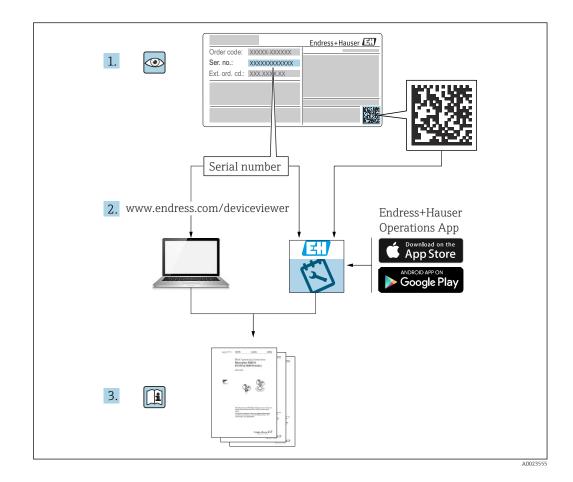
BA01450G/00/EN/07.22-00 71583081 2022-09-15 Valid as of version 01.06.zz (Device firmware)

# Operating Instructions Micropilot NMR81

Tank Gauging







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### 1 About this document

### 1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

### 1.2 Symbols

### 1.2.1 Safety symbols

### **DANGER**

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

### A WARNING

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

### **A**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.

### 1.2.2 Electrical symbols

### $\sim$

Alternating current

### $\sim$

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.

### 1.2.3 Tool symbols

#### ● // Flat blade screwdriver

O ↓ Torx screwdriver

🔾 🕼 Allen key

ダ Open-ended wrench

### **1.2.4** Symbols for certain types of information and graphics

# PermittedProcedures, processes or actions that are permittedPreferred

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

#### $\underline{\mathbf{\Lambda}} \rightarrow \mathbf{\mathbf{I}}$ 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

### 1.3 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

### 1.3.1 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.

### 1.3.2 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.

### 1.3.3 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.

### 1.3.4 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.

### 1.3.5 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.

### 1.3.6 Installation instructions (EA)

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

### 1.4 Registered trademarks

### Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

### 2 Basic safety instructions

### 2.1 Requirements for the personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before 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.

The operating personnel must fulfill the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

### 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.

### Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

▶ If modifications are nevertheless required, consult with the manufacturer.

### Repair

To ensure continued operational safety and reliability:

- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to the repair of an electrical device.
- Use only original spare parts and accessories from the manufacturer.

### 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.

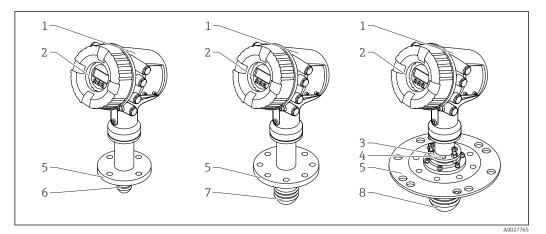
### 2.5.2 EAC conformity

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.

#### **Product description** 3

#### Product design 3.1



- **1** Design of Micropilot NMR81
- 1 Electronics housing
- Display and operating module (can be operated without opening the cover) Alignment device for antenna 100 mm (4 in) 2
- 3
- 4 Level tool (used to check the correct alignment of the antenna)
- 5 Process connection (flange)
- Antenna 50 mm (2 in) Antenna 80 mm (3 in) 6
- 7 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

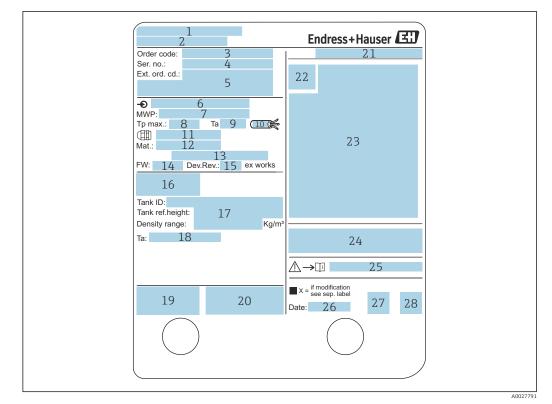
The following options are available for identification of the measuring device:

- 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 Nameplate



#### ☑ 2 Nameplate

- 1 Manufacturer address
- 2 Device name
- 3 Order code
- 4 Serial number
- 5 Extended order code
- 6 Supply voltage
- 7 Maximum process pressure
- 8 Maximum process temperature
- 9 Permitted ambient temperature  $(T_a)$
- 10 Temperature resistance of cable
- 11 Thread for cable entry
- 12 Material in contact with process
- 13 Not used
- 14 Firmware version
- 15 Device revision
- 16 Metrology certification numbers
- 17 Customized parametrization data
- 18 Ambient temperature range
- 19 CE mark / C-tick mark
- 20 Additional information on the device version
- 21 Ingress protection
- 22 Certificate symbol
- 23 Data concerning the Ex approval
- 24 General certificate of approval
- 25 Associated Safety Instructions (XA)
- 26 Manufacturing date
- 27 RoHS mark
- 28 QR code for the Endress+Hauser Operations App

### 4.2.2 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

### **A**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.

### Emitting angle

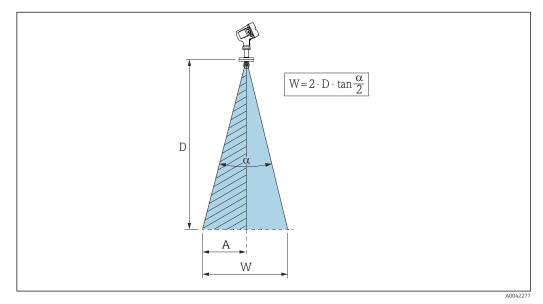


Image: Selationship between beam angle a, distance D and beam diameter W. Distance A is the minimum distance to the tank wall (or other installations). Distance A equals the half of beam diameter W

The beam angle is defined as the angle  $\alpha$  where the energy density of the radar waves reaches half the value of the maximum energy density (3-dB-width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations.

#### Beam diameter **W** as a function of beam angle $\alpha$ and measuring distance **D**:

NMR81								
<b>S</b> <sup>1)</sup>	50 mm (2 in)	80 mm (3 in)	100 mm (4 in)					
α <sup>2)</sup>	7°	4°	3°					
<b>D</b> <sup>3)</sup>		<b>W</b> <sup>4)</sup>						
5 m (16 ft)	0.61 m (2 ft)	0.35 m (1.1 ft)	0.26 m (0.9 ft)					
10 m (33 ft)	1.22 m (4 ft)	0.7 m (2.3 ft)	0.52 m (1.7 ft)					
15 m (49 ft)	1.83 m (6 ft)	1.05 m (3.4 ft)	0.79 m (2.6 ft)					
20 m (66 ft)	2.44 m (8 ft)	1.4 m (4.6 ft)	1.05 m (3.4 ft)					
25 m (82 ft)	3.05 m (10 ft)	1.74 m (5.7 ft)	1.31 m (4.3 ft)					
30 m (98 ft)	3.66 m (12 ft)	2.09 m (6.9 ft)	1.57 m (5.2 ft)					

1) Antenna size

2)

Beam angle Measuring distance 3)

4) Beam diameter

### Minimum distance (A) to tank wall or other installations

	NMR81								
S <sup>1)</sup>	50 mm (2 in)	80 mm (3 in)	100 mm (4 in)						
α <sup>2)</sup>	7°	4°	3°						
<b>D</b> <sup>3)</sup>		<b>A</b> <sup>4)</sup>							
5 m (16 ft)	0.31 m (1 ft)	0.17 m (0.6 ft)	0.13 m (0.4 ft)						
10 m (33 ft)	0.61 m (2 ft)	0.35 m (1.1 ft)	0.26 m (0.9 ft)						
15 m (49 ft)	0.92 m (3 ft)	0.52 m (1.7 ft)	0.39 m (1.3 ft)						
20 m (66 ft)	1.22 m (4 ft)	0.7 m (2.3 ft)	0.52 m (1.7 ft)						
25 m (82 ft)	1.53 m (5 ft)	0.87 m (2.9 ft)	0.65 m (2.1 ft)						
30 m (98 ft) 1.83 m (6 ft)		1.05 m (3.4 ft)	0.79 m (2.6 ft)						

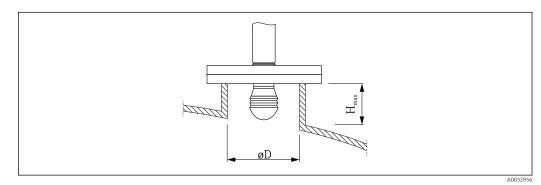
1) Antenna size

2) Beam angle

3) Measuring distance

4) Minimum distance

#### Mounting nozzle 5.1.2



ØD Inner nozzle diameter *H<sub>max</sub> Maximum nozzle length* 

ØD <sup>1)</sup>	M (H <sub>max</sub> ) <sup>2)</sup>				
	50 mm (2 in) <sup>3)</sup>	80 mm (3 in) <sup>4)</sup>	100 mm (4 in) <sup>5)</sup>		
> 45 mm (1.77 in); ≤ 75 mm (2.95 in)	600 mm (24 in)	-	-		
> 75 mm (2.95 in); ≤ 95 mm (3.74 in)	1000 mm (40 in)	1700 mm (68 in)	-		
> 95 mm (3.74 in); ≤ 150 mm (5.91 in)	1250 mm (50 in)	2 150 mm (86 in)	2 850 mm (114 in)		
> 150 mm (5.91 in)	1850 mm (74 in)	3200 mm (128 in)	4300 mm (172 in)		

1) Inner nozzle diameter

Maximum nozzle length ( $H_{max}$ ). In case of longer nozzles, a reduced measuring performance is to be 2) expected.

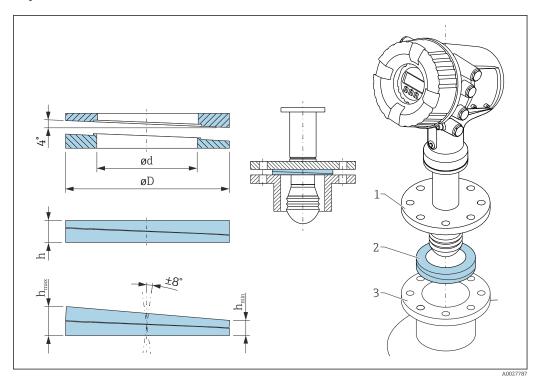
- Feature 100 of the product structure: Antenna AB Feature 100 of the product structure: Antenna AC 3)
- 4)

5) Feature 100 of the product structure: Antenna AD

### 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



 $\blacksquare$  4 Adjustable seal used to align the device by ±8 °

P 1)	620 <sup>2)</sup>						
	PS	PT	PU				
OC 3)	71285499	71285501	71285503				
C <sup>4)</sup>	DN50 PN10-40 ASME 2" 150lbs JIS 50A 10K	DN80 PM10-40	ASME 3" 150lbs JIS 80A 10K				
L <sup>5)</sup>	100 mm (3.9 in)	100 mm (3.9 in)	100 mm (3.9 in)				
S <sup>6)</sup>	M14	M14	M14				
M <sup>7)</sup>	FKM	FKM	FKM				
P <sup>8)</sup>		-0.1 to +0.1 bar (-1.45 to +1.45 psi)					
T <sup>9)</sup>		−40 to +80 °C (−40 to +176 °F)					
ØD	105 mm (4.13 in)	142 mm (5.59 in)	133 mm (5.24 in)				
Ød	60 mm (2.36 in)	89 mm (3.5 in)	89 mm (3.5 in)				
h	16.5 mm (0.65 in)	22 mm (0.87 in)	22 mm (0.87 in)				

P <sup>1)</sup>	620 <sup>2)</sup>							
	PS PT PU							
h <sub>min</sub>	9 mm (0.35 in)	14 mm (0.55 in)	14 mm (0.55 in)					
h <sub>max</sub>	24 mm (0.95 in)	30 mm (1.18 in)	30 mm (1.18 in)					

1) Property

2) Ordering feature 620 "Accessory Enclosed". With this ordering feature the adjustable seal is supplied together with the device.

3) This order code must be used if the adjustable seal is ordered separately.

4) Compatible with

5) Length of screws

6) Size of screws

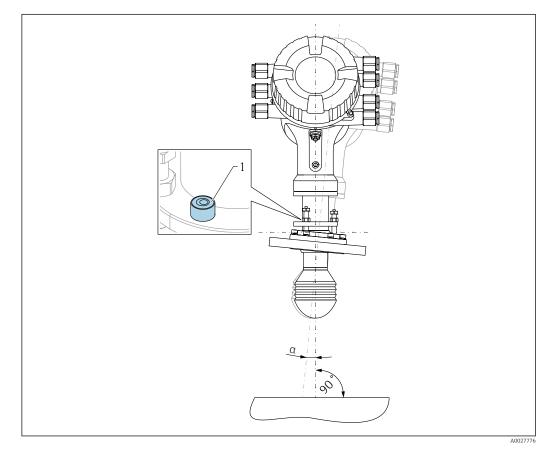
7) Material

8) Process pressure

9) Process temperature

### 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.



■ 5 Alignment unit of the 100mm(4") antenna

1 Level tool indicating the correct alignment

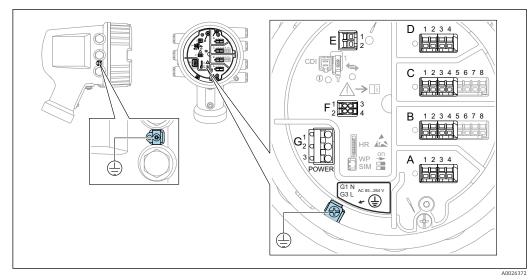
a Alignment angle;  $a_{max} = 25^{\circ}$ 

### 5.2 Post-installation check

0	Is the device undamaged (visual inspection)?
o	<ul> <li>Does the device conform to the measuring point specifications?</li> <li>For example: <ul> <li>Process temperature</li> <li>Process pressure (refer to the chapter on "Material load curves" of the "Technical Information" document)</li> <li>Ambient temperature range</li> <li>Measuring range</li> </ul> </li> </ul>
0	Are the measuring point identification and labeling correct (visual inspection)?
0	Is the device adequately protected from precipitation and direct sunlight?

### 6 Electrical connection

### 6.1 Terminal assignment



*■ 6 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  $\rightarrow \cong 22$ .

#### Terminal area E

Module: HART Ex i/IS interface

- E1: H+
- E2:H-

#### Terminal area F

Remote display

- F1: V<sub>CC</sub> (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+

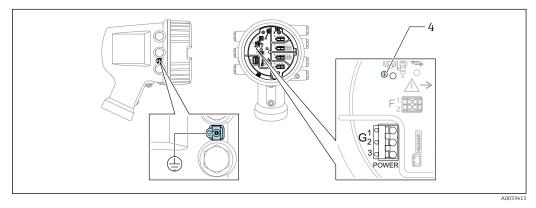
#### Terminal area: Protective ground

Module: Protective ground connection (M4 screw)



#### 🖻 7 Terminal area: Protective ground

### 6.1.1 Power supply



#### 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<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>

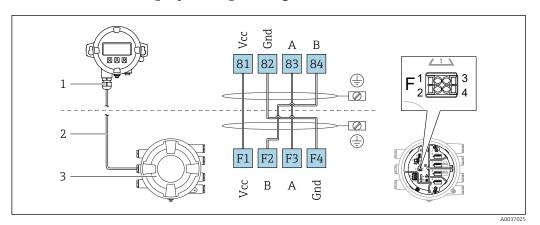
#### Power consumption

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

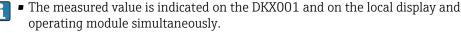
Low voltage DC power supply:  $13.4\ \mathrm{W}$ 



### 6.1.2 Remote display and operating module DKX001

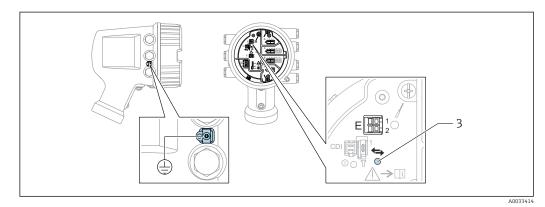
- 8 Connection of the remote display and operating module DKX001 to the Tank Gauging device (NMR8x, NMS8x or NRF8x)
- 1 Remote display and operating module
- 2 Connecting cable
- 3 Tank Gauging device (NMR8x, NMS8x or NRF8x)

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



• The 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



E1 H+

E2 H-

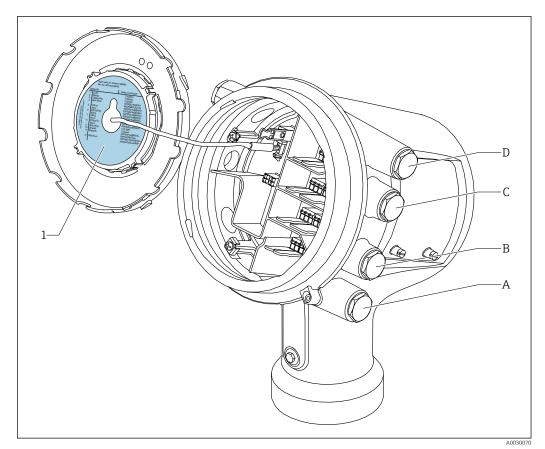
3 Orange LED: indicates data communication

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  $\rightarrow \square 36 \rightarrow \square 38$ .

### 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 table below shows which module is located in which slot for a specific device version.

The slot assignment for the device is also indicated on a label attached to the back cover of the display module.



- 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

#### List of abbreviations used in table "Primary Output" (040) = "Modbus" (A1)

- O Ordering feature
- T Terminal area
- 040 Primary Output
- 050 Secondary IO Analog
- 060 Secondary IO Digital Ex d/XP
- M Modbus
- D Digital
- A/XP Analog Ex d/XP
- A/IS Analog Ex i/IS

"Primary Output" (040) = "Modbus" (A1)

	$\begin{array}{c c} \hline & & \\ \hline \\ \hline$						
	0 <sup>1)</sup>			Т	2)		
NMx8x -	- xxxx XX XX 040 05	<u>X</u> XX 0 060					
040 <sup>3)</sup>	050 <sup>4)</sup>	060 <sup>5)</sup>	A 1234	<b>B</b> 1 2 3 4 5 6 7 8	C 1 2 3 4 5 6 7 8	0 1 2 3 4 A0023888	
A1	XO	XO	М	-	-	-	
A1	XO	A1	М	-	-	D	
A1	XO	A2	М	-	D	D	
A1	XO	A3	М	D	D	D	
A1	XO	B1	М	М	-	-	
A1	XO	B2	М	М	-	D	
A1	XO	B3	М	М	D	D	
A1	X0	C1	М	V1	-	-	
A1	XO	C2	М	V1	-	D	
A1	X0	C3	М	V1	D	D	
A1	XO	E1	М	W	-	-	
A1	X0	E2	М	W	-	D	
A1	X0	E3	М	W	D	D	
A1	A1	XO	М	A/XP	-	-	
A1	A1	A1	М	A/XP	-	D	
A1	A1	A2	М	A/XP	D	D	
A1	A1	B1	М	М	A/XP	-	
A1	A1	B2	М	М	A/XP	D	
A1	A1	C1	М	V1	A/XP	-	
A1	A1	C2	М	V1	A/XP	D	
A1	A1	E1	М	W	A/XP	-	
A1	A1	E2	М	W	A/XP	D	
A1	A2	XO	М	A/XP	A/XP	-	
A1	A2	A1	М	A/XP	A/XP	D	
A1	A2	B1	М	A/XP	A/XP	М	
A1	A2	C1	М	A/XP	A/XP	V1	
A1	A2	E1	М	A/XP	A/XP	W	
A1	B1	XO	М	A/IS	-	-	
A1	B1	A1	М	A/IS	-	D	
A1	B1	A2	М	A/IS	D	D	

	0 1)			Т	2)			
NMx8x	- xxxx XX X 040 05	X XX 0 060						
040 <sup>3)</sup>	050 <sup>4)</sup>	060 5)	A 1 2 3 4	<b>B</b> 1 2 3 4 5 6 7 8	C 1 2 3 4 5 6 7 8			
A1	B1	B1	М	М	A/IS	-		
A1	B1	B2	М	М	A/IS	D		
A1	B1	C1	М	V1	A/IS	-		
A1	B1	C2	М	V1	A/IS	D		
A1	B1	E1	М	W	A/IS	-		
A1	B1	E2	М	W	A/IS	D		
A1	B2	XO	М	A/IS	A/IS	-		
A1	B2	A1	М	A/IS	A/IS	D		
A1	B2	B1	М	A/IS	A/IS	М		
A1	B2	C1	М	A/IS	A/IS	V1		
A1	B2	E1	М	A/IS	A/IS	W		
A1	C2	XO	М	A/IS	A/XP	-		
A1	C2	A1	М	A/IS	A/XP	D		
A1	C2	B1	М	A/IS	A/XP	М		
A1	C2	C1	М	A/IS	A/XP	V1		
A1	C2	E1	М	A/IS	A/XP	W		

- 1) Ordering feature
- 2) Terminal area
- 3) Primary Output
- 4) Secondary IO Analog
- 5) Secondary IO Digital Ex d/XP

### List of abbreviations used in table "Primary Output" (040) = "V1" (B1)

- O Ordering feature
- T Terminal area
- 040 Primary Output
- 050 Secondary IO Analog
- 060 Secondary IO Digital Ex d/XP
- V1 Sakura V1
- M Modbus
- W Whessoe WM550
- D Digital
- A/XP Analog Ex d/XP
- A/IS Analog Ex i/IS

"Primary Output" (040) = "V1" (B1)

-	0 <sup>1)</sup>	) = "VI" (BI	T <sup>2)</sup>				
NMx8x	- xxxx XX XX	X XX					
TWINON	040 05	0 060					
040 3)	050 <sup>4)</sup>	060 <sup>5)</sup>	A 1234	<b>B</b> 1 2 3 4 5 6 7 8	C 1 2 3 4 5 6 7 8	D 1 2 3 4 A0023888	
B1	XO	XO	V1	-	-	-	
B1	X0	A1	V1	-	-	D	
B1	XO	A2	V1	-	D	D	
B1	X0	A3	V1	D	D	D	
B1	X0	B1	V1	М	-	-	
B1	XO	B2	V1	М	-	D	
B1	XO	B3	V1	М	D	D	
B1	XO	C1	V1	V1	-	-	
B1	XO	C2	V1	V1	-	D	
B1	XO	С3	V1	V1	D	D	
B1	XO	E1	V1	W	-	-	
B1	XO	E2	V1	W	-	D	
B1	X0	E3	V1	W	D	D	
B1	A1	XO	V1	A/XP	-	-	
B1	A1	A1	V1	A/XP	-	D	
B1	A1	A2	V1	A/XP	D	D	
B1	A1	B1	V1	М	A/XP	-	
B1	A1	B2	V1	М	A/XP	D	
B1	A1	C1	V1	V1	A/XP	-	
B1	A1	C2	V1	V1	A/XP	D	
B1	A1	E1	V1	W	A/XP	-	
B1	A1	E2	V1	W	A/XP	D	
B1	A2	XO	V1	A/XP	A/XP	-	
B1	A2	A1	V1	A/XP	A/XP	D	
B1	A2	B1	V1	A/XP	A/XP	М	
B1	A2	C1	V1	A/XP	A/XP	V1	
B1	A2	E1	V1	A/XP	A/XP	W	
B1	B1	XO	V1	A/IS	-	-	
B1	B1	A1	V1	A/IS	-	D	
B1	B1	A2	V1	A/IS	D	D	

	0 1)			1	2)			
NMx8x	- xxxx XX XX 040 05	X XX 0 060						
040 <sup>3)</sup>	050 <sup>4)</sup>	060 5)	A 1234	B 1 2 3 4 5 6 7 8	C 1 2 3 4 5 6 7 8			
B1	B1	B1	V1	М	A/IS	-		
B1	B1	B2	V1	М	A/IS	D		
B1	B1	C1	V1	V1	A/IS	-		
B1	B1	C2	V1	V1	A/IS	D		
B1	B1	E1	V1	W	A/IS	-		
B1	B1	E2	V1	W	A/IS	D		
B1	B2	XO	V1	A/IS	A/IS	-		
B1	B2	A1	V1	A/IS	A/IS	D		
B1	B2	B1	V1	A/IS	A/IS	М		
B1	B2	C1	V1	A/IS	A/IS	V1		
B1	B2	E1	V1	A/IS	A/IS	W		
B1	C2	X0	V1	A/IS	A/XP	-		
B1	C2	A1	V1	A/IS	A/XP	D		
B1	C2	B1	V1	A/IS	A/XP	М		
B1	C2	C1	V1	A/IS	A/XP	V1		
B1	C2	E1	V1	A/IS	A/XP	W		

- 1) Ordering feature
- 2) Terminal area
- 3) Primary Output
- 4) Secondary IO Analog
- 5) Secondary IO Digital Ex d/XP

### List of abbreviations used in table "Primary Output" (040) = "V1" (B1)

- O Ordering feature
- T Terminal area
- 040 Primary Output
- 050 Secondary IO Analog
- 060 Secondary IO Digital Ex d/XP
- V1 Sakura V1
- M Modbus
- W Whessoe WM550
- D Digital
- A/XP Analog Ex d/XP
- A/IS Analog Ex i/IS

"Primary Output" (040) = "WM550" (C1)

0 <sup>1)</sup>			T <sup>2)</sup>				
NMy8y - yyyy VV VV VV							
NMx8x - xxxx XX XX XX 040 050 060							
040 3)	050 <sup>4)</sup>	060 5)	A 1 2 3 4	B 1 2 3 4 5 6 7 8	C 1 2 3 4 5 6 7 8		
61		NO.	TAT			A0023888	
C1	XO	XO	W	-	-	-	
C1	XO	A1	W	-	-	D	
C1	XO	A2	W	-	D	D	
C1	X0	A3	W	D	D	D	
C1	X0	B1	W	М	-	-	
C1	X0	B2	W	М	-	D	
C1	X0	B3	W	М	D	D	
C1	X0	C1	W	V1	-	-	
C1	X0	C2	W	V1	-	D	
C1	X0	C3	W	V1	D	D	
C1	X0	E1	W	W	-	-	
C1	XO	E2	W	W	-	D	
C1	XO	E3	W	W	D	D	
C1	A1	XO	W	A/XP	-	-	
C1	A1	A1	W	A/XP	-	D	
C1	A1	A2	W	A/XP	D	D	
C1	A1	B1	W	М	A/XP	-	
C1	A1	B2	W	М	A/XP	D	
C1	A1	C1	W	V1	A/XP	-	
C1	A1	C2	W	V1	A/XP	D	
C1	A1	E1	W	W	A/XP	-	
C1	A1	E2	W	W	A/XP	D	
C1	A2	XO	W	A/XP	A/XP	-	
C1	A2	A1	W	A/XP	A/XP	D	
C1	A2	B1	W	A/XP	A/XP	М	
C1	A2	C1	W	A/XP	A/XP	V1	
C1	A2	E1	W	A/XP	A/XP	W	
C1	B1	XO	W	A/IS	-	-	
C1	B1	A1	W	A/IS	-	D	
C1	B1	A2	W	A/IS	D	D	

0 <sup>1)</sup>			T <sup>2)</sup>				
NMx8x - xxxx XX XX XX 040 050 060							
040 3)	050 <sup>4)</sup>	060 <sup>5)</sup>	A 1 2 3 4	<b>B</b> 1 2 3 4 5 6 7 8	C 1 2 3 4 5 6 7 8		
C1	B1	B1	W	М	A/IS	-	
C1	B1	B2	W	М	A/IS	D	
C1	B1	C1	W	V1	A/IS	-	
C1	B1	C2	W	V1	A/IS	D	
C1	B1	E1	W	W	A/IS	-	
C1	B1	E2	W	W	A/IS	D	
C1	B2	XO	W	A/IS	A/IS	-	
C1	B2	A1	W	A/IS	A/IS	D	
C1	B2	B1	W	A/IS	A/IS	М	
C1	B2	C1	W	A/IS	A/IS	V1	
C1	B2	E1	W	A/IS	A/IS	W	
C1	C2	XO	W	A/IS	A/XP	-	
C1	C2	A1	W	A/IS	A/XP	D	
C1	C2	B1	W	A/IS	A/XP	М	
C1	C2	C1	W	A/IS	A/XP	V1	
C1	C2	E1	W	A/IS	A/XP	W	

- 1) Ordering feature
- 2) Terminal area
- 3) Primary Output
- 4) Secondary IO Analog
- 5) Secondary IO Digital Ex d/XP

### List of abbreviations used in table "Primary Output" (040) = "V1" (B1)

- O Ordering feature
- T Terminal area
- 040 Primary Output
- 050 Secondary IO Analog
- 060 Secondary IO Digital Ex d/XP
- V1 Sakura V1
- M Modbus
- W Whessoe WM550
- D Digital
- A/XP Analog Ex d/XP
- A/IS Analog Ex i/IS

"Primary Output" (040) = "4-20mA HART Ex d" (E1)

$\mathbf{O}^{(1)}$			T <sup>2)</sup>				
NMx8x - xxxx XX XX XX 040 050 060							
040 <sup>3)</sup>	050 4)	060 5)	A 1234	B 12345678	C 1 2 3 4 5 6 7 8		
E1	XO	XO	-	A/XP	-	-	
E1	XO	A1	-	A/XP	-	D	
E1	XO	A2	-	A/XP	D	D	
E1	XO	A3	D	A/XP	D	D	
E1	XO	B1	М	A/XP	-	-	
E1	XO	B2	М	A/XP	-	D	
E1	XO	B3	М	A/XP	D	D	
E1	XO	C1	V1	A/XP	-	-	
E1	XO	C2	V1	A/XP	-	D	
E1	XO	C3	V1	A/XP	D	D	
E1	A1	XO	-	A/XP	A/XP	-	
E1	A1	A1	-	A/XP	A/XP	D	
E1	A1	A2	D	A/XP	A/XP	D	
E1	A1	B1	М	A/XP	A/XP	-	
E1	A1	B2	М	A/XP	A/XP	D	
E1	A1	C1	V1	A/XP	A/XP	-	
E1	A1	C2	V1	A/XP	A/XP	D	
E1	B1	XO	-	A/XP	A/IS	-	
E1	B1	A1	-	A/XP	A/IS	D	
E1	B1	A2	D	A/XP	A/IS	D	
E1	B1	B1	М	A/XP	A/IS	-	
E1	B1	B2	М	A/XP	A/IS	D	
E1	B1	C1	V1	A/XP	A/IS	-	
E1	B1	C2	V1	A/XP	A/IS	D	

Ordering feature Terminal area

1) 2) 3) 4) 5)

Primary Output Secondary IO Analog Secondary IO Digital Ex d/XP

#### List of abbreviations used in table "Primary Output" (040) = "V1" (B1)

- O Ordering feature
- T Terminal area
- 040 Primary Output
- 050 Secondary IO Analog
- 060 Secondary IO Digital Ex d/XP
- V1 Sakura V1
- M Modbus
- W Whessoe WM550
- D Digital
- A/XP Analog Ex d/XP
- A/IS Analog Ex i/IS

"Primary Output" (040) = "4-20mA HART Ex i" (H1)

0 1)			$T^{2}$				
NMx8x - xxxx XX XX XX 040 050 060							
040 <sup>3)</sup>	050 <sup>4)</sup>	060 5)	A 1234	B 1 2 3 4 5 6 7 8	C 1 2 3 4 5 6 7 8		
H1	XO	XO	-	A/IS	-	-	
H1	XO	A1	-	A/IS	-	D	
H1	XO	A2	-	A/IS	D	D	
H1	XO	A3	D	A/IS	D	D	
H1	XO	B1	М	A/IS	-	-	
H1	XO	B2	М	A/IS	-	D	
H1	XO	B3	М	A/IS	D	D	
H1	XO	C1	V1	A/IS	-	-	
H1	XO	C2	V1	A/IS	-	D	
H1	XO	С3	V1	A/IS	D	D	
H1	A1	XO	-	A/IS	A/XP	-	
H1	A1	A1	-	A/IS	A/XP	D	
H1	A1	A2	D	A/IS	A/XP	D	
H1	A1	B1	М	A/IS	A/XP	-	
H1	A1	B2	М	A/IS	A/XP	D	
H1	A1	C1	V1	A/IS	A/XP	-	
H1	A1	C2	V1	A/IS	A/XP	D	
H1	B1	XO	-	A/IS	A/IS	-	
H1	B1	A1	-	A/IS	A/IS	D	
H1	B1	A2	D	A/IS	A/IS	D	
H1	B1	B1	М	A/IS	A/IS	-	
H1	B1	B2	М	A/IS	A/IS	D	
H1	B1	C1	V1	A/IS	A/IS	-	
H1	B1	C2	V1	A/IS	A/IS	D	

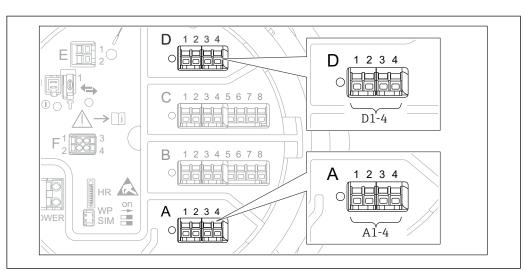
Ordering feature Terminal area

1) 2) 3) 4) 5)

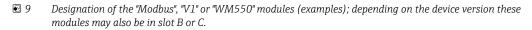
Primary Output Secondary IO Analog Secondary IO Digital Ex d/XP

### List of abbreviations used in table "Primary Output" (040) = "V1" (B1)

- O Ordering feature
- T Terminal area
- 040 Primary Output
- 050 Secondary IO Analog
- 060 Secondary IO Digital Ex d/XP
- V1 Sakura V1
- M Modbus
- W Whessoe WM550
- D Digital
- A/XP Analog Ex d/XP
- A/IS Analog Ex i/IS



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



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)

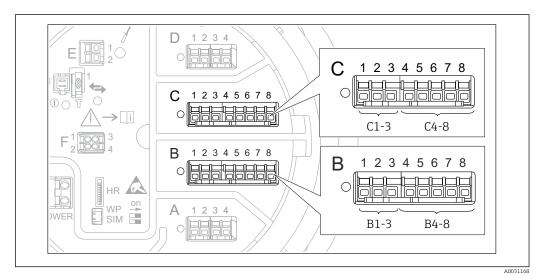
- X1<sup>1)</sup>
  - Terminal name: S
  - Description: Cable shielding connected via a capacitor to EARTH
- X2 <sup>1)</sup>
  - Terminal name: 0V
  - Description: Common reference
- X3 <sup>1)</sup>
  - Terminal name: B-
  - Description: Non-inverting signal line
- X4 <sup>1)</sup>
  - Terminal name: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

<sup>1)</sup> 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 +



### 6.1.6 Terminals of the "Analog I/O" module (Ex d /XP or Ex i/IS)

### Terminal: B1-3

Function: Analog input or output (configurable)

- Passive usage:  $\rightarrow$  🗎 36
- Active usage:  $\rightarrow \implies 38$
- Designation in the operating menu: Analog I/O B1-3 ( $\rightarrow \square$  145)

### Terminal: C1-3

Function: Analog input or output (configurable)

- Passive usage: → 🗎 36
- Active usage: → 🗎 38

#### Terminal: B4-8

Function: Analog input

- RTD: → 🗎 39
- Designation in the operating menu: Analog IP B4-8 ( $\rightarrow \triangleq 139$ )

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

#### Terminal: C4-8

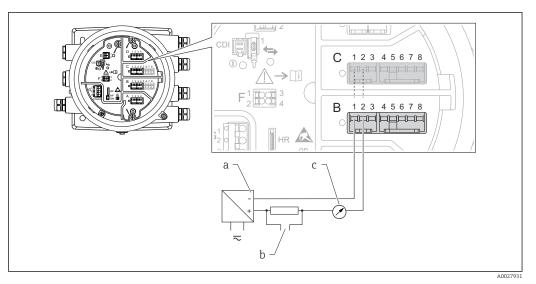
Function: Analog input

- RTD: → 🖺 39
- Designation in the operating menu: Analog IP C4-8 ( $\rightarrow \cong$  139)

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

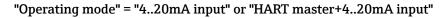
- In the passive usage the supply voltage for the communication line must be supplied by an external source.
  - The wiring must be in accordance with the intended operating mode of the Analog I/O module; see the drawings below.
  - Screened cable must be used for the 4...20mA signal line.

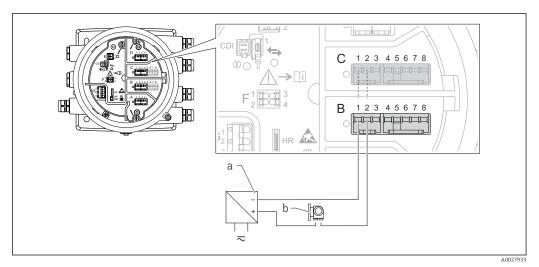
#### "Operating mode" = "4..20mA output" or "HART slave +4..20mA output"



■ 10 Passive usage of the Analog I/O module in the output mode

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

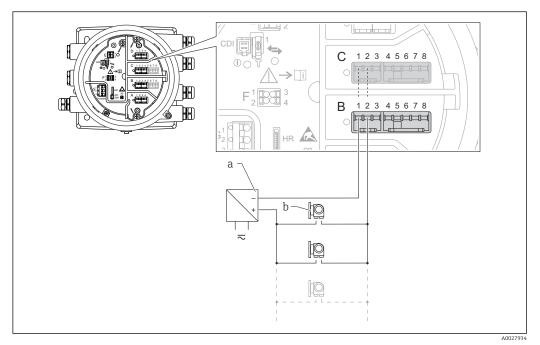




■ 11 Passive usage of the Analog I/O module in the input mode

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

#### "Operating mode" = "HART master"



 $\blacksquare 12 \qquad \textit{Passive usage of the Analog I/O module in the HART master mode}$ 

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

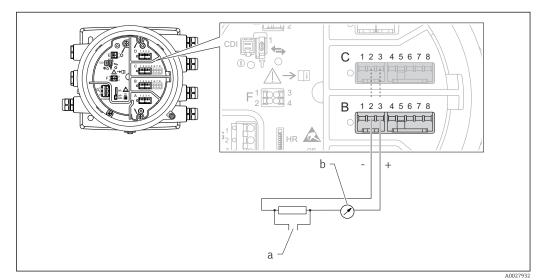
#### 6.1.8 Connection of the "Analog I/O" module for active usage

- 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).

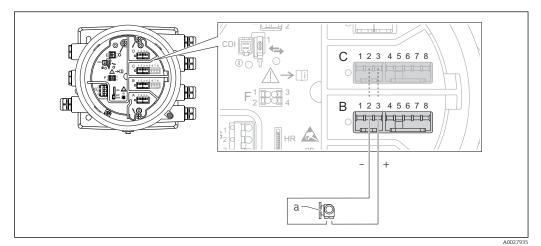
- Output voltage of the Ex-d module: 17.0 V@4 mA to 10.5 V@22 mA
- Output voltage of the Ex-ia module: 18.5 V@4 mA to 12.5 V@22 mA

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



- 13 Active usage of the Analog I/O module in the output mode
- a HART signal output
- b Analog signal evaluation

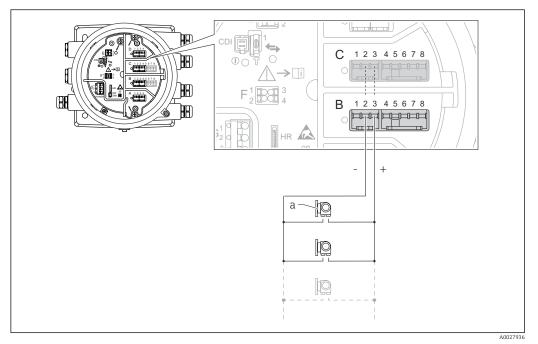
#### "Operating mode" = "4..20mA input" or "HART master+4..20mA input"



I4 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"

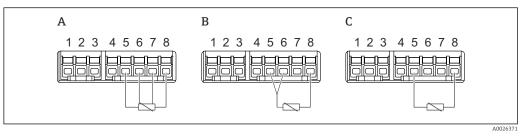


I5 Active usage of the Analog I/O module in the HART master mode

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).

#### 6.1.9 Connection of a RTD



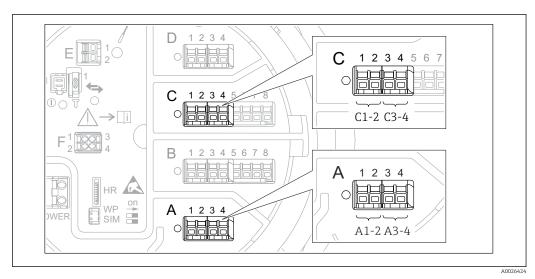
A 4-wire RTD connection

B 3-wire RTD connection

C 2-wire RTD connection

F

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



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

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 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:  $\leq 0.3 \ \mu F$

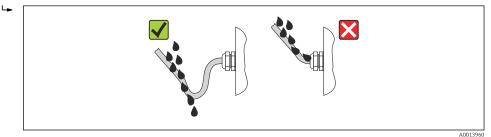
#### WM550 communication line

- 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").



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

## 6.4 Post-connection check

О	Are cables or the device undamaged (visual inspection)?				
0	Do the cables comply with the requirements?				
0	Do the cables have adequate strain relief?				
0	Are all cable glands installed, firmly tightened and correctly sealed?				
0	Does the supply voltage match the specifications on the transmitter nameplate?				
О	Is the terminal assignment correct $\rightarrow \cong 19$ ?				
0	If required: Is the protective earth connected correctly ?				
о	If supply voltage is present: Is the device ready for operation and do values appear on the display module?				
0	Are all housing covers installed and firmly tightened?				
О	Is the securing clamp tightened correctly?				

## 7 Operability

## 7.1 Overview of the operation options

The device is operated via an operating menu  $\rightarrow \cong$  44. This menu can be accessed by the following interfaces:

- FieldCare connected through Tankvision Tank Scanner NXA820 (remote operation;  $\rightarrow \cong 56$ ).
- FieldCare connected through Commubox FXA195 ( $\rightarrow \cong$  105) to a HART interface of the device.

## 7.2 Structure and function of the operating menu

Menu	Submenu / parameter	Meaning
Operation	Level	Shows the measured and calculated level values.
	Temperature	Shows the measured and calculated temperature values.
	Density	Shows the measured and calculated density values.
	Pressure	Shows the measured and calculated pressure values.
	GP values	Shows the general purpose values.
Setup	Parameters 1 to N	Standard commissioning parameters
	Advanced setup	<ul> <li>Contains further parameters and submenus:</li> <li>to adapt the device to special measuring conditions.</li> <li>to process the measured value.</li> <li>to configure the signal output.</li> </ul>
Diagnostics	Diagnostic parameters	<ul> <li>Indicates:</li> <li>The latest diagnostic messages and their timestamps.</li> <li>The operating time (overall time and time since last restart).</li> <li>The time according to the real-time clock.</li> </ul>
	Diagnostic list	Contains up to 5 currently active error messages.
	Device information	Contains information needed to identify the device.
	Simulation	Used to simulate measured values or output values.
	Device check	Contains all parameters needed to check the measurement capability of the device.
<b>Expert</b> <sup>1)</sup> Contains all parameters of the device (including those which are already contained in one of the	System	Contains all general device parameters which do not affect the measurement or the communication interface.
other menus). This menu is organized according to the function blocks of the device.	Sensor	Contains all parameters needed to configure the measurement.
The parameter of the <b>Expert</b> menu are described in: GP01068G (NMR81)	Input/output	Contains submenus to configure the analog and discrete I/O modules and connected HART devices.
	Communication	Contains all parameters needed to configure the digital communication interface.
	Application	Contains submenus to configure <ul> <li>the tank gauging application</li> <li>the tank calculations</li> <li>the alarms.</li> </ul>
	Tank values	Shows measured and calculated tank values
	Diagnostics	Contains all parameters needed to detect and analyze operational errors.

1) On entering the "Expert" menu, an access code is always requested. If a customer specific access code has not been defined, "0000" has to be entered.

# 7.3 Access to the operating menu via the local or remote display and operating module

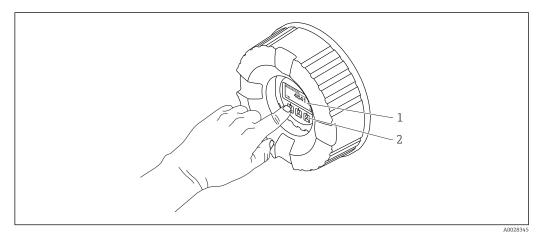
Operating via the remote display and operating module DKX001 (→ 
 <sup>(→)</sup> 21) or the local display and operating module at the device are equivalent.

- 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).

#### 7.3.1 Display and operating elements

The device has an illuminated **liquid crystal display (LCD)** that shows measured and calculated values as well as the device status in the standard view. Other views are used to navigate through the operating menu and to set parameter values.

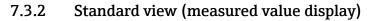
The device is operated by **three optical keys**, namely "-", "+" and "E". They are actuated when the appropriate field on the protective glass of the front is **lightly** touched with the finger ("touch control").

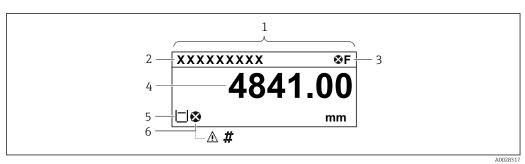


■ 17 Display and operating elements

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.







- 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

#### Status symbols

Symbol	Meaning				
A0013956	<b>"Failure"</b> A device error is present. The measured value is no longer valid.				
C "Function check" The device is in service mode (e.g. during a simulation).					
<b>S</b> A0013958	<ul> <li>"Out of specification"</li> <li>The device is operated:</li> <li>Outside of its technical specifications (e.g. during startup or a cleaning)</li> <li>Outside of the configuration carried out by the user (e.g. level outside configured span)</li> </ul>				
A0013957	"Maintenance required" Maintenance is required. The measured value is still valid.				

#### Measured value symbols

Symbol 1	Symbol 2	Measured value
A0028148		<ul><li>Tank level</li><li>Measured level</li><li>Tank level %</li></ul>
A0028149		Water level
<b>T</b>		Liquid temperature
Т	V	Vapor temperature
A0028528	A0027990	Air temperature
A0028528	A0027991	
LE A0027993		<ul><li>Tank ullage</li><li>Tank ullage %</li></ul>
ρ		Observed density value
A0028150		

Symbol 1	Symbol 2	Measured value
p	(1)	P1 (bottom)
A0028151	A0028141	
p	(2)	P2 (middle)
A0028151	A0028142	
p	(3)	P3 (top)
A0028151	A0028146	
G	(1)	GP 1 value
A0027992	A0028141	This is used for an external device.
G	(2)	GP 2 value
A0027992	A0028142	This is used for an external device.
G	(3)	GP 3 value
A0027992	A0028146	This is used for an external device.
G	<b>(4</b> )	GP 4 value
A0027992	A0028147	This is used for an external device.

Measured value status symbols

Symbol	Meaning				
A0012102	Status "Alarm" The measurement is interrupted. The output assumes the defined alarm value. A diagnostic message is generated.				
A0012103	Status "Warning" The device continues measuring. A diagnostic message is generated.				
<i>.</i>	Calibration to regulatory standards disturbed				
A0031169	<ul> <li>Is displayed in the following situations:</li> <li>The write protection switch is OFF. →  54</li> <li>The write protection switch is ON but the level value can currently not be guaranteed.</li> </ul>				

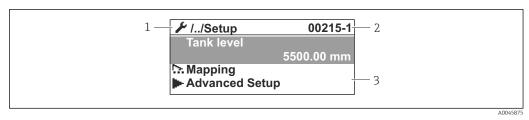
#### Locking state symbols

:	Symbol	Meaning			
	A0011978	<b>Display parameter</b> Marks display-only parameters which cannot be edited.			
Device locked		Device locked			
	A0011979	<ul><li>In front of a parameter name: The device is locked via software and/or hardware.</li><li>In the header of the measured value screen: The device is locked via hardware.</li></ul>			

#### Meaning of the keys in the standard view

Кеу	Meaning
	<ul> <li>Enter key</li> <li>Pressing the key briefly opens the operating menu.</li> <li>Pressing the key for 2 s opens the context menu: <ul> <li>Level (visible if the keylock is inactive):</li> <li>Shows the measured levels.</li> <li>Keylock on (visible if the keylock is inactive):</li> <li>Activates the keylock.</li> <li>Keylock off (visible if the keylock is active):</li> <li>Deactivates the keylock.</li> </ul> </li> </ul>

#### 7.3.3 Navigation view



#### I9 Navigation view

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

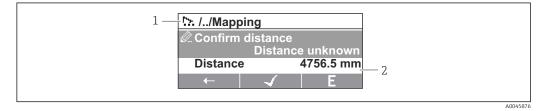
#### Navigation symbols

Symbol	Meaning				
A0011975	<ul> <li>Operation</li> <li>Is displayed:</li> <li>in the main menu next to the selection Operation</li> <li>in the header, if you are in the Operation menu.</li> </ul>				
A0011974	<ul> <li>Setup</li> <li>Is displayed:</li> <li>in the main menu next to the selection Setup</li> <li>in the header, if you are in the Setup menu</li> </ul>				
A0011976	<ul> <li>Expert</li> <li>Is displayed:</li> <li>in the main menu next to the selection Expert</li> <li>in the header, if you are in the Expert menu</li> </ul>				
V.	<ul> <li>Diagnostics</li> <li>Is displayed:</li> <li>in the main menu next to the selection Diagnostics</li> <li>in the header, if you are in the Diagnostics menu</li> </ul>				
A0013967	Submenu				
A0013968	Wizard				
A0013963	<b>Parameter locked</b> When displayed in front of a parameter name, indicates that the parameter is locked.				

#### Meaning of the keys in the navigation view

	Key		Meaning
<b>—</b>		A0028324	<b>Minus key</b> Moves the selection bar upwards in a picklist.
6-		A0028325	<b>Plus key</b> Moves the selection bar downwards in a picklist.
<u>_</u>		A0028326	<ul> <li>Enter key</li> <li>Pressing the key briefly opens the selected menu, submenu or parameter.</li> <li>For parameters: Pressing the key for 2 s opens the help text for the function of the parameter (if present).</li> </ul>
( <del>0</del> -			<ul> <li>Escape key combination (press keys simultaneously)</li> <li>Pressing the keys briefly <ul> <li>Exits the current menu level and takes you to the next higher level.</li> <li>If help text is open, closes the help text of the parameter.</li> </ul> </li> <li>Pressing the keys for 2 s returns you to the measured value display ("standard view").</li> </ul>

#### 7.3.4 Wizard view



₽ 20 Wizard view on the display module

Current wizard 1

2 Display area for navigation

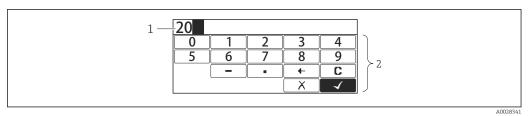
#### Wizard navigation symbols

Symbol	Meaning				
Parameters within a wizard					
A0013978	Switches to the previous parameter.				
A0013976	Confirms the parameter value and switches to the next parameter.				
E A0013977	Opens the editing view of the parameter.				



In the wizard view the meaning of the keys is indicated by the navigation symbol directly above the respective key (softkey functionality).

#### 7.3.5 Numeric editor



🖻 21 Numeric editor on the display module

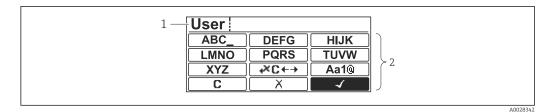
- 1 Display area of the entered value
- 2 Input mask

Symbol	Meaning
	Selection of numbers from 0 to 9.
9 A0013998	
	Inserts decimal separator at the input position.
A0016619	
<b>—</b>	Inserts minus sign at the input position.
A0016620	
	Confirms selection.
A0013985	
← )	Moves the input position one position to the left.
A0016621	
	Exits the input without applying the changes.
A0013986	
C	Clears all entered characters.
A0014040	

Meaning of the keys in the numeric editor

Key		Meaning
	A0028324	<b>Minus key</b> In the input mask, moves the selection bar to the left (backwards).
	A0028325	<b>Plus key</b> In the input mask, moves the selection bar to the right (forwards).
	A0028326	<ul> <li>Enter key</li> <li>Pressing the key briefly adds the selected number to the current decimal place or carries out the selected action.</li> <li>Pressing the key for 2 s confirms the edited parameter value.</li> </ul>
	A0028327	Escape key combination (press keys simultaneously) Closes the text or numeric editor without applying changes.

#### 7.3.6 Text editor



#### 🖻 22 Text editor on the display module

- 1 Display area of the entered text
- 2 Input mask

#### Text editor symbols

Symbol	Meaning
(ABC_)	Selection of letters from A to Z
<b>XYZ</b>	
Aa1@	Toggle • Between upper-case and lower-case letters • For entering numbers • For entering special characters
A0013985	Confirms selection.
	Switches to the selection of the correction tools.
A0013986	Exits the input without applying the changes.
A0014040	Clears all entered characters.

#### Correction symbols under $\textcircled{\texttt{CC+}}$

<b>C</b>	Clears all entered characters.
A0013991	Moves the input position one position to the right.
A0013990	Moves the input position one position to the left.
A0013988	Deletes one character immediately to the left of the input position.

Meaning of the keys in the text editor

Кеу	Meaning
▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲	<b>Minus key</b> In the input mask, moves the selection bar to the left (backwards).
	<b>Plus key</b> In the input mask, moves the selection bar to the right (forwards).
A0028326	<ul> <li>Enter key</li> <li>Pressing the key briefly</li> <li>Opens the selected group.</li> <li>Carries out the selected action.</li> <li>Pressing the key for 2 s confirms the edited parameter value.</li> </ul>
▲ ▲ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	<b>Escape key combination (press keys simultaneously)</b> Closes the text or numeric editor without applying changes.

### 7.3.7 Keypad lock

#### Automatic keypad lock

Operation via the local display is automatically locked:

- after a start-up or restart of the device.
- if the device has not been operated via the display for > 1 minute.

When attempting to access the operating menu while the keylock is enabled, the **Keylock on** message appears.

#### Disabling the keypad lock

1. The keylock is enabled.

Press E for at least 2 seconds.

└ A context menu appears.

2. Select **Keylock off** from the context menu.

└ The keylock is disabled.

#### Manual activation of the keypad lock

After commissioning of the device the keypad lock can be activated manually.

1. The device is in the measured value display.

Press E for at least 2 seconds.

└ A context menu appears.

2. Select **Keylock on** from the context menu.

└ The keylock is enabled.

#### 7.3.8 Access code and user roles

#### Meaning of the access code

An access code can be defined in order to distinguish between the following user roles:

User role	Definition	
Maintenance	<ul><li>• Knows the access code.</li><li>• Has write access to all parameters (except service parameters).</li></ul>	
Operator	<ul><li>Doesn't know the access code.</li><li>Has write access to only a few parameters.</li></ul>	

The description of parameters states which role is needed at least for read and write access to each parameter.

- The current user role is indicated by the **Access status display** parameter.
- If the access code is **"0000"**, every user is in the **Maintenance** role. This is the default setting on delivery of the device.

#### Defining an access code

- **1.** Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Administration  $\rightarrow$  Define access code  $\rightarrow$  Define access code
- 2. Enter the intended access code (max. 4 digits).
- 3. Repeat the same code in the **Confirm access code** parameter.
  - ← The user is in the **Operator** role. The B-symbol appears in front of all write-protected parameters.

#### Switching to the "Maintenance" role

If the *g*-symbol appears on the local display in front of a parameter, the parameter is write-protected because the user is in the **Operator** role. To switch to the **Maintenance** role, proceed as follows:

1. Press E.

- └ The input prompt for the access code appears.
- 2. Enter the access code.
  - → The user is in the **Maintenance** role. The B-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

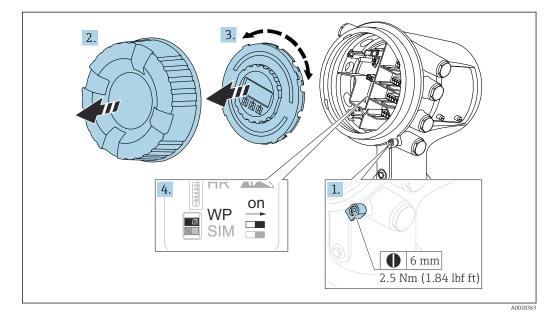
#### Switching back to the "Operator" role automatically

The user automatically switches back to the **Operator** role:

- if no key is pressed for 10 minutes in the navigation and editing mode.
- 60 s after going back from the navigation and editing mode to the standard view (measured value display).

#### 7.3.9 Write protection switch

The operating menu can be locked by a hardware switch in the connection compartment. In this locking state W&M related parameters are read only.

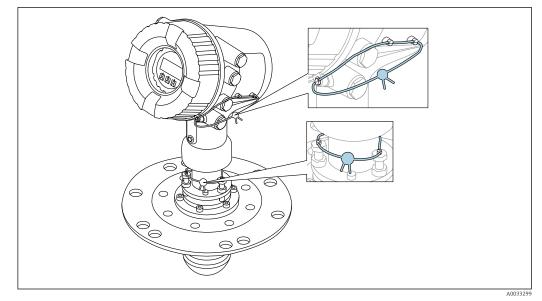


The display module can be attached to the edge of the electronics compartment. This makes it easier to access the lock switch.

1. Loosen the securing clamp.

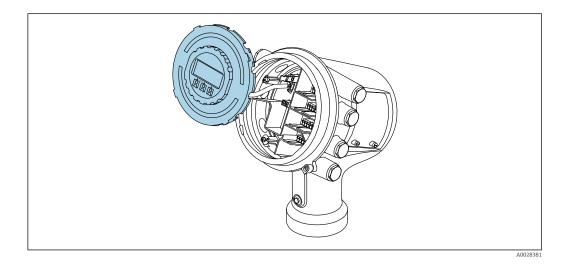
2. Unscrew the housing cover.

- 3. Pull out the display module with a gentle rotation movement.
- 4. Using a flat blade screwdriver or a similar tool, set the write protection switch **(WP)** into the desired position. **ON:** operating menu is locked; **OFF:** operating menu is unlocked.
- 5. Put the display module onto the connection compartment, screw the cover closed and tighten the securing clamp.
- To avoid access to the write protection switch, the cover of the connection compartment can be secured by a lead seal.
  - For devices with alignment unit: To avoid unauthorized changes of the antenna alignment, the alignment unit can be secured by a lead seal.

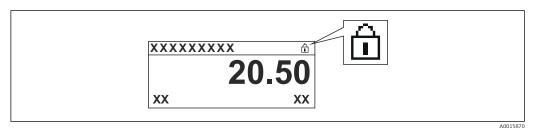


23 Sealing of the cover of the connection compartment (top) and the alignment unit (bottom)

For LNE approval, bolts at built in flange additionally must be secured by a lead seal.



#### Indication of the locking state

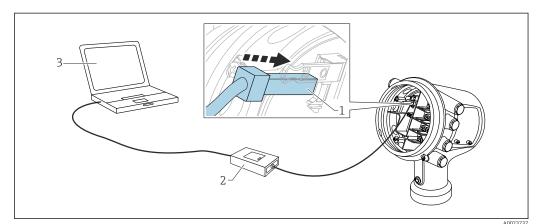


■ 24 Write protection symbol in the header of the display

Write protection via locking switch is indicated as follows:

- Locking status (→ 
   <sup>1</sup> 131) = Hardware locked
- appears in the header of the display.

# 7.4 Access to the operating menu via the service interface and FieldCare



☑ 25 Operation via service interface

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

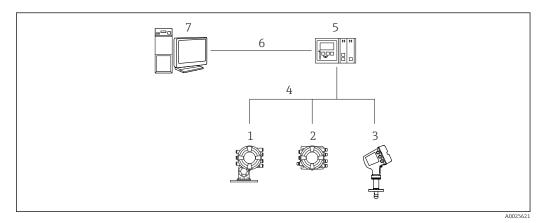
#### The "Save/Restore" function

After a device configuration has been saved to a computer and restored to the device using the **Save/Restore** function of FieldCare, the device must be restarted by the following setting:

Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Administration  $\rightarrow$  Device reset = Restart device. This ensures correct operation of the device after the restore.

## 7.5 Access to the operating menu via Tankvision Tank Scanner NXA820 and FieldCare

#### 7.5.1 Wiring scheme



26 Connection of Tank Gauging devices to FieldCare via the Tankvision Tank Scanner NXA820

- 1 Proservo NMS8x
- 2 Tankside Monitor NRF81
- 3 Micropilot NMR8x
- 4 Field protocol (e.g. Modbus, V1)
- 5 Tankvision Tank Scanner NXA820
- 6 Ethernet
- 7 Computer with FieldCare installed

#### 7.5.2 Establishing the connection between FieldCare and the device

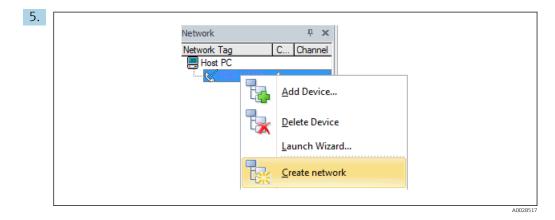
- **1.** Make sure the **HART CommDTM NXA** is installed and update the DTM catalogue if required.
- 2. Create a new project in FieldCare.

CDI Communication I		Version	Class
CDI Communication FXA291		V2.05.01 (2015-04-28)	
CDI Communication TCP/IP		V2.05.01 (2015-04-28)	•
CDI Communication USB		V2.05.01 (2015-04-28)	÷
CommDTM PROFIBI	JS DP-V1	V4.0.0.9 (2011-01-17)	
FF H1 CommDTM		V1.5 (2009-08-17)	•
Flow Communication	FXA193/291	V3.26.00 (2015-04-07)	43
FXA520		V1.05.09 (2011-07-15)	20
HART Communicatio		V1.0.52 (2015-03-17)	•
IPC (Level, Pressure)		V1.02.17 (2014-02-21)	
NXA HART Commun		V1.1.0.911 (2013-03-27)	dtmSpecifi
PCP (Readwin) TXU	10/FXA291	V1.01.18 (2014-02-21)	•
PROFIdtm DPV1 SFGNetwork		V 2.11(115) (2010-08-18) V1.06.00.285 (2015-03-25)	dtmSpecifi
•	III		
•			
	Device type	(DTM) information	
Device:	Device type NXA HART (	Communication	
Device: Manufacturer:	Device type	Communication	
Device:	Device type NXA HART ( Endress+Hau	Communication	
Device: Manufacturer:	Device type NXA HART (	Communication	
Device: Manufacturer: Device ID / SubID:	Device type NXA HART ( Endress+Hau	Communication	
Device: Manufacturer: Device ID / SubID: Manufacturer ID:	Device type NXA HART ( Endress+Hau	Communication	
Device: Manufacturer: Device ID / SubID: Manufacturer ID; Hardware revision:	Device type NXA HART ( Endress+Hau	Communication	
Device: Manufacturer: Device ID / SubID: Manufacturer ID: Hardware revision: Software revision:	Device type NXA HART ( Endress+Hau	Communication	

#### Add a new device: NXA HART Communication

NXA HART Communication	n (Configuration) 🗴		
NXA820 IP Address NXA820 Port Password	1	192.168.2.100 3000	
Tank Identification		Tank_1	
Address range to scan	Start address End address		0 🗸
Communication timeout (	(seconds)		10 🗸

Open the configuration of the DTM and enter the required data (IP address of the NXA820; "Password" = "hart"; "Tank identification" only with NXA V1.05 or higher)



Select **Create network** from the context menu.

└ The device is detected and the DTM is assigned.

Tank level (139):       C         Distance (120):       C         Status signal:       C	494,8 mm	Liguid temperature: 🖏 Water level: 🖏
🏚 🗖 🖬 📝 🔽 🛃 Menu / Variable	🖄 🛃 💠 🚺 🚱	Wizard
NMR8x       P     Access status tooling:       P     Operation       P     Setup       P     Diagnostics       P     Expert	Maintenance	Instrument health status

└ The device can be configured.

#### The "Save/Restore" function

i

After a device configuration has been saved to a computer and restored to the device using the **Save/Restore** function of FieldCare, the device must be restarted by the following setting:

Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Administration  $\rightarrow$  Device reset = Restart device. This ensures correct operation of the device after the restore.

## 8 System integration

## 8.1 Overview of the Device Description files (DTM)

To integrate the device via HART into FieldCare, a Device Description file (DTM) according to the following specification is required:

Manufacturer ID	0x11
Device type (NMR8x)	0x112E
HART specification	7.0
DD files	For information and files see: www.endress.com

## 9 Commissioning

# 

#### 9.1 Terms related to tank measurement

■ 27 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

## 9.2 Initial settings

#### 9.2.1 Setting the display language

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

- 1. While in the standard view (→ 🗎 46), 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  $\rightarrow$  Advanced setup  $\rightarrow$  Display  $\rightarrow$  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.

#### 9.2.2 Setting the real-time clock

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

- **1.** Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  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. 2.	Navigate to: Setup -	→ Advanced setup → Date / time
۵.	Date/time: 🞝	2016-04-20 09:32:24
	Set date:	Please select
		Please select
		Abort
		Start
		Confirm time

Go to the **Set date** parameter and select the **Start** option.

3.	Date/time: 🕻	2016-04-20 09:34:25
	Set date: ?	Please select
	Year:	2016
	Month:	4
	Day:	20
	Hour:	9
	Minute:	34

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  ${\bf Set}\ {\bf date}\ {\bf parameter}\ {\bf and}\ {\bf select}\ {\bf the}\ {\bf Confirm}\ {\bf time}\ {\bf option}.$ 

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

## 9.3 Configuring the measuring device

#### 9.3.1 Configuration of the level measurement

The first parameters of the **Setup** menu are used to configure the measurement. A short description is given in the following sections. For a more detailed description refer to the parameter description in the appendix  $\rightarrow \bigoplus 125$ .

#### Basic settings

Navigation path: Setup

Parameter	Meaning	Description
Setup → Device tag	Define a name to identify the measuring point within the plant.	→ 🖺 125
Setup → Units preset	Select a set of units for length, pressure and temperature.	→ 🖺 125
Setup → Empty	Enter the distance from the lower edge of the device flange to the datum plate.	→ 🖺 126
Setup $\rightarrow$ Tank level	Shows the measured level. Check whether the indicated value matches the actual level.	→ 🖺 116
Setup → Set level	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 defined.	→ 🖺 127

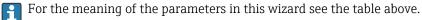
The **Set level** parameter can only be used to compensate for a constant level error. To eliminate errors resulting from interference echos, use the interference echo suppression (map).

Interference echo suppression (map) in an operating tool (e.g. FieldCare/DeviceCare) Navigation path: Setup

Parameter	Meaning	Description
Setup → Distance	Shows the measured distance from the lower edge of the device flange to the product surface. Check whether this value is correct.	→ 🗎 130
Setup → Confirm distance	Specify whether the measured distance matches the actual distance. The selection determines up to which distance an interference echo suppression is recorded.	→ 🗎 127
Present mapping	Shows up to which distance a mapping has already been recorded.	
Setup → Mapping end point	Only visible for <b>Confirm distance = 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.	
Setup → Record map	Only visible for <b>Confirm distance = Manual map</b> Select <b>Record map</b> . This starts the recording of the new map.	→ 🖺 129

#### Interference echo suppression on the local display

Navigation path: Setup  $\rightarrow$  Mapping



#### Dip table

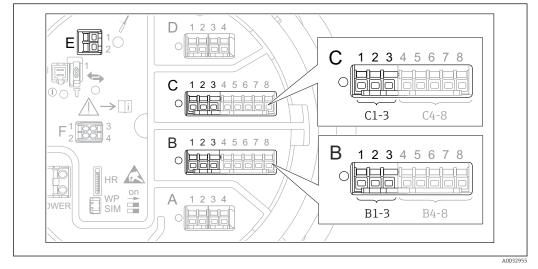
The dip table is used to correct the level readings using independently taken hand dips. The dip table is used in particular to adapt the level gauge to the specific application conditions such as a mechanical offset and the tank or stilling well design.

The dip table is managed in the **Dip-table** submenu  $\rightarrow \implies 212$ .

## 9.4 Configuring the tank gauging application

Configuration of the inputs:	Description
HART inputs	→ 🗎 66
NMT532/539/81 connected via HART	→ 🗎 68
4-20mA inputs	→ 🗎 70
RTD input	→ 🗎 71
Digital inputs	→ 🗎 73
Configuration of the data processing in the device:	Description
Linking input values to tank variables	→ 🗎 74
Tank calculation: Direct Level Measurement	→ 🗎 75
Tank calculation: Hybrid Tank Measurement System (HTMS)	→ 🗎 76
Tank calculation: Correction of the Hydrostatic Tank Deformation (HyTD)	→ 🗎 77
Tank calculation: Thermal Tank Shell Correction (CTSh)	→ 🗎 78
Alarms (limit evaluation)	→ 🗎 79
Configuration of the signal output:	Description
4-20mA output	→ 🖺 80
HART slave + 4-20mA output	→ 🖺 81
Modbus	→ 🖺 82
V1	→ 🖹 83
Digital outputs	→ 🖺 84
WM550	→ 🖺 83

#### 9.4.1 Configuration of the HART inputs



#### Connecting and addressing HART devices



- B Analog I/O module in slot B (availability depending on device version  $\rightarrow \square 22$ )
- C Analog I/O module in slot C (availability depending on device version  $\rightarrow \square 22$ )
- E HART Ex is output (available in all device versions)

#### Slot B or C: Setting the operating mode of the Analog I/O module

This section is not relevant for the HART Ex is output (Slot E). This output always functions as a HART master for the connected HART slaves.

If HART devices are connected to an Analog I/O module (slot B or C in the terminal compartment), this module must be configured as follows:

**1.** Navigate to the submenu of the respective Analog I/O module: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O X1-3

2. Go to the **Operating mode** parameter ( $\Rightarrow \square 145$ ).

3. If only one HART device is connected to this loop:

Select the **HART master+4..20mA input** option. In this case the 4-20mA signal can be used in addition to the HART signal. For the configuration of the 4-20mA input:  $\rightarrow \square$  70.

4. If up to 6 HART devices are connected to this loop: Select the **HART master** option.

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

#### Defining the type of measured value

This setting can be skipped for a connected Prothermo NMT5xx and NMT8x as the type of measured value is automatically recognized by the Micropilot NMR8x in this case.

• The measured values can only be used in the system if the unit of the assigned HART variable fits the type of measured value. The HART variable assigned to **Output temperature**, for example, has to be in °C or °F.

• A HART variable with unit "%" cannot be used for **Output level**. Instead, the HART variable must be in mm, m, ft or in.

The type of measured value must be specified for each HART variable (PV, SV, TV and QV). To do so, proceed as follows:

- **1.** Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices
  - └ There is a submenu for each connected HART device.
- 2. For each device go to the corresponding submenu.
- 3. If the device measures a pressure:

Go to the **Output pressure** parameter ( $\rightarrow \triangleq 135$ ) and specify which of the four HART variables contains the measured pressure. Only a HART variable with a pressure unit may be selected.

4. If the device measures a density:

Go to the **Output density** parameter ( $\rightarrow \triangleq 136$ ) and specify which of the four HART variables contains the measured density. Only a HART variable with a density unit may be selected.

5. If the device measures a temperature:

Go to the **Output temperature** parameter ( $\rightarrow \square$  136) and specify which of the four HART variables contains the measured temperature. Only a HART variable with a temperature unit may be selected.

6. If the device measures the vapor temperature:

Go to the **Output vapor temperature** parameter ( $\rightarrow \implies 137$ ) and specify which of the four HART variables contains the measured vapor temperature. Only a HART variable with a temperature unit may be selected.

#### **Disconnecting HART devices**

When a HART device is disconnected from the device, it must also be logically removed as follows:

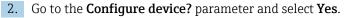
- **1.** Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  Forget device
  - 2. Select the HART device to be removed.

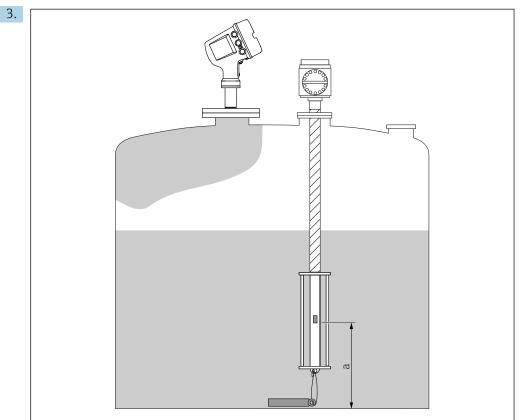
This procedure is also necessary if a defective device is exchanged.

## 9.4.2 Configuration of a connected Prothermo temperature transmitter

If a Prothermo NMT532, NMT539 or NMT8x temperature transmitter is connected via HART, it can be configured as follows:

1. Navigate to: Expert → Input/output → HART devices → HART Device(s) → NMT device config; here, **HART Device(s)** is the name of the connected Prothermo.



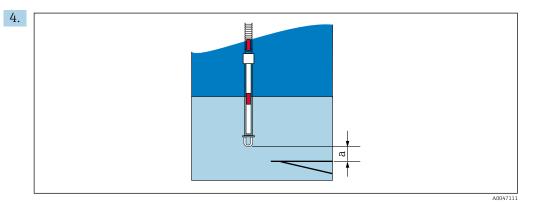


■ 29 Prothermo NMT53x: Position of the bottom temperature element

a Distance from bottom temperature element to zero reference (tank bottom or datum plate).

To configure a **Prothermo NMT53x**: Go to the **Bottom point** parameter and enter the position of the bottom temperature element (see picture above).

The value entered into the Bottom point parameter in the Tank Gauging device is handed over to the Bottom point parameter in the connected Prothermo NMT53x. -



30 Prothermo NMT8x: Distance between the physical end of the probe and the zero level value

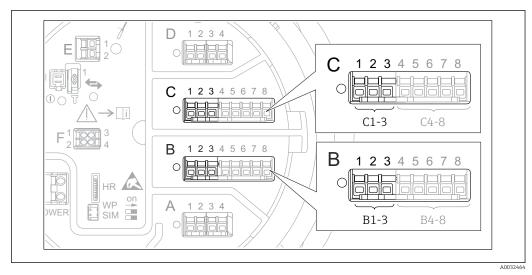
a Distance between the physical end of the probe and the zero level value in the tank (tank bottom or datum plate).

To configure a **Prothermo NMT8x**: Go to the **Bottom point** parameter and enter the distance between the physical end of the probe and the zero level value in the tank (tank bottom or datum plate).

└ The value entered into the Bottom point parameter in the Tank Gauging device is handed over to the End of probe to zero distance parameter in the connected Prothermo NMT8x.

To check the temperatures measured by the individual elements, go to the following submenu: Operation  $\rightarrow$  Temperature  $\rightarrow$  NMT element values  $\rightarrow$  Element temperature

There is a **Element temperature X** parameter for each element of the Prothermo.

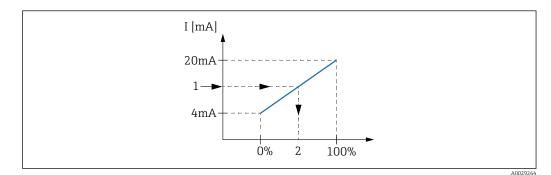


#### 9.4.3 Configuration of the 4-20mA inputs

■ 31 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  $\rightarrow \cong 22$ .

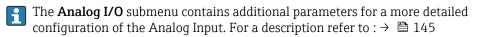
For each Analog I/O module to which a 4-20mA device is connected, proceed as follows:

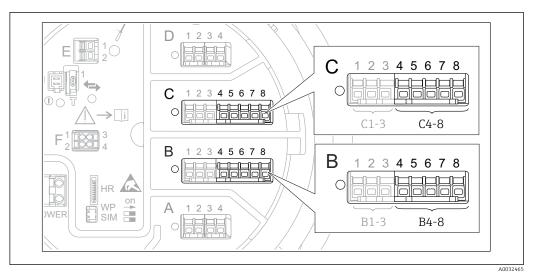
- **1.** Make sure the 4-20mA devices are connected as defined by the terminal assignment  $\rightarrow \cong 34$ .
- 2. Navigate to the submenu of the respective Analog I/O module: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O X1-3
- 3. Go to the **Operating mode** parameter (→ 🗎 145) and select **4..20mA input** or **HART master+4..20mA input**.
- 4. Go to the **Process variable** parameter ( $\rightarrow \triangleq 151$ ) and specify which process variable is transmitted by the connected device.
- **5.** Go to the **Analog input 0% value** parameter ( $\rightarrow \triangleq 151$ ) and define which value of the process variable corresponds to an input current of 4 mA (see diagram below).
- 6. Go to the **Analog input 100% value** parameter (→ 🗎 151) and define which value of the process variable corresponds to an input current of 20 mA (see diagram below).
- 7. Go to the **Process value** parameter ( $\rightarrow \triangleq 152$ ) and check whether the indicated value matches the actual value of the process variable.



■ 32 Scaling of the 4-20mA input to the process variable

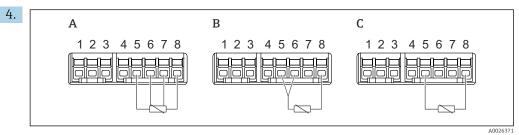
- 1 Input value in mA
- 2 Process value





#### 9.4.4 Configuration of a connected RTD

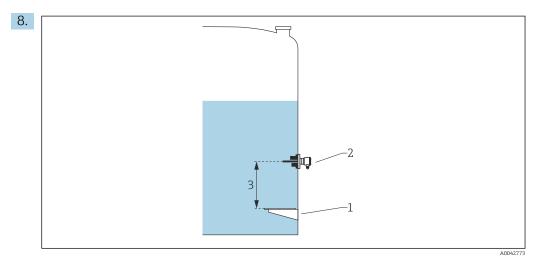
- 33 Possible locations of the Analog I/O modules, to which an RTD can be connected. The order code of the device determines which of these modules is actually present  $\rightarrow \cong 22$ .
- **1.** Make sure the RTD is connected as defined by the terminal assignment  $\rightarrow \square$  39.
- 2. Navigate to the submenu of the respective Analog I/O module: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP X4-8.
- **3.** Go to the **RTD type** parameter ( $\rightarrow \square$  139) and specify the type of the connected RTD.



- 34 RTD connection types
- A 4 wire RTD connection
- *B* 3 wire RTD connection
- C 2 wire RTD connection

Go to the **RTD connection type** parameter ( $\Rightarrow \square 140$ ) and specify the type of connection of the RTD (2-, 3- or 4-wire).

- **5.** Go to the **Input value** parameter ( $\rightarrow \square$  142) and check whether the indicated temperature matches the actual temperature.
- **6.** Go to the **Minimum probe temperature** parameter (→ 🗎 142) and specify the minimum approved temperature of the connected RTD.
- 7. Go to the **Maximum probe temperature** parameter (→ 🗎 143) and specify the maximum approved temperature of the connected RTD.



- 1 Datum plate
- 2 RTD
- *3 Probe position* ( $\rightarrow \square 143$ )

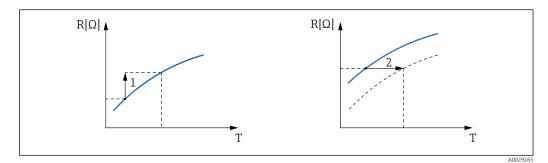
Go to the **Probe position** parameter and enter the mounting position of the RTD (measured from the datum plate).

└ This parameter, in conjunction with the measured level, determines whether the measured temperature refers to the product or to the gas phase.

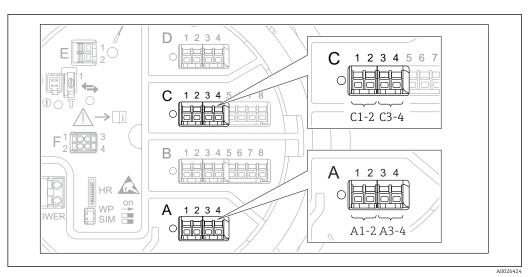
#### Offset for resistance and/or temperature

An offset for the resistance or the temperature can be defined in the following submenu: Expert  $\rightarrow$  Input/output  $\rightarrow$  Analog IP X4-8.

- **Ohms offset** is added to the measured resistance before the calculation of the temperature.
- **Temperature offset after conversion** is added to the measured temperature.



- 1 Ohms offset
- 2 Temperature offset after conversion



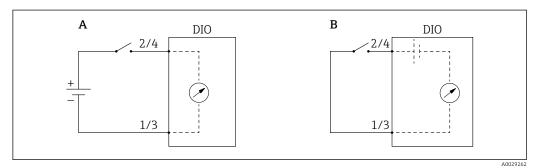
## 9.4.5 Configuration of the digital inputs

■ 35 Possible locations of the Digital I/O modules (examples); the order code defines the number and location of digial input modules  $\rightarrow \cong 22$ .

There is a **Digital Xx-x** submenu 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**.

#### The "Operating mode" parameter

Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x  $\rightarrow$  Operating mode



A "Operating mode" = "Input passive"

B "Operating mode" = "Input active"

Meaning of the options

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 at the input (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.

#### The "Contact type" parameter

 $\mathsf{Setup} \to \mathsf{Advanced} \ \mathsf{setup} \to \mathsf{Input/output} \to \mathsf{Digital} \ \mathsf{Xx-x} \to \mathsf{Contact} \ \mathsf{type}$ 

This parameter determines how the state of the external switch is mapped to the internal states of the DIO module:

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 situations:			
During start-up	Unknown	Unknown	
Fault in measurement	Error	Error	

- The internal state of the Digital Input can be transferred to a Digital Output or can be used to control the measurement.

## 9.4.6 Linking input values to tank variables

Measured values must be linked to tank variables before they can be used in the Tank Gauging application. This is done by defining the source of each tank variable in the following parameters:

Tank variable	Parameter defining the source of this variable
Bottom water level	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank configuration $\rightarrow$ Level $\rightarrow$ Water level source
Average or spot temperature of the product	<ul> <li>Setup → Liquid temp source</li> <li>Setup → Advanced setup → Application → Tank configuration</li> <li>→ Temperature → Liquid temp source</li> </ul>
Temperature of the air surrounding the tank	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank configuration $\rightarrow$ Temperature $\rightarrow$ Air temperature source
Temperature of the vapor above the product	Setup $\rightarrow$ Advanced setup $\rightarrow$ Tank configuration $\rightarrow$ Temperature $\rightarrow$ Vapor temp source
Density of the product	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank configuration $\rightarrow$ Density $\rightarrow$ Observed density source
Bottom pressure (P1)	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank configuration $\rightarrow$ Pressure $\rightarrow$ P1 (bottom) source
Top pressure (P3)	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank configuration $\rightarrow$ Pressure $\rightarrow$ P3 (top) source

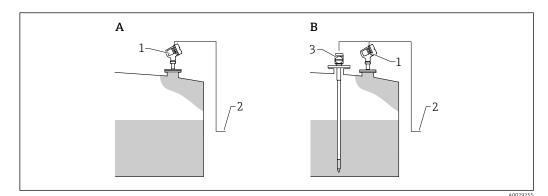
Depending on the application not all these parameters will be relevant in a given situation.

The product level is always the level measured by the Micropilot itself. It needs not to be linked.

-

### 9.4.7 Tank calculation: Direct level measurement

If no tank calculation is configured, level and temperature are measured directly.



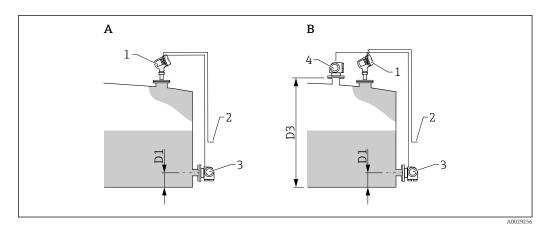
- *A Direct level measurement (without temperature)*
- *B* Direct level and temperature measurement
- 1 Level transmitter
- 2 To inventory management system
- 3 Temperature transmitter
- If a temperature transmitter is connected:

Navigate to: "Setup  $\rightarrow$  Liquid temp source" and specify from which device the temperature is obtained.

#### 9.4.8 Tank calculation: Hybrid tank measurement system (HTMS)

HTMS uses level and pressure measurements to calculate the density of the medium.

In non-atmospheric (i.e. pressurized) tanks it is recommended to use the **HTMS P1+P3** mode. Two pressure sensors are required in this case. In atmospheric (i.e. unpressurized) tanks the **HTMS P1** with only one pressure sensor is sufficient.



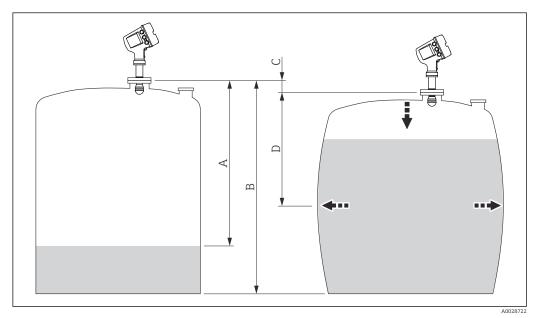
- A "'HTMS mode" parameter" = "'HTMS P1" option"
- *B* "'HTMS mode" parameter" = "'HTMS P1+P3" option"
- D1 P1 position
- D3 P3 position
- 1 Micropilot
- 2 To inventory management system
- 3 Pressure sensor (bottom)
- 4 Pressure sensor (top)

**1.** Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank configuration  $\rightarrow$  Pressure

- Go to P1 (bottom) source (→ 
   <sup>(⇒)</sup> 191) and specify from which device the bottom pressure (P1) is obtained.
- If a top pressure transmitter (P3) is connected:
   Go to P3 (top) source (→ 
   <sup>193</sup>) and specify from which device the top pressure (P3) is obtained.
- 4. Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  HTMS
- 5. Go to **HTMS mode** ( $\rightarrow \cong 208$ ) and specify the HTMS mode.
- 6. Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank configuration  $\rightarrow$  Density
- 7. Go to **Observed density source** ( $\rightarrow \triangleq$  **189**) and select **HTMS**.
- 8. Use the other parameters of the **HTMS** submenu to configure the calculation. For a detailed description:  $\rightarrow \cong 206$

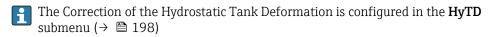
## 9.4.9 Tank calculation: Hydrostatic Tank Deformation (HyTD)

Hydrostatic Tank Deformation can be used to compensate the vertical movement of the Gauge Reference Height (GRH) due to bulging of the tank shell caused by the hydrostatic pressure exerted by the liquid stored in the tank. The compensation is based on a linear approximation obtained from manual hand dips at several levels divided over the full range of the tank.



☑ 36 Correction of the hydrostatic tank deformation (HyTD)

- A "Distance" (tank nearly empty)
- B Gauge Reference Height (GRH)
- C HyTD correction value
- D "Distance" (tank filled)



## 9.4.10 Tank calculation: Thermal tank shell correction (CTSh)

CTSh (correction for the thermal expansion of the tank shell) compensates for effects on the Gauge Reference Height (GRH) and on the expansion or contraction of the measuring wire due to temperature effects on the tank shell or stilling well. The temperature effects are separated into two parts, respectively affecting the 'dry' and 'wetted' part of the tank shell or stilling well. The correction function is based on thermal expansion coefficients of steel and insulation factors for both the 'dry' and 'wet' parts of the wire and the tank shell. The temperatures used for the correction can be selected from on manual or measured values.

This correction is recommended for the following situations:

- if the operating temperature deviates considerably from the temperature during calibration ( $\Delta T > 10 \degree C (18 \degree F)$ )
- for extremely high tanks

i

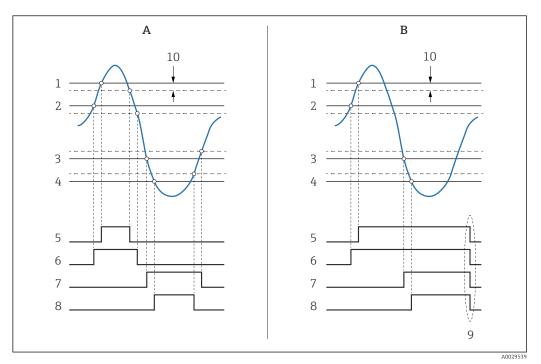
for refrigerated, cryogenic or heated applications

As the use of this correction will influence the innage level reading, it is recommended to ensure the manual hand dip and level verification procedures are being conducted correctly before enabling this correction method.

This mode cannot be used in conjunction with HTG because the level is not measured relative to the gauge reference height with HTG.

#### 9.4.11 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.



🛃 37 Principle of the limit evaluation

- Α Alarm mode = On
- В Alarm mode = Latching
- 1 HH alarm value
- H alarm value 2
- 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

The limit evaluation is configured in the **Alarm 1 to 4** submenus.

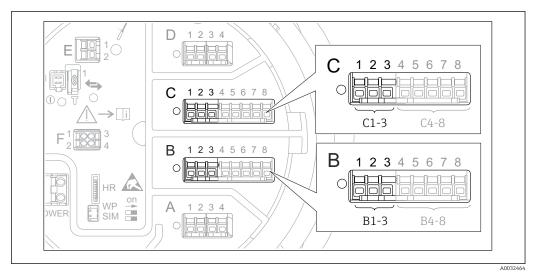
Navigation path: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Alarm  $\rightarrow$  Alarm 1 to 4



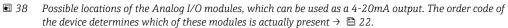
For Alarm mode = Latching all alarms remain active until the user selects Clear **alarm** = **Yes** or the power is switched off and on.



Make sure to also configure the parameter "Hysteresis" parameter accordingly, depending on tank variable and unit used.

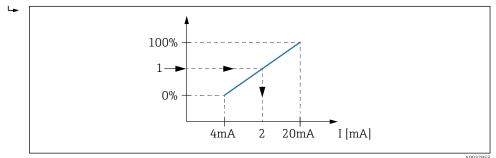


## 9.4.12 Configuration of the 4-20mA output



Each Analog I/O module of the device can be configured as a 4...20mA analog output. To do so, proceed as follows:

- **1.** Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O X1-3.
- Go to the Operating mode parameter and select 4..20mA output or HART slave +4..20mA output<sup>4)</sup>.
- **3.** Go to the **Analog input source** parameter and select the tank variable which is to be transmitted via the 4...20mA output.
- 4. Go to the **0 % value** parameter and enter the value of the selected tank variable which will be mapped to 4 mA.
- 5. Go to the **100 % value** parameter and enter the value of the selected tank variable which will be mapped to 20 mA.



Scaling of the tank variable to the output current

1 Tank variable

2

-

Output current

After startup of the device, as long as the assigned tank variable is not yet available, the output current assumes the defined error value.

The **Analog I/O** submenu contains more parameters which can be used for a more detailed configuration of the analog output. For a description see  $\rightarrow \cong 145$ 

<sup>4) &</sup>quot;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: → <a>B</a> 81

## 9.4.13 Configuration of the HART slave + 4-20mA output

If **Operating mode** = **HART slave +4..20mA output** has been selected for an Analog I/O module, it serves as a HART slave which sends up to four HART variables to a HART master.

The 4-20 mA signal can be used in this case, too. For its configuration: → 🖺 80

#### Standard case: PV = 4-20mA signal

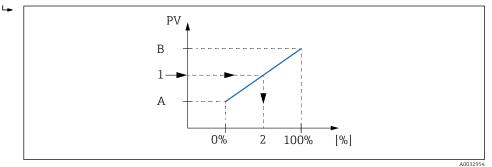
By default, the Primary Variable (PV) is identical to the tank variable transmitted by the 4-20mA output. To define the other HART variables and to configure the HART output in more detail, proceed as follows:

- **1.** Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration
- 2. Go to the **System polling address** parameter and set the HART slave address of the device.
- **3.** Use the following parameters to assign tank variables to the second to fourth HART variable: **Assign SV**, **Assign TV**, **Assign QV**.
  - └ The four HART variables are transmitted to a connected HART Master.

#### Special case: PV ≠ 4-20mA signal

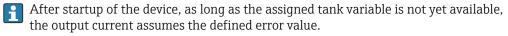
In exceptional cases it might be required that the Primary Variable (PV) transmits a different tank variable than the 4-20mA output. This is configured as follows.

- **1.** Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration
- 2. Go to the **PV source** parameter and select **Custom**.
  - └→ The following additional parameters appear in the submenu: Assign PV, 0 % value, 100 % value and PV mA selector.
- **3.** Go to the **Assign PV** parameter and select the tank variable to be transmitted as the Primary Variable (PV).
- 4. Use the **0** % value and **100** % value parameters to define a range for the PV. The **Percent of range** parameter indicates the percentage for the actual value of the PV. It is included in the cyclical output to the HART master.



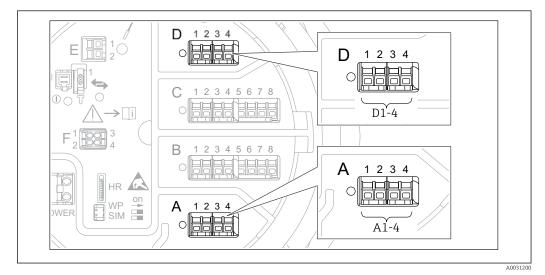
40 Scaling of the tank variable to the percentage

- A 0 % value
- B 100 % value
- 1 Primary variable (PV)
- 2 Percent of range
- 5. Use the **PV mA selector** parameter to define whether the output current of an Analog I/O module is to be included in the cyclical HART output.



The **PV mA selector** parameter does not influence the output current at the terminals of the Analog I/O module. It only defines whether the value of this current is part of the HART output or not.

## 9.4.14 Configuration of the Modbus output

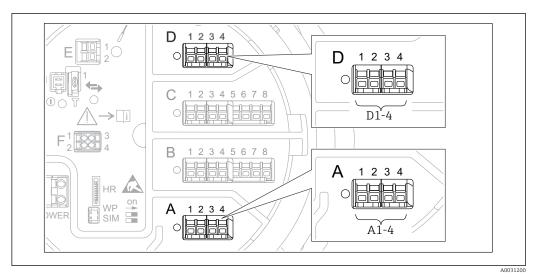


■ 41 Possible locations of the Modbus modules (examples); depending on the device version these modules may also be in slot B or  $C \rightarrow \cong 22$ .

The Micropilot NMR8x acts as a Modbus slave. Measured or calculated tank values are stored in registers which can be requested by a Modbus master.

The following submenu is used to configure the communication between the device and the Modbus master:

Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  Modbus X1-4  $\rightarrow$ Configuration ( $\rightarrow \square$  161)



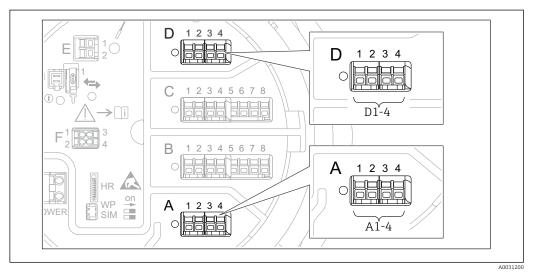
## 9.4.15 Configuration of the V1 output

■ 42 Possible locations of the V1 modules (examples); depending on the device version these modules may also be in slot B or  $C \rightarrow \bigoplus 22$ .

The following submenus are used to configure the V1 communication between the device and the control system:

- Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4  $\rightarrow$  Configuration  $\rightarrow$  🖺 164
- Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4  $\rightarrow$  V1 input selector  $\rightarrow$  🗎 167

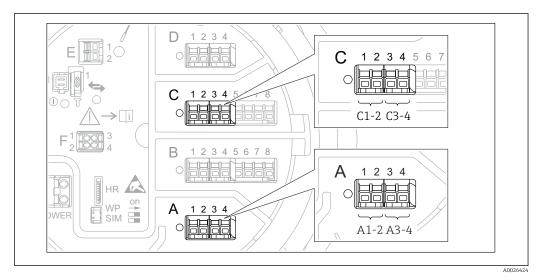
## 9.4.16 Configuration of the WM550 output



■ 43 Possible locations of the WM550 modules (examples); depending on the device version these modules may also be in slot B or  $C \rightarrow \cong 22$ .

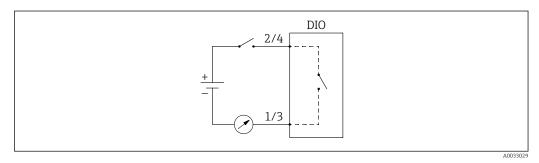
The following submenus are used to configure the WM550 communication between the device and the control system:

- Setup menu → Advanced setup submenu → Communication submenu → WM550 X1-4
   → Configuration submenu → 
   160
- Setup menu → Advanced setup submenu → Communication submenu → WM550 X1-4
   → WM550 input selector submenu → 
   169



#### 9.4.17 Configuration of the digital outputs

 E 44 Possible locations of the Digital I/O modules (examples); the order code defines the number and location of Digital I/O modules → 
 \u00e9 22.



🗟 45 Usage of the Digital I/O module as a digital output

There is a **Digital Xx-x** submenu 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, Digital input source** and **Contact type**.

A digital output can be used to

- output the state of an alarm (if an alarm has been configured  $\rightarrow \square$  79)
- transmit the status of a digital input (if a digital input has been configured  $\rightarrow \implies 73$ )

To configure a digital output, proceed as follows:

- **1.** Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x, where Xx-x designates the digital I/O module to be configured.
- 2. Go to the **Operating mode** parameter and select the **Output passive** option.
- 3. Go to the **Digital input source** parameter and select the alarm or digital input to be transmitted.
- 4. Go to the **Contact type** parameter and select how the internal state of the alarm or digital input is to be mapped to the digital output (see table below).

State of the alarm	Switching state of the digital output		
<ul> <li>Internal state of the digital input</li> </ul>	Contact type = Normally open	Contact type = Normally closed	
Inactive	Open	Closed	
Active	Closed	Open	

- For SIL applications, **Contact type** is automatically set to **Normally closed** by the device when starting the SIL confirmation procedure.
  - In case of a power supply failure, the switching state is always "open", irrespective of the selected option.

## 9.5 Advanced settings

For a more detailed configuration of the signal inputs, the tank calculations and the signal outputs refer to the **Advanced setup** submenu ( $\rightarrow \cong 131$ ).

## 9.6 Simulation

To check the correct configuration of the device and of the control system, it is possible to simulate different situations (measured values, diagnostic messages etc.). See the **Simulation** submenu ( $\rightarrow \cong 253$ ) for details.

## 9.7 Protecting settings from unauthorized access

There are two possibilities to protect the settings from unauthorized access:

- By an access code ( $\rightarrow \square 53$ )
  - This locks the access via the display and operating module.
- By the protection switch (→ 
   <sup>1</sup> 54)
   This locks the access to W&M-related parameters by any user interface (display and operating module, FieldCare, other configuration tools).

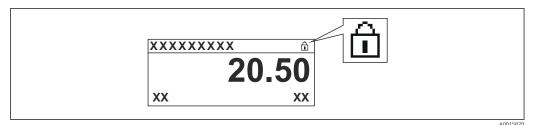
# 10 Operation

## 10.1 Reading off the device locking status

Depending on the locking state of the device some operations may be locked. The current locking status is indicated at: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Locking status. The following table summarizes the different locking statuses:

Locking status	Meaning	Unlocking procedure	
Hardware locked	The device is locked by the write-protection switch in the terminal compartment.	→ 🗎 54	
SIL locked	The device is in SIL-locked mode.	Detailed information on this topic see SIL Safety manual	
CT active - all parameters	The custody transfer mode is active.	→ 🗎 54	
WHG locked	The device is in WHG-locked mode.	Detailed information on this topic see SIL Safety manual	
Temporarily locked	Write access to the parameters is temporarily lock due to device-internal processing (e.g. data upload/ download, reset). Once the internal processing has been completed, the parameters can be changed again.	Wait for completion of the device-internal processing.	

A locking is indicated by the write protection symbol in the header of the display:



## **10.2** Reading off measured values

Tank values can be read off in the following submenus:

- Operation  $\rightarrow$  Level
- Operation  $\rightarrow$  Temperature
- Operation  $\rightarrow$  Density
- Operation  $\rightarrow$  Pressure

# 11 Diagnostics and troubleshooting

## 11.1 General trouble shooting

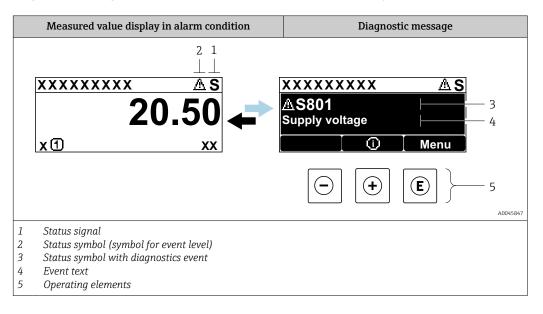
## 11.1.1 General errors

Error	Possible cause	Remedial action
Device does not respond.	Supply voltage not connected.	Connect the correct voltage.
	The cables do not contact the terminals properly.	Ensure electrical contact between the cable and the terminal.
Values on the display invisible	The plug of the display cable is not connected correctly.	Connect the plug correctly.
	Display is defective.	Replace display.
	Display contrast too low.	Set Setup $\rightarrow$ Advanced setup $\rightarrow$ Display $\rightarrow$ Contrast display to a value $\geq$ 60 %.
"Communication error" is	Electromagnetic interference	Check grounding of the device.
indicated on the display when starting the device or connecting the display	Broken display cable or display plug.	Exchange display.
CDI communication does not work.	Wrong setting of the COM port on the computer.	Check the setting of the COM port on the computer (e.g. FieldCare) and change it if necessary.
Device measures incorrectly.	Parametrization error	Check and adjust parameterization.

## 11.2 Diagnostic information on local display

## 11.2.1 Diagnostic message

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



#### Status signals

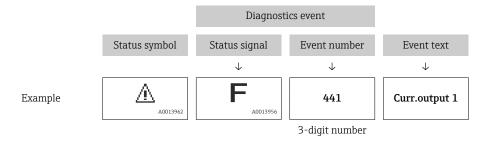
A0013956	<b>"Failure"</b> A device error is present. The measured value is no longer valid.
<b>C</b>	<b>"Function check"</b> The device is in service mode (e.g. during a simulation or a warning).
<b>S</b> A0013958	<ul> <li>"Out of specification"</li> <li>The device is operated:</li> <li>Outside of its technical specifications (e.g. during startup or a cleaning)</li> <li>Outside of the configuration carried out by the user (e.g. level outside configured span)</li> </ul>
M	<b>"Maintenance required"</b> Maintenance is required. The measured value is still valid.

#### Status symbol (symbol for event level)

A0013961	"Alarm" status The measurement is interrupted. The signal outputs take on the defined alarm condition. A diagnostic message is generated.
A0013962	"Warning" status The device continues to measure. A diagnostic message is generated.

#### Diagnostics event and event text

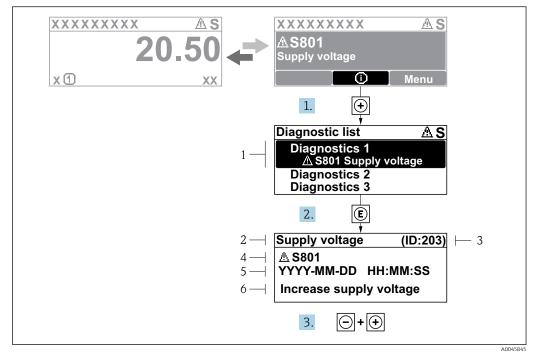
The fault can be identified using the diagnostics event. The event text helps you by providing information about the fault. In addition, the corresponding symbol is displayed before the diagnostics event.



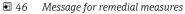
If two or more diagnostic messages are pending simultaneously, only the message with the highest priority is shown. Additional pending diagnostic messages can be shown in **Diagnostic list** submenu ( $\rightarrow \cong 249$ ).

#### **Operating elements**

Operating functions in menu, submenu		
Plus key       Opens the message about the remedial measures.		
(E) A0013952	Enter key Opens the operating menu.	



#### 11.2.2 Calling up remedial measures



- 1 Diagnostic information
- 2 Short text
- 3 Service ID
- 4 Diagnostic behavior with diagnostic code
- 5 Operation time of occurrence6 Remedial measures

A diagnostic message appears in the standard view (measured value display).

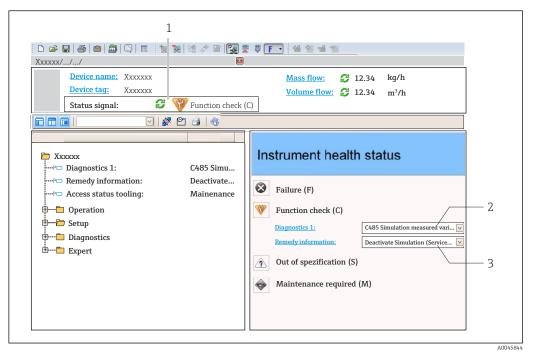
- 1. Press 🗄 (ⓒ symbol).
  - ← The **Diagnostic list** submenu opens.
- **2.** Select the desired diagnostic event with  $\pm$  or  $\Box$  and press  $\mathbb{E}$ .
  - └ The message for the remedial measures for the selected diagnostic event opens.
- 3. Press  $\Box$  +  $\pm$  simultaneously.
  - └ The message for the remedial measures closes.

The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or in the **Previous diagnostics**.

- 1. Press E.
  - └ The message for the remedial measures for the selected diagnostic event opens.
- 2. Press = +  $\pm$  simultaneously.
  - ← The message for the remedial measures closes.

## 11.3 Diagnostic information in FieldCare

Any faults detected by the measuring device are displayed on the home page of the operating tool once the connection has been established.



- 1 Status area with status signal
- 2 Diagnostic information
- 3 Remedial measures with Service ID

Furthermore, diagnostic events that have occurred can be viewed in the **Diagnostic list** submenu.

## 11.3.1 Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
A0017271	Failure A device error has occurred. The measured value is no longer valid.
A0017278	<b>Function check</b> The device is in service mode (e.g. during a simulation or a warning).
A0017277	Out of specification The device is operated outside its technical specification limits (e.g. outside the process temperature range)
A0017276	Maintenance required Maintenance is required. The measured value is still valid.

The status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

## 11.3.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly:

- On the home page
- Remedy information is displayed in a separate field below the diagnostics information.
- In the **Diagnostics** menu Remedy information can be called up in the working area of the user interface.

The user is in the **Diagnostics** menu.

1. Call up the desired parameter.

- 2. On the right in the working area, mouse over the parameter.
  - ← A tool tip with remedy information for the diagnostic event appears.

11.4	Overview of the diagnostic messages
------	-------------------------------------

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of :	sensor			
102	Sensor incompatible error	<ol> <li>Restart device</li> <li>Contact service</li> </ol>	F	Alarm
150	Detector error	<ol> <li>Restart device</li> <li>Check electrical connections of detector</li> <li>Replace detector unit</li> </ol>	F	Alarm
151	Sensor electronic failure	Replace sensor electronic module	F	Alarm
Diagnostic of	electronic		-	
242	Software incompatible	<ol> <li>Check software</li> <li>Flash or change main electronic module</li> </ol>	F	Alarm
252	Modules incompatible	<ol> <li>Check if correct electronic module is plugged</li> <li>Replace electronic module</li> </ol>	F	Alarm
261	Electronic modules	<ol> <li>Restart device</li> <li>Check electronic modules</li> <li>Change I/O module or main electronics</li> </ol>	F	Alarm
262	Module connection	<ol> <li>Check module connections</li> <li>Replace electronic modules</li> </ol>	F	Alarm
270	Main electronics failure	Replace main electronics	F	Alarm
271	Main electronics failure	<ol> <li>Restart device</li> <li>Change main electronic module</li> </ol>	F	Alarm
272	Main electronics failure	Restart device	F	Alarm
272	Main electronics failure	<ol> <li>Restart device</li> <li>Contact service</li> </ol>	F	Alarm
273	Main electronics failure	<ol> <li>Emergency operation via display</li> <li>Change main electronics</li> </ol>	F	Alarm
275	I/O module failure	<ol> <li>Restart device</li> <li>Change I/O module</li> </ol>	F	Alarm
276	I/O module faulty	<ol> <li>Restart device</li> <li>Change I/O module</li> </ol>	F	Alarm
282	Data storage	<ol> <li>Restart device</li> <li>Contact service</li> </ol>	F	Alarm
283	Memory content	1. Transfer data or reset device 2. Contact service	F	Alarm
284	Detector SW update in progress	Firmware update active, please wait!	F	Alarm
311	Electronics failure	Maintenance required! 1. Do not perform reset 2. Contact service	M	Warning
333	System recovery required	HW change detected System configuration recovery required Go to menu on device and perform recovery	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
334	System recovery failure	HW changed, system recovery failure. Return to factory	F	Alarm
381	Displacer distance invalid	<ol> <li>Calibrate sensor</li> <li>Restart device</li> <li>Replace sensor electronics</li> </ol>	F	Alarm
382	Sensor communication	<ol> <li>Check connection of sensor electronics</li> <li>Restart device</li> <li>Replace sensor electronics</li> </ol>	F	Alarm
Diagnostic of o	configuration			1
400	AIO simulation output	Deactivate simulation AIO output	С	Warning
401	DIO simulation output	Deactivate simulation DIO output	С	Warning
403	Calibration AIO	1. Restart device 2. Change I/O module	F	Alarm
404	Calibration AIP	1. Restart device 2. Change I/O module	F	Alarm
405	COMM timeout DIO 1 to 8	<ol> <li>Check wiring</li> <li>Change I/O module</li> </ol>	F	Alarm
406	IOM offline	<ol> <li>Check wiring</li> <li>Change I/O module</li> </ol>	F	Alarm
407	COMM timeout AIO 1 to 2	<ol> <li>Check wiring</li> <li>Change I/O module</li> </ol>	F	Alarm
408	Invalid range AIO 1 to 2	<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	С	Warning
409	RTD temp out of range 1 to 2	<ol> <li>Check electronic modules</li> <li>Change I/O or main electronic module</li> </ol>	С	Warning
410	Data transfer	<ol> <li>Retry data transfer</li> <li>Check connection</li> </ol>	F	Alarm
411	Hart device 1 to 15 has malfunction	1. Check HART device 2. Change HART device	F	Alarm <sup>1)</sup>
412	Processing download	Download active, please wait	С	Warning
413	NMT 1 to 15: element is open or short	<ol> <li>Check NMT wiring connection</li> <li>Replace NMT</li> </ol>	С	Warning
415	Hart device 1 to 15 offline	<ol> <li>Check HART device</li> <li>Change HART device</li> </ol>	С	Warning
416	Warning occurred for HART device 1 to 15	Check connected HART device	М	Warning
434	Real time clock defective	Replace main electronics	С	Warning
436	Date/time incorrect	Check date and time settings.	М	Warning
437	Configuration incompatible	<ol> <li>Restart device</li> <li>Contact service</li> </ol>	F	Alarm
438	Dataset	<ol> <li>Check data set file</li> <li>Check device configuration</li> <li>Up- and download new configuration</li> </ol>	М	Warning
441	AIO 1 to 2 current output alarm	<ol> <li>Check process</li> <li>Check current output settings</li> </ol>	F	Alarm
	1			

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
442	AIO 1 to 2 current output warning	<ol> <li>Check process</li> <li>Check current output settings</li> </ol>	С	Warning
443	AIO 1 to 2 Input not HART compatible	Change PV source or AIO input source.	С	Warning
484	Failure mode simulation	Deactivate simulation	С	Alarm
495	Diagnostic event simulation	Deactivate simulation	С	Warning
500	AIO C1-3 source no longer valid	Change input source	С	Warning
501	Level source no longer valid	Change input source	С	Warning
502	GP1 source no longer valid	Change input source	С	Warning
503	GP2 source no longer valid	Change input source	С	Warning
504	GP3 source no longer valid	Change input source	С	Warning
505	GP4 source no longer valid	Change input source	С	Warning
506	Water level source no longer valid	Change input source	С	Warning
507	Liquid temp source no longer valid	Change input source	С	Warning
508	Vapor temperatur source no longer valid	Change input source	С	Warning
509	Air temperature source no longer valid	Change input source	С	Warning
510	P1 source no longer valid	Change input source	С	Warning
511	P2 source no longer valid	Change input source	С	Warning
512	P3 source no longer valid	Change input source	С	Warning
513	Upper density source no longer valid	Change input source	С	Warning
514	Middle density source no longer valid	Change input source	С	Warning
515	Lower density source no longer valid	Change input source	С	Warning
516	Gauge command source no longer valid	Change input source	С	Warning
517	Gauge status source no longer valid	Change input source	С	Warning
518	Average density source no longer valid	Change input source	С	Warning
519	Upper interface source no longer valid	Change input source	С	Warning
520	Lower interface source no longer valid	Change input source	С	Warning
521	Bottom level source no longer valid	Change input source	С	Warning
522	Displacer position source not valid	Change input source	С	Warning
523	Distance source no longer valid	Change input source	С	Warning
524	Balance flag source no longer valid	Change input source	С	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
525	One time cmd source no longer valid	Change input source	С	Warning
526	Alarm 1 to 4 source no longer valid	Change input source	С	Warning
527	AIO B1-3 source no longer valid	Change input source	С	Warning
528	CTSh	<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	С	Warning
529	HTG	<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	С	Warning
530	HTMS	<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	С	Warning
531	HyTD correction value	<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	С	Warning
532	HART output: PV source not valid	Change input source	С	Warning
533	HART output: SV source not valid	Change input source	С	Warning
534	HART output: QV source not valid	Change input source	С	Warning
535	HART output: TV source not valid	Change input source	С	Warning
536	Display: source no longer valid	Change input source	С	Warning
537	Trend: source no longer valid	Change input source	С	Warning
538	HART output: PV mA source not valid	Change input source	С	Warning
539	Modbus 1-4 SP source invalid	Set valid SP input selector	С	Warning
540	V1 1-4 SP source invalid	Set valid SP input selector	С	Warning
541	Modbus 1-4 alarm source invalid	Set valid alarm input selector	С	Warning
542	V1 1-4 alarm source invalid	Set valid alarm input selector	С	Warning
543	Modbus 1-4 analog source invalid	Set valid analog input selector	С	Warning
544	V1 1-4 analog source invalid	Set valid analog input selector	С	Warning
545	Modbus 1-4 user value source invalid	Set valid user value input selector	С	Warning
546	Modbus 1-4 discrete value source invalid	Set valid user discrete input selector	С	Warning
547	V1 1-4 user value source invalid	Set valid user value input selector	С	Warning
548	V1 1-4 discrete value source invalid	Set valid user discrete input selector	С	Warning
549	Modbus 1-4 percent source invalid	Set valid percentage input selector	С	Warning
550	V1 1-4 percent source invalid	Set valid percentage input selector	С	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
560	Calibration mandatory	<ol> <li>Carry out weight calibration</li> <li>Carry out reference calibration</li> <li>Carry out drum calibration</li> </ol>	C	Alarm
564	DIO B1-2 source no longer valid	Change input source	С	Warning
565	DIO B3-4 source not valid	Change input source	С	Warning
566	DIO C1-2 source no longer valid	Change input source	С	Warning
567	DIO C3-4 source no longer valid	Change input source	С	Warning
568	DIO D1-2 source no longer valid	Change input source	С	Warning
569	DIO D3-4 source no longer valid	Change input source	С	Warning
585	Simulation distance	Deactivate simulation	С	Warning
586	Record map	Recording of mapping please wait	С	Warning
598	DIO A1-2 source no longer valid	Change input source	С	Warning
599	DIO A3-4 source no longer valid	Change input source	С	Warning
Diagnostic of J	process			
801	Energy too low	Increase supply voltage	S	Warning
803	Current loop	1. Check device configuration.	F	Alarm
803	Current loop 1 to 2	2. Check wiring.	М	Warning
803	Current loop		С	Warning
825	System temperature	1. Check ambient temperature	S	Warning
825	System temperature	2. Check process temperature	F	Alarm
826	Sensor temperature	1. Check ambient temperature	S	Warning
826	Sensor temperature	2. Check process temperature	F	Alarm
844	Process value out of specification	<ol> <li>Check process value</li> <li>Check application</li> </ol>	S	Warning <sup>1)</sup>
844	Process value out of specification	- 3. Check sensor	S	Warning
901	Level held	Normal state while Dip Freeze is turned on, otherwise check configuration	S	Warning
903	Current loop 1 to 2	<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	F	Alarm
904	Digital output 1 to 8	<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	F	Alarm
941	Echo lost	<ol> <li>Check process value</li> <li>Check application</li> <li>Check sensor</li> </ol>	S	Warning
942	In safety distance	<ol> <li>Check level</li> <li>Check safety distance</li> <li>Reset self holding</li> </ol>	S	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
943	In blocking distance	Reduced accuracy Check level	S	Warning
950	Advanced diagnostics	Maintain your diagnostic event	М	Warning
961	Alarm 1 to 4 HighHigh	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	С	Warning
962	Alarm 1 to 4 High	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	С	Warning
963	Alarm 1 to 4 Low	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	С	Warning
964	Alarm 1 to 4 LowLow	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	С	Warning
965	Alarm 1 to 4 HighHigh	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	F	Alarm
966	Alarm 1 to 4 High	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	F	Alarm
967	Alarm 1 to 4 Low	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	F	Alarm
968	Alarm 1 to 4 LowLow	<ol> <li>Check alarm source</li> <li>Check configuration settings</li> </ol>	F	Alarm
970	Overtension	<ol> <li>Check displacer and process conditions</li> <li>Release overtension</li> </ol>	С	Alarm
971	Undertension	Check displacer and process.	С	Alarm

1) Diagnostic behavior can be changed.



The parameters No.941, 942, and 943 are only used for NMR8x and NRF81.

## 11.5 Diagnostic list

In the Diagnostic list submenu, up to 5 currently pending diagnostic messages can be displayed. If more than 5 messages are pending, the messages with the highest priority are shown on the display.

#### Navigation path

Diagnostics  $\rightarrow$  Diagnostic list

#### Calling up and closing the remedial measures

1. Press E.

└ The message for the remedial measures for the selected diagnostic event opens.

2. Press - + + simultaneously.

└ The message about the remedial measures closes.

## 11.6 Reset measuring device

To reset the device to a defined state use the **Device reset** parameter ( $\rightarrow \triangleq 244$ ).

## 11.7 Device information

Information on the device (order code, hardware and software version of the individual modules etc.) can be found in the **Device information** submenu ( $\rightarrow \textcircled{B} 250$ ).

## 11.8 Firmware history

Date	Software	Modifications	Documentation (NMR81)			
version		Operating Instructions	Description of Parameters	Technical Information		
04.2016	01.00.zz	Original software	BA01450G/00/EN/01.16	GP01068G/00/EN/01.16	TI01252G/00/EN/01.16	
12.2016	01.02.zz	Bugfixes and improvements	BA01450G/00/EN/02.17	GP01068G/00/EN/02.17	TI01252G/00/EN/02.17	
07.2018	01.03.zz	Software update	BA01450G/00/EN/04.18		TI01252G/00/EN/03.18	
05.2020	01.04.zz	Software update	BA01450G/00/EN/05.20		TI01252G/00/EN/04.20	
08.2021	01.05.zz	Software update	BA01450G/00/EN/06.21	GP01068G/00/EN/ 04.22-00	TI01252G/00/EN/05.21	
08.2022	01.06.zz	Software update	BA01450G/00/EN/ 07.22-00		TI01252G/00/EN/06.22-00	

## 12 Maintenance

## 12.1 Maintenance tasks

No special maintenance work is required.

## 12.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

## 12.2 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

## 13 Repair

## 13.1 General information on repairs

## 13.1.1 Repair concept

The Endress+Hauser repair concept assumes that the devices have a modular design and that repairs can be done by the Endress+Hauser service or specially trained customers.

Spare parts are contained in suitable kits. They contain the related replacement instructions.

For more information on service and spare parts, contact the Service Department at Endress+Hauser.

## 13.1.2 Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, please note the following:

- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry out the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

## 13.1.3 Replacement of a device or electronic module

After a complete device or the electronic mainboard has been replaced, the parameters can be downloaded into the instrument again via FieldCare.

Condition: The configuration of the old device has been saved to the computer via FieldCare.

You can continue to measure without carrying out a new setup. Only a linearization and a tank map (interference echo suppression) have to be recorded again.



#### The "Save/Restore" function

After a device configuration has been saved to a computer and restored to the device using the **Save/Restore** function of FieldCare, the device must be restarted by the following setting:

Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Administration  $\rightarrow$  Device reset = Restart device. This ensures correct operation of the device after the restore.

## 13.2 Spare parts

Some interchangeable measuring device components are listed on an overview sign in the connection compartment cover.

The spare part overview sign contains the following information:

- A list of the most important spare parts for the measuring device, including their ordering information.
- The URL for the *W@M Device Viewer* (www.endress.com/deviceviewer): All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.

## 13.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

## 13.4 Return

The requirements for safe device return can vary depending on the device type and national legislation.

- Refer to the web page for information: http://www.endress.com/support/return-material
   Select the region.
- 2. Return the device if repairs or a factory calibration are required, or if the wrong device was ordered or delivered.

## 13.5 Disposal

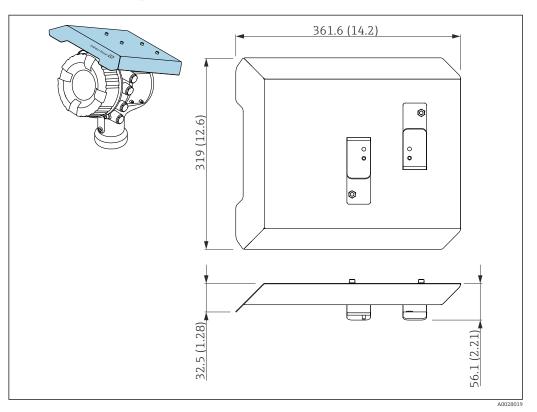
## X

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

#### 14 Accessories

#### **Device-specific accessories** 14.1

#### 14.1.1 Weather protection cover



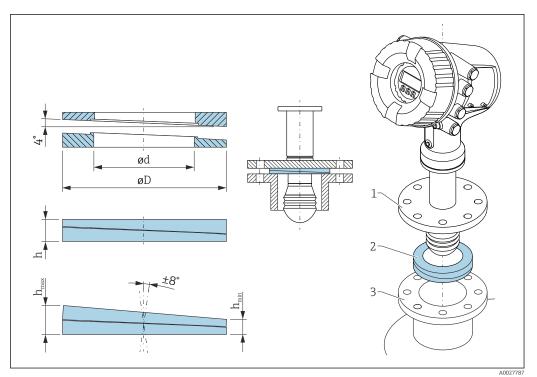
**4**7 Weather protection cover; dimensions: mm (in)

#### Materials

- Protection cover and mounting brackets Material 316L (1.4404)
- Screws and washers Material

A4

- The weather protection cover can be ordered together with the device: -
  - Ordering feature 620 "Accessory Enclosed", option PA "Weather Protection Cover") • It can also be ordered as an accessory:
    - Order code: 71292751 (for NMR8x and NRF8x)



## 14.1.2 Adjustable seal

• 48 Adjustable seal used to align the device by  $\pm 8^{\circ}$ 

P 1)	620 <sup>2)</sup>				
	PS	PT	PU		
OC <sup>3)</sup>	71285499	71285501	71285503		
C <sup>4)</sup>	DN50 PN10-40 ASME 2" 150lbs JIS 50A 10K	DN80 PM10-40	ASME 3" 150lbs JIS 80A 10K		
L <sup>5)</sup>	100 mm (3.9 in)	100 mm (3.9 in)	100 mm (3.9 in)		
S <sup>6)</sup>	M14	M14	M14		
M 7)	FKM	FKM	FKM		
P <sup>8)</sup>	-0.1 to +0.1 bar (-1.45 to +1.45 psi)				
T <sup>9)</sup>		-40 to +80 °C (-40 to +176 °F)			
ØD	105 mm (4.13 in)	142 mm (5.59 in)	133 mm (5.24 in)		
Ød	60 mm (2.36 in)	89 mm (3.5 in)	89 mm (3.5 in)		
h	16.5 mm (0.65 in)	22 mm (0.87 in)	22 mm (0.87 in)		
h <sub>min</sub>	9 mm (0.35 in)	14 mm (0.55 in)	14 mm (0.55 in)		
h <sub>max</sub>	24 mm (0.95 in)	30 mm (1.18 in)	30 mm (1.18 in)		

1) Property

2) Ordering feature 620 "Accessory Enclosed". With this ordering feature the adjustable seal is supplied together with the device.

4) Compatible with

5) Length of screws

6) Size of screws

7) Material

8) Process pressure

9) Process temperature

<sup>3)</sup> This order code must be used if the adjustable seal is ordered separately.

## 14.2 Communication-specific accessories

#### WirelessHART adapter SWA70

- Is used for the wireless connection of field devices
- The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks

For details, see Operating Instructions BA00061S

#### Gauge Emulator, Modbus to BPM

- Using the protocol converter, it is possible to integrate a field device into a host system even if the field device does not know the communication protocol of the host system. Eliminates vendor lock-in for field devices.
- Field communication protocol (field device): Modbus RS485
- Host communication protocol (host system): Enraf BPM
- 1 measuring device per Gauge Emulator
- Separate power supply: 100 to 240  $V_{AC}$ , 50 to 60 Hz, 0.375 A, 15 W
- Several approvals for the hazardous area

#### Gauge Emulator, Modbus to TRL/2

- Using the protocol converter, it is possible to integrate a field device into a host system even if the field device does not know the communication protocol of the host system. Eliminates vendor lock-in for field devices.
- Field communication protocol (field device): Modbus RS485
- Host communication protocol (host system): Saab TRL/2
- 1 measuring device per Gauge Emulator
- Separate power supply: 100 to 240  $V_{AC}$ , 50 to 60 Hz, 0.375 A, 15 W
- Several approvals for the hazardous area

## 14.3 Service-specific accessories

#### **Commubox FXA195 HART**

For intrinsically safe HART communication with FieldCare via the USB interface

For details, see "Technical Information" TI00404F

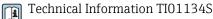
#### **Commubox FXA291**

Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop Order number: 51516983

For details, see "Technical Information" TI00405C

#### DeviceCare SFE100

Configuration tool for HART, PROFIBUS and FOUNDATION Fieldbus field devices DeviceCare is available for download at <u>www.software-products.endress.com</u>. You need to register in the Endress+Hauser software portal to download the application.



#### FieldCare SFE500

FDT-based plant asset management tool

It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.



Technical Information TI00028S

## 14.4 System components

#### RIA15

Compact process display unit with very low voltage drop for universal use to display 4 to 20 mA/HART signals

Technical Information TI01043K

# Tankvision Tank Scanner NXA820 / Tankvision Data Concentrator NXA821 / Tankvision Host Link NXA822

Inventory Management System with completely integrated software for operation via standard web browser

Technical Information TI00419G

## 15 Operating menu

• 🗐 : Navigation path for operating module at the device

- 🗐 : Navigation path for operating tool (e.g. FieldCare)
- 🖻 : Parameter can be locked via software locking

## 15.1 Overview of the operating menu

• This section lists the parameters of the following menus:

- Operation (→ 🖺 116)
- Setup (→ 🗎 125)
- Diagnostics ( $\rightarrow \square 246$ )
- For the **Expert** menu refer to the "Description of Device Parameters" (GP) of the respective device.
- Depending on the device version and parametrization some parameters will not be available in a given situation. For details refer to the "Prerequisite" category in the description of the respective parameter.
- The representation essentially corresponds to the menu in an operating tool (e.g. FieldCare). On the local display there may be minor differences in the menu structure. Details are mentioned in the description of the respective submenu.

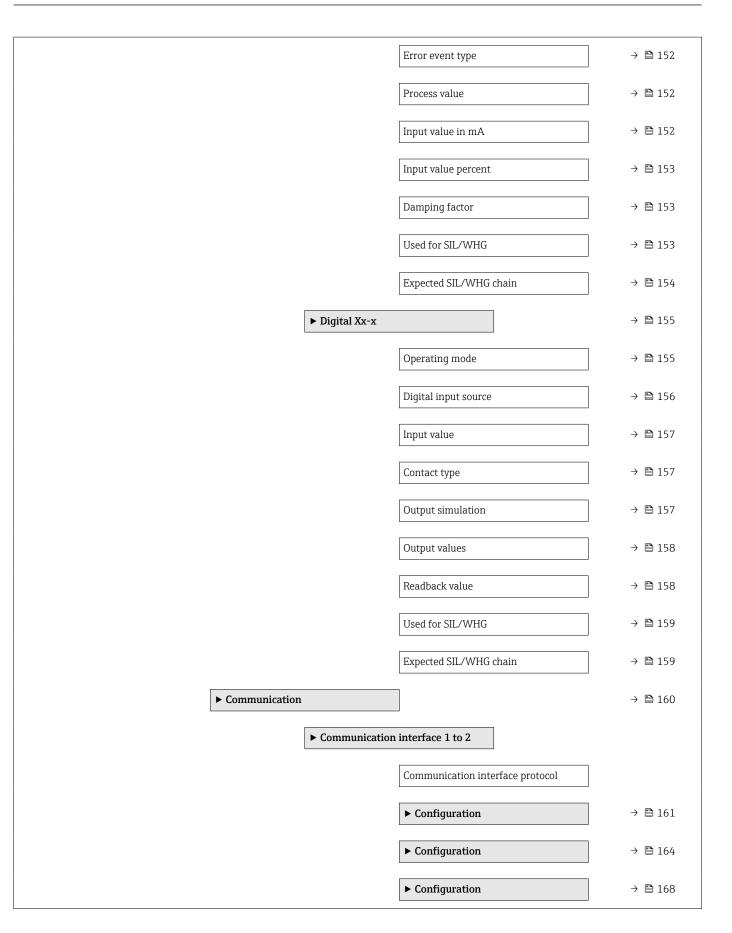
Navigation	8 8	Operating tool
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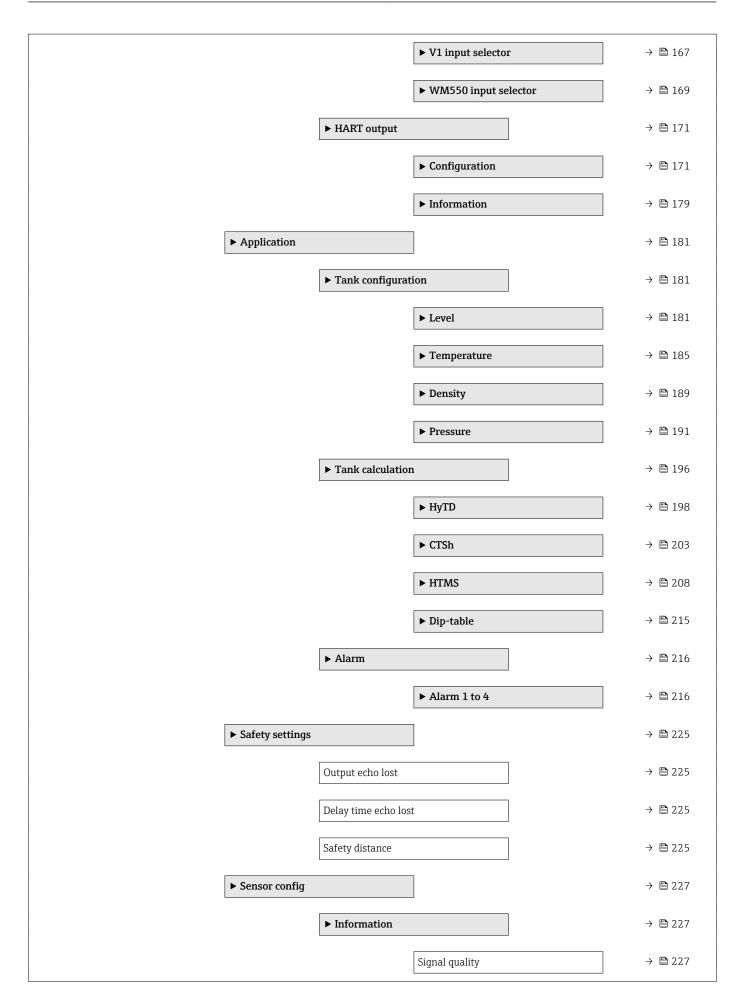
	→ 🗎 116
	→ 🗎 116
Dip Freeze	→ 🗎 116
Tank level	→ 🗎 116
Tank Level %	→ 🗎 116
Tank ullage	→ 🗎 117
Tank ullage %	→ 🗎 117
Upper interface level	→ 🗎 117
Lower interface level	→ 🗎 117
Water level	→ 🗎 118
Measured level	→ 🗎 118
Distance	→ 🗎 118
rature	→ 🗎 118
Air temperature	→ 🗎 118
Liquid temperature	→ 🗎 119
	Tank level   Tank Level %   Tank ullage   Tank ullage %   Upper interface level   Lower interface level   Water level   Measured level   Distance   rature

-	Vapor temperature		→ 🗎 119
[	► NMT element values		→ 🗎 119
	► Elemen	nt temperature	→ 🗎 119
		Element temperature 1 to 24	→ 🖺 119
	► Elemen	nt position	→ 🗎 120
		Element position 1 to 24	→ 🗎 120
► Density			→ 🗎 120
	Observed density		→ 🗎 120
	Observed density temperature		→ 🗎 120
	Vapor density		→ 🗎 121
	Air density		→ 🗎 121
[	Measured upper density		→ 🗎 121
	Measured middle density		→ 🗎 121
[	Measured lower density		→ 🗎 122
► Pressure			→ 🗎 122
[	P1 (bottom)		→ 🗎 122
[	P3 (top)		→ 🗎 122
► GP values			→ 🗎 123
	GP 1 to 4 name		→ 🗎 123
[	GP Value 1		→ 🗎 123
	GP Value 2		→ 🗎 123
	GP Value 3		→ 🗎 123
[	GP Value 4		→ 🗎 124
🖌 Setup			→ 🗎 125
Device tag			→ 🗎 125

Units preset		]		→ 🗎 125
Empty		]		→ 🗎 126
Tank reference heig	ht	]		→ 🖺 126
Tank level		]		→ 🗎 116
Set level				→ 🗎 127
Confirm distance				→ 🗎 127
Present mapping				→ 🗎 128
Mapping end point				→ 🗎 129
Record map		]		→ 🗎 129
Distance		]		→ 🗎 130
Liquid temp source		]		→ 🗎 130
<ul> <li>Advanced setup</li> </ul>		]		→ 🗎 131
- Auvanceu Setup			1	
	Locking status			→ 🗎 131
	User role			→ 🖺 131
	Enter access code		]	→ 🗎 131
	► Input/output		]	→ 🗎 132
		► HART devices		→ 🗎 132
			Number of devices	→ 🗎 132
			► HART Device(s)	→ 🗎 133
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			RTD type	→ 🖺 139
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	100 % value	→ 🗎 142
	Input value	→ 🗎 142
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	Maximum probe temperature	→ 🗎 143
	Probe position	→ 🗎 143
	Damping factor	→ 🗎 144
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	Failure mode	→ 🗎 148
	Error value	→ 🖺 149
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	Analog input 0% value	→ 🗎 151
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	Relative echo amplitude	→ 🖹 227
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	► Echo tracking	→ 🗎 229
	Evaluation mode	→ 🗎 229
	History reset	→ 🗎 229
► Display		→ 🗎 230
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			Set date	→ 🗎 240
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	Device tag	→ 🗎 250
	Serial number	→ 🗎 250
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► Device check		→ 🗎 256
	Start device check	→ 🖺 256
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# 15.2 "Operation" menu

The **Operation** menu ( $\rightarrow \implies$  116) shows the most important measured values.

*Navigation* 🗟 🖾 Operation

#### 15.2.1 "Level" submenu

*Navigation*  $\square \square$  Operation  $\rightarrow$  Level

Dip Freeze	
Navigation	
Description	If activated the level values are frozen and a warning is shown.
Selection	<ul><li>Off</li><li>On</li></ul>
Factory setting	Off
Additional information	This function can be used when performing a manual dipping in the same stilling well or nozzle where the radar device is mounted.

Tank level		
Navigation	$ \blacksquare \Box  \text{Operation} \rightarrow \text{Level} \rightarrow \text{Tank} $	level
Description	Shows the distance from the zero surface.	position (tank bottom or datum plate) to the product
Additional information	Read access	Operator
	Write access	-

Tank Level %			
Navigation	$  \  \  \  \  \  \  \  \  \  \  \  \  \$	Level %	
Description	Shows the level as a percentage of the full measuring range.		
Additional information	Read access Operator		
	Write access	-	

Tank ullage			
Navigation	$ \blacksquare \Box  \text{Operation} \rightarrow \text{Level} \rightarrow \text{Tank} $	ullage	
Description	Shows the remaining empty space in the tank.		
Additional information	Read access	Operator	
	Write access	-	

Tank ullage %			
Navigation		cullage %	
Description	Shows the remaining empty space in percentage related to parameter tank reference height.		
Additional information	Read access	Operator	
	Write access	-	

Upper interface level		
Navigation		er I/F level
Description	Shows measured interface level from zero position (tank bottom or datum plate). Value is updated when device generates a valid Interface measurement.	
Additional information Read access Maintenance		Maintenance
	Write access	-

Lower interface level		
Navigation		er I/F level
Description	Shows measured interface level from zero position (tank bottom or datum plate). Value is updated when device generates a valid interface measurement.	
Additional information Read access Maintenance		Maintenance
	Write access	-

Operating	menu
-----------	------

Water level			
Navigation		er level	
Description	Shows the bottom water level.		
Additional information	Read access	Operator	
	Write access	-	
Measured level			
Navigation			
Description	Shows the measured level without any correction from the tank calculations.		
Additional information	Read access Operator		
	Write access -		
Distance			
Navigation			
Description	Distance from lower edge of device flange to product surface.		

Additional information	Read access	Operator
	Write access	-

## 15.2.2 "Temperature" submenu

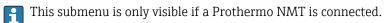
Navigation

Air temperature		
Navigation		$\rightarrow$ Air temp.
Description	Shows the air temperature.	
Additional information	Read access Operator	
	Write access	-

Liquid temperature		
Navigation	Image: B □ Operation → Temperature	→ Liquid temp.
Description	Shows the average or spot temperature of the measured liquid.	
Additional information	formation Read access Operator	
	Write access	-

Vapor temperature				
Navigation	$\blacksquare$ □ Operation → Temperature	$e \rightarrow$ Vapor temp.		
Description	Shows the measured vapor temperature.			
Additional information	Read access	Read access Operator		
	Write access	-		

'NMT element values" submenu	u	
------------------------------	---	--



*Navigation*  $\square$  Operation  $\rightarrow$  Temperature  $\rightarrow$  NMT elem. values

"Element temperature" submenu

Navigation $\Box$ Operation  $\rightarrow$  Temperature  $\rightarrow$  NMT elem. values  $\rightarrow$  Element<br/>temp.

Element temperature 1 to 24				
Navigation		Operation → Temperature 1 to 24	→ NMT elem. values → Element temp. → Element temp	
Description	Shows the temperature of an element in the NMT.			
Additional information	Read	Read access Operator		
	Writ	e access	-	

"Element position" submenu

Navigation

Element position 1 to 24			
Navigation		Operation $\rightarrow$ Temperature 1 to 24	→ NMT elem. values → Element position → Element pos.
Description	Show	rs the position of the selected	d element in the NMT.
Additional information	Read	access	Operator
	Write	access	-

#### 15.2.3 "Density" submenu

Navigation

Observed density		
Navigation	$ \blacksquare \square  Operation \rightarrow Density \rightarrow C $	bserved density
Description	Calculated density of the product.	
Additional information	Read access Operator	
	Write access	-

This value is calculated from different measured variables depending on the selected calculation method.

Observed density temperat	ture	
Navigation	□ □ Operation → Density → Obs. dens. temp.	
Description	Corresponding temperature of measured density. Can be used for reference density calculation.	
User interface	Signed floating-point number	
Factory setting	0 °C	

Vapor density		ß
Navigation	$ \blacksquare \Box  \text{Operation} \rightarrow \text{Density} \rightarrow V $	apor density
Description	Defines the density of the gas pl	hase in the tank.
User entry	0.0 to 500.0 kg/m <sup>3</sup>	
Factory setting	1.2 kg/m <sup>3</sup>	
Additional information	Read access	Operator
	Write access	Maintenance

Air density		۵	
Navigation	$ \blacksquare \Box  \text{Operation} \rightarrow \text{Density} \rightarrow A $	ir density	
Description	Defines the density of the air su	Defines the density of the air surrounding the tank.	
User entry	0.0 to 500.0 kg/m <sup>3</sup>		
Factory setting	1.2 kg/m <sup>3</sup>		
Additional information	Read access	Operator	
	Write access	Maintenance	

Measured upper density		
Navigation		eas upper dens.
Description	Shows the density of the upper phase.	
Additional information	Read access Operator	
	Write access	-

Measured middle density		
Navigation	8 8	Operation $\rightarrow$ Density $\rightarrow$ Meas middle dens

**Description** Density of the middle phase.

Additional information	Read access	Operator
	Write access	-

#### Measured lower density

**Navigation** B Operation  $\rightarrow$  Density  $\rightarrow$  Meas lower dens.

Description

Density of the lower phase.

Additional information	Read access	Maintenance
	Write access	-

#### 15.2.4 "Pressure" submenu

Navigation

# P1 (bottom) Navigation Image: Operation $\rightarrow$ Pressure $\rightarrow$ P1 (bottom)

**Description** Shows the pressure at the tank bottom.

Additional information	Read access	Operator
	Write access	-

P3 (top)		
Navigation		3 (top)
Description	Shows the pressure (P3) at the top transmitter.	
Additional information	Read access	Operator
	Write access	-

#### 15.2.5 "GP values" submenu

*Navigation*  $\square \square$  Operation  $\rightarrow$  GP values

GP 1 to 4 name			
Navigation		GP 1 name	
Description	Defines the label associated with	Defines the label associated with the respective GP value.	
User entry	Character string comprising numbers, letters and special characters (15)		
Factory setting	GP Value 1		
Additional information	Read access	Operator	
	Write access	Maintenance	

GP Value 1		
Navigation		GP Value 1
Description	Displays the value that will be used as general purpose value.	
Additional information	Read access Operator	
	Write access	-

GP Value 2		
Navigation		GP Value 2
Description	Displays the value that will be used as general purpose value.	
Additional information	Read access Operator	
	Write access	-

GP Value 3	
Navigation	Image: Boost of the second secon
Description	Displays the value that will be used as general purpose value.

Additional information	Read access	Operator
	Write access	-

GP Value 4			
Navigation			
Description	Displays the value that will be used as general purpose value.		
Additional information	Read access Operator		
	Write access	-	

#### "Setup" menu 15.3

Navigation

🗟 🛛 Setup

Device tag			
Navigation	Image: Setup → Device tag		
Description	Enter a unique name for the measuring point to identify the device quickly within the plant.		
User entry	Character string comprising numbers, letters and special characters (32)		
Factory setting	NMR8x		
Additional information	Read access Operator		
	Write access	Maintenance	

Units preset			
Navigation	Image: Barbon Setup → Units pr	□ $□$ Setup → Units preset	
Description	Defines a set of units fo	or length, pressure and temperature.	
Selection	<ul> <li>mm, bar, °C</li> <li>m, bar, °C</li> <li>mm, PSI, °C</li> <li>ft, PSI, °F</li> <li>ft-in-16, PSI, °F</li> <li>ft-in-8, PSI, °F</li> <li>Customer value</li> </ul>		
Factory setting	mm, bar, °C		
Additional information	Read access	Operator	
	Write access	Maintenance	

respective unit: • Distance unit ( $\rightarrow \cong 237$ )

- Pressure unit (→ 
  <sup>●</sup> 238)
  Temperature unit (→ 
  <sup>●</sup> 238)

Empty			Ê
Navigation			
Description	Distance from reference point to	Distance from reference point to zero position (tank bottom or datum plate).	
User entry	0 to 10 000 000 mm		
Factory setting	Dependent on the device version		
Additional information	Read access Operator		
	Write access	Maintenance	

The reference point is the lower edge of the device flange.

- After changing the **Empty** parameter (→ 
   <sup>™</sup> 126), the **Table mode** parameter (→ 
   <sup>™</sup> 215) is automatically set to **Disable**.
  - If **Empty** ( $\rightarrow \triangleq 126$ ) has been changed by more than 20 mm (0.8 in), it is recommended to delete the dip table.
  - The dip table values are not affected by a change of the **Empty** parameter (→ 
     <sup>(→)</sup> 126).

Tank reference height			
Navigation	Image: Setup → Tank ref height		
Description	Defines the distance from the dipping reference point to the zero position (tank bottom or datum plate).		
User entry	0 to 10 000 000 mm		
Factory setting	Dependent on the device version		
Additional information	Read access     Operator		
	Write access	Maintenance	

Tank level		
Navigation		
Description	Shows the distance from the zero position (tank bottom or datum plate) to the product surface.	
Additional information	Read access Operator	
	Write access	-

Set level		8	
Navigation	□ Setup $\rightarrow$ Set leve	1	
Description	-	If the level measured by the device does not match the actual level obtained by a manual dip, enter the correct level into this parameter.	
User entry	0 to 10 000 000 mm	0 to 10 000 000 mm	
Factory setting	0 mm		
Additional information	Read access	Read access     Operator	
	Write access	Maintenance	

The device adjusts the **Empty** parameter ( $\rightarrow \triangleq 126$ ) according to the entered value, such that the measured level will match the actual level.

- After the change of the **Empty** parameter ( $\rightarrow \cong 126$ ), the **Table mode** parameter ( $\rightarrow \cong 215$ ) is automatically set to **Disable**.
  - If **Empty** has been changed by more than 20 mm (0.8 in), it is recommended to delete the dip table.
  - The dip table values are not affected by a change of the **Empty** parameter.

Confirm distance			Ê
Navigation	□ Setup $\rightarrow$ Confirm dista	nce	
Description	Specify, whether the measured distance matches the real distance. Depending on the selection the device automatically sets the range of mapping.		
Selection	<ul> <li>Distance ok</li> <li>Distance unknown</li> <li>Distance too small *</li> <li>Distance too big *</li> <li>Tank empty</li> <li>Manual map</li> <li>Factory map</li> </ul>		
Factory setting	Distance unknown		
Additional information	Read access	Operator	
	Write access	Maintenance	

<sup>\*</sup> Visibility depends on order options or device settings

#### Meaning of the options

Distance ok

To be selected if the measured distance matches the actual distance. The device performs a mapping.

Distance unknown

To be selected if the actual distance is unknown. No mapping will be recorded in this case.

Distance too small <sup>5)</sup>

To be selected if the measured distance is smaller than the actual distance. The device searches for the next echo and returns to the **Confirm distance** parameter ( $\rightarrow \implies 127$ ). The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **"Distance ok" option**.

Distance too big<sup>5)</sup>

To be selected if the measured distance exceeds the actual distance. The device adjusts the signal evaluation and returns to the **Confirm distance** parameter ( $\rightarrow \square 127$ ). The distance is recalculated and displayed. The comparison must be repeated until the displayed distance matches the actual distance. After this, the recording of the map can be started by selecting **"Distance ok" option**.

Tank empty

To be selected if the tank is completely empty. The device records a mapping covering the complete measuring range as defined by the **Empty** parameter ( $\rightarrow \square$  126).

Manual map

To be selected if the range of mapping is to be defined manually in the **Mapping end point** parameter ( $\Rightarrow \square 129$ ). In this case it is not necessary to confirm the distance.

Factory map

To be selected if the present mapping curve (if one exists) is to be deleted. The factory map is used, instead.

When operating via the display module, the measured distance is displayed together with this parameter for reference purposes.

If the teaching procedure with the **Distance too small** or **Distance too big** option is quit before the distance has been confirmed, a map is **not** recorded and the teaching procedure is reset after 60 s.

#### **Present mapping**

Navigation

 $\square$  Setup  $\rightarrow$  Present mapping

**Description** Present end of mapping.

Additional information

Read access	Operator
Write access	-

<sup>5)</sup> Only available for "Evaluation mode ( $\rightarrow \square 229$ )" = "Short time history"

Mapping end point			
Navigation	□ Setup $\rightarrow$ Map. end po	□ Setup $\rightarrow$ Map. end point	
Prerequisite	Confirm distance (> 🗎 12	27) = Manual map	
Description	*	Defines up to which distance the new mapping has to be recorded. Remark: Make sure the level signal is not covered by the mapping.	
User entry	100 to 999 999.9 mm		
Factory setting	100 mm		
Additional information	Read access Operator		
	Write access	Maintenance	

Record map		<u>Â</u>
Navigation	□ Setup $\rightarrow$ Record map	
Prerequisite	Confirm distance ( $\rightarrow \cong 127$ ) =	= Manual map
Description	Controls the recording of the m	ap.
Selection	<ul> <li>No</li> <li>Record map</li> <li>Overlay map</li> <li>Factory map</li> <li>Delete partial map</li> </ul>	
Factory setting	No	
Additional information	Read access     Operator	

#### Meaning of the options

No

- The map is not recorded.
- Record map

Write access

The map is recorded. After the recording is completed, the new measured distance and the new mapping range appear on the display. When operating via the local display, these values must be confirmed by pressing  $\square$ .

Maintenance

Recalculate map

Used internally by the software. Initiates a new calculation of the map from the new data points.

#### Overlay map

The new mapping curve is generated by overlaying the old and the current envelope curves.

A

Factory map

The factory map stored in the ROM of the device is used.

- Delete partial map The mapping curve is deleted up to Mapping end point (→ 
  <sup>□</sup> 129).
  Stop overlay
- Stops the overlaying of the map.

Distance			
Navigation	□ $□$ Setup $→$ Distance		
Description	Distance from lower edge of device flange to product surface.		
Additional information	Read access Operator		
	Write access	-	

#### Liquid temp source

Navigation	Setup → Liq temp source		
Description	Defines source from which the liquid temperature is obtained.		
Selection	<ul> <li>Manual value</li> <li>HART device 1 15 temperatu</li> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> <li>AIP C4-8 value</li> </ul>	re	
Factory setting	Manual value		
Additional information	Read access	Operator	
	Write access	Maintenance	

### 15.3.1 "Advanced setup" submenu

*Navigation*  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup

Locking status			
Navigation	Image: Barbon Setup → Advanced setup -	> Locking status	
Description	Indicates the type of locking.		
	'Hardware locked' (HW) The device is locked by the 'WP' s switch into the OFF position.	witch on the main electronics module. To unlock, set the	
	'WHG locked' (SW) Unlock the device by entering the appropriate access code in 'Enter access code'.		
	'SIL locked' (SW) Unlock the device by entering the appropriate access code in 'Enter access code'.		
	'Temporarily locked' (SW) The device is temporarily locked by processes in the device (e.g. data upload/download, reset). The device will automatically be unlocked after completion of these processes.		
Additional information	Read access	Operator	
	Write access	Operator -	

$tup \rightarrow Advanced setup \rightarrow User role$		
Shows the access authorization to the parameters via the operating tool		
Read access Operator		
ess -		

Enter access code			
Navigation	■ Setup → Advanced setup $\exists$	→ Ent. access code	
Description	Enter access code to disable write protection of parameters.		
Additional information	Read access     Operator		
	Write access	Operator	

	"Input/output" submenu		
	Navigation	®= S	Setup $\rightarrow$ Advanced setup $\rightarrow$ Input/output
	"HART devices" subn	nenu	
	Navigation	®= S	Setup $\rightarrow$ Advanced setup $\rightarrow$ Input/output $\rightarrow$ HART devices
Number of devices			
Navigation	■ $\square$ Setup $\rightarrow$ Adv	anced se	etup $\rightarrow$ Input/output $\rightarrow$ HART devices $\rightarrow$ Number devices
Description	Shows the number of devices on the HART bus.		
Additional information	Read access		Operator
	Write access		-

	There is a <b>HART Device(s)</b> submenu for each HART slave device found on the HART loop.		
	Navigation		$\rightarrow$ Advanced setup $\rightarrow$ Input/output $\rightarrow$ HART devices RT Device(s)
Device name			
Navigation	Image: Bold Setup → Adv→ Device na	-	→ Input/output → HART devices → HART Device(s)
Description	Shows the name of	the transmit	er.
Additional information	Read access		Operator
	Write access		-
Polling address			
Navigation	Setup → Advanced setup → Input/output → HART devices → HART Device(s) → Polling address		
Description	Shows the polling address of the transmitter.		
Additional information	Read access Operator		
	Write access		-
Device tag			
Navigation	■ Setup $\rightarrow$ Adv $\rightarrow$ Device tag		→ Input/output → HART devices → HART Device(s)

"HART Device(s)" submenu

**Description** Shows the device tag of the transmitter.

Read access	Operator
Write access	-

Additional information

Operating mode		٦
Navigation	Image: Setup → Advanced setup → Operating mode	→ Input/output → HART devices → HART Device(s)
Prerequisite	Not available if the HART device	e is a Prothermo NMT.
Description	Selection of the operation mode PV only or PV,SV,TV,QV. Devines which values are polled from the connected HART Device.	
Selection	<ul> <li>PV only</li> <li>PV,SV,TV &amp; QV</li> <li>Level <sup>6)</sup></li> <li>Measured level <sup>6)</sup></li> </ul>	
Factory setting	PV,SV,TV & QV	
Additional information	Read access	Operator
	Write access	Maintenance

Communication status			
Navigation	Image: Setup → Advance → Comm. status	ed setup $\rightarrow$ Input/output $\rightarrow$ HART devices $\rightarrow$ HART Device(s)	
Description	Shows the operating status of the transmitter.		
User interface	<ul><li> Operating normally</li><li> Device offline</li></ul>		
Additional information	dditional information Read access Operator		
	Write access	-	

#### #blank# ( HART PV - designation dependent on device)

Navigation	8 2	Setup → Advanced setup → Input/output → HART devices → HART Device(s) → #blank#	
Description	Shows	Shows the first HART variable (PV).	
Additional information	Read a	access Operator	
	Write	access -	

<sup>6)</sup> only visible if the connected device is a Micropilot

#blank# (HART SV - designation dependent on device)				
Navigation	Setup → Advanced setup → → #blank#	→ Input/output → HART devices → HART Device(s)		
Prerequisite	For HART devices other than NMT: <b>Operating mode (→ 🗎 134) = PV,SV,TV &amp; QV</b>			
Description	Shows the second HART variable (SV).			
Additional information	Read access Operator			
	Write access	-		

#blank# (HART TV - designation dependent on device)				
Navigation		Setup → Advanced setup → Input/output → HART devices → HART Device(s) → #blank#		
Prerequisite	For HAR	For HART devices other than NMT: <b>Operating mode (→ 🗎 134) = PV,SV,TV &amp; QV</b>		
Description	Shows th	Shows the third HART variable (TV).		
Additional information	Read acce	Read access Operator		
	Write acce	ess	-	

#blank# (HART QV - designation dependent on device)			
Navigation	Image: Setup → Advanced setup → #blank#	→ Input/output → HART devices → HART Device(s)	
Prerequisite	For HART devices other than NM	T: Operating mode (→ 🗎 134) = PV,SV,TV & QV	
Description	Shows the fourth HART variable (QV).		
Additional information	Read access	Operator	
	Write access	-	

Output pressure		
Navigation	Setup → Advanced setup → Input/output → HART devices → HART Device(s) → Output pressure	
Prerequisite	Not available for Micropilot S FMR5xx, Prothermo NMT53x and Prothermo NMT8x. In these cases the measured variables are allocated automatically.	

Description	Defines which HART variable is the pressure.	
Selection	<ul> <li>No value</li> <li>Primary variable (PV)</li> <li>Secondary variable (SV)</li> <li>Tertiary variable (TV)</li> <li>Quaternary variable (QV)</li> </ul>	
Factory setting	No value	
Additional information	Read access	Operator
	Write access	Maintenance

Output density		Ê
Navigation	Image: Setup → Advanced setu → Output density	p → Input/output → HART devices → HART Device(s)
Prerequisite	Not available for Micropilot S FMR5xx, Prothermo NMT53x and Prothermo NMT8x. In these cases the measured variables are allocated automatically.	
Description	Defines which HART variable is the density.	
Selection	<ul> <li>No value</li> <li>Primary variable (PV)</li> <li>Secondary variable (SV)</li> <li>Tertiary variable (TV)</li> <li>Quaternary variable (QV)</li> </ul>	
Factory setting	No value	
Additional information	Read access	Operator
	Write access	Maintenance

Output temperature		
Navigation	Setup → Advanced setup → Input/output → HART devices → HART Device(s) → Output temp.	
Prerequisite	Not available for Micropilot S FMR5xx, Prothermo NMT53x and Prothermo NMT8x. Ir these cases the measured variables are allocated automatically.	1
Description	Defines which HART variable is the temperature.	
Selection	<ul> <li>No value</li> <li>Primary variable (PV)</li> <li>Secondary variable (SV)</li> <li>Tertiary variable (TV)</li> <li>Quaternary variable (QV)</li> </ul>	

# Factory setting No value Additional information Read access Operator Write access Maintenance

Output vapor temperature			ß
Navigation	<ul> <li>Image: Setup → Advanced setup -</li> <li>→ Output vapor tmp</li> </ul>	→ Input/output → HART devices → HART Device(s)	
Prerequisite	Not available for Micropilot S FN these cases the measured variable	R5xx, Prothermo NMT53x and Prothermo NMT8x. In es are allocated automatically.	
Description	Defines which HART variable is t	he vapor temperature.	
Selection	<ul> <li>No value</li> <li>Primary variable (PV)</li> <li>Secondary variable (SV)</li> <li>Tertiary variable (TV)</li> <li>Quaternary variable (QV)</li> </ul>		
Factory setting	No value		
Additional information	Read access	Operator	
	Write access	Maintenance	

Output level		ß
Navigation	<ul> <li>B ⊆ Setup → Advanced setup -</li> <li>→ Output level</li> </ul>	→ Input/output → HART devices → HART Device(s)
Prerequisite	Not available for Micropilot S FN these cases the measured variable	IR5xx, Prothermo NMT53x and Prothermo NMT8x. In les are allocated automatically.
Description	Defines which HART variable is the level.	
Selection	<ul> <li>No value</li> <li>Primary variable (PV)</li> <li>Secondary variable (SV)</li> <li>Tertiary variable (TV)</li> <li>Quaternary variable (QV)</li> </ul>	
Factory setting	No value	
Additional information	Read access	Operator
	Write access	Maintenance

"Forget device" wizard

Read access       Maintenance                 This submenu is only visible if Number of devices (→ ● 132) ≥ 1.           Navigation              Setup → Advanced setup → Input/output → HART devices → Forget device           Forget device              Ø          Navigation              Setup → Advanced setup → Input/output → HART devices → Forget device → Forget device         Description              With this function an offline device can be deleted from the device list.          Selection              HART Device 1                 HART Device 2                   HART Device 3                   HART Device 4                   HART Device 5                   HART Device 6                   HART Device 1                   HART Device 2                   HART Device 3                   HART Device 1                 HART				
Navigation       Image: Setup → Advanced setup → Input/output → HART devices → Forget device         Forget device       Image: Setup → Advanced setup → Input/output → HART devices → Forget device → Forget device         Navigation       Image: Setup → Advanced setup → Input/output → HART devices → Forget device → Forget device         Description       With this function an offline device can be deleted from the device list.         Selection       • HART Device 1 * • HART Device 2 * • HART Device 4 * • HART Device 6 * • HART Device 6 * • HART Device 6 * • HART Device 1 * • HART		Read access	Maintenance	
<ul> <li>→ Forget device</li> <li>Forget device</li> <li>Ravigation</li> <li>Setup → Advanced setup → Input/output → HART devices → Forget device → Forget device</li> <li>Description</li> <li>With this function an offline device can be deleted from the device list.</li> <li>Selection</li> <li>HART Device 1*         <ul> <li>HART Device 3*</li> <li>HART Device 3*</li> <li>HART Device 4*</li> <li>HART Device 6*</li> <li>HART Device 10*</li> <li>HART Device 10*</li> <li>HART Device 10*</li> <li>HART Device 13*</li> <li>HART Device 14*</li> <li>HART Device 15*</li> <li>None</li> </ul> </li> </ul>		This submenu is only visible if <b>Number of devices (</b> $\rightarrow \cong 132$ ) $\geq 1$ .		
Navigation       B Setup → Advanced setup → Input/output → HART devices → Forget device → Forget device         Description       With this function an offline device can be deleted from the device list.         Selection       HART Device 1 *         HART Device 3 *       HART Device 3 *         HART Device 6 *       HART Device 6 *         HART Device 6 *       HART Device 7 *         HART Device 10 *       HART Device 10 *         HART Device 11 *       HART Device 13 *         HART Device 13 *       HART Device 15 *         None       None				
device         Description       With this function an offline device can be deleted from the device list.         Selection       • HART Device 1 *         • HART Device 2 *       • HART Device 3 *         • HART Device 4 *       • HART Device 5 *         • HART Device 6 *       • HART Device 6 *         • HART Device 9 *       • HART Device 10 *         • HART Device 11 *       • HART Device 12 *         • HART Device 15 *       • None         Factory setting       None	Forget device		<u>م</u>	
Selection       • HART Device 1 *         • HART Device 2 *       • HART Device 3 *         • HART Device 4 *       • HART Device 5 *         • HART Device 6 *       • HART Device 6 *         • HART Device 7 *       • HART Device 8 *         • HART Device 10 *       • HART Device 10 *         • HART Device 10 *       • HART Device 12 *         • HART Device 13 *       • HART Device 13 *         • HART Device 15 *       • None         Factory setting       None	Navigation		$\rightarrow$ Input/output $\rightarrow$ HART devices $\rightarrow$ Forget device $\rightarrow$ Forget	
<ul> <li>HART Device 2*</li> <li>HART Device 3*</li> <li>HART Device 4*</li> <li>HART Device 5*</li> <li>HART Device 6*</li> <li>HART Device 7*</li> <li>HART Device 8*</li> <li>HART Device 9*</li> <li>HART Device 10*</li> <li>HART Device 11*</li> <li>HART Device 12*</li> <li>HART Device 13*</li> <li>HART Device 14*</li> <li>HART Device 15*</li> <li>None</li> </ul>	Description	With this function an offline de	vice can be deleted from the device list.	
	Selection	<ul> <li>HART Device 2 *</li> <li>HART Device 3 *</li> <li>HART Device 4 *</li> <li>HART Device 5 *</li> <li>HART Device 6 *</li> <li>HART Device 7 *</li> <li>HART Device 8 *</li> <li>HART Device 9 *</li> <li>HART Device 10 *</li> <li>HART Device 11 *</li> <li>HART Device 12 *</li> <li>HART Device 13 *</li> <li>HART Device 14 *</li> <li>HART Device 15 *</li> </ul>		
Additional information Read access Operator	Factory setting	None		
	Additional information	Read access	Operator	

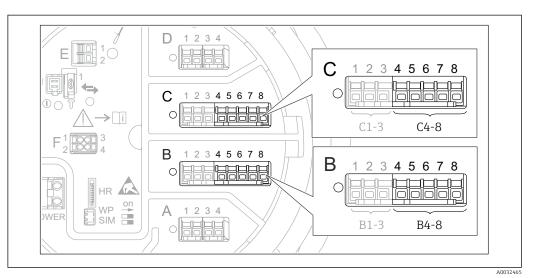
Maintenance

Write access

<sup>\*</sup> Visibility depends on order options or device settings

#### "Analog IP" submenu

There is a **Analog IP** submenu for each Analog I/O module of the device. This submenu refers to terminals 4 to 8 of this module (the analog input). They are primarily used to connect an RTD. For terminals 1 to 3 (analog input or output) refer to → 🗎 145.



■ 49 Terminals for the "Analog IP" submenu ("B4-8" or "C4-8", respectively)

*Navigation*  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP

Operating mode			
Navigation	Image: Bearing and the setuped of the setup of the s	→ Input/output → Analog IP → Operating mode	
Description	Defines the operating mode of th	ne analog input.	
Selection	<ul><li>Disabled</li><li>RTD temperature input</li><li>Gauge power supply</li></ul>		
Factory setting	Disabled		
Additional information	Read access	Operator	
	Write access	Maintenance	

RTD type		
Navigation	$\textcircled{B} \boxminus Setup \rightarrow Advanced setup \rightarrow Input/output \rightarrow Analog IP \rightarrow RTD type$	
Prerequisite	Operating mode ( $\Rightarrow \triangleq 139$ ) = RTD temperature input	
Description	Defines the type of the connected RTD.	

Selection	<ul> <li>Cu50 (w=1.428, GOST)</li> <li>Cu53 (w=1.426, GOST)</li> <li>Cu90; 0°C (w=1.4274, GOST)</li> <li>Cu100; 25°C (w=1.4274, GOST)</li> <li>Cu100; 0°C(w=1.4274, GOST)</li> <li>Pt46 (w=1.391, GOST)</li> <li>Pt50 (w=1.391, GOST)</li> <li>Pt100(385) (a=0.00385, IEC75)</li> <li>Pt100(389) (a=0.003916, JIS1</li> <li>Pt100 (w=1.391, GOST)</li> <li>Pt500(385) (a=0.00385, IEC75)</li> <li>Pt1000(385) (a=0.00385, IEC755)</li> <li>Pt1000(385) (a=0.00385, IEC7555)</li> <li>Pt1000(385) (a=0.00385, IEC75555)</li> <li>Pt1000(385) (a=0.00385, IEC7555555)</li> <li>Pt1000(385) (a=0.00385, IEC7555555555555555555555555555555555555</li></ul>	51) dian) 604) 51) 751) 3760) 3760)
Factory setting	Pt100(385) (a=0.00385, IEC751	)
Additional information	Read access	Operator
	Write access	Maintenance

Thermocouple type		
Navigation	Image: Setup → Advanced setup → Input/output → Analog IP → Thermocouple typ	
Description	Defines the type of the connected thermocouple.	
Selection	<ul> <li>N type</li> <li>B type</li> <li>C type</li> <li>D type</li> <li>J type</li> <li>K type</li> <li>L type</li> <li>L GOST type</li> <li>R type</li> <li>S type</li> <li>T type</li> <li>U type</li> </ul>	
Factory setting	N type	

RTD connection type		
Navigation	Image: Setup → Advanced setup → Input/output → Analog IP → RTD connect type	
Prerequisite	Operating mode (→ 🗎 139) = RTD temperature input	
Description	Defines the connection type of the RTD.	

	<ul><li>4 wire RTD connection</li><li>2 wire RTD connection</li><li>3 wire RTD connection</li></ul>	
Factory setting	4 wire RTD connection	
Additional information	Read access	Operator
	Write access	Maintenance

Process value		
Navigation	$ \blacksquare \blacksquare  \text{Setup} \rightarrow \text{Advanced setup} -$	→ Input/output → Analog IP → Process value
Prerequisite	Operating mode ( $\rightarrow \triangleq 139$ ) $\neq$ Disabled	
Description	Shows the measured value received via the analog input.	
Additional information	Read access	Operator
	Write access	-

Process variable			æ
Navigation	Image: Barbon Setup → Advanced setup	$\rightarrow$ Input/output $\rightarrow$ Analog IP $\rightarrow$ Process variable	
Prerequisite	Operating mode (→ 🗎 139) ≠ RTD temperature input		
Description	Determines type of measured value.		
Selection	<ul> <li>Level linearized</li> <li>Temperature</li> <li>Pressure</li> <li>Density</li> </ul>		
Factory setting	Level linearized		
Additional information	Read access	Operator	
	Write access	Maintenance	

0 % value		ß
Navigation		
Prerequisite	Operating mode (→ 🗎 139) = 420mA input	

Description	Defines the value represented by a current of 4mA.	
User entry	Signed floating-point number	
Factory setting	0 mm	
Additional information	Read access Operator	
	Write access	Maintenance

100 % value			
Navigation	Image: Boost of the setupe of the setup	→ Input/output → Analog IP → 100 % value	
Prerequisite	Operating mode (→ 🗎 139) = 420mA input		
Description	Defines the value represented by a current of 20mA.		
User entry	Signed floating-point number		
Factory setting	0 mm		
Additional information	Read access	Operator	

Maintenance

Write access

Input value		
Navigation	■ $\square$ Setup → Advanced setup	$\rightarrow$ Input/output $\rightarrow$ Analog IP $\rightarrow$ Input value
Prerequisite	Operating mode (→ 🗎 139) ≠ Disabled	
Description	Shows the value received via the analog input.	
Additional information	Read access Operator	
	Write access	-

Minimum probe temperature		æ
Navigation	□ $□$ Setup → Advanced setup → Input/output → Analog IP → Min. probe temp	
Prerequisite	Operating mode (→ 🗎 139) = RTD temperature input	
Description	Minimum approved temperature of the connected probe. If the temperature falls below this value, the W&M status will be 'invalid'.	

User entry	−213 to 927 °C	
Factory setting	-100 ℃	
Additional information	Read access Operator	
	Write access	Maintenance

Maximum probe tempera	ture		
Navigation	■ ■ Setup → Advanced setup -	→ Input/output → Analog IP → Max. probe temp	
Prerequisite	Operating mode (→ 🖺 139) = ]	Operating mode ( > 🗎 139) = RTD temperature input	
Description	Maximum approved temperature of the connected probe. If the temperature rises above this value, the W&M status will be 'invalid'.		
User entry	−213 to 927 °C		
Factory setting	250 °C		
Additional information	Read access	Operator	
	Write access	Maintenance	

Probe position		ඕ
Navigation	■ $\square$ Setup → Advanced setup =	$\rightarrow$ Input/output $\rightarrow$ Analog IP $\rightarrow$ Probe position
Prerequisite	Operating mode (→ 🗎 139) = RTD temperature input	
Description	Position of the temperature probe, measured from zero position (tank bottom or datum plate). This parameter, in conjunction with the measured level, determines whether the temperature probe is still covered by the product. If this is no longer the case, the status of the temperature value will be 'invalid'.	
User entry	-5 000 to 30 000 mm	
Factory setting	5 000 mm	
Additional information	Read access	Operator
	Write access	Maintenance

A

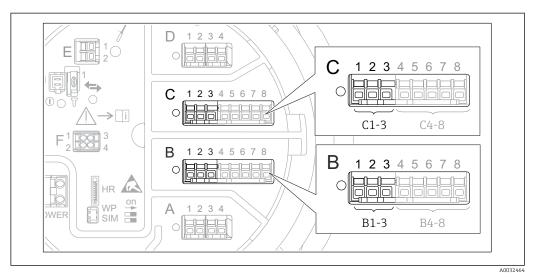
Damping factor			
Navigation	□ Setup → Advanced setup → Input/output → Analog IP → Damping factors	ctor	

Navigation			
Prerequisite	Operating mode ( $\Rightarrow \triangleq 139$ ) $\neq$ Disabled		
Description	Defines the damping constant (in seconds).		
User entry	0 to 999.9 s		
Factory setting	0 s		
Additional information	Read access	Operator	
	Write access	Maintenance	

Gauge current			
Navigation			
Prerequisite	Operating mode ( > 🗎 139) = Gauge power supply		
Description	Shows the current on the power supply line for the connected device.		
Additional information	Read access	Operator	
	Write access	-	

#### "Analog I/O" submenu

There is a **Analog I/O** submenu for each Analog I/O module of the device. This submenu refers to terminals 1 to 3 of this module (an analog input or output). For terminals 4 to 8 (always an analog input) refer to → 🗎 139.



☑ 50 Terminals for the "Analog I/O" submenu ("B1-3" or "C1-3", respectively)

*Navigation*  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O

Operating mode			
Navigation	Setup → Advanced setup	→ Input/output → Analog I/O → Operating mode	
Description	Defines the operating mode of t	he analog I/O module.	
Selection	<ul> <li>Disabled</li> <li>420mA input</li> <li>HART master+420mA input</li> <li>HART master</li> <li>420mA output</li> <li>HART slave +420mA output</li> </ul>		
Factory setting	Disabled		
Additional information	Read access	Operator	
	Write access	Maintenance	

#### Meaning of the options

Operating mode ( $\rightarrow \square$ 145)	Direction of signal	Type of signal
Disabled	-	-
420mA input	Input from 1 external device	Analog (420mA)
HART master+420mA input	Input from 1 external device	<ul><li>Analog (420mA)</li><li>HART</li></ul>
HART master	Input from up to 6 external devices	HART

Operating mode ( $\rightarrow \square$ 145)	Direction of signal	Type of signal
420mA output	Output to higher-level unit	Analog (420mA)
HART slave +420mA output	Output to higher-level unit	<ul><li>Analog (420mA)</li><li>HART</li></ul>

Depending on the terminals used, the Analog I/O module is used in the passive or active mode.

Mode	Terminals	s of the I/	e I/O module		
	1	2	3		
Passive (power supply from external source)	-	+	not used		
Active (power supplied by the device itself)	not used	-	+		

In the active mode the following conditions must be met:

- 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

Current span			
Navigation	Image: Boots and the setupe of the setup of the setu	→ Input/output → Analog I/O → Current span	
Prerequisite	<b>Operating mode</b> parameter ( $\rightarrow$	145) ≠ Disabled option or HART master option	
Description	Defines the current range for the	e measured value transmission.	
Selection	<ul> <li>420 mA NE (3.820.5 mA)</li> <li>420 mA US (3.920.8 mA)</li> <li>420 mA (4 20.5 mA)</li> <li>Fixed value*</li> </ul>		
Factory setting	420 mA NE (3.820.5 mA)		
Additional information	Read access	Operator	
	Write access	Maintenance	

#### Meaning of the options

Option	Current range for process variable	Minimum value	Lower alarm signal level	Upper alarm signal level	Maximum value
420 mA (4 20.5 mA)	4 to 20.5 mA	3.5 mA	< 3.6 mA	> 21.95 mA	22.6 mA
420 mA NE (3.820.5 mA)	3.8 to 20.5 mA	3.5 mA	< 3.6 mA	> 21.95 mA	22.6 mA

Visibility depends on order options or device settings

Option	Current range for process variable	Minimum value	Lower alarm signal level	Upper alarm signal level	Maximum value
420 mA US (3.920.8 mA)	3.9 to 20.8 mA	3.5 mA	< 3.6 mA	> 21.95 mA	22.0 mA
Fixed current	Constant current, defined in the <b>Fixed current</b> parameter ( $\rightarrow \square 147$ ).				

In the case of an error, the output current assumes the value defined in the Failure mode parameter ( $\Rightarrow \triangleq 148$ ).

Fixed current			
Navigation	$\blacksquare$ □ Setup → Advanced setup -	→ Input/output → Analog I/O → Fixed current	
Prerequisite	Current span (→ 🗎 146) = Fixe	ed current	
Description	Defines the fixed output current.		
User entry	4 to 22.5 mA		
Factory setting	4 mA		
Additional information	Read access	Operator	
	Write access	Maintenance	

Analog input source		Ê
Navigation	Image: Setup → Advanced setup → Input/output → Analog I/O → Analog source	
Prerequisite	<ul> <li>Operating mode (→          145) = 420mA output or HART slave +420mA output     </li> <li>Current span (→          146) ≠ Fixed current     </li> </ul>	
Description	Defines the process variable transmitted via the AIO.	
Selection	<ul> <li>None</li> <li>Tank level</li> <li>Tank level %</li> <li>Tank ullage</li> <li>Tank ullage %</li> <li>Measured level</li> <li>Distance</li> <li>Displacer position</li> <li>Water level</li> <li>Upper interface level</li> <li>Lower interface level</li> <li>Bottom level</li> <li>Tank reference height</li> <li>Liquid temperature</li> </ul>	

Vapor temperature

<ul> <li>Air temperat</li> </ul>	ure
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- Observed density value
   Average profile density<sup>7)</sup>
- Upper density
- Middle density
- Lower density
- P1 (bottom)
- P2 (middle)
- P3 (top)
- GP 1 ... 4 value
- AIO B1-3 value <sup>7)</sup>
- AIO B1-3 value mA<sup>7)</sup>
- AIO C1-3 value<sup>7)</sup>
- AIO C1-3 value mA<sup>7)</sup>
- AIP B4-8 value <sup>7)</sup>
- AIP C4-8 value<sup>7)</sup>
- Element temperature 1 ... 24<sup>7)</sup>
- HART device 1...15 PV<sup>7</sup>
- HART device 1 ... 15 PV mA<sup>7)</sup>
- HART device 1 ... 15 PV %<sup>7</sup>
- HART device 1 ... 15 SV<sup>7</sup>
- HART device 1 ... 15 TV<sup>7)</sup>
- HART device 1 ... 15 QV<sup>7)</sup>

Factory setting

Tank level

#### 1

Additional information	Read access	Operator
	Write access	Maintenance

Failure mode			Â
Navigation	Image: Below a setup → Advanced setup →	→ Input/output → Analog I/O → Failure mode	
Prerequisite	Operating mode (→ 🗎 145) = 4	a20mA output or HART slave +420mA output	
Description	Defines the output behavior in ca	se of an error.	
Selection	<ul> <li>Min.</li> <li>Max.</li> <li>Last valid value</li> <li>Actual value</li> <li>Defined value</li> </ul>		
Factory setting	Max.		
Additional information	Read access	Operator	

Maintenance

Write access

<sup>7)</sup> Visibility depends on order options or device settings

Navigation	Image: Betup → Advanced	setup $\rightarrow$ Input/output $\rightarrow$ Analog I/O $\rightarrow$ Error value	
Prerequisite	Failure mode (→ 🗎 148) = Defined value		
Description	Defines the output value in case of an error.		
User entry	3.4 to 22.6 mA		
Factory setting	22 mA		
Additional information	Read access Operator		
	Write access	Maintenance	

Navigation		→ Input/output → Analog I/O → Input value
Prerequisite	<ul> <li>Operating mode (→          145) = 420mA output or HART slave +420mA output     </li> <li>Current span (→          146) ≠ Fixed current     </li> </ul>	
Description	Shows the input value of the analog I/O module.	
Additional information	Read access	Operator
	Write access	-

0 % value			ß
Navigation	Image: Setup → Advanced setup	→ Input/output → Analog I/O → 0 % value	
Prerequisite	■ Operating mode (→ 🗎 145) ■ Current span (→ 🗎 146) ≠ F	= 420mA output or HART slave +420mA output ixed current	
Description	Value corresponding to an output current of 0% (4mA).		
User entry	Signed floating-point number		
Factory setting	0 Unitless		
Additional information	Read access	Operator	
	Write access	Maintenance	

100 % value			
Navigation	□ $□$ Setup → Advanced setup −	→ Input/output → Analog I/O → 100 % value	
Prerequisite	■ Operating mode (→ 🗎 145) = ■ Current span (→ 🗎 146) ≠ Fi	= 420mA output or HART slave +420mA output xed current	
Description	Value corresponding to an outpu	t current of 100% (20mA).	
User entry	Signed floating-point number		
Factory setting	0 Unitless		
Additional information	Read access	Operator	
	Write access	Maintenance	

Input value %		
Navigation	Image: Betup → Advanced setup →	→ Input/output → Analog I/O → Input value %
Prerequisite	<ul> <li>Operating mode (→          145) = 420mA output or HART slave +420mA output     </li> <li>Current span (→          146) ≠ Fixed current     </li> </ul>	
Description	Shows the output value as a percentage of the complete 420mA range.	
Additional information	Read access Operator	
	Write access	-

Output value		
Navigation	Image: Bearing and Bearing	$\rightarrow$ Input/output $\rightarrow$ Analog I/O $\rightarrow$ Output value
Prerequisite	Operating mode (→ 🗎 145) = 420mA output or HART slave +420mA output	
Description	Shows the output value in mA.	
Additional information	Read access Operator	
	Write access	-

Prerequisite

Description

Selection

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# Process variable Navigation B ■ Setup → Advanced setup → Input/output → Analog I/O → Process variable

Operating mode ( $\rightarrow \cong 145$ ) = 4..20mA input or HART master+4..20mA input

Defines the type of measuring variable.

- Level linearized
  - TemperaturePressure
  - PressureDensity
- Factory setting Level linearized

Additional information	Read access	Operator
	Write access	Maintenance

Analog input 0% value	
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Navigation		
Prerequisite	Operating mode (→ 🗎 145) = 420mA input or HART master+420mA input	
Description	Value corresponding to an input current of 0% (4mA).	
User entry	Signed floating-point number	
Factory setting	0 mm	
Additional information	Read access	Operator
	Write access	Maintenance

Analog input 100% value		
Navigation	■ Setup → Advanced setup → Input/output → Analog I/O → AI 100% value	
Prerequisite	Operating mode (→ 🗎 145) = 420mA input or HART master+420mA input	
Description	Value corresponding to an input current of 100% (20mA).	
User entry	Signed floating-point number	
Factory setting	0 mm	

Additional information	Read access	Operator
	Write access	Maintenance

Error event type		<u> </u>	
Navigation		$\rightarrow$ Input/output $\rightarrow$ Analog I/O $\rightarrow$ Error event type	
Prerequisite	Operating mode ( $\rightarrow \square 145$ ) ≠	<b>Operating mode (</b> $\rightarrow$ <b>🗎 145)</b> $\neq$ <b>Disabled</b> or <b>HART master</b>	
Description	9 <b>1</b>	Defines the type of event message (alarm/warning) in case of an error or output out of range in the analog I/O module.	
Selection	<ul><li>None</li><li>Warning</li><li>Alarm</li></ul>		
Factory setting	Warning		
Additional information	Read access	Operator	
	Write access	Maintenance	

Process value			
Navigation	Setup → Advanced setup → Input/output → Analog I/O → Process value		
Prerequisite	Operating mode (→ 🗎 145) = 420mA input or HART master+420mA input		
Description	Shows the input value scaled to customer units.		
Additional information	Read access	Operator	
	Write access	-	

Input value in mA		
Navigation	$ \blacksquare \Box  \text{Setup} \rightarrow \text{Advanced setup} $	→ Input/output → Analog I/O → Input val. in mA
Prerequisite	Operating mode (→ 🗎 145) = 420mA input or HART master+420mA input	
Description	Shows the input value in mA.	
Additional information	Read access	Operator
	Write access	-

Input value percent		
Navigation		→ Input/output → Analog I/O → Input value [%]
Prerequisite	Operating mode (→ 🗎 145) = 420mA input or HART master+420mA input	
Description	Shows the input value as a percentage of the complete 420mA current range.	
Additional information	Read access Operator	
	Write access	-

Damping factor			
Navigation	Image: Barbon Setup → Advanced setup	→ Input/output → Analog I/O → Damping factor	
Prerequisite	Operating mode (→ 🗎 145) ≠	<b>Operating mode (</b> $\rightarrow \square$ <b>145)</b> $\neq$ <b>Disabled</b> or <b>HART master</b>	
Description	Defines the damping constant (in seconds).		
User entry	0 to 999.9 s		
Factory setting	0 s		
Additional information	Read access	Operator	
	Write access	Maintenance	

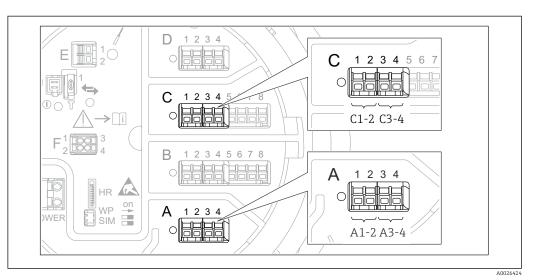
Used for SIL/WHG			
Navigation	Image: Barbon Setup → Advanced setup	→ Input/output → Analog I/O → Used for SIL/WHG	
Prerequisite	<ul> <li>Operating mode (→          <sup>145</sup>) = 420mA output or HART slave +420mA output</li> <li>The device has a SIL approval.</li> </ul>		
Description	Determines whether the discret	Determines whether the discrete I/O module is in SIL/WHG mode.	
Selection	<ul><li>Enabled</li><li>Disabled</li></ul>		
Factory setting	Disabled		
Additional information	Read access	Operator	
	Write access	Maintenance	

Expected SIL/WHG chain		
Navigation	Image: Setup → Advanced setup →	• Input/output $\rightarrow$ Analog I/O $\rightarrow$ SIL/WHG chain
Prerequisite	<ul> <li>Operating mode (→          <sup>(⇒)</sup> 145) = 420mA output or HART slave +420mA output</li> <li>The device has a SIL approval.</li> </ul>	
Additional information	Read access	Operator
	Write access	-

"Digital Xx-x" submenu

• In the operating menu, each digital input or output is designated by the respective slot of the terminal compartment 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.

• In this document, Xx-x designates any of these submenus. The structure of all these submenus is the same.

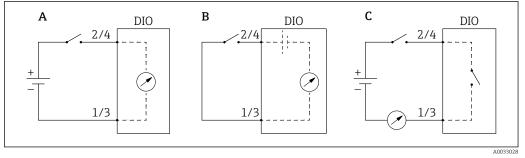


🛃 51 Designation of the digital inputs or outputs (examples)

Navigation  $\square$  Setup → Advanced setup → Input/output → Digital Xx-x

Operating mode		
Navigation	Impose Barrier Setup → Advanced setup → Input/output → Digital Xx-x → Operating mode	
Description	Defines the operating mode of the discrete I/O module.	
Selection	<ul> <li>Disabled</li> <li>Output passive</li> <li>Input passive</li> <li>Input active</li> </ul>	
Factory setting	Disabled	

#### Additional information



- ☑ 52 Operating modes of the Digital I/O module
- A Input passive
- B Input active
- C Output passive

#### Digital input source

Â

Navigation	Setup → Advanced setup → Input/output → Digital Xx-x → Digital source
Prerequisite	Operating mode ( $\rightarrow \triangleq 155$ ) = Output passive
Description	Defines which device state is indicated by the digital output.
Selection	<ul> <li>None</li> <li>Alarm x any</li> <li>Alarm x High</li> <li>Alarm x High or HighHigh</li> <li>Alarm x Low</li> <li>Alarm x LowLow</li> <li>Alarm x Low or LowLow</li> <li>Digital Xx-x</li> <li>Primary Modbus x</li> <li>Secondary Modbus x</li> </ul>
Factory setting	None
Additional information	<ul> <li>Meaning of the options</li> <li>Alarm x any, Alarm x High, Alarm x HighHigh, Alarm x High or HighHigh, Alarm x Low, Alarm x LowLow, Alarm x Low or LowLow</li> <li>The digital output indicates if the selected alarm is currently active. The alarms themselves are defined in the Alarm 1 to 4 submenus.</li> <li>Digital Xx-x<sup>8)</sup></li> <li>The digital signal present at the digital input Xx-x is passed through to the digital output.</li> <li>Modbus A1-4 Discrete x</li> <li>Modbus B1-4 Discrete x</li> <li>Modbus D1-4 Discrete x</li> <li>The digital value written by the Modbus Master device to the Modbus discrete x parameter<sup>9)</sup> is passed to the digital output. For details refer to Special Documentation SD02066G.</li> </ul>

<sup>8)</sup> Only present if "Operating mode ( $\rightarrow ext{ ($155)"}$  = "Input passive" or "Input active" for the respective Digital I/O module.

<sup>9)</sup> Expert  $\rightarrow$  Communication  $\rightarrow$  Modbus Xx-x  $\rightarrow$  Modbus discrete x

Input value			
Navigation	$ \blacksquare \Box  \text{Setup} \rightarrow \text{Advanced set} $	tup $\rightarrow$ Input/output $\rightarrow$ Digital Xx-x $\rightarrow$ Input value	
Prerequisite	Operating mode (→ 🗎 155	Operating mode ( $\Rightarrow \equiv 155$ ) = "Input passive" option or "Input active" option	
Description	Shows the digital input value.		
Additional information	Read access	Operator	
	Write access	-	

Contact type		
Navigation	Image: Boundary Setup → Advanced setup → Input/output → Digital Xx-x → Contact type	
Prerequisite	Operating mode ( $\rightarrow \cong 155$ ) $\neq$ Disabled	
Description	Determines the switching behavior of the input or output.	
Selection	<ul><li>Normally open</li><li>Normally closed</li></ul>	
Factory setting	Normally open	
Output simulation		Â
Navigation		

Prerequisite	Operating mode ( $\rightarrow$	🗎 155) = Output passive
--------------	--------------------------------	-------------------------

**Description** Sets the output to a specific simulated value.

Disable
Simulating active
Simulating inactive
Fault 1

Fault 1Fault 2

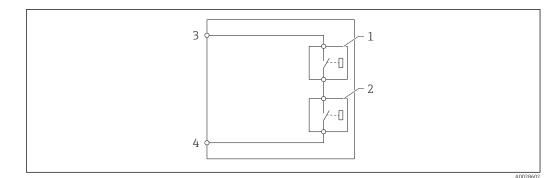
Fault Z

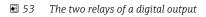
Factory setting Disable

Additional information	Read access	Operator
	Write access	Maintenance

The digital output consists of two relays connected in series:

Selection





1/2 The relays

3/4 The terminals of the digital output

The switching state of these relays is defined by the **Output simulation** parameter as follows:

Output simulation	State of relay 1	State of relay 2	Expected result on the terminals of the I/O module
Simulating active	Closed	Closed	Closed
Simulating inactive	Open	Open	Open
Fault 1	Closed	Open	Open
Fault 2	Open	Closed	Open

The **Fault 1** and **Fault 2** options can be used to check the correct switching behavior of the two relays.

Output value				
Navigation	Image: Barbon Setup → Advanced setup	$\rightarrow$ Input/output $\rightarrow$ Digital Xx-x $\rightarrow$ Output values		
Prerequisite	Operating mode (→ 🗎 155) =	Operating mode (→ 🗎 155) = Output passive		
Description	Shows the digital output value.			
Additional information	Read access	Operator		
	Write access	-		

Readback value	
Navigation	$\textcircled{B} \square  \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Input/output} \rightarrow \text{Digital Xx-x} \rightarrow \text{Readback value}$
Prerequisite	Operating mode (→ 🗎 155) = Output passive
Description	Shows the value read back from the output.

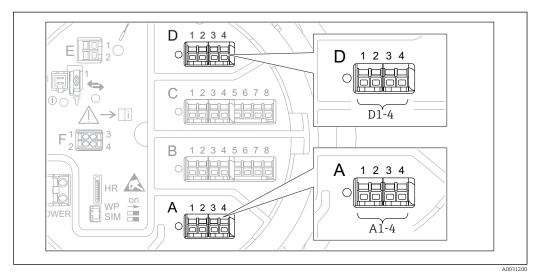
Additional information	Read access	Operator
	Write access	-

Used for SIL/WHG			
Navigation		$\rightarrow$ Input/output $\rightarrow$ Digital Xx-x $\rightarrow$ Used for SIL/WHG	
Prerequisite	<ul> <li>Operating mode (→          <sup>⊕</sup> 155)</li> <li>The device has a SIL certificate</li> </ul>		
Description	Determines whether the discrete I/O module is in SIL/WHG mode.		
Selection	<ul><li>Enabled</li><li>Disabled</li></ul>		
Factory setting	Disabled		
Additional information	Read access	Operator	
	Write access	Maintenance	

Expected SIL/WHG chain		
Navigation		→ Input/output → Digital C3-4 → SIL/WHG chain
Prerequisite	Operating mode ( $\rightarrow \triangleq 155$ ) = Output passive	
Additional information	Read access	Service
	Write access	-

#### "Communication" submenu

This menu contains a submenu for each digital communication interface of the device. The communication interfaces are designated by "X1-4" where "X" specifies the slot in the terminal compartment and "1-4" the terminals within this slot.



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

 $\square$  □ Setup → Advanced setup → Communication Navigation

#### "Modbus X1-4", "V1 X1-4" and "WM550 X1-4" submenu

This submenu is only present for devices with MODBUS and/or V1 and/or "WM550" option communication interface. There is one submenu of this type for each communication interface.

Navigation	8 2	Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ Modbus X1-4
Navigation	8 8	Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ V1 X1-4
Navigation	8 2	Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ WM550 X1-4

Communication interface protocol		
Navigation	Image: Setup → Advanced setu X1-4 → Commu I/F pro	up → Communication → Modbus X1-4 / V1 X1-4 / WM550 otoc
Description	Shows the type of communication protocol.	
Additional information	Read access	Operator
	Write access	-

	<i>"Configuration" submenu</i> This submenu is only present for devices with a <b>MODBUS</b> communication interface.		
	NavigationSetup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ Modbus X1- $\rightarrow$ Configuration		tup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ Modbus X1-4
Baudrate			۵
Navigation	Image: Setup → Adv → Baudrate	vanced setu	up → Communication → Modbus X1-4 → Configuration
Prerequisite	Communication interface protocol ( $\rightarrow \cong 160$ ) = MODBUS		
Description	Defines the baud rate of the communication.		
Selection	<ul> <li>600 BAUD</li> <li>1200 BAUD</li> <li>2400 BAUD</li> <li>4800 BAUD</li> <li>9600 BAUD *</li> <li>19200 BAUD *</li> </ul>		
Factory setting	9600 BAUD		
Additional information	Read access		Operator
	Write access		Maintenance

Parity			
Navigation	Image: Betup → Advanced setup → Parity	$\rightarrow$ Communication $\rightarrow$ Modbus X1-4 $\rightarrow$ Configuration	
Prerequisite	Communication interface pro	tocol (→ 🗎 160) = MODBUS	
Description	Defines the parity of the Modbus communication.		
Selection	<ul> <li>Odd</li> <li>Even</li> <li>None / 1 stop bit</li> <li>None / 2 stop bits</li> </ul>		
Factory setting	None / 1 stop bit		
Additional information	Read access	Operator	
	Write access	Maintenance	

<sup>\*</sup> Visibility depends on order options or device settings

User entry

æ

Modbus address	
Navigation	Setup → Advanced setup → Communication → Modbus X1-4 → Configuration → Device ID
Prerequisite	Communication interface protocol ( $\rightarrow \cong 160$ ) = MODBUS
Description	Defines the Modbus address of the device.

1 to 247

Factory setting	1	
Additional information	Read access	Operator
	Write access	Maintenance

Float swap mode			
Navigation	Setup → Advanced setup → Float swap mode	$\rightarrow$ Communication $\rightarrow$ Modbus X1-4 $\rightarrow$ Configuration	
Prerequisite	Communication interface protocol ( $\Rightarrow \triangleq 160$ ) = MODBUS		
Description	Sets the format of how the floating point value is transferred on Modbus.		
Selection	<ul> <li>Normal 3-2-1-0</li> <li>Swap 0-1-2-3</li> <li>WW Swap 1-0-3-2</li> </ul>		
Factory setting	Swap 0-1-2-3		
Additional information	Read access	Operator	
	Write access	Maintenance	

Bus termination	8
Navigation	$\blacksquare$ Setup → Advanced setup → Communication → Modbus X1-4 → Configuration → Bus termination
Prerequisite	Communication interface protocol ( $\rightarrow \triangleq 160$ ) = MODBUS
Description	Activates or deactivates the bus termination at the device. Should only be activated on the last device in a loop.
Selection	<ul><li>Off</li><li>On</li></ul>

# Factory setting

#### Off

Additional information

Read access	Operator
Write access	Maintenance

#### "Configuration" submenu

This submenu is only present for devices with a **V1** communication interface.

Navigation

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

Communication interface protocol variant		8
Navigation	Setup → Advanced setup → Communication → V1 X1-4 → Configuration → Protocol variant	
Description	Determines which variant of the V1 protocol is used.	
User interface	<ul> <li>None</li> <li>V1 *</li> </ul>	
Factory setting	None	
Additional information	Read access Operator	
	Write access	Maintenance

V1 address			Â
Navigation	Image: Betup → Advanced setup - address	→ Communication → V1 X1-4 → Configuration → V1	
Prerequisite	Communication interface protocol variant ( $\rightarrow \cong 164$ ) = V1		
Description	Identifier of the device for the V1 communication.		
User entry	0 to 99		
Factory setting	1		
Additional information	Read access	Operator	
	Write access	Maintenance	

<sup>\*</sup> Visibility depends on order options or device settings

V1 address			Â
Navigation	Setup → Advanced setup - address	→ Communication → V1 X1-4 → Configuration → V1	
Prerequisite	Communication interface protocol variant ( $ ightarrow  extsf{B}$ 164)		
Description	Identifier of the previous device for V1 communication.		
User entry	0 to 255		
Factory setting	1		
Additional information	Read access	Operator	
	Write access	Maintenance	

Level mapping		Â	
Navigation	Image: Setup → Advanced setup mapping	→ Communication → V1 X1-4 → Configuration → Level	
Prerequisite	Communication interface protocol ( $\Rightarrow \triangleq 160$ ) = V1		
Description	Determines the transmittable range of levels.		
Selection	■ +ve ■ +ve & -ve		
Factory setting	+ve		
Additional information	Read access	Operator	
	Write access	Maintenance	

In V1, the level is always represented by a number in the range from 0 to 999999. This number corresponds to a level as follows:

"Level mapping" = "+ve"

Number	Corresponding level
0	0.0 mm
999 999	99 999.9 mm

"Level mapping" = "+ve & -ve"

Number	Corresponding level
0	0.0 mm
500 000	50 000.0 mm

Number	Corresponding level	
500001	-0.1 mm	
999999	-49 999.9 mm	

Line impedance			
Navigation	Image: Setup → Advanced setup impedance	→ Communication → V1 X1-4 → Configuration → Line	
Prerequisite	Communication interface protocol ( $\Rightarrow \triangleq 160$ ) = V1		
Description	Adjusts the impedance of the communication line.		
User entry	0 to 15		
Factory setting	15		
Additional information	Read access	Operator	
	Write access	Maintenance	

The line impedance affects the voltage difference between a logical 0 and a logical 1 on the message of the device to the bus. The default setting is suitable for most applications.

"V1 input selector" submenu

This submenu is only present for devices with a **V1** communication interface.

Navigation	8 8	Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ V1 X1-4 $\rightarrow$ V1
		input select.

Alarm 1 input source		۵
Navigation	Image: Setup → Advanced setup - input src	→ Communication → V1 X1-4 → V1 input select. → Alarm1
Description	Determines which discrete value	will be transmitted as V1 alarm 1 status.
Selection	<ul> <li>None</li> <li>Alarm 1-4 any</li> <li>Alarm 1-4 HighHigh</li> <li>Alarm 1-4 High or HighHigh</li> <li>Alarm 1-4 High</li> <li>Alarm 1-4 Low</li> <li>Alarm 1-4 Low or LowLow</li> <li>Alarm 1-4 LowLow</li> </ul>	
Factory setting	None	
Additional information	Read access	Operator
	Write access	Maintenance

Alarm 2 input source		8
Navigation	Image: Setup → Advanced setup - input src	→ Communication → V1 X1-4 → V1 input select. → Alarm2
Description	Determines which discrete value	will be transmitted as V1 alarm 2 status.
Selection	<ul> <li>None</li> <li>Alarm 1-4 any</li> <li>Alarm 1-4 HighHigh</li> <li>Alarm 1-4 High or HighHigh</li> <li>Alarm 1-4 High</li> <li>Alarm 1-4 Low</li> <li>Alarm 1-4 Low or LowLow</li> <li>Alarm 1-4 LowLow</li> </ul>	
Factory setting	None	
Additional information	Read access	Operator
	Write access	Maintenance

Value percent selector		<u> </u>	
Navigation	<ul><li>Image: Setup → Advance</li><li>% select</li></ul>	ed setup $\rightarrow$ Communication $\rightarrow$ V1 X1-4 $\rightarrow$ V1 input select. $\rightarrow$ Value	
Description	Selects which value shall be transmitted as a $0100\%$ value in the V1 Z0/Z1 message.		
Selection	<ul> <li>None</li> <li>Tank level %</li> <li>Tank ullage %</li> <li>AIO B1-3 value %<sup>*</sup></li> <li>AIO C1-3 value %<sup>*</sup></li> </ul>		
Factory setting	None		
Additional information	Read access	Operator	
	Write access	Maintenance	
	"Configuration" subment This submenu is only pr interface. Navigation	resent for devices with a <b>"WM550" option</b> communication	
Baudrate	This submenu is only pr interface.	resent for devices with a <b>"WM550" option</b> communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration	
Baudrate	This submenu is only pr interface.	resent for devices with a <b>"WM550" option</b> communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration	
	This submenu is only printerface.	resent for devices with a <b>"WM550" option</b> communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration	
Navigation	This submenu is only printerface.  Navigation  ■  Setup → Advance → Baudrate	resent for devices with a <b>"WM550" option</b> communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration	
Navigation Prerequisite	This submenu is only printerface. Navigation $\textcircled{\ }$	resent for devices with a <b>"WM550" option</b> communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration $\square$ red setup → Communication → WM550 X1-4 → Configuration	
Navigation Prerequisite Description	This submenu is only printerface. Navigation $\textcircled{\ }$	resent for devices with a "WM550" option communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration ed setup → Communication → WM550 X1-4 → Configuration Face protocol (→ 🖺 160) = "WM550" option	
Navigation Prerequisite Description Selection	This submenu is only printerface. Navigation  Setup → Advance → Baudrate  Communication interf Defines the baud rate o  600 BAUD 1200 BAUD 2400 BAUD 2400 BAUD	resent for devices with a "WM550" option communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration ed setup → Communication → WM550 X1-4 → Configuration Face protocol (→ 🖺 160) = "WM550" option	
Baudrate Navigation Prerequisite Description Selection Factory setting Additional information	This submenu is only printerface. Navigation  Setup → Advance → Baudrate  Communication interf  Defines the baud rate o  600 BAUD  1200 BAUD  2400 BAUD  4800 BAUD	resent for devices with a "WM550" option communication Setup → Advanced setup → Communication → WM550 X1-4 → Configuration ed setup → Communication → WM550 X1-4 → Configuration Face protocol (→ 🖺 160) = "WM550" option	

<sup>\*</sup> Visibility depends on order options or device settings

WM550 address	
Navigation	Setup → Advanced setup → Communication → WM550 X1-4 → Configuration → WM550 address
Description	Describes the WM550 address of the device.
User entry	0 to 63
Factory setting	1
Software ID	
Navigation	Setup → Advanced setup → Communication → WM550 X1-4 → Configuration → Software ID
Prerequisite	Communication interface protocol ( $\Rightarrow \triangleq 160$ ) = "WM550" option
Description	Defines content for WM550 Task 32.
	Detailed information on content for WM550 Task 32, Special Documentation SD02567G.
User entry	0 to 9999
Factory setting	2 000
	"WM550 input selector" submenu
	This submenu is only present for devices with a <b>"WM550" option</b> communication interface.
	NavigationImage: Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ WM550 X1-4 $\rightarrow$ WM550 inp select

Discrete 1 selector	
Navigation	Setup → Advanced setup → Communication → WM550 X1-4 → WM550 inp select → Discrete 1select
Description	Determines the input source which is transferred as Alarm bit [n] value in the corresponding WM550 tasks.
Selection	<ul> <li>None</li> <li>Balance flag optionVisibility depends on order options or device settings</li> <li>Alarm 14 any</li> <li>Alarm 14 HighHigh</li> </ul>

- Alarm 1...4 High or HighHighAlarm 1...4 High
- Alarm 1...4 Low
- Alarm 1...4 Low or LowLow
- Alarm 1...4 LowLow
- Digital Xx-x

# Factory setting

None

# Additional information

Read access	Operator
Write access	Maintenance

"HART output" su	bmenu	
Navigation	8 8	Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ HART output
"Configuration" of	. h	
"Configuration" su	IDmenu	
Navigation	88	Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ HART output $\rightarrow$ Configuration

System polling address			Ê
Navigation	Setup → Advanced setup → Communication → HART output → Configuration → Polling address		
Description	Device address for HART commu	Device address for HART communication.	
User entry	0 to 63		
Factory setting	15		
Additional information	Read access Operator		
	Write access	Maintenance	

No. of preambles		8
Navigation	Image: Setup → Advanced setup of preambles	$\rightarrow$ Communication $\rightarrow$ HART output $\rightarrow$ Configuration $\rightarrow$ No.
Description	Defines the number of preamble	es in the HART telegram.
User entry	5 to 20	
Factory setting	5	
Additional information	Read access	Operator
	Write access	Maintenance

PV source	
Navigation	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$
Description	Decides, if the PV configuration is according to an analog output (HART slave) or customized (in case of HART tunneling only).

Selection	<ul> <li>AIO B1-3<sup>*</sup></li> <li>AIO C1-3<sup>*</sup></li> <li>Custom</li> </ul>	
Factory setting	Custom	
Additional information	Read access	Maintenance
	Write access	Maintenance

Assign PV		Ê
Navigation	Setup → Advanced setup → Communication → HART output → Configuration → Assign PV	
Prerequisite	PV source ( $\rightarrow \equiv 171$ ) = Custom	
Description	Assign a measured variable to the primary dynamic variable (PV).	
	Additional information: The assigned measured variable is also used by the current output.	
Selection	<ul> <li>None</li> <li>Tank level</li> <li>Tank ullage</li> <li>Measured level</li> <li>Distance</li> <li>Displacer position</li> <li>Water level</li> <li>Upper interface level</li> <li>Lower interface level</li> <li>Bottom level</li> <li>Tank reference height</li> <li>Liquid temperature</li> <li>Vapor temperature</li> <li>Air temperature</li> <li>Observed density value</li> <li>Average profile density</li> <li>Upper density</li> <li>Middle density</li> <li>Lower density</li> <li>P1 (bottom)</li> <li>P2 (middle)</li> <li>P3 (top)</li> <li>GP 1 value</li> <li>GP 2 value</li> <li>GP 4 value</li> </ul>	
Factory setting	Tank level	

<sup>\*</sup> Visibility depends on order options or device settings

#### Additional information

[	Read access	Operator
	Write access	Maintenance

The **Measured level** option doesn't contain a unit. If a unit is needed, select the **Tank level** option.

0 % value		8
Navigation	Image: Setup → Advanced setup - value	→ Communication → HART output → Configuration → 0 %
Prerequisite	PV source = Custom	
Description	0% value of the primary variable (PV).	
User entry	Signed floating-point number	
Factory setting	0 mm	
Additional information	Read access	Operator
	Write access	Maintenance

100 % value		Ŕ
Navigation	Image: Setup → Advanced setup - % value	→ Communication → HART output → Configuration → 100
Prerequisite	PV source = Custom	
Description	100% value of the primary variable (PV).	
User entry	Signed floating-point number	
Factory setting	0 mm	
Additional information	Read access	Operator
	Write access	Maintenance

PV mA selector	٨
Navigation	$\begin{tabular}{lllllllllllllllllllllllllllllllllll$
Prerequisite	PV source = Custom

Description	Assigns a current to the primary HART variable (PV).	
	<ul> <li>None</li> <li>AIO B1-3 value mA<sup>*</sup></li> <li>AIO C1-3 value mA<sup>*</sup></li> </ul>	
Factory setting	None	
Additional information	Read access	Operator
	Write access	Maintenance

# Primary variable (PV) Navigation Image: Setup $\rightarrow$ Advanced setup $\rightarrow$ Communication $\rightarrow$ HART output $\rightarrow$ Configuration $\rightarrow$ Primary var (PV)

## **Description** Shows the current measured value of the primary dynamic variable (PV)

Additional information	Read access	Operator
	Write access	-

Percent of range		
Navigation	Image: Setup → Advanced and Advanced an	setup $\rightarrow$ Communication $\rightarrow$ HART output $\rightarrow$ Configuration
Description	Shows the value of the primary variable (PV) as a percentage of the defined 0% to 100% range.	
Additional information	Read access	Operator
	Write access	-

Assign SV		â
Navigation	Image: Betup → Advanced setup → Communication → HART output → Configuration → Assign SV	
Description	Assign a measured variable to the second dynamic variable (SV).	
Selection	<ul> <li>None</li> <li>Tank level</li> <li>Tank ullage</li> </ul>	

Visibility depends on order options or device settings

- Measured level
- Distance
- Displacer position
- Water level
- Upper interface level
- Lower interface level
- Bottom level
- Tank reference height
- Liquid temperature
- Vapor temperature
- Air temperature
- Observed density value
- Average profile density
- Upper density
- Middle density
- Lower density
- P1 (bottom)
- P2 (middle)
- P3 (top)
- GP 1 value
- GP 2 value
- GP 3 value
- GP 4 value

**Factory setting** 

Liquid temperature

Additional information

mation	Read access	Operator
	Write access	Maintenance

The **Measured level** option doesn't contain a unit. If a unit is needed, select the **Tank level** option.

Secondary variable (SV)			
Navigation	<ul><li>B ⊒ Setup → Advan</li><li>→ Second.var(S</li></ul>	ced setup $\rightarrow$ Communication $\rightarrow$ HART output $\rightarrow$ Configuration V)	
Prerequisite	Assign SV (→ 🗎 174) ≠ None		
Description	Shows the current measured value of the secondary dynamic variable (SV)		
Additional information	Read access	Operator	
	Write access	-	

Assign TV		
Navigation	Setup → Advanced setup → Communication → HART output → Configuration → Assign TV	
Description	Assign a measured variab	le to the tertiary dynamic variable (TV).
Selection Factory setting	<ul> <li>None</li> <li>Tank level</li> <li>Tank ullage</li> <li>Measured level</li> <li>Distance</li> <li>Displacer position</li> <li>Water level</li> <li>Upper interface level</li> <li>Lower interface level</li> <li>Bottom level</li> <li>Tank reference height</li> <li>Liquid temperature</li> <li>Vapor temperature</li> <li>Air temperature</li> <li>Observed density value</li> <li>Average profile density</li> <li>Upper density</li> <li>Middle density</li> <li>Lower density</li> <li>P1 (bottom)</li> <li>P2 (middle)</li> <li>P3 (top)</li> <li>GP 1 value</li> <li>GP 2 value</li> <li>GP 4 value</li> <li>Water level</li> </ul>	
Additional information	[	Operator
	Read access	Operator Maintananaa
	Write access	Maintenance

level option.

Tertiary variable (TV)		
Navigation	Setup → Advanced setup → Communication → HART output → Configuration → Tertiary var(TV)	
Prerequisite	Assign TV (→ 🖹 176) ≠ None	
<b>Description</b> Shows the current measured value of the tertiary (third) dynamic variable (TV)		

Additional information	Read access	Operator	
	Write access	-	
Assign QV		6	1
Navigation		setup $\rightarrow$ Communication $\rightarrow$ HART output $\rightarrow$ Configuration	
Description	Assign a measured variable to the quaternary dynamic variable (QV).		
Selection	Assign a measured variable to the quaternary dynamic variable (QV).  None Tank level Tank ullage Measured level Distance Displacer position Water level Upper interface level Lower interface level Bottom level Tank reference height Liquid temperature Vapor temperature Air temperature Air temperature Observed density value Average profile density Upper density Lower density F1 (bottom) P2 (middle) P3 (top) GP 1 value GP 2 value GP 4 value		
Factory setting	Observed density value		

## Additional information

Read access	Operator
Write access	Maintenance



Quaternary variable (QV)			
Navigation	Setup → Advanced setup → Communication → HART output → Configuration → Quaterna.var(QV)		
Prerequisite	Assign QV ( $\rightarrow \cong 177$ ) $\neq$ None		
Description	Shows the current measured value of the quaternary (fourth) dynamic variable (QV)		
Additional information	Read access	Operator	
	Write access	-	

#### "Information" submenu

Navigation

 $\label{eq:setup} \fbox{\ } \mathsf{Setup} \to \mathsf{Advanced \ setup} \to \mathsf{Communication} \to \mathsf{HART} \ \mathsf{output} \\ \to \mathsf{Information}$ 

HART short tag				Â
Navigation	Setup → Advanced setup → Communication → HART output → Information → HART short tag		Information → HART	
Description	Defines the short tag for the measuring point.			
	Maximum length: 8 characters Allowed characters: A-Z, 0-9, certain special characters			
User entry	Character string comprising numbers, letters and special characters (8)			
Factory setting	NMR8x			
Additional information	Read access		Operator	
	Write access		Maintenance	

Device tag		8
Navigation	Image Setup → Advanced setup - tag	→ Communication → HART output → Information → Device
Description	Enter a unique name for the measuring point to identify the device quickly within the plant.	
User entry	Character string comprising numbers, letters and special characters (32)	
Factory setting	NMR8x	
Additional information	Read access	Operator
	Write access	Maintenance

HART descriptor		
Navigation	Image: Setup → Advanced setup → Communication → HART output → Information → HART descriptor	
Description	Enter description for the measuring point	
User entry	Character string comprising numbers, letters and special characters (16)	

Factory setting	NMR8x		
Additional information	Read access	Operator	
	Write access	Maintenance	
HART message		٦	
Navigation	Setup → Advanced setup → Communication → HART output → Information → HART message		
Description	Use this function to define a HART message which is sent via the HART protocol when requested by the master.		
	Maximum length: 32 characters Allowed characters: A-Z, 0-9, certain special characters		
User entry	Character string comprising numbers, letters and special characters (32)		
Factory setting	NMR8x		
Additional information	Read access Operator		
	Write access     Maintenance		

HART date code		Ŕ	
Navigation	Setup → Advanced setup → Communication → HART output → Information → HART date code		
Description	Enter date of the last configuration change. Use this format yyyy-mm-dd		
User entry	Character string comprising numbers, letters and special characters (10)		
Factory setting	2009-07-20		
Additional information	Read access Operator		
	Write access	Maintenance	

## "Application" submenu

Navigation	8 8	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application	1
		FI THE FILLER FILLER	

"Tank configuration	" subm	enu
Navigation	8 2	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank config
"Level" submenu		
Navigation	8 8	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Level

Empty			Ê
Navigation	Image: Bearing and Setup and Advance	ed setup $\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Level $\rightarrow$ Empty	
Description	Distance from reference	Distance from reference point to zero position (tank bottom or datum plate).	
User entry	0 to 10 000 000 mm		
Factory setting	Dependent on the devi	ce version	
Additional information	Read access	Operator	
	Write access	Maintenance	

- After changing the **Empty** parameter (→ 
   <sup>™</sup> 126), the **Table mode** parameter (→ 
   <sup>™</sup> 215) is automatically set to **Disable**.
  - If Empty (→ 
     <sup>126</sup>) has been changed by more than 20 mm (0.8 in), it is recommended to delete the dip table.
  - The dip table values are not affected by a change of the **Empty** parameter (→ 
     <sup>(→</sup>) 126).

Tank reference height	â
Navigation	$\textcircled{B} \square  \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Application} \rightarrow \text{Tank config} \rightarrow \text{Level} \rightarrow \text{Tank ref height}$
Description	Defines the distance from the dipping reference point to the zero position (tank bottom or datum plate).
User entry	0 to 10 000 000 mm
Factory setting	Dependent on the device version

Additional information	Read access	Operator	
	Write access	Maintenance	
Tank level			
Navigation	□ Setup $\rightarrow$ Advanced setup $\rightarrow$	Application $\rightarrow$ Tank config $\rightarrow$ Level $\rightarrow$ Tank level	
<b>D</b>			
-	Shows the distance from the zero position (tank bottom or datum plate) to the product surface.		
	burrace.		
Additional information	Read access	Operator	

Write access

Set level		٦
Navigation		etup $\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Level $\rightarrow$ Set level
Description	If the level measured by the device does not match the actual level obtained by a manual dip, enter the correct level into this parameter.	
User entry	0 to 10 000 000 mm	
Factory setting	0 mm	
Additional information	Read access	Operator
	Write access	Maintenance

The device adjusts the **Empty** parameter ( $\Rightarrow \implies 126$ ) according to the entered value, such that the measured level will match the actual level.

- After the change of the **Empty** parameter (→ ≅ 126), the **Table mode** parameter (→ ≅ 215) is automatically set to **Disable**.
  - If **Empty** has been changed by more than 20 mm (0.8 in), it is recommended to delete the dip table.
  - The dip table values are not affected by a change of the **Empty** parameter.

Water level source		
Navigation	Image: Setup → Advanced setup → Application → Tank config → Level → Water level srow	1
Description	Defines the source of the bottom water level.	
Selection	<ul> <li>Manual value</li> <li>Bottom level</li> <li>HART device 1 15 level</li> </ul>	

	<ul> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> <li>AIP C4-8 value</li> </ul>	
Factory setting	Manual value	
Additional information	Read access	Operator
	Write access	Maintenance

Manual water level		٨
Navigation	Image: Setup → Advanced setup -	→ Application → Tank config → Level → Man. water level
Prerequisite	Water level source (→ 🗎 182)	= Manual value
Description	Defines the manual value of the bottom water level.	
User entry	-2 000 to 5 000 mm	
Factory setting	0 mm	
Additional information	Read access	Operator
	Write access	Maintenance

Water level		
Navigation		$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Level $\rightarrow$ Water level
Description	Shows the bottom water level.	
Additional information	Read access	Operator
	Write access	-

Blocking distance		Ê
Navigation	$ \blacksquare \blacksquare Setup \rightarrow Advanced setup \rightarrow Application \rightarrow Tank config \rightarrow Level \rightarrow Blocking dist. $	
Description	No echos are evaluated within the blocking distance BD. Therefore, BD can be used to suppress interference echos in the vicinity of the antenna.	
User entry	Positive floating-point number	
Factory setting	800 mm	

## Additional information

Read access	Operator
Write access	Maintenance

	"Temperature" submenu		
	Read access	Maintenance	
	Navigation 🛛 🗐 🗎	Setup $\rightarrow$ Advanced setup $\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Temperature	
Liquid temp source		<u>B</u>	
Navigation	Image: Setup → Advanced source	setup $\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Temperature $\rightarrow$ Liq temp	
Description	Defines source from which the liquid temperature is obtained.		
Selection	<ul> <li>Manual value</li> <li>HART device 1 15 temperature</li> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> <li>AIP C4-8 value</li> </ul>		
Factory setting	Manual value		
Additional information	Read access	Operator	
	Write access	Maintenance	

Manual liquid temperature	2	
Navigation	Setup → Advanced setup → Application → Tank config → Temperature → Man. liquid temp	
Prerequisite	Liquid temp source ( > 🗎 130) = Manual value	
Description	Defines the manual value of the liquid temperature.	
User entry	−50 to 300 °C	
Factory setting	25 ℃	

Additional information	Read access	Operator
	Write access	Maintenance

Liquid temperature			
Navigation	Image: Setup → Advanced setup → Application → Tank config → Temperature → Liquid temp.		
Description	Shows the average or spot temperature of the measured liquid.		
Additional information	Read access	Operator	
	Write access	-	
Air temperature source			
Navigation	Setup → Advanced setup → Application → Tank config → Temperature → Air temp. source		
Description	Defines source from wh	ich the air temperature is obtained.	
Description Selection	Defines source from white Manual value HART device 1 15 to AIO B1-3 value AIO C1-3 value AIP B4-8 value AIP C4-8 value		
Selection	<ul> <li>Manual value</li> <li>HART device 1 15 to</li> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> </ul>		
-	<ul> <li>Manual value</li> <li>HART device 1 15 to</li> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> <li>AIP C4-8 value</li> </ul>		

Manual air temperature		۵	
Navigation	Image: Setup → Advanced setup temp.	$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Temperature $\rightarrow$ Manual air	
Prerequisite	Air temperature source (→ 🗎 186) = Manual value		
Description	Defines the manual value of the air temperature.		
User entry	–50 to 300 °C		
Factory setting	25 °C		
Additional information	Read access	Operator	
	Write access	Maintenance	

Air temperature			
Navigation	Setup → Advanced setup →	Application $\rightarrow$ Tank config $\rightarrow$ Temperature $\rightarrow$ Air temp.	
Description	Shows the air temperature.		
Additional information	Read access Operator		
	Write access	-	

Vapor temp source		බ	
Navigation	$\textcircled{B} \boxminus Setup \rightarrow Advanced setup \rightarrow Application \rightarrow Tank config \rightarrow Temperature \rightarrow Vapor temp src$		
Description	Defines the source from which the vapor temperature is obtained.		
Selection	<ul> <li>Manual value</li> <li>HART device 1 15 vapor temp</li> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> <li>AIP C4-8 value</li> </ul>		
Factory setting	Manual value		
Additional information	ormation Read access Operator		
	Write access	Maintenance	

Manual vapor temperature				
Navigation	8 8	Setup → Advanced setup → vapor temp.	Application $\rightarrow$ Tank config $\rightarrow$ Temperature $\rightarrow$ Man.	
Prerequisite	Vapor temp source ( > 🗎 187) = Manual value			
Description	Defines the manual value of the vapor temperature.			
User entry	−50 to 300 °C			
Factory setting	25 ℃			
Additional information	Read access Operator			
	Write	access	Maintenance	

Vapor temperature			
Navigation	8 2	Setup $\rightarrow$ Advanced setup $\rightarrow$ temp.	Application $\rightarrow$ Tank config $\rightarrow$ Temperature $\rightarrow$ Vapor
Description	Shows the measured vapor temperature.		
Additional information	Read access Operator		
	Write	access	-

## "Density" submenu

Navigation

Observed density source		٦	
Navigation		$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Density $\rightarrow$ Density source	
Description	Determines how the density is obtained.		
Selection	<ul> <li>HTG<sup>*</sup></li> <li>HTMS<sup>*</sup></li> <li>Average profile density<sup>*</sup></li> <li>Upper density</li> <li>Middle density</li> <li>Lower density</li> </ul>		
Factory setting	Dependent on the device version		
Additional information	Read access	Operator	
	Write access	Maintenance	

Observed density			
Navigation	Image: Setup → Advanced setup - density	→ Application → Tank config → Density → Observed	
Description	Shows the measured or calculate	d density.	
Additional information	Read access	Operator	
	Write access	-	
Air density			A
Navigation	Image: Setup → Advanced setup -	$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Density $\rightarrow$ Air density	
Description	Defines the density of the air surrounding the tank.		
User entry	0.0 to 500.0 kg/m <sup>3</sup>		
Factory setting	1.2 kg/m³		

<sup>\*</sup> Visibility depends on order options or device settings

Additional information	Read access	Operator	
	Write access	Maintenance	
Vapor density		Â	
Navigation			
Description	Defines the density of the gas phase in the tank.		
User entry	0.0 to 500.0 kg/m <sup>3</sup>		
Factory setting	1.2 kg/m <sup>3</sup>		
Additional information	Read access	Operator	
	Write access	Maintenance	

#### "Pressure" submenu

Navigation

P1 (bottom) source		۵
Navigation Description	Setup → Advanced setup → Application → Tank config → Pressure → P1 (bot) source Defines the source of the bottom pressure (P1).	
Selection	<ul> <li>Manual value</li> <li>HART device 1 15 pressure</li> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> <li>AIP C4-8 value</li> </ul>	
Factory setting	Manual value	
Additional information	Read access	Operator
	Write access	Maintenance

P1 (bottom)		
Navigation		$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ P1 (bottom)
Description	Shows the pressure at the tank bottom.	
Additional information	Read access     Operator	
	Write access	-

P1 (bottom) manual pressure		A
Navigation	Setup → Advanced setup → Application → Tank config → Pressure → P1 (bot) manual	
Prerequisite	P1 (bottom) source (→ 🗎 191) = Manual value	
Description	Defines the manual value of the bottom pressure (P1).	
User entry	-25 to 25 bar	
Factory setting	0 bar	

Additional information	Read access	Operator
	Write access	Maintenance

P1 position		8
Navigation	■ $\square$ Setup → Advanced setup →	Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ P1 position
Description	Defines the position of the bottom pressure transmitter (P1), measured from zero position (tank bottom or datum plate).	
User entry	-10 000 to 100 000 mm	
Factory setting	5 000 mm	
Additional information	Read access	Operator
	Write access	Maintenance

P1 offset			Â
Navigation	Image: Boost Setup → Advanced setup -	$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ P1 offset	
Description	Offset for the bottom pressure (P1). The offset is added to the measured pressure prior to any tank calculation.		
User entry	-25 to 25 bar		
Factory setting	0 bar		
Additional information	Read access	Operator	
	Write access	Maintenance	

P1 absolute / gauge		A
Navigation	Setup → Advanced setup → Application → Tank config → Pressure → P1 absolut/ gauge	1
Description	Defines whether the connected pressure transmitter measures an absolute or a gauge pressure.	
Selection	<ul><li>Absolute</li><li>Gauge</li></ul>	
Factory setting	Gauge	

Additional information	Read access	Operator
	Write access	Maintenance

P3 (top) source		Ŕ
Navigation	Image: Barbon Setup → Advanced setup -	$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ P3 (top) source
Description	Defines the source of the top pre	ssure (P3).
Selection	<ul> <li>Manual value</li> <li>HART device 1 15 pressure</li> <li>AIO B1-3 value</li> <li>AIO C1-3 value</li> <li>AIP B4-8 value</li> <li>AIP C4-8 value</li> </ul>	
Factory setting	Manual value	
Additional information	Read access	Operator
	Write access	Maintenance

P3 (top)		
Navigation		$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ P3 (top)
Description	Shows the pressure (P3) at the top transmitter.	
Additional information	Read access Operator	
	Write access	-

P3 (top) manual pressure		Â
Navigation	Setup → Advanced setup → Application → Tank config → Pressure → P3 (top) manual	)
Prerequisite	P3 (top) source ( $\rightarrow \square$ 193) = Manual value	
Description	Defines the manual value of the top pressure (P3).	
User entry	-2.5 to 2.5 bar	
Factory setting	0 bar	

Additional information	Read access	Operator
	Write access	Maintenance

P3 position		۵	
Navigation	$ \blacksquare \blacksquare  \text{Setup} \rightarrow \text{Advanced setup} -$	$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ P3 position	
Description	Defines the position of the top pressure transmitter (P3), measured from zero position (tank bottom or datum plate).		
User entry	0 to 100000 mm		
Factory setting	20000 mm		
Additional information	Read access	Operator	
	Write access	Maintenance	

P3 offset			Î
Navigation	Image: Bearing → Advanced setup →	$\rightarrow$ Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ P3 offset	
Description	Offset for the top pressure (P3). The offset is added to the measured pressure prior to any tank calculation.		
User entry	-2.5 to 2.5 bar		
Factory setting	0 bar		
Additional information	Read access	Operator	
	Write access	Maintenance	

P3 absolute / gauge		
Navigation	Setup → Advanced setup → Application → Tank config → Pressure → P3 absolut/ gauge	/
Description	Defines whether the connected pressure transmitter measures an absolute or a gauge pressure.	
Selection	<ul><li>Absolute</li><li>Gauge</li></ul>	
Factory setting	Gauge	

Read access Operator		
Write access	Maintenance	
Setup → Advanced setup → pressure	Application $\rightarrow$ Tank config $\rightarrow$ Pressure $\rightarrow$ Ambient	
Defines the manual value of the a	ambient pressure.	
0 to 2.5 bar		
1 bar		
Read access	Ongrator	
	Write access Write access Setup $\rightarrow$ Advanced setup $\rightarrow$ pressure Defines the manual value of the a 0 to 2.5 bar	Write access       Maintenance         Image: Setup → Advanced setup → Application → Tank config → Pressure → Ambient pressure         Defines the manual value of the ambient pressure.         0 to 2.5 bar         1 bar         Read access       Operator

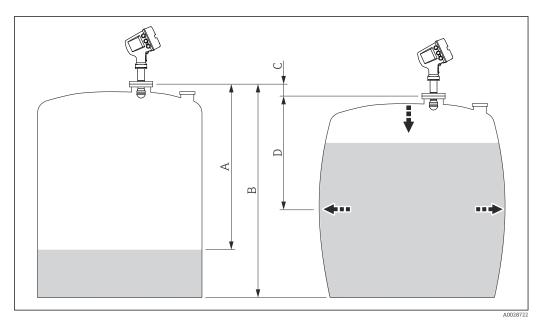
#### "Tank calculation" submenu

*Navigation*  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation

## "HyTD" submenu

Overview

Hydrostatic Tank Deformation can be used to compensate the vertical movement of the Gauge Reference Height (GRH) due to bulging of the tank shell caused by the hydrostatic pressure exerted by the liquid stored in the tank. The compensation is based on a linear approximation obtained from manual hand dips at several levels distributed over the full range of the tank.

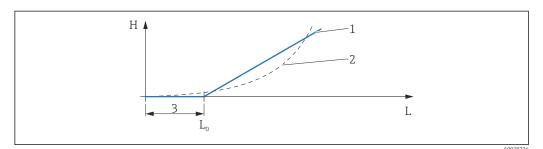


☑ 55 Correction of the hydrostatic tank deformation (HyTD)

- A "Distance" (level below  $L_0 \rightarrow$  "HyTD correction value" = 0)
- *B* Gauge Reference Height (GRH)
- C HyTD correction value
- D "Distance" (level above  $L_0 \rightarrow$  "HyTD correction value" > 0)

## Linear approximation of the HyTD correction

The real amount of deformation varies non-linearly with the level due to the construction of the tank. However, as the correction values are typically small compared to the measured level, a simple straight line method can be used with good results.



#### ■ 56 Calculation of the HyTD correction

- 1 Linear correction according to "Deformation factor ( $\rightarrow \square$  199)"
- 2 Real correction
- 3 Starting level ( $\rightarrow \square$  198)
- L Measured level ( $\rightarrow \square 118$ )
- *H* HyTD correction value ( $\rightarrow \square 198$ )

#### Calculation of the HyTD correction

L	$\leq L_0 \implies$	$C_{HyTD} = 0$
L	$> \Gamma^0 \implies$	$C_{HyTD} = - (L - L_0) \times D$

L	Measured level
L <sub>0</sub>	Starting level
c <sub>HyTD</sub>	HyTD correction value
D	Deformation factor

A0028715

Description of parameters

Navigation $\ensuremath{\boxtimes}\xspace \square$ Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation $\rightarrow$  HyTD

HyTD correction value				
Navigation	⊜⊟ Setu value		Application $\rightarrow$ Tank calculation $\rightarrow$ HyTD $\rightarrow$ HyTD corr.	
Description	Shows the o	Shows the correction value from the Hydrostatic Tank Deformation.		
Additional information	Read access	Read access Operator		
	Write access	5	-	

HyTD mode		8
Navigation	Image: Bearing and the setup Image: Bearing and the se	$\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ HyTD $\rightarrow$ HyTD mode
Description	Activates or deactivates the calo	culation of the Hydrostatic Tank Deformation.
Selection	■ No ■ Yes	
Factory setting	No	
Additional information	Read access	Operator
	Write access	Maintenance

Starting level		8	
Navigation	Image: Barbon Setup → Advanced setup →	$\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ HyTD $\rightarrow$ Starting level	
Description	Defines the starting level for the Hydrostatic Tank Deformation. Levels below this value are not corrected.		
User entry	0 to 5 000 mm		
Factory setting	500 mm		
Additional information	Read access	Operator	
	Write access	Maintenance	

Deformation factor		Â	
Navigation	Image: Boost Setup → Advanced setup -	$\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ HyTD $\rightarrow$ Deform factor	
Description	Defines the deformation factor for the HyTD (change of device position per change of level).		
User entry	-1.0 to 1.0 %		
Factory setting	0.2 %		
Additional information	Read access	Operator	
	Write access	Maintenance	

## "CTSh" submenu

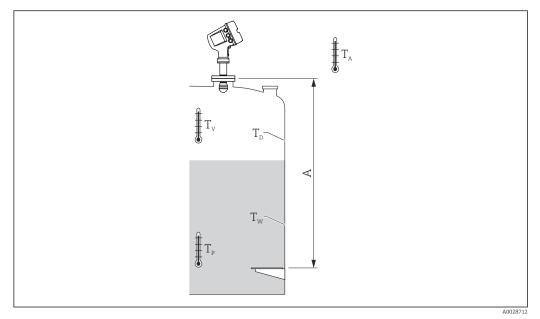
## Overview

CTSh (correction for the thermal expansion of the tank shell) compensates for effects on the Gauge Reference Height (GRH) and on the expansion or contraction of the measuring wire due to temperature effects on the tank shell or stilling well. The temperature effects are separated into two parts, respectively affecting the 'dry' and 'wetted' part of the tank shell or stilling well. The correction function is based on thermal expansion coefficients of steel and insulation factors for both the 'dry' and 'wet' parts of the wire and the tank shell. The temperatures used for the correction can be selected from on manual or measured values.

This correction is recommended for the following situations:

- if the operating temperature deviates considerably from the temperature during calibration ( $\Delta T > 10 \degree C (18 \degree F)$ )
- for extremely high tanks
- for refrigerated, cryogenic or heated applications
- As the use of this correction will influence the innage level reading, it is recommended to ensure the manual hand dip and level verification procedures are being conducted correctly before enabling this correction method.
- This mode cannot be used in conjunction with HTG because the level is not measured relative to the gauge reference height with HTG.

## CTSh: Calculation of the wall temperature



57 Parameters for the CTSh calculation

A Gauge Reference Height (GRH)

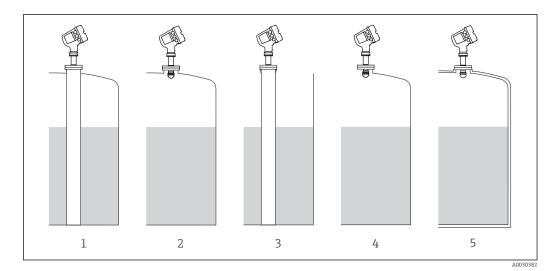
T <sub>w</sub>	Temperature of the wetted part of the tank shell	
T <sub>D</sub>	Temperature of the dry part of the tank shell	
T <sub>P</sub>	Product temperature	
T <sub>V</sub>	Vapor temperature (in the tank)	
T <sub>A</sub>	Ambient temperature (atmosphere surrounding the tank)	

## CTSh: Calculation of the wall temperature

Depending on the parameters **Covered tank** ( $\rightarrow \cong 203$ ) and **Stilling well** ( $\rightarrow \cong 204$ ), the temperatures  $T_W$  of the wetted and  $T_D$  of the dry part of the tank wall are calculated as follows:

Covered tank (→ 🗎 203)	Stilling well (→ 🗎 204)	T <sub>W</sub>	T <sub>D</sub>
Covered	Yes <sup>1)</sup>	T <sub>p</sub>	T <sub>V</sub>
	No	(7/8) T <sub>P</sub> + (1/8) T <sub>A</sub>	(1/2) T <sub>V</sub> + (1/2) T <sub>A</sub>
Open top	Yes	T <sub>P</sub>	T <sub>A</sub>
	No	(7/8) T <sub>P</sub> + (1/8) T <sub>A</sub>	T <sub>A</sub>

1) This option is also valid for insulated tanks without a stilling welll. This is due to the temperature inside and outside of the tank shell being the same due to the insulation of the tank.



- Covered tank ( $\rightarrow \square 203$ ) = Covered; Stilling well ( $\rightarrow \square 204$ ) = Yes 1
- 2
- 3
- 4 5
- Covered tank ( $\rightarrow \square 203$ ) = Covered; Stilling well ( $\rightarrow \square 204$ ) = No Covered tank ( $\rightarrow \square 203$ ) = Open top; Stilling well ( $\rightarrow \square 204$ ) = No Covered tank ( $\rightarrow \square 203$ ) = Open top; Stilling well ( $\rightarrow \square 204$ ) = No Insulated tank: Covered tank ( $\rightarrow \square 203$ ) = Open top; Stilling well ( $\rightarrow \square 204$ ) = Yes

CTSh: Calculation of the correction

$$C_{\text{CTSh}} = \alpha (H - L) (T_{\text{D}} - T_{\text{cal}}) + \alpha L (T_{\text{W}} - T_{\text{cal}})$$

Н	Gauge Reference Height	
L	Measured level	
T <sub>D</sub>	Temperature of the dry part of the tank shell (calculated from $T_{\rm P},T_{\rm V}\text{and}T_{\rm A})$	
T <sub>W</sub>	Temperature of the wetted part of the tank shell (calculated from $T_{\rm P},T_{\rm V}$ and $T_{\rm A})$	
T <sub>cal</sub>	Temperature at which the measurement has been calibrated	
α	Linear expansion coefficient	
C <sub>CTSh</sub>	CTSh correction value	

## Description of parameters

Navigation

 $\label{eq:setup} \fboxspace{-1.5mu} \begin{array}{l} \mbox{Setup} \rightarrow \mbox{Advanced setup} \rightarrow \mbox{Application} \rightarrow \mbox{Tank calculation} \\ \rightarrow \mbox{CTSh} \end{array}$ 

CTSh correction value			
Navigation	8 8	Setup → Advanced setup → value	$\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ CTSh $\rightarrow$ CTSh corr
Description	Show	rs the CTSh correction value.	
Additional information	Read	access	Operator
	Write	access	-

CTSh mode		8
Navigation		$\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ CTSh $\rightarrow$ CTSh mode
Description	Activates or deactivates the CTS	1.
Selection	<ul> <li>No</li> <li>Yes</li> <li>With wire *</li> <li>Only wire *</li> </ul>	
Factory setting	No	
Additional information	Read access	Operator
	Write access	Maintenance

Covered tank	
Navigation	□ Setup → Advanced setup → Application → Tank calculation → CTSh → Covered tank
Description	Determines whether the tank is covered.
Selection	<ul><li>Open top</li><li>Covered</li></ul>
Factory setting	Open top

<sup>\*</sup> Visibility depends on order options or device settings

# Additional information

Read access	Operator
Write access	Maintenance

The **Covered** option is only valid for fixed tank roofs. For a floating roof select **Open top**.

Stilling well		8
Navigation	Image: Bearing → Advanced setup -	$\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ CTSh $\rightarrow$ Stilling well
Description	Determines whether the device i	s mounted on a stilling well.
Selection	■ No ■ Yes	
Factory setting	No	
Additional information	Read access	Operator
	Write access	Maintenance

Calibration temperature			C	<u>-</u>
Navigation	9 8	Setup → Advanced setup <del>→</del> temp	Application $\rightarrow$ Tank calculation $\rightarrow$ CTSh $\rightarrow$ Calibration	
Description	Specif	Specify temperature at which the measurement has been calibrated.		
User entry	-50 to	−50 to 250 °C		
Factory setting	25 °C	25 °C		
Additional information	Read a	Read access     Operator		
	Write	access	Maintenance	

Linear expansion coefficier	nt	
Navigation	$\textcircled{B} \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$	
Description	Defines the linear expansion coefficient of the tank shell material.	
User entry	0 to 100 ppm	
Factory setting	15 ppm	

Additional information	Read access	Operator
	Write access	Maintenance

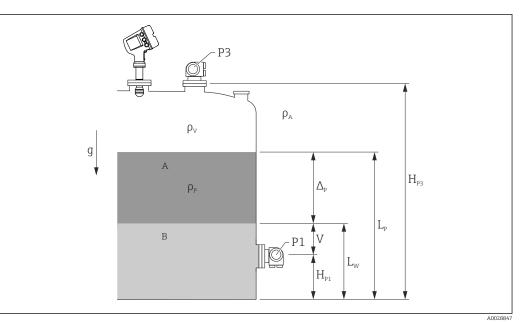
Wire expansion coefficient	
Navigation	■ Setup → Advanced setup → Application → Tank calculation → CTSh → Wire exp coeff
Description	Defines the expansion coefficient of the wire material of the drum. Value is programmed in factory.
User entry	0 to 100 ppm
Factory setting	15 ppm

## "HTMS" submenu

## Overview

The Hybrid Tank Measurement System (HTMS) is a method to calculate the density of a product in a tank based on both a (top mounted) level and at least one (bottom mounted) pressure measurement. An additional pressure sensor can be installed at the top of the tank to provide information about the vapor pressure and to make the density calculation more accurate. The calculation method also takes into account a possible level of water at the bottom of the tank to make density calculations as accurate as possible.

## HTMS parameters



■ 58 HTMS parameters

- A Product
- B Water

Parameter	Navigation path	
P1 (Bottom pressure)	Setup $\rightarrow$ Advanced setup $\rightarrow$ Tank configuration $\rightarrow$ Pressure $\rightarrow$ P1 (bottom)	
$H_{P1}$ (Position of P1 transmitter)	Setup $\rightarrow$ Advanced setup $\rightarrow$ Tank configuration $\rightarrow$ Pressure $\rightarrow$ P1 position	
P3 (Top pressure)	Setup $\rightarrow$ Advanced setup $\rightarrow$ Tank configuration $\rightarrow$ Pressure $\rightarrow$ P3 (top)	
$H_{P3}$ (Position of P3 transmitter)	Setup $\rightarrow$ Advanced setup $\rightarrow$ Tank configuration $\rightarrow$ Pressure $\rightarrow$ P3 position	
$\rho_P$ (Density of the product $^{1)})$	<ul> <li>Measured value: Setup → Advanced setup → Calculation → HTMS → Density value</li> <li>User-defined value: Setup → Advanced setup → Calculation → HTMS → Manual upper density</li> </ul>	
$\rho_V$ (Vapor density)	Expert $\rightarrow$ Application $\rightarrow$ Tank configuration $\rightarrow$ Density $\rightarrow$ Vapor density	
$\rho_A$ (Ambient air temperature)	Setup $\rightarrow$ Advanced setup $\rightarrow$ Tank configuration $\rightarrow$ Density $\rightarrow$ Air density	
g (Local gravity)	Expert $\rightarrow$ Application $\rightarrow$ Tank Calculation $\rightarrow$ Local gravity	
L <sub>p</sub> (Level of the product)	Operation → Tank level	
L <sub>W</sub> (Bottom water level)	Operation $\rightarrow$ Water level	
$V = L_W - H_{P1}$		
$\Delta_{\rm P} = L_{\rm P} - L_{\rm W} = L_{\rm P} - V - H_{\rm P1}$		

1) Depending on the situation this parameter is measured or a user-defined value is used.

## HTMS modes

Two HTMS modes can be selected in the **HTMS mode** parameter ( $\rightarrow \square 208$ ). The mode determines whether one or two pressure values are used. Depending on the selected mode a number of additional parameters are required for the calculation of the product density.

The **HTMS P1+P3** option must be used in pressurized tanks in order to compensate for the pressure of the vapor phase.

HTMS mode (→ 🗎 208)	Measured variables	Required additional parameters	Calculated variables
HTMS P1	• P <sub>1</sub> • L <sub>P</sub>	• g • $H_{P1}$ • $L_W$ (optional)	ρ <sub>Ρ</sub>
HTMS P1+P3	<ul> <li>P<sub>1</sub></li> <li>P<sub>3</sub></li> <li>L<sub>P</sub></li> </ul>	• $\rho_V$ • $\rho_A$ • $g$ • $H_{P1}$ • $H_{P3}$ • $L_W$ (optional)	ρ <sub>P</sub> (more precise calculation for pressurized tanks)

#### Minimum level

The density of the product can only be calculated if the product has a minimum thickness :

 $\Delta_{\rm P} \geq \Delta_{\rm P, min}$ 

This is equivalent to the following condition for the product level:

$$L_{P}-V\geq \Delta_{P,\min}+H_{P1}=L_{\min}$$

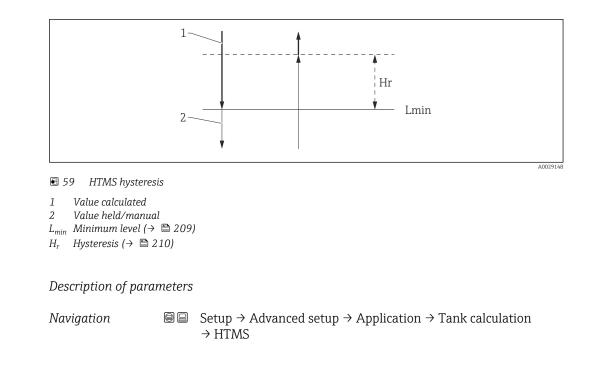
 $L_{min}$  is defined in the **Minimum level** parameter ( $\rightarrow \cong 209$ ). As can be seen from the formula it always must be bigger than  $H_{P1}$ .

If  $L_P$  - V falls below this limit, the density is calculated as follows:

- If a previous calculated value is available, this value will be kept as long as no new calculation is possible.
- If no value was previously calculated, the manual value (defined in the **Manual upper density** parameter) will be used.

#### Hysteresis

The level of the product in a tank is not constant but slightly varies, due for example to filling disturbances. If the level oscillates around the changeover level (**Minimum level** ( $\rightarrow \implies 209$ )), the algorithm will constantly switch between calculating the value and holding the previous result. To avoid this effect a positional hysteresis is defined around the changeover point.



HTMS mode		Â
Navigation	Image: Barbon Setup → Advance	ced setup $\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ HTMS $\rightarrow$ HTMS mode
Description	Defines the HTMS mo used.	de. Depending on the mode one or two pressure transmitters are
Selection	<ul><li>HTMS P1</li><li>HTMS P1+P3</li></ul>	
Factory setting	HTMS P1	
Additional information	Read access	Operator
	Write access	Maintenance
	HTMS P1+P3	us ure transmitter (P1) is used. op (P3) pressure transmitter are used. This option should be selected

for pressurized tanks.

Manual density		
Navigation		
Description	Defines the manual density.	

User entry	0 to $3000 \text{ kg/m}^3$			
Factory setting	800 kg/m³			
Additional information	Read access	Maintenance		
	Write access	Maintenance		
Density value				
Navigation	Image: Barbon Barbo	$\phi$ → Application → Tank calculation → HTMS → Density value		
Description	Shows the calculated product of	lensity.		
Additional information	Read access	Operator		
	Write access	-		
Minimum level		<u>8</u>		
Navigation	Image: Barbon Setup → Advanced setup	$\rightarrow$ Application → Tank calculation → HTMS → Min. level		
Description	Defines the minimum product	level for a HTMS calculation.		
	If Lp - V falls below the limit defined in this parameter, the density retains its last value or the manual value is used instead.			
User entry	0 to 20 000 mm			
Factory setting	7 000 mm			

Additional information	Read access	Operator	
	Write access	Maintenance	

Minimum pressure		
Navigation	Setup → Advanced setup → Application → Tank calculation → HTMS → Min. pressure	
Description	Defines the minimum pressure for a HTMS calculation.	
	If the pressure P1 (or the difference P1 - P3) falls below the limit defined in this parameter, the density retains its last value or the manual value is used instead.	
User entry	0 to 100 bar	
Factory setting	0.1 bar	

Additional information	Read access	Operator
	Write access	Maintenance

Safety distance			
Navigation	Image: Setup → Advanced setup - distance	$\rightarrow$ Application $\rightarrow$ Tank calculation $\rightarrow$ HTMS $\rightarrow$ Safety	
Description	Defines the minimum level which before its signal is used for the ca	n must be present above the bottom pressure sensor alculation.	
User entry	0 to 10 000 mm		
Factory setting	2 000 mm		
Additional information	Read access	Operator	
	Write access	Maintenance	

Hysteresis		ඕ
Navigation	Image: Boost Setup → Advanced setup -	→ Application → Tank calculation → HTMS → Hysteresis
Description	Defines the hysteresis for the HT near the switch-over point.	MS calculation. Prevents constant switching if the level is
User entry	0 to 2 000 mm	
Factory setting	50 mm	
Additional information	Read access	Operator
	Write access	Maintenance

Water density		Ê
Navigation	Setup → Advanced setup → Application → Tank calculation → HTMS → Water density	
Description	Density of the water in the tank.	
User entry	Signed floating-point number	
Factory setting	1000 kg/m <sup>3</sup>	

#### Additional information

Read access	Operator
Write access	Maintenance

"Dip-table" submenu

## Dip table

The dip table is used to correct the level readings using independently taken hand dips. The dip table is used in particular to adapt the level gauge to the specific application conditions such as a mechanical offset and the tank or stilling well design. Depending on national regulations, national inspectors will dip the tank at one to three levels during a calibration run and check the level readings.

Only one value pair must be entered into the dip table to correct the measurement offset. If a second value pair is entered into the dip table, the device accepts the corrected measured values identically for both value pairs. All other measured values are determined by linear extrapolation.

If more than two value pairs are entered, the system carries out a linear interpolation between adjacent value pairs. Outside these value pairs, extrapolation is also linear.

Before a table is entered, delete any existing table values by selecting **Table settings**  $(\Rightarrow \cong 215) = "Clear table" option.$ 

- The offset should **not** be determined and entered within the close range of the antenna or immediately in the range of the tank bottom, because within these ranges interferences of the radar signal may occur.
- After changing the **Empty** parameter ( $\rightarrow \cong 126$ ), the **Table mode** parameter ( $\rightarrow \cong 215$ ) is automatically set to **Disable**.
  - If Empty (→ 
     <sup>126</sup>) has been changed by more than 20 mm (0.8 in), it is recommended to delete the dip table.
  - The dip table values are not affected by a change of the **Empty** parameter (→ 
     <sup>(→)</sup> 126).

#### Semiautomatic creation of a dip table

In order not to mix up measurement values corrected by the dip table with uncorrected measurement values, it is recommended to enter new data pairs semiautomatically into the table. This means: the uncorrected level is measured by the device and the user only enters the corresponding dip value.

The first dip value should be entered immediately after the basic calibration. Further dip points should be entered only after a level change of at least 2 m (6.6 ft) and a deviation between the uncorrected measurement value and the hand dip value of at least 4 mm (0.16 in).

If this procedure can not be followed, then **no** value pair should be entered into the dip table after basic calibration. Measurement data and hand dip values should be collected over the full measurement range and be evaluated with regard to a good linear fit. Only then characteristic value pairs should be entered into the dip table using the "manual mode" (see below).

#### Manual creation of a dip table

Before creating a dip table manually, measured levels and dip values should be collected over the full measurement range and be evaluated with regard to a linear fit. Only then characteristic value pairs from this fit should be entered into the dip table using the manual mode. In the manual mode both, the measured level (without correction) and the corresponding dip value are entered by the user.



If further linearisation is needed, further hand dip values should be entered using only the "semi-automatic" mode (see above).

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The table editor on the local display

**1.** Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  Dip-table  $\rightarrow$  Table mode and select the **Disable** option.

**2.** Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Calculation  $\rightarrow$  Dip-table  $\rightarrow$  Edit table

F	//Edit ta	able	13953-1
N	Dip Tabl	e De. 🛛 🛛	ip Table Di.
1		10.0	10.1
2		5.0	4.2
3		1.0	1.0
			E

🖻 60 The dip table editor on the local display

- N Number of the line
- De. Device level
- Di. Dip level

╘

4

**3.** Use the " $\uparrow$ " and " $\downarrow$ " keys to move to the line you want to edit.

1	//Edit t	able	13964-
N	Dip Tab	le De.	Dip Table Di
3		1.0	1.(
4		0.0	0.0
5		0.0	0.0
	<u>†</u>	Ļ	E

4. Press "E" to open the line.

5. Use " $\rightarrow$ " to select the cell you want to edit.

N         Dip Table De.         Dip Table Di.           3         1.0         1.0           4         0.0         0.0           5         0.0         0.0	٢	//Edit table	13964-1
4 0.0 0.0	Ν	Dip Table De.	Dip Table Di.
	3	1.0	1.0
5 0.0 0.0	4	0.0	0.0
	5	0.0	0.0

- 6. Press "E" to open the cell.
- 7. Enter the required number  $\rightarrow \cong 50$ .
- 8. Continue until all required table points have been entered.
- 9. Press "-" and "+" simultaneously to quit the table editor.
- 10. Navigate to Setup → Advanced setup → Application → Tank calculation → Dip-table
   → Table settings and select the **Sort table** option.
  - $\blacktriangleright$  The table points are arranged in an ascending order.
- **11.** Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  Dip-table  $\rightarrow$  Table modeand select the **Enable** option.
  - └ The new dip table is active.

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The table editor in FieldCare

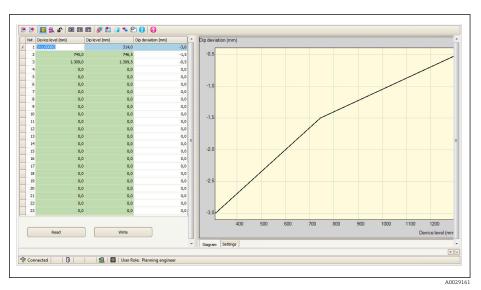
In the FieldCare table editor the dip table can only be entered manually. Even if the semiautomatic method has been selected in the **Table settings** parameter (→ 🖺 215), the complete table will be written from the editor to the device in the manual mode.

Tank level (139):         C         C           Distance (120):         0	0399,6200 mm	Liquid temper	rature: ()	-273,15 °C 0,0000 mm	Observed density: 🔇	800,000
		1				
(a) 💼 💼 🖬 All parameters	🖂 🕺 🗖	🔁 🖻 🖪	🞋 🕕 🕜			
Menu / Variable		Table Settings:	Manual			
📄 🦢 Advanced setup						
-PC Locking status:						
P Access status tooling:						
-P Enter access code:						
🔁 🧰 Input/Output						
🔅 🛅 Communication						
🔃 🛅 🛛 Tank configuration						
🖹 🦾 Tank Calculation						
🗐 🛅 НуТО						
🕀 🛅 CTSh						
🕀 🚞 НТБ						
😟 🛅 HTMS						
🖃 🗁 Dip table						

1 Table icon; calls up the table editor.

Open the table editor by clicking on the table icon.

← The graphical table editor appears:



- 2. If the device already contains a dip table: Click "Read" to load it into the editor.
- **3.** Enter or change table values in the table on the right. A graphical representation of the table is shown in the diagram on the right.
- 4. Click "Write" to write the table back to the device.

## Description of parameters

Navigation

 $\label{eq:setup} \fboxspace{-1.5mu} \begin{array}{l} \mbox{Setup} \rightarrow \mbox{Advanced setup} \rightarrow \mbox{Application} \rightarrow \mbox{Tank calculation} \\ \rightarrow \mbox{Dip-table} \end{array}$ 

Table settings					
Navigation	Image: Setup → Advanced setup → Application → Tank calculation → Dip-table → Table settings				
Description	Defines the dip-table operation to be performed.				
Selection	<ul> <li>Manual</li> <li>Semiautomatic</li> <li>Clear table</li> <li>Sort table</li> </ul>				
Factory setting	Manual				
Additional information	Read access	Operator			
	Write access	Maintenance			
	<ul> <li>Semiautomatic The device level of e dip level must be en</li> <li>Clear table Deletes the complet</li> <li>Sort table Sorts the table poin</li> </ul>	rel and the dip level for each table point have to be entered manual each table point is measured by the device itself, the corresponding ntered manually.			

Table mode				
Navigation				
Description	Enables or disables the dip-table.			
Selection	<ul><li>Disable</li><li>Enable</li></ul>			
Factory setting	Disable			

## Additional information

Read access	Operator
Write access	Maintenance

"Alarm" submenu

*Navigation*  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm

## "Alarm" submenu

Navigation

 $\label{eq:setup} \fbox{ Setup} \rightarrow \texttt{Advanced setup} \rightarrow \texttt{Application} \rightarrow \texttt{Alarm} \rightarrow \texttt{Alarm}$ 

► Alarm	
Alarm mode	] → 🗎 217
Error value	→ 🗎 218
Alarm value source	) → 🖹 219
Alarm value	] → 🗎 220
HH alarm value	] → 🗎 220
H alarm value	] → 🗎 220
L alarm value	) → 🗎 221
LL alarm value	) → 🗎 221
HH alarm	) → 🗎 221
H alarm	) → 🗎 222
HH+H alarm	→ 🗎 222
L alarm	→ 🗎 222
LL alarm	) → 🗎 222
LL+L alarm	) → 🗎 223
Any error	→ 🗎 223
Clear alarm	) → 🗎 223

Alarm hysteresis	→ 🗎 224
Damping factor	→ 🗎 224

Alarm mode			Ê
Navigation	■ $\square$ Setup $\rightarrow$ Advanced s	setup $\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ Alarm mo	ode
Description	Defines the alarm mode of the selected alarm.		
Selection	<ul><li> Off</li><li> On</li><li> Latching</li></ul>		
Factory setting	Off		
Additional information	Read access	Operator	
	Write access	Maintenance	

Meaning of the options

• Off

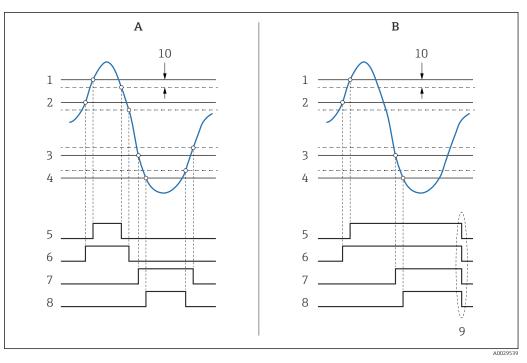
No alarms are generated.

• 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** ( $\rightarrow \implies 223$ ) = **Yes** or the power is switched off and on.



🖻 *61* Principle of the limit evaluation

- Α
- Alarm mode ( $\rightarrow \square 217$ ) = On Alarm mode ( $\rightarrow \square 217$ ) = Latching HH alarm value ( $\rightarrow \square 220$ ) В
- 1
- 2 H alarm value ( $\rightarrow \square 220$ )
- 3 L alarm value ( $\rightarrow \square 221$ )
- LL alarm value ( $\rightarrow \square 221$ ) 4
- HH alarm (→ 🖺 221) 5
- 6 7
- 8 LL alarm ( $\rightarrow \square 222$ )
- 9 "Clear alarm ( $\rightarrow \boxtimes 223$ )" = "Yes" or power off-on 10 Hysteresis ( $\rightarrow \boxtimes 224$ )

LITUI Value	Error	val	lue
-------------	-------	-----	-----

Navigation	Setup → Advanced setup → Application → Alarm → Alarm → Error value		
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq$ Off		
Description	Defines the alarm to be issued if the input value is invalid.		
Selection	<ul> <li>No alarm</li> <li>HH+H alarm</li> <li>H alarm</li> <li>L alarm</li> <li>LL+L alarm</li> <li>All alarms</li> </ul>		
Factory setting	All alarms		
Additional information	Read access	Operator	
	Write access	Maintenance	

A

Navigation Prerequisite Description Selection	Alarm mode (→ 🗎 217) ≠ Off Determines the process variable t • Tank level • Liquid temperature	Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ Alarm source to be monitored.	
Prerequisite Description	Alarm mode (→ 🗎 217) ≠ Off Determines the process variable t • Tank level • Liquid temperature		
Description	Determines the process variable t • Tank level • Liquid temperature	to be monitored.	
	<ul><li>Tank level</li><li>Liquid temperature</li></ul>	to be monitored.	
Selection	<ul> <li>Liquid temperature</li> </ul>		
	<ul> <li>Vapor temperature</li> </ul>		
	<ul> <li>Water level</li> </ul>		
	<ul><li>P1 (bottom)</li></ul>		
	<ul> <li>P2 (middle)</li> </ul>		
	■ P3 (top)		
	<ul> <li>Observed density value</li> </ul>		
	<ul> <li>Volume</li> </ul>		
	<ul> <li>Flow velocity</li> </ul>		
	<ul> <li>Volume flow</li> </ul>		
	<ul> <li>Vapor density</li> </ul>		
	<ul> <li>Middle density</li> </ul>		
	<ul> <li>Upper density</li> </ul>		
	<ul> <li>Correction</li> </ul>		
	Tank level %		
	<ul> <li>GP 14 value</li> </ul>		
	<ul> <li>Measured level</li> </ul>		
	<ul> <li>P3 position</li> </ul>		
	<ul> <li>Tank reference height</li> </ul>		
	<ul> <li>Local gravity</li> </ul>		
	<ul><li>P1 position</li></ul>		
	<ul><li>Manual density</li></ul>		
	<ul><li>Tank ullage</li></ul>		
	<ul> <li>Average profile density</li> </ul>		
	<ul> <li>Lower density</li> <li>Upper interface level</li> </ul>		
	<ul> <li>Upper interface level</li> </ul>		
	<ul> <li>Lower interface level</li> <li>Detterm level</li> </ul>		
	<ul> <li>Bottom level</li> </ul>		
	<ul> <li>Displacer position</li> </ul>		
	<ul> <li>HART device 115 PV</li> </ul>		
	<ul> <li>HART device 115 SV</li> </ul>		
	<ul> <li>HART device 115 TV</li> </ul>		
	<ul> <li>HART device 115 QV</li> </ul>		
	<ul> <li>HART device 115 PV mA</li> </ul>		
	HART device 115 PV %		
	<ul> <li>Element temperature 124</li> </ul>		
	<ul> <li>AIO B1-3 value</li> </ul>		
	<ul> <li>AIO C1-3 value</li> </ul>		
	<ul> <li>AIP B4-8 value</li> </ul>		
	<ul> <li>AIP C4-8 value</li> </ul>		
	<ul> <li>None</li> </ul>		
Factory setting	None		
Additional information	Read access	Operator	

Maintenance

Write access

Alarm value			
Navigation		Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ Alarm value	
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq$ Off		
Description	Shows the current value of the process variable being monitored.		
User interface	Signed floating-point number		
Factory setting	0 None		
Additional information	Read access	Operator	
	Write access	-	

HH alarm value			
Navigation		$\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ HH alarm value	
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq$ Off		
Description	Defines the high-high(HH) limit value.		
User entry	Signed floating-point number		
Factory setting	0 None		
Additional information	Read access	Operator	
	Write access	Maintenance	

H alarm value			£
Navigation		$\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ H alarm value	
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq$ Off		
Description	Defines the high(H) limit value.		
User entry	Signed floating-point number		
Factory setting	0 None		
Additional information	Read access	Operator	
	Write access	Maintenance	

L alarm value			£
Navigation	Image: Bearing and the second se	etup $\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ L alarm value	
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq$ Off		
Description	Defines the low limit value.		
User entry	Signed floating-point number		
Factory setting	0 None		
Additional information	Read access	Operator	
	Write access	Maintenance	
LL alarm value			æ

Navigation	$\textcircled{B} \boxminus Setup \rightarrow Advanced setup \rightarrow Application \rightarrow Alarm \rightarrow Alarm \rightarrow LL alarm value$		
Prerequisite	Alarm mode (→ 🗎 217) ≠ Off		
Description	Defines the low-low(LL) limit value.		
User entry	Signed floating-point number		
Factory setting	0 None		
Additional information	Read access	Operator	
	Write access	Maintenance	

HH alarm			
Navigation	Image: Below a setup → Advanced setup -	$\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ HH alarm	
Prerequisite	Alarm mode ( $\Rightarrow \triangleq 217$ ) $\neq Off$		
Description	Shows whether an HH alarm is currently active.		
Additional information	Read access	Operator	
	Write access	-	

H alarm			
Navigation	Image: Setup → Advanced setup → Application → Alarm → Alarm → H alarm		
Prerequisite	Alarm mode ( $\rightarrow \triangleq 217$ ) $\neq Off$		
Description	Shows whether an H alarm is currently active.		
Additional information	Read access		Operator
	Write access		-
HH+H alarm			
Navigation	Image: Setup → Advanced setup → Application → Alarm → Alarm → HH+H alarm		
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq$ Off		
Description	Shows whether an HH	Shows whether an HH or H alarm is currently active.	
Additional information	Read access		Operator
	Write access		-
L alarm			
Navigation	Image: Betup → Advanced setup → Application → Alarm → Alarm → L alarm		
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq$ Off		

Description	Shows whether an L alarm is currently active.	
Additional information	Read access	Operator
	Write access	-

LL alarm	
Navigation	$\textcircled{B} \boxminus Setup \rightarrow Advanced setup \rightarrow Application \rightarrow Alarm \rightarrow Alarm \rightarrow LL alarm$
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq Off$
Description	Shows whether an LL alarm is currently active.

Additional information	Read access	Operator
	Write access	-

LL+L alarm		
Navigation	Image: Bearing of the setup of the setu	$\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ LL+L alarm
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) $\neq Off$	
Description	Shows whether an LL or L alarm is currently active.	
Additional information	Read access Operator	
	Write access	-

Any error		
Navigation	Image: Boundary Advanced setup → Application → Alarm → Alarm → Any error	
Prerequisite	Alarm mode ( $\rightarrow \square 217$ ) = Off	
Description	Show whether any alarm is currently active.	
User interface	<ul> <li>Unknown</li> <li>Inactive</li> <li>Active</li> <li>Error</li> </ul>	
Factory setting	Unknown	
Additional information	Read access	Operator
	Write access	-

Clear alarm	8
Navigation	Image: Boundary Setup → Advanced setup → Application → Alarm → Alarm → Clear alarm
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) = Latching
Description	Deletes an alarm which is still active although the alarm condition is no longer present.
Selection	<ul><li>No</li><li>Yes</li></ul>
Factory setting	No

Additional information	Read access	Operator
	Write access	Maintenance

Alarm hysteresis		Â
Navigation		$\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ Alarm hysteresis
Prerequisite	Alarm mode ( $\rightarrow \cong 217$ ) = Off	
Description	Defines the hysteresis for the limit values. The hystersis prevents constant changes of the alarm state if the level is near one of the limit values.	
User entry	Signed floating-point number	
Factory setting	0.001	
Additional information	Read access	Maintenance
	Write access	Maintenance

Damping factor			Â
Navigation	Image: Barbon Setup → Advanced setup -	$\rightarrow$ Application $\rightarrow$ Alarm $\rightarrow$ Alarm $\rightarrow$ Damping factor	
Description	Defines the damping constant (in seconds).		
User entry	0 to 999.9 s		
Factory setting	0 s		
Additional information	Read access	Operator	
	Write access	Maintenance	

#### "Safety settings" submenu

*Navigation*  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings

Output echo lost			Â
Navigation	B ■ Setup → Advance	red setup $ ightarrow$ Safety settings $ ightarrow$ Output echo los	t
Description	Defines the output beh	avior in case of a lost echo.	
Additional information	Read access	Operator	
	Write access	Service	
	Meaning of the option • Last valid value The last value before • Alarm The device generates	the occurence of the echo is kept.	
Delay time echo lost			6

Navigation	$\textcircled{B} \boxminus Setup \rightarrow Advanced setup \rightarrow Safety settings \rightarrow Delay echo lost$	
Description	Time between the echo loss and the reaction defined for the output.	
User entry	0 to 99 999.9 s	
Factory setting	60.0 s	
Additional information	Read access	Operator
	Write access	Maintenance

Safety distance	ß
Navigation	Image: Setup → Advanced setup → Safety settings → Safety distance
Description	Defines the safety distance (measured from the reference point). A warning is issued if the level rises into the safety distance.
User entry	Signed floating-point number
Factory setting	0 mm

#### Additional information

Read access	Operator
Write access	Maintenance

	"Sensor config" submenu		
	Navigation	8 8	Setup $\rightarrow$ Advanced setup $\rightarrow$ Sensor config
	"Information" subme	enu	
	Navigation	8 8	Setup $\rightarrow$ Advanced setup $\rightarrow$ Sensor config $\rightarrow$ Information
Signal quality			

Navigation	Setup → Advanced setup →	Sensor config $\rightarrow$ Information $\rightarrow$ Signal quality
Description	Shows the quality of the evaluate	d level signal.
Additional information	Read access	Operator
	Write access	-

Absolute echo amplitude			
Navigation		Sensor config $\rightarrow$ Information $\rightarrow$ Abs. echo ampl.	
Description	Shows the absolute amplitude of the evaluated level signal.		
Additional information	Read access	Operator	
	Write access	-	

Relative echo amplitude		
Navigation		Sensor config $\rightarrow$ Information $\rightarrow$ Relat.echo ampl.
Description	Shows the relative amplitude (i.e level signal.	the distance to the evaluation curve) of the evaluated
Additional information	Read access	Operator
	Write access	-

Distance		
Navigation	Image: Betup → Advanced setup →	Sensor config $\rightarrow$ Information $\rightarrow$ Distance
Description	Distance from lower edge of device flange to product surface.	
Additional information	Read access	Operator
	Write access	-

#### "Echo tracking" submenu

*Navigation*  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Echo tracking

Evaluation mode			(
Navigation	Image: Betup → Advance	ed setup $\rightarrow$ Sensor config $\rightarrow$ Echo tracking $\rightarrow$ Evaluation mode	
Description	Defines the evaluation mode for the echo tracking.		
Selection	<ul><li>Short time history</li><li>History off</li></ul>		
Factory setting	Short time history		
Additional information	Read access	Operator	
	Write access	Maintenance	

#### Meaning of the options

Short time history

In addition to the static algorithms a dynamic echo trace is continuously generated and evaluated.

• **History off** The envelope curve is evaluated only statically.

History reset			
Navigation	$ \blacksquare \blacksquare Setup \rightarrow Advanced s $	etup $\rightarrow$ Sensor config $\rightarrow$ Echo tracking $\rightarrow$ History reset	
Description	Resets the history of the echo tracking.		
Selection	<ul><li>Reset done</li><li>Restart echo tracking</li><li>Delete history</li></ul>		
Factory setting	Reset done		
Additional information	Read access	Operator	
	Write access	Maintenance	

Meaning of options:

Reset done
 Does not initiate an action but is only a display option. It is displayed as soon as the reset operation has been accomplished.

Delete history
 The echo tracking and tank trace are reset.

#### "Display" submenu

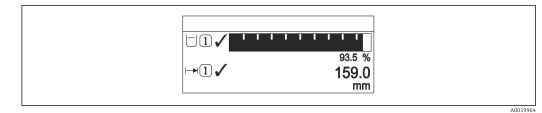
This menu is only visible if the device has a local display.

*Navigation*  $\textcircled{B} \boxminus$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display

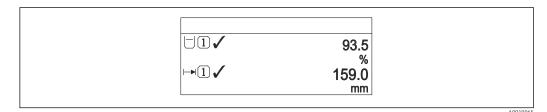
Language		
Navigation		ightarrow Display $ ightarrow$ Language
Prerequisite	The device has a local display.	
Description	Set display language.	
Selection	<ul> <li>English</li> <li>Deutsch</li> <li>русский язык (Russian)</li> <li>日本語 (Japanese)</li> </ul>	
Factory setting	English	
Additional information	Read access	Operator
	Write access	Operator

Format display			
Navigation	Image: Boundary Setup → Advanced setup → Display → Format display		
Prerequisite	The device has a local display.		
Description	Select how measured values are shown on the display.		
Selection	<ul> <li>1 value, max. size</li> <li>1 bargraph + 1 value</li> <li>2 values</li> <li>1 value large + 2 values</li> <li>4 values</li> </ul>		
Factory setting	1 value, max. size		
Additional information	4841.000 □1√ mm		

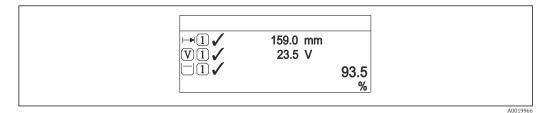
🖻 62 "Format display" = "1 value, max. size"



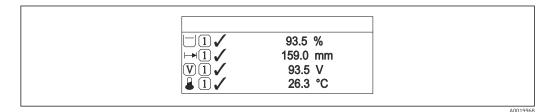
63 "Format display" = "1 bargraph + 1 value"



■ 64 "Format display" = "2 values"



65 "Format display" = "1 value large + 2 values"



66 "Format display" = "4 values"

Read access	Operator
Write access	Operator

- The Value 1 to 4 display (→ 
   <sup>(⇒)</sup> 231) parameters specify which measured values are shown on the display and in which order.
- If more measured values are specified than the current display mode permits, the values alternate on the device display. The display time until the next change is configured in the **Display interval** parameter ( $\Rightarrow \triangleq 234$ ).

Value 1 to 4 display		
Navigation	Setup → Advanced setup → Display → Value 1 display	
Prerequisite	The device has a local display.	

Description	Select the measured value that is shown on the local display.
Selection	<ul> <li>None <sup>10)</sup></li> </ul>
	<ul> <li>Tank level</li> </ul>
	<ul> <li>Measured level</li> </ul>
	<ul> <li>Level linearized</li> </ul>
	<ul> <li>Tank level %</li> </ul>
	<ul> <li>Water level <sup>10)</sup></li> </ul>
	<ul> <li>Liquid temperature <sup>10)</sup></li> </ul>
	<ul> <li>Vapor temperature <sup>10)</sup></li> </ul>
	<ul> <li>Air temperature <sup>10)</sup></li> </ul>
	<ul> <li>Tank ullage</li> </ul>
	<ul> <li>Tank ullage %</li> </ul>
	<ul> <li>Observed density value <sup>10)</sup></li> </ul>
	P1 (bottom) <sup>10)</sup>
	P2 (middle) <sup>10)</sup>
	<ul> <li>P3 (top) <sup>10)</sup></li> </ul>
	• GP 1 value <sup>10)</sup>
	GP 2 value <sup>10)</sup>
	GP 3 value <sup>10)</sup>
	■ GP 4 value <sup>10)</sup>
	Gauge command <sup>10)</sup>
	<ul> <li>Gauge status <sup>10)</sup></li> </ul>
	<ul> <li>AIO B1-3 value <sup>10)</sup></li> </ul>
	<ul> <li>AIO B1-3 value mA<sup>10)</sup></li> </ul>
	<ul> <li>AIO B1-3 value % <sup>10)</sup></li> </ul>
	<ul> <li>AIO C1-3 value <sup>10)</sup></li> </ul>
	AIO C1-3 value mA <sup>10</sup>
	<ul> <li>AIO C1-3 value % <sup>10)</sup></li> </ul>
	<ul> <li>AIP B4-8 value <sup>10)</sup></li> </ul>
	<ul> <li>AIP B4-8 value mA<sup>10)</sup></li> </ul>
	<ul> <li>AIP B4-8 value % <sup>10)</sup></li> </ul>
	<ul> <li>AIP C4-8 value <sup>10)</sup></li> </ul>
	<ul> <li>AIP C4-8 value mA<sup>10)</sup></li> </ul>
	<ul> <li>AIP C4-8 value % <sup>10)</sup></li> </ul>
Factory setting	Depending on device version

Factory	setting
---------	---------

Depending on device version

Additional information	Read access	Operator
	Write access	Maintenance

Decimal places 1 to 4		
Navigation		
Prerequisite	The device has a local display.	
Description	This selection does not affect the measurement and calculation accuracy of the device.	

<sup>10)</sup> not available for the Value 1 display parameter

Selection	■ X
	■ X.X
	■ X.XX
	■ X.XXX
	X.XXXX
Factory setting	X.X
Additional information	The setting does not affect the measuring or computational accuracy of the device.

Read access	Operator
Write access	Maintenance

Separator		6	<b>a</b>
Navigation	Image: Boost Setup → Advanced setup -	$\rightarrow$ Display $\rightarrow$ Separator	
Prerequisite	The device has a local display.		
Description	Select decimal separator for disp	laying numerical values.	
Selection	■. ■,		
Factory setting			
Additional information	Read access	Operator	
	Write access	Maintenance	

Number format		6
Navigation	■ $\square$ Setup → Advanced setup →	$\rightarrow$ Display $\rightarrow$ Number format
Prerequisite	The device has a local display.	
Description	Choose number format for the di	splay.
Selection	<ul><li>Decimal</li><li>ft-in-1/16"</li></ul>	
Factory setting	Decimal	
Additional information	Read access	Operator
	Write access	Maintenance

The **ft-in-1/16**" option is only valid for distance values.

Header		ඕ
Navigation	Image: Bootstand Setup Advanced setup	$\rightarrow$ Display $\rightarrow$ Header
Prerequisite	The device has a local display.	
Description	Select header contents on local o	lisplay.
Selection	<ul><li>Device tag</li><li>Free text</li></ul>	
Factory setting	Device tag	
Additional information	Read access	Operator
	Write access	Maintenance

#### Meaning of the options

- Device tag
  - The header contents is defined in the **Device tag** parameter ( $\rightarrow \square$  125).
- Free text The header contents is defined in the Header text parameter ( $\Rightarrow \square 234$ ).

Header text			
Navigation	Image: Barbon Setup → Advanced setu	p → Display → Header text	
Prerequisite	Header (Ə 🗎 234) = Free te	xt	
Description	Enter display header text.		
User entry	Character string comprising m	umbers, letters and special characters (11)	
Factory setting	TG-Platform		
Additional information	Read access	Operator	
	Write access	Maintenance	

Display interval		
Navigation	Setup → Advanced setup → Display → Display interval	
Description	Set time measured values are shown on display if display alternates between values.	
User entry	1 to 10 s	
Factory setting	5 s	

#### Additional information



This parameter is only relevant if the number of selected measuring values exceeds the number of values the selected display format can display simultaneously.

Read access	Operator
Write access	Operator

Display damping				
Navigation		→ Display → Display damping		
Prerequisite	The device has a local display.	The device has a local display.		
Description	Set display reaction time to fluct	Set display reaction time to fluctuations in the measured value.		
User entry	0.0 to 999.9 s			
Factory setting	0.0 s			
Additional information	Read access	Operator		
	Write access	Maintenance		

Backlight		
Navigation	■ $\square$ Setup $\rightarrow$ Advanced setup $\neg$	→ Display → Backlight
Prerequisite	The device has a local display.	
Description	Switch the local display backlight on and off.	
Selection	<ul><li>Disable</li><li>Enable</li></ul>	
Factory setting	Enable	
Additional information	Read access	Operator
	Write access	Operator

Contrast display	
Navigation	$ \blacksquare \blacksquare Setup \rightarrow Advanced setup \rightarrow Display \rightarrow Contrast display $
Prerequisite	The device has a local display.
Description	Adjust local display contrast setting to ambient conditions (e.g. lighting or reading angle)

User entry	20 to 80 %	
Ş	201000 /0	
Factory setting	30 %	
Additional information	Read access	Operator
	Write access	Operator

#### "System units" submenu

*Navigation*  $\ \ \square \ \ \square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  System units

Units preset			
Navigation	Image: Beta and	setup $\rightarrow$ System units $\rightarrow$ Units preset	
Description	Defines a set of units for length, pressure and temperature.		
Selection	<ul> <li>mm, bar, °C</li> <li>m, bar, °C</li> <li>mm, PSI, °C</li> <li>ft, PSI, °F</li> <li>ft-in-16, PSI, °F</li> <li>ft-in-8, PSI, °F</li> <li>Customer value</li> </ul>		
Factory setting	mm, bar, °C		
Additional information	Read access	Operator	
	Write access	Maintenance	
		8)	

A

Navigation		
Description	Select distance unit.	
Selection	• m • mm • cm	
Factory setting	mm	
Additional information	Read access	Operator
	Write access	Maintenance (if <b>Units preset (→</b> 🗎 <b>125)</b> = <b>Customer value</b> )

Pressure unit			
Navigation	🗐 🛛 Setup → Adva	nced setup $ ightarrow$ System units $ ightarrow$	Pressure unit
Selection	SI units • bar • Pa • kPa • MPa • mbar a	US units psi	Other units • inH2O • inH2O (68°F) • ftH2O (68°F) • mmH2O • mmHg
Factory setting	bar		
Additional information	Read access	Operator	
	Write access	Maintenance (if <b>U</b>	nits preset (→ 🗎 125) = Customer value)

Temperature unit		
Navigation	Image: Barbon Setup → Advance	d setup $\rightarrow$ System units $\rightarrow$ Temperature unit
Description	Select temperature unit.	
Selection	<i>SI units</i> ■ °C ■ K	US units ■ °F ■ °R
Factory setting	°C	
Additional information	Read access	Operator
	Write access	Maintenance (if <b>Units preset (→</b> 🗎 <b>125) = Customer value</b> )

Density unit				
Navigation	Image: Barbon Barbo	anced setup $\rightarrow$ System units $\rightarrow$ D	ensity unit	
Description	Select density unit.			
Selection	SI units g/cm <sup>3</sup> g/ml g/l kg/l kg/dm <sup>3</sup> kg/m <sup>3</sup>	US units • lb/ft <sup>3</sup> • lb/gal (us) • lb/in <sup>3</sup> • STon/yd <sup>3</sup>	Other units • °API • SGU	
Factory setting	kg/m³			

#### Additional information

Read access	Operator
Write access	Maintenance (if Units preset ( $\rightarrow \triangleq 125$ ) = Customer value)

#### "Date / time" submenu

Navigation

 $\blacksquare \blacksquare \quad \text{Setup} \rightarrow \text{Advanced setup} \rightarrow \text{Date} / \text{time}$ 

Date/time		
Navigation	Image: Bearing and the setup → Advanced setup →	Date / time $\rightarrow$ Date/time
Description	Displays the device internal real time clock.	
Additional information	Read access Operator	
	Write access	-

Set date			
Navigation	□ Setup $\rightarrow$ Advance	ed setup $\rightarrow$ Date / time $\rightarrow$ Set date	
Description	Controls the setting of the real-time clock.		
Selection	<ul> <li>Please select</li> <li>Abort</li> <li>Start</li> <li>Confirm time</li> </ul>		
Factory setting	Please select		
Additional information	Read access	Operator	
	Write access	Maintenance	
	<ul> <li>Meaning of the option</li> <li>Please select <ul> <li>Prompts the user to s</li> </ul> </li> <li>Abort <ul> <li>Discards the entered</li> </ul> </li> <li>Start <ul> <li>Start sthe setting of t</li> </ul> </li> <li>Confirm time <ul> <li>Sets the real-time closed</li> </ul> </li> </ul>	elect an action. date and time.	

Year		
Navigation	$ \qquad \qquad$	
Prerequisite	Set date (→ 🗎 240) = Start	

Description	Enter the current year.		
User entry	2016 to 2079		
Factory setting	2016		
Additional information	Read access	Operator	
	Write access	Maintenance	

Month		٦
Navigation	$ \qquad \qquad$	$\rightarrow$ Date / time $\rightarrow$ Month
Prerequisite	Set date (→ 🗎 240) = Start	
Description	Enter the current month.	
User entry	1 to 12	
Factory setting	1	
Additional information	Read access	Operator
	Write access	Maintenance

Day		බ
Navigation	$ \qquad \qquad$	$p \rightarrow Date / time \rightarrow Day$
Prerequisite	Set date ( > 🗎 240) = Start	
Description	Enter the current day.	
User entry	1 to 31	
Factory setting	1	
Additional information	Read access	Operator
	Write access	Maintenance

Hour			
Navigation		Setup $\rightarrow$ Advanced setup $\rightarrow$ Date / time $\rightarrow$ Hour	
Prerequisite	Set date (→ 🗎 240) = Start		

Description	Enter the current hour.	
User entry	0 to 23	
Factory setting	0	
Additional information	Read access	Operator
	Write access	Maintenance

Minute		8
Navigation	$ \qquad \qquad$	$\rightarrow$ Date / time $\rightarrow$ Minute
Prerequisite	Set date (Ə 🗎 240) = Start	
Description	Enter the current minute.	
User entry	0 to 59	
Factory setting	0	
Additional information	Read access	Operator
	Write access	Maintenance

#### "SIL confirmation" wizard



• The **SIL confirmation** wizard is only available for devices with SIL or WHG approval (Feature 590: "Additional Approval", option LA: "SIL" or LC: "WHG overfill prevention" ) which are currently **not** in the SIL- or WHG-locked state.

• The **SIL confirmation** wizard is required to lock the device according to SIL or WHG. For details refer to the "Functional Safety Manual" of the respective device, which describes the locking procedure and the parameters of this wizard.

*Navigation*  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  SIL confirmation

#### "Deactivate SIL/WHG" wizard

- The **Deactivate SIL/WHG** wizard is only available for devices with SIL or WHG approval (Feature 590: "Additional Approval", option LA: "SIL" or LC: "WHG overfill prevention" ) which are currently in the SIL- or WHG-locked state.
  - The **Deactivate SIL/WHG** wizard is required to undo the locking of the device according to SIL or WHG. For details refer to the "Functional Safety Manual" of the respective device, which describes the locking procedure and the parameters of this wizard.

*Navigation*  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Deactiv. SIL/WHG

#### "Administration" submenu

Navigation

Define access code			â	
Navigation	□ Setup → Advance	d setup $\rightarrow$ Administration $\rightarrow$ Def. acces	ss code	
Description	Define release code for	Define release code for write access to parameters.		
User entry	0 to 9 999	0 to 9 999		
Factory setting	0			
Additional information	Read access	Operator		
	Write access	Maintenance		
	are not write-prote modified. The user	g is not changed or 0 is defined as the cted and the configuration data of the is logged on in the <i>Maintenance</i> role. n affects all parameters marked with t	device can then always be	
	<ul> <li>document.</li> <li>Once the access code has been defined, write-protected parameters can only be modified if the access code is entered in the Enter access code parameter (→</li></ul>			
Device reset			6	

Navigation	Setup → Advanced setup → Administration → Device reset
Description	Reset the device configuration - either entirely or in part - to a defined state
Selection	<ul><li>Cancel</li><li>To factory defaults</li><li>Restart device</li></ul>
Factory setting	Cancel
Additional information	<ul> <li>Meaning of the options</li> <li>Cancel <ul> <li>No action</li> </ul> </li> <li>To factory defaults <ul> <li>All parameters are reset to the order-code specific factory setting.</li> </ul> </li> <li>Restart device <ul> <li>The restart resets every parameter which is stored in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.</li> </ul> </li> </ul>

Read access	Operator
Write access	Maintenance

# 15.4 "Diagnostics" menu

Navigation

Image: Barbor Barbo

Actual diagnostics		
Navigation	Image: Barbon Barbo	al diagnos.
Description	Displays the currently active diagnostic message. If there is more than one pending diagnostic event, the message for the diagnostic even with the highest priority is displayed.	
Additional information	Read access	Operator
	Write access	-
	The display consists of: • Symbol for event behavio • Code for diagnostic beha • Operating time of occurr • Event text	vior

If several messages are active at the same time, the messages with the highest priority is displayed.

Information on what is causing the message, and remedy measures, can be viewed via the ① symbol on the display.

### 

**Description** Displays the timestamp for the currently active diagnostic message.

Additional information	Read access	Operator
	Write access	-

# Previous diagnostics Navigation Image: Diagnostics → Prev.diagnostics Description Displays the diagnostic message for the last diagnostic event that has ended. Additional information Read access Operator Write access

The display consists of:

- Symbol for event behavior
- Code for diagnostic behavior
- Operating time of occurrence
- Event text

If several messages are active at the same time, the messages with the highest priority is displayed.

Information on what is causing the message, and remedy measures, can be viewed via the ① symbol on the display.

Timestamp		
Navigation	B □ Diagnostics → Timestamp	
Description	Displays the timestamp of the diagnostic message generated for the last diagnostic event that has ended.	
Additional information	Read access     Operator	
	Write access	-

Operating time from restart		
Navigation	Image: Barbon Barb	
Description	Indicates how long the device has been in operation since the last time the device was restarted.	
Additional information Read access Operator		Operator
	Write access	-

Operating time		
Navigation	Image: Barbon Barbo	me
Description	Indicates how long the device has been in operation.	
Additional information	Read access Operator	
	Write access	-

Date/time		
Navigation		
Description	Displays the device internal real time clock.	
Additional information	Read access     Operator	
	Write access	-

#### 15.4.1 "Diagnostic list" submenu

*Navigation*  $\square$  Diagnostics  $\rightarrow$  Diagnostic list

Diagnostics 1 to 5	
Navigation	
Description	Displays the currently active diagnostic message with the highest priority.
Additional information	The display consists of: • Symbol for event behavior • Code for diagnostic behavior • Operating time of occurrence • Event text
Timestamp 1 to 5	
<b>NT 1</b> (1	

NavigationImage: Diagnostics → Diagnostic list → Timestamp 1 to 5DescriptionTimestamp of the diagnostic message.

#### 15.4.2 "Device information" submenu

Navigation

Device tag		
Navigation	■ Diagnostics $\rightarrow$ Device info -	→ Device tag
Description	Shows the device tag.	
User interface	Character string comprising numbers, letters and special characters	
Factory setting	- none -	
Additional information	Read access	Operator
	Write access	-

Serial number		
Navigation	B □ Diagnostics → I	Device info $\rightarrow$ Serial number
Description	The serial number is a unique alphanumerical code identifying the device. It is printed on the nameplate. In combination with the Operations app it allows to access all device related documentation.	
Additional information	Read access	Operator
	Write access	-

Firmware version		
Navigation		$\rightarrow$ Firmware version
Description	Displays the device firmware version installed.	
Additional information	Read access Operator	
	Write access	-

Firmware CRC			
Navigation	B □ Diagnostics → Device	info $\rightarrow$ Firmware CRC	
Description	Result of the cyclic redundar	Result of the cyclic redundancy check of the firmware.	
Additional information	Read access	Operator	
	Write access	-	

Weight and measures configuration CRC			
Navigation			
Description	Result of the cyclic redundancy check of the weights and measure relevant parameters.		
Additional information	Read access     Operator       Write access     -		

Device name		
Navigation	B □ Diagnostics → Device info	$\rightarrow$ Device name
Description	Use this function to display the device name. It can also be found on the nameplate.	
Additional information	Read access Operator	
	Write access	-

Order code			
Navigation	Image: Barbon Barbo	$\rightarrow$ Order code	
Description	Shows the device order code.		
Additional information	Read access	Read access Operator	
	Write access	Service	

Extended order code 1 to 3			A
Navigation	■ Diagnostics $\rightarrow$ Device info	$\rightarrow$ Ext. order cd. 1	
Description	Display the three parts of the extended order code.		
User interface	Character string comprising numbers, letters and special characters		
Additional information	Read access Operator		
	Write access	Service	

The extended order code indicates the selected option of all ordering features and thus uniquely identifies the device.

#### 15.4.3 "Simulation" submenu

Read access			Maintenance
Navigation	8 8	Diagnostics $\rightarrow$ Simulation	

Device alarm simulation		8
Navigation	Image: Bell Big	on $\rightarrow$ Dev. alarm sim.
Description	Switch the device alarm on an	d off.
Selection	<ul><li>Off</li><li>On</li></ul>	
Factory setting	Off	
Additional information	Read access	Operator
	Write access	Maintenance

Diagnostic event simulation			Â
Navigation	Image: Barborn Bar	n → Diag. event sim.	
Description	Select a diagnostic event to sim	ulate this event.	
Selection	The diagnostic events of the device		
Factory setting	Off		
Additional information	Read access Operator		
	Write access Maintenance		



Simulation distance on		
Navigation	□ □ Diagnostics → Simulation → Sim distance on	
Description	Switches the distance simulation on or off.	
Selection	<ul><li>Off</li><li>On</li></ul>	

Factory setting	Off		
Additional information	Read access	Operator	
	Write access	Maintenance	
Simulation distance			
Navigation	$ \blacksquare \Box Diagnostics \rightarrow Simulation \rightarrow Sim distance $		
Prerequisite	Simulation distance on ( $\rightarrow \cong 253$ ) = On		
Description	Defines the distance value to be simulated.		
User entry	Signed floating-point number		

Factory setting	0 mm	
Additional information	Read access	Operator
	Write access	Maintenance

Current output N simulati	on		
Navigation	Image: Diagnostics → Simulation	□ □ Diagnostics → Simulation → Curr.outp N sim.	
Prerequisite	<ul> <li>The device has an Anlog I/O module.</li> <li>Operating mode (→          <sup>B</sup> 145) = 420mA output or HART slave +420mA output</li> </ul>		
Description	Switches the simulation of the current on or off.		
Selection	<ul><li>Off</li><li>On</li></ul>		
Factory setting	Off		
Additional information	Read access Operator		
	Write access	Maintenance	

Simulation value		
Navigation	□ □ Diagnostics → Simulation → Simulation value	
Prerequisite	Current output simulation ( $\rightarrow \square 254$ ) = On	
Description	Defines the current to be simulated.	

# User entry 3.4 to 23 mA Factory setting The current at the time the simulation was started. Additional information Read access Vrite access Operator Write access Maintenance

# 15.4.4 "Device check" submenu

Navigation 🛛 🗐 🖾 Diagno

Start device check		8
Navigation	■ Diagnostics $\rightarrow$ Device che	ck → Start dev. check
Description	Starts the device check.	
Selection	<ul><li>No</li><li>Yes</li></ul>	
Factory setting	No	
Additional information	Read access	Operator
	Write access	Maintenance

Result device check		
Navigation		
Description	Shows the overall resul	It of the device check.
Additional information	Read access	Operator
	Write access	-
	The device has a function that detects and reports any interference by unfavorable installation situation. Here, the amplitudes of measured signals are monitored, which ref to interference in the near range.	
Level signal		
Navigation	Image of the second secon	
Prerequisite	Only visible after a device check.	

**Description** Shows the result of the device check for the level signal.

Additional information	Read access	Operator
	Write access	-

Near distance		le l	
Navigation	■ Diagnostics $\rightarrow$ Device chee	$k \rightarrow Near distance$	
Prerequisite	Only visible after a device check	Only visible after a device check	
Description	Shows the result of the device check for the near distance area.		
Additional information	Read access	Operator	
	Write access	-	

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