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output.
The difference between the upper value of the pressure window "FH1/FH2" and the lower value of the pressure window "FL1/FL2" is known as the pressure window.

Prerequisite

- This function is only available if the window function has been defined for the switch output.
- The upper value of the pressure window "FH1/FH2" must be greater than the lower value of the pressure window "FL1/FL2"!
  A diagnostic message is displayed if the upper value entered for the pressure window "FH1/FH2" is smaller than the lower value of the pressure window "FL1/FL2". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!

Note

To prevent constant switch-on and switch-off if values are around the switch point "SP1/SP2" and switchback point "RP1/RP2", a delay can be set for the relevant points. See the parameter description for "dS1/dS2" and "dR1/dR2" for this purpose.

Options

No selection. The user is free to edit the values.

Factory setting

Factory setting if no customer-specific setting is ordered:
Switch point FH1: 90 %; switchback point FL1: 10 %
Switch point FH2: 95 %; switchback point FH2: 15 %

8.8 Current output

STL value for 4 mA (LRV)

Navigation

STL

Description

Assignment of the pressure value which should correspond to the 4 mA value.
It is possible to invert the current output. To do so, assign the pressure upper range value to the lower measuring current.

Prerequisite

Electronic version with current output

Note

Enter the value for 4 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).

Selection

No selection. The user is free to edit the values.

Factory setting

0.0 or as per order specifications

STU value for 20 mA (URV)

Navigation

STU

Description

Assignment of the pressure value which should correspond to the 20 mA value.
It is possible to invert the current output. To do so, assign the pressure lower range value to the upper measuring current.

Prerequisite

Electronic version with current output

Note Enter the value for 20 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).

Selection No selection. The user is free to edit the values.

Factory setting Upper measuring limit or as per order specifications.

GTL Pressure applied for 4mA (LRV)

Navigation EF → I → GTL

Description The pressure value present is automatically adopted for the 4 mA current signal.
Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current.
The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant.
The LRV and URV pressure measuring span can be edited over the entire sensor range.
An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431.
The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits.
If the entry is not OK, it is rejected, the message "FAIL" appears on the local display and the last valid value before the change is used again.
The measured value currently present is accepted as the value for 4mA anywhere within the measuring range.
There is a parallel shift of the sensor characteristic so that the pressure present becomes the zero value.

Selection
- NO
- YES

Factory setting NO

GTU Pressure applied for 20 mA (URV)

Navigation EF → I → GTU

Description

The pressure value present is automatically adopted for the 20 mA current signal.
Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current.
The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant.
The LRV and URV pressure measuring span can be edited over the entire sensor range.
An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431.
The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits.
If the entry is not OK, it is rejected, the message "FAIL" appears on the local display and the last valid value before the change is used again.
The measured value currently present is accepted as the value for 20 mA anywhere within the measuring range.
There is a parallel shift of the sensor characteristic so that the pressure present becomes the max value.

Selection

- NO
- YES

Factory setting

NO

8.9 Application examples

8.9.1 Compressor control with hysteresis function

Example: The compressor is started when the pressure drops below a certain value. The compressor is switched off when a certain value is exceeded.

1. Set the switch point to 2 bar (29 psi)
2. Set the switchback point to 1 bar (14.5 psi)
3. Configure the switch output as an "NC contact" (HNC function)

The compressor is controlled by the defined settings.

8.9.2 Pump control with hysteresis function

Example: The pump should switch on when 2 bar (29 psi) is reached (increasing pressure) and switch off when 1 bar (14.5 psi) is reached (decreasing pressure).

1. Set the switch point to 2 bar (29 psi)
2. Set the switchback point to 1 bar (14.5 psi)
3. Configure the switch output as an "NO contact" (HNO function)

The pump is controlled by the defined settings.

8.10 Configuring the local display

8.10.1 Adjusting the local display

The local display can be adjusted in the following menu:

EF → DIS

8.11 Protecting settings from unauthorized access

→ 27

9 Diagnostics and troubleshooting

9.1 Troubleshooting

If an invalid configuration exists in the device, the device switches to the fault state.

Example:
- Diagnostic message "C469", for example, appears on the local display, the status LED is lit red and the background of the local display changes from white to red.
- The switch outputs are opened. The current output adopts the configured alarm current.
- If the device configuration is corrected, e.g., by resetting the device, the device quits the fault state and switches to the measuring mode.
- Faults and warning messages relating to several channels appear on the display with the same diagnostic number and associated output.

General faults

Fault	Possible cause	Remedial action
Device does not respond.	Supply voltage does not match the voltage specified on the nameplate.	Connect the correct voltage.
	Supply voltage has incorrect polarity.	Reverse polarity of supply voltage.
	The cables do not contact the terminals properly.	Check the contacting of the cables and terminals and correct if necessary.
No display	The local display might be switched off.	Switch on the local display (see the "DOF" parameter description).
Output current ≤ 3.6 mA	Signal cable is not wired correctly.	Check wiring.
Device is measuring incorrectly.	Parameter configuration error	Check and adjust parameter configuration.

9.2 Diagnostic events

9.2.1 Diagnostic message

Faults detected by the self-monitoring system of the measuring instrument are displayed as a diagnostic message in alternation with the measured value display.

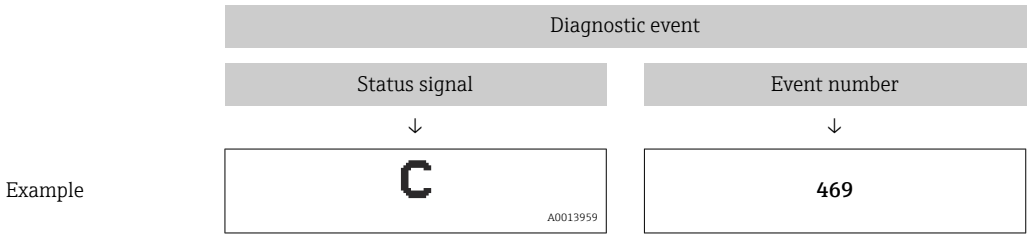
Status signals

The table → 📄 44 lists the messages that may occur. The ALARM STATUS parameter shows the message with the highest priority. The device has four different status information codes according to NE 107:

F A0013956	**"Failure"** A device fault has occurred. The measured value is no longer valid.
M A0013957	**"Maintenance required"** Maintenance is required. The measured value is still valid.
C A0013959	**"Function check"** The device is in the service mode (e.g. during a simulation).
S A0013958	**"Out of specification"** The device is operated: ▪ Outside its technical specifications (e.g. during startup or cleaning) ▪ Outside the configuration performed by the user (e.g. level outside the configured range)

Diagnostic event and event text

The failure can be identified by means of the diagnostic event.



If several diagnostic events are pending at the same time, only the diagnostic message with the highest priority is displayed.

The last diagnostic message is displayed - see the LST parameter in the **DIAG** submenu → 📄 66.

9.2.2 List of diagnostic events

Diagnostic event		Cause	Remedial action
Code	Description		
0	No fault	-	-
C431 [1] in the case of an absolute pressure device.	Invalid position adjustment	The adjustment performed would cause the nominal sensor range to be exceeded or undershot.	Position adjustment + parameter of the current output must be within the sensor nominal range ▪ Check the position adjustment (see the ZRO parameter). ▪ Check the measuring range (see the STU and STL parameters).
C432 alternating with Ou1 or Ou2, depending on the switch output selected [1]	Invalid position adjustment, output 1 or 2	The adjustment performed leads to switch points being outside the sensor nominal range.	Position adjustment + parameter of the hysteresis and window function must be within the sensor nominal range ▪ Check the position adjustment (see the ZRO parameter). ▪ Check the switch point, switchback point for hysteresis and window function.
C469 alternating with Ou1 or Ou2	Switch points for output 1 or 2 violated	Switch point ≤ switchback point	Check switch points at output
C485	Simulation active	During simulation of the switch output or current output, the device issues a warning message for the duration of the simulation.	Switch off simulation.
F270 [2] [3]	Overpressure/vacuum	Overpressure or vacuum present	▪ Check the process pressure. ▪ Check the sensor range. ▪ Restart device.
	Defect in electronics/sensor	Defect in electronics/sensor	Replace device.
F437 [2]	Configuration incompatible	Invalid device configuration	▪ Restart device. ▪ Reset device. ▪ Replace device.
F804	Overload at switch output 1 or 2 or at both switch outputs	Load current > 250 mA per output [4]	Increase load resistance at switch output
		Switch output defective	▪ Check output circuit. ▪ Replace device.
S140 [2]	Sensor signal outside of permitted ranges	Overpressure or vacuum present	Operate device in the specified measuring range.
		Sensor defective	Replace device.
S510 [2]	Turn down violated	A change in the span results in a violation of the turn down (max. TD 5:1). Values for adjustment (lower range value and upper range value) are too close together.	▪ Operate device in the specified measuring range. ▪ Check the measuring range.
S803 [2]	Current loop 2	Impedance of load resistance at analog output is too high.	▪ Check the cabling and load at the current output. ▪ If the current output is not required, switch it off via the parameter configuration.

Diagnostic event		Cause	Remedial action
Code	Description		
	Current output not connected	Current output not connected	▪ Connect current output with load. ▪ If the current output is not required, switch it off via the parameter configuration.
S971	Measured value is outside sensor range	The current is outside the permitted range of 3.8 to 20.5 mA. The pressure present is outside the configured measuring range (but may be within the sensor range).	Operate the device within the set span.

1) If no remedial action is taken, the warning messages are displayed following a device restart if configuration (span, switch points and offset) is performed with a gauge pressure device and readings are > URL + 10 % or < LRL + 5 %, and if readings are > URL + 10% or < LRL
2) The switch outputs are opened and the current output adopts the configured alarm current. Therefore, faults affecting the switch output are not displayed since the switch output is in the safe state.
3) The device outputs a failure current of 0 mA if an internal communication fault occurs. In all other cases the device returns the configured failure current.
4) The device can be subject to a total maximum load current of 500 mA at the switch outputs. This load can be distributed asymmetrically between the two outputs.

9.3 Behavior of the device in the event of a failure

The device displays warnings and failures on the local display and indicates them via the status LEDs. All the device warnings and failures are for information purposes only and do not have a safety function. The faults diagnosed by the device are shown on the local display in accordance with NE107. The device reacts to the diagnostic message with either a warning or a failure. A distinction must be made between the following types of fault here:

- Warning:
  - The device continues measuring if this type of fault occurs. The output signal is not affected (exception: simulation is active).
  - The local display alternates between the warning and the main measured value.
  - The switch outputs remain in the state defined by the switch points.
  - Status LED flashes red.
  - The background remains white in the event of a warning
- Failure:
  - The device does **not** continue measuring if this type of fault occurs. The output signal adopts its fault state (value in the event of a fault - see the following section).
  - The fault state is indicated on the local display.
  - The switch outputs assume the "opened" state.
  - For the analog output option, a fault is signaled with the configured alarm current behavior.

9.4 Response of output to failures

The response of the output to error is regulated in accordance with NAMUR NE 43.

The behavior of the current output in the event of errors is defined in the following parameters:
- Alarm Current FCU "MIN": Lower alarm current (≤3.6 mA) (optional, see the following table)
- Alarm Current FCU "MAX" (factory setting): Upper alarm current (≥21 mA)
- Alarm Current FCU "HLD" (HOLD) (optional, see the following table): Last measured current value is held. When the device starts, the current output is set to "Lower alarm current" (≤3.6 mA).

- The selected alarm current is used for all errors.
- Errors and warning messages are displayed via IO-Link.
- Errors and warning messages are displayed only on the primary value page (topmost display level) and are not displayed in the operating menu.
- In the operating menu the error is only indicated by the color of the display background.
- The status LED always indicates an error.
- It is not possible to acknowledge errors and warnings. The relevant message disappears if the event is no longer pending.
- The failsafe mode can be changed directly when a device is running (see the following table).

Changing the failsafe mode	After confirming with E
from MAX to MIN	active immediately
from MIN to MAX	active immediately
from HLD (HOLD) to MAX	active immediately
from HLD (HOLD) to MIN	active immediately
from MIN to HLD (HOLD)	active outside the fault state
from MAX to HLD (HOLD)	active outside the fault state

9.4.1 Alarm current

Name	Option
Min. alarm current set	IA [1]
1 low ≤3.6 mA 2 high ≥21 mA 3 last current value	U [2]

1) Product Configurator, order code for "Service"
2) Product Configurator order code for "Calibration/unit"

9.5 Behavior of the device in the event of a voltage drop

A diagnostic message is not output. The configuration and the settings made are retained.

9.6 Behavior of the device in the event of an incorrect entry

In the case of incorrect entries, the value entered is not accepted. No failure or warning is issued in this case. The value to be adjusted cannot be changed to a value outside the specified limit. This makes it impossible to configure the device using incorrect values. An exception to this is the configuration of the measuring span, which can lead to a turndown violation and result in a fault state.

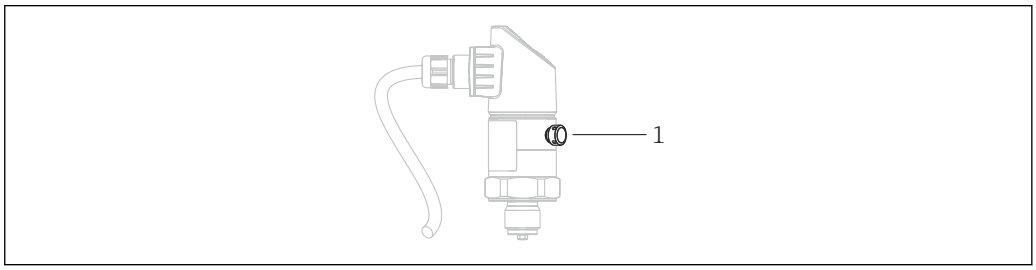
9.7 Disposal

When disposing, separate and recycle the device components based on the materials.

10 Maintenance

No special maintenance work is required.

Keep the pressure compensation element (1) free from contamination.



A0022140

10.1 Exterior cleaning

Please note the following points when cleaning the device:

- The cleaning agents used should not corrode the surface and the seals.
- Mechanical damage to the process isolating diaphragm, e.g. due to sharp objects, must be avoided.
- Observe the degree of protection of the device. See the nameplate if necessary → 14.

11 Repair

11.1 General information

11.1.1 Repair concept

Repairs are not possible.

11.2 Return

The measuring device must be returned if the wrong device has been ordered or delivered.

As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

11.3 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

12 Overview of the operating menu

Depending on the parameter configuration, not all submenus and parameters are available. Information on this can be found in the parameter description under "Prerequisite".

Switch output [1]			Level 0	Level 1	Level 2	Level 3	Description	Details
1 x PNP	2 x PNP	1 x PNP + 4 to 20 mA						
✔	✔	✔	KYL	If "KYL" is shown on the display, this means that the keys of the device are locked. To unlock the keys, see → 27				
✔	✔	✔	SP1				Switch point value, output 1	→ 35
✔	✔	✔	RP1				Switchback point value, output 1	→ 35
✔	✔	✔	FH1				Upper value for pressure window, output 1	→ 37
✔	✔	✔	FL1				Lower value for pressure window, output 1	→ 37
		✔	STL				Value for 4 mA (LRV)	→ 38
		✔	STU				Value for 20 mA (URV)	→ 38
	✔		SP2				Switch point, output 2	→ 35
	✔		RP2				Switchback point, output 2	→ 35
	✔		FH2				Upper value for pressure window, output 2	→ 37
	✔		FL2				Lower value for pressure window, output 2	→ 37
✔	✔	✔	**EF**				Extended functions	
✔	✔	✔		**RES**			Reset	→ 56
✔	✔	✔		dS1			Switching delay time, output 1	→ 56
✔	✔	✔		dR1			Switchback delay time, output 1	→ 56
	✔			dS2			Switching delay time, output 2	→ 56
	✔			dR2			Switchback delay time, output 2	→ 56
✔	✔	✔		**Ou1**			Output 1	
					HNO		NO contact for hysteresis function	→ 57
					HNC		NC contact for hysteresis function	→ 58
					FNO		NO contact for window function	→ 58
					FNC		NC contact for window function	→ 58
	✔			**Ou2**			Output 2	
					HNO		NO contact for hysteresis function	→ 57
					HNC		NC contact for hysteresis function	→ 58
					FNO		NO contact for window function	→ 58
					FNC		NC contact for window function	→ 58
		✔		**I**			Current output	
		✔			**GTL**		Pressure applied for 4mA (LRV)	→ 39
		✔			**GTU**		Pressure applied for 20mA (URV)	→ 39
		✔			**FCU**		Alarm current	→ 60
						MIN	In the event of an error: MIN (≤3.6 mA)	
						MAX	In the event of an error: MAX (≥21 mA)	
						HLD	Last current value (HOLD)	
		✔			**OFF**		Switch off the current output (only visible if switch output is "ON")	→ 60
		✔			**ON**		Switch on the current output (only visible if switch output is "OFF")	→ 61

Switch output [1]			Level 0	Level 1	Level 2	Level 3	Description	Details
1 x PNP	2 x PNP	1 x PNP + 4 to 20 mA						
✔	✔	✔		**UNI**			Unit changeover	→ 🖹 61
					BAR		Unit bar	
					KPA		Unit kPa (depends on the sensor measuring range))	
					MPA		Unit MPa (depends on the sensor measuring range)	
					PSI		Unit psi	
✔	✔	✔		HI			Max value (maximum indicator)	→ 🖹 61
✔	✔	✔		LO			Min value (minimum indicator)	→ 🖹 62
✔	✔	✔		ZRO			Zero point configuration	→ 🖹 32
✔	✔	✔		GTZ			Zero point adoption	→ 🖹 33
✔	✔	✔		TAU			Damping	→ 🖹 63
✔	✔	✔		**DIS**			Display	→ 🖹 64
✔	✔	✔			**DVA**	PV	Display measured value	→ 🖹 64
						PV',	Display the measured value as a percentage of the set span	
						SP	Display set switch point	
✔	✔	✔			**DRO**		Display measured value rotated by 180°	→ 🖹 64
✔	✔	✔			**DOF**		Display off	→ 🖹 64
✔	✔	✔		**ADM**			Administration	
					LCK		Unlocking code	→ 🖹 28
					COD		Locking code	→ 🖹 27
✔	✔	✔	**DIAG**				Diagnostics	
				STA			Current device status	→ 🖹 66
				LST			Last device status	→ 🖹 66
				RVC			Revision counter	→ 🖹 66
✔	✔	✔		**SM1**			Simulation output 1	→ 🖹 66
					OFF			
					OPN		Switch output opened	
					CLS		Switch output closed	
	✔	✔		**SM2** [2]			Simulation output 2	→ 🖹 67
	✔	✔			OFF			
	✔				OPN		Switch output opened	
	✔				CLS		Switch output closed	
		✔			3.5		Simulation value for analog output in mA	
		✔			4.0		Simulation value for analog output in mA	
		✔			8.0		Simulation value for analog output in mA	
		✔			12.0		Simulation value for analog output in mA	
		✔			16.0		Simulation value for analog output in mA	
		✔			20.0		Simulation value for analog output in mA	
		✔			21.95		Simulation value for analog output in mA	

1) The assignment of the outputs cannot be modified.
2) For devices with current output: can only be selected if the current output is switched on.

13 Description of device parameters

13.1 Switch output 1 and switch output 2

13.1.1 Hysteresis (switch point and switchback point)

SP1/SP2 switch point value, output 1/2
RP1/RP2 switchback point value, output 1/2

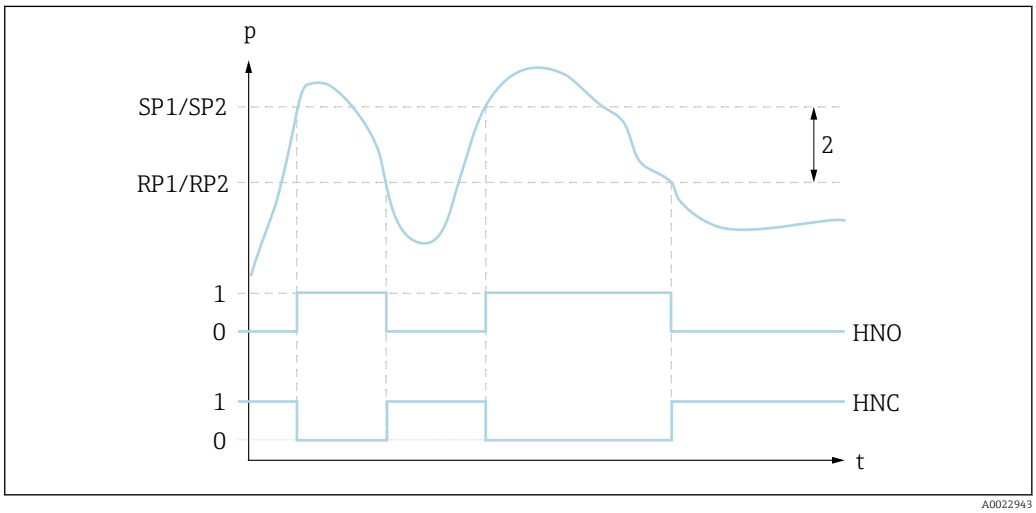
Navigation

SP1/SP2
RP1/RP2

Note

The hysteresis is implemented using the "SP1/SP2" and "RP1/RP2" parameters. Since the parameter settings depend on one another, the parameters are described all together.

- SP1 = switch output 1
- SP2 = switch output 2 (optional)
- RP1 = switchback point 1
- RP2 = switchback point 2 (optional)



3 SP1/SP2: switch point 1/2; RP1/RP2: switch-back point 1/2

0 0-signal. Output open in quiescent state.
1 1-signal. Output closed in quiescent state.
2 Hysteresis
HNO Closing
HNC NC contact

Description

The switch point "SP1/SP2" and the switchback point "RP1/RP2" can be defined with these functions (e.g. for pump control).
When the set switch point "SP1/SP2" is reached (with increasing pressure), an electrical signal change takes place at the switch output.

When the set switchback point "RP1/RP2" is reached (with decreasing pressure), an electrical signal change takes place at the switch output.
The difference between the value of the switch point "SP1/SP2" and the switchback point "RP1/RP2" is known as the hysteresis.

Prerequisite

- These functions are only available if the hysteresis function has been defined for the switch output.
- The configured value for the switch point "SP1/SP2" must be greater than the switchback point "RP1/RP2"!
  A diagnostic message is displayed if a switch point "SP1/SP2" is entered that is ≤ the switchback point "RP1/RP2". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!

Note

To prevent constant switch-on and switch-off if values are around the switch point "SP1/SP2" and switchback point "RP1/RP2", a delay can be set for the relevant points. See the parameter description for "dS1/dS2" and "dR1/dR2" for this purpose.

Options

No selection. The user is free to edit the values.

Factory setting

Factory setting (if no customer-specific setting is ordered):
Switch point SP1: 90%; switchback point RP1: 10%
Switch point SP2: 95 %; switchback point RP2: 15 %

13.1.2 Window function

- SP1 = switch output 1
- SP2 = switch output 2 (optional)

FH1/FH2 Upper value for pressure window, output 1/2
FL1/FL2 Lower value for pressure window, output 1/2

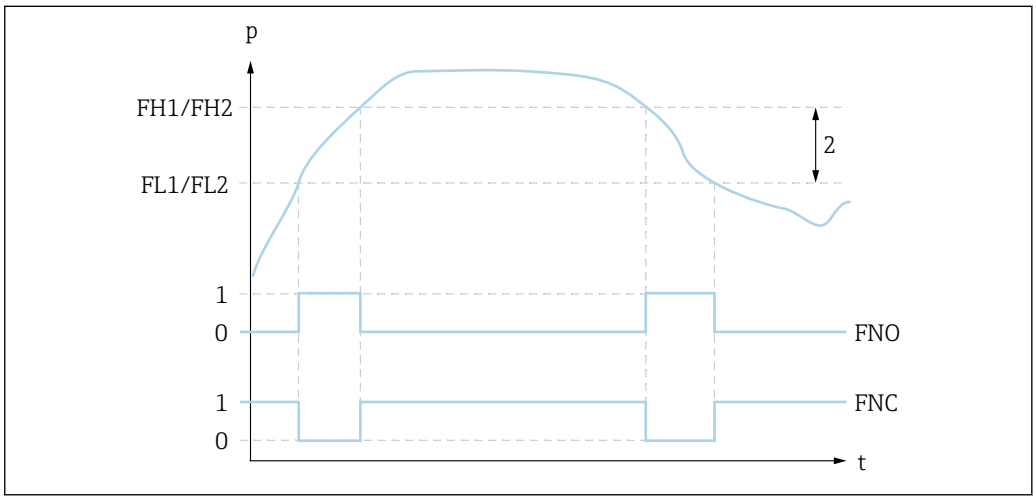
Navigation

FH1/FH2
FL1/FL2

Note

The window function is implemented using the "FH1/FH2" and "FL1/FL2" parameters. Since the parameter settings depend on one another, the parameters are described all together.

- FH1 = Upper value of pressure window 1
- FH2 = Upper value of pressure window 2 (optional)
- FL1 = Lower value of pressure window 1
- FL2 = Lower value of pressure window 2 (optional)



4 *FH1/FH2: upper value of pressure window; FL1/FL2: lower value of pressure window*

0 0-signal. Output open in quiescent state.
1 1-signal. Output closed in quiescent state.
2 Pressure window (difference between the value of the high window "FH1/FH2" and the low window "FL1/FL2")
FNO Closing
FNC NC contact

Description

The upper value of the pressure window "FH1/FH2" and the lower value of the pressure window "FL1/FL2" can be defined with these functions (e.g. for monitoring a certain pressure range).
When the lower value of the pressure window "FL1/FL2" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output.

When the upper value of the pressure window "FH1/FH2" is reached (with increasing or decreasing pressure), an electrical signal change takes place at the switch output.
The difference between the upper value of the pressure window "FH1/FH2" and the lower value of the pressure window "FL1/FL2" is known as the pressure window.

Prerequisite

- This function is only available if the window function has been defined for the switch output.
- The upper value of the pressure window "FH1/FH2" must be greater than the lower value of the pressure window "FL1/FL2"!
  A diagnostic message is displayed if the upper value entered for the pressure window "FH1/FH2" is smaller than the lower value of the pressure window "FL1/FL2". While it is possible to make this entry, it does not take effect in the device. The entry must be corrected!

Note

To prevent constant switch-on and switch-off if values are around the switch point "SP1/SP2" and switchback point "RP1/RP2", a delay can be set for the relevant points. See the parameter description for "dS1/dS2" and "dR1/dR2" for this purpose.

Options

No selection. The user is free to edit the values.

Factory setting

Factory setting if no customer-specific setting is ordered:
Switch point FH1: 90 %; switchback point FL1: 10 %
Switch point FH2: 95 %; switchback point FH2: 15 %

13.2 Current output

STL value for 4 mA (LRV)

Navigation	STL
Description	Assignment of the pressure value which should correspond to the 4 mA value. It is possible to invert the current output. To do so, assign the pressure upper range value to the lower measuring current.
Prerequisite	Electronic version with current output
Note	Enter the value for 4 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).
Selection	No selection. The user is free to edit the values.
Factory setting	0.0 or as per order specifications

STU value for 20 mA (URV)

Navigation	STU
Description	Assignment of the pressure value which should correspond to the 20 mA value. It is possible to invert the current output. To do so, assign the pressure lower range value to the upper measuring current.
Prerequisite	Electronic version with current output
Note	Enter the value for 20 mA in the selected pressure unit anywhere within the measuring range. The value can be entered in increments of 0.1 (increment depends on the measuring range).
Selection	No selection. The user is free to edit the values.
Factory setting	Upper measuring limit or as per order specifications.

13.3 EF menu (extended functions)

RES Reset

Navigation
EF → RES

Description

⚠ WARNING

Confirming the reset by selecting "YES" causes an immediate device reset to the factory settings of the order configuration.
If the factory settings have been changed, downstream processes might be affected following a reset (the behavior of the switch output or current output might be changed).
► Make sure that downstream processes are not started unintentionally.

To carry out a reset, you must answer the query with "Yes". The reset is not subject to additional locking, such as in the form of device locking. The reset also depends on the device status.
Any customer-specific configuration carried out at the factory is not affected by a reset (customer-specific configuration remains).

The following parameters are **not** reset when a reset is performed:
- LO (Min value (minimum indicator))
- HI (Max value (maximum indicator))
- LST (Last device status)
- RVC (Revision counter)

A reset to the factory settings also includes the locking code configured in the "COD" parameter. The locking code is reset to "0000".

Value at switch-on
NO

Note
Must be actively changed to "YES".
The last error is not reset in a reset.

Options
- NO
- YES

Factory setting
NO

dS1/dS2 switching delay time, output 1/2
dR1/dR2 switchback delay time, output 1/2

Note
The switch delay time/switchback delay time function is implemented using the "dS1/dS2" and "dR1/dR2" parameters. Since the parameter settings depend on one another, the parameters are described all together.

- dS1 = switching delay time, output 1
- dS2 = switching delay time, output 2
- dR1 = switchback delay time, output 1
- dR2 = switchback delay time, output 2

Navigation
EF → dS1/dS2
EF→ dR1/dR2

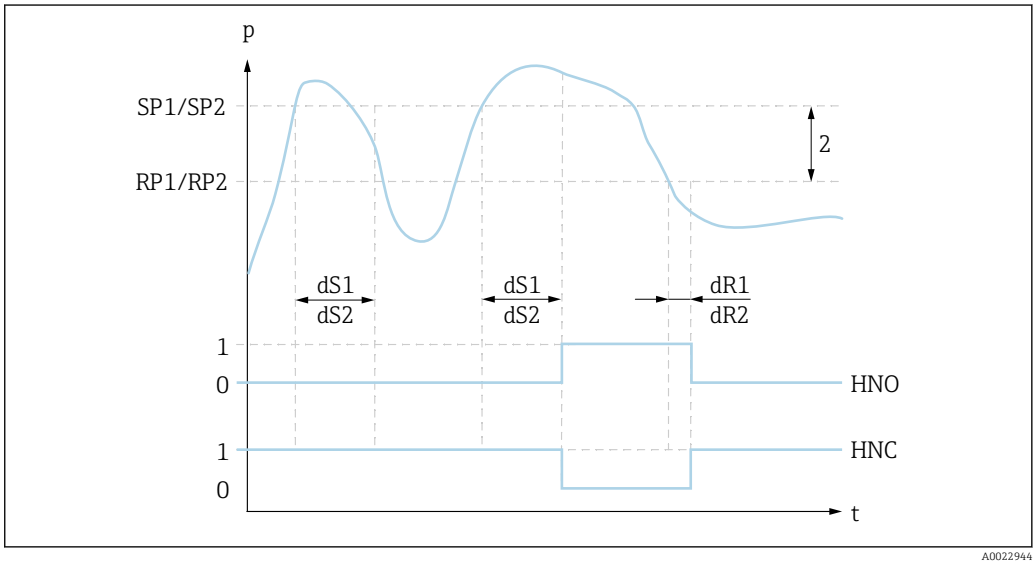
Description

To prevent constant switch-on and switch-off if values are around the switch point "SP1/SP2" or the switchback point "RP1/RP2", a delay in a range of 0 – 50 seconds, to two decimal places, can be set for the individual points.
If the measured value leaves the switching range during the delay time, the delay time starts again from scratch.

Example

- SP1/SP2 = 2 bar (29 psi)
- RP1/RP2 = 1 bar (14.5 psi)
- dS1/dS2 = 5 seconds
- dR1/dR2 = 2 seconds

dS1/dS2: ≥2 bar (29 psi) must be present for at least 5 seconds for SP1/SP2 to become active.
dR1/dR2: ≤1 bar (14.5 psi) must be present for at least 2 seconds for RP1/RP2 to become active.



0 0-signal. Output open in quiescent state.
1 1-signal. Output closed in quiescent state.
2 Hysteresis (difference between the value of the switch point "SP1/SP2" and the value of the switchback point "RP1/SP2")
HNO Closing
HNC NC contact
SP1/ Switch point 1/2
SP2
RP1/ Switchback point 1/2
RP2
dS1/ Set time for which the specific switch point must be reached continuously without interruption until an
dS2 electrical signal change takes place.
dR1/ Set time for which the specific switchback point must be reached continuously without interruption until an
dR2 electrical signal change takes place.

Value at switch-on

0

Input range

0.00 - 50.00 seconds

Factory setting

0

HNO NO contact for hysteresis function

Navigation EF → Ou1 → HNO
EF → Ou2 → HNO

Description If this parameter is selected, the switch output is defined as an NO contact with a hysteresis property.
Navigate to the parameter and press the E key.

Factory setting The switch output is opened in the quiescent state (not actuated) and returns a "0" signal.

HNC NC contact for hysteresis function

Navigation EF → Ou1 → HNC
EF → Ou2 → HNC

Description If this parameter is selected, the switch output is defined as an NC contact with a hysteresis property.
Navigate to the parameter and press the E key.

Factory setting The switch output is closed in the quiescent state (not actuated) and returns a "1" signal.

FNO NO contact for window function

Navigation EF → Ou1 → FNO
EF → Ou2 → FNO

Description If this parameter is selected, the switch output is defined as an NO contact with a window property.
Navigate to the parameter and press the E key.

Factory setting The switch output is opened in the quiescent state (not actuated) and returns a "0" signal.

FNC NC contact for window function

Navigation EF → Ou1 → FNC
EF → Ou2 → FNC

Description If this parameter is selected, the switch output is defined as an NC contact with a window property.
Navigate to the parameter and press the E key.

Factory setting The switch output is closed in the quiescent state (not actuated) and returns a "1" signal.

GTL Pressure applied for 4mA (LRV)

Navigation EF → I → GTL

Description The pressure value present is automatically adopted for the 4 mA current signal.
Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current.
The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant.
The LRV and URV pressure measuring span can be edited over the entire sensor range.
An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431.
The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits.
If the entry is not OK, it is rejected, the message "FAIL" appears on the local display and the last valid value before the change is used again.
The measured value currently present is accepted as the value for 4mA anywhere within the measuring range.
There is a parallel shift of the sensor characteristic so that the pressure present becomes the zero value.

Selection
- NO
- YES

Factory setting NO

GTU Pressure applied for 20 mA (URV)

Navigation EF → I → GTU

Description The pressure value present is automatically adopted for the 20 mA current signal.
Parameter for which the current range can be assigned to any section of the nominal range. This occurs by assigning the pressure lower range value to the lower measuring current and the pressure upper range value to the upper measuring current.
The pressure lower range value and upper range value can be configured independently of one another so the pressure measuring span does not remain constant.
The LRV and URV pressure measuring span can be edited over the entire sensor range.
An invalid TD value is indicated by diagnostic message S510. An invalid position offset is indicated by diagnostic message C431.
The editing operation cannot result in the device being operated outside the minimum and maximum sensor limits.
If the entry is not OK, it is rejected, the message "FAIL" appears on the local display and the last valid value before the change is used again.
The measured value currently present is accepted as the value for 20 mA anywhere within the measuring range.
There is a parallel shift of the sensor characteristic so that the pressure present becomes the max value.

Selection
- NO
- YES

Factory setting NO

FCU Alarm current

Navigation EF → FCU

Description The device displays warnings and faults. This is done on the local display via the diagnostic message stored in the device. The purpose of all device diagnostics is solely to provide information to the user; they do not have a safety function. The errors diagnosed by the Ceraphant are shown on the display in accordance with NE107. In accordance with the diagnostic message, the device behaves as per a warning or fault condition:
Warning (S971, S140, C485, C431, C432):
With this type of error, the device continues to measure. The output signal does not adopt its fault state (value in the event of an error). The local display alternates (0.5 Hz) between the main measured value and the state in the form of the letter plus a defined number. The switch outputs remain in the state defined by the switch points. The status LED flashes red in addition to the display output.
Fault (F437, S803, F270, S510, C469, F804):
With this type of error, the device does not continue to measure. The output signal adopts its fault state (value in the event of an error). The fault state is shown on the local display in the form of the letter plus a defined number. For a device with 2 outputs, the display alternates (0.5 Hz) between the error and the respective channel assignment (OuX) (exception F804). The switch outputs assume the defined state (open). For the analog output option, an error is also signaled and transmitted via the 4 to 20mA signal. In NE43, NAMUR defines a current ≤3.6 mA and ≥21 mA as a device failure. A corresponding diagnostic message is displayed. Current levels available for selection:
The selected alarm current is used for all errors. Diagnostic messages are displayed only on the primary value page (topmost display level) with digits and a letter and not in the operating menu – only the display color and LED provide an indication here. It is not possible to acknowledge all the diagnostic messages. The relevant message disappears if the event is no longer pending.

The messages are displayed in order of priority:
- Highest priority = first message displayed
- Lowest priority = last message displayed

Options
- MIN: Lower alarm current (≤3.6 mA)
- MAX: Upper alarm current (≥21 mA)
- HLD (HOLD): Last measured current value is held. When the device starts, the current output is set to "Lower alarm current" (≤3.6 mA. If error S803 or S510 has occurred, the device always outputs a MIN failure current ≤3.6 mA irrespective of the configuration. If error S803 occurs during a device restart, the device switches briefly to the measuring mode and by doing so displays the HLD value of the process pressure present and does not output ≤3.6 mA.

Factory setting MAX

OFF Switch off current output

Navigation EF → I → OFF

Description Switches off the current output.

Prerequisite Is only displayed if the current output is switched on.

Selection
- NO (current output remains switched on)
- YES (current output is switched off)

Factory setting NO

ON Switch on current output

Navigation EF → I → ON

Description Switches on the current output.

Prerequisite Is only displayed if the current output is switched off.

Selection
- NO (current output remains switched off)
- YES (current output is switched on)

Factory setting NO

UNI unit changeover

Navigation EF → UNI

Description Select the pressure engineering unit. If a new pressure engineering unit is selected, all pressure-specific parameters are converted and displayed with the new unit.

Value at switch-on Depends on order specifications.

Selection
- BAR (bar)
- KPA (kPa) (depends on the sensor measuring range)
- MPA (Mpa) (depends on the sensor measuring range)
- PSI (psi)

Factory setting Depends on order specifications.

HI Max value (maximum indicator)

Navigation EF → HI

Description This parameter (also known as the maximum indicator) makes it possible to call up retroactively the highest value ever measured for pressure.
A pressure that is present for at least 2.5 ms is logged to the maximum indicator.
The maximum indicators cannot be reset.

LO Min value (minimum indicator)

Navigation EF → LO

Description This parameter (also known as the minimum indicator) makes it possible to call up retroactively the lowest value ever measured for pressure.
A pressure that is present for at least 2.5 ms is logged to the maximum indicator.
The maximum indicators cannot be reset.

ZRO manual position adjustment (typically for absolute pressure sensor)

Navigation EF → ZRO

Description The pressure resulting from the orientation of the device can be corrected here.
The pressure difference between zero (set point) and the measured pressure must be known.

Prerequisite An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The set value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function.
Maximum offset value = ± 20 % of the sensor nominal range.
If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and shown on the display. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration.

The sensor can
- be operated in a physically unfavorable range, i.e. outside its specifications, or
- be operated by making appropriate corrections to the offset or span.

Raw measured value − (manual offset) = display value (measured value)

Example
- Measured value = 2.2 mbar (0.033 psi)
- Set the measured value in the parameter to 2.2.
- Measured value (after position adjustment) = 0.0 mbar
- The current value is also corrected.

Note Setting in increments of 0.1. As the value is entered numerically, the increment depends on the measuring range

Options No selection. The user is free to edit the values.

Factory setting 0

GTZ automatic position adjustment (typically for gauge pressure sensor)

Navigation EF → GTZ

Description

The pressure resulting from the orientation of the device can be corrected here.
The pressure difference between zero (set point) and the measured pressure need not be known.

Prerequisite

An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The set value of the parameter is subtracted from the "raw measured value". The requirement to be able to perform a zero point shift without changing the span is met with the offset function.
Maximum offset value = ± 20 % of the sensor nominal range.
If an offset value is entered that shifts the span beyond the physical limits of the sensor, the value is admitted but a warning message is generated and shown on the display. The warning message only disappears when the span is within the sensor limits, taking the offset value currently configured into consideration.

The sensor can
- be operated in a physically unfavorable range, i.e. outside its specifications, or
- be operated by making appropriate corrections to the offset or span.

Raw measured value − (manual offset) = display value (measured value)

Example 1

- Measured value = 2.2 mbar (0.033 psi)
- You use the "GTZ" parameter to correct the measured value with the value, e.g. 2.2 mbar (0.033 psi). This means that you are assigning the value 0 mbar (0 psi) to the pressure present.
- Measured value (after pos. zero adjust) = 0 mbar (0 psi)
- The current value is also corrected.
- If necessary, check and correct switch points and span settings.

Example 2

Sensor measuring range: −0.4 to +0.4 bar (−6 to +6 psi) (SP1 = 0.4 bar (6 psi); STU = 0.4 bar (6 psi))
- Measured value = 0.08 bar (1.2 psi)
- You use the "GTZ" parameter to correct the measured value with the value, e.g. 0.08 bar (1.2 psi). This means that you are assigning the value 0 mbar (0 psi) to the pressure present.
- Measured value (after pos. zero adjust) = 0 mbar (0 psi)
- The current value is also corrected.
- Warnings C431 or C432 appear because the value 0 bar (0 psi) was assigned to the real value of 0.08 bar (1.2 psi) present and the sensor measuring range was thus exceeded by ± 20%.
  SP1 and STU values must be readjusted downwards by 0.08 bar (1.2 psi).

Factory setting

0.0

TAU damping

Navigation

EF → TAU

Description

The damping affects the speed at which the measured value reacts to changes in pressure. Damping causes a change in the current value in the "HLD" (HOLD) error current mode.

Input range

0.0 to 999.9 seconds in increments of 0.1 seconds

Factory setting

2 seconds

DVA Measured value display

Navigation EF → DIS → DVA

Description Configuration of the measured value display and display of the configured switch point.

Selection
- PV = display measured value
- PV,/' = display measured value as a percent (only for devices with a current output)
  - 0% is equivalent to LRV
  - 100% is equivalent to URV
- SP = display set switch point

Factory setting PV
PV,/' (only for devices with a current output)

DRO Display measured value rotated by 180°

Navigation EF → DIS → DRO

Description Use this function to rotate the measured value display by 180°.

Selection
- NO
- YES

DOF Switch display on or off

Navigation EF → DIS → DOF

Description Use this function to switch the display on or off.
When the user exits the menu, a 30 second delay elapses until the display (including the back-lighting) switches off.

Selection
- NO
- YES

LCK unlocking code

Navigation Display: EF → ADM → LCK
IO-Link: EF → ADM → LCK

Description The device is unlocked by entering the code defined in COD.

Input range 0000-9999

Note If parameters are locked, the word "LCK" appears on the local display as soon as an attempt is made to change a parameter. Locking is enabled again after 60 seconds in the measured value display and following a device restart.

COD locking code

Navigation Display: EF → ADM → COD
IO-Link: EF → ADM → COD

Description A code can be entered to protect parameter settings against unauthorized and unwanted access.

Input range 0000: Device is permanently unlocked
0001-9999: Device is locked

Factory setting 0000

Note Locking is enabled after 60 seconds in the measured value display and following a device restart.

13.4 DIAG menu (diagnosis)

STA Current device status

Navigation DIAG → STA

Description Displays the current device status.

LST Last device status

Navigation DIAG → LST

Description Displays the last device status (error or warning) which has been rectified during operation.

RVC Revision counter

Navigation DIAG → RVC

Description Counter that indicates the number of parameter changes.

SM1 Simulation output 1

Navigation DIAG → SM1

Description Switch output simulation.
If a simulation is active, a warning to this effect is displayed so that it is obvious to the user that the device is in the simulation mode. A visual warning is indicated on the local display (C485 - Simulation Active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and then power is resupplied afterwards, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.

Selection
- OFF
- OPN (switch output open)
- CLS (switch output closed)

SM2 Simulation output 2 (for devices with a 4 to 20 mA current output)

Navigation DIAG → SM2

Description

Analog output simulation.
If a simulation is active, a warning to this effect is displayed so that it is obvious to the user that the device is in the simulation mode. A visual warning is indicated on the local display (C485 - Simulation Active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and then power is resupplied afterwards, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.

Selection

- OFF
- 3.5
- 4
- 8
- 12
- 16
- 20
- 21.95

SM2 Simulation output 2 (for devices with 2 switch outputs)

Navigation

DIAG → SM2

Description

Switch output simulation.
If a simulation is active, a warning to this effect is displayed so that it is obvious to the user that the device is in the simulation mode. A visual warning is indicated on the local display (C485 - Simulation Active). The simulation must be ended actively via the menu. If the device is disconnected from the power supply during the simulation and then power is resupplied afterwards, the simulation mode is not resumed, and instead the device continues operation in the measuring mode.

Selection

- OFF
- OPN (switch output open)
- CLS (switch output closed)

14 Accessories

14.1 Weld-in adapter

Various weld-in adapters are available for installation in vessels or pipes.

Device	Description	Option [1]	Order number
PTP33B	Weld-in adapter M24, d=65, 316L	PM	71041381
PTP33B	Weld-in adapter M24, d=65, 316L 3.1 EN10204-3.1 material, inspection certificate	PN	71041383
PTP31B	Weld-in adapter G½, 316L	QA	52002643
PTP31B	Weld-in adapter G½, 316L 3.1 EN10204-3.1 material, inspection certificate	QB	52010172
PTP31B	Weld-in tool adapter G½, brass	QC	52005082
PTP33B	Weld-in adapter G1, 316L, conical metal joint	QE	52005087
PTP33B	Weld-in adapter G1, 316L, 3.1, conical metal joint, EN10204-3.1 material, inspection certificate	QF	52010171
PTP33B	Weld-in tool adapter G1, brass	QG	52005272
PTP33B	Weld-in adapter G1, 316L, silicone O-ring seal	QJ	52001051
PTP33B	Weld-in adapter G1, 316L, 3.1, silicone O-ring seal, EN10204-3.1 material, inspection certificate	QK	52011896

1) Product Configurator, order code for "Accessory enclosed"

If installed horizontally and weld-in adapters with a leakage hole are used, ensure that the leakage hole is pointing down. This allows leaks to be detected as quickly as possible.

14.2 Process adapter M24

The following process adapters can be ordered for the process connections with order option X2J and X3J:

Device	Description	Order number	Order number with inspection certificate 3.1 EN10204
PTP33B	Varivent F DN32 PN40	52023996	52024003
PTP33B	Varivent N DN50 PN40	52023997	52024004
PTP33B	DIN11851 DN40	52023999	52024006
PTP33B	DIN11851 DN50	52023998	52024005
PTP33B	SMS 1½"	52026997	52026999
PTP33B	Clamp 1½"	52023994	52024001
PTP33B	Clamp 2"	52023995	52024002
PTP33B	APV Inline	52024000	52024007

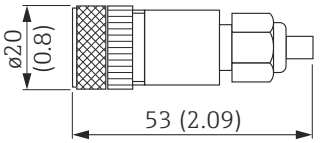
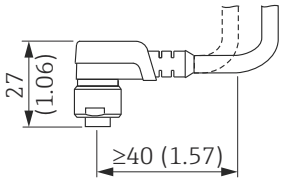
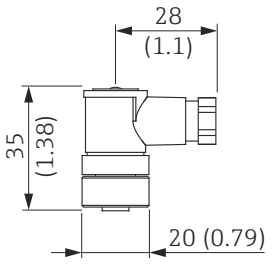
14.3 Flush mount pipe connections M24

Device	Description	Option [1]
PTP33B	Pipe connection DN25 DIN11866, weld-in, flush mount, for devices with M24 connection	QS
PTP33B	Pipe connection DN25 DIN11866, Clamp DIN32676, flush mount, for devices with M24 connection	QT

Device	Description	Option [1]
PTP33B	Pipe connection DN32 DIN11866, weld-in, flush mount, for devices with M24 connection	QU
PTP33B	Pipe connection DN32 DIN11866, Clamp DIN32676, flush mount, for devices with M24 connection	QV
PTP33B	Pipe connection DN40 DIN11866, weld-in, flush mount, for devices with M24 connection	QW
PTP33B	Pipe connection DN40 DIN11866, Clamp DIN32676, flush mount, for devices with M24 connection	QX
PTP33B	Pipe connection DN50 DIN11866, weld-in, flush mount, for devices with M24 connection	QY
PTP33B	Pipe connection DN50 DIN11866, Clamp DIN32676, flush mount, for devices with M24 connection	QZ

1) Product Configurator, order code for "Accessory enclosed"

14.4 M12 plug-in jack

Plug	Degree of protection	Material	Option [1]	Order number
M12 (self-terminated connection at M12 plug) 	IP67	▪ Union nut: Cu Sn/Ni ▪ Body: PBT ▪ Seal: NBR	R1	52006263
M12 90 degrees with 5m (16 ft) cable 	IP67	▪ Union nut: GD Zn/Ni ▪ Body: PUR ▪ Cable: PVC Cable colors ▪ 1 = BN = brown ▪ 2 = WT = white ▪ 3 = BU = blue ▪ 4 = BK = black	RZ	52010285
M12 90 degrees (self-terminated connection at M12 plug) 	IP67	▪ Union nut: GD Zn/Ni ▪ Body: PBT ▪ Seal: NBR	RM	71114212

1) Product Configurator, order code for "Accessory enclosed"

15 Technical data

15.1 Input

15.1.1 Measured variable

Measured process variable

- Gauge and absolute pressure and hygienic applications
- Gauge pressure and absolute pressure

Calculated process variable

Pressure

15.1.2 Measuring range

Ceramic process membrane

Devices for gauge pressure measurement

Sensor	Device	Maximum sensor measuring range		Smallest calibratable span [1]	MWP	OPL	Factory settings [2]	Option [3]
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]		
100 mbar (1.5 psi) [4]	PTC31B	−0.1 to −1.5	+0.1 (+1.5)	0.02 (0.3)	2.7 (40.5)	4 (60)	0 to 100 mbar (0 to 1.5 psi)	1C
250 mbar (4 psi) [5]	PTC31B	−0.25 (−4)	+0.25 (+4)	0.05 (1)	3.3 (49.5)	5 (75)	0 to 250 mbar (0 to 4 psi)	1E
400 mbar (6 psi) [6]	PTC31B	−0.4 (−6)	+0.4 (+6)	0.08 (1.2)	5.3 (79.5)	8 (120)	0 to 400 mbar (0 to 6 psi)	1F
1 bar (15 psi) [6]	PTC31B	−1 (−15)	+1 (+15)	0.2 (3)	6.7 (100.5)	10 (150)	0 to 1 bar (0 to 15 psi)	1H
2 bar (30 psi) [6]	PTC31B	−1 (−15)	+2 (+30)	0.4 (6)	12 (180)	18 (270)	0 to 2 bar (0 to 30 psi)	1K
4 bar (60 psi) [6]	PTC31B	−1 (−15)	+4 (+60)	0.8 (12)	16.7 (250.5)	25 (375)	0 to 4 bar (0 to 60 psi)	1M
10 bar (150 psi) [6]	PTC31B	−1 (−15)	+10 (+150)	2 (30)	26.7 (400.5)	40 (600)	0 to 10 bar (0 to 150 psi)	1P
40 bar (600 psi) [6]	PTC31B	−1 (−15)	+40 (+600)	8 (120)	40 (600)	60 (900)	0 to 40 bar (0 to 600 psi)	1S

1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.
2) Other measuring ranges (e.g.−1 to +5 bar (−15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option "U"). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV
3) Product Configurator, order code for "Sensor range"
4) Vacuum resistance: 0.7 bar (10.5 psi) abs.
5) Vacuum resistance: 0.5 bar (7.5 psi) abs.
6) Vacuum resistance: 0 bar (0 psi) abs.

Devices for absolute pressure measurement

Sensor	Device	Maximum sensor measuring range		Smallest calibratable span [1]	MWP	OPL	Factory settings [2]	Option [3]
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]		
100 mbar (1.5 psi)	PTC31B	0	+0.1 (+1.5)	0.1 (1.5)	2.7 (40.5)	4 (60)	0 to 100 mbar (0 to 1.5 psi)	2C
250 mbar (4 psi)	PTC31B	0	+0.25 (+4)	0.25 (4)	3.3 (49.5)	5 (75)	0 to 250 mbar (0 to 4 psi)	2E
400 mbar (6 psi)	PTC31B	0	+0.4 (+6)	0.4 (6)	5.3 (79.5)	8 (120)	0 to 400 mbar (0 to 6 psi)	2F
1 bar (15 psi)	PTC31B	0	+1 (+15)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 1 bar (0 to 15 psi)	2H
2 bar (30 psi)	PTC31B	0	+2 (+30)	0.4 (6)	12 (180)	18 (270)	0 to 2 bar (0 to 30 psi)	2K
4 bar (60 psi)	PTC31B	0	+4 (+60)	0.8 (12)	16.7 (250.5)	25 (375)	0 to 4 bar (0 to 60 psi)	2M
10 bar (150 psi)	PTC31B	0	+10 (+150)	2 (30)	26.7 (400.5)	40 (600)	0 to 10 bar (0 to 150 psi)	2P
40 bar (600 psi)	PTC31B	0	+40 (+600)	8 (120)	40 (600)	60 (900)	0 to 40 bar (0 to 600 psi)	2S

1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.
2) Other measuring ranges (e.g.–1 to +5 bar (–15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option "U"). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV
3) Product Configurator, order code for "Sensor range"

Maximum turn down which can be ordered for absolute pressure and gauge pressure sensors

Devices for gauge pressure measurement
- 6 bar (90 psi), 16 bar (240 psi), 25 bar (375 psi): TD 1:1 to TD 2.5:1
- All other measuring ranges: TD 1:1 to TD 5:1

Devices for absolute pressure measurement
- 100 mbar (1.5 psi), 250 mbar (4 psi), 400 mbar (6 psi): TD 1:1
- 1 bar (15 psi): TD 1:1 to TD 2.5:1
- All other measuring ranges: TD 1:1 to TD 5:1

Metallic process membrane

Devices with gauge pressure measurement

Sensor	Device	Maximum sensor measuring range		Smallest calibratable span [1]	MWP	OPL	Factory settings [2]	Option [3]
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]		
400 mbar (6 psi) [4]	PTP31B PTP33B	−0.4 (−6)	+0.4 (+6)	0.4 (6)	1 (15)	1.6 (24)	0 to 400 mbar (0 to 6 psi)	1F
1 bar (15 psi) [4]	PTP31B PTP33B	−1 (−15)	+1 (+15)	0.4 (6)	2.7 (40.5)	4 (60)	0 to 1 bar (0 to 15 psi)	1H
2 bar (30 psi) [4]	PTP31B PTP33B	−1 (−15)	+2 (+30)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 2 bar (0 to 30 psi)	1K
4 bar (60 psi) [4]	PTP31B PTP33B	−1 (−15)	+4 (+60)	0.8 (12)	10.7 (160.5)	16 (240)	0 to 4 bar (0 to 60 psi)	1M
10 bar (150 psi) [4]	PTP31B PTP33B	−1 (−15)	+10 (+150)	2 (30)	25 (375)	40 (600)	0 to 10 bar (0 to 150 psi)	1P
40 bar (600 psi) [4]	PTP31B PTP33B	−1 (−15)	+40 (+600)	8 (120)	100 (1500)	160 (2400)	0 to 40 bar (0 to 600 psi)	1S
100 bar (1 500 psi) [4]	PTP31B	−1 (−15)	+100 (+1500)	20 (300)	100 (1500)	160 (2400)	0 to 100 bar (0 to 1 500 psi)	1U
400 bar (6 000 psi) [4]	PTP31B	−1 (−15)	+400 (+6000)	80 (1200)	400 (6000)	600 (9000)	0 to 400 bar (0 to 6 000 psi)	1W

1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.
2) Other measuring ranges (e.g.−1 to +5 bar (−15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option "U"). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV
3) Product Configurator, order code for "Sensor range"
4) Vacuum resistance: 0.01 bar (0.145 psi) abs.

Devices with absolute pressure measurement

Sensor	Device	Maximum sensor measuring range		Smallest calibratable span [1]	MWP	OPL	Factory settings [2]	Option [3]
		lower (LRL)	upper (URL)					
		[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]	[bar (psi)]		
400 mbar (6 psi)	PTP31B PTP33B	0 (0)	0.4 (+6)	0.4 (6)	1 (15)	1.6 (24)	0 to 400 mbar (0 to 6 psi)	2F
1 bar (15 psi)	PTP31B PTP33B	0 (0)	1 (+15)	0.4 (6)	2.7 (40.5)	4 (60)	0 to 1 bar (0 to 15 psi)	2H
2 bar (30 psi)	PTP31B PTP33B	0 (0)	2 (+30)	0.4 (6)	6.7 (100.5)	10 (150)	0 to 2 bar (0 to 30 psi)	2K
4 bar (60 psi)	PTP31B PTP33B	0 (0)	4 (+60)	0.8 (12)	10.7 (160.5)	16 (240)	0 to 4 bar (0 to 60 psi)	2M
10 bar (150 psi)	PTP31B PTP33B	0 (0)	10 (+150)	2 (30)	25 (375)	40 (600)	0 to 10 bar (0 to 150 psi)	2P
40 bar (600 psi)	PTP31B PTP33B	0 (0)	+40 (+600)	8 (120)	100 (1500)	160 (2400)	0 to 40 bar (0 to 600 psi)	2S
100 bar (1 500 psi)	PTP31B	0 (0)	+100 (+1500)	20 (300)	100 (1500)	160 (2400)	0 to 100 bar (0 to 1 500 psi)	2U
400 bar (6 000 psi)	PTP31B	0 (0)	+400 (+6000)	80 (1200)	400 (6000)	600 (9000)	0 to 400 bar (0 to 6 000 psi)	2W

1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.
2) Other measuring ranges (e.g.−1 to +5 bar (−15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option "U"). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV
3) Product Configurator, order code for "Sensor range"

Maximum turn down which can be ordered for absolute pressure and gauge pressure sensors

Ranges 0.5%/0.3%: TD 1:1 to TD 5:1

15.2 Output

15.2.1 Output signal

Description	Option [1]
PNP switch output + 4 to 20 mA output (4-wire) IO-Link (SSP Ed.2 V1.1)	A
2 x PNP switch output (4-wire) IO-Link (SSP Ed.2 V1.1)	B
PNP switch output (3-wire)	4
PNP switch output + 4 to 20 mA output (4-wire), IO-Link	7
2 x PNP switch output (4-wire), IO-Link	8

1) Product Configurator, order code for "Output"

15.2.2 Range of adjustment

- Switch output
  Switch point (SP): 0.5 to 100 % in increments of 0.1% (min. 1 mbar * (0.015 psi)) of the upper range limit (URL) switchback point (RSP): 0 to 99.5% in increments of 0.1% (min. 1 mbar * (0.015 psi)) of the upper range limit (URL)
  Minimum distance between SP and RSP: 0.5 % URL
- Analog output (if available)
  Lower range value (LRV) and upper range value (URV) can be set anywhere within the sensor range (LRL - URL). Turn down for analog output up to 5:1 of upper sensor limit (URL).
- Factory setting (if no customer-specific setting is ordered):
  Switch point SP1: 90 %; switchback point RP1: 10 %;
  Switch point SP2: 95 %; switchback point RP2: 15 %;
  Analog output: LRV 0 %; URV 100 %

* For measuring ranges with a negative gauge pressure up to 4 bar (60 psi), the increment when setting the switch point is min. 10 mbar (0.15 psi)

15.2.3 Relay switching capacity

- Switch state ON: $I_a \leq 250$ mA; switch state OFF: $I_a \leq 1$ mA
- Switch cycles: >10,000,000
- Voltage drop PNP: ≤2 V
- Overload protection: Automatic load testing of switching current;
  - Max. capacitance load: 14 µF at max. supply voltage (without resistive load)
  - Max. cycle duration: 0.5 s; min. t_{on}: 4 ms
  - Periodic disconnection from protective circuit in the event of overcurrent (f = 2 Hz) and "F804" displayed

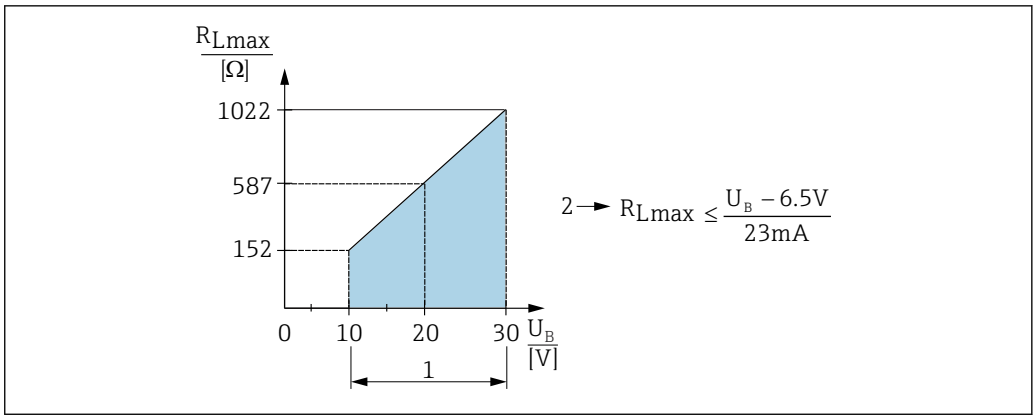
15.2.4 Signal range 4 to 20 mA

3.8 to 20.5 mA

15.2.5 Load (for devices with analog output)

In order to guarantee sufficient terminal voltage, a maximum load resistance R_L (including line resistance) must not be exceeded depending on the supply voltage U_B of the supply unit.

The maximum load resistance depends on the terminal voltage and is calculated according to the following formula:



1 Power supply 10 to 30 V DC
2 R_{Lmax} maximum load resistance
U_B Supply voltage

If load is too great:
- failure current is output and "S803" displayed (output: MIN alarm current)
- Periodic checking to establish if it is possible to quit fault state
- In order to guarantee sufficient terminal voltage, a maximum load resistance RL (including line resistance) must not be exceeded depending on the supply voltage UB of the supply unit.

15.2.6 Signal on alarm 4 to 20 mA

The response of the output to error is regulated in accordance with NAMUR NE 43.

The behavior of the current output in the event of errors is defined in the following parameters:
- Alarm Current FCU "MIN": Lower alarm current (≤3.6 mA) (optional, see the following table)
- Alarm Current FCU "MAX" (factory setting): Upper alarm current (≥21 mA)
- Alarm Current FCU "HLD" (HOLD) (optional, see the following table): Last measured current value is held. When the device starts, the current output is set to "Lower alarm current" (≤3.6 mA).

- The selected alarm current is used for all errors.
- Errors and warning messages are displayed via IO-Link.
- Errors and warning messages are displayed only on the primary value page (topmost display level) and are not displayed in the operating menu.
- In the operating menu the error is only indicated by the color of the display background.
- The status LED always indicates an error.
- It is not possible to acknowledge errors and warnings. The relevant message disappears if the event is no longer pending.
- The failsafe mode can be changed directly when a device is running (see the following table).

Changing the failsafe mode	After confirming with E
from MAX to MIN	active immediately
from MIN to MAX	active immediately
from HLD (HOLD) to MAX	active immediately
from HLD (HOLD) to MIN	active immediately
from MIN to HLD (HOLD)	active outside the fault state
from MAX to HLD (HOLD)	active outside the fault state

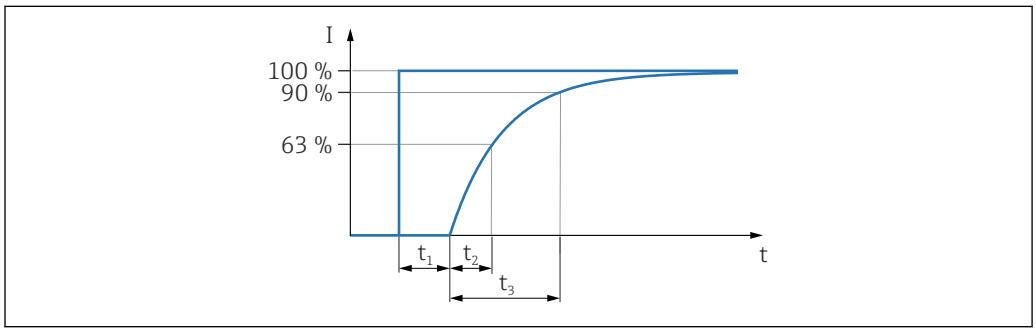
Alarm current

Name	Option
Min. alarm current set	IA [1]
1 low ≤3.6 mA 2 high ≥21 mA 3 last current value	U [2]

1) Product Configurator, order code for "Service"
2) Product Configurator order code for "Calibration/unit"

15.2.7 Dead time, time constant

Presentation of the dead time and the time constant:



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15.2.8 Dynamic behavior

Analog electronics

Dead time (t_1) [ms]	Time constant (T63), t_2 [ms]	Time constant (T90), t_3 [ms]
7 ms	11 ms	16 ms

15.2.9 Dynamic behavior of switch output

PNP switch output and 2 x PNP switch output: response time ≤20 ms

15.3 Performance characteristics of the ceramic process membrane

15.3.1 Reference conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range of: +21 to +33 °C (+70 to +91 °F)
- Humidity φ = constant, in the range of 5 to 80 % rH
- Atmospheric pressure p_A = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in the range of: horizontal ±1° (see also "Influence of orientation" section)
- Zero based span
- Material of process membrane: Al_2O_3 (aluminum-oxide ceramic, Ceraphire®)
- Supply voltage: 24 V DC ±3 V DC
- Load: 320 Ω (at 4 to 20 mA output)

15.3.2 Uncertainty of measurement for small absolute pressure ranges

The smallest extended uncertainty of measurement that can be delivered by our standards is

- in the range of 1 to 30 mbar (0.0145 to 0.435 psi): 0.4 % of reading
- in the range of < 1 mbar (0.0145 psi): 1 % of reading.

15.3.3 Influence of orientation

→ 🖹 16

15.3.4 Resolution

Current output: min. 1.6 µA

Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

15.3.5 Reference accuracy

The reference accuracy includes the non-linearity [DIN EN 61298-2 3.11] including the pressure hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770].

Device	% of the calibrated span to the maximum turn down		
	Reference accuracy	Non-linearity [1)]	Non-repeatability
PTC31B - standard	±0.5	±0.1	±0.1
PTC31B - platinum	±0.3	±0.1	±0.1

1) The non-linearity for the 40 bar (600 psi) sensor can be up to ± 0.15% of the calibrated span up to the maximum turn down.

Overview of the turn down ranges → 🖹 71

15.3.6 Thermal change of the zero output and the output span

Measuring cell	−20 to +85 °C (−4 to +185 °F)	−40 to −20 °C (−40 to −4 °F) +85 to +100 °C (+185 to +212 °F)
	% of the URL for TD 1:1	
<1 bar (15 psi)	<1	<1.2
≥1 bar (15 psi)	<0.8	<1

15.3.7 Long-term stability

1 year	5 years	8 years
% of the URL		
±0.2	±0.4	Under development

15.3.8 Switch-on time

≤2 s

For small measuring ranges, pay attention to the thermal compensation effects.

15.4 Performance characteristics of metallic process membrane

15.4.1 Reference conditions

- As per IEC 60770
- Ambient temperature T_A = constant, in the range of: +21 to +33 °C (+70 to +91 °F)
- Humidity φ = constant, in the range of: 5 to 80 % rH
- Atmospheric pressure p_A = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of the measuring cell = constant, in the range of: horizontal ±1° (see also "Influence of orientation" section)
- Zero based span
- Process membrane material: AISI 316L (1.4435)
- Filling oil: synthetic oil polyalphaolefin FDA 21 CFR 178.3620, NSF H1
- Supply voltage: 24 V DC ±3 V DC
- Load: 320 Ω (at 4 to 20 mA output)

15.4.2 Uncertainty of measurement for small absolute pressure ranges

The smallest extended uncertainty of measurement that can be delivered by our standards is

- in the range of 1 to 30 mbar (0.0145 to 0.435 psi): 0.4 % of reading
- in the range of < 1 mbar (0.0145 psi): 1 % of reading.

15.4.3 Influence of orientation

→ 16

15.4.4 Resolution

Current output: min. 1.6 µA

Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

15.4.5 Reference accuracy

The reference accuracy includes the non-linearity [DIN EN 61298-2 3.11] including the pressure hysteresis [DIN EN 61298-23.13] and non-repeatability [DIN EN 61298-2 3.11] in accordance with the limit point method as per [DIN EN 60770].

Device	% of the calibrated span to the maximum turn down		
	Reference accuracy	Non-linearity	Non-repeatability
PTP31B - standard	±0.5	±0.1	±0.1
PTP31B - platinum	±0.3	±0.1	±0.1
PTP33B - standard	±0.5	±0.1	±0.1
PTP33B - platinum	±0.3	±0.1	±0.1

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15.4.6 Thermal change of the zero output and the output span

Measuring cell	−20 to +85 °C (−4 to +185 °F)	−40 to −20 °C (−40 to −4 °F) +85 to +100 °C (+185 to +212 °F)
	% of the calibrated span for TD 1:1	
<1 bar (15 psi)	<1	<1.2
≥1 bar (15 psi)	<0.8	<1

Measuring cell	−20 to +85 °C (−4 to +185 °F)	−40 to −20 °C (−40 to −4 °F) +85 to +100 °C (+185 to +212 °F)
	% of the calibrated span for TD 1:1	
<1 bar (15 psi)	<1	<1.2
≥1 bar (15 psi)	<0.8	<1

15.4.7 Long-term stability

1 year	5 years	8 years
% of the URL		
±0.2	±0.4	Under development

15.4.8 Switch-on time

≤2 s

15.5 Environment

15.5.1 Ambient temperature range

Ambient temperature range [1)]
- −20 to +70 °C (−4 to +158 °F)
- IO-Link: −20 to +70 °C (−4 to +158 °F)
  (in the range of the temperature limits with restrictions in optical properties, such as display speed and contrast)

15.5.2 Storage temperature range

−40 to +85 °C (−40 to +185 °F)

15.5.3 Climate class

Climate class	Note
Class 3K5	Air temperature: −5 to +45 °C (+23 to +113 °F), relative humidity: 4 to 95 % satisfied according to IEC 721-3-3 (condensation not possible)

15.5.4 Degree of protection

Communication version	Connector	Degree of protection	Option [1)]
Analog	Cable 5 m (16 ft)	IP66/67 NEMA Type 4X enclosure	D
	Cable 10 m (33 ft)	IP66/67 NEMA Type 4X enclosure	E
	Cable 25 m (82 ft)	IP66/67 NEMA Type 4X enclosure	F
	Valve plug ISO4400 M16	IP65 NEMA Type 4X enclosure	U
	Valve plug ISO4400 NPT ½	IP65 NEMA Type 4X enclosure	V
Analog, IO-Link	M12 plug	IP65/67 NEMA Type 4X enclosure	M

1) Product Configurator, order code for "Electrical connection"

15.5.5 Vibration resistance

Test standard	Vibration resistance
IEC 60068-2-64:2008	Guaranteed for 5 to 2000Hz: 0.05 g^2/Hz

15.5.6 Electromagnetic compatibility

- Interference emission as per EN 61326-1 equipment B
- Interference immunity as per EN 61326-1 (industrial environment)
-
- Maximum deviation: 1.5% with TD 1:1

1) Exception: the following cable is designed for an ambient temperature range of −25 to +70 °C (−13 to +158 °F): Product Configurator, order code for "Accessory enclosed" option "RZ".

For more details, please refer to the Declaration of Conformity.

15.6 Process

15.6.1 Process temperature range for devices with ceramic process membrane

−25 to +100 °C (−13 to +212 °F)

- For saturated steam applications, use a device with a metallic process membrane, or provide a siphon for temperature isolation when installing.
- Observe the process temperature range of the seal. See also the following table.

Seal	Notes	Process temperature range	Option
FKM	-	−20 to +100 °C (−4 to +212 °F)	A [1]
FKM	Cleaned for O_2 application	−10 to +60 °C (+14 to +140 °F)	A [1] and HB [2]
EPDM 70	-	−25 to +100 °C (−13 to +212 °F)	J [1]

1) Product Configurator, order code for "Seal"
2) Product Configurator, order code for "Service"

Applications with jumps in temperature

Frequent extreme changes in temperatures can temporarily cause measuring errors. Temperature compensation occurs after a few minutes. Internal temperature compensation occurs more quickly the smaller the change in temperature and the longer the time interval involved.

For further information please contact your local Endress+Hauser Sales Center.

15.6.2 Process temperature range for devices with metallic process membrane

−40 to +100 °C (−40 to +212 °F)

- −10 to +100 °C (+14 to +212 °F)
- SIP cleaning
  at +135 °C (+275 °F) for a maximum of one hour (device in operation but not within measurement specification)

Applications with jumps in temperature

Frequent extreme changes in temperatures can temporarily cause measuring errors. Internal temperature compensation occurs more quickly the smaller the change in temperature and the longer the time interval involved.

For further information please contact your local Endress+Hauser Sales Center.

15.6.3 Pressure specifications

⚠ WARNING

The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.

- For pressure specifications, see the "Measuring range" section and "Mechanical construction" section in the Technical Information.
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.
- MWP (maximum working pressure): The MWP (maximum working pressure) is specified on the nameplate. This value is based on a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited period of time. Observe the temperature dependency of the MWP.
- OPL (over pressure limit): The test pressure corresponds to the over pressure limit of the sensor and may only be applied temporarily to ensure that the measurement is within the specifications and no permanent damage develops. In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value.
- Devices with ceramic process isolating diaphragm: avoid steam hammering! Steam hammering can cause zero point drifts. Recommendation: Residue (water droplets or condensation) may remain on the process isolating diaphragm following CIP cleaning and can result in local steam hammering the next time steam cleaning takes place. In practice, drying the process isolating diaphragm (e.g. by blowing) has proved to prevent steam hammering.

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