Operating Instructions

Ceraphant PTP31B, PTP33B

Process pressure measurement
Pressure switch for safe measurement and monitoring of absolute and gauge pressure
- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Instructions.
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1 Document information

1.1 Document function
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.

1.2 Symbols used

1.2.1 Safety symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="DANGER" /></td>
<td>DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.</td>
</tr>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.</td>
</tr>
<tr>
<td><img src="image" alt="CAUTION" /></td>
<td>CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.</td>
</tr>
<tr>
<td><img src="image" alt="NOTE" /></td>
<td>NOTE! This symbol contains information on procedures and other facts which do not result in personal injury.</td>
</tr>
</tbody>
</table>

1.2.2 Electrical symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Protective ground connection" /></td>
<td>A terminal which must be connected to ground prior to establishing any other connections.</td>
</tr>
<tr>
<td><img src="image" alt="Ground connection" /></td>
<td>A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.</td>
</tr>
</tbody>
</table>

1.2.3 Tool symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Open-ended wrench" /></td>
<td>Open-ended wrench</td>
</tr>
</tbody>
</table>

1.2.4 Symbols for certain types of information

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Permitted" /></td>
<td>Permitted. Procedures, processes or actions that are permitted.</td>
</tr>
<tr>
<td><img src="image" alt="Forbidden" /></td>
<td>Forbidden. Procedures, processes or actions that are forbidden.</td>
</tr>
<tr>
<td><img src="image" alt="Tip" /></td>
<td>Indicates additional information.</td>
</tr>
</tbody>
</table>
### 1.2.5 Symbols in graphics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
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<td><img src="image1" alt="Symbol" /></td>
<td>Reference to documentation</td>
</tr>
<tr>
<td><img src="image2" alt="Symbol" /></td>
<td>Reference to page</td>
</tr>
<tr>
<td><img src="image3" alt="Symbol" /></td>
<td>Reference to graphic</td>
</tr>
<tr>
<td><img src="image4" alt="Symbol" /></td>
<td>Series of steps</td>
</tr>
<tr>
<td><img src="image5" alt="Symbol" /></td>
<td>Result of a step</td>
</tr>
<tr>
<td><img src="image6" alt="Symbol" /></td>
<td>Visual inspection</td>
</tr>
</tbody>
</table>

### 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

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 Brief Operating Instructions (KA): getting the 1st measured value quickly

KA01163P:  
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
### 1.4 Terms and abbreviations

<table>
<thead>
<tr>
<th>Item</th>
<th>Term/abbreviation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>OPL</td>
<td>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 → 76. The OPL may only be applied for a limited period of time.</td>
</tr>
<tr>
<td>2</td>
<td>MWP</td>
<td>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 → 76. The MWP may be applied at the device for an unlimited period. The MWP can also be found on the nameplate.</td>
</tr>
<tr>
<td>3</td>
<td>Maximum sensor measuring range</td>
<td>Span between LRL and URL. This sensor measuring range is equivalent to the maximum calibratable/adjustable span.</td>
</tr>
<tr>
<td>4</td>
<td>Calibrated/adjusted span</td>
<td>Span between LRV and URV. Factory setting: 0 to URL. Other calibrated spans can be ordered as customized spans.</td>
</tr>
</tbody>
</table>

- **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

<table>
<thead>
<tr>
<th>LRL</th>
<th>LRV</th>
<th>URV</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

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):**

\[
TD = \frac{URL}{URV - LRV}
\]

**Example:**

- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

**TD:**

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

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

2.1 Requirements concerning the staff
The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

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

The operating personnel must fulfill the following requirements:

‣ Being instructed and authorized according to the requirements of the task by the facility's owner-operator
‣ Following the instructions in these Operating Instructions

2.2 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

3.1 Product design

<table>
<thead>
<tr>
<th>Overview</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>A</td>
<td>Valve plug</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Cable</td>
<td></td>
</tr>
</tbody>
</table>
| C | M12 plug 
Housing cap made of plastic |
| D | Housing |
| E | Process connection (sample illustration) |

3.2 Function

3.2.1 Calculating the pressure

Devices with metallic process isolating diaphragm

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

4.1 Incoming acceptance

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

Are the goods undamaged?

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

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

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

4.2.1 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 Mounting dimensions
For dimensions, see the "Mechanical construction" section in the Technical Information.

5.2 Installation conditions
• No moisture may enter the housing when installing or operating the device, or when establishing the electrical connection.
• Do not clean or touch process isolating diaphragms with hard and/or pointed objects.
• Do not remove the protector on the process isolating diaphragm until just before installation.
• Always firmly tighten the cable entry.
• Point the cable and connector downwards where possible to prevent moisture from entering (e.g. rain or condensation water).
• Protect the housing from impact
• The following instruction applies for devices with a gauge pressure sensor and M12 plug or valve plug:

NOTICE
If a heated device is cooled during the cleaning process (e.g. by cold water), a vacuum develops for a short time, whereby moisture can penetrate the sensor through the pressure compensation element (1).
Device could be destroyed!
• In this case, mount the device with the pressure compensation element (1) pointing diagonally downwards where possible or to the side.

5.3 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.

<table>
<thead>
<tr>
<th>Process isolating diaphragm axis is horizontal (A)</th>
<th>Process isolating diaphragm pointing upwards (B)</th>
<th>Process isolating diaphragm pointing downwards (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration position, no effect</td>
<td>Up to +4 mbar (+0.058 psi)</td>
<td>Up to –4 mbar (–0.058 psi)</td>
</tr>
</tbody>
</table>

A position-dependent zero shift can be corrected on the device.
5.4 Mounting location

5.4.1 Pressure measurement

Functional testing can be carried out more easily if you mount the device downstream from a shutoff device.

Pressure measurement in gases

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

![Diagram showing device and shutoff device mounted above tapping point for gases]

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.

![Diagram showing device and shutoff device mounted below tapping point for vapors, with siphon for temperature reduction]
**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.

![Diagram of pressure measurement in liquids](image)

1. **Device**
2. **Shutoff device**
3. **Siphon**

**5.4.2 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.
- Functional testing can be carried out more easily if you mount the device downstream from a shutoff device.

![Diagram of level measurement](image)
### 5.5 Post-installation check

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>Is the device undamaged (visual inspection)?</td>
</tr>
</tbody>
</table>
| ☐ | Does the device conform to 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 from precipitation and direct sunlight? |
| ☐ | Are the securing screws tightened securely? |
| ☐ | Does the pressure compensation element point downwards at an angle or to the side? |
| ☐ | To prevent the penetration of moisture: are the connecting cables/plugs pointing downwards? |
6 Electrical connection

6.1 Connecting the measuring unit

6.1.1 Terminal assignment

⚠️ WARNING
Risk of injury from the uncontrolled activation of processes!
- Switch off the supply voltage before connecting the device.
- Make sure that downstream processes are not started unintentionally.

⚠️ WARNING
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 whether the supply voltage matches the supply voltage indicated on the nameplate.
2. Connect device in accordance with the following diagram.

Switch on 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

<table>
<thead>
<tr>
<th>M12 plug</th>
<th>Valve plug</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- Brown = L+
- Black = switch output 1
- White = not assigned
- Blue = L-
- Green/yellow = ground
- (a) reference air hose
2 x PNP switch outputs R1 and R2

<table>
<thead>
<tr>
<th>M12 plug</th>
<th>Valve plug</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1 3 4</td>
<td></td>
<td>0.63A L+ L-</td>
</tr>
<tr>
<td>2a 2b 3 4</td>
<td>1 2a 3 4</td>
<td></td>
</tr>
<tr>
<td>brown = L+</td>
<td>R1</td>
<td>R2</td>
</tr>
<tr>
<td>black = switch output 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>white = switch output 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blue = L-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green/yellow = ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) reference air hose</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>M12 plug</th>
<th>Valve plug</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 1 3 4</td>
<td></td>
<td>0.63A L+ L-</td>
</tr>
<tr>
<td>2a 2b 3 4</td>
<td>1 2a 3 4</td>
<td></td>
</tr>
<tr>
<td>brown = L+</td>
<td>R1</td>
<td>R2</td>
</tr>
<tr>
<td>black = switch output 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>white = analog output 4 to 20 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>blue = L-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>green/yellow = ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) reference air hose</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.1.2 Supply voltage
Supply voltage: 10 to 30 V DC

6.1.3 Current consumption and alarm signal

<table>
<thead>
<tr>
<th>Intrinsic power consumption</th>
<th>Alarm current (for devices with analog output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 60 mA</td>
<td>≥ 21 mA (factory setting)</td>
</tr>
</tbody>
</table>

6.2 Relay switching capacity
- Switch state ON: \( I_s \leq 250 \text{ mA} \); switch state OFF: \( I_s \leq 1 \text{ mA} \)
- Switch cycles: \( >10,000,000 \)
- Voltage drop PNP: \( \leq 2 \text{ V} \)
- Overload protection: Automatic load testing of switching current;
  - Max. capacitance load: 14 \( \mu \text{F} \) 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 (\( f = 2 \text{ Hz} \)) and "F804" display
6.3 Connection conditions

6.3.1 Cable specification
For valve plug: < 1.5 mm² (16 AWG) and Ø3.5 to 6.5 mm (0.14 to 0.26 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:

\[
R_{L\text{max}} = \frac{U_B - 6.5\text{V}}{23\text{mA}}
\]

Where:
1. Power supply 10 to 30 V DC
2. \(R_{L\text{max}}\), maximum load resistance
3. \(U_B\), Supply voltage

When excessively high load:
- Output of the fault current and display of “S803”
- Periodic review whether error condition may be left

6.5 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 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".

<table>
<thead>
<tr>
<th>User role</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator (display level)</td>
<td>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 simple forward the information on the errors but do not intervene themselves.</td>
</tr>
<tr>
<td>Maintenance (user level)</td>
<td>Service engineers usually work with the devices in the phases following device commissioning. They are primarily involved in maintenance and troubleshooting activities for which simple settings have to be made at the device. Technicians work with the devices over the entire life cycle of the product. Thus, commissioning and advanced settings and configurations are some of the tasks they have to carry out.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>User role</th>
<th>Submenu</th>
<th>Meaning/use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator (display level)</td>
<td>Display/operat.</td>
<td>Display of measured values, fault and information messages</td>
</tr>
<tr>
<td>Maintenance (user level)</td>
<td>Parameters on the topmost menu level.</td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>EF</td>
<td>The submenu &quot;EF&quot; contains additional parameters which allow more accurate configuration of the measurement, conversion of the measured value and scaling of the output signal.</td>
</tr>
<tr>
<td></td>
<td>DIAG</td>
<td>Contains all the parameters that are needed to detect and analyze operating errors.</td>
</tr>
</tbody>
</table>

For an overview of the entire operating menu, see the → 46

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 the values can be rotated electronically by 180° (see parameter description for 'DRO' → 62). 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.
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 key is pressed by way of confirmation. Enter the desired value with the or key and press the 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 effects the TD, an diagnostic message is issued.

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.

<table>
<thead>
<tr>
<th>Operating key(s)</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| +               | • Navigate downwards in the picklist  
|                 | • Edit the numerical values and characters within a function |
| -               | • Navigate upwards in the picklist  
|                 | • Edit the numerical values and characters within a function |
| E               | • Confirm entry  
|                 | • Jump to the next item  
|                 | • Selection of a menu item and activation of edit mode  
|                 | • The key lock function (KYL) is accessed by pressing the key for longer than 2 seconds |

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 \( \text{ } \) key for at least 2 seconds and then release it
2. By confirming with \( \text{ } \) "ON" is displayed
3. Use \( \text{ } \) and \( \text{ } \) to toggle between "ON" and "OFF"
4. Key locking is disabled as soon as \( \text{ } \) is pressed to confirm "OFF"

The display changes to the main value level (topmost menu level) if the \( \text{ } \) key is pressed briefly. The display changes to the key locking if the \( \text{ } \) 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 \( \text{ } \) 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

<table>
<thead>
<tr>
<th>COD locking code</th>
</tr>
</thead>
</table>

**Navigation**
EF → ADM → COD

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

**Selection**
To lock: Enter a number ≠ the LCK release code (value range: 1 to 9999).

**Factory setting**
0000

7.6.3 Unlocking parameter settings

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

<table>
<thead>
<tr>
<th>LCK unlocking code</th>
</tr>
</thead>
</table>

---

Endress+Hauser
<table>
<thead>
<tr>
<th><strong>Navigation</strong></th>
<th>EF → ADM → LCK</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Use this function to enter the code (which was defined in the COD parameter) to enable configuration. Keys are evaluated but parameters are read only. The parameters can only be changed after unlocking. If an attempt is made to write to a parameter, a prompt for the device access code appears. To unlock, enter the user-defined device access code (which was specified in the COD parameter).</td>
</tr>
<tr>
<td><strong>User entry</strong></td>
<td>To unlock: Enter the access code.</td>
</tr>
<tr>
<td><strong>Factory setting</strong></td>
<td>0000</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>The access code is &quot;0000&quot; in the order configuration. Another access code can be defined in the parameter &quot;COD&quot;.</td>
</tr>
</tbody>
</table>
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 |
| Initial setting is "NO" (display 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
- One LED indicates if the device is switched on or if an error or fault has occurred

![Status LEDs diagram](image)

1 Status LED
2 Switch output LEDs

7.9 Resetting to factory settings (reset)
See parameter description for RES → ▶ 54
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
- 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 → 18
- 'Post-connection check' checklist → 21

8.2 Enabling configuration/operation

The device features
- Automatic key locking → 24
- Parameter locking → 24.

8.3 Commissioning with an operating menu

Commissioning comprises the following steps:
- Configuration of pressure measurement → 27
- If necessary, perform position adjustment → 29
- If necessary, Configuration of process monitoring if necessary → 32
- If necessary, Configuration of the local display if necessary → 37
- If necessary, Protection of settings from unauthorized access if necessary → 38

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 "Position adjustment" section.

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

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: STL. 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 "Position adjustment" section.

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

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, or 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 → 32.

<table>
<thead>
<tr>
<th>Function</th>
<th>Output</th>
<th>Abbreviation for operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysteresis</td>
<td>Closing</td>
<td>HNO</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>NC contact</td>
<td>HNC</td>
</tr>
<tr>
<td>Window</td>
<td>Closing</td>
<td>FNO</td>
</tr>
<tr>
<td>Window</td>
<td>NC contact</td>
<td>FNC</td>
</tr>
</tbody>
</table>

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.
  - 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.

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)

Description

The switch point "SP1/SP2" and the switchback point "RP1/RP2" can be defined with these functions (e.g. for pump control).

When the set switch point "SP1/SP2" is reached (with increasing pressure), an electrical signal change takes place at the switch output.

When the set switchback point "RP1/RP2" is reached (with decreasing pressure), an electrical signal change takes place at the switch output.

The difference between the value of the switch point "SP1/SP2" and the switchback point "RP1/RP2" is known as the hysteresis.

Prerequisite

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

Note

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

Selection

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

Factory setting

Factory setting (if no customer-specific setting is ordered):
Switch point SP1: 45 %; switchback point RP1: 44.5 %
Switch point SP2: 55 %; switchback point RP2: 54.5 %
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)

**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!

Selection

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

Factory setting

Factory setting if no customer-specific setting is ordered:
Switch point FH1: 45 %; switchback point FL1: 44.5 %
Switch point FH2: 55 %; switchback point FH2: 54.5 %

8.8 Current output

STL value for 4 mA (LRV)

Navigation

STL

Description

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

Prerequisite

Electronic version with current output

Note

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

Selection

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

Factory setting

0.0 or as per order specifications

STU value for 20 mA (URV)

Navigation

STU

Description

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

Prerequisite

Electronic version with current output

Note

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

Ceraphant PTP31B, PTP33B

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

Factory setting
Upper measuring limit or as per order specifications.

---

GTL Pressure applied for 4mA (LRV)

Navigation
EF → I → GTL

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

Selection
- NO
- YES

Factory setting
NO

---

GTU Pressure applied for 20 mA (URV)

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

Selection
- NO
- YES

Factory setting
NO

8.9 Application examples

8.9.1 Compressor control with hysteresis function
Example: The compressor is started when the pressure drops below a certain value. The compressor is switched off when a certain value is exceeded.
1. Set the switch point to 2 bar (29 psi)
2. Set the switchback point to 1 bar (14.5 psi)
3. Configure the switch output as an 'NC contact' (HNC function)
The compressor is controlled by the defined settings.

8.9.2 Pump control with hysteresis function
Example: The pump should switch on when 2 bar (29 psi) is reached (increasing pressure) and switch off when 1 bar (14.5 psi) is reached (decreasing pressure).
1. Set the switch point to 2 bar (29 psi)
2. Set the switchback point to 1 bar (14.5 psi)
3. Configure the switch output as an 'NC contact'
The pump is controlled by the defined settings.

8.10 Configuring the local display

8.10.1 Adjusting the local display
The local display can be adjusted in the following menu:
EF → DIS
8.11 Protecting settings from unauthorized access  
→ 24
9 Diagnostics and troubleshooting

9.1 Troubleshooting

If an illegal configuration exists in the device, the device switches to error mode.

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

General errors

<table>
<thead>
<tr>
<th>Error</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device is not responding.</td>
<td>Supply voltage does not match that specified on the nameplate.</td>
<td>Apply correct voltage.</td>
</tr>
<tr>
<td></td>
<td>Supply voltage has incorrect polarity.</td>
<td>Reverse polarity of supply voltage.</td>
</tr>
<tr>
<td></td>
<td>Connecting cables are not in contact with the terminals.</td>
<td>Check the contacting of the cables and correct if necessary.</td>
</tr>
<tr>
<td>No display</td>
<td>The local display might be switched off.</td>
<td>Switch on the local display (see the 'DOF' parameter description).</td>
</tr>
<tr>
<td>Output current ≤ 3.6 mA</td>
<td>Signal line is not wired correctly.</td>
<td>Check wiring.</td>
</tr>
<tr>
<td>Device measures incorrectly.</td>
<td>Configuration error.</td>
<td>Check and correct the parameter configuration.</td>
</tr>
</tbody>
</table>
9.2 Diagnostic events

9.2.1 Diagnostic message

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

Status signals

The table lists the messages that may occur. The ALARM STATUS parameter shows the message with the highest priority. The device has four different status information codes according to NE107:

<table>
<thead>
<tr>
<th>Status signal</th>
<th>Event number</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>A0013956</td>
<td>“Failure” A device error has occurred. The measured value is no longer valid.</td>
</tr>
<tr>
<td>M</td>
<td>A0013957</td>
<td>“Maintenance required” Maintenance is required. The measured value remains valid.</td>
</tr>
<tr>
<td>C</td>
<td>A0013959</td>
<td>“Function check” The device is in service mode (e.g. during a simulation).</td>
</tr>
</tbody>
</table>
| S             | A0013960     | “Out of specification” The device is being operated:  
  - Outside its technical specifications (e.g. during warmup or cleaning processes)  
  - Outside the parameter configuration undertaken by the user (e.g. level outside of configured range) |

Diagnostics event and event text

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

<table>
<thead>
<tr>
<th>Diagnostic event</th>
<th>Status signal</th>
<th>Event number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>C</td>
<td>469</td>
</tr>
</tbody>
</table>

If two or more diagnostic events are pending simultaneously, only the message with the highest priority is shown.

The last diagnostic message is displayed - see the LST parameter in the DIAG submenu → 64.
### 9.2.2 List of diagnostic events

<table>
<thead>
<tr>
<th>Code</th>
<th>Diagnostic event</th>
<th>Cause</th>
<th>Corrective measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No error</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
| C431 | Invalid position adjustment | The calibration performed would cause the sensor nominal range to be exceeded or undershot. | Position adjustment + parameter of the current output must be within the sensor nominal range  
• Check the position adjustment (see the ZRO parameter)  
• Check the measuring range (see the STU and STL parameters) |
| C432 alternating with Ou1 | Invalid position adjustment, output 1 | The calibration performed causes the switch points to be outside the sensor nominal range. | Position adjustment + parameter of the hysteresis and window function must be within the sensor nominal range  
• Check the position adjustment (see the ZRO parameter)  
• Check the switch point, switchback point for hysteresis and window function |
| C432 alternating with Ou2 | Invalid position adjustment, output 2 | The calibration performed causes the switch points to be outside the sensor nominal range. | Position adjustment + parameter of the hysteresis and window function must be within the sensor nominal range  
• Check the position adjustment (see the ZRO parameter)  
• Check the switch point, switchback point for hysteresis and window function |
| C469 alternating with OU1 or OU2 | Switch points output 1 or 2 violated | Switch point ≤ switchback point | Check switch points at output |
| C485 | Simulation active | During simulation of the switch output or current output, the device issues a warning message for the duration of the simulation. | Switch off simulation |
| F270 | Overpressure/low pressure | Overpressure or low pressure present | • Check the process pressure  
• Check sensor range  
• Restart the device |
| F437 | Incompatible configuration | Invalid device configuration | • Restart the device  
• Reset device  
• Replace device |
| F804 | Overload at switch output 1 or 2 or both switch outputs | Load current > 250 mA per per output | Increase load resistance at switch output  
• Check output circuit  
• Replace device |
| S140 | Sensor signal outside of permitted ranges | Overpressure or low pressure present  
Sensor defective | Operate device in the specified measuring range  
Replace device |
| S510 | Turn down violated | A change in the span results in a violation of the turn down (max. TD 5:1)  
Values for calibration (lower range value and upper range value) are too close together | Operate device in the specified measuring range  
• Check the measuring range |
| S803 | Current loop 2 | Impedance of load resistance at analog output is too high | • Check the cabling and load at the current output.  
• If the current output is not required, switch the current output off via the configuration. |
### 9.3 Behavior of the device in the event of a fault

The device displays warnings and faults on the local display and indicates them via the status LEDs. All the device warnings and faults are for information purposes only and do not have a safety function. The errors diagnosed by the device are shown on the local display in accordance with NE107. In accordance with the diagnostic message, the device behaves as per a warning or fault condition. It is necessary to distinguish between the following types of errors here:

- **Warning:**
  - The device continues measuring if this type of error occurs. The output signal is not affected (exception: simulation is active).
  - The local display alternates between the warning and the main measured value.
  - The switch outputs remain in the state defined by the switch points.
  - Status LED flashes red.
  - The background remains white in the event of a warning

- **Fault:**
  - The device does **not** continue measuring if this type of error occurs. The output signal adopts its fault state (value in the event of an error - see the following section).
  - The fault state is indicated on the local display.
  - The switch outputs assume the "opened" state.
  - For the analog output option, an error is signaled with the configured alarm current behavior.

### 9.4 Response of output to errors

The response of the output to error is regulated in accordance with NAMUR NE43.
The behavior of the current output in case of fault is defined by the following parameters:
- FCU ‘MIN’: Lower alarm current (≤3.6 mA) (optional, see the following table) → 58
- FCU ‘MAX’ (factory setting): Upper alarm current (≥21 mA) → 58
- FCU ‘HLD’ (HOLD): Last measured current value is held. When the device starts, the current output is set to 'Lower alarm current' (≤3.6 mA). → 58

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

<table>
<thead>
<tr>
<th>Changing the failsafe mode</th>
<th>After confirming with</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>from MAX to MIN</td>
<td>active immediately</td>
<td></td>
</tr>
<tr>
<td>from MIN to MAX</td>
<td>active immediately</td>
<td></td>
</tr>
<tr>
<td>from HLD (HOLD) to MAX</td>
<td>active immediately</td>
<td></td>
</tr>
<tr>
<td>from HLD (HOLD) to MIN</td>
<td>active immediately</td>
<td></td>
</tr>
<tr>
<td>from MIN to HLD (HOLD)</td>
<td>outside the error condition</td>
<td>active</td>
</tr>
<tr>
<td>from MAX to HLD (HOLD)</td>
<td>outside the error condition</td>
<td>active</td>
</tr>
</tbody>
</table>

### 9.4.1 alarm current

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP31B PTP33B</td>
<td>Adjusted min. alarm current</td>
<td>IA 1)</td>
</tr>
<tr>
<td>PTP31B PTP33B</td>
<td>1 low ≤3.6 mA 2 high ≥21 mA 3 last current value</td>
<td>U 2)</td>
</tr>
</tbody>
</table>

1) Product Configurator order code for ‘Service’
2) Product Configurator order code for ‘Calibration/unit’

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

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

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

In the case of incorrect entries, the value entered is not accepted. No fault or warning is issued in this case. The value to be adjusted cannot be changed to a value outside the specified limit. This makes it impossible to configure the device using incorrect values. An exception to this is the configuration of the span, which results in a violation of the turn down, which in turn gives rise to a fault state.

### 9.7 Disposal

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

No special maintenance work is required.
Keep the pressure compensation element (1) free from contamination.

10.1 Exterior cleaning

Please note the following points when cleaning the device:

- The cleaning agents used should not corrode the surface and the seals.
- Mechanical damage to the process isolating diaphragm, e.g. due to sharp objects, must be avoided.
- Observe the degree of protection of the device. See the nameplate if necessary → 13.
11 Repair

11.1 General notes

11.1.1 Repair concept
Repairs are not possible.

11.2 Return
The measuring device must be returned if the wrong device has been ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material
12 Overview of the operating menu

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

<table>
<thead>
<tr>
<th>Switch output 1)</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="1 x PNP" /></td>
<td><img src="image" alt="2 x PNP" /></td>
<td><img src="image" alt="1 x PNP + 4 to 20 mA" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>KYL</td>
<td>If &quot;KYL&quot; is shown on the display, this means that the keys of the device are locked. To unlock the keys, see → 24</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>SP1</td>
<td>Switch point value, output 1 → 32</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>RP1</td>
<td>Switchback point value, output 1 → 32</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>FH1</td>
<td>Upper value for pressure window, output 1 → 34</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>FL1</td>
<td>Lower value for pressure window, output 1 → 34</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>STL</td>
<td>Value for 4 mA (LRV) → 35</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>STU</td>
<td>Value for 20 mA (URV) → 35</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>SP2</td>
<td>Switch point, output 2 → 32</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>RP2</td>
<td>Switchback point, output 2 → 32</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>FH2</td>
<td>Upper value for pressure window, output 2 → 34</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>FL2</td>
<td>Lower value for pressure window, output 2 → 34</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>EF</td>
<td>Extended functions</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>RES</td>
<td>Enter reset code → 54</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>dS1</td>
<td>Switching delay time, output 1 → 54</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>dR1</td>
<td>Switchback delay time, output 1 → 54</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>dS2</td>
<td>Switching delay time, output 2 → 54</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>dR2</td>
<td>Switchback delay time, output 2 → 54</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>Ou1</td>
<td>Output 1</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>Ou2</td>
<td>Output 2</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>HNO</td>
<td>NO contact for hysteresis function → 55</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>HNC</td>
<td>NC contact for hysteresis function → 56</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>FNO</td>
<td>NO contact for window function → 56</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>FNC</td>
<td>NC contact for window function → 56</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>I</td>
<td>Current output</td>
</tr>
<tr>
<td><img src="image" alt="✓" /></td>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>GTL</td>
<td>Pressure applied for 4mA (LRV) → 36</td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>NO</td>
<td>→ 36</td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td>YES</td>
<td>→ 36</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td></td>
<td>GTU</td>
<td>Pressure applied for 20mA (URV) → 36</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td></td>
<td>NO</td>
<td>→ 36</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="✓" /></td>
<td></td>
<td></td>
<td>YES</td>
<td>→ 36</td>
</tr>
</tbody>
</table>
## Overview of the operating menu

<table>
<thead>
<tr>
<th>Switch output</th>
<th>1 x PNP</th>
<th>2 x PNP</th>
<th>1 x PNP + 4 to 20 mA</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>FCU</td>
<td></td>
<td></td>
<td>alarm current</td>
<td>→ 58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MIN</td>
<td></td>
<td></td>
<td>In the event of an error: MIN (≤3.6 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MAX</td>
<td></td>
<td></td>
<td>In the event of an error: MAX (≥21 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HLD</td>
<td></td>
<td></td>
<td>Last current value (HOLD)</td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>OFF</td>
<td></td>
<td></td>
<td>Switch off the current output (only visible if switch output is “ON”)</td>
<td>→ 58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
<td></td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>ON</td>
<td></td>
<td></td>
<td>Switch on the current output (only visible if switch output is “OFF”)</td>
<td>→ 59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO</td>
<td></td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>UNI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unit changeover</td>
<td>→ 59</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BAR</td>
<td></td>
<td></td>
<td>Unit bar</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>KPA</td>
<td></td>
<td></td>
<td>Unit kPa (depends on the sensor measuring range)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MPA</td>
<td></td>
<td></td>
<td>Unit MPa (depends on the sensor measuring range)</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td>PSI</td>
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<td></td>
<td>Unit psi</td>
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</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>HI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Max value (maximum indicator)</td>
<td>→ 59</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>LO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min value (minimum indicator)</td>
<td>→ 60</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>ZRO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Zero point configuration</td>
<td>→ 29</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>GTZ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Zero point adoption</td>
<td>→ 30</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>TAU</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Damping</td>
<td>→ 61</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>DIS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Display</td>
<td>→ 62</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>DVA</td>
<td>PV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Display measured value</td>
<td>→ 62</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PVV/</td>
<td></td>
<td></td>
<td></td>
<td>Display the measured value as a percentage of the set span</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SP</td>
<td></td>
<td></td>
<td></td>
<td>Display set switch point</td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>DRO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Display measured value rotated by 180°</td>
<td>→ 62</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>DOF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Display off</td>
<td>→ 62</td>
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<td></td>
<td></td>
<td></td>
<td>NO</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>ADM</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>Administration</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td>LCK</td>
<td></td>
<td></td>
<td></td>
<td>Unlocking code</td>
<td>→ 24</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>COD</td>
<td></td>
<td></td>
<td></td>
<td>Locking code</td>
<td>→ 24</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>DIAG</td>
<td></td>
<td></td>
<td></td>
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<td>Diagnostics</td>
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<td></td>
<td></td>
<td>STA</td>
<td></td>
<td></td>
<td></td>
<td>Current device status</td>
<td>→ 64</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LST</td>
<td></td>
<td></td>
<td></td>
<td>Last device status</td>
<td>→ 64</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>RVC</td>
<td></td>
<td></td>
<td></td>
<td>Change counter</td>
<td>→ 64</td>
</tr>
<tr>
<td>✓ ✓ ✓</td>
<td>SM1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Simulation output 1</td>
<td>→ 64</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OFF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OPN</td>
<td></td>
<td></td>
<td></td>
<td>Switch output opened</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CLS</td>
<td></td>
<td></td>
<td></td>
<td>Switch output closed</td>
<td></td>
</tr>
</tbody>
</table>
### Overview of the operating menu

**Ceraphant PTP31B, PTP33B**

<table>
<thead>
<tr>
<th>Switch output</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x PNP</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>SM2</td>
<td>Simulation output 2</td>
</tr>
<tr>
<td>2 x PNP</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>1 x PNP + 4 to 20 mA</td>
<td>✔</td>
<td></td>
<td>OPN</td>
<td>Switch output opened</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td></td>
<td>CLS</td>
<td>Switch output closed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>3.5</td>
<td></td>
<td>Simulation value for analog output in mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>4.0</td>
<td></td>
<td>Simulation value for analog output in mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>8.0</td>
<td></td>
<td>Simulation value for analog output in mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>12.0</td>
<td></td>
<td>Simulation value for analog output in mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>16.0</td>
<td></td>
<td>Simulation value for analog output in mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>20.0</td>
<td></td>
<td>Simulation value for analog output in mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>21.95</td>
<td></td>
<td>Simulation value for analog output in mA</td>
<td></td>
</tr>
</tbody>
</table>

1) The assignment of the outputs cannot be modified.

2) For devices with current output: can only be selected if the current output is switched on.
13 Description of device parameters

13.1 Switch output 1 and switch output 2

13.1.1 Hysteresis (Switch point and switchback point)

**Navigation**

<table>
<thead>
<tr>
<th>SP1/SP2</th>
<th>switch point value, output 1/2</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP1/RP2</td>
<td>switchback point value, output 1/2</td>
</tr>
</tbody>
</table>

**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)

**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.
Description of device parameters

Ceraphant PTP31B, PTP33B

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

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

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

**Factory setting**
Factory setting (if no customer-specific setting is ordered):
Switch point SP1: 45 %; switchback point RP1: 44.5 %
Switch point SP2: 55 %; switchback point RP2: 54.5 %
13.1.2 Window function

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

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

Navigation

FH1/FH2
FL1/FL2

Note

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

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

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!

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

### Factory setting
Factory setting if no customer-specific setting is ordered:
- Switch point FH1: 45 %; switchback point FL1: 44.5 %
- Switch point FH2: 55 %; switchback point FH2: 54.5 %
13.2 Current output

**STL value for 4 mA (LRV)**

**Navigation**

STL

**Description**

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

**Prerequisite**

Electronic version with current output

**Note**

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

**Selection**

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

**Factory setting**

0.0 or as per order specifications

---

**STU value for 20 mA (URV)**

**Navigation**

STU

**Description**

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

**Prerequisite**

Electronic version with current output

**Note**

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

**Selection**

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

**Factory setting**

Upper measuring limit or as per order specifications.
13.3 EF menu (extended functions)

RES Reset

Navigation  
EF → RES

Description  

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

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

The following parameters are not reset when a reset is performed:  
• LO  
• HI  
• LST  
• RVC

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

Value at switch-on  
NO

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

Options  
• NO  
• YES

Factory setting  
NO

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

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

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

Navigation  
EF → dS1/dS2  
EF → dR1/dR2
Description

To prevent constant switch-on and switch-off if values are around the switch point "SP1/SP2" or the switchback point "RP1/RP2", a delay in a range of 0 – 50 seconds, to two decimal places, can be set for the individual points.

If the measured value leaves the switching range during the delay time, the delay time starts again from scratch.

Example

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

dS1/dS2: ≥2 bar (29 psi) must be present for at least 5 seconds for SP1/SP2 to become active.

dR1/dR2: ≤1 bar (14.5 psi) must be present for at least 2 seconds for RP1/RP2 to become active.

Diagram:

- 0: 0-signal. Output open in quiescent state.
- 2: Hysteresis (difference between the value of the switch point "SP1/SP2" and the value of the switchback point "RP1/RP2")

HNO: Closing
HNC: NC contact
SP1/SP2: Switch point 1/2
RP1/RP2: Switchback point 1/2

dS1: Set time for which the specific switch point must be reached continuously without interruption until an electrical signal change takes place.

dR1: Set time for which the specific switchback point must be reached continuously without interruption until an electrical signal change takes place.

Value at switch-on: 0
Input range: 0.00 - 50.00 seconds
Factory setting: 0

HNO: NO contact for hysteresis function
<table>
<thead>
<tr>
<th>Description of device parameters</th>
<th>Ceraphant PTP31B, PTP33B</th>
</tr>
</thead>
</table>
| **Navigation** | EF → Ou1 → HNO  
EF → Ou2 → HNO |
| **Description** | If this parameter is selected, the switch output is defined as an NO contact with a hysteresis property.  
Navigate to the parameter and press the ⬤ key. |
| **Factory setting** | The switch output is opened in the quiescent state (not actuated) and returns a 0 signal. |

**HNC** NC contact for hysteresis function

| Navigation | EF → Ou1 → HNC  
EF → Ou2 → HNC |
| Description | If this parameter is selected, the switch output is defined as an NC contact with a hysteresis property.  
Navigate to the parameter and press the ⬤ key. |
| Factory setting | The switch output is closed in the quiescent state (not actuated) and returns a 1 signal. |

**FNO** NO contact for window function

| Navigation | EF → Ou1 → FNO  
EF → Ou2 → FNO |
| Description | If this parameter is selected, the switch output is defined as an NO contact with a window property.  
Navigate to the parameter and press the ⬤ key. |
| Factory setting | The switch output is opened in the quiescent state (not actuated) and returns a 0 signal. |

**FNC** NC contact for window function

| Navigation | EF → Ou1 → FNC  
EF → Ou2 → FNC |
| Description | If this parameter is selected, the switch output is defined as an NC contact with a window property.  
Navigate to the parameter and press the ⬤ key. |
| Factory setting | The switch output is closed in the quiescent state (not actuated) and returns a 1 signal. |

**GTL** Pressure applied for 4mA (LRV)
Ceraphant PTP31B, PTP33B

Description of device parameters

Navigation
EF → I → GTL

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

Selection
• NO
• YES

Factory setting
NO

GTU Pressure applied for 20 mA (URV)

Navigation
EF → I → GTU

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

Selection
• NO
• YES

Factory setting
NO
FCU Alarm current

Navigation
EF → FCU

Description
The device displays warnings and faults. This is done on the local display via the diagnostic message stored in the device. The purpose of all device diagnostics is solely to provide information to the user; they do not have a safety function. The errors diagnosed by the Ceraphant are shown on the display in accordance with NE107. In accordance with the diagnostic message, the device behaves as per a warning or fault condition:

**Warning (S971, S140, C485, C431, C432):**

With this type of error, the device continues to measure. The output signal does not adopt its fault state (value in the event of an error). The local display alternates (0.5 Hz) between the main measured value and the state in the form of the letter plus a defined number. The switch outputs remain in the state defined by the switch points. The status LED flashes red in addition to the display output.

**Fault (F437, S803, F270, S510, C469, F804):**

With this type of error, the device does not continue to measure. The output signal adopts its fault state (value in the event of an error). The fault state is shown on the local display in the form of the letter plus a defined number. In the case of devices with 2 outputs, the display alternates (0.5 Hz) between the error display and the channel assignment (OuX). The switch outputs assume the defined state (open). For the analog output option, an error is also signaled and transmitted via the 4 to 20mA signal. In NE43, NAMUR defines a current ≤3.6 mA and ≥21 mA as a device failure. A corresponding diagnostic message is displayed. Current levels available for selection:

The selected alarm current is used for all errors. Diagnostic messages are displayed only on the primary value page (topmost display level) with digits and a letter and not in the operating menu – only the display color and LED provide an indication here. It is not possible to acknowledge all the diagnostic messages. The relevant message disappears if the event is no longer pending.

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

Selection
- MIN: Lower alarm current (≤3.6 mA)
- MAX: Upper alarm current (≥21 mA)
- HLD (HOLD): Last measured current value is held. When the device starts, the current output is set to 'Lower alarm current' (≤3.6 mA).

Factory setting: MAX
If error S803 has occurred, the error always outputs a MIN error current ≤3.6 mA irrespective of the configuration.

OFF Switch off current output

Navigation
EF → I → OFF

Description
Switches off the current output.

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

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

Factory setting

NO

**ON** Switch on current output

**Navigation**

EF → I → ON

**Description**

Switches on the current output.

**Prerequisite**

Is only displayed if the current output is switched off.

**Selection**

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

**Factory setting**

NO

**UNI** unit changeover

**Navigation**

EF → UNI

**Description**

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

**Value at switch-on**

Depends on order specifications.

**Selection**

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

**Factory setting**

Depends on order specifications.

**HI** Max value (maximum indicator)

**Navigation**

EF → HI

**Description**

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

**Factory setting**

Start value LRL, cannot be deleted afterwards
**LO** Min value (minimum indicator)

**Navigation**
EF → LO

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

**Factory setting**
Start value URL, cannot be deleted afterwards

**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.

**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.

Example 1
• Measured value = 2.2 mbar (0.033 psi)
• You use the "GTZ" parameter to correct the measured value with the value, e.g.
  2.2 mbar (0.033 psi). This means that you are assigning the value 0 mbar (0 psi) to the
  pressure present.
• Measured value (after pos. zero adjust) = 0 mbar (0 psi)
• The current value is also corrected.
• If necessary, check and correct switch points and span settings.

Example 2
Sensor measuring range: –0.4 to +0.4 bar (–6 to +6 psi) (SP1 = 0.4 bar (6 psi); STU =
0.4 bar (6 psi))
• Measured value = 0.08 bar (1.2 psi)
• You use the "GTZ" parameter to correct the measured value with the value, e.g.
  0.08 bar (1.2 psi). This means that you are assigning the value 0 mbar (0 psi) to the
  pressure present.
• Measured value (after pos. zero adjust) = 0 mbar (0 psi)
• The current value is also corrected.
• Warnings C431 or C432 appear because the value 0 bar (0 psi) was assigned to the real
  value of 0.08 bar (1.2 psi) present and the sensor measuring range was thus exceeded
  by ± 20%.
  SP1 and STU values must be readjusted downwards by 0.08 bar (1.2 psi).

Factory setting
0.0

TAU damping

Navigation
EF → TAU

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

Input range
0.0 to 999.9 seconds in increments of 0.1 seconds

Factory setting
2 seconds or according to order specifications
DVA Measured value display

Navigation  
EF → DIS → DVA

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

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

Factory setting  
PV

DRO Display measured value rotated by 180°

Navigation  
EF → DIS → DRO

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

Selection  
- NO
- YES

DOF Switch display on or off

Navigation  
EF → DIS → DOF

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

Selection  
- NO
- YES

LCK Unlocking code

Navigation  
EF → ADM → LCK
### Description
Use this function to enter the code (which was defined in the COD parameter) to enable configuration. Keys are evaluated but parameters are read only. The parameters can only be changed after unlocking. If an attempt is made to write to a parameter, a prompt for the device access code appears. To unlock, enter the user-defined device access code (which was specified in the COD parameter).

### User entry
To unlock: Enter the access code.

### Factory setting
0000

### Note
The access code is '0000' in the order configuration. Another access code can be defined in the parameter 'COD'.

---

### COD locking code

<table>
<thead>
<tr>
<th>Navigation</th>
<th>EF → ADM → COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>A code can be entered to protect parameter settings against unauthorized and unwanted access.</td>
</tr>
<tr>
<td>Selection</td>
<td>To lock: Enter a number ≠ the LCK release code (value range: 1 to 9999).</td>
</tr>
<tr>
<td>Factory setting</td>
<td>0000</td>
</tr>
</tbody>
</table>
### 13.4 DIAG menu (diagnosis)

#### STA Current device status

**Navigation**

DIAG → STA

**Description**

Displays the current device status.

#### LST Last device status

**Navigation**

DIAG → LST

**Description**

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

#### RVC Revision counter

**Navigation**

DIAG → RVC

**Description**

Counter that indicates the number of parameter changes.

#### SM1 Simulation output 1

**Navigation**

DIAG → SM1

**Description**

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

**Selection**

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

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

**Navigation**

DIAG → SM2
Description

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

Selection

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

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

Navigation

DIAG → SM2

Description

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

Selection

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

14.1 Weld-in adapter

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

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

1) Product Configurator, order code for “Enclosed accessories”

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

14.2 Process adapter M24

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

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Order number</th>
<th>Order number with inspection certificate 3.1 EN10204</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP33B</td>
<td>Varivent F DN32 PN40</td>
<td>52023996</td>
<td>52024003</td>
</tr>
<tr>
<td>PTP33B</td>
<td>Varivent N DN50 PN40</td>
<td>52023997</td>
<td>52024004</td>
</tr>
<tr>
<td>PTP33B</td>
<td>DIN11851 DN40</td>
<td>52023999</td>
<td>52024006</td>
</tr>
<tr>
<td>PTP33B</td>
<td>DIN11851 DN50</td>
<td>52023998</td>
<td>52024005</td>
</tr>
<tr>
<td>PTP33B</td>
<td>SMS 1½&quot;</td>
<td>52026997</td>
<td>52026999</td>
</tr>
<tr>
<td>PTP33B</td>
<td>Clamp 1½&quot;</td>
<td>52023994</td>
<td>52024001</td>
</tr>
<tr>
<td>PTP33B</td>
<td>Clamp 2&quot;</td>
<td>52023995</td>
<td>52024002</td>
</tr>
</tbody>
</table>
### 14.3 M12 plug connectors

<table>
<thead>
<tr>
<th>Connector</th>
<th>Degree of protection</th>
<th>Material</th>
<th>Option</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 (self-terminated connection at M12 plug)</td>
<td>IP67</td>
<td>Union nut: Cu Sn/Ni&lt;br&gt;Body: PBT&lt;br&gt;Seal: NBR</td>
<td>R1</td>
<td>52006263</td>
</tr>
<tr>
<td>M12 90 degrees with 5m (16 ft) cable</td>
<td>IP67</td>
<td>Union nut: GD Zn/Ni&lt;br&gt;Body: PUR&lt;br&gt;Cable: PVC</td>
<td>RZ</td>
<td>52010285</td>
</tr>
<tr>
<td>M12 90 degrees (self-terminated connection at M12 plug)</td>
<td>IP67</td>
<td>Union nut: GD Zn/Ni&lt;br&gt;Body: PBT&lt;br&gt;Seal: NBR</td>
<td>RM</td>
<td>71114212</td>
</tr>
</tbody>
</table>

1) Product Configurator, order code for 'Enclosed accessories'
15 Technical data

15.1 Input

15.1.1 Measured variable

Measured process variable
Gauge pressure or absolute pressure

Calculated process variable
Pressure

15.1.2 Measuring range

Metal process isolating diaphragm

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Device</th>
<th>Maximum Sensor measuring range</th>
<th>Lowest calibratable span</th>
<th>MWP</th>
<th>OPL</th>
<th>Factory settings</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>lower (LRL)</td>
<td>upper (URL)</td>
<td>[bar (psi)]</td>
<td>[bar (psi)]</td>
<td>[bar (psi)]</td>
<td>[bar (psi)]</td>
</tr>
<tr>
<td>400 mbar (6 psi)</td>
<td>PTP31B PTP33B</td>
<td>-0.4 (-6)</td>
<td>+0.4 (+6)</td>
<td>0.4 (0.6)</td>
<td>1 (15)</td>
<td>1.6 (24)</td>
<td>0 to 400 mbar (0 to 6 psi)</td>
</tr>
<tr>
<td>1 bar (15 psi)</td>
<td>PTP31B PTP33B</td>
<td>-1 (-15)</td>
<td>+1 (+15)</td>
<td>1 (15)</td>
<td>2.7 (40.5)</td>
<td>4 (60)</td>
<td>0 to 1 bar (0 to 15 psi)</td>
</tr>
<tr>
<td>2 bar (30 psi)</td>
<td>PTP31B PTP33B</td>
<td>-1 (-15)</td>
<td>+2 (+30)</td>
<td>0.4 (0.6)</td>
<td>6.7 (100.5)</td>
<td>10 (150)</td>
<td>0 to 2 bar (0 to 30 psi)</td>
</tr>
<tr>
<td>4 bar (60 psi)</td>
<td>PTP31B PTP33B</td>
<td>-1 (-15)</td>
<td>+4 (+60)</td>
<td>0.8 (1.2)</td>
<td>10.7 (160.5)</td>
<td>16 (240)</td>
<td>0 to 4 bar (0 to 60 psi)</td>
</tr>
<tr>
<td>10 bar (150 psi)</td>
<td>PTP31B PTP33B</td>
<td>-1 (-15)</td>
<td>+10 (+150)</td>
<td>2 (30)</td>
<td>25 (375)</td>
<td>40 (600)</td>
<td>0 to 10 bar (0 to 150 psi)</td>
</tr>
<tr>
<td>40 bar (600 psi)</td>
<td>PTP31B PTP33B</td>
<td>-1 (-15)</td>
<td>+40 (+600)</td>
<td>8 (120)</td>
<td>100 (1500)</td>
<td>160 (2400)</td>
<td>0 to 40 bar (0 to 600 psi)</td>
</tr>
<tr>
<td>100 bar (1500 psi)</td>
<td>PTP31B</td>
<td>-1 (-15)</td>
<td>+100 (+1500)</td>
<td>20 (300)</td>
<td>100 (1500)</td>
<td>160 (2400)</td>
<td>0 to 100 bar (0 to 1500 psi)</td>
</tr>
<tr>
<td>400 bar (6000 psi)</td>
<td>PTP31B</td>
<td>-1 (-15)</td>
<td>+400 (+6000)</td>
<td>80 (1200)</td>
<td>400 (6000)</td>
<td>600 (9000)</td>
<td>0 to 400 bar (0 to 6000 psi)</td>
</tr>
</tbody>
</table>
# Technical data

**Sensor**

<table>
<thead>
<tr>
<th>Device</th>
<th>Maximum sensor measuring range</th>
<th>Lowest calibratable span (^1)</th>
<th>MWP</th>
<th>OPL</th>
<th>Factory settings (^2)</th>
<th>Option (^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lower (LRL) [bar (psi)]</td>
<td>upper (URL) [bar (psi)]</td>
<td>[bar (psi)]</td>
<td>[bar (psi)]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400 mbar (6 psi) (^4)</td>
<td>PTP31B PTP33B</td>
<td>0 (0)</td>
<td>0.4 (+6)</td>
<td>0.4 (0.6)</td>
<td>1 (15)</td>
<td>1.6 (24)</td>
</tr>
<tr>
<td>1 bar (15 psi) (^4)</td>
<td>PTP31B PTP33B</td>
<td>0 (0)</td>
<td>1 (+15)</td>
<td>1 (15)</td>
<td>2.7 (40.5)</td>
<td>4 (60)</td>
</tr>
<tr>
<td>2 bar (30 psi) (^4)</td>
<td>PTP31B PTP33B</td>
<td>0 (0)</td>
<td>2 (+30)</td>
<td>0.4 (0.6)</td>
<td>6.7 (100.5)</td>
<td>10 (150)</td>
</tr>
<tr>
<td>4 bar (60 psi) (^4)</td>
<td>PTP31B PTP33B</td>
<td>0 (0)</td>
<td>4 (+60)</td>
<td>0.8 (1.2)</td>
<td>10.7 (160.5)</td>
<td>16 (240)</td>
</tr>
<tr>
<td>10 bar (150 psi) (^4)</td>
<td>PTP31B PTP33B</td>
<td>0 (0)</td>
<td>10 (+150)</td>
<td>2 (30)</td>
<td>25 (375)</td>
<td>40 (600)</td>
</tr>
<tr>
<td>40 bar (600 psi) (^4)</td>
<td>PTP31B PTP33B</td>
<td>0 (0)</td>
<td>+40 (+600)</td>
<td>8 (120)</td>
<td>100 (1500)</td>
<td>160 (2400)</td>
</tr>
<tr>
<td>100 bar (1500 psi) (^4)</td>
<td>PTP31B PTP33B</td>
<td>0 (0)</td>
<td>+100 (+1500)</td>
<td>20 (300)</td>
<td>100 (1500)</td>
<td>160 (2400)</td>
</tr>
<tr>
<td>400 bar (6000 psi) (^4)</td>
<td>PTP31B</td>
<td>0 (0)</td>
<td>+400 (+6000)</td>
<td>80 (1200)</td>
<td>400 (6000)</td>
<td>600 (9000)</td>
</tr>
</tbody>
</table>

---

1) Highest turn down that can be set at the factory: 5:1. The turn down is preset and cannot be changed.

2) Other measuring ranges (e.g., −1 to +5 bar (−15 to 75 psi)) can be ordered with customer-specific settings (see the Product Configurator, order code for "Calibration; Unit" option \(^\dagger\)). It is possible to invert the output signal (LRV = 20 mA; URV = 4 mA). Prerequisite: URV < LRV

3) Product Configurator, order code for "Sensor range"

4) Vacuum resistance: 0.01 bar (0.145 psi)

---

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

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

15.2.1 Output signal

<table>
<thead>
<tr>
<th>Description</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNP switch output + 4 to 20 mA output (4-wire)</td>
<td>3</td>
</tr>
<tr>
<td>PNP switch output (3-wire)</td>
<td>4</td>
</tr>
<tr>
<td>2 x PNP switch output (4-wire)</td>
<td>5</td>
</tr>
</tbody>
</table>

1) Product Configurator, order code for “Output”

15.2.2 Range of adjustment

- Switch output
  Switch point (SP): 0.5 to 100 % in increments of 0.1% (min. 1 mbar * (0.015 psi)) of the upper range limit (URL) switchback point (RSP): 0 to 99.5% in increments of 0.1% (min. 1 mbar * (0.015 psi)) of the upper range limit (URL)
  Minimum distance between SP and RSP: 0.5 % URL

- Analog output (if available)
  Lower range value (LRV) and upper range value (URV) can be set anywhere within the sensor range (LRL - URL). Turn down for analog output up to 5:1 of upper sensor limit (URL).

- Factory setting (if no customer-specific setting is ordered):
  Switch point SP1: 45 %; switch-back point RSP1: 44.5 %;
  Switch point SP2: 55 %; switch-back point RSP2: 54.5 %;
  Analog output: LRV 0 %; URV 100 %

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

15.2.3 Relay switching capacity

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

15.2.4 Signal range 4 to 20 mA

3.8 mA to 20.5 mA

15.2.5 Load (for devices with analog output)

The maximum load resistance depends on the terminal voltage and is calculated according to the following formula:
When excessively high load:
- Output of the fault current and display of "S803"
- Periodic review whether error condition may be left

### 15.2.6 Signal on alarm 4 to 20 mA

The response of the output to error is regulated in accordance with NAMUR NE43.

The behavior of the current output in case of fault is defined by the following parameters:
- FCU "MIN": Lower alarm current (≤3.6 mA) (optional, see the following table) →  58
- FCU "MAX" (factory setting): Upper alarm current (≥21 mA) →  58
- FCU "HLD" (HOLD): Last measured current value is held. When the device starts, the current output is set to "Lower alarm current" (≤3.6 mA). →  58

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

<table>
<thead>
<tr>
<th>Changing the failsafe mode</th>
<th>After confirming with ( \text{\textcolor{red}{#}} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>from MAX to MIN</td>
<td>active immediately</td>
</tr>
<tr>
<td>from MIN to MAX</td>
<td>active immediately</td>
</tr>
<tr>
<td>from HLD (HOLD) to MAX</td>
<td>active immediately</td>
</tr>
<tr>
<td>from HLD (HOLD) to MIN</td>
<td>active immediately</td>
</tr>
<tr>
<td>from MIN to HLD (HOLD)</td>
<td>outside the error condition active</td>
</tr>
<tr>
<td>from MAX to HLD (HOLD)</td>
<td>outside the error condition active</td>
</tr>
</tbody>
</table>

\( {R_{\text{Lmax}}} \leq \frac{U_{\text{b}} - 6.5V}{23\text{mA}} \)
alarm current

<table>
<thead>
<tr>
<th>Device</th>
<th>Description</th>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP31B</td>
<td>Adjusted min. alarm current</td>
<td>IA 1)</td>
</tr>
<tr>
<td>PTP33B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTP31B</td>
<td>1 low ≤3.6 mA</td>
<td>U 2)</td>
</tr>
<tr>
<td>PTP33B</td>
<td>2 high ≥21 mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 last current value</td>
<td></td>
</tr>
</tbody>
</table>

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

15.2.7 Dead time, time constant

Presentation of the dead time and the time constant:

![Diagram of dead time and time constant]

15.2.8 Dynamic behavior

Analog electronics

<table>
<thead>
<tr>
<th>Dead time (t_1) [ms]</th>
<th>Time constant (T63), t_2 [ms]</th>
<th>Time constant (T90), t_3 [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 ms</td>
<td>11 ms</td>
<td>16 ms</td>
</tr>
</tbody>
</table>

15.2.9 Dynamic behavior of switch output

PNP switch output and 2 x PNP switch output: response time ≤20 ms
15.3 Performance characteristics of metallic process isolating diaphragm

15.3.1 Reference operating conditions
- As per IEC 60770
- Ambient temperature $T_A$ = constant, in the range of: +21 to +33 °C (+70 to +91 °F)
- Humidity $\varphi$ = constant, in the range of 5 to 80 % rH
- Ambient pressure $p_A$ = constant, in the range of: 860 to 1060 mbar (12.47 to 15.37 psi)
- Position of measuring cell = constant, in range: horizontal ±1° (see also "Influence of the installation position" section → 15)
- Zero based span
- Process isolating diaphragm material: AISI 316L (1.4435)
- Filling oil: NSF-H1 synthetic oil in accordance with FDA 21 CFR 178.3570
- Supply voltage: 24 V DC ±3 V DC
- Load: 320 Ω

15.3.2 Measuring uncertainty for small absolute pressure measuring ranges
The smallest extended uncertainty of measurement that can delivered by our standards is:
- in range 1 to 30 mbar (0.0145 to 0.435 psi): 0.4 % of reading
- in range < 1 mbar (0.0145 psi): 1 % of reading.

15.3.3 Influence of the installation position
→ 15

15.3.4 Resolution
Current output: min. 1.6 μA
Display: can be set (factory setting: presentation of the maximum accuracy of the transmitter)

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

<table>
<thead>
<tr>
<th>Measuring ranges</th>
<th>TD 1)</th>
<th>% of calibrated span</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standard 2)</td>
</tr>
<tr>
<td>400 mbar (6 psi)</td>
<td>TD 1:1 to TD 5:1</td>
<td>±0.5</td>
</tr>
<tr>
<td>1 bar (15 psi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 to 400 bar (30 to 6000 psi)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Overview of the turn down ranges → 69
2) Ordering information: Product Configurator order code for "Reference accuracy" option 'G'
3) Ordering information: Product Configurator order code for "Reference accuracy", option 'D'
15.3.6  **Thermal change of the zero output and the output span**

<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>(-20) to (+85) °C ((-4) to (+185) °F)</th>
<th>(\geq 1) bar (15 psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(&lt;1) span for TD 1:1</td>
<td>(&lt;0.8) span for TD 1:1</td>
</tr>
<tr>
<td>(&lt;1) bar (15 psi)</td>
<td>(&lt;1)</td>
<td>(&lt;1)</td>
</tr>
<tr>
<td>(\geq 1) bar (15 psi)</td>
<td>(&lt;0.8)</td>
<td>(&lt;1)</td>
</tr>
</tbody>
</table>

PTP33B

<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>((-10) to (+85) °C ((+14) to (+185) °F)</th>
<th>(\geq 1) bar (15 psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(&lt;1) span for TD 1:1</td>
<td>(&lt;0.8) span for TD 1:1</td>
</tr>
<tr>
<td>(&lt;1) bar (15 psi)</td>
<td>(&lt;1)</td>
<td>(&lt;1)</td>
</tr>
<tr>
<td>(\geq 1) bar (15 psi)</td>
<td>(&lt;0.8)</td>
<td>(&lt;1)</td>
</tr>
</tbody>
</table>

15.3.7  **Long-term stability**

<table>
<thead>
<tr>
<th>Measuring ranges</th>
<th>1 year</th>
<th>5 years</th>
<th>10 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>(400) mbar (6 psi) to (400) bar (6 000 psi)</td>
<td>(\pm 0.2)</td>
<td>(\pm 0.4)</td>
<td>In preparation</td>
</tr>
</tbody>
</table>

15.3.8  **Switch-on time**

\(\leq 2\) s
15.4 Environment

15.4.1 Ambient temperature range

<table>
<thead>
<tr>
<th>Device</th>
<th>Ambient temperature range 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP31B</td>
<td>–20 to +70 °C (~4 to +158 °F)</td>
</tr>
<tr>
<td>PTP33B</td>
<td>–20 to +70 °C (~4 to +158 °F)</td>
</tr>
</tbody>
</table>

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

15.4.2 Storage temperature range

–40 to +85 °C (~40 to +185 °F)

15.4.3 Climate class

<table>
<thead>
<tr>
<th>Device</th>
<th>Climate class</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP31B</td>
<td>Class 3K5</td>
<td></td>
</tr>
<tr>
<td>PTP33B</td>
<td>Class 3K5</td>
<td></td>
</tr>
</tbody>
</table>

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

15.4.4 Degree of protection

<table>
<thead>
<tr>
<th>Device</th>
<th>Connection</th>
<th>Climate class</th>
<th>Option 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP31B</td>
<td>Cable 5 m (16 ft)</td>
<td>IP66/67 NEMA type 4X enclosure</td>
<td>D</td>
</tr>
<tr>
<td>PTP33B</td>
<td>Cable 10 m (33 ft)</td>
<td>IP66/67 NEMA type 4X enclosure</td>
<td>E</td>
</tr>
<tr>
<td>PTP31B</td>
<td>Cable 25 m (82 ft)</td>
<td>IP66/67 NEMA type 4X enclosure</td>
<td>F</td>
</tr>
<tr>
<td>PTP31B</td>
<td>M12 plug made of plastic</td>
<td>IP65/67 NEMA type 4X enclosure</td>
<td>M</td>
</tr>
<tr>
<td>PTP33B</td>
<td>Valve plug ISO4400 M16</td>
<td>IP65 NEMA type 4X enclosure</td>
<td>U</td>
</tr>
<tr>
<td>PTP31B</td>
<td>Valve plug ISO4400 NPT ½</td>
<td>IP65 NEMA type 4X enclosure</td>
<td>V</td>
</tr>
</tbody>
</table>

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

15.4.5 Vibration resistance

<table>
<thead>
<tr>
<th>Test standard</th>
<th>Vibration resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60068-2-64:2008</td>
<td>Guaranteed for 5 to 2000Hz: 0.05g²/Hz</td>
</tr>
</tbody>
</table>

15.4.6 Electromagnetic compatibility

- Interference emission as per EN 61326-1 equipment B
- Interference immunity as per EN 61326-1 (Industrial sector)
- NAMUR recommendation EMC (NE21)
- Maximum deviation: 1.5% for TD 1:1

For further details refer to the Declaration of Conformity.
15.5 Process

15.5.1 Process temperature range for devices with metallic process isolating diaphragm

<table>
<thead>
<tr>
<th>Device</th>
<th>Process temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTP31B</td>
<td>–40 to +100 °C (–40 to +212 °F)</td>
</tr>
<tr>
<td>PTP33B</td>
<td>–10 to +100 °C (+14 to +212 °F)</td>
</tr>
<tr>
<td>PTP33B</td>
<td>At +135°C (+275 °F) for a maximum of one hour (device in operation but not within measuring specification)</td>
</tr>
</tbody>
</table>

Applications with changes in temperature

Frequent extreme changes in temperatures can temporarily cause measuring errors. Internal temperature compensation is faster the smaller the change in temperature and the longer the time interval.

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

15.5.2 Pressure specifications

**WARNING**

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

- For pressure specifications, see the 'Measuring range' section and 'Mechanical construction' section in the Technical Information.
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation 'PS'. The abbreviation 'PS' corresponds to the MWP (maximum working pressure) of the measuring device.
- **MWP** (maximum working pressure): The MWP (maximum working pressure) is specified on the nameplate. This value is based on a reference temperature of +20 °C (+68 °F) and may be applied to the device for an unlimited period of time. Observe the temperature dependency of the MWP.
- **OPL** (over pressure limit): The test pressure corresponds to the over pressure limit of the sensor and may only be applied temporarily to ensure that the measurement is within the specifications and no permanent damage develops. In the case of sensor range and process connections where the over pressure limit (OPL) of the process connection is smaller than the nominal value of the sensor, the device is set at the factory, at the very maximum, to the OPL value of the process connection. If you want to use the entire sensor range, select a process connection with a higher OPL value.
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