Products   Solutions   Services

Brief Operating Instructions
Tankside Monitor NRF81
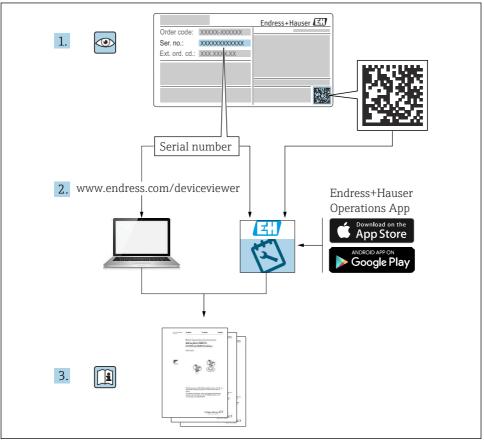
Tank Gauging

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
- Smart phone/tablet: *Endress+Hauser Operations App*

Endress+Hauser **EH**

People for Process Automation

1.

Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXXX.XX

Endress+Hauser

Serial number

2. www.endress.com/deviceviewer

Endress+Hauser
Operations App

Download on the App Store

ANDROID APP ON Google Play

3.

A0023555

Table of contents

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

ℹ️ 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):

For an overview of the scope of the associated Technical Documentation, refer to the
following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from
  the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan
  the matrix code on the 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 device described in these Operating Instructions is a monitoring unit for use with the Endress+Hauser Micropilot M and Micropilot S-series radars and other HART compatible devices. Mounted at the tank side, it provides indication of measured data, allows configuration and supplies intrinsically safe (i.s.) or explosion proof (XP) power to the connected sensors on the tank. Various industry standard digital gauging communication protocols support integration into open architecture tank gauging and inventory systems.

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).
▶ 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.

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 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.
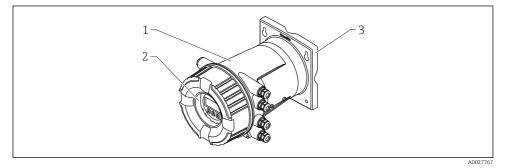
2.5.1   CE mark

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

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

3   Product description

3.1   Product design

 1   Design of Tankside Monitor NRF81

1   Housing
2   Display and operating module (can be operated without opening the cover)
3   Mounting plate for wall or pipe mounting

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 measuring device:
- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the 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 ℃ (−58 to +176 ℉)
- Store the device in its original packaging.
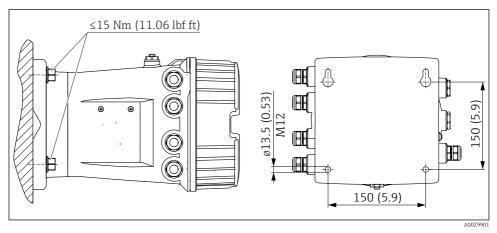
4.3.2   Transport

⚠ CAUTION

Risk of injury
▸ Transport the measuring device to the measuring point in its original packaging.
▸ 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
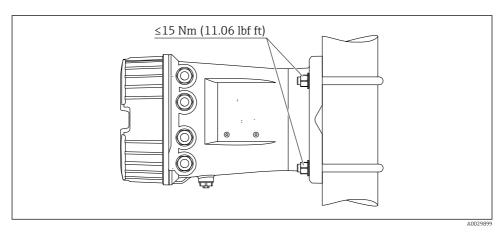
5.1 Installation conditions

5.1.1 Wall mounting

2   Wall mounting of the Tankside Monitor

5.1.2 Pipe mounting

Ordering feature 620 "Accessory enclosed"	Mounting kit
PV	Mounting kit, pipe, DN32-50 (1-1/4" - 2")
PW	Mounting kit, pipe, DN80 (3")

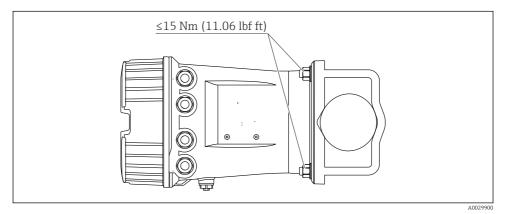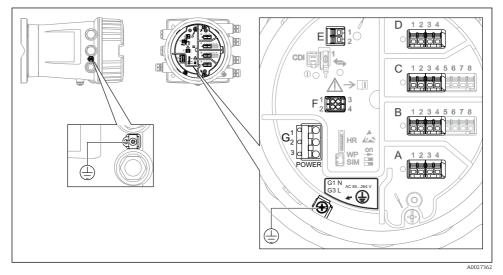*3   Mounting of the Tankside Monitor at a vertical pipe*

4   Mounting of the Tankside Monitor at a horizontal pipe

6   Electrical connection

6.1   Terminal assignment

A0027362

🖼 *5   Terminal compartment (typical example) and ground terminals*

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.

The exact assignment of the modules to the slots is dependent on the device version
→ 🖺 18.

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 (connec t 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)
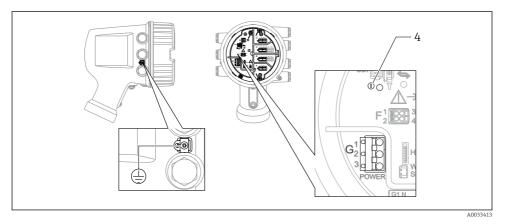• G1: L-
• G2: not connected
• G3: L+

Terminal area: Protective ground
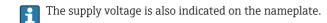Module: Protective ground connection (M4 screw)

A0018339

 6   Terminal area: Protective ground

6.1.1   Power supply

A0033413

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_{AC} (- 15 % + 10 %) = 85 to 264 V_{AC} , 50/60 Hz

Low voltage AC power supply:
Operational value:
65 V_{AC} (- 20 % + 15 %) = 52 to 75 V_{AC} , 50/60 Hz

Low voltage DC power supply:
Operational value:
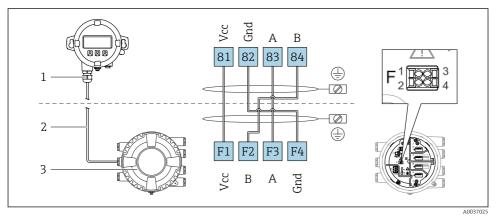24 to 55 V_{DC} (- 20 % + 15 %) = 19 to 64 V_{DC}

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

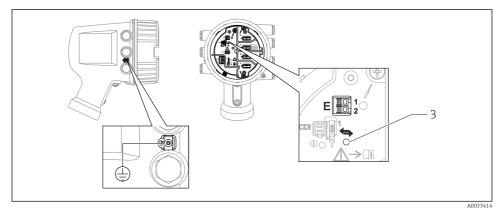## 6.1.2   Remote display and operating module DKX001

A0037025

 7   *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)

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

• 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).
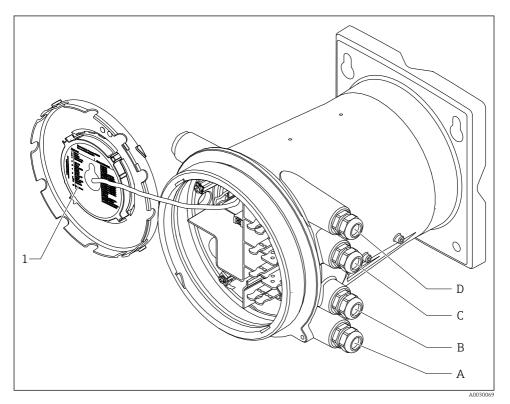
6.1.3 HART Ex i/IS interface

A0033414

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

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 → 🖹 21 → 🖹 24.

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.

A0030069

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

A0031200

☒ *8*   *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 [1]
  - Terminal name: S
  - Description: Cable shielding connected via a capacitor to EARTH
- X2 [1]
  - Terminal name: 0V
  - Description: Common reference
- X3 [1]
  - Terminal name: B-
  - Description: Non-inverting signal line
- X4 [1]
  - 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)
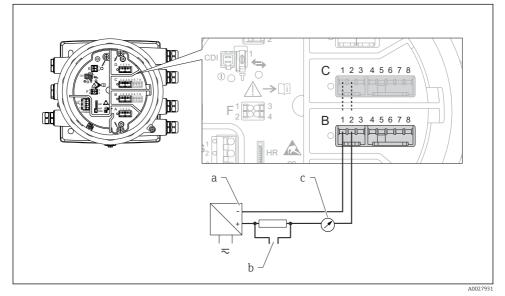
- X1 [2)]
  - Terminal name: S
  - Description: Cable shielding connected via a capacitor to EARTH
- X2 [1)]
  - Terminal name: -
  - Description: not connected
- X3 [1)]
  - Terminal name: B-
  - Description: Protocol loop signal -
- X4 [1)]
  - Terminal name: A+
  - Description: Protocol loop signal +

---

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

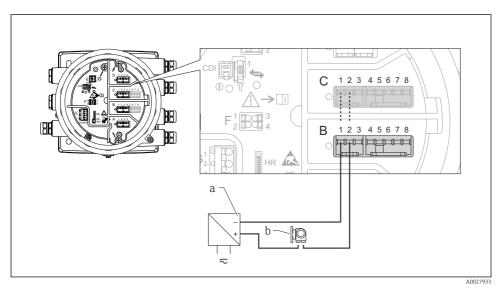### 6.1.6 Connection of the "Analog I/O" module for passive usage

ℹ️ • 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.

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

A0027931

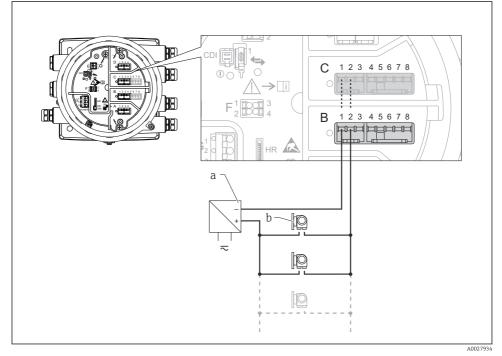⊠ *9   Passive usage of the Analog I/O module in the output mode*

a   Power supply
b   HART signal output
c   Analog signal evaluation

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

A0027933

⊠ *10   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
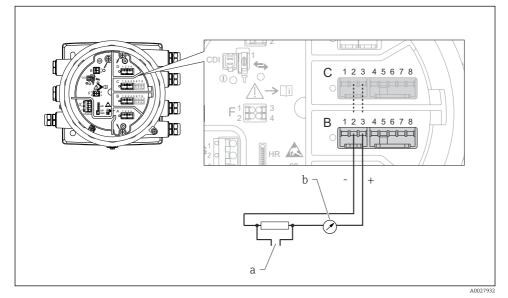
"Operating mode" = "HART master"

A0027934

🔲 *11 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

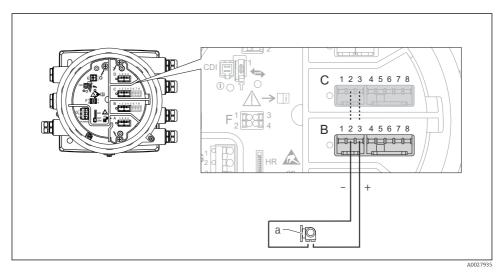### 6.1.7   Connection of the "Analog I/O" module for active usage

i • 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.

i • 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"

A0027932
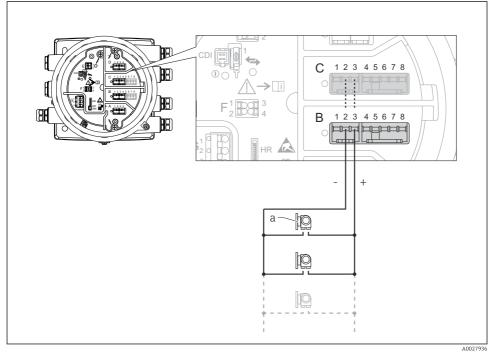
⊞ *12   Active usage of the Analog I/O module in the output mode*

a   HART signal output
b   Analog signal evaluation

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

A0027935

🖾 *13　Active usage of the Analog I/O module in the input mode*

a　External device with 4...20mA and/or HART signal output
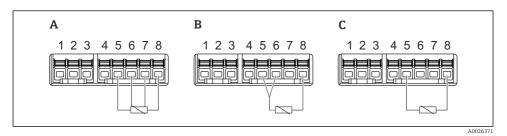
"Operating mode" = "HART master"

A0027936

⊞ *14   Active usage of the Analog I/O module in the HART master mode*

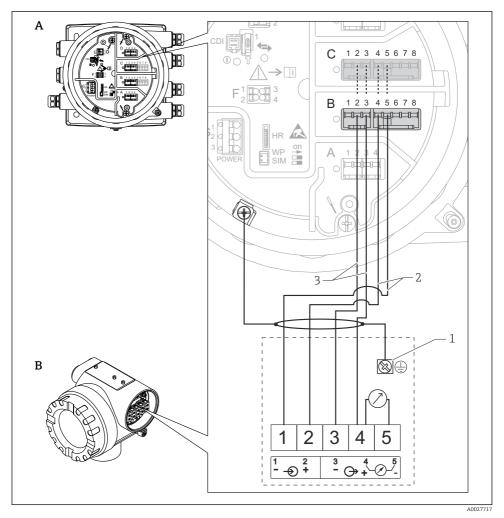*a   Up to 6 external devices with HART signal output*

ℹ️ 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

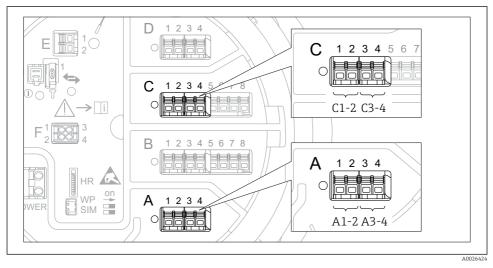### 6.1.9   Connection of a Micropilot S FMR5xx

A0027717

⊡ 15   Connection of a Micropilot S FMR5xx to the Analog input module of a Tankside Monitor NRF81

A   Tankside Monitor NRF81
B   Micropilot S FMR5xx
1   Grounding
2   Power supply (from NRF81 to FMR5xx)
3   4-20mA/HART signal (from FMR5xx to NRF81)

ℹ️   If connected in this way, the Micropilot S FMR5xx gets its supply voltage from the
       Tankside Monitor NRF81.

6.1.10   Terminals of the "Digital I/O" module

A0026424

⚄ *16   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 mm² (24 to 13 AWG)
Use for terminals with function: Signal and power supply
• Spring terminals (NRF81-xx1...)
• Screw terminals (NRF81-xx2...)

Wire cross section max. 2.5 mm² (13 AWG)
Use for terminals with function: Ground terminal in the terminal compartment

Wire cross section max. 4 mm² (11 AWG)
Use for terminals with function: Ground terminal at the housing

Power supply line

Standard device cable is sufficient for the power line.

HART communication line

• Standard device cable is sufficient if only the analog signal is used.
• 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
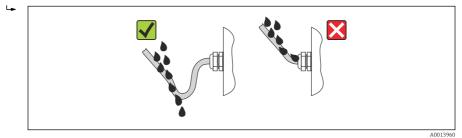• Resistance in one cable: ≤ 120 Ω
• Capacitance between lines: ≤ 0.3 µF

WM550 communication line

• 2-wire twisted pair, unscreened cable
• Cross section minimum 0.5 mm² (20 AWG)
• Maximum total cable resistance: ≤ 250 Ω
• 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").
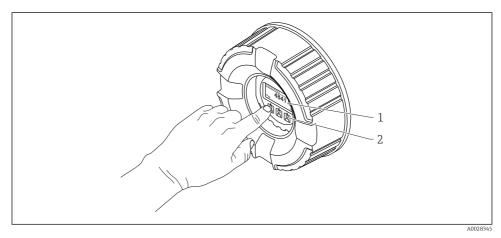

A0013960

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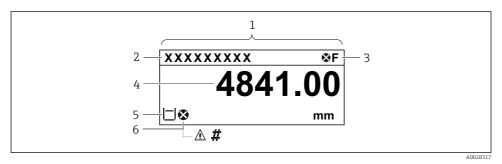
7   Commissioning

7.1   Operating methods

7.1.1   Operation via the local display

A0028345

 17   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

🖼 *18   Typical appearance of the standard view (measured value display)*
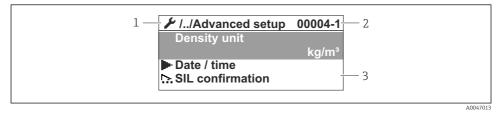
1   Display module
2   Device tag
3   Status area
4   Display area for measured values
5   Display area for measured value and status symbols
6   Measured value status symbol

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

Navigation view (operating menu)

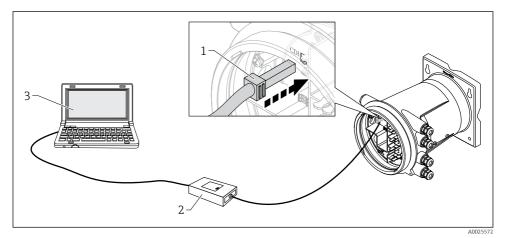To access the operating menu (navigation view), proceed as follows:

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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🖼 *19   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

A0025572

20   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   Initial settings

7.2.1   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** parameter appears.
2. Open the **Language** parameter 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.

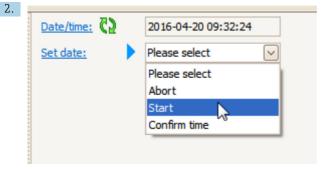### 7.2.2   Setting the real-time clock

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 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** parameter and select the **Start** option.

3.

Use the following parameters to set the date and time: **Year**, **Month**, **Day**, **Hour**,
Minutes.
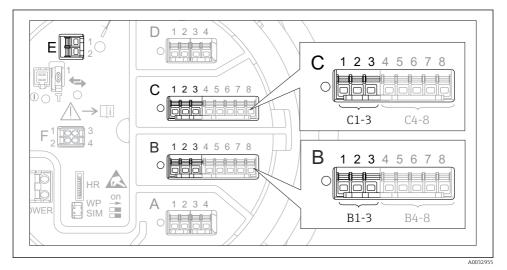
4.

Date/time:		2016-04-20 09:35:49
Set date: ? ▶		Please select ⌄
Year:		Please select
		Abort
Month:		Start
Day:		Confirm time
Hour:		9
Minute:		34

Go to the **Set date** parameter and select the **Confirm time** option.
↳ The real-time clock is set to the current date and time.

7.3   Configuration of the inputs

7.3.1   Configuration of the HART inputs

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⊕ *21   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)

ℹ️ HART devices must be configured and given a unique HART address [3] via their own user interface before they are connected to the Tankside Monitor NRF81.

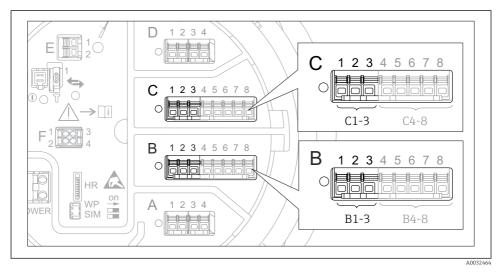| Submenu: Setup → Advanced setup → Input/output → Analog I/O	
Parameter	**Meaning / Action**
Operating mode	Select: • **HART master+4..20mA input** if only one HART device is connected to this loop. In this case the 4-20mA signal can be used in addition to the HART signal. • **HART master** if up to 6 HART devices are connected to this loop.

---

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

Submenu: Setup → Advanced setup → Input/output → HART devices → HART Device(s) [1] [2]	
Parameter	Meaning / Action
Output pressure	• If the device measures a pressure: Select which of the HART variables (PV, SV, TV or QV) contains the pressure. • Otherwise: Keep the factory setting: **No value**
Output density	• If the device measures a density: Select which of the HART variables (PV, SV, TV or QV) contains the density. • Otherwise: Keep the factory setting: **No value**
Output temperature	• If the device measures a temperature: Select which of the HART variables (PV, SV, TV or QV) contains the temperature. • Otherwise: Keep the factory setting: **No value**
Output vapor temperature	• If the device measures the vapor temperature: Select which of the HART variables (PV, SV, TV or QV) contains the vapor temperature. • Otherwise: Keep the factory setting: **No value**
Output level	• If the device measures a level: Select which of the HART variables (PV, SV, TV or QV) contains the level. • Otherwise: Keep the factory setting: **No value**

1)   There is a **HART Device(s)** submenu 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.
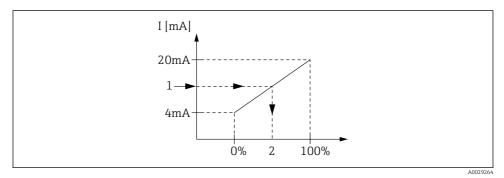
7.3.2   Configuration of the 4-20mA inputs

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⊠ 22   *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.*
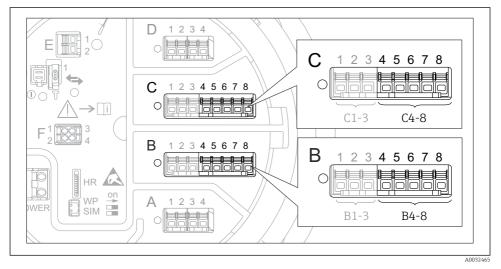
Submenu: Setup → Advanced setup → Input/output → Analog I/O [1]	
Parameter	**Meaning / Action**
Operating mode	Select **4..20mA input** or **HART master+4..20mA input**
Process variable	Select which process variable is transmitted by the connected device.
Analog input 0% value	Define which value of the 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** submenu for each Analog I/O module of the device.

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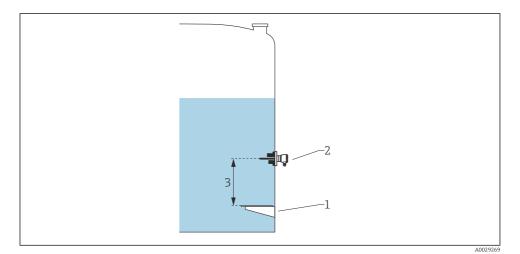⊡ *23*   *Scaling of the 4-20mA input to the process variable*

1   Input value in mA
2   Process value
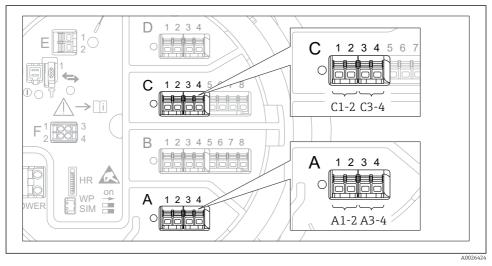
7.3.3   Configuration of a connected RTD

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⊠ 24   *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).

A0029269

1   Datum plate
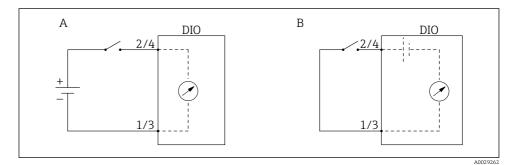*2   RTD*
3   Probe position

7.3.4 Configuration of the digital inputs

A0026424

⊠ 25   *Possible locations of the Digital I/O modules (examples); the order code defines the number and location of digial input modules.*

ℹ️ There is a **Digital Xx-x** submenu for each digital input of the device. "X" designates the slot in the terminal compartment, "x-x" the terminals within this slot.

Submenu: Setup → Advanced setup → Input/output → Digital Xx-x	
Parameter	**Meaning / Action**

Operating mode	Select the operating mode (see diagram below).
	• **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.
	• **Input active**
	  The DIO module provides a voltage and uses it to detect whether the external switch is open or closed.

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.

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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

7.4   Linking measured values to tank variables

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

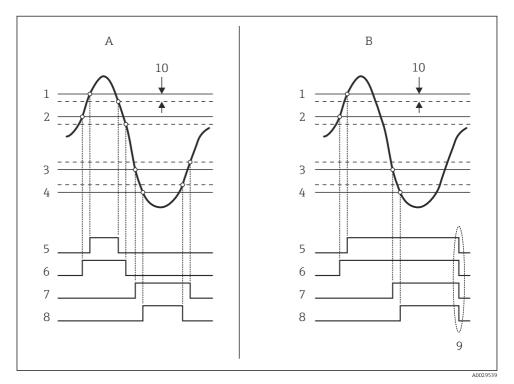ℹ️ Depending on the application not all these parameters will be relevant in a given situation.

Submenu: Setup → Advanced setup → Application → Tank configuration → Level	
Parameter	**Defines the source of the following tank variable**
Level source	Product level
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)
P2 (middle) source	Middle pressure (P2)
P3 (top) source	Top pressure (P3)

7.5   Configuration of the limit evaluation

A limit evaluation can be configured for up to 4 tank variables. The limit evaluation generates 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.

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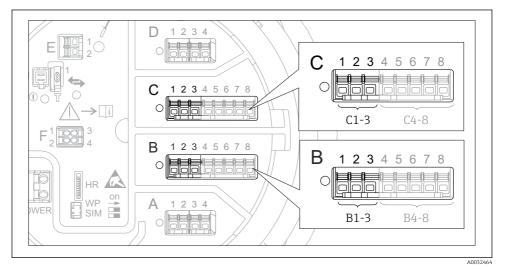
⊠ 26   *Principle of the limit evaluation*

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
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	**Off** No alarms are generated. **On** An alarm disappears if the alarm condition is no longer present (taking into consideration the hysteresis). **Latching** All alarms remain active until the user selects **Clear alarm** = **Yes**.
Alarm value source	Select process variable to be checked for limit violation.
HH alarm value **H alarm value** **L alarm value** **LL alarm value**	Assign appropriate limit values (see diagram above).

7.6   Configuration of the signal output

7.6.1   Analog output (4...20mA)

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🖼 27   *Possible locations of the Analog I/O modules, which can be used as an analog 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...20mA 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 **4..20mA output** or **HART slave +4..20mA output** [1]→ 🖺 48.
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.
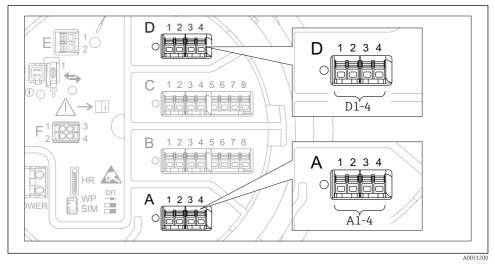
1)   "HART slave +4..20mA output " means that the Analog I/O module serves as a HART slave which cyclically sends up to four HART variables to a HART master. For the configuration of the HART output:

7.6.2   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.
• **Assign SV** • **Assign TV** • **Assign QV**	Select which tank variables are to be transmitted by the HART variables. ℹ️ By default, **PV** transmitts the same variable as the analog output and needs not to be assigned.

7.6.3   Modbus, V1 or WM550 output

⊠ 28   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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