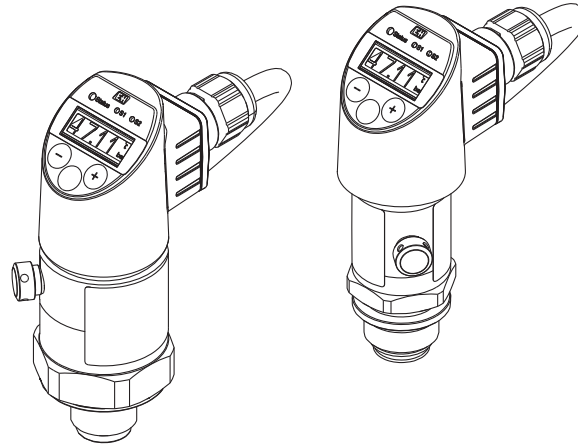
Brief Operating Instructions **Ceraphant PTC31B, PTP31B, PTP33B**

Process pressure measurement



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

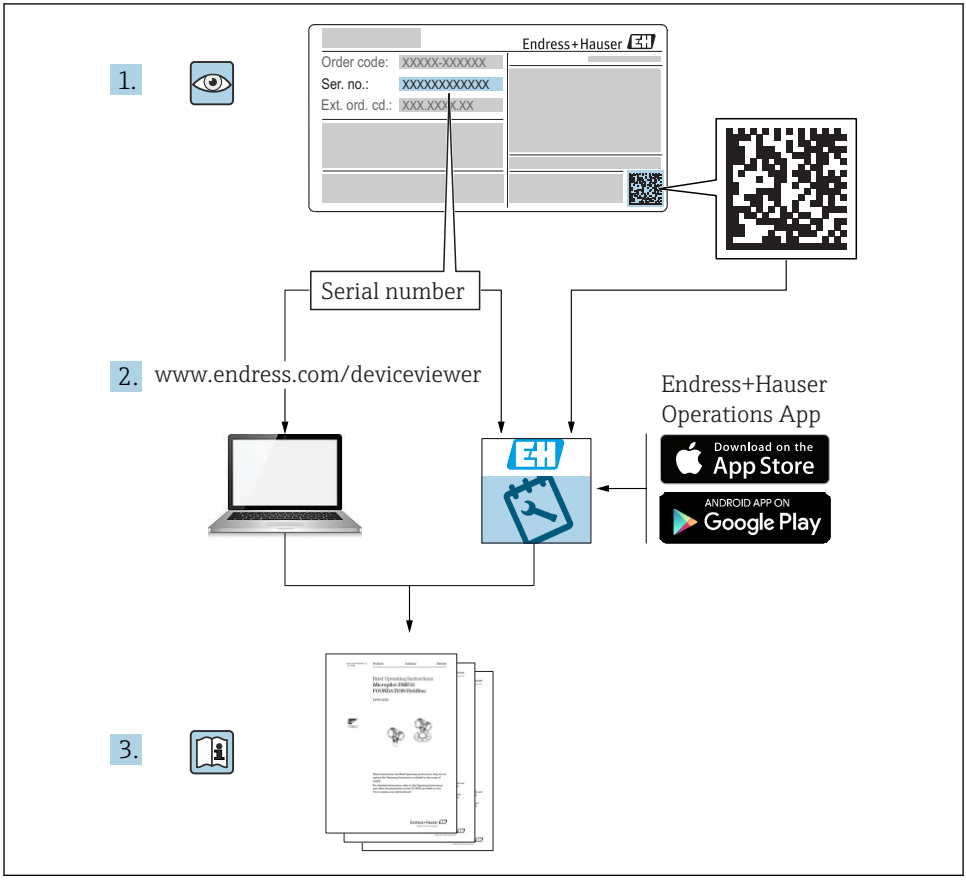

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXX-XXX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.

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Table of contents

1 Document information

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

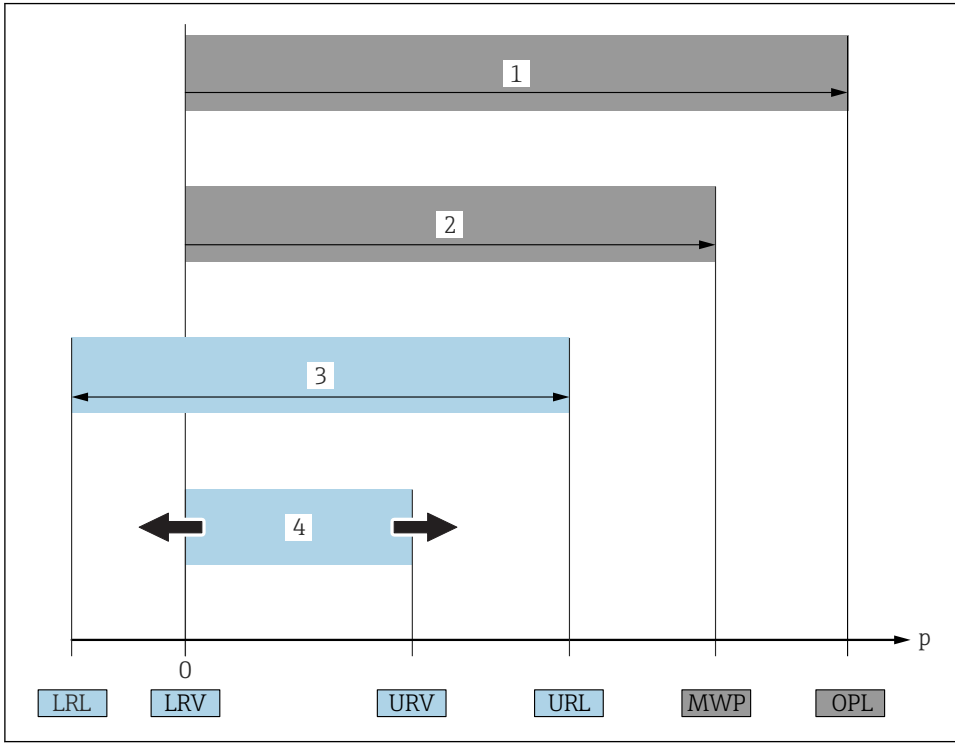
The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

1.3.2 Operating Instructions (BA): your comprehensive reference

BA01270P

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



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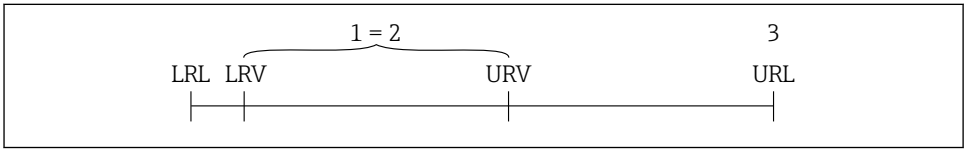
Item	Term/ abbreviation	Explanation
1	OPL	The OPL (over pressure limit = sensor overload limit) for the measuring device depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring 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.

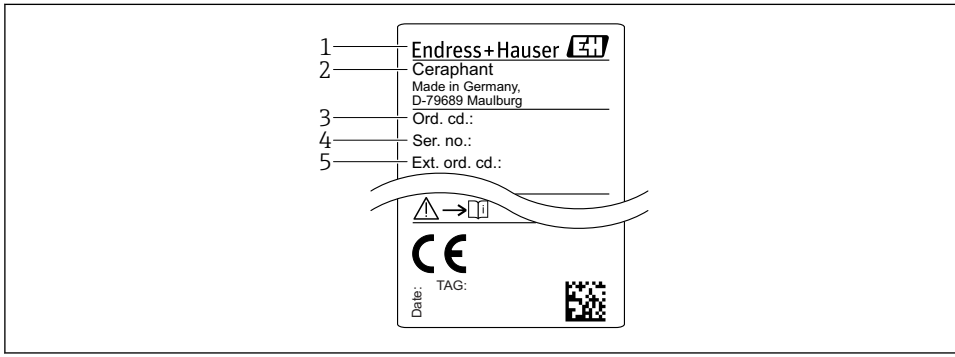
For an overview of the technical documentation provided, enter the serial number from the nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer)

4.2.1 Manufacturer address

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

Address of the manufacturing plant: See nameplate.

4.2.2 Nameplate



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

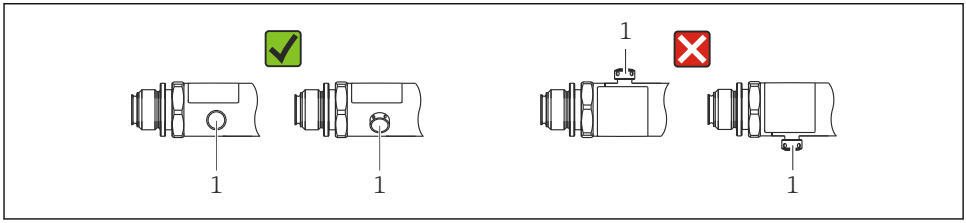
- Moisture must not penetrate the housing when mounting the device, establishing the electrical connection and during operation.
- Do not clean or touch process isolating diaphragms with hard and/or pointed objects.
- Do not remove process isolating diaphragm protection until shortly before installation.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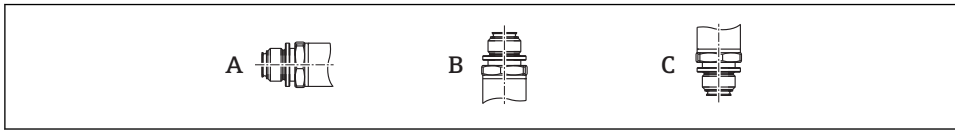
5.2 Influence of the installation position

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

Limitation of electrical safety due to 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).
- ▶ 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.

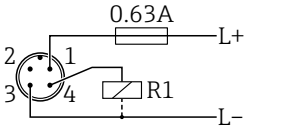
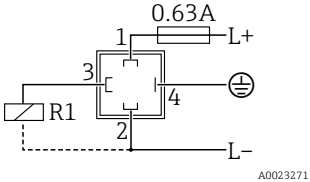
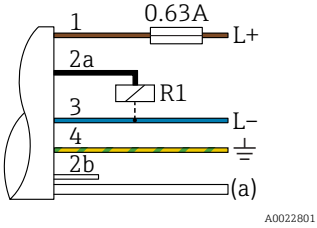
Connect the device in the following order:

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.

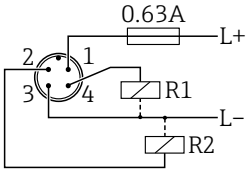
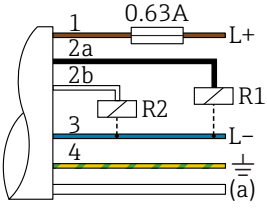
Switch on the supply voltage.

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.

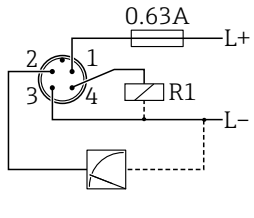
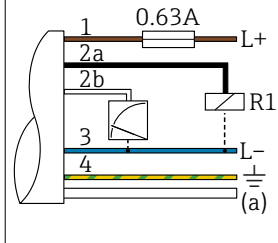
1 x PNP switch output R1

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

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*

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

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*

6.1.2 Supply voltage

Supply voltage: 10 to 30 V DC

6.1.3 Current consumption and alarm signal

Intrinsic power consumption	Alarm current (for device with analog output)
≤ 60 mA	≥21 mA (factory setting)

6.2 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. capacitive 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

6.3 Connection conditions

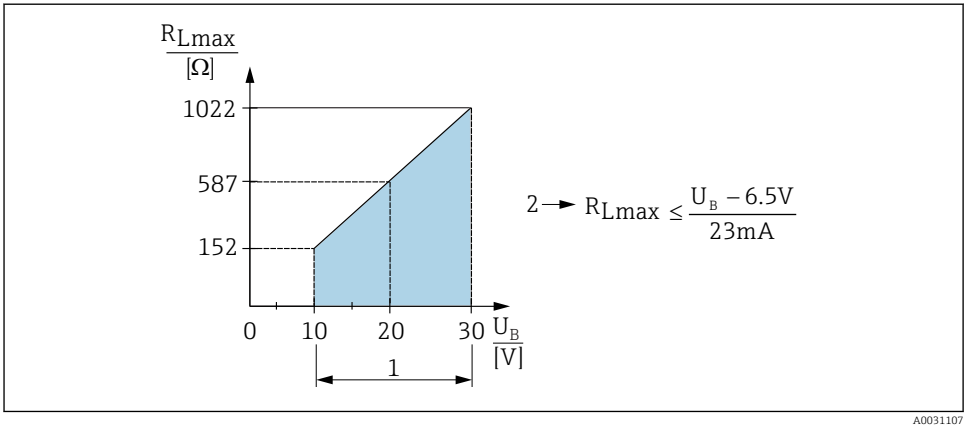
6.3.1 Cable specification

For valve plug: < 1.5 mm^2 (16 AWG) and Ø4.5 to 10 mm (0.18 to 0.39 in)

6.4 Connection data

6.4.1 Load (for devices with analog output)

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

6.5 Post-connection check

❑	Is the device or cable undamaged (visual check)?
❑	Do the cables comply with the requirements?
❑	Do the mounted 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 LED lit on the electronic insert?

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 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.

7.2 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 Operating Instructions

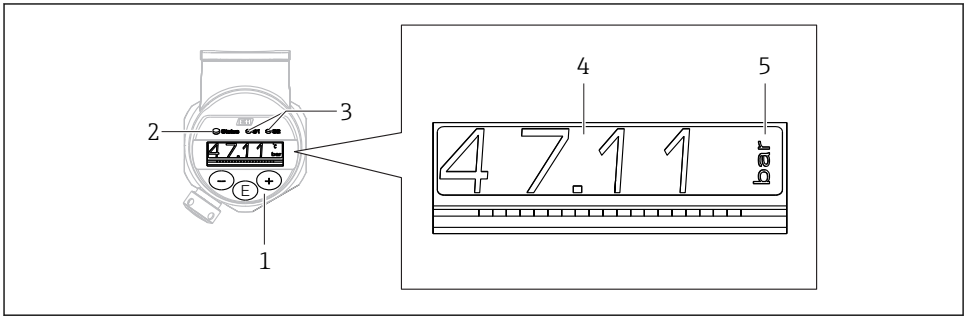
7.3 Operation with local display

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.

7.4 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, an 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.

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

7.6 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

See Operating Instructions.

7.6.3 Unlocking parameter settings

See Operating Instructions.

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.

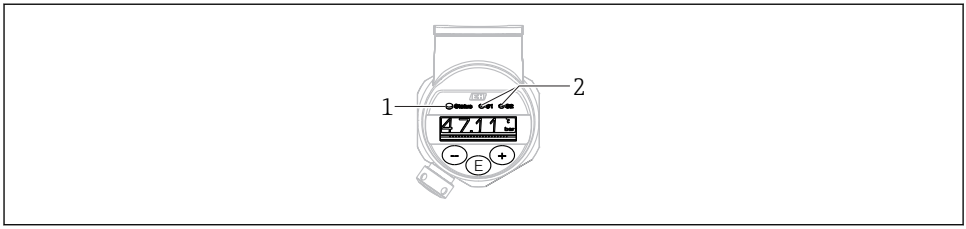
Menu path: EF → TAU

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



1 Status LED
2 Switch output LEDs

7.9 Resetting to factory settings (reset)

See Operating Instructions.

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 → 14
- "Post-connection check" checklist → 18

8.2 Enabling configuration/operation

The device features
- Automatic key locking → 22
- Parameter locking → 22.

8.3 Commissioning with an operating menu

Commissioning comprises the following steps:
- Configuration of pressure measurement → 25
- If necessary, perform position adjustment → 26
- If necessary, Configuration of process monitoring if necessary → 30
- If necessary, Configuration of the local display if necessary → 34
- If necessary, Protection of settings from unauthorized access if necessary → 34

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 → 26.

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

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 → 26.

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

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 → 30.

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 (see the Operating Instructions).
  - 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 (see the Operating Instructions).

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

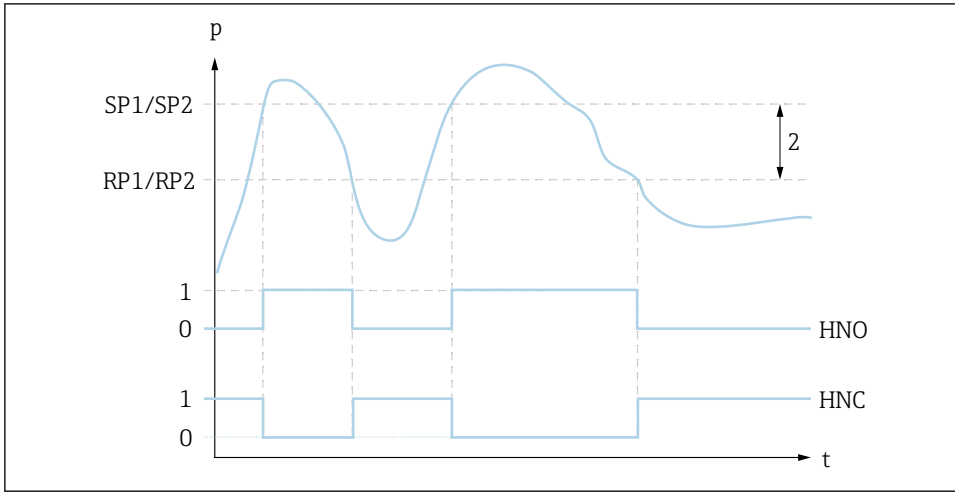
Navigation

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" in the Operating Instructions 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

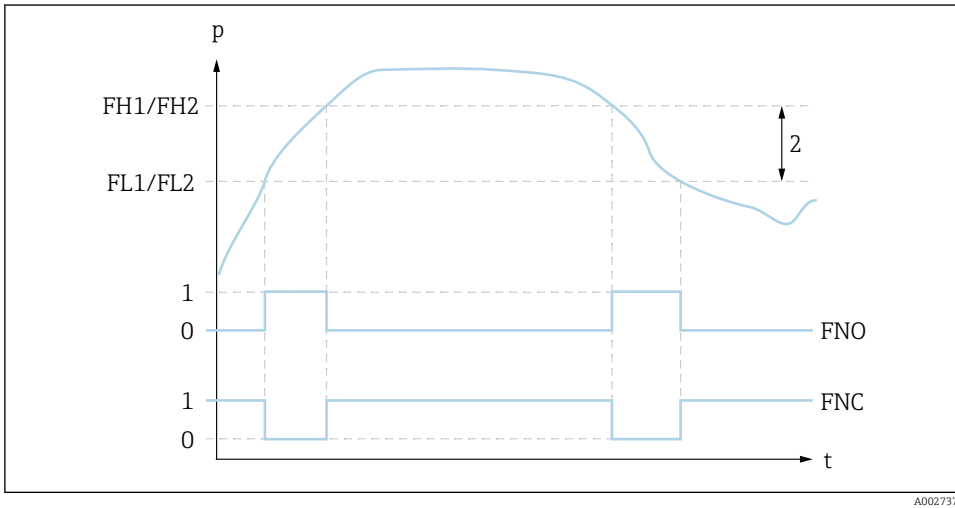
Navigation

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" in the Operating Instructions 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 Application examples

See Operating Instructions.

8.9 Configuring the local display

See Operating Instructions.

8.10 Protecting settings from unauthorized access

See Operating Instructions.

9 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 → 🖹 22				
✔	✔	✔	SP1				Switch point value, output 1	→ 🖹 30
✔	✔	✔	RP1				Switchback point value, output 1	→ 🖹 30
✔	✔	✔	FH1				Upper value for pressure window, output 1	→ 🖹 32
✔	✔	✔	FL1				Lower value for pressure window, output 1	→ 🖹 32
		✔	STL				Value for 4 mA (LRV)	
		✔	STU				Value for 20 mA (URV)	
	✔		SP2				Switch point, output 2	→ 🖹 30
	✔		RP2				Switchback point, output 2	→ 🖹 30
	✔		FH2				Upper value for pressure window, output 2	→ 🖹 32
	✔		FL2				Lower value for pressure window, output 2	→ 🖹 32
✔	✔	✔	**EF**				Extended functions	
✔	✔	✔		**RES**			Reset	
✔	✔	✔		dS1			Switching delay time, output 1	
✔	✔	✔		dR1			Switchback delay time, output 1	
	✔			dS2			Switching delay time, output 2	
	✔			dR2			Switchback delay time, output 2	
✔	✔	✔		**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	

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						
	✔			**Ou2**			Output 2	
					HNO		NO contact for hysteresis function	
					HNC		NC contact for hysteresis function	
					FNO		NO contact for window function	
					FNC		NC contact for window function	
		✔		**I**			Current output	
		✔			**GTL**		Pressure applied for 4mA (LRV)	
		✔			**GTU**		Pressure applied for 20mA (URV)	
		✔			**FCU**		Alarm current	
						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")	
		✔			**ON**		Switch on the current output (only visible if switch output is "OFF")	
✔	✔	✔		**UNI**			Unit changeover	
					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)	
✔	✔	✔		LO			Min value (minimum indicator)	
✔	✔	✔		ZRO			Zero point configuration	→ 📄 26
✔	✔	✔		GTZ			Zero point adoption	→ 📄 27
✔	✔	✔		TAU			Damping	
✔	✔	✔		**DIS**			Display	
✔	✔	✔			**DVA**	PV	Display measured value	

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						
						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	
✔	✔	✔		**ADM**			Administration	
					LCK		Unlocking code	
					COD		Locking code	
✔	✔	✔	**DIAG**				Diagnostics	
				STA			Current device status	
				LST			Last device status	
				RVC			Revision counter	
✔	✔	✔		**SM1**			Simulation output 1	
					OFF			
					OPN		Switch output opened	
					CLS		Switch output closed	
	✔	✔		**SM2** [2]			Simulation output 2	
	✔	✔			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.

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