KA01404P/00/EN/02.20
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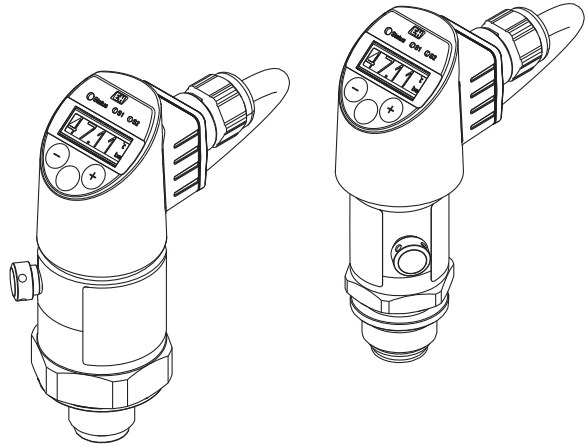
2020-10-15

Brief Operating Instructions
Ceraphant PTC31B, PTP31B, PTP33B
IO-Link

Process pressure measurement

IO-Link



These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:
Available for all device versions via:
- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: *Endress+Hauser Operations App*

Endress+Hauser
People for Process Automation

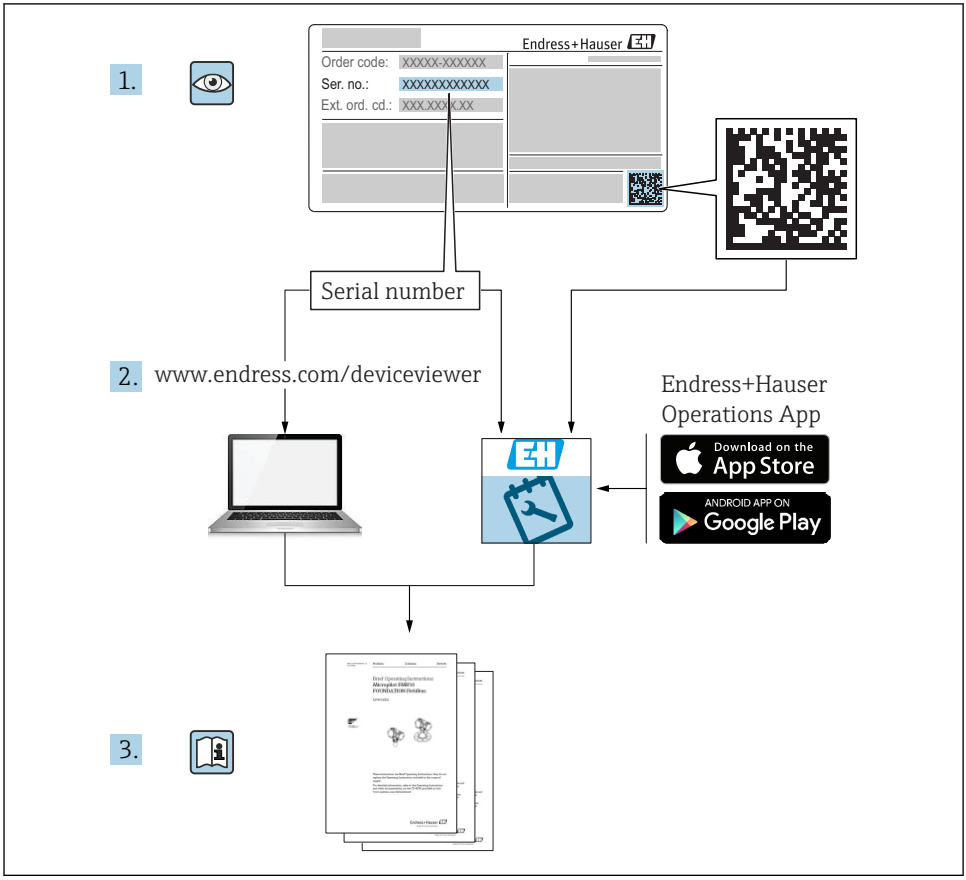

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXX-XXX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.

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Table of contents

1 About this document

1.1 Document function

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning	Symbol	Meaning
	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.		**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

1.2.3 Tool symbols

Symbol	Meaning
 A0011222	Open-ended wrench

1.2.4 Symbols for certain types of information

Symbol	Meaning	Symbol	Meaning
	**Permitted** Procedures, processes or actions that are permitted.		**Tip** Indicates additional information.
	**Forbidden** Procedures, processes or actions that are forbidden.	1. , 2. , 3. ...	Series of steps
	Reference to documentation		Result of a step
	Reference to graphic		Visual inspection
	Reference to page		

1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views

1.3 Documentation

The document types listed are available:
In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

1.3.1 Technical Information (TI): planning aid for your device

PTC31B: TI01130P

PTP31B: TI01130P

PTP33B: TI01246P

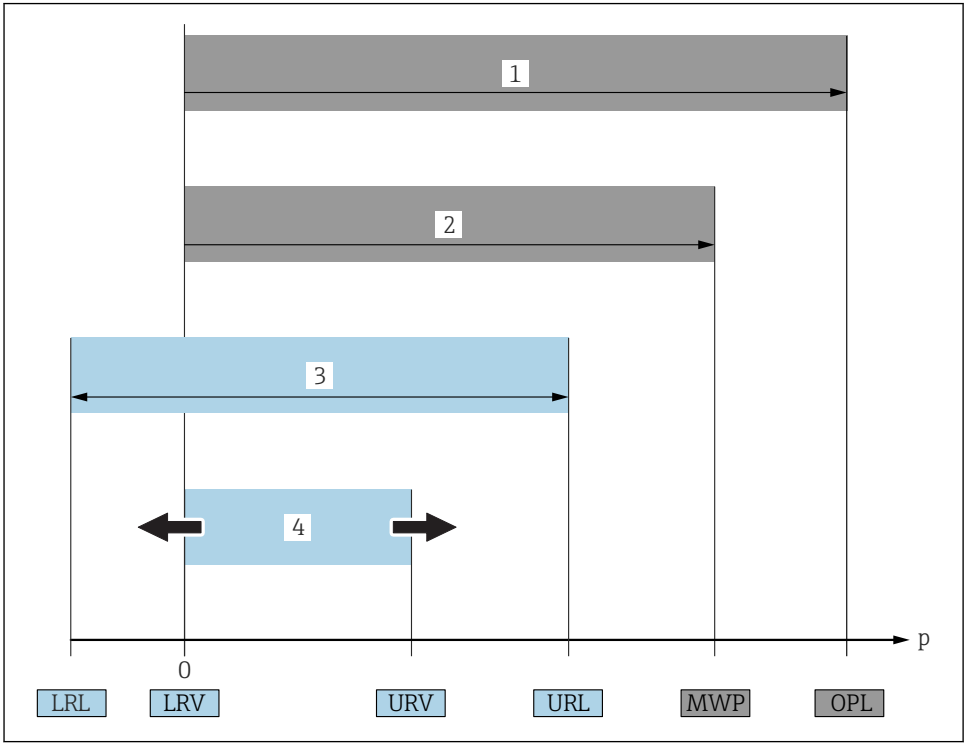
The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

1.3.2 Operating Instructions (BA): your comprehensive reference

Devices with IO-Link: BA01911P

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

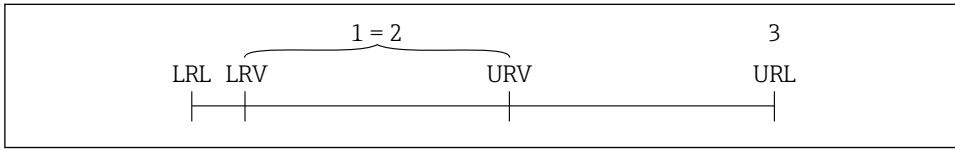
1.4 Terms and abbreviations



Item	Term/ abbreviation	Explanation
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. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section of the Operating Instructions . The OPL may only be applied for a limited 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. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see the "Pressure specifications" section of the Operating Instructions . The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate.
3	Maximum sensor measuring range	Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span.

Item	Term/ abbreviation	Explanation
4	Calibrated/adjusted span	Span between 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)	Turn down Example - see the following section.

1.5 Turn down calculation



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1 Calibrated/adjusted span
2 Zero point-based span
3 URL sensor

Example

- Sensor:10 bar (150 psi)
- Upper range value (URL) = 10 bar (150 psi)

Turn down (TD):

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

$$TD = \frac{10\ bar\ (150\ psi)}{|5\ bar\ (75\ psi) - 0\ bar\ (0\ psi)|} = 2$$

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

- 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)

2 Basic safety instructions

2.1 Requirements concerning the staff

The staff must fulfill the following requirements for their tasks:
- Trained staff: Must have a qualification which corresponds to their function and tasks.
- Authorized by the plant operator.
- Familiar with the national regulations.
- Before starting their work: Must have read and understood all instructions in the operating manual and supplementary documentation as well as the certificate (depending on the application).
- Must comply with all instructions and the regulatory framework.

2.2 Designated 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 pressure or absolute pressure

Calculated process variable

Pressure

2.2.2 Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use.

Verification for borderline cases:
- For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of process-wetted materials, but does not accept any warranty or liability.

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

For work on and with the device:
- Wear the required personal protective equipment according to federal/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 measuring 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 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

See Operating Instructions.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

- Is the order code on the delivery note identical to the order code on the product sticker?
- Are the goods undamaged?
- Do the data on the nameplate correspond to the order specifications and the delivery note?
- If required (see nameplate): Are the safety instructions (XA) provided?
- Is the documentation available?

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 the identification of the measuring device:
- Nameplate specifications
- Order code with a breakdown of the device features on the delivery note
- Enter the serial numbers from the nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All the information about the measuring device is displayed.

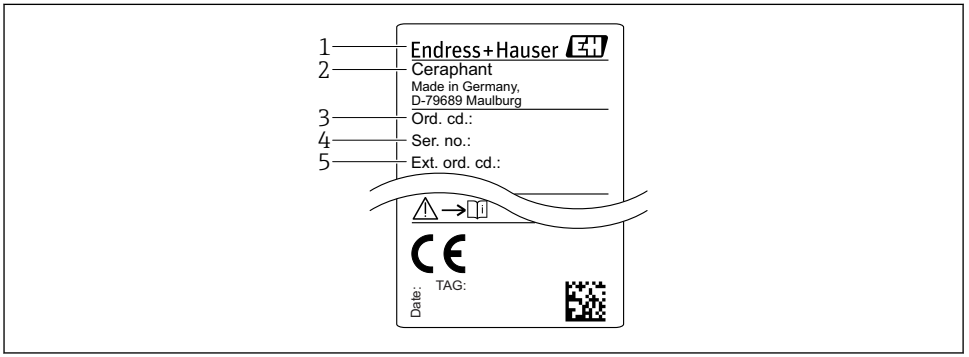
For an overview of the technical documentation provided, enter the serial number from the nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer)

4.2.1 Manufacturer address

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

Place of manufacture: See nameplate.

4.2.2 Nameplate



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1 *Manufacturer's address*
2 *Device name*
3 *Order number*
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 Installation

5.1 Installation conditions

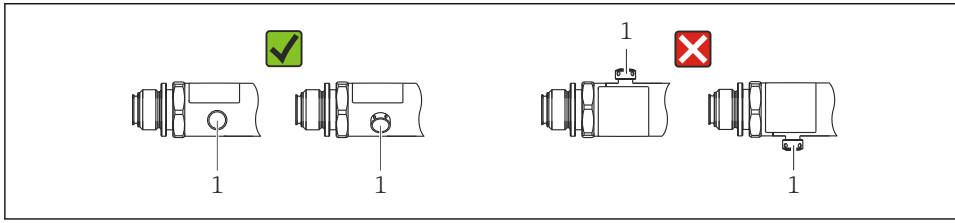
- Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.
- Do not clean or touch process isolating diaphragms with hard and/or pointed objects.
- Do not remove process isolating diaphragm protection until shortly before installation.
- 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, 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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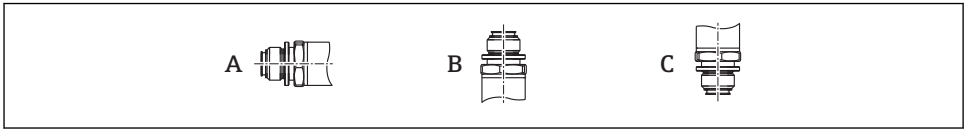
5.2 Influence of the installation position

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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Type	Process isolating diaphragm axis is horizontal (A)	Process isolating diaphragm pointing upwards (B)	Process isolating diaphragm pointing downwards (C)
PTP31B PTP33B	Calibration position, no effect	Up to +4 mbar (+0.058 psi)	Up to −4 mbar (−0.058 psi)
PTC31B < 1 bar (15 psi)	Calibration position, no effect	Up to +0.3 mbar (+0.0044 psi)	Up to −0.3 mbar (−0.0044 psi)
PTC31B ≥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 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.

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.

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.

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
  - Or 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.

5.4 Mounting instructions for oxygen applications

See Operating Instructions.

5.5 Post-installation check

❑	Is the device undamaged (visual inspection)?
❑	Does the device comply with the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure ▪ Ambient temperature range ▪ 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 tightened securely?
❑	Is the pressure compensation element pointing downwards at an angle or to the side?
❑	To prevent moisture from penetrating, ensure that the connecting cables/plugs are 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

Electrical safety is compromised by an incorrect connection!

- In accordance with IEC/EN61010 a separate circuit breaker must be provided for the device.
- The device must be operated with a 630 mA fine-wire fuse (slow-blow).
- The maximum current is restricted to Ii = 100 mA by the transmitter power supply unit when the device 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

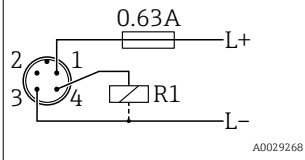
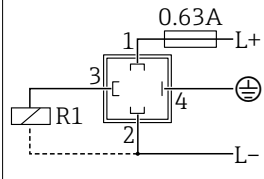
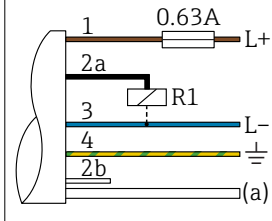
- Do not connect the active PNP switch output of the device to the 4 to 20 mA input of a PLC.

Connect the device in the following order:

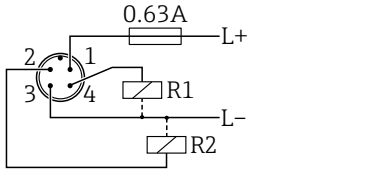
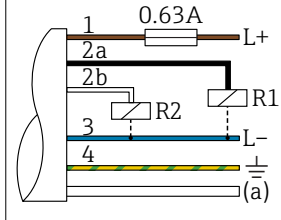
1. Check that the supply voltage corresponds to the supply voltage indicated on the nameplate.
2. Connect the device in accordance with the following diagram.

Switch on supply voltage.

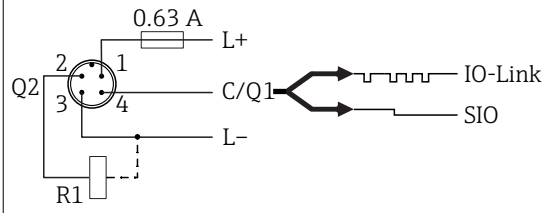
1 x PNP switch output R1 (not with IO-Link functionality)

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

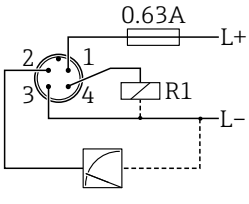
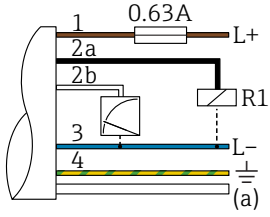
2 x PNP switch output R1 and R2 (not with IO-Link functionality)

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

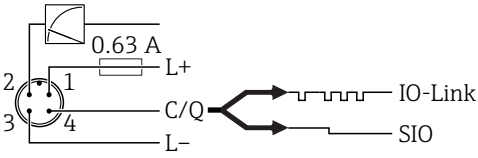
IO-Link: 2 x PNP switch output R1 and R2

M12 plug


1 x PNP switch output R1 with additional analog output 4 to 20 mA (active), (not with IO-Link functionality)

M12 plug	Valve plug	Cable
	-	 *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*

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

M12 plug


6.1.2 Supply voltage

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

IO-Link communication is guaranteed only if the supply voltage is at least 18 V.

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)
Maximum current consumption: ≤ 300 mA	

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 Switching capacity

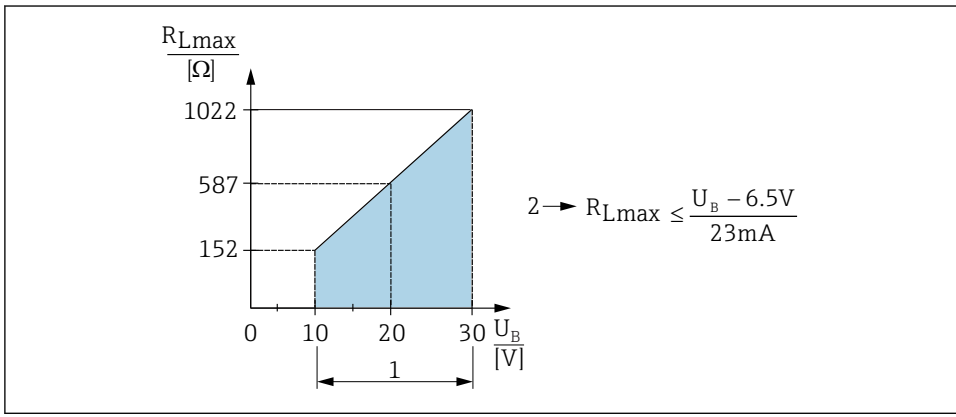
- Switch status ON [1]: $I_a \leq 200$ mA [2]; switch status OFF: $I_a \leq 100$ µA
- Switch cycles: >10,000,000
- Voltage drop PNP: ≤2 V
- Overload protection: Automatic load testing of switching current;
  - Max. capacitive load: 1 µF at max. supply voltage (without resistive load)
  - Max. cycle duration: 0.5 s; min. t_{on}: 40 µs
  - Periodic disconnection from protective circuit in the event of overcurrent (f = 2 Hz) and "F804" displayed

6.3 Connection data

6.3.1 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

1) 100 mA can be guaranteed over the entire temperature range for the switch outputs "2 x PNP" and "1 x PNP + 4 to 20 mA output". For lower ambient temperatures, higher currents are possible but cannot be guaranteed. Typical value at 20 °C (68 °F) approx. 200 mA. 200 mA can be guaranteed over the entire temperature range for the "1 x PNP" current output.
2) Larger currents are supported, thus deviating from the IO-Link standard.

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.

6.4 Post-connection check

❑	Is the device or cable undamaged (visual check)?
❑	Do the cables comply with the requirements?
❑	Do the cables have adequate strain relief?
❑	Are all the cable glands installed, firmly 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 IO-Link

IO-Link information

IO-Link is a point-to-point connection for communication between the measuring device and an IO-Link master. The measuring device features an IO-Link communication interface type 2 with a second IO function on pin 4. This requires an IO-Link-compatible assembly (IO-Link master) for operation. The IO-Link communication interface enables direct access to the process and diagnostic data. It also provides the option of configuring the measuring device on the fly.

Physical layer, the measuring device supports the following features:
- IO-Link specification: version 1.1
- IO-Link Smart Sensor Profile 2nd Edition (supports minimum scope of IdentClass)
- SIO mode: yes
- Speed: COM2; 38.4 kBaud
- Minimum cycle time: 2.5 msec.
- Process data width: 32 bit
- IO-Link data storage: yes
- Block parameterization: yes

IO-Link download

http://www.endress.com/download
- Select "Software" as the media type.
- Select "Device Driver" as the software type.
  Select IO-Link (IODD).
- In the "Text Search" field enter the device name.

https://ioddfinder.io-link.com/
Search by
- Manufacturer
- Article number
- Product type

7.1.2 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 on 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.

7.1.3 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 operating menu, see → 33 and → 36

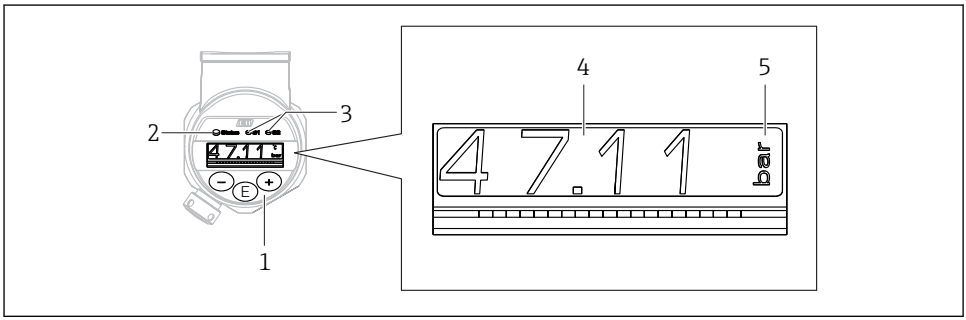
7.2 Operation with local display

7.2.1 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" in the Operating Instructions). 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.

7.2.2 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

Operational states	Function of status-LED and onsite display
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

7.3 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.

7.4 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.

Operating 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

7.5 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.

7.5.1 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.

7.5.2 Locking and unlocking parameter settings

The device settings can be protected from unauthorized access.

COD parameter: define the locking code

0000	Device is permanently unlocked (factory setting)
0001-9999	Device is locked

LCK parameter: unlock parameter locking (enter the COD)

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

Examples:

Locking the device with a customer-specific code

1. EF → ADM → COD

2. Enter a COD not equal to 0000 (value range: 0001 to 9999)
3. Wait 60 seconds or restart the device
4. Parameters are locked (protected against changes)

Changing a parameter when the device is locked (taking the example of STL)

1. STL, LCK is displayed
2. Enter the customer-specific value defined in COD
3. STL can be edited
4. The device is locked again after 60 seconds or following a restart

Unlocking the locking mechanism permanently

1. EF → ADM → COD
2. LCK is displayed, enter the customer-specific value defined in COD
3. Enter "0000"
4. The device is unlocked (even after the device is restarted)

7.6 Navigation examples

7.6.1 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

7.6.2 User-definable parameters

Example: setting the "TAU" damping parameter.

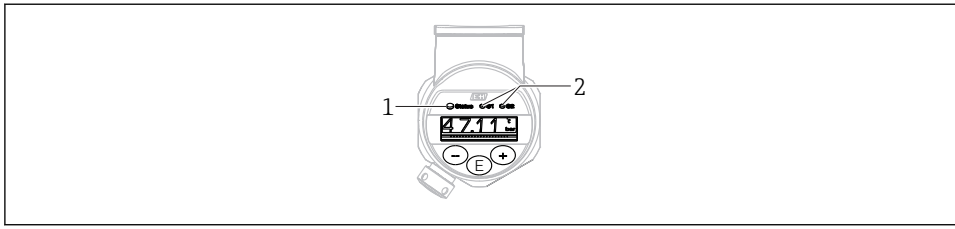
Menu path: EF → TAU

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

7.7 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

7.8 Resetting to factory settings (reset)

See Operating Instructions.

8 System integration

See Operating Instructions.

9 Commissioning

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

If block parameterization is used, a parameter change is only adopted after the parameter download.

⚠ 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:

► S140
► F270

NOTICE

An IO-DD with corresponding default values is used for all pressure measuring ranges. This IO-DD applies to all measuring ranges! The default values of this IO-DD can be inadmissible for this device. IO-Link messages (e.g. "Parameter value above limit") may be displayed when the device is updated with these default values. Existing values are not accepted in this case. The default values apply exclusively to the 10 bar (150 psi) sensor.

▶ The data must first be read out of the device before default values are written from the IO-DD to the device.

9.1 Function check

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

- "Post-installation check" checklist→ 🖹 13
- "Post-connection check" checklist

9.2 Commissioning with an operating menu

Commissioning comprises the following steps:

- Configure pressure measurement → 🖹 27
- Where applicable, perform position adjustment→ 🖹 29
- Where applicable, configure process monitoring → 🖹 32

9.3 Configuring pressure measurement

9.3.1 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 → 29.

For a description of the parameters mentioned and possible error messages, see the Operating Instructions.

Performing the configuration

1. Select a pressure unit, here "bar" for example, via the **Unit changeover (UNI)** parameter.
2. Select **Value for 4 mA (STL)** parameter. Enter the value (0 bar (0 psi)) and confirm.
   ↳ This pressure value is assigned to the lower current value (4 mA).
3. Select **Value for 20 mA (STU)** parameter. 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 set for 0 to 300 mbar (0 to 4.4 psi).

9.3.2 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. The device is already mounted, for example.

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 → 29.

For a description of the parameters mentioned and possible error messages, see the Operating Instructions.

Performing the configuration

1. Select a pressure unit, here "bar" for example, via the **Unit changeover (UNI)** parameter.
2. The pressure for the LRV (4 mA value) is present at the device, here 0 bar (0 psi) for example. Select **Pressure applied for 4mA (GTL)** parameter. The selection is confirmed by pressing "Get Lower Limit".
   ↳ The pressure value present 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 **Pressure applied for 20mA (GTU)** parameter. The selection is confirmed by pressing "Get Lower Limit".
   ↳ The pressure value present is assigned to the upper current value (20 mA).

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

9.4 Performing position adjustment

Zero point configuration (ZRO)

Navigation

Display: EF → Zero point configuration (ZRO)
IO-Link: Parameter → Application → Sensor → Zero point configuration (ZRO)

Description

(Typically absolute pressure sensor)
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 displayed via IO-Link. 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 =0.002 bar (0.029 psi)
- Set the measured value in the parameter to 0.002.
- Measured value (after pos. zero adjust) = 0.000 mbar (0 psi)
- The current value is also corrected.

Note Setting in increments of 0.001. 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

Zero point adoption (GTZ)

Navigation Display: EF → Zero point adoption (GTZ)
IO-Link: Parameter → Application → Sensor → Zero point adoption (GTZ)

Description (Typically gauge pressure sensor)
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 The pressure value present is automatically adopted as the zero point.
An offset is possible (parallel shifting of the sensor characteristic) to correct the orientation and any zero point drift. The accepted 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 displayed via IO-Link. 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 = 0.002 bar (0.029 psi)
- Use the **Zero point adoption (GTZ)** parameter to correct the measured value with the value, e.g. 0.002 mbar (0.029 psi). This means that you are assigning the value 0.000 (0 psi) to the pressure present.
- Measured value (after pos. zero adjust) = 0.000 mbar (0 psi)
- The current value is also corrected.
- Where applicable, 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)
- Use the **Zero point adoption (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).

9.5 Configuring process monitoring

To monitor the process, it is possible to specify a pressure range which is monitored by the point level switch. 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 point level switches to monitor the ranges.

9.5.1 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.

Function	Selection	Output	Abbreviation for operation
Hysteresis	Hysteresis normally open	Closing	HNO
Hysteresis	Hysteresis normally closed	NC contact	HNC
Window	Window normally open	Closing	FNO
Window	Window normally closed	NC contact	FNC

If the device is restarted within the given hysteresis, the switch output is open (0 V present at the output).

9.5.2 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 linearly. 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 (see the Operating Instructions).
  - If the defined limit is undershot, the device continues measuring linearly. 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 (see the Operating Instructions).

9.6 Application examples

See Operating Instructions.

10 Overview of the onsite display 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 + 4-20 mA						
✔	✔	✔	KYL	If "KYL" is shown on the display, this means that the keys of the device are locked. To unlock the keys, see → 22				
✔	✔	✔	SP1				Switch point value, output 1	
✔	✔	✔	RP1				Switchback point value, output 1	
✔	✔	✔	FH1				Upper value for pressure window, output 1	
✔	✔	✔	FL1				Lower value for pressure window, output 1	
	✔	B [2]	SP2				Switch point, output 2	
	✔	B [2]	RP2				Switchback point, output 2	
	✔	B [2]	FH2				Upper value for pressure window, output 2	
	✔	B [2]	FL2				Lower value for pressure window, output 2	
		A [3]	STL				Value for 4 mA (LRV)	
		A [3]	STU				Value for 20 mA (URV)	
			EF	FUNC			Extended functions	
	✔	✔			OFF			-
		✔			I [4]			-
	✔	✔			PNP			-
				UNI				
✔	✔	✔			BAR		Unit bar	-
✔	✔	✔			KPA		Unit kPa (depends on the sensor measuring range)	-
✔	✔	✔			MPA		Unit MPa (depends on the sensor measuring range)	-
✔	✔	✔			PSI		Unit psi	-

Switch output [1]			Level 0	Level 1	Level 2	Level 3	Description	Details
1 x PNP	2 x PNP	1 x PNP + 4-20 mA						
✔	✔	✔		ZRO			Zero point configuration	→ 🖹 29
✔	✔	✔		GTZ			Zero point adoption	→ 🖹 30
✔	✔	✔		TAU			Damping	
		A [3]		**I**			Current output	-
					GTL		Pressure applied for 4mA (LRV)	
					GTU		Pressure applied for 20mA (URV)	
					FCU		Alarm current	
		A [3]				MIN	In the event of an error: MIN (≤3.6 mA)	-
		A [3]				MAX	In the event of an error: MAX (≥21 mA)	-
		A [3]				HLD	Last current value (HOLD)	-
✔	✔	✔		dS1			Switching delay time, output 1	
✔	✔	✔		dR1			Switchback delay time, output 1	
				Ou1			Output 1	-
✔	✔	✔			HNO		NO contact for hysteresis function	
✔	✔	✔			HNC		NC contact for hysteresis function	
✔	✔	✔			FNO		NO contact for window function	
✔	✔	✔			FNC		NC contact for window function	
	✔	B [2]		dS2			Switching delay time, output 2	
	✔	B [2]		dR2			Switchback delay time, output 2	
				Ou2			Output 2	-
	✔	B [2]			HNO		NO contact for hysteresis function	
	✔	B [2]			HNC		NC contact for hysteresis function	
	✔	B [2]			FNO		NO contact for window function	
	✔	B [2]			FNC		NC contact for window function	
✔	✔	✔		HI			Max value (maximum indicator)	
✔	✔	✔		LO			Min value (minimum indicator)	
✔	✔	✔		RVC			Revision counter	
✔	✔	✔		RES			Reset	
				ADM			Administration	-
✔	✔	✔			LCK		Unlocking code	

Switch output [1]			Level 0	Level 1	Level 2	Level 3	Description	Details
1 x PNP	2 x PNP	1 x PNP + 4-20 mA						
✔	✔	✔			COD		Locking code	
				DIS			Display	-
✔	✔	✔			**DVA**	PV	Display measured value	
		A [3]				PV'/,	Display the measured value as a percentage of the set span	-
✔	✔	✔				SP	Display set switch point	-
✔	✔	✔			**DRO**		Display measured value rotated by 180°	
✔	✔	✔			**DOF**		Display off	
			DIAG				Diagnosis	-
✔	✔	✔		STA			Current device status	
✔	✔	✔		LST			Last device status	
				SM1			Simulation output 1	
✔	✔	✔			OFF			-
✔	✔	✔			OPN		Switch output opened	-
✔	✔	✔			CLS		Switch output closed	-
				SM2 [5]			Simulation output 2	
							Current output simulation	
	✔	✔			OFF			-
	✔	B [2]			OPN		Switch output opened	-
	✔	B [2]			CLS		Switch output closed	-
		A [3]			3.5		Simulation value for analog output in mA	-
		A [3]			4		Simulation value for analog output in mA	-
		A [3]			8		Simulation value for analog output in mA	-
		A [3]			12		Simulation value for analog output in mA	-
		A [3]			16		Simulation value for analog output in mA	-
		A [3]			20		Simulation value for analog output in mA	-
		A [3]			21.95		Simulation value for analog output in mA	-

1) The assignment of the outputs cannot be modified.
2) B = Functionality is active if "PNP" has been configured in the "FUNC" menu.
3) A = Functionality is active if "I" has been configured in the "FUNC" menu.
4) I can only be selected if the device has been ordered with 4-20 mA.
5) For devices with a 4-20 mA current output: can only be selected if the output is switched on.

11 Overview of the IO-Link 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".

Level 0	Level 1	Level 2	Level 3	Details
Identification	Serial number			-
	Firmware version			-
	Extended Ordercode			
	ProductName			-
	ProductText			-
	VendorName			-
	Hardware revision			-
	ENP_VERSION			
	Application Specific Tag			
	Device Type			-
Diagnosis	Actual Diagnostics (STA)			
	Last Diagnostic (LST)			
	Simulation Switch Output (OU1)			
	Simulation Current Output (OU2)			
	Simulation Switch Output (OU2)			
	Device Search			
Parameter	Application	Sensor	Operating Mode (FUNC)	
			Unit changeover (UNI)	
			Zero point configuration (ZRO)	→ 29
			Zero point adoption (GTZ)	→ 30
			Damping (TAU)	
		Current output	Value for 4 mA (STL)	
			Value for 20 mA (STU)	
			Pressure applied for 4mA (GTL)	
			Pressure applied for 20mA (GTU)	
			Alarm current (FCU)	
		Switch output 1	Switch point value / Upper value for pressure window, output 1 (SP1 / FH1)	
			Switchback point value / Lower value for pressure window, output 1 (RP1 / FL1)	

Level 0	Level 1	Level 2	Level 3	Details
			Switching delay time, output 1 (dS1)	
			Switchback delay time, output 1 (dR1)	
			Output 1 (OU1)	
		Switch output 2	Switch point value / Upper value for pressure window, output 2 (SP2 / FH2)	
			Switchback point value / Lower value for pressure window, output 2 (RP2 / FL2)	
			Switching delay time, output 2 (dS2)	
			Switchback delay time, output 2 (dR2)	
			Output 2 (OU2)	
	System	Device Management	Hi Max value (maximum indicator)	
			Lo Min value (minimum indicator)	
			Revisioncounter (RVC)	
			Standard Command (Restore factory settings)	
			Device Access Locks.Data Storage Lock	
		User Administration (ADM)	Unlocking code (LCK)	
			Locking code (COD)	
			Device Access Lock.Local Parametrization Lock	
		Display (DIS)	Measured value display (DVA)	
			Display measured value rotated by 180° (DRO)	
			Switch display on or off (DOF)	
Observation	Pressure			
	Switch State Output (Ou1)			
	Switch State Output (Ou2)			

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