Brief Operating Instructions
Flowmeter
Proline 200

HART transmitter
with vortex flow sensor

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

**Brief Operating Instructions part 2 of 2: Transmitter**
Contain information about the transmitter.

Brief Operating Instructions part 1 of 2: Sensor →  3
Brief Operating Instructions for the flowmeter

The device consists of a transmitter and a sensor.

The process of commissioning these two components is described in two separate manuals, that form the Brief Operating Instructions of the flowmeter:

- Brief Operating Instructions part 1: Sensor
- Brief Operating Instructions part 2: Transmitter

Please refer to both Brief Operating Instructions when commissioning the flowmeter as the contents complement one another:

**Brief Operating Instructions part 1: Sensor**
The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device.
- Incoming acceptance and product identification
- Storage and transport
- Installation

**Brief Operating Instructions part 2: Transmitter**
The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value).
- Product description
- Installation
- Electrical connection
- Operation options
- System integration
- Commissioning
- Diagnostic information

Additional device documentation

These Brief Operating Instructions are the *Brief Operating Instructions part 2: Transmitter*.

The "Brief Operating Instructions part 1: Sensor" are available via:
- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: Endress+Hauser Operations App

Detailed information about the device can be found in the Operating Instructions and the other documentation:
- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: Endress+Hauser Operations App
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1 Document information

1.1 Symbols used

1.1.1 Safety symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![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>![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>![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>![NOTE]</td>
<td>NOTE! This symbol contains information on procedures and other facts which do not result in personal injury.</td>
</tr>
</tbody>
</table>

1.1.2 Symbols for certain types of information

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Permitted]</td>
<td>Procedures, processes or actions that are permitted.</td>
</tr>
<tr>
<td>![Preferred]</td>
<td>Procedures, processes or actions that are preferred.</td>
</tr>
<tr>
<td>![Forbidden]</td>
<td>Procedures, processes or actions that are forbidden.</td>
</tr>
<tr>
<td>![Tip]</td>
<td>Indicates additional information.</td>
</tr>
<tr>
<td>![Reference to documentation]</td>
<td>Reference to documentation</td>
</tr>
<tr>
<td>![Reference to page]</td>
<td>Reference to page</td>
</tr>
<tr>
<td>![Reference to graphic]</td>
<td>Reference to graphic</td>
</tr>
<tr>
<td>![Series of steps]</td>
<td>Series of steps</td>
</tr>
<tr>
<td>![Result of a step]</td>
<td>Result of a step</td>
</tr>
<tr>
<td>![Visual inspection]</td>
<td>Visual inspection</td>
</tr>
</tbody>
</table>

1.1.3 Electrical symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Direct current]</td>
<td>Direct current</td>
</tr>
<tr>
<td>![Alternating current]</td>
<td>Alternating current</td>
</tr>
<tr>
<td>![Direct current and alternating current]</td>
<td>Direct current and alternating current</td>
</tr>
<tr>
<td>![Ground connection]</td>
<td>Ground connection</td>
</tr>
</tbody>
</table>
### Protective Earth (PE)

A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device:
- **Inner ground terminal**: Connects the protective earth to the mains supply.
- **Outer ground terminal**: Connects the device to the plant grounding system.

### 1.1.4 Communication symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>📀</td>
<td>Wireless Local Area Network (WLAN) Communication via a wireless, local network.</td>
</tr>
<tr>
<td>🕵️‍♂️</td>
<td>LED Light emitting diode is on.</td>
</tr>
<tr>
<td>🕵️‍♀️</td>
<td>LED Light emitting diode is flashing.</td>
</tr>
</tbody>
</table>

### 1.1.5 Tool symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚙️</td>
<td>Torx screwdriver</td>
</tr>
<tr>
<td>🔪</td>
<td>Flat blade screwdriver</td>
</tr>
<tr>
<td>🔪</td>
<td>Cross-head screwdriver</td>
</tr>
<tr>
<td>🔪</td>
<td>Allen key</td>
</tr>
<tr>
<td>🔪</td>
<td>Open-ended wrench</td>
</tr>
</tbody>
</table>

### 1.1.6 Symbols in graphics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3,...</td>
<td>Item numbers</td>
</tr>
<tr>
<td>A, B, C, ...</td>
<td>Views</td>
</tr>
<tr>
<td>A-A, B-B, C-C, ...</td>
<td>Sections</td>
</tr>
<tr>
<td>🟢</td>
<td>Hazardous area</td>
</tr>
<tr>
<td>🟢</td>
<td>Safe area (non-hazardous area)</td>
</tr>
<tr>
<td>⚔️ ➡️</td>
<td>Flow direction</td>
</tr>
</tbody>
</table>
2  Basic safety instructions

2.1  Requirements for the personnel
The personnel must fulfill the following requirements for its tasks:
‣ 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 starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
‣ Follow instructions and comply with basic conditions.

2.2  Designated use
Application and media
Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Measuring devices for use in hazardous areas, in hygienic applications or where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
‣ Keep within the specified pressure and temperature range.
‣ Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
‣ Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
‣ Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
‣ If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: 'Documentation' section.
‣ Protect the measuring device permanently against corrosion from environmental influences.

Incorrect use
Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

⚠️ WARNING

Danger of breakage due to corrosive or abrasive fluids!
‣ Verify the compatibility of the process fluid with the sensor material.
‣ Ensure the resistance of all fluid-wetted materials in the process.
‣ Keep within the specified pressure and temperature range.
NOTICE

Verification for borderline cases:

‣ For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

Residual risks

⚠️ WARNING

The electronics and the medium may cause the surfaces to heat up. This presents a burn hazard!

‣ For elevated fluid 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.

For welding work on the piping:

‣ Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:

‣ Due to the increased risk of electric shock, gloves must be worn.

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.

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.

2.6 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.
2.7 Device-specific IT security
The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly.

For detailed information on device-specific IT security, see the Operating Instructions for the device.

3 Product description
The device consists of a transmitter and a sensor.

Two device versions are available:
- Compact version – transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

For detailed information on the product description, see the Operating Instructions for the device.

4 Installation

For detailed information about mounting the sensor, see the Sensor Brief Operating Instructions → 3

4.1 Mounting the pressure measuring unit

For detailed information on mounting the pressure measuring unit, see the Brief Operating Instructions for the sensor.→ 3

4.2 Mounting the transmitter of the remote version

⚠️ CAUTION
Ambient temperature too high!
Danger of electronics overheating and housing deformation.
- Do not exceed the permitted maximum ambient temperature.
- If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

⚠️ CAUTION
Excessive force can damage the housing!
- Avoid excessive mechanical stress.

The transmitter of the remote version can be mounted in the following ways:
- Wall mounting
- Pipe mounting
4.2.1  Wall mounting

4.2.2  Post mounting
4.3  Turning the transmitter housing
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.

1. Release the fixing screw.
2. Turn the housing to the desired position.
3. Firmly tighten the securing screw.

4.4  Turning the display module
The display module can be turned to optimize display readability and operability.

1. Loosen the securing clamp of the electronics compartment cover using an Allen key.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Optional: pull out the display module with a gentle rotational movement.
4. Turn the display module to the desired position: max. 8 × 45° in every direction.
5. Without display module pulled out:
   Allow display module to engage at desired position.
6. With display module pulled out:
   Feed the cable into the gap between the housing and main electronics module and plug
   the display module into the electronics compartment until it engages.

7. Reverse the removal procedure to reassemble the transmitter.

### 4.5 Transmitter post-installation check

The post-installation check must always be performed after the following tasks:
- Turning the transmitter housing
- Turning the display module

<table>
<thead>
<tr>
<th>Question</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the device undamaged (visual inspection)?</td>
<td></td>
</tr>
<tr>
<td>Are the securing screw and securing clamp tightened securely?</td>
<td></td>
</tr>
</tbody>
</table>
5 Electrical connection

5.1 Connection conditions

5.1.1 Required tools
- For cable entries: Use corresponding tools
- For securing clamp: Allen key 3 mm
- Wire stripper
- When using stranded cables: Crimper for wire end ferrule
- For removing cables from terminal: Flat blade screwdriver ≤ 3 mm (0.12 in)

5.1.2 Connecting cable requirements

The connecting cables provided by the customer must fulfill the following requirements.

Electrical safety

In accordance with applicable federal/national regulations.

Permitted temperature range

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Signal cable

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe grounding concept of the plant.

Current output 4 to 20 mA

Standard installation cable is sufficient.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Current input

Standard installation cable is sufficient.

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Plug-in spring terminals for device version without integrated overvoltage protection: wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- Screw terminals for device version with integrated overvoltage protection: wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)
5.1.3 Connecting cable for remote version

Connecting cable (standard)

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard cable</td>
<td>2 × 2 × 0.5 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) ¹)</td>
</tr>
<tr>
<td>Flame resistance</td>
<td>According to DIN EN 60332-1-2</td>
</tr>
<tr>
<td>Oil-resistance</td>
<td>According to DIN EN 60811-2-1</td>
</tr>
<tr>
<td>Shielding</td>
<td>Galvanized copper-braid, opt. density approx. 85%</td>
</tr>
<tr>
<td>Cable length</td>
<td>5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)</td>
</tr>
</tbody>
</table>

¹) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (reinforced)

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable, reinforced</td>
<td>2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded) and additional steel-wire braided sheath ¹)</td>
</tr>
<tr>
<td>Flame resistance</td>
<td>According to DIN EN 60332-1-2</td>
</tr>
<tr>
<td>Oil-resistance</td>
<td>According to DIN EN 60811-2-1</td>
</tr>
<tr>
<td>Shielding</td>
<td>Galvanized copper-braid, opt. density approx. 85%</td>
</tr>
<tr>
<td>Strain relief and reinforcement</td>
<td>Steel-wire braid, galvanized</td>
</tr>
<tr>
<td>Cable length</td>
<td>5 m (16 ft), 10 m (32 ft), 20 m (65 ft), 30 m (98 ft)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)</td>
</tr>
</tbody>
</table>

¹) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.

Connecting cable (option "mass pressure-/temperature-compensated")

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB, DC, DD

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard cable</td>
<td>[(3 × 2) + 1] × 0.34 mm² (22 AWG) PVC cable with common shield (3 pairs, pair-stranded) ¹)</td>
</tr>
<tr>
<td>Flame resistance</td>
<td>According to DIN EN 60332-1-2</td>
</tr>
<tr>
<td>Oil-resistance</td>
<td>According to DIN EN 60811-2-1</td>
</tr>
<tr>
<td>Shielding</td>
<td>Galvanized copper-braid, opt. density approx. 85%</td>
</tr>
</tbody>
</table>
### Electrical connection

<table>
<thead>
<tr>
<th>Cable length</th>
<th>10 m (32 ft), 30 m (98 ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>When mounted in a fixed position: –50 to +105 °C (–58 to +221 °F); when cable can move freely: –25 to +105 °C (–13 to +221 °F)</td>
</tr>
</tbody>
</table>

1) UV radiation may cause damage to the outer jacket of the cable. Protect the cable from exposure to sun as much as possible.
5.1.4  Terminal assignment

Transmitter

4-20 mA HART connection version with additional inputs and outputs

Maximum number of terminals
Terminals 1 to 6:
Without integrated overvoltage protection

Output 1 (passive): supply voltage and signal transmission
Output 2 (passive): supply voltage and signal transmission
Input (passive): supply voltage and signal transmission
Ground terminal for cable shield

Maximum number of terminals for order code for
"Accessory mounted", option NA "Overvoltage protection"
- Terminals 1 to 4: With integrated overvoltage protection
- Terminals 5 to 6: Without integrated overvoltage protection

Order code for "Output"  Terminal numbers

<table>
<thead>
<tr>
<th>Order code for &quot;Output&quot;</th>
<th>Output 1</th>
<th>Terminal numbers</th>
<th>Output 2</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 (+)</td>
<td>2 (-)</td>
<td>3 (+)</td>
<td>4 (-)</td>
</tr>
<tr>
<td>Option A</td>
<td>4-20 mA HART (passive)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Option B 1)</td>
<td>4-20 mA HART (passive)</td>
<td>Pulse/frequency/switch output (passive)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Option C 1)</td>
<td>4-20 mA HART (passive)</td>
<td>4-20 mA analog (passive)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Option D 1) 2)</td>
<td>4-20 mA HART (passive)</td>
<td>Pulse/frequency/switch output (passive)</td>
<td>4-20 mA current input (passive)</td>
<td></td>
</tr>
</tbody>
</table>

1) Output 1 must always be used; output 2 is optional.
2) The integrated overvoltage protection is not used with option D: Terminals 5 and 6 (current input) are not protected against overvoltage.
Connecting cable for remote version

Transmitter and sensor connection housing

In the case of the remote version, the sensor and transmitter are mounted separately from one another and connected by a connecting cable. Connection is performed via the sensor connection housing and the transmitter housing.

How the connecting cable is connected in the transmitter housing depends on the measuring device approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable
- Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB, DC, DD

In the following versions, an M12 device connector is used for connection in the transmitter housing:
- All other approvals
- Use of connecting cable (standard)

Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

Connecting cable (standard, reinforced)

![Diagram of connecting cable connections]

- **Terminals for connection compartment in the transmitter wall holder and the sensor connection housing**
  1. Terminals for connecting cable
  2. Grounding via the cable strain relief
## Electrical connection

### Flowmeter Proline 200

<table>
<thead>
<tr>
<th>Terminal number</th>
<th>Assignment</th>
<th>Cable color Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply voltage</td>
<td>Brown</td>
</tr>
<tr>
<td>2</td>
<td>Grounding</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>RS485 (+)</td>
<td>Yellow</td>
</tr>
<tr>
<td>4</td>
<td>RS485 (–)</td>
<td>Green</td>
</tr>
</tbody>
</table>

**Connecting cable (option "mass pressure-/temperature-compensated")**

Order code for "Sensor version; DSC sensor; measuring tube", option DA, DB, DC, DD

| 2               | RES GND VCC         | + | – |
| 1               |                      | + | – |
| 1               | 1 2 3 4 5 6 7       |   |
| 2               | BN WH GN RD BK YE BU |   |
| 1               | 1 2 3 4 5 6 7       |   |
| 2               | RES GND VCC         | + | – |

**4 Terminals for connection compartment in the transmitter wall holder and the sensor connection housing**

1. Terminals for connecting cable
2. Grounding via the cable strain relief

<table>
<thead>
<tr>
<th>Terminal number</th>
<th>Assignment</th>
<th>Cable color Connecting cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RS485 (–) DPC</td>
<td>Brown</td>
</tr>
<tr>
<td>2</td>
<td>RS485 (+) DPC</td>
<td>White</td>
</tr>
<tr>
<td>3</td>
<td>Reset</td>
<td>Green</td>
</tr>
<tr>
<td>4</td>
<td>Supply voltage</td>
<td>red</td>
</tr>
<tr>
<td>5</td>
<td>Grounding</td>
<td>Black</td>
</tr>
<tr>
<td>6</td>
<td>RS485 (+)</td>
<td>Yellow</td>
</tr>
<tr>
<td>7</td>
<td>RS485 (–)</td>
<td>Blue</td>
</tr>
</tbody>
</table>
5.1.5 Requirements for the supply unit

Supply voltage

Transmitter
An external power supply is required for each output.

Supply voltage for a compact version without a local display

<table>
<thead>
<tr>
<th>Order code for &quot;Output&quot;</th>
<th>Minimum terminal voltage</th>
<th>Maximum terminal voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A: 4-20 mA HART</td>
<td>≥ DC 12 V</td>
<td>DC 35 V</td>
</tr>
<tr>
<td>Option B: 4-20 mA HART, pulse/frequency/switch output</td>
<td>≥ DC 12 V</td>
<td>DC 35 V</td>
</tr>
<tr>
<td>Option C: 4-20 mA HART + 4-20 mA analog</td>
<td>≥ DC 12 V</td>
<td>DC 30 V</td>
</tr>
<tr>
<td>Option D: 4-20 mA HART, pulse/frequency/switch output, 4-20 mA current input</td>
<td>≥ DC 12 V</td>
<td>DC 35 V</td>
</tr>
</tbody>
</table>

1) In event of external supply voltage of the power supply unit with load
2) The minimum terminal voltage increases if local operation is used: see the following table
3) Voltage drop 2.2 to 3 V for 3.59 to 22 mA

Increase in minimum terminal voltage

<table>
<thead>
<tr>
<th>Local operation</th>
<th>Increase in minimum terminal voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order code for &quot;Display; Operation&quot;, option C: Local operation SD02</td>
<td>+ DC 1 V</td>
</tr>
<tr>
<td>Order code for &quot;Display; Operation&quot;, option E: Local operation SD03 with lighting (backlighting not used)</td>
<td>+ DC 1 V</td>
</tr>
<tr>
<td>Order code for &quot;Display; Operation&quot;, option E: Local operation SD03 with lighting (backlighting used)</td>
<td>+ DC 3 V</td>
</tr>
<tr>
<td>Order code for &quot;Sensor version; DSC sensor; measuring tube&quot;, option DA, DB, DC, DD: Mass (pressure-/temperature-compensated)</td>
<td>+ DC 1 V</td>
</tr>
</tbody>
</table>

Load
Load for current output: 0 to 500 Ω, depending on the external supply voltage of the power supply unit

Calculation of the maximum load
Depending on the supply voltage of the power supply unit \( U_S \), the maximum load \( R_B \) including line resistance must be observed to ensure adequate terminal voltage at the device. In doing so, observe the minimum terminal voltage
Electrical connection

- \( R_b \leq (U_s - U_{\text{term. min}}) : 0.022 \text{ A} \)
- \( R_b \leq 500 \text{ } \Omega \)

### Load for a compact version without local operation

#### Operating range

1. For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with Ex i and option C "4-20 mA HART + 4-20 mA analog"

2. For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" for non-hazardous area and Ex d

#### Sample calculation

Supply voltage of power supply unit:
- \( U_s = 19 \text{ V} \)
- \( U_{\text{term. min}} = 12 \text{ V (measuring device)} + 1 \text{ V (local operation without lighting)} = 13 \text{ V} \)

Maximum load: \( R_b \leq (19 \text{ V} - 13 \text{ V}) : 0.022 \text{ A} = 273 \text{ } \Omega \)

The minimum terminal voltage \( (U_{kl \text{ min}}) \) increases if local operation is used. → 19.

#### Preparing the measuring device

Carry out the steps in the following order:

1. Mount the sensor and transmitter.
2. Connection housing, sensor: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect signal cable and cable for supply voltage.

**NOTICE**

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

- Use suitable cable glands corresponding to the degree of protection.
1. Remove dummy plug if present.

2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.

3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 13.

5.2 Connecting the measuring device

NOTICE
Limitation of electrical safety due to incorrect connection!
- Have electrical connection work carried out by appropriately trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable before connecting additional cables.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

5.2.1 Connecting the compact version

Connecting the transmitter

Connection via terminals

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Push the cable through the cable entry. To ensure tight sealing, do not remove the sealing ring from the cable entry.

4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.

5. Connect cable in accordance with terminal assignment→ 16.. For HART communication: when connecting the cable shielding to the ground clamp, observe the grounding concept of the facility.

6. **WARNING**

   **Housing degree of protection may be voided due to insufficient sealing of the housing.**
   
   – Screw in the screw without using any lubricant. The threads on the cover are coated with a dry lubricant.

   Firmly tighten the cable glands.

7. Reverse the removal procedure to reassemble the transmitter.

**Removing a cable**

- To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes while simultaneously pulling the cable end out of the terminal.

5.2.2 **Connecting the remote version**

**WARNING**

**Risk of damaging the electronic components!**

- Connect the sensor and transmitter to the same potential equalization.
- Only connect the sensor to a transmitter with the same serial number.
The following procedure (in the action sequence given) is recommended for the remote version:

1. Mount the sensor and transmitter.
2. Connect the connecting cable for the remote version.
3. Connect the transmitter.

How the connecting cable is connected in the transmitter housing depends on the measuring device approval and the version of the connecting cable used.

In the following versions, only terminals can be used for connection in the transmitter housing:
- Certain approvals: Ex nA, Ex ec, Ex tb and Division 1
- Use of reinforced connecting cable
- Order code for 'Sensor version; DSC sensor; measuring tube', option DA, DB, DC, DD

In the following versions, an M12 device connector is used for connection in the transmitter housing:
- All other approvals
- Use of connecting cable (standard)

Terminals are always used to connect the connecting cable in the sensor connection housing (tightening torques for screws for cable strain relief: 1.2 to 1.7 Nm).

### Connecting the sensor connection housing

1. Loosen the securing clamp.
2. Unscrew the housing cover.
3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).

4. Wire the connecting cable:
   - Terminal 1 = brown cable
   - Terminal 2 = white cable
   - Terminal 3 = yellow cable
   - Terminal 4 = green cable

5. Connect the cable shield via the cable strain relief.

6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.

7. Reverse the removal procedure to reassemble the connection housing.

**Connecting cable (option "mass pressure-/temperature-compensated")**

3. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).

4. Wire the connecting cable:
   - Terminal 1 = brown cable
   - Terminal 2 = white cable
   - Terminal 3 = green cable
   - Terminal 4 = red cable
   - Terminal 5 = black cable
   - Terminal 6 = yellow cable
   - Terminal 7 = blue cable

5. Connect the cable shield via the cable strain relief.

6. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.
7. Reverse the removal procedure to reassemble the connection housing.

**Connecting the transmitter**

*Connecting transmitter via plug*

- Connect the plug.

**Connecting transmitter via terminals**

1. Loosen the securing clamp of the electronics compartment cover.
2. Unscrew the electronics compartment cover.
3. Pull out the display module with a gentle rotational movement. To make it easier to access the lock switch, attach the display module to the edge of the electronics compartment.
4. Loosen the locking screw of the transmitter housing.
5. Loosen the securing clamp of the transmitter housing.

6. Turn the transmitter housing to the right until it reaches the marking.

7. **NOTICE**
   The connection board of the wall housing is connected to the electronics board of the transmitter via a signal cable!
   ▶ Pay attention to the signal cable when lifting the transmitter housing!

Lift the transmitter housing.


8. **Sample graphic**

9. **Sample graphic**

**Connecting cable (standard, reinforced)**

8. Disconnect the signal cable from the connection board of the wall housing by pressing in the locking clip on the connector. Remove the transmitter housing.

9. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).

10. Wire the connecting cable:
    - Terminal 1 = brown cable
    - Terminal 2 = white cable
    - Terminal 3 = yellow cable
    - Terminal 4 = green cable
11. Connect the cable shield via the cable strain relief.

12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.

13. Reverse the removal procedure to reassemble the transmitter housing.

**Connecting cable (option "mass pressure-/temperature-compensated")**

8. Disconnect both signal cables from the connection board of the wall housing by pressing in the locking clip on the connector. Remove the transmitter housing.

9. Guide the connecting cable through the cable entry and into the connection housing (if using a connecting cable without an M12 device plug, use the shorter stripped end of the connecting cable).

10. Wire the connecting cable:
   - Terminal 1 = brown cable
   - Terminal 2 = white cable
   - Terminal 3 = green cable
   - Terminal 4 = red cable
   - Terminal 5 = black cable
   - Terminal 6 = yellow cable
   - Terminal 7 = blue cable

11. Connect the cable shield via the cable strain relief.

12. Tighten the screws for the cable strain relief using a torque in the range of 1.2 to 1.7 Nm.

13. Reverse the removal procedure to reassemble the transmitter housing.

5.2.3 Connecting the connecting cable for the pressure measuring cell

When delivered to the customer, the connecting cable is connected as follows:
- Compact version: to transmitter housing
- Remote version: to sensor connection housing

For connection to sensor and pressure measuring cell:
- Insert M12 plug of connecting cable into pressure measuring cell and screw into place.

5.2.4 Ensuring potential equalization

**Requirements**

Please consider the following to ensure correct measurement:
- Same electrical potential for the medium and sensor
- Remote version: same electrical potential for the sensor and transmitter
- Company-internal grounding concepts
- Pipe material and grounding

5.3 Ensuring the degree of protection

The measuring device fulfills all the requirements for the IP66/67 degree of protection, Type 4X enclosure.
To guarantee IP66/67 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.
3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.
5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").
6. Insert dummy plugs into unused cable entries.

### 5.4  Post-connection check

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are cables or the device undamaged (visual inspection)?</td>
<td></td>
</tr>
<tr>
<td>Do the cables used meet the requirements?</td>
<td></td>
</tr>
<tr>
<td>Do the mounted cables have adequate strain relief?</td>
<td></td>
</tr>
<tr>
<td>Are all cable glands installed, securely tightened and leak-tight?</td>
<td></td>
</tr>
<tr>
<td>Cable run with &quot;water trap&quot;</td>
<td></td>
</tr>
<tr>
<td>Depending on the device version, are all the device plugs firmly tightened?</td>
<td></td>
</tr>
<tr>
<td>Only for remote version: is the sensor connected to the right transmitter?</td>
<td></td>
</tr>
<tr>
<td>Check the serial number on the nameplate of the sensor and transmitter.</td>
<td></td>
</tr>
<tr>
<td>Does the supply voltage match the specifications on the transmitter nameplate?</td>
<td></td>
</tr>
<tr>
<td>Is the terminal assignment correct?</td>
<td></td>
</tr>
<tr>
<td>If supply voltage is present, do values appear on the display module?</td>
<td></td>
</tr>
<tr>
<td>Are all the housing covers installed and tightened?</td>
<td></td>
</tr>
<tr>
<td>Is the securing clamp tightened correctly?</td>
<td></td>
</tr>
<tr>
<td>Have the screws for the cable strain relief been tightened using the correct torque?</td>
<td></td>
</tr>
<tr>
<td>Has the M12 plug of the connecting cable been correctly connected to the pressure measuring cell?</td>
<td></td>
</tr>
</tbody>
</table>
6 Operation options

6.1 Overview of operation options

1 Local operation via display module
2 Computer with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)
3 Field Xpert SFX350 or SFX370
4 Field Communicator 475
5 Control system (e.g. PLC)
6 VIATOR Bluetooth modem with connecting cable
6.2  Structure and function of the operating menu

6.2.1  Structure of the operating menu

![Schematic structure of the operating menu]

The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

For detailed information on the operating philosophy, see the Operating Instructions for the device.
6.3 Access to the operating menu via the local display

1 Operational display with measured value shown as "1 value, max." (example)
   1.1 Device tag
   1.2 Display area for measured values (4-line)
   1.3 Explanatory symbols for measured value: Measured value type, measuring channel number, symbol for diagnostic behavior
   1.4 Status area
   1.5 Measured value
   1.6 Unit for the measured value
   1.7 Operating elements
2 Operational display with measured value shown as "1 bar graph + 1 value" (example)
   2.1 Bar graph display for measured value 1
   2.2 Measured value 1 with unit
   2.3 Explanatory symbols for measured value 1: measured value type, measuring channel number
   2.4 Measured value 2
   2.5 Unit for measured value 2
   2.6 Explanatory symbols for measured value 2: measured value type, measuring channel number
3 Navigation view: picklist of a parameter
   3.1 Navigation path and status area
   3.2 Display area for navigation: ✓ designates the current parameter value
4 Editing view: text editor with input mask
5 Editing view: numeric editor with input mask
6.3.1 Operational display

<table>
<thead>
<tr>
<th>Explanatory symbols for the measured value</th>
<th>Status area</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Depends on the device version, e.g.:</td>
<td>The following symbols appear in the status area of the operational display at the top right:</td>
</tr>
<tr>
<td>– Q: Volume flow</td>
<td>• Status signals</td>
</tr>
<tr>
<td>– m: Mass flow</td>
<td>– F: Failure</td>
</tr>
<tr>
<td>– p: Density</td>
<td>– C: Function check</td>
</tr>
<tr>
<td>– G: Conductivity</td>
<td>– S: Out of specification</td>
</tr>
<tr>
<td>– t: Temperature</td>
<td>– M: Maintenance required</td>
</tr>
<tr>
<td>• Σ: Totalizer</td>
<td>• Diagnostic behavior</td>
</tr>
<tr>
<td>• G: Output</td>
<td>– ⨯: Alarm</td>
</tr>
<tr>
<td>• ☰: Input</td>
<td>– ⨯: Warning</td>
</tr>
<tr>
<td>• ❋: Measurement channel number 1)</td>
<td>• Locking (locked via hardware))</td>
</tr>
<tr>
<td>• Diagnostic behavior 2)</td>
<td>• Communication via remote operation is active.</td>
</tr>
<tr>
<td>– ⨯: Alarm</td>
<td></td>
</tr>
<tr>
<td>– ⨯: Warning</td>
<td></td>
</tr>
<tr>
<td>1) If there is more than one channel for the same measured variable type (totalizer, output etc.).</td>
<td></td>
</tr>
<tr>
<td>2) For a diagnostic event that concerns the displayed measured variable.</td>
<td></td>
</tr>
</tbody>
</table>

6.3.2 Navigation view

<table>
<thead>
<tr>
<th>Status area</th>
<th>Display area</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following appears in the status area of the navigation view in the top right corner:</td>
<td>• Icons for menus</td>
</tr>
<tr>
<td>• In the submenu</td>
<td>– ☰: Operation</td>
</tr>
<tr>
<td>– The direct access code for the parameter you are navigating to (e.g. 0022-1)</td>
<td>– ☰: Setup</td>
</tr>
<tr>
<td>– If a diagnostic event is present, the diagnostic behavior and status signal</td>
<td>– ☰: Diagnostics</td>
</tr>
<tr>
<td>• In the wizard</td>
<td>– ☰: Expert</td>
</tr>
<tr>
<td>If a diagnostic event is present, the diagnostic behavior and status signal</td>
<td>• ▸: Submenus</td>
</tr>
<tr>
<td></td>
<td>• ☰: Wizards</td>
</tr>
<tr>
<td></td>
<td>• ☰: Parameters within a wizard</td>
</tr>
<tr>
<td></td>
<td>• ☰: Parameter locked</td>
</tr>
</tbody>
</table>

6.3.3 Editing view

<table>
<thead>
<tr>
<th>Text editor</th>
<th>Correction symbols under ☰+ rookies</th>
</tr>
</thead>
<tbody>
<tr>
<td>✅</td>
<td>☰ clears all entered characters.</td>
</tr>
<tr>
<td>✗</td>
<td>☰ moves the input position one position to the right.</td>
</tr>
<tr>
<td>☰</td>
<td>☰ moves the input position one position to the left.</td>
</tr>
<tr>
<td>☰+ rookies</td>
<td>☰ deletes one character immediately to the left of the input position.</td>
</tr>
<tr>
<td>Aa1g</td>
<td>Toggle</td>
</tr>
<tr>
<td>✷</td>
<td>Between upper-case and lower-case letters</td>
</tr>
<tr>
<td>✷</td>
<td>For entering numbers</td>
</tr>
<tr>
<td>✷</td>
<td>For entering special characters</td>
</tr>
</tbody>
</table>

Endress+Hauser
### Numeric editor

<table>
<thead>
<tr>
<th>Key symbol</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔️</td>
<td>Confirms selection.</td>
</tr>
<tr>
<td>❌</td>
<td>Moves the input position one position to the left.</td>
</tr>
<tr>
<td>✖️</td>
<td>Exits the input without applying the changes.</td>
</tr>
<tr>
<td>−</td>
<td>Inserts minus sign at the input position.</td>
</tr>
<tr>
<td>-</td>
<td>Inserts decimal separator at the input position.</td>
</tr>
<tr>
<td>C</td>
<td>Clears all entered characters.</td>
</tr>
</tbody>
</table>

### 6.3.4 Operating elements

#### Keys and meaning

**Enter key**

*For operational display*
- Pressing the key briefly opens the operating menu.
- Pressing the key for 2 s opens the context menu.

*In a menu, submenu*
- Pressing the key briefly
  - Opens the selected menu, submenu or parameter.
  - Starts the wizard.
  - If help text is open:
    - Closes the help text of the parameter.
- Pressing the key for 2 s for parameter:
  - If present, opens the help text for the function of the parameter.

*With a wizard:* Opens the editing view of the parameter.

*With a text and numeric editor:*
- Pressing the key briefly
  - Opens the selected group.
  - Carries out the selected action.
- Pressing the key for 2 s:
  - Confirms the edited parameter value.

**Minus key**

*In a menu, submenu:* Moves the selection bar upwards in a choose list.
*With a wizard:* Confirms the parameter value and goes to the previous parameter.
*With a text and numeric editor:* Moves the selection bar to the left (backwards) in an input screen.

**Plus key**

*In a menu, submenu:* Moves the selection bar downwards in a choose list.
*With a wizard:* Confirms the parameter value and goes to the next parameter.
*With a text and numeric editor:* Moves the selection bar to the right (forwards) in an input screen.

**Escape key combination (press keys simultaneously)**

*In a menu, submenu*
- Pressing the key briefly
  - Exits the current menu level and takes you to the next higher level.
  - If help text is open, closes the help text of the parameter.
- Pressing the key for 2 s for the parameter: Returns you to the operational display ('home position').

*With a wizard:* Exits the wizard and takes you to the next higher level.
*With a text and numeric editor:* Closes the text or numeric editor without applying changes.

**Minus/Enter key combination (press the keys simultaneously)**
### Keys and meaning

<table>
<thead>
<tr>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduces the contrast (brighter setting).</td>
<td></td>
</tr>
<tr>
<td><strong>Plus/Enter key combination</strong> (press and hold down the keys simultaneously)</td>
<td>Increases the contrast (darker setting).</td>
</tr>
<tr>
<td><strong>Minus/Plus/Enter key combination</strong> (press the keys simultaneously)</td>
<td>For operational display: Enables or disables the keypad lock.</td>
</tr>
</tbody>
</table>

### 6.3.5 Further information

For further information on the following topics, see the Operating Instructions for the device:

- Calling up help text
- User roles and related access authorization
- Disabling write protection via access code
- Enabling and disabling the keypad lock

### 6.4 Access to the operating menu via the operating tool

The operating menu can also be accessed via the FieldCare and DeviceCare operating tools. See the Operating Instructions for the device.

### 7 System integration

For detailed information on system integration, see the Operating Instructions for the device.

- Overview of device description files:
  - Current version data for the device
  - Operating tools
- Measured variables via HART protocol
- Burst mode functionality in accordance with HART 7 Specification

### 8 Commissioning

#### 8.1 Function check

Before commissioning the measuring device:

- Make sure that the post-installation and post-connection checks have been performed.

  - "Post-installation check" checklist → 12
  - "Post-connection check" checklist → 29
8.2  Switching on the measuring device

► After a successful function check, switch on the measuring device.

❖ After a successful startup, the local display switches automatically from the startup display to the operational display.

If nothing appears on the local display or a diagnostic message is displayed, refer to the Operating Instructions for the device →  2

8.3  Setting the operating language

Factory setting: English or ordered local language

8.4  Configuring the measuring device

The Setup menu with its System units submenu and various guided wizards enable fast commissioning of the measuring device.
The desired units can be selected in the **System units** submenu. The wizards systematically guide the user through all the parameters required for configuration, such as parameters for measurement or outputs.

The wizards available in the particular device can vary on account of the device version (e.g. sensor).

<table>
<thead>
<tr>
<th>Wizard</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>System units</td>
<td>Configure the units for all measured variables</td>
</tr>
<tr>
<td>Medium selection</td>
<td>Define the medium</td>
</tr>
<tr>
<td>Current input</td>
<td>Configure the current input</td>
</tr>
<tr>
<td>Current output 1 to n</td>
<td>Set current output 1-2</td>
</tr>
<tr>
<td>Pulse/frequency/switch output</td>
<td>Configure the selected output type</td>
</tr>
<tr>
<td>Display</td>
<td>Configure the measured value display</td>
</tr>
<tr>
<td>Output conditioning</td>
<td>Define the output conditioning</td>
</tr>
<tr>
<td>Low flow cut off</td>
<td>Set the low flow cut off</td>
</tr>
<tr>
<td>Advanced setup</td>
<td>Additional parameters for configuration:</td>
</tr>
<tr>
<td></td>
<td>• Medium properties</td>
</tr>
<tr>
<td></td>
<td>• External compensation</td>
</tr>
<tr>
<td></td>
<td>• Sensor adjustment</td>
</tr>
<tr>
<td></td>
<td>• Totalizer 1 to n</td>
</tr>
<tr>
<td></td>
<td>• SIL confirmation</td>
</tr>
<tr>
<td></td>
<td>• Deactivate SIL</td>
</tr>
<tr>
<td></td>
<td>• Heartbeat</td>
</tr>
<tr>
<td></td>
<td>• Configuration backup display</td>
</tr>
<tr>
<td></td>
<td>• Administration</td>
</tr>
</tbody>
</table>

### 8.5 Defining the tag name

To enable fast identification of the measuring point within the system, you can enter a unique designation using the **Device tag** parameter and thus change the factory setting.

1. **Device tag**

**Navigation**

"Setup" menu → Device tag
Parameter overview with brief description

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>User entry</th>
<th>Factory setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device tag</td>
<td>Enter the name for the measuring point.</td>
<td>Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).</td>
<td>Prowirl</td>
</tr>
</tbody>
</table>

8.6 Protecting settings from unauthorized access

The following write protection options exist in order to protect the configuration of the measuring device from unintentional modification:

- Protect access to parameters via access code
- Protect access to local operation via key locking
- Protect access to measuring device via write protection switch

For detailed information on protecting the settings against unauthorized access, see the Operating Instructions for the device.

8.7 Application-specific commissioning

8.7.1 Steam application

Select medium

Navigation:
Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Steam** option.
3. When pressure measured value is read in:
   - In the **Steam calculation mode** parameter, select the **Automatic (p-/T-compensated)** option.
4. If pressure measured value is not read in:
   - In the **Steam calculation mode** parameter, select the **Saturated steam (T-compensated)** option.
5. In the **Steam quality value** parameter, enter the steam quality present in the pipe.

   Without **Wet Steam Detection/Measurement** application package: Measuring device uses this value to calculate the mass flow of the steam.
   With **Wet Steam Detection/Measurement** application package: Measuring device uses this value if the steam quality cannot be calculated (steam quality is not compliant with basic conditions).

1) Sensor version option "mass (integrated pressure and temperature measurement)", Pressure read in via current input/HART/
Configuring the current output
6. Configure current output.

Configuring the external compensation
7. With Wet Steam Detection/Measurement application package:
   In the **Steam quality** parameter, select the **Calculated value** option.

For detailed information on the basic conditions for wet steam applications, see the Special Documentation.

8.7.2 Liquid application
User-specific liquid, e.g. heat carrier oil

Select medium
Navigation:
Setup → Medium selection

1. Call up the **Medium selection** wizard.
2. In the **Select medium** parameter, select the **Liquid** option.
3. In the **Select liquid type** parameter, select the **User-specific liquid** option.
4. In the **Enthalpy type** parameter, select the **Heat** option.
   - **Heat** option: Non-flammable liquid that serves as a heat carrier.
   - **Calorific value** option: Flammable liquid whose combustion energy is calculated.

Configuring fluid properties
Navigation:
Setup → Advanced setup → Medium properties

5. Call up the **Medium properties** submenu.
6. In the **Reference density** parameter, enter the reference density of the fluid.
7. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.
8. In the **Linear expansion coefficient** parameter, enter the expansion coefficient of the fluid.
9. In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.
10. In the **Dynamic viscosity** parameter, enter the viscosity of the fluid.
8.7.3 Gas applications

For accurate mass or corrected volume measurement, it is recommended to use the pressure-/temperature-compensated sensor version. If this sensor version is not available, read in the pressure via the current input/HART. If neither of these two options is possible, the pressure can also be entered as a fixed value in the Fixed process pressure parameter.

Flow computer available only with the order code for "Sensor version", option "mass" (integrated temperature measurement)" or option "mass (integrated pressure/ temperature measurement)".

Single gas
Combustion gas, e.g. methane CH₄

Select medium

Setup → Medium selection

1. Call up the Medium selection wizard.
2. In the Select medium parameter, select the Gas option.
3. In the Select gas type parameter, select the Single gas option.
4. In the Gas type parameter, select the Methane CH₄ option.

Configuring fluid properties

Setup → Advanced setup → Medium properties

5. Call up the Medium properties submenu.
6. In the Reference combustion temperature parameter, enter the reference combustion temperature of the fluid.
7. 

Configuring the current output

8. Configure the current output for the "energy flow" process variable.

Configuring optional fluid properties for output of corrected volume flow

Setup → Advanced setup → Medium properties

9. Call up the Medium properties submenu.
10. In the Reference pressure parameter, enter the reference pressure of the fluid.
11. In the Reference temperature parameter, enter the reference temperature of the fluid.
Gas mixture
Forming gas for steel mills and rolling mills, e.g. N₂/H₂

Select medium
Navigation:
Setup → Medium selection
1. Call up the Medium selection wizard.
2. In the Select medium parameter, select the Gas option.
3. In the Select gas type parameter, select the Gas mixture option.

Configuring gas composition
Navigation:
Setup → Advanced setup → Medium properties → Gas composition
4. Call up the Gas composition submenu.
5. In the Gas mixture parameter, select the Hydrogen H₂ option and the Nitrogen N₂ option.
6. In the Mol% H₂ parameter, enter the quantity of hydrogen.
7. In the Mol% N₂ parameter, enter the quantity of nitrogen.
   All quantities must add up to 100 %.
   The density is determined according to NEL 40.

Configuring optional fluid properties for output of corrected volume flow
Navigation:
Setup → Advanced setup → Medium properties
8. Call up the Medium properties submenu.
9. In the Reference pressure parameter, enter the reference pressure of the fluid.
10. In the Reference temperature parameter, enter the reference temperature of the fluid.

Air

Select medium
Navigation:
Setup → Medium selection
1. Call up the Medium selection wizard.
2. In the Select medium parameter, select the Gas option.
3. In the Select gas type parameter, select the Air option.
   The density is determined according to NEL 40.
4. Enter the value in the **Relative humidity** parameter.
   ↳ The relative humidity is entered as a %. The relative humidity is converted internally to absolute humidity and is then factored into the density calculation according to NEL 40.

5. In the **Fixed process pressure** parameter, enter the value of the process pressure present.

**Configuring fluid properties**

**Navigation:**

Setup → Advanced setup → Medium properties

6. Call up the **Medium properties** submenu.

7. In the **Reference pressure** parameter enter the reference pressure for calculating the reference density.
   ↳ Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.

8. In the **Reference temperature** parameter enter the temperature for calculating the reference density.

Endress+Hauser recommends the use of active pressure compensation. This fully rules out the risk of measured errors due to pressure variations and incorrect entries.

**Natural gas**

**Select medium**

**Navigation:**

Setup → Medium selection

1. Call up the **Medium selection** wizard.

2. In the **Select medium** parameter, select the **Gas** option.

3. In the **Select gas type** parameter, select the **Natural gas** option.

4. In the **Fixed process pressure** parameter, enter the value of the process pressure present.

5. In the **Enthalpy calculation** parameter, select one of the following options:
   ↳ AGA5
      ISO 6976 option (contains GPA 2172)

6. In the **Density calculation** parameter, select one of the following options.
   ↳ AGA Nx19
      ISO 12213- 2 option (contains AGA8-DC92)
      ISO 12213- 3 option (contains SGERG-88, AGA8 Gross Method 1)

**Configuring fluid properties**

**Navigation:**
Setup → Advanced setup → Medium properties

7. Call up the **Medium properties** submenu.

8. In the **Calorific value type** parameter, select one of the options.

9. In the **Reference gross calorific value** parameter, enter the reference gross calorific value of the natural gas.

10. In the **Reference pressure** parameter enter the reference pressure for calculating the reference density.

   Pressure that is used as a static reference for combustion. This makes it possible to compare combustion processes at different pressures.

11. In the **Reference temperature** parameter enter the temperate for calculating the reference density.

12. In the **Relative density** parameter, enter the relative density of the natural gas.

Endress+Hauser recommends the use of active pressure compensation. This fully rules out the risk of measured errors due to pressure variations and incorrect entries.

**Ideal gas**

The unit "corrected volume flow" is often used to measure industrial gas mixtures, in particular natural gas. To do so, the calculated mass flow is divided by a reference density. To calculate the mass flow, knowledge of the exact composition of the gas is essential. In practice, however, this information is often not available (e.g. as it varies over time). In this case, it can be useful to regard the gas as an ideal gas. This means that only the operating temperature and operating pressure variables as well as the reference temperature and reference pressure variables are needed to calculate the corrected volume flow. The error resulting from this assumption (typically 1 to 5 %) is often considerably smaller than the error caused by inaccurate composition data. This method should not be used for condensing gases (e.g. saturated steam).

**Select medium**

Navigation:

Setup → Medium selection

1. Call up the **Medium selection** wizard.

2. In the **Select medium** parameter, select the **Gas** option.

3. In the **Select gas type** parameter, select the **User-specific gas** option.

4. For non-flammable gas:

   In the **Enthalpy type** parameter, select the **Heat** option.

**Configuring fluid properties**

Navigation:

Setup → Advanced setup → Medium properties

5. Call up the **Medium properties** submenu.
6. In the **Reference density** parameter, enter the reference density of the fluid.

7. In the **Reference pressure** parameter, enter the reference pressure of the fluid.

8. In the **Reference temperature** parameter, enter the fluid temperature associated with the reference density.

9. In the **Reference Z-factor** parameter, enter the value 1.

10. If specific heat capacity is to be measured:
    In the **Specific heat capacity** parameter, enter the heat capacity of the fluid.

11. In the **Z-factor** parameter, enter the value 1.

12. In the **Dynamic viscosity** parameter, enter the viscosity of the fluid under operating conditions.

### 9 Diagnostic information

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display. The message on remedial measures can be called up from the diagnostic message, and contains important information on the fault.
13 Message about remedial measures

1 Diagnostic information
2 Short text
3 Service ID
4 Diagnostic behavior with diagnostic code
5 Operation time of occurrence
6 Remedial measures

1. The user is in the diagnostic message.
   Press ( symbol).
   The Diagnostic list submenu opens.

2. Select the desired diagnostic event with or and press .
   The message about the remedial measures opens.

3. Press + simultaneously.
   The message about the remedial measures closes.