

# Brief Operating Instructions

## Micropilot NMR81

### Tank Gauging

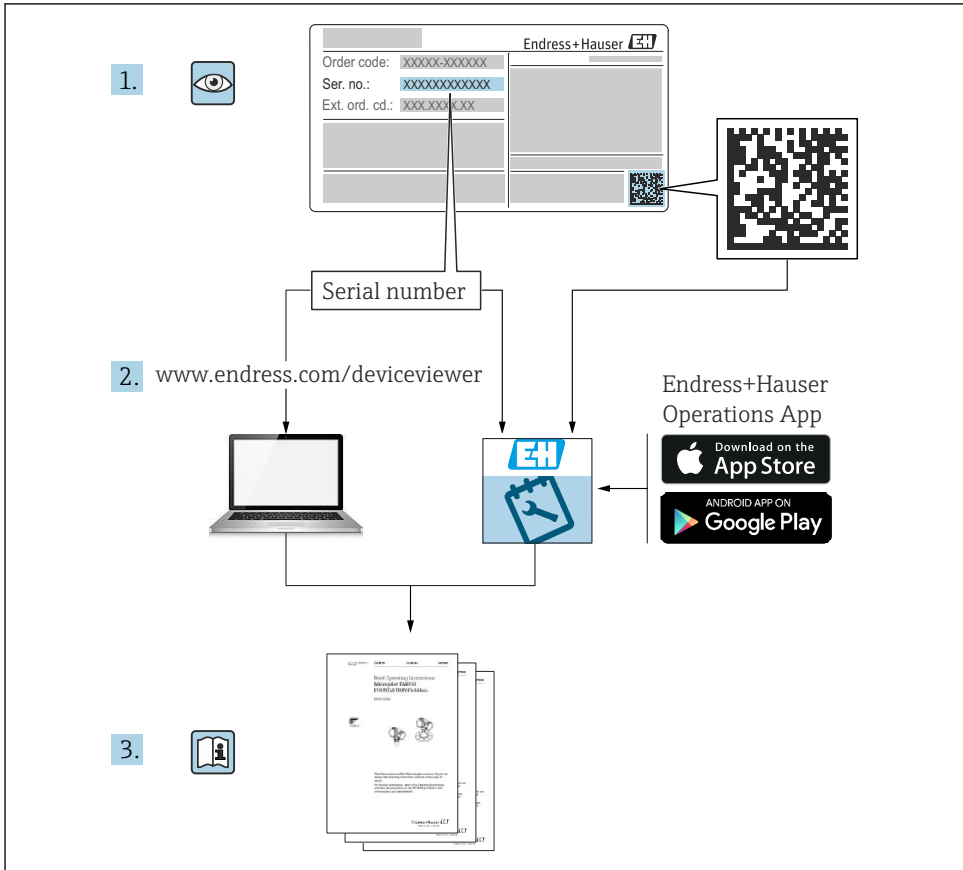


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:  
Available for all device versions via:

- Internet: [www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)
- Smart phone/tablet: *Endress+Hauser Operations App*





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# 1 About this document

## 1.1 Symbols

### 1.1.1 Safety symbols

#### **DANGER**

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

#### **WARNING**

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

#### **CAUTION**

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

#### **NOTICE**

This symbol contains information on procedures and other facts which do not result in personal injury.

### 1.1.2 Electrical symbols



Alternating current



Direct current and alternating current



Direct current



Ground connection

A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

#### **Protective earth (PE)**

Ground terminals that must be connected to ground prior to establishing any other connections.

The ground terminals are located on the interior and exterior of the device:

- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

### 1.1.3 Tool symbols



Phillips head screwdriver



Flat blade screwdriver





Torx screwdriver



Allen key



Open-ended wrench

#### 1.1.4 Symbols for certain types of information and graphics



##### **Permitted**

Procedures, processes or actions that are permitted



##### **Preferred**

Procedures, processes or actions that are preferred



##### **Forbidden**

Procedures, processes or actions that are forbidden



##### **Tip**

Indicates additional information



Reference to documentation



Reference to graphic



Notice or individual step to be observed



1., 2., 3.

Series of steps



Result of a step



Visual inspection



Operation via operating tool



Write-protected parameter

1, 2, 3, ...

Item numbers

A, B, C, ...

Views



##### **Safety instructions**

Observe the safety instructions contained in the associated Operating Instructions



##### **Temperature resistance of the connection cables**

Specifies the minimum value of the temperature resistance of the connection cables



## 1.2 Documentation

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



For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

### 1.2.1 Technical Information (TI)

#### Planning aid

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

### 1.2.2 Brief Operating Instructions (KA)

#### Guide that takes you quickly to the 1st measured value

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

### 1.2.3 Operating Instructions (BA)

The 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.

It also contains a detailed explanation of each individual parameter in the operating menu (except the **Expert** menu). The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

### 1.2.4 Description of Device Parameters (GP)

The Description of Device Parameters provides a detailed explanation of each individual parameter in the 2nd part of the operating menu: the **Expert** menu. It contains all the device parameters and allows direct access to the parameters by entering a specific code. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

### 1.2.5 Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.



The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

### 1.2.6 Installation instructions (EA)

Installation Instruction are used to replace a faulty unit with a functioning unit of the same type.



## 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 Intended use

#### **Application and measured materials**

The measuring device described in these Operating Instructions is intended for the continuous, contact-less level measurement of liquids. The device must be installed in closed metallic tanks or reinforced concrete tanks, or similar enclosure structures made of comparable attenuating material. Operation is completely harmless to humans and animals.

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 in applications 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:

- ▶ 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.
- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area (e.g. explosion protection, pressure vessel safety).
- ▶ Use the measuring device only for media against which the process-wetted materials are adequately 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.
- ▶ Protect the measuring device permanently against corrosion from environmental influences.
- ▶ Observe the limit values in the "Technical Information".

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

#### **Residual risk**

During operation the sensor may assume a temperature near the temperature of the measured material.

Danger of burns due to heated surfaces!

- ▶ For high process temperatures: Install protection against contact in order 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.

## 2.4 Operational safety

Risk of injury!

- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for interference-free operation of the device.

### Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):

- Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

## 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 the general safety standards and legal requirements.

### NOTICE

#### Loss of degree of protection by opening of the device in humid environments

- If the device is opened in a humid environment, the degree of protection indicated on the nameplate is no longer valid. This may also impair the safe operation of the device.

### 2.5.1 CE mark

The measuring system meets the legal requirements of the applicable EU directives. These are listed in the corresponding EU Declaration of Conformity together with the standards applied.

The manufacturer confirms successful testing of the device by affixing to it the CE mark.

### 2.5.2 EAC conformity

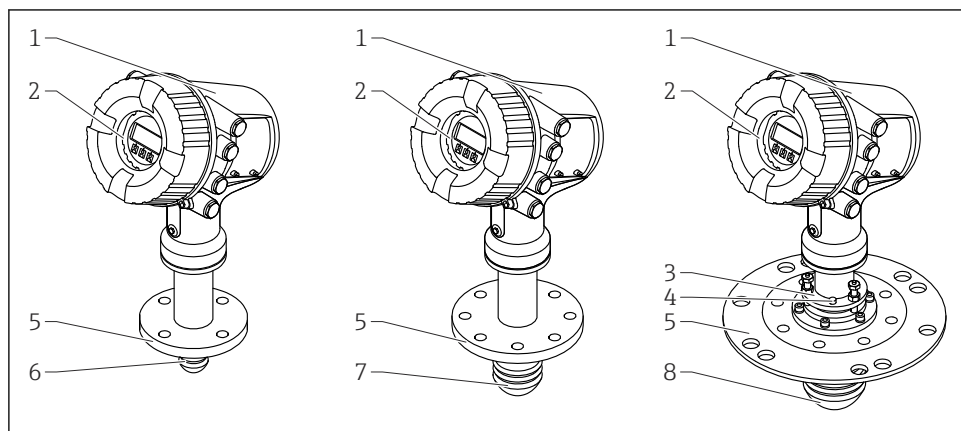
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

The manufacturer confirms successful testing of the device by affixing to it the EAC mark.



## 3 Product description

### 3.1 Product design



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#### 1 Design of Micropilot NMR81

- 1 Electronics housing
- 2 Display and operating module (can be operated without opening the cover)
- 3 Alignment device for antenna 100 mm (4 in)
- 4 Level tool (used to check the correct alignment of the antenna)
- 5 Process connection (flange)
- 6 Antenna 50 mm (2 in)
- 7 Antenna 80 mm (3 in)
- 8 Antenna 100 mm (4 in)



## 4 Incoming acceptance and product identification

### 4.1 Incoming acceptance

Upon receipt of the goods check the following:

- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?



If one of these conditions is not satisfied, contact your Endress+Hauser Sales Center.

### 4.2 Product identification

The following options are available for identification of the device:

- Nameplate specifications
- Enter the serial number from the nameplate in the *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): all the information about the device and an overview of the Technical Documentation supplied with the device are displayed.
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the device and the technical documentation pertaining to the device is displayed.



For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

#### 4.2.1 Manufacturer address

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

Place of manufacture: See nameplate.

### 4.3 Storage and transport

#### 4.3.1 Storage conditions

- Storage temperature: -50 to +80 °C (-58 to +176 °F)
- Store the device in its original packaging.



### 4.3.2 Transport

#### CAUTION

**Housing or antenna may be damaged or break away.**

Risk of injury

- ▶ Transport the measuring device to the measuring point in its original packaging or at the process connection.
- ▶ Do not fasten lifting devices (hoisting slings, lifting eyes etc.) at the housing or the antenna but at the process connection. Take into account the mass center of the device in order to avoid unintended tilting.
- ▶ Comply with the safety instructions, transport conditions for devices over 18 kg (39.6 lb) (IEC 61010).



# 5 Installation

## 5.1 Installation conditions

### 5.1.1 Mounting position

**General conditions**

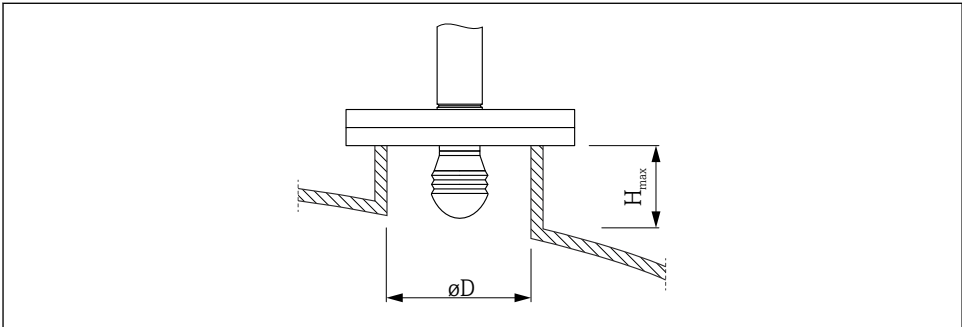
- Do not install in the centre of the tank.
- Do not install above a filling stream.
- Avoid any tank installations (e.g. limit switches, temperature probes) within in the signal beam.

*Minimum wall distance*

Measuring range	Minimum wall distance		
	Antenna 50mm/2" <sup>1)</sup>	Antenna 80mm/3" <sup>2)</sup>	Antenna 100mm/4" <sup>3)</sup>
5 m (16 ft)	0.3 m (0.98 ft)	0.17 m (0.55 ft)	0.13 m (0.44 ft)
10 m (33 ft)	0.6 m (1.9 ft)	0.33 m (1.1 ft)	0.27 m (0.87 ft)
15 m (49 ft)	0.9 m (2.9 ft)	0.5 m (1.6 ft)	0.4 m (1.3 ft)
20 m (66 ft)	1.2 m (3.9 ft)	0.67 m (2.2 ft)	0.53 m (1.7 ft)
25 m (82 ft)	1.5 m (4.9 ft)	0.83 m (2.7 ft)	0.67 m (2.2 ft)
30 m (98 ft)	1.8 m (5.9 ft)	1.0 m (3.3 ft)	0.8 m (2.6 ft)

- 1) Ordering feature 100 "Antenna", option AB
- 2) Ordering feature 100 "Antenna", option AC
- 3) Ordering feature 100 "Antenna", option AD

### 5.1.2 Mounting nozzle



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Inner nozzle diameter (ØD)	Maximum nozzle length (H <sub>max</sub> ) <sup>1)</sup>		
	Antenna AB <sup>2)</sup> : 50mm/2"	Antenna AC: 80mm/3"	Antenna AD: 100mm/4"
> 45 mm (1.77 in); ≤ 75 mm (2.95 in)	600 mm (24 in)	-	-
> 75 mm (2.95 in); ≤ 95 mm (3.74 in)	1 000 mm (40 in)	1 700 mm (68 in)	-
> 95 mm (3.74 in); ≤ 150 mm (5.91 in)	1 250 mm (50 in)	2 150 mm (86 in)	2 850 mm (114 in)
> 150 mm (5.91 in)	1 850 mm (74 in)	3 200 mm (128 in)	4 300 mm (172 in)

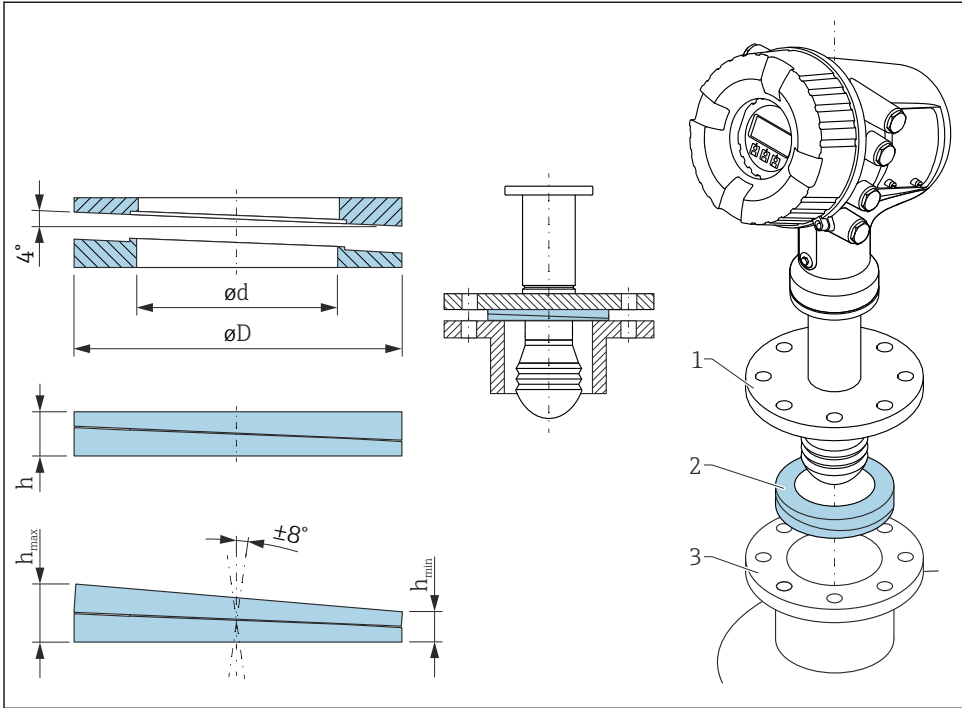
- 1) In case of longer nozzles, a reduced measuring performance is to be expected.
- 2) Feature 100 of the product structure



### 5.1.3 Vertical alignment of the 50mm(2") and 80mm (3") antenna

For optimum measuring accuracy the antenna must be installed at right angles to the medium surface. An adjustable seal is available for the alignment.

#### Adjustable seal



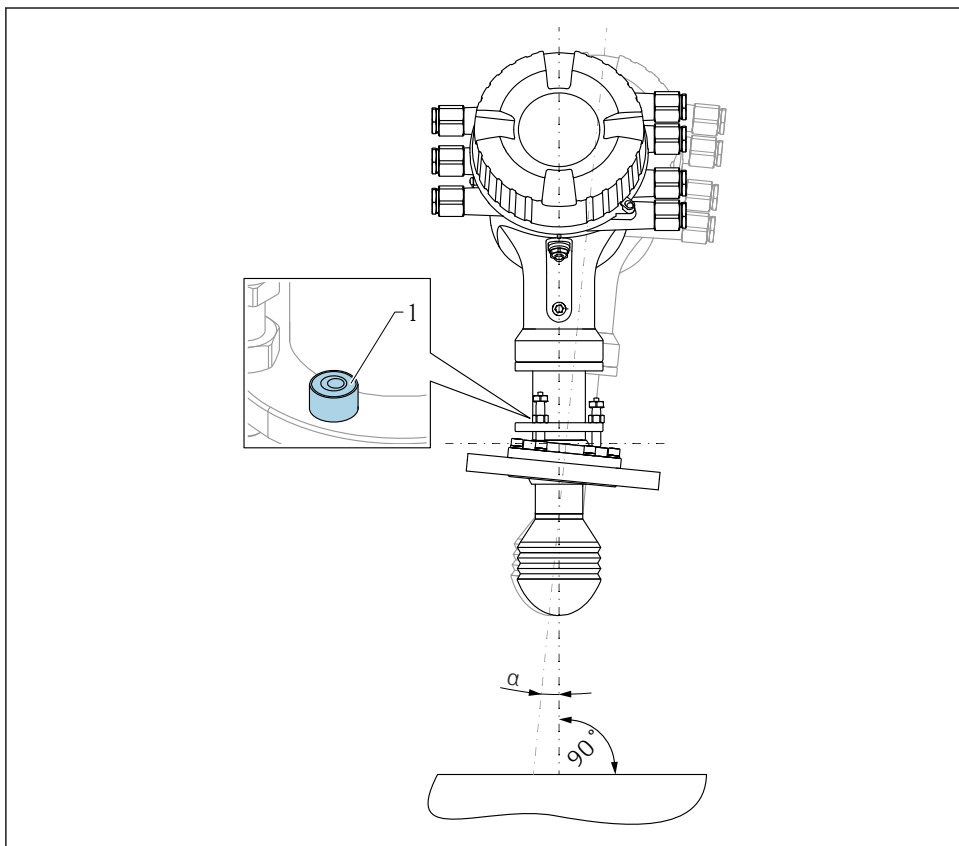
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2 Adjustable seal used to align the device by  $\pm 8^\circ$



### 5.1.4 Vertical alignment of the 100mm(4") antenna

For optimum measuring accuracy the antenna must be installed at right angles to the medium surface. For this purpose the 100mm(4") antenna always has an alignment unit. A level tool indicating the correct alignment is attached to the alignment tool.



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3 Alignment unit of the 100mm(4") antenna

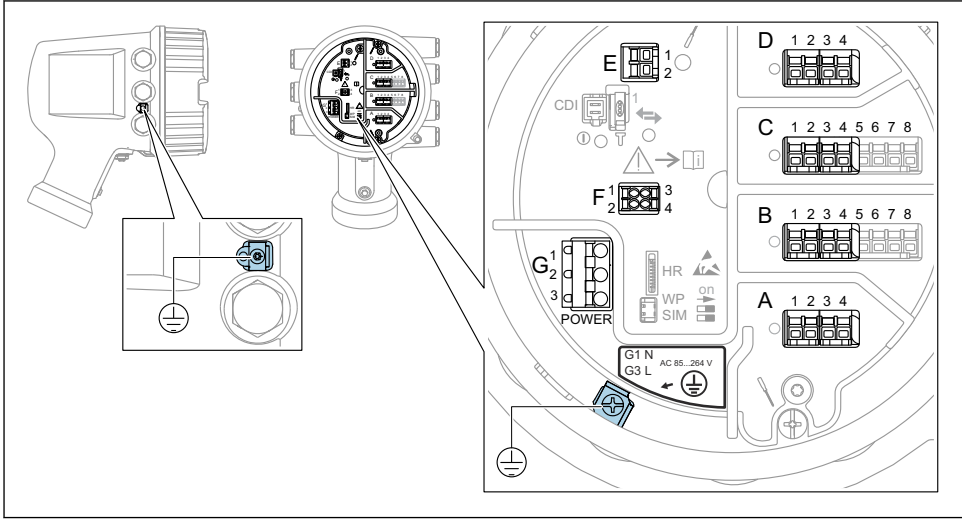
1 Level tool indicating the correct alignment

$\alpha$  Alignment angle;  $\alpha_{max} = 25^\circ$



## 6 Electrical connection

### 6.1 Terminal assignment



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4 Terminal compartment (typical example) and ground terminals

#### **i** Housing thread

The threads of the electronics and connection compartment can be coated with an anti-friction coating.

The following applies for all housing materials:

**⊗ Do not lubricate the housing threads.**

#### **Terminal area A/B/C/D (slots for I/O modules)**

Module: Up to four I/O modules, depending on the order code

- Modules with four terminals can be in any of these slots.
- Modules with eight terminals can be in slot B or C.

**i** The exact assignment of the modules to the slots is dependent on the device version  
→ 21.

#### **Terminal area E**

Module: HART Ex i/IS interface

- E1: H+
- E2: H-



**Terminal area F**

Remote display

- F1:  $V_{CC}$  (connect to terminal 81 of the remote display)
- F2: Signal B (connect to terminal 84 of the remote display)
- F3: Signal A (connect to terminal 83 of the remote display)
- F4: Gnd (connect to terminal 82 of the remote display)

**Terminal area G (for High voltage AC power supply and Low voltage AC power supply)**

- G1: N
- G2: not connected
- G3: L

**Terminal area G (for Low voltage DC power supply)**


- G1: L-
- G2: not connected
- G3: L+

**Terminal area: Protective ground**

Module: Protective ground connection (M4 screw)

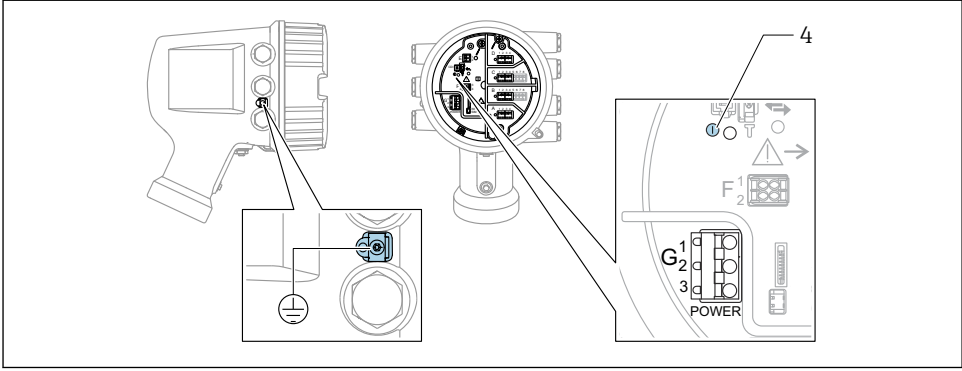


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 5     *Terminal area: Protective ground*



### 6.1.1 Power supply



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- G1 N
- G2 not connected
- G3 L
- 4 Green LED: indicates power supply



The supply voltage is also indicated on the nameplate.

#### Supply voltage

##### High voltage AC power supply:

Operational value:

100 to 240 V<sub>AC</sub> (- 15 % + 10 %) = 85 to 264 V<sub>AC</sub> , 50/60 Hz

##### Low voltage AC power supply:

Operational value:

65 V<sub>AC</sub> (- 20 % + 15 %) = 52 to 75 V<sub>AC</sub> , 50/60 Hz

##### Low voltage DC power supply:

Operational value:

24 to 55 V<sub>DC</sub> (- 20 % + 15 %) = 19 to 64 V<sub>DC</sub>

#### Power consumption

Maximum power varies depending on the configuration of the modules. The value shows maximum apparent power, select the applicable cables accordingly. The actual consumed effective power is 12 W.

##### High voltage AC power supply:

28.8 VA

##### Low voltage AC power supply:

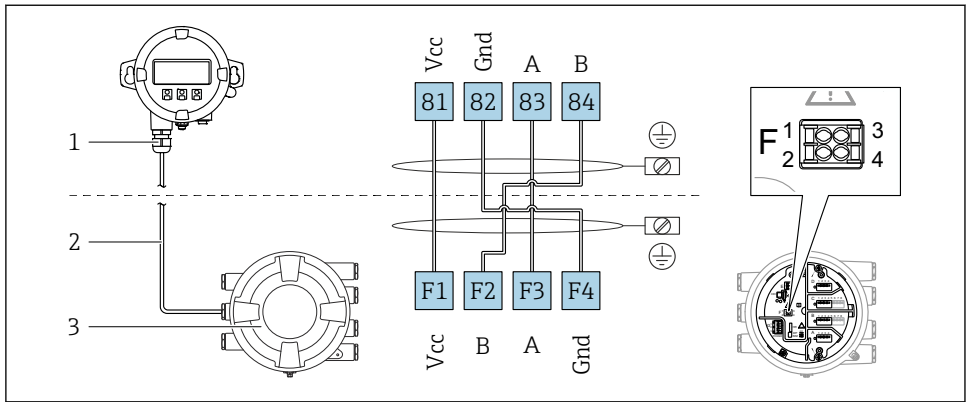
21.6 VA

##### Low voltage DC power supply:

13.4 W



### 6.1.2 Remote display and operating module DKX001



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6 Connection of the remote display and operating module DKX001 to the Tank Gauging device (NMR8x, NMS8x or NRF8x)

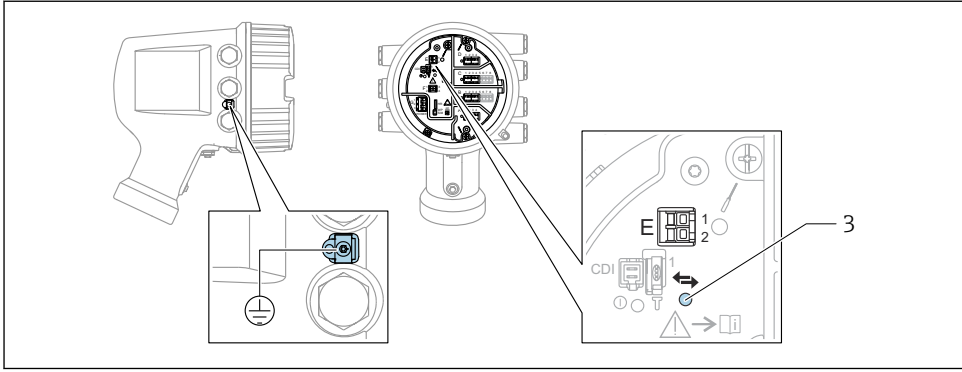
- 1 Remote display and operating module
- 2 Connecting cable
- 3 Tank Gauging device (NMR8x, NMS8x or NRF8x)

**i** The remote display and operating module DKX001 is available as an accessory. For details refer to SD01763D.

- i**
  - The measured value is indicated on the DKX001 and on the local display and operating module simultaneously.
  - The operating menu cannot be accessed on both modules at the same time. If the operating menu is entered in one of these modules, the other module is automatically locked. This locking remains active until the menu is closed in the first module (back to measured value display).



### 6.1.3 HART Ex i/IS interface



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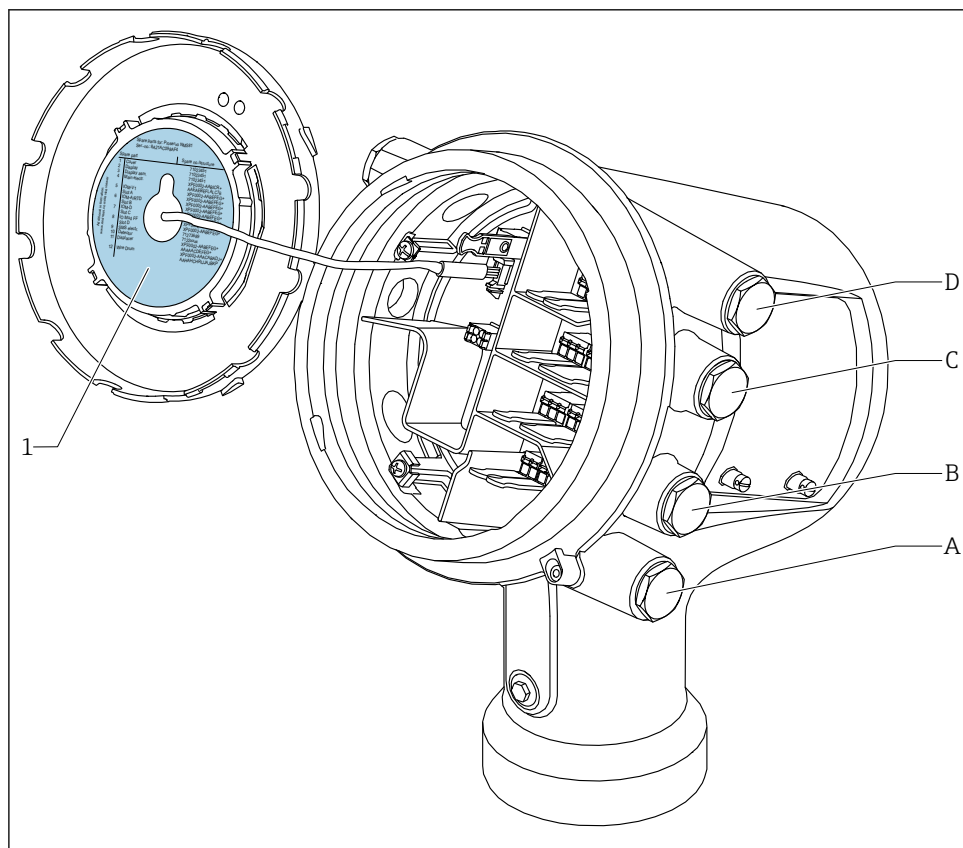
- E1 H+
- E2 H-
- 3 Orange LED: indicates data communication

**i** This interface always operates as the main HART master for connected HART slave transmitters. The Analog I/O modules, on the other hand, can be configured as a HART master or slave → 24 → 27.



### 6.1.4 Slots for I/O modules

The terminal compartment contains four slots (A, B, C and D) for I/O modules. Depending on the device version (ordering features 040, 050 and 060) these slots contain different I/O modules. The slot assignment for the device at hand is indicated on a label attached to the back cover of the display module.

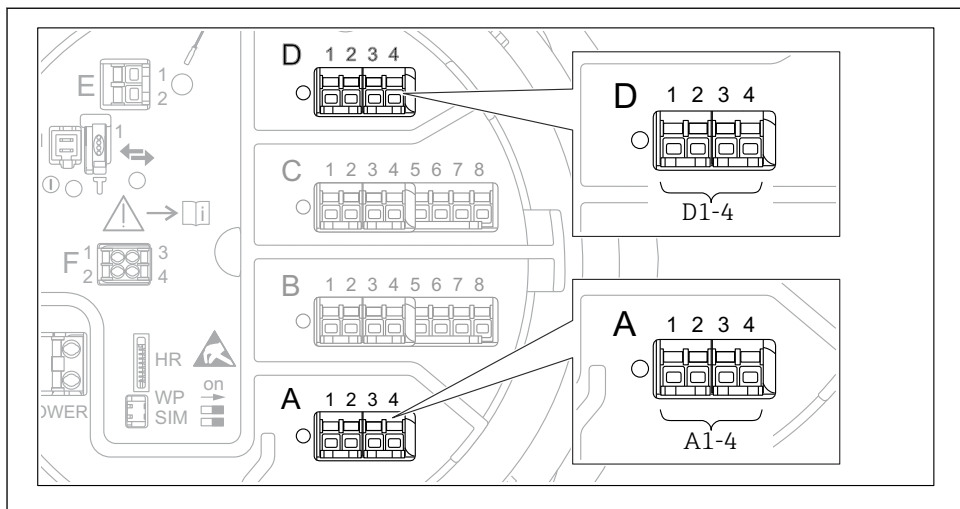


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- 1 Label showing (among other things) the modules in the slots A to D.
- A Cable entry for slot A
- B Cable entry for slot B
- C Cable entry for slot C
- D Cable entry for slot D



### 6.1.5 Terminals of the "Modbus" module, "V1" module or "WM550" module



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- 7 Designation of the "Modbus", "V1" or "WM550" modules (examples); depending on the device version these modules may also be in slot B or C.

Depending on the device version, the "Modbus" and/or "V1" or "WM550" module may be in different slots of the terminal compartment. In the operating menu the "Modbus" and "V1" or "WM550" interfaces are designated by the respective slot and the terminals within this slot: **A1-4, B1-4, C1-4, D1-4.**

#### Terminals of the "Modbus" module

Designation of the module in the operating menu: **Modbus X1-4;** (X = A, B, C or D)

- X1<sup>1)</sup>
  - Terminal name: S
  - Description: Cable shielding connected via a capacitor to EARTH
- X2<sup>1)</sup>
  - Terminal name: 0V
  - Description: Common reference
- X3<sup>1)</sup>
  - Terminal name: B-
  - Description: Non-inverting signal line
- X4<sup>1)</sup>
  - Terminal name: A+
  - Description: Inverting signal line

1) Here, "X" stands for one of the slots "A", "B", "C", or "D".



**Terminals of the "V1" and "WM550" module**

Designation of the module in the operating menu: **V1 X1-4** or **WM550 X1-4**; (X = A, B, C or D)


- X1 <sup>2)</sup>
  - Terminal name: S
  - Description: Cable shielding connected via a capacitor to EARTH
- X2 <sup>1)</sup>
  - Terminal name: -
  - Description: not connected
- X3 <sup>1)</sup>
  - Terminal name: B-
  - Description: Protocol loop signal -
- X4 <sup>1)</sup>
  - Terminal name: A+
  - Description: Protocol loop signal +

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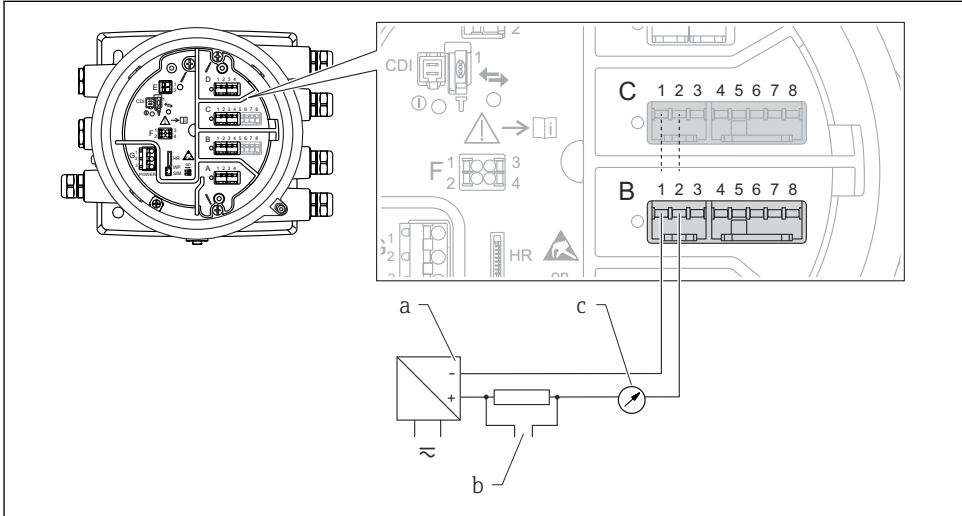
2) Here, "X" stands for one of the slots "A", "B", "C", or "D".



### 6.1.6 Connection of the "Analog I/O" module for passive usage

-  In the passive usage the supply voltage for the communication line must be supplied by an external source.
- The wiring must be in accordance with the intended operating mode of the Analog I/O module; see the drawings below.
- Screened cable must be used for the 4...20mA signal line.

"Operating mode" = "4...20mA output" or "HART slave +4...20mA output"



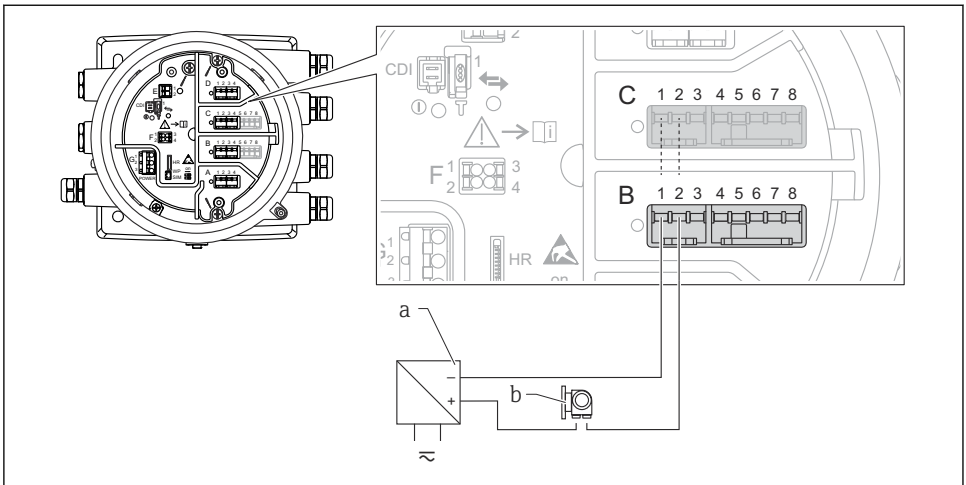
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#### 8 Passive usage of the Analog I/O module in the output mode

- a* Power supply
- b* HART signal output
- c* Analog signal evaluation



# "Operating mode" = "4...20mA input" or "HART master+4...20mA input"



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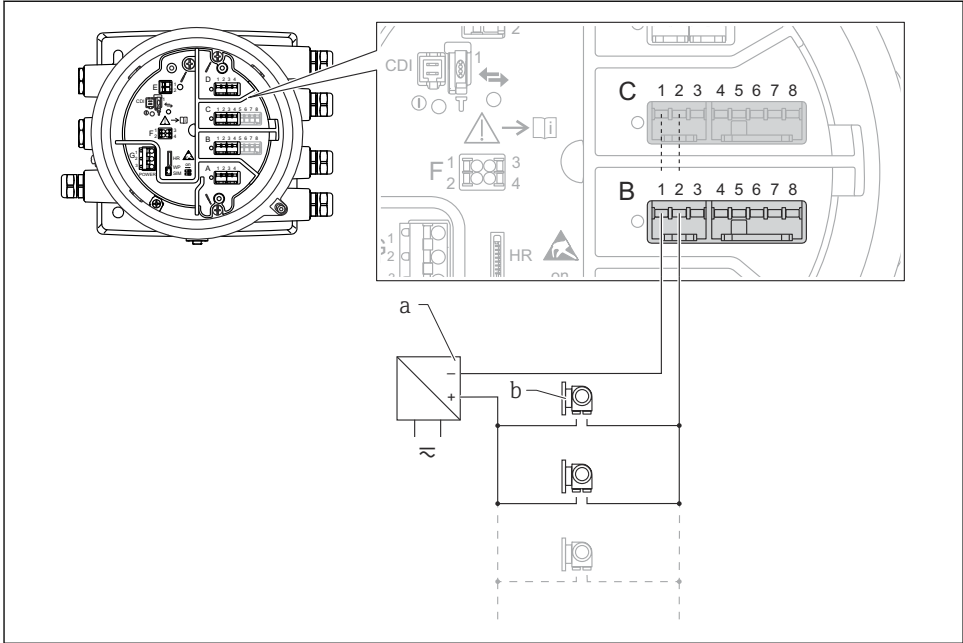
## 9 Passive usage of the Analog I/O module in the input mode

a Power supply

b External device with 4...20mA and/or HART signal output



"Operating mode" = "HART master"



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10 Passive usage of the Analog I/O module in the HART master mode

- a Power supply
- b Up to 6 external devices with HART signal output



### 6.1.7 Connection of the "Analog I/O" module for active usage

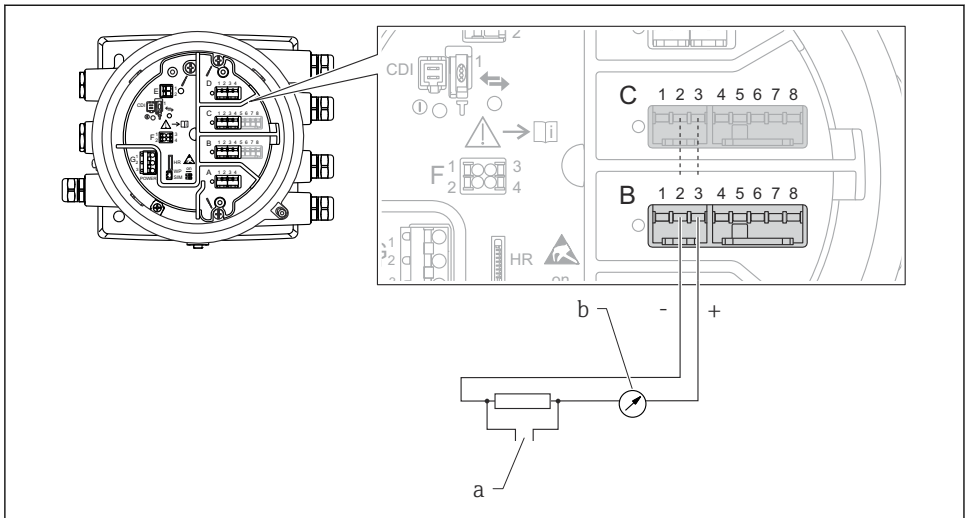


- In the active usage the supply voltage for the communication line is supplied by the device itself. There is no need of an external power supply.
- The wiring must be in accordance with the intended operating mode of the Analog I/O module; see the drawings below.
- Screened cable must be used for the 4...20mA signal line.



- Maximum current consumption of the connected HART devices: 24 mA (i.e. 4 mA per device if 6 devices are connected).
- Output voltage of the Ex-d module: 17.0 V@4 mA to 10.5 V@22 mA
- Output voltage of the Ex-ia module: 18.5 V@4 mA to 12.5 V@22 mA

"Operating mode" = "4..20mA output" or "HART slave +4..20mA output"



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11 Active usage of the Analog I/O module in the output mode

- a HART signal output  
b Analog signal evaluation

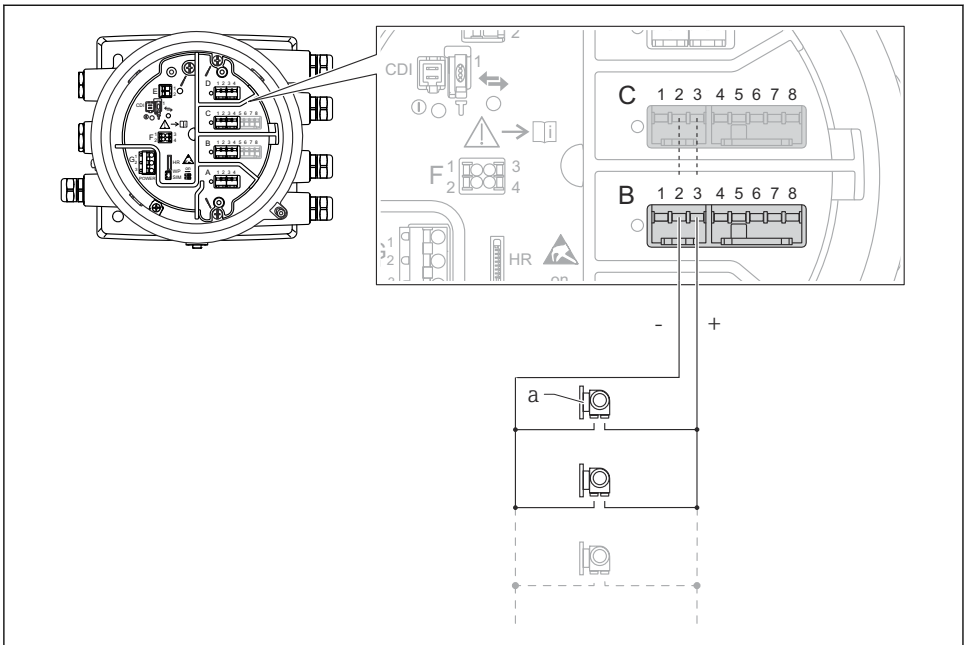


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- a External device with 4...20mA and/or HART signal output



## "Operating mode" = "HART master"



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### 13 Active usage of the Analog I/O module in the HART master mode

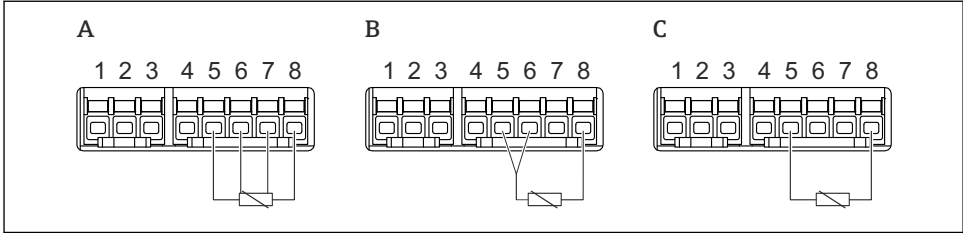
a Up to 6 external devices with HART signal output



The maximum current consumption for the connected HART devices is 24 mA (i.e. 4 mA per device if 6 devices are connected).




### 6.1.8 Connection of a RTD



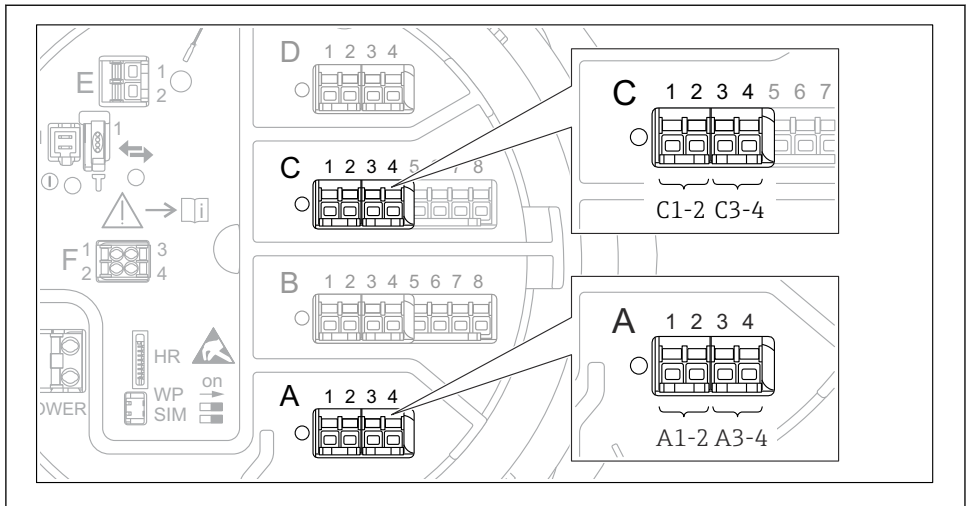
A0026371

- A 4-wire RTD connection
- B 3-wire RTD connection
- C 2-wire RTD connection

 Screened cable must be used for the connection of the RTD.



### 6.1.9 Terminals of the "Digital I/O" module



A0026424

14 Designation of the digital inputs or outputs (examples)

- Each Digital IO Module provides two digital inputs or outputs.
- In the operating menu each input or output is designated by the respective slot and two terminals within this slot. **A1-2**, for example, denotes terminals 1 and 2 of slot **A**. The same is valid for slots **B**, **C** and **D** if they contain a Digital IO module.
- For each of these pairs of terminals, one of the following operating modes can be selected in the operating menu:
  - Disable
  - Passive Output
  - Passive Input
  - Active Input



## 6.2 Connecting requirements

### 6.2.1 Cable specification

#### Terminals

##### Wire cross section 0.2 to 2.5 mm<sup>2</sup> (24 to 13 AWG)

Use for terminals with function: Signal and power supply

- Spring terminals (NMx8x-xx1...)
- Screw terminals (NMx8x-xx2...)

##### Wire cross section max. 2.5 mm<sup>2</sup> (13 AWG)

Use for terminals with function: Ground terminal in the terminal compartment

##### Wire cross section max. 4 mm<sup>2</sup> (11 AWG)

Use for terminals with function: Ground terminal at the housing

#### Power supply line

Standard device cable is sufficient for the power line.

#### Analog signal lines

Screened cable must be used for:

- the 4 to 20 mA signal lines.
- the RTD connection.

#### Digital I/O signal lines

- Shielded cable is recommended if using the relays.
- Observe the grounding concept of the plant.

#### HART communication line

Shielded cable is recommended if using the HART protocol. Observe the grounding concept of the plant.

#### Modbus communication line

- Observe the cable conditions from the TIA-485-A, Telecommunications Industry Association.
- Additional conditions: Use shielded cable.

#### V1 communication line

- 2-wire twisted pair, screened or unscreened cable
- Resistance in one cable:  $\leq 120 \Omega$
- Capacitance between lines:  $\leq 0.3 \mu\text{F}$

#### WM550 communication line

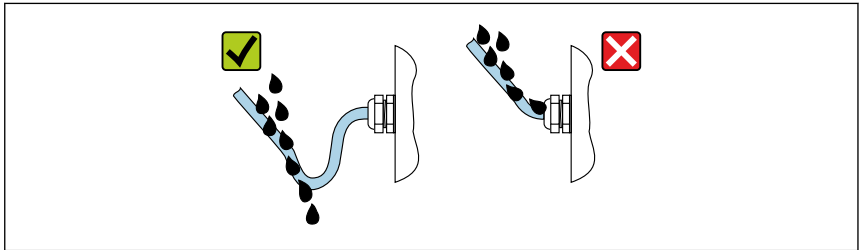
- 2-wire twisted pair, unscreened cable
- Cross section minimum 0.5 mm<sup>2</sup> (20 AWG)
- Maximum total cable resistance:  $\leq 250 \Omega$
- Cable with low capacitance



### 6.3 Ensuring the degree of protection

To guarantee the specified degree of protection, carry out the following steps after the electrical connection:

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



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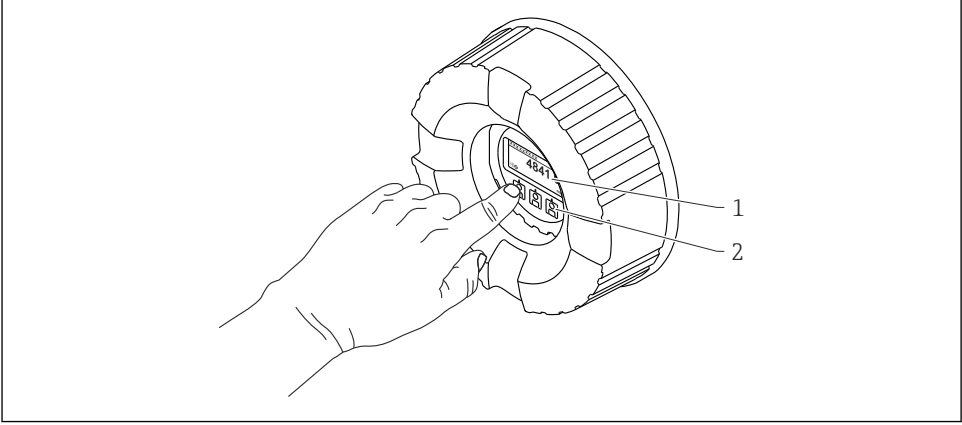
5. Insert blind plugs appropriate for the safety rating of the device (e.g. Ex d/XP).



## 7 Commissioning

### 7.1 Operating methods

#### 7.1.1 Operation via the local display



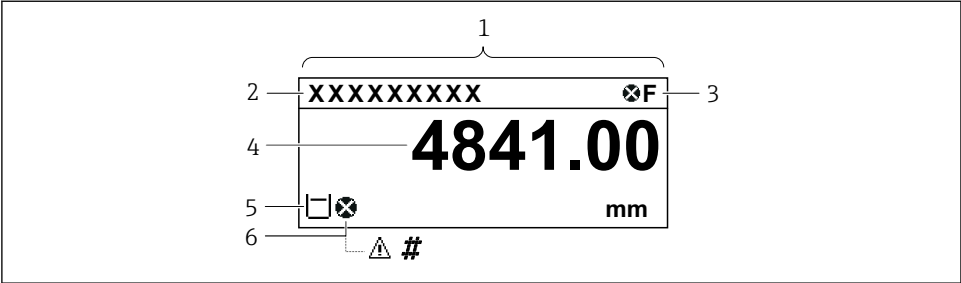
A0028345

#### 15 Display and operating elements

- 1 Liquid crystal display (LCD)
- 2 Optical keys; can be operated through the cover glass. If used without the cover glass, lightly place your finger in front of the optical sensor for activation. Do not press hard.



Standard view (measured value display)






A0028317

 16 Typical appearance of the standard view (measured value display)

- 1 Display module
- 2 Device tag
- 3 Status area
- 4 Display area for measured values
- 5 Display area for measured value and status symbols
- 6 Measured value status symbol

 For the meaning of the display symbols refer to the Operating Instructions (BA) of the device.

Function of the keys in the standard view

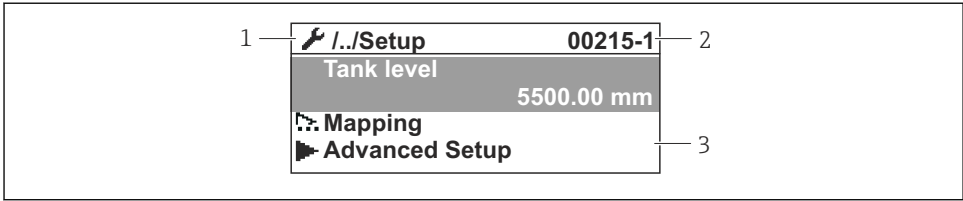
Key	Meaning
   A0028326	<b>Enter key</b> <ul style="list-style-type: none"><li>■ Pressing the key briefly opens the operating menu.</li><li>■ Pressing the key for 2 s opens the context menu.</li></ul>

Navigation view (operating menu)

To access the operating menu (navigation view), proceed as follows:

- 1. While in the standard view, press **E** for at least two seconds.
  - ↳ A context menu appears.
- 2. Select **Keylock off** from the context menu and confirm by pressing **E**.
- 3. Press **E** again to access the oprating menu.



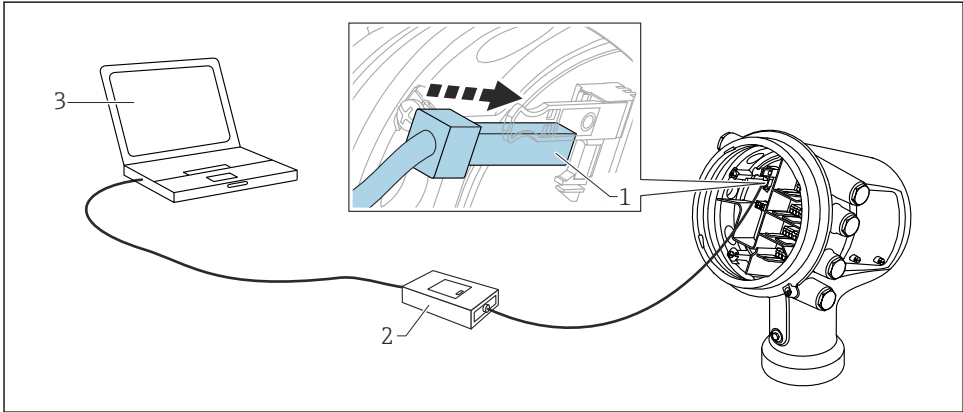


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17 Navigation view

- 1 Current submenu or wizard
- 2 Quick access code
- 3 Display area for navigation

### 7.1.2 Operation via service interface and FieldCare/DeviceCare



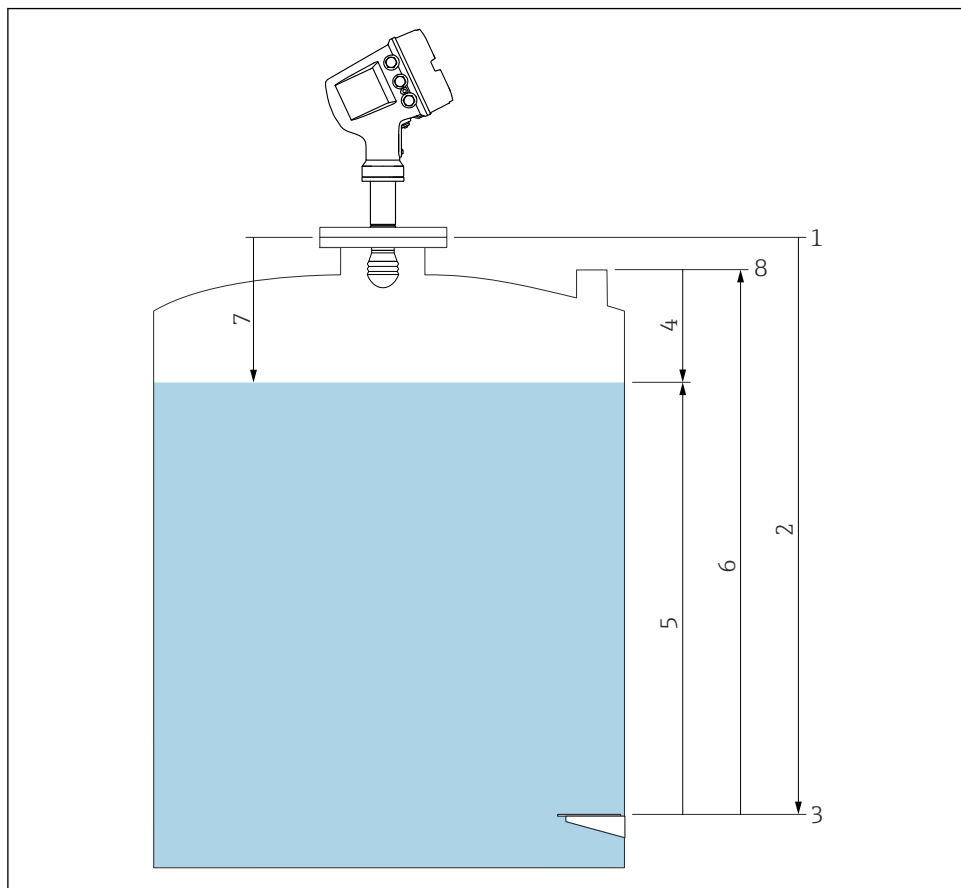
A0023737

18 Operation via service interface

- 1 Service interface (CDI = Endress+Hauser Common Data Interface)
- 2 Commubox FXA291
- 3 Computer with "FieldCare" or "DeviceCare" operating tool and "CDI Communication FXA291" COM DTM



## 7.2 Terms related to tank measurement



A0029794

19 Terms related to radar tank measurement

- 1 Gauge reference height
- 2 Empty
- 3 Datum plate
- 4 Tank ullage
- 5 Tank level
- 6 Tank reference height
- 7 Distance
- 8 Dipping reference



## 7.3 Initial settings


### 7.3.1 Setting the display language

#### Setting the display language via the display module

1. While in the standard view (), press "E". If required, select **Keylock off** from the context menu and press "E" again.
  - ↳ The Language appears.
2. Open the Language and select the display language.

#### Setting the display language via an operating tool (e.g. FieldCare)

1. Navigate to: Setup → Advanced setup → Display → Language
2. Select the display language.

 This setting only affects the language on the display module. To set the language in the operating tool use the language setting functionality of FieldCare or DeviceCare, respectively.

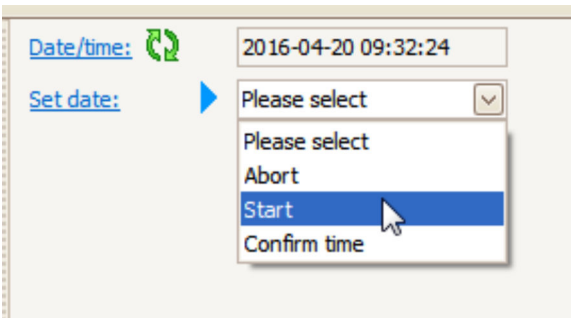
### 7.3.2 Setting the real-time clock

#### Setting the real-time clock via the display module

1. Navigate to: Setup → Advanced setup → Date / time → Set date
2. Use the following parameters to set the real-time clock to the current date and time:  
**Year, Month, Day, Hour, Minutes.**

#### Setting the real-time clock via an operating tool (e.g. FieldCare)





1. Navigate to: Setup → Advanced setup → Date / time
- 2.



Go to the Set date and select the Start.








3.

<a href="#">Date/time:</a>		2016-04-20 09:34:25
<a href="#">Set date:</a>	 	Please select 
<a href="#">Year:</a>		2016
<a href="#">Month:</a>		4
<a href="#">Day:</a>		20
<a href="#">Hour:</a>		9
<a href="#">Minute:</a>		34

Use the following parameters to set the date and time: **Year, Month, Day, Hour, Minutes.**

4.

<a href="#">Date/time:</a>		2016-04-20 09:35:49
<a href="#">Set date:</a>	 	Please select 
<a href="#">Year:</a>		Please select
<a href="#">Month:</a>		Abort
<a href="#">Day:</a>		Start
<a href="#">Hour:</a>		Confirm time 
<a href="#">Minute:</a>		9
		34


Go to the Set date and select the Confirm time.

↳ The real-time clock is set to the current date and time.



## 7.4 Configuration of the radar measurement

### 7.4.1 Basic settings

Submenu: Setup	
Parameter	Meaning / Action
Device tag	Define a name to identify the measuring point within the plant.
Units preset	Select a set of units for length, pressure and temperature.
Empty	Enter the distance from the lower edge of the device flange to the datum plate.
Tank level	Shows the measured level. Check whether the indicated value matches the actual level.
Set level	<p>Can be used to correct a constant shift of the measured level:            If the indicated level does not match the actual level: Enter the actual level into this parameter. An offset for the measured level is then automatically applied.</p> <p> The <b>Set level</b> parameter can only be used to compensate for a constant level error. To eliminate errors resulting from interference echos, use the interference echo suppression (map).</p>

### 7.4.2 Interference echo suppression (map)

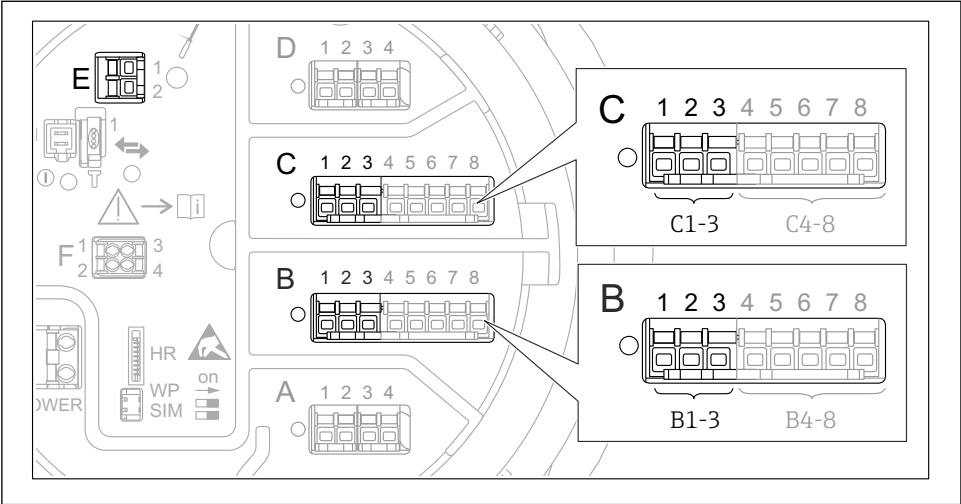
Submenu: Setup	
Parameter	Meaning / Action
Distance	Shows the measured distance from the lower edge of the device flange to the product surface. Check whether this value is correct.
Confirm distance	Specify whether the measured distance matches the actual distance.
Present mapping	Shows up to which distance a mapping has already been recorded.
Mapping end point	<p>Only visible for <b>Confirm distance</b> = <b>Manual map</b>.            Determines up to which distance the new mapping will be recorded.            Depending on the selection in <b>Confirm distance</b> a suitable value is preset in this parameter.            Usually, there is no need to change this value.</p>
Record map	<p>Only visible for <b>Confirm distance</b> = <b>Manual map</b>.            Select <b>Record map</b>. This starts the recording of the new map.</p>



## 7.5 Configuration of the inputs

### 7.5.1 Configuration of the HART inputs

#### Connecting and addressing HART devices



A0032955

20 Possible terminals for HART loops

- B Analog I/O module in slot B (availability depending on device version )
- C Analog I/O module in slot C (availability depending on device version )
- E HART Ex is output (available in all device versions)

**i** HART devices must be configured and given a unique HART address via their own user interface before they are connected to the Micropilot NMR8x<sup>3)</sup>.

Submenu: Setup → Advanced setup → Input/output → Analog I/O	
Parameter	Meaning / Action
Operating mode	Select: <ul style="list-style-type: none"><li>■ <b>HART master+4...20mA input</b> if only one HART device is connected to this loop. In this case the 4-20mA signal can be used in addition to the HART signal.</li><li>■ <b>HART master</b> if up to 6 HART devices are connected to this loop.</li></ul>

3) The current software does not support HART devices with address 0 (zero).



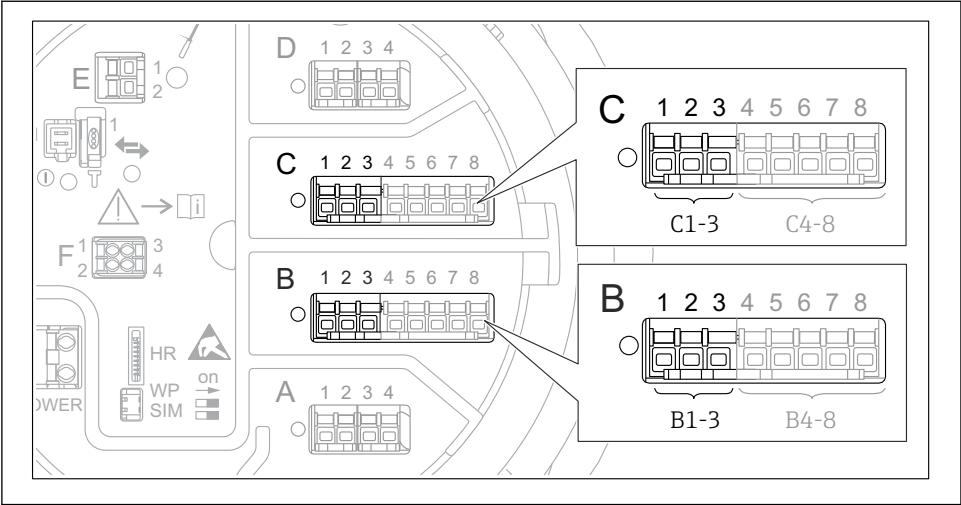
Submenu: Setup → Advanced setup → Input/output → HART devices → HART Device(s) <sup>1) 2)</sup>	
Parameter	Meaning / Action
Output pressure	<ul style="list-style-type: none"> <li>■ If the device measures a pressure: Select which of the HART variables (PV, SV, TV or QV) contains the pressure.</li> <li>■ Otherwise: Keep the factory setting: <b>No value</b></li> </ul>
Output density	<ul style="list-style-type: none"> <li>■ If the device measures a density: Select which of the HART variables (PV, SV, TV or QV) contains the density.</li> <li>■ Otherwise: Keep the factory setting: <b>No value</b></li> </ul>
Output temperature	<ul style="list-style-type: none"> <li>■ If the device measures a temperature: Select which of the HART variables (PV, SV, TV or QV) contains the temperature.</li> <li>■ Otherwise: Keep the factory setting: <b>No value</b></li> </ul>
Output vapor temperature	<ul style="list-style-type: none"> <li>■ If the device measures the vapor temperature: Select which of the HART variables (PV, SV, TV or QV) contains the vapor temperature.</li> <li>■ Otherwise: Keep the factory setting: <b>No value</b></li> </ul>
Output level	<ul style="list-style-type: none"> <li>■ If the device measures a level: Select which of the HART variables (PV, SV, TV or QV) contains the level.</li> <li>■ Otherwise: Keep the factory setting: <b>No value</b></li> </ul>

1) There is a "HART Device(s)" for each connected HART device.

2) This setting can be skipped for a connected Prothermo NMT5xx and NMT8x or Micropilot FMR5xx as for these devices the type of measured value is identified automatically.



7.5.2 Configuration of the 4-20mA inputs

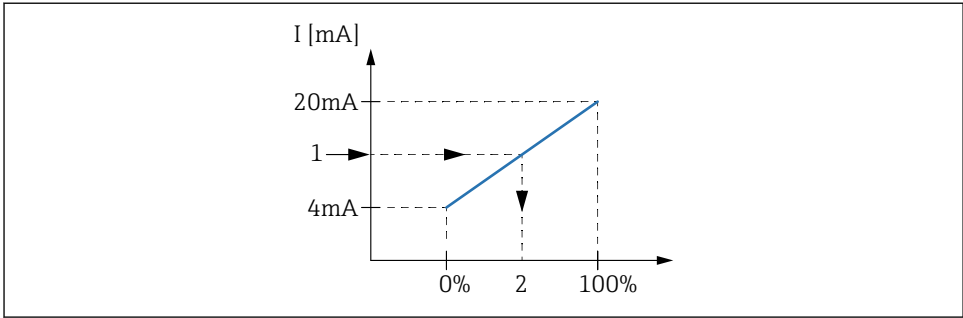


21 Possible locations of the Analog I/O modules, which can be used as a 4-20mA input. The order code of the device determines which of these modules is actually present.

Submenu: Setup → Advanced setup → Input/output → Analog I/O <sup>1)</sup>	
Parameter	Meaning / Action
Operating mode	Select 4..20mA input or HART master+4..20mA input
Process variable	Select which process variable is transmitted by the connected device.
Analog input 0% value	Define which value of the process variable corresponds to an input current of 4 mA.
Analog input 100% value	Define which value of the process variable corresponds to an input current of 20 mA.
Process value	Check whether the indicated value matches the actual value of the process variable.

1) There is a "Analog I/O" for each Analog I/O module of the device.





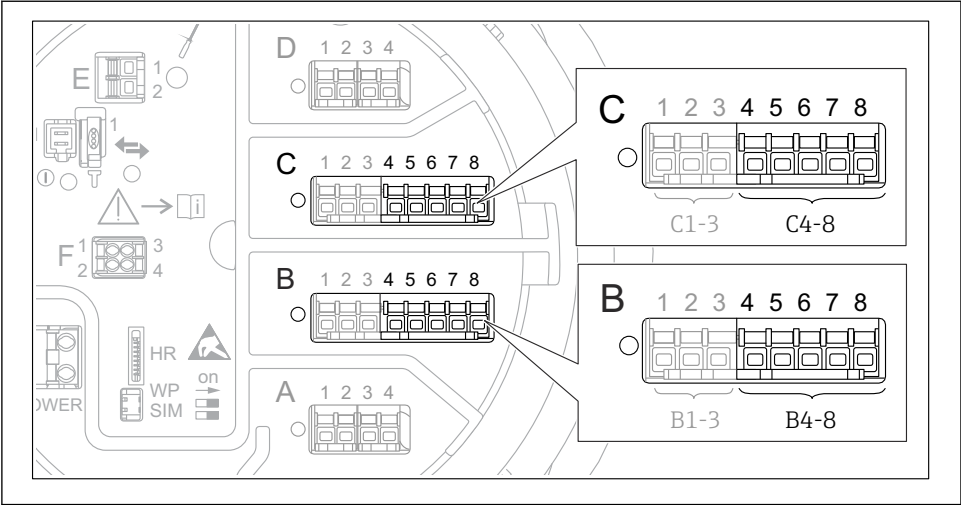
A0029264

22 *Scaling of the 4-20mA input to the process variable*

- 1 *Input value in mA*
- 2 *Process value*



7.5.3 Configuration of a connected RTD

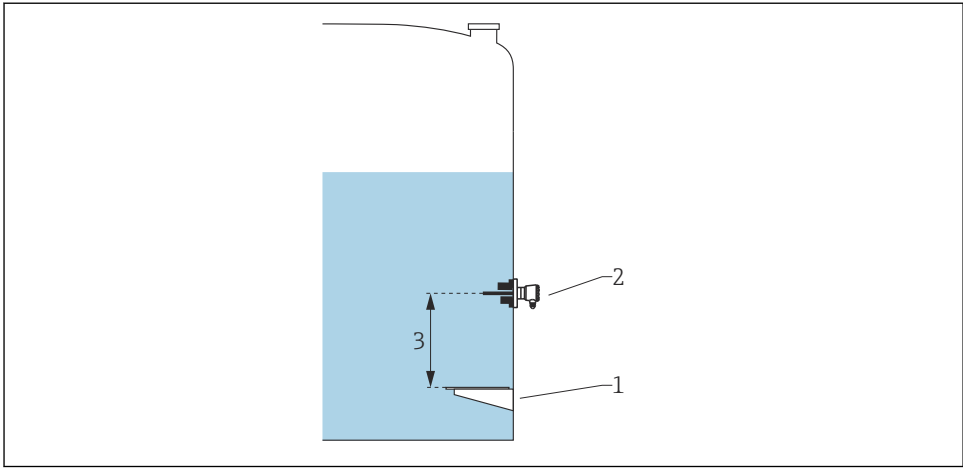


A0032465

23 Possible locations of the Analog I/O modules, to which an RTD can be connected. The order code of the device determines which of these modules is actually present.

Submenu: Setup → Advanced setup → Input/output → Analog IP	
Parameter	Meaning / Action
RTD type	Specify the type of the connected RTD.
RTD connection type	Specify the type of connection of the RTD (2-, 3- or 4-wire).
Input value	Check whether the indicated value matches the actual temperature.
Minimum probe temperature	Specify the minimum approved temperature of the connected RTD.
Maximum probe temperature	Specify the maximum approved temperature of the connected RTD.
Probe position	Enter the mounting position of the RTD (measured from the datum plate).



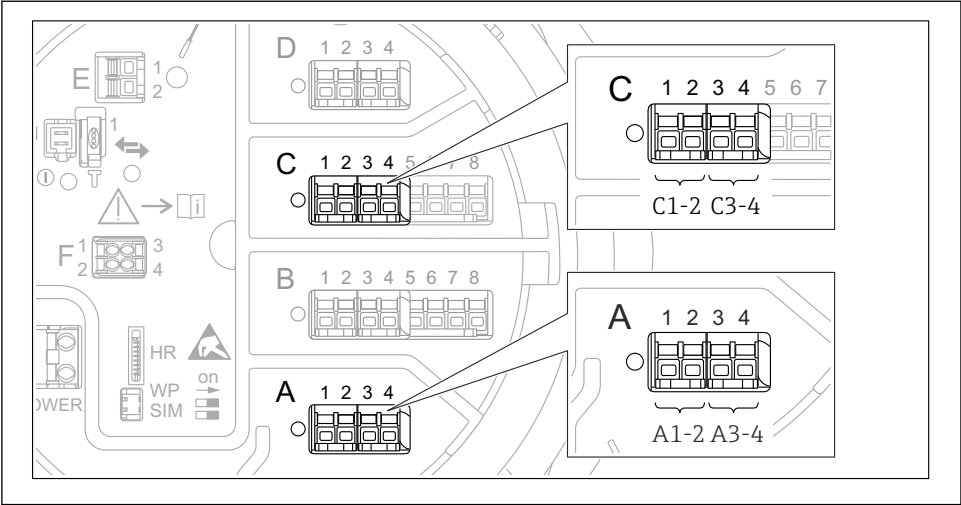


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- 1 Datum plate
- 2 RTD
- 3 Probe position



7.5.4 Configuration of the digital inputs



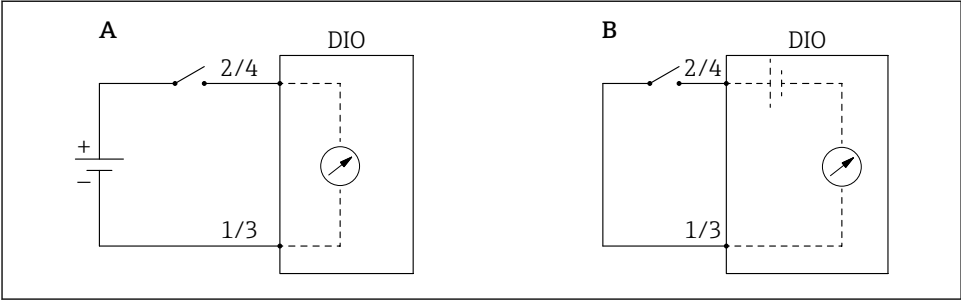
A0026424

24 Possible locations of the Digital I/O modules (examples); the order code defines the number and location of digital input modules.

There is a **Digital Xx-x** for each digital I/O module of the device. "X" designates the slot in the terminal compartment, "x-x" the terminals within this slot. The most important parameters of this submenu are **Operating mode** and **Contact type**.

Submenu: Setup → Advanced setup → Input/output → Digital Xx-x	
Parameter	Meaning / Action
Operating mode	Select the operating mode (see diagram below). <ul style="list-style-type: none"><li>Input passive The DIO module measures the voltage provided by an external source. Depending on the status of the external switch, this voltage is 0 (switch open) or exceeds a certain limit voltage (switch closed). These two states represent the digital signal.</li><li>Input active The DIO module provides a voltage and uses it to detect whether the external switch is open or closed.</li></ul>
Contact type	Determines how the state of the external switch is mapped to the internal states of the DIO module (see table below). The internal state of the Digital Input can then be transferred to a Digital Output or can be used to control the measurement.





A0029262

- A "Operating mode" = "Input passive"
- B "Operating mode" = "Input active"

State of the external switch	Internal state of the DIO module	
	Contact type = Normally open	Contact type = Normally closed
Open	Inactive	Active
Closed	Active	Inactive
Behavior in special situaions:		
During start-up	Unknown	Unknown
Fault in measurement	Error	Error



## 7.6 Linking measured values to tank variables

Measured values must be linked to tank variables before they can be used in the Tank Gauging application.



Depending on the application not all these parameters will be relevant in a given situation.

Submenu: Setup → Advanced setup → Application → Tank configuration → Level	
Parameter	Defines the source of the following tank variable
Water level source	Bottom water level

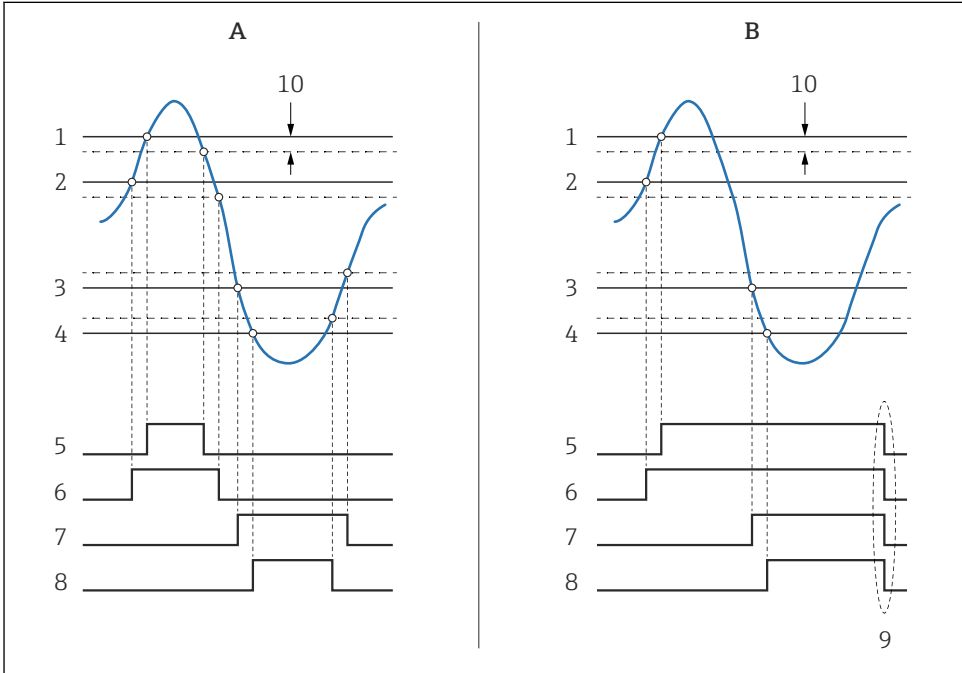
Submenu: Setup → Advanced setup → Application → Tank configuration → Temperature	
Parameter	Defines the source of the following tank variable
Liquid temp source	Average or spot temperature of the product
Air temperature source	Temperature of the air surrounding the tank
Vapor temp source	Temperature of the vapor above the product

Submenu: Setup → Advanced setup → Application → Tank configuration → Pressure	
Parameter	Defines the source of the following tank variable
P1 (bottom) source	Bottom pressure (P1)
P3 (top) source	Top pressure (P3)



## 7.7 Configuration of the alarms (limit evaluation)

A limit evaluation can be configured for up to 4 tank variables. The limit evaluation issues an alarm if the value exceeds an upper limit or falls below a lower limit, respectively. The limit values can be defined by the user.



A0029539

25 Principle of the limit evaluation

- A Alarm mode = On
- B Alarm mode = Latching
- 1 HH alarm value
- 2 H alarm value
- 3 L alarm value
- 4 LL alarm value
- 5 HH alarm
- 6 H alarm
- 7 L alarm
- 8 LL alarm
- 9 "Clear alarm" = "Yes" or power off-on
- 10 Hysteresis

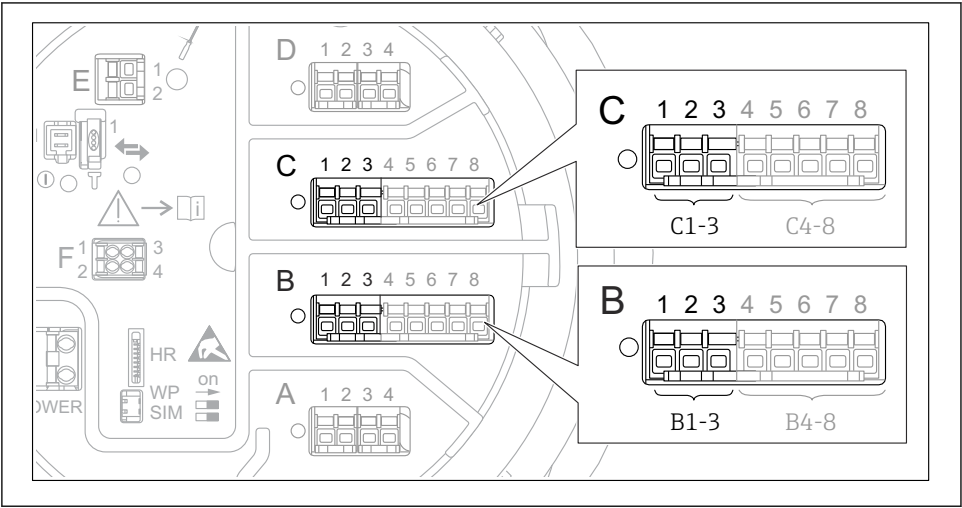


To configure an alarm, assign appropriate values to the following parameters:

Submenu: Setup → Advanced setup → Application → Alarm → Alarm 1 to 4	
Parameter	Meaning / Action
Alarm mode	<ul style="list-style-type: none"><li>■ <b>Off</b> No alarms are generated.</li><li>■ <b>On</b> An alarm disappears if the alarm condition is no longer present (taking into consideration the hysteresis).</li><li>■ <b>Latching</b> All alarms remain active until the user selects <b>Clear alarm = Yes</b>.</li></ul>
Alarm value source	Select process variable to be checked for limit violation.
<ul style="list-style-type: none"><li>■ HH alarm value</li><li>■ H alarm value</li><li>■ L alarm value</li><li>■ LL alarm value</li></ul>	Assign appropriate limit values (see diagram above).

## 7.8 Configuration of the signal output

### 7.8.1 Analog output 4 to 20 mA output



26 Possible locations of the Analog I/O modules, which can be used as a 4 to 20 mA output. The order code of the device determines which of these modules is actually present.



Each Analog I/O module of the device can be configured as 4 to 20 mA analog output. To do so, assign appropriate values to the following parameters:


Setup → Advanced setup → Input/output → Analog I/O	
Parameter	Meaning / Action
Operating mode	Select <b>4..20mA output</b> or <b>HART slave +4..20mA output</b> <sup>1)</sup> → ⓘ 53.
Analog input source	Select which tank variable is transmitted via the analog output.
Analog input 0% value	Specify which value of the tank variable corresponds to an output current of 4 mA.
Analog input 100% value	Specify which value of the tank variable corresponds to an output current of 20 mA.

1) "HART slave +4..20mA output" means that the Analog I/O module serves as a HART slave which cyclically sends up to four HART variables to a HART master. For the configuration of the HART output:



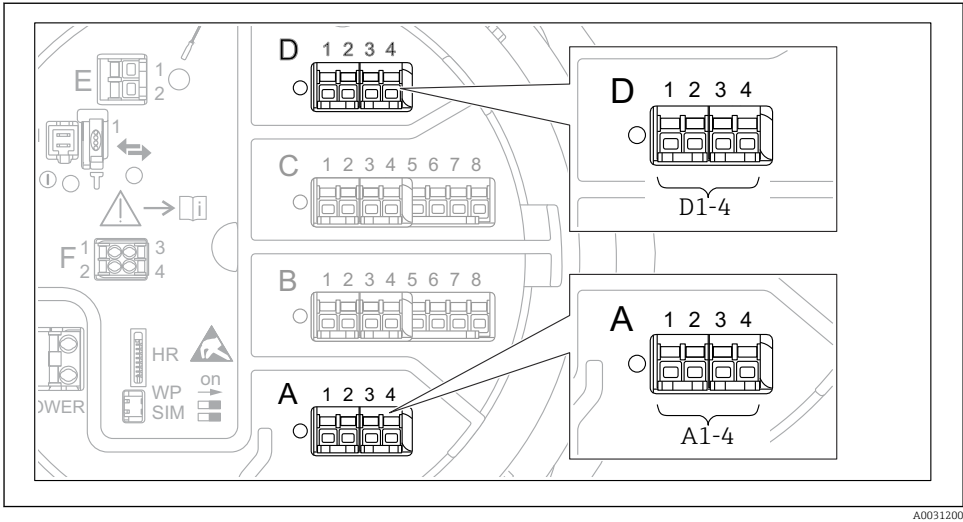
## 7.8.2 HART output

This section is only valid for **Operating mode = HART slave +4..20mA output**.

Setup → Advanced setup → Communication → HART output → Configuration	
Parameter	Meaning / Action
System polling address	Set the HART communication address of the device.
<ul style="list-style-type: none"> <li>▪ Assign SV</li> <li>▪ Assign TV</li> <li>▪ Assign QV</li> </ul>	<p>Select which tank variables are to be transmitted by the HART variables.</p> <p> By default, <b>PV</b> transmits the same variable as the analog output and needs not to be assigned.</p>



### 7.8.3 Modbus, V1 or WM550 output



27 Possible locations of the Modbus or V1 modules (examples); depending on the device version these modules may also be in slot B or C .

Depending on the order code the device may have one or two Modbus or V1 communication interfaces. These are configured in the following submenus:

#### Modbus

Setup → Advanced setup → Communication → Modbus X1-4 → Configuration

#### V1

- Setup → Advanced setup → Communication → V1 X1-4 → Configuration
- Setup → Advanced setup → Communication → V1 X1-4 → V1 input selector

#### WM550

- Setup → Advanced setup → Communication → WM550 X1-4 → Configuration
- Setup → Advanced setup → Communication → WM550 X1-4 → WM550 input selector



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