Valid as of version 01.07.zz (Device firmware) Products Solutions

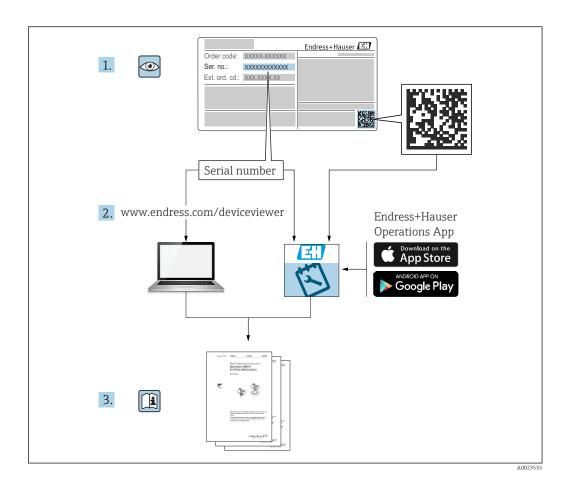
Services

# Operating Instructions **Proservo NMS80**

Tank Gauging







Proservo NMS80 Table of contents

# Table of contents

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About this document Proservo NMS80

### 1 About this document

### 1.1 Document function

These Operating Instructions contain all the information required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to installation, 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.

#### **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



Alternating current



Direct current and alternating current

Direct current



Ground connection

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

### Protective earth (PE)

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

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

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

### 1.2.3 Tool symbols



Phillips head screwdriver

Proservo NMS80 About this document



Flat blade screwdriver



Torx screwdriver

06

Allen key



Open-ended wrench

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

### Permitted

Procedures, processes or actions that are permitted

### **✓** ✓ Preferred

Procedures, processes or actions that are preferred

### **X** Forbidden

Procedures, processes or actions that are forbidden



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

### $\triangle \rightarrow \square$ 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

About this document Proservo NMS80

### 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:

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

### 1.3.1 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.

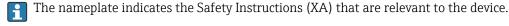
It also contains a detailed explanation of each individual parameter in the operating menu (except the **Expert** menu). The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

### 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.



### 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<sup>®</sup>

Registered trademark of SCHNEIDER AUTOMATION, INC.

Proservo NMS80 Basic safety instructions

# 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

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.

Basic safety instructions Proservo NMS80

# 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

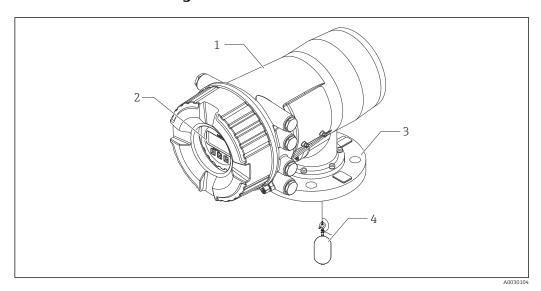
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

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

Proservo NMS80 Product description

# **3** Product description

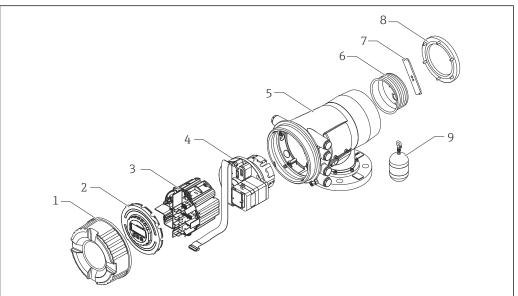
# 3.1 Product design



■ 1 Design of Proservo NMS80

1 Housing

- 2 Display and operating module (can be operated without opening the cover)
- 3 Process connection (Flange)
- 4 Displacer



A002010

■ 2 Configuration of NMS80

- 1 Front cover
- 2 Display
- 3 Modules
- 4 Sensor unit (detector unit and cable)
- 5 Housing
- 6 Wire drum
- 7 Bracket
- 8 Housing cover
- 9 Displacer

# 4 Incoming acceptance and product identification

## 4.1 Incoming acceptance

Upon receipt of the goods check the following:

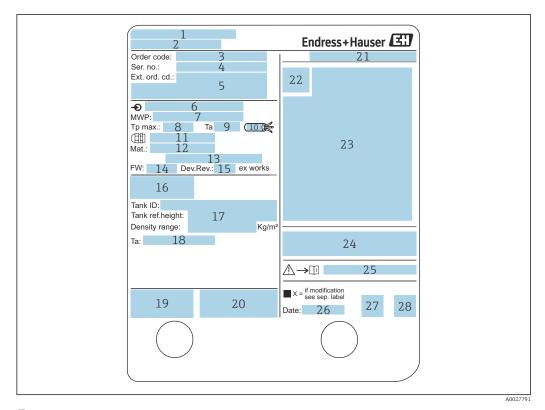
- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?
- If one of these conditions is not satisfied, contact your Endress+Hauser Sales Center.

### 4.2 Product identification

The following options are available for identification of the device:

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

### 4.2.1 Nameplate



■ 3 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
- $20\quad Additional\ information\ on\ the\ device\ version$
- 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 China RoHS mark
- 28 QR code for the Endress+Hauser Operations App

### 4.2.2 Manufacturer address

Endress+Hauser Yamanashi Co., Ltd.

406-0846

862-1 Mitsukunuqi, Sakaigawa-cho, Fuefuki-shi, Yamanashi

# 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

### Risk of injury

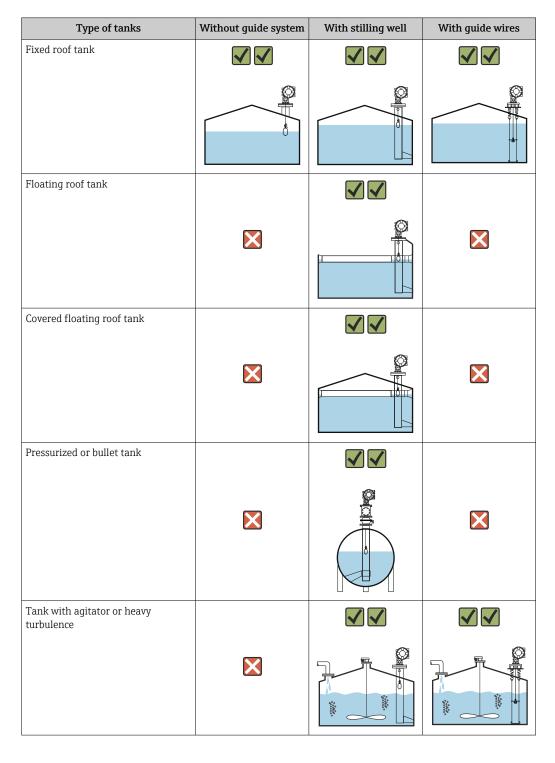
- ► Transport the measuring device to the measuring point in its original packaging.
- ► Take into account the mass center of the device in order to avoid unintended tilting.
- ► Comply with the safety instructions, transport conditions for devices over 18 kg (39.6 lb) (IEC 61010).

# 5 Installation

# 5.1 Requirements

## 5.1.1 Type of tanks

Depending on the type of tank and application, different installation procedures are recommended for NMS8x.

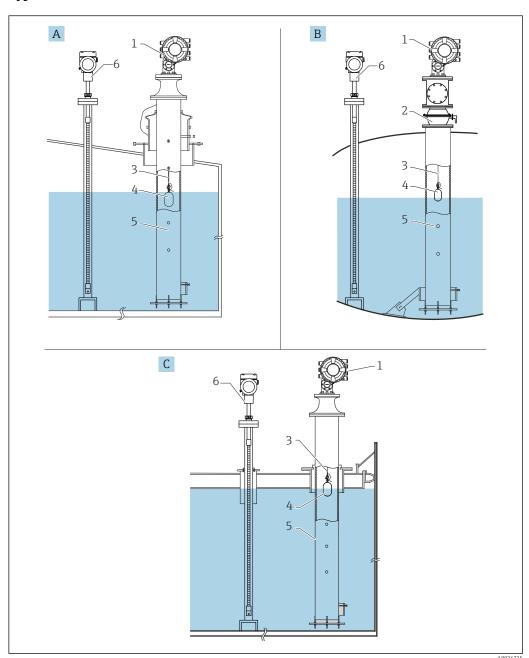


• A stilling well is required in a floating roof tank and a covered floating roof tank.

• Guide wires cannot be installed in a floating roof tank. When the measuring wire is exposed to free space, it may break due to an external shock.

■ Installing guide wires is not allowed in pressurized tanks because the wires would prevent closing the valve for replacing the wire, wire drum, or displacer. NMS8x installation position is important for applications without the guide wire system in order to prevent the measuring wire from being broken (refer to Operating Instructions for details).

### Typical tank installation



€ 4 Typical tank installation

- Α
- В
- Fixed roof tank High pressure tank Floating roof tank with stilling well NMS8x С
- 2 Ball valve
- Measuring wire Displacer
- Stilling well
- Prothermo NMT53x

# 5.1.2 Displacer selection guide

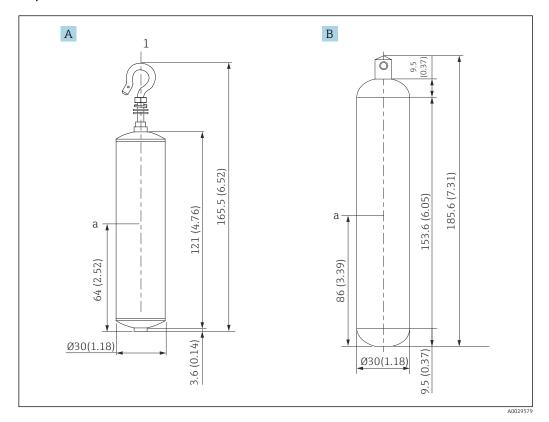
A wide variety of displacers are available to suit different application. Proper displacer selection ensures optimal performance and longevity. The following guidelines will assist you in selecting the most suitable displacer for your application.

### Displacer types

The following NMS8x displacers are available.

30 mm (1.18 in)	30 mm (1.18 in) 50 mm (1.97 in)		110 mm (4.33 in)
316L/PTFE	316L/AlloyC276/PTFE	316L	316L

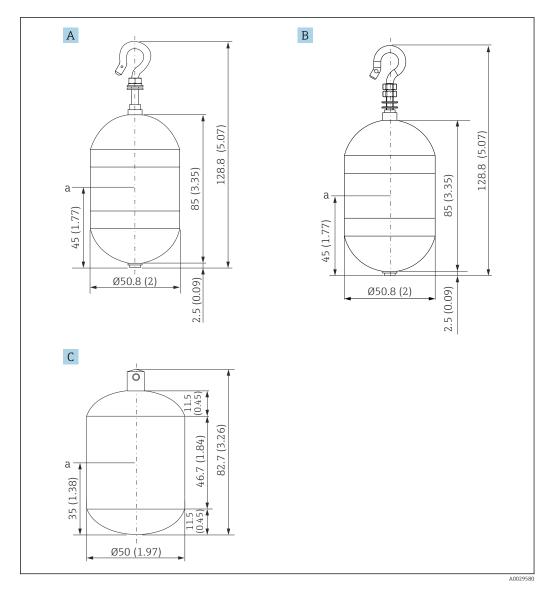
### Displacer dimensions



- Ø30 mm (1.18 in) 316L cylindrical displacer Ø30 mm (1.18 in) PTFE cylindrical displacer Α
- В
- Immersion point

Item	Ø30 mm (1.18 in) 316L cylindrical displacer	Ø30 mm (1.18 in) PTFE cylindrical displacer
Weight (g)	261	250
Volume (ml)	84.3	118
Balance volume (ml)	41.7	59

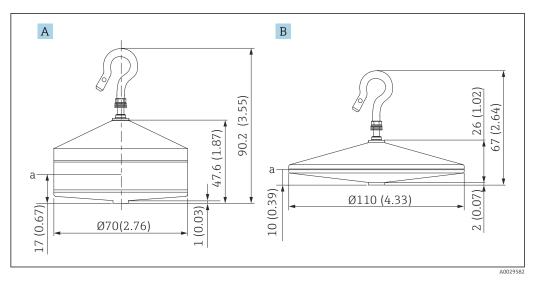
The weight, volume, and balance volume are individually determined by each displacer and also might vary depending on the values stated above.



- Α Ø50 mm (1.97 in) 316L cylindrical displacer
- Ø50 mm (1.97 in) AlloyC276 cylindrical displacer Ø50 mm (1.97 in) PTFE cylindrical displacer В
- С
- Immersion point

Item	Ø50 mm (1.97 in) 316L cylindrical displacer	Ø50 mm (1.97 in) AlloyC276 cylindrical displacer	Ø50 mm (1.97 in) PTFE cylindrical displacer
Weight (g)	253	253	250
Volume (ml)	143	143	118
Balance volume (ml)	70.7	70.7	59

The weight, volume, and balance volume are individually determined by each displacer and also might vary depending on the values stated above.



- A Ø70 mm (2.76 in) 316L conical displacer
- B Ø110 mm (4.33 in) 316L conical displacer
- a Immersion point

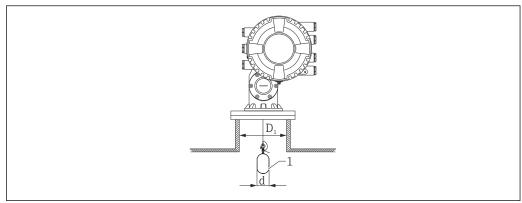
Item	Ø70 mm (2.76 in) 316L conical displacer	Ø110 mm (4.33 in) 316L conical displacer
Weight (g)	245	223
Volume (ml)	124	108
Balance volume (ml)	52.8	36.3

The weight, volume, and balance volume are individually determined by each displacer and also might vary depending on the values stated above.

### Recommended displacer by application

Application	Product level	Interface level	Density
Viscous liquid	50 mm (1.97 in) PTFE	Not Recommended	Not Recommended
Black oil (e.g. crude oil, heavy oil)	50 mm (1.97 in) 316L 50 mm (1.97 in) PTFE	50 mm (1.97 in) 316L 50 mm (1.97 in) PTFE	50 mm (1.97 in) 316L 50 mm (1.97 in) PTFE
White oil (e.g. gasoline, diesel, heating oil)	50 mm (1.97 in) or 70 mm (2.76 in) 316L	50 mm (1.97 in) or 70 mm (2.76 in) 316L	50 mm (1.97 in) or 70 mm (2.76 in) 316L
Liquefied gas, LPG/LNG	50 mm (1.97 in) or 70 mm (2.76 in) 316L	50 mm (1.97 in) or 70 mm (2.76 in) 316L	50 mm (1.97 in) or 70 mm (2.76 in) 316L
Corrosive liquid	50 mm (1.97 in) AlloyC276 50 mm (1.97 in) PTFE	50 mm (1.97 in) AlloyC276 50 mm (1.97 in) PTFE	50 mm (1.97 in) AlloyC276 50 mm (1.97 in) PTFE

# 5.1.3 Mounting without a guide system



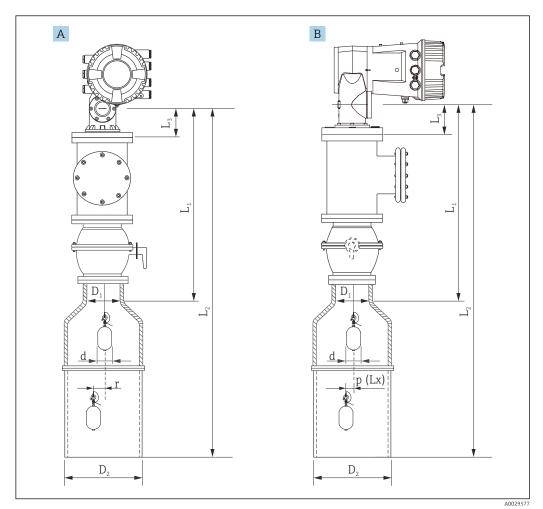
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■ 5 No guide system

- $D_1$  Inner diameter of the tank nozzle
- d Diameter of the displacer
- 1 Displacer

# 5.1.4 Mounting with a stilling well

The stilling well diameter that is required to protect the measuring wire without disturbing its operation varies depending on the tank height. The stilling well could either be of constant diameter, or narrower at its upper part and wider at its lower part. The following figure shows two examples of the latter case, namely a concentric stilling well and an asymmetric stilling well.

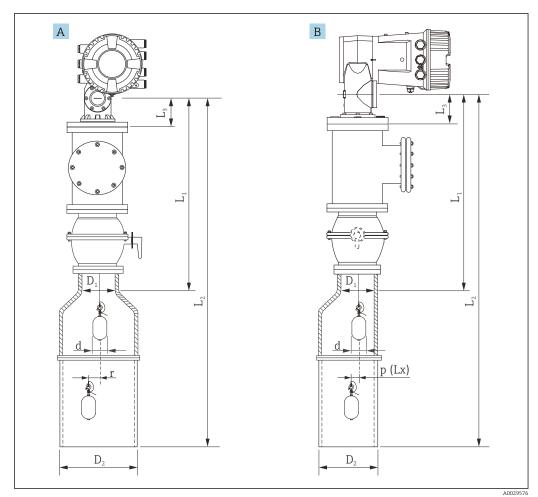


■ 6 Mounting with concentric stilling well

- A Front view
- Side view
- $L_1$  Length from the center of the calibration window to the upper part of the stilling well
- $L_2$  Length from the center of the calibration window to the bottom of the stilling well
- $L_3$  Length from the center of the calibration window to the bottom of the flange
- $D_1$  Diameter of upper part of stilling well
- D<sub>2</sub> Diameter of stilling well
- d Diameter of displacer
- p Longitudinal wire position from the center of the flange

(Lx)

r Radial direction offset



Mounting with asymmetric stilling well

A Front view

B Side view

**₽** 7

- $L_1$  Length from the center of the calibration window to the upper part of the stilling well
- $L_2$  Length from the center of the calibration window to the bottom of the stilling well
- $L_3$  Length from the center of the calibration window to the bottom of the flange
- $D_1$  Diameter of upper part of stilling well
- D<sub>2</sub> Diameter of stilling well
- d Diameter of displacer
- p Longitudinal wire position from the center of the flange

(Lx)

r Radial direction offset

- i
- $L_3$ : length from center of the calibration window to the bottom of the flange built-in NMS8x (77 mm (3.03 in) + flange thickness).

For JIS 10K 150A RF, the flange thickness is 22 mm (0.87 in).

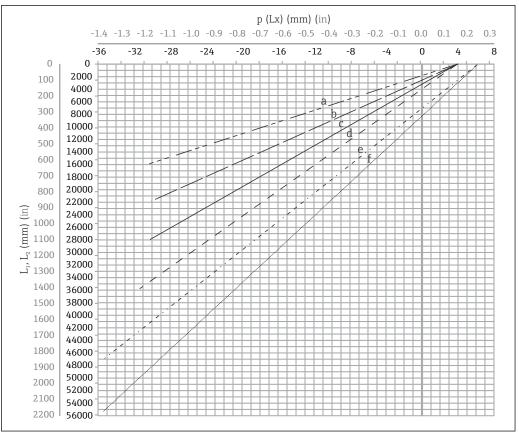
- When using an asymmetric stilling well, take into account the lateral shift of the displacer and follow the NMS8x mounting direction as shown in the figure.
- To calculate the required stilling well diameters, the formula below should be used. The following tables contain the necessary parameters in order to calculate the dimensions of the stilling well. Be sure to have appropriate dimensions of the stilling well according to each dimension in the table.
- The radial direction offset (r) is required for only the 47 m (154.20 ft) and 55 m (180.45 ft) wire drum. For all other drums, the offset is 0 mm/in.

Feature: 110	Description (Measuring range; Wire; Diameter)	NMS80	NMS81	NMS83	r
G1	47 m (154.20 ft); 316L; 0.15 mm (0.00591 in)		$\checkmark$		6 mm (0.24 in)
H1	55 m (180.45 ft); 316L 0.15 mm (0.00591 in)		<b>✓</b>		6 mm (0.24 in)

Feature: 120	Description (Displacer material; Type)	NMS80	NMS81	NMS83	d
1AA	316L; 30 mm (1.18 in) cylindrical	$\checkmark$	$\checkmark$		30 mm (1.18 in)
1AC	316L; 50 mm (1.97 in) cylindrical	<b>~</b>	<b>✓</b>		50 mm (1.97 in)
1BE	316L; 70 mm (2.76 in) conical	<b>~</b>	<b>✓</b>		70 mm (2.76 in)
1BJ	316L;110 mm (4.33 in) conical	<b>\</b>	<b>✓</b>		110 mm (4.33 in)
2AA	PTFE; 30 mm (1.18 in) cylindrical	<b>\</b>	<b>✓</b>		30 mm (1.18 in)
2AC	PTFE; 50 mm (1.97 in) cylindrical	<b>~</b>	<b>✓</b>		50 mm (1.97 in)
3AC	AlloyC276; 50 mm (1.97 in) cylindrical	<b>\</b>	<b>✓</b>		50 mm (1.97 in)
4AC	316L polished; 50 mm (1.97 in) cylindrical			<b>~</b>	50 mm (1.97 in)
4AE	316L polished; 70 mm (2.76 in) conical			<b>~</b>	70 mm (2.76 in)
5AC	PTFE; 50 mm (1.97 in) cylindrical, hygienic white			<b>\</b>	50 mm (1.97 in)

Parameter	Description				
d	Diameter of displacer				
p(Lx)	Longitudinal wire position from the center of the flange The value can be determined by using following graph.				
r	Radial direction offset				
S	Safety factor recommended: 5 mm (0.197 in)				

The following graph shows the lateral shift of the displacer depending on the measured distance for the different wire drums.



A002799

■ 8 Lateral shift of displacer according to measurement range

- a 16 m (A3) (NMS80/NMS81/NMS83)
- b 22 m (C2) (NMS80/NMS81/NMS83)
- c 28 m (D1) (NMS80/NMS81)
- d 36 m (F1) (NMS80/NMS81)
- e 47 m (G1) (NMS81)
- f 55 m(H1) (NMS81)

### Upper diameter of stilling well

The dimension of  $D_1$  has to be the largest value of the dimensions  $D_{1a}$ ,  $D_{1b}$ ,  $D_{1c}$ , and  $D_{1d}$  according to the following formula.

D <sub>1</sub> Dimension	2.11		Description	Formula
(Example)			Description	rormula
>68.1 mm (2.68 in)	68.1 mm (2.68 in)	$D_{1a}$	$D_1$ dimension when the displacer is at the center of the calibration window	= 2 x (  p (0) + d/2 + s)
	65.6 mm (2.58 in)	$D_{1b}$	$D_1$ dimension when the displacer is at the upper part of the stilling well	$= 2 \times ( p(L_1)  + d/2 + s)$

D <sub>1</sub> Dimension	D <sub>1x</sub> Dimension		Description	Formula	
(Example)	Example	Parameter	Description	Formula	
	50.9 mm (2.00 in)	$D_{1c}$	$D_1$ dimension when the displacer is at the bottom of the stilling well	$= 2 \times ( p(L_2)  + s)$	
		$D_{1d}$	$D_1$ dimension when the radial direction offset is considered. This calculation is used only with the 47 m (154.20 ft) wire drum (G1 in Feature110) and 55 m (180.45 ft) (H1 in feature 110)	$= 2 \times (d/2 + r + s)$	

Example:  $L_1 = 1000 \text{ mm}$ ,  $L_2 = 20000 \text{ mm}$ , d = 50 mm, s = 5.0, 28 m drum

### Lower diameter of stilling well

The dimension of  $\mathsf{D}_2$  has to be the larger value of the dimensions  $\mathsf{D}_1$  and  $\mathsf{D}_{2b}$  . See the table below.

### Concentric pipe

D <sub>2</sub> Dimension	D <sub>2x</sub> Dimension		Description	Formula
(Example)	Example	Parameter	Description	Formula
>100.9 mm (3.97 in)	68.1 mm (2.68 in)	$D_1$	Calculated D <sub>1</sub> value	
	100.9 mm (3.97 in)	D <sub>2b</sub>	$D_2$ dimension when the displacer is in $L_2$ length	$= 2 \times ( p(L_2)  + d/2 + s)$

Example:  $L_2 = 20\,000$  mm, d = 50 mm, s = 5.0, 28 m drum

### Asymmetric pipe

D <sub>2</sub> Dimension	D <sub>2x</sub> Dir	nension	- Description Formula	Formula
(Example)	Example	Parameter		romuia
>84.5 mm (3.33 in)	68.1 mm (2.68 in)	$D_1$	Calculated D <sub>1</sub> value	
	84.5 mm (3.33 in)	D <sub>2b</sub>	$D_2$ dimension that the displacer can pass through (nth groove)	$=  p(L_2)  + d/2 + s + D_1/2$

Example:  $L_2 = 20\,000$  mm, d = 50 mm, s = 5.0, 28 m drum

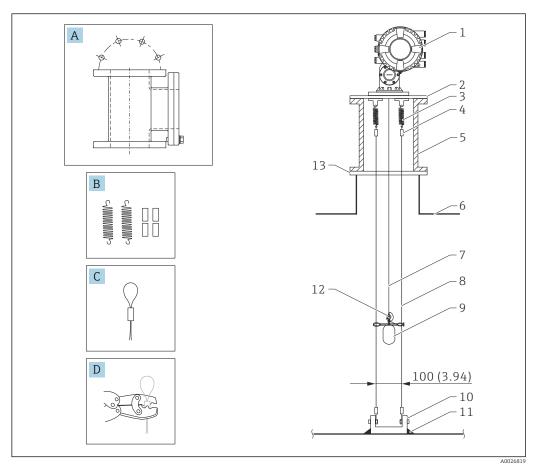
### Recommendations for NMS8x mounting with a stilling well

Follow the recommendations for mounting NMS8x with a stilling well.

- Keep the pipe connection welds smooth.
- When drilling holes into the pipe, keep the interior surface of the holes clear of metal chips and burrs.
- Coat or paint the interior surface of the pipe to prevent corrosion.
- Keep the pipe as vertical as possible. Check using a plumb bob.
- Install the asymmetric pipe under the valve and align the centers of the NMS8x and the valve.
- Set the center of the lower part of the asymmetric pipe in the direction of the lateral motion.
- Observe the recommendations as per API MPMS chapter 3.1B.
- Confirm grounding between NMS8x and the tank nozzle.

# 5.1.5 Mounting with guide wires

It is also possible to guide the displacer with guide wires to prevent swinging.



■ 9 Guide wire; dimensions mm (in)

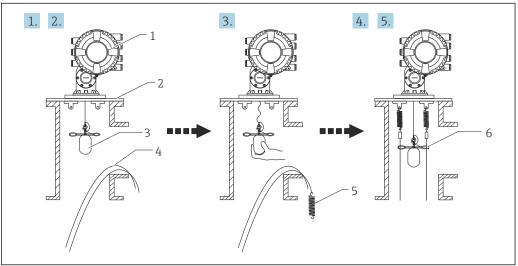
No.	Description	
A	Maintenance chamber	
В	Spring and sleeve	
С	Guide wire sleeve	
D	Crimp tool	
1	NMS8x	
2	Reducer plate (incl. guide wire option)	
3	Spring, 304 (incl. guide wire option)	
4	Sleeve,316 (incl. guide wire option)	
5	Maintenance chamber	
6	Tank	
7	Measuring wire	
8	Guide wire, 316 (incl. guide wire option)	
9	Displacer with rings (incl. guide wire option)	
10	Anchor hook plate, 304 (incl. guide wire option)	
11	Welding point	
12	Wire ring, 316L	
13	Flange	

### Guide wire installation

### Guide wire installation procedure

- 1. Install NMS8x [1] on the reducer plate.
- - Make sure that the displacer does not touch the guide wires during calibration. This could be done by mounting the NMS8x to the reducer plate [2] prior to fitting the guide wires [4].
- Perform calibration steps so that displacer does not touch the guide wires if the guide wires are already installed to the reducer plate.
- 3. Secure the guide wires to the hooks of the springs [5].
- 4. Secure the springs to the reducer plate.
- 5. Put the guide wires through the displacer guide ring [6] and set the displacer.

This completes the guide wire installation procedure.



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- 10 Guide wire installation
- 1 NMS8x
- 2 Reducer plate
- 3 Displacer
- 4 Guide wires
- 5 Springs
- 6 Displacer guide ring

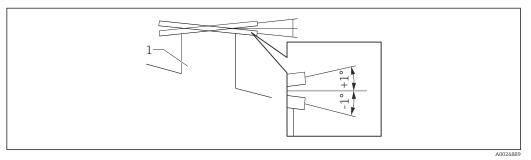
### 5.1.6 Alignment of NMS8x

### Flange

Confirm that the size of the nozzle and the flange is matched prior to mounting NMS8x on the tank. The flange size and the rating of NMS8x vary depending on the customer's specifications.



- Check the flange size of NMS8x.
- Mount the flange on the top of the tank. The deviation of the flange from the horizontal plane should not exceed +/- 1 degree.
- When mounting NMS8x on a long nozzle, make sure that the displacer does not touch the inner wall of the nozzle.



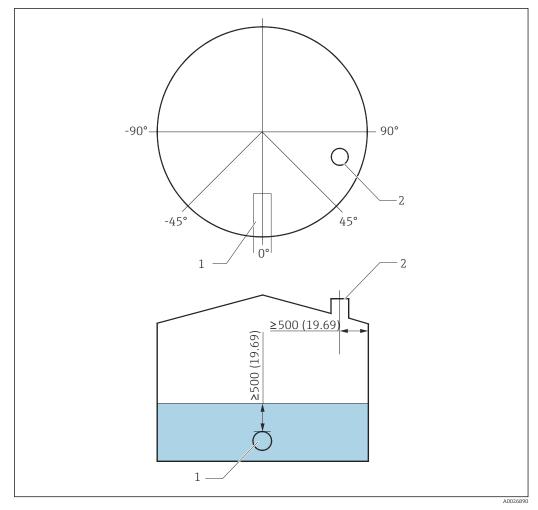
 $\blacksquare 11$  Allowable inclination of mounting flange

1 Nozzle



When NMS8x is installed without a guide system, follow the recommendations below:

- Confirm the mounting nozzle is in the sector between 45 and 90 degrees (or -45 and -90 degrees) away from the inlet pipe of the tank. This prevents heavy swinging of the displacer caused by waves or turbulence from the inlet liquid.
- Confirm the mounting nozzle is 500 mm (19.69 in) or more away from the tank wall.
- Confirm the minimum measuring level is at 500 mm (19.69 in) or more above the top of the inlet pipe by setting the low stop (for details of low stop setting,
- If a stilling well cannot be mounted in the tank due to the shape or condition of the tank, attaching a guide system is recommended. Consult E+H services for further information.



12 Recommended position for mounting NMS8x and minimum measuring level; dimensions mm (in)

- 1 Inlet pipe
- 2 Tank nozzle
- Before pouring liquid into the tank, confirm that liquid flowing through the inlet of the pipe will not contact the displacer directly.
  - When discharging liquid out of the tank, ensure that the displacer will not get caught in the liquid current and sucked into the outlet pipe.

### 5.1.7 Electrostatic charge

When liquid measured by NMS8x has a conductivity of  $1\,\text{uS/m}$  or less, it is quasi-nonconductive. In this case, using a stilling well or guide wire is recommended. This diffuses the electrostatic charge on the liquid surface.

# 5.2 Mounting of the device

The NMS8x is delivered in two different packing styles depending on the mounting method of the displacer.

- For the all-in-one method, the displacer is mounted on the measuring wire of NMS8x.
- For the displacer shipped separately method, it is necessary to install the displacer on the measuring wire inside NMS8x.

### 5.2.1 Available installations

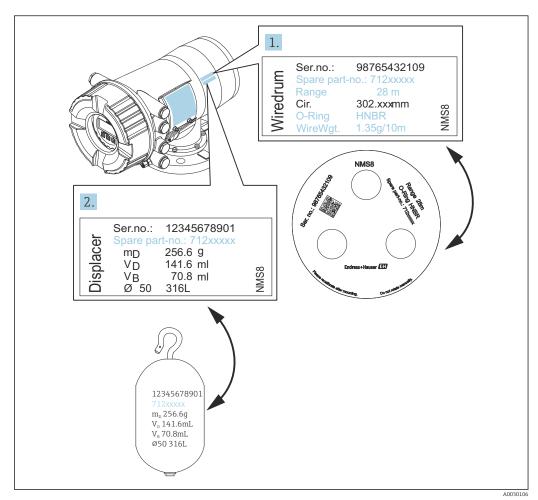
The following installation procedures are available for NMS8x.

- Mounting without guide system
- Mounting with stilling well
- Mounting with guide wire

Mounting options	Without guide system (Free-space mounting)	With stilling well	With guide wire
Type of tanks			
Type of installations	<ul><li>All-in one</li><li>Displacer shipped separately</li><li>Displacer installation through calibration window</li></ul>	<ul> <li>All-in one</li> <li>Displacer shipped separately</li> <li>Displacer installation through calibration window</li> </ul>	Displacer shipped separately

# 5.2.2 Verification of displacer and wire drum

Prior to installation of NMS8x, confirm that the serial numbers of displacer and the wire drum match with those printed to the label attached on the housing.



■ 13 Verification of displacer and wire drum

# 5.2.3 Tools to be required for installation

The following tools are required when installing NMS8x.

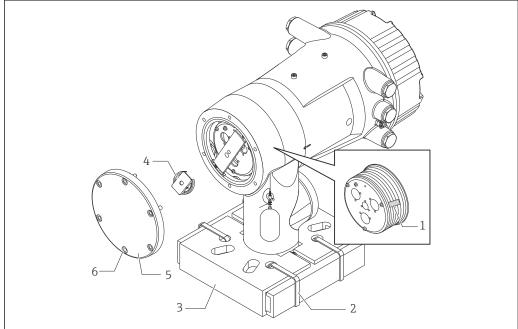
Tools	Figures	Notes
Crescent wrench		Use the size of 350 mm (13.78 in)
Allen key		Use the size of 3 mm (0.12 in)or 5 mm (0.17 in)
Screw driver	e	
<ul><li>Cross-head screwdriver</li><li>Flat-blade screwdriver</li></ul>		
Wire cutters or terminal pliers		
Crimp terminal	A	A: Signal and power supply: 0.2 to 2.5 mm² (24 to 13 AWG)  Ground terminal in the terminal compartment: max. 2.5 mm² (13 AWG)  Ground terminal at the housing: max. 4 mm² (11 AWG)
Water pump pliers		
Density calibration test weight		This tool is used especially for density measurement application (optional).

### 5.2.4 Installation for all-in-one

The device can be delivered by all-in-one method.

Displacer is shipped separately according to the following specifications.

- 316L 30 mm (1.18 in) displacer
- 316L 110 mm (4.33 in) displacer
- PTFE 30 mm (1.18 in) displacer
- PTFE 50 mm (1.97 in) displacer
- Guide wire assembly
- Cleaned from oil + grease option



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**■** 14 Removing packing materials

- 1 Tape
- 2 Fixing band
- 3 Displacer holder
- 4 Wire drum stopper
- 5 Drum housing cover
- 6 Screws and bolts

Procedures	Notes
1. Hold the gauge so that it stays horizontal against the flange.	Perform these steps before mounting NMS8x on the nozzle.
2. Cut the fixing bands [2].	Do not tilt NMS8x after removing the displacer holder.
Remove the displacer holder [3] and packing material of the displacer.	
4. Mount NMS8x on the nozzle.	<ul> <li>Make sure that the measuring wire hangs vertically.</li> <li>Confirm that there are no kinks or other defects in the measuring wire.</li> </ul>
5. Remove screws and M6 bolts [6] (M10 bolts for stainless steel housing) to remove the drum housing cover [5].	Be sure not to lose the O-ring and the fixing bolts for the cover of the drum housing.
6. Loosen two screws and remove the wire drum stopper [4].	

Procedures	Notes
7. Remove the tape [1] from the wire drum carefully.	<ul> <li>Remove the tape by hand to avoid damaging the wire drum.</li> <li>Make sure that the measuring wire is wound so that it fits correctly in the grooves.</li> </ul>
8. Mount the drum housing cover.	Confirm that the O-ring is in the drum housing cover.
9. Turn on the power of NMS8x.	Sensor, reference, and drum calibration steps are not required because they are all performed prior to delivery.

# 5.2.5 Installation for displacer shipped separately method

It is necessary to remove the wire drum from NMS8x, remove the tape on the wire drum, mount the wire drum in the drum housing, and install the displacer on the measuring wire.

Use blocks or a pedestal to secure NMS8x and provide an environment where electrical power can be supplied to NMS8x.

Procedures	Figures
<ol> <li>Secure NMS8x on the blocks or pedestal.</li> <li>Confirm that there is enough space under NMS8x.</li> <li>Be careful not to drop NMS8x.</li> </ol>	130 (5.12) 130 (5.12)
	Dimensions mm (in)
3. Remove screws and M6 bolts [6] (M10 bolts for stainless steel housing).	
4. Remove the wire drum cover [5], wire drum stopper [4], and the bracket [2].	
5. Remove the wire drum [1] from the drum housing.	
6. Remove the tape [3] on the wire drum.	1-
7. Unwind the measuring wire approximately 250 mm (9.84 in) so that the wire ring is positioned under the flange.	5-4-2-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3
8. Mount the wire drum on NMS8x.	
9. Mount the bracket.	6 A0030109
<ul> <li>Take special care to not hit the wire drum against the housing due to strong magnet force.</li> <li>Handle the measuring wire with care. It may kink.</li> <li>Be sure that the wire is wound correctly in the grooves.</li> </ul>	
10. Hook the displacer [3] on the ring [2].	
<ul> <li>Be sure that the wire is wound correctly in the grooves.</li> <li>If not, remove the displacer and the wire drum, and repeat step 7.</li> </ul>	1 3 2

Proservo NMS80 Installation

Proce	dures	Figures
11.	Turn on the power of NMS8x.	
12.	Perform sensor calibration	5-
13.	Secure the displacer $[2]$ to the measuring wire $[1]$ using the securing wire $[4]$ .	
14.	Install the ground wire [3] of the displacer (for details of displacer ground wire installation $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
15.	Perform reference calibration.	1
16.	Turn off the power.	2
17.	Mount the wire drum cover [5].	
	<ul> <li>For sensor calibration, →</li></ul>	A0030111
18.	Mount NMS8x on the tank nozzle [1].	
19.	Confirm that the displacer does not touch the inner wall of the nozzle. $ \\$	
20.	Turn on the power.	
21.	Perform drum calibration.	
i	For drum calibration, → 🖺 91	
		A0030112

Installation Proservo NMS80

### 5.2.6 Installation through the calibration window

In the case of a 50~mm (1.97 in) diameter displacer, the displacer can be installed through the calibration window.

It is only possible to install the following displacers through the calibration window: 50 mm 316L, 50 mm AlloyC276, 50 mm PTFE

Proce	dures	Figures
1.	Remove the calibration window cover [1].	A0030113
2.	Remove M6 bolts and screws [6] (M10 bolts for stainless steel housing).	
3.	Remove the cover [5], wire drum stopper [4], and the bracket [3].	1-0-3
4.	Remove the wire drum $[1]$ from the drum housing.	2
5.	Remove the tape [2] that is securing the wire.	
i	Handle the measuring wire with care. It may kink.	A0030114
6.	Holding the wire drum [1] with one hand, unwind the measuring wire [3] approximately 500 mm (19.69 in).	$\frac{1}{2}$
7.	Secure the wire $[3]$ temporarily with the tape $[2]$ .	
8.	Insert the wire ring [4] into the drum housing.	_3
9.	Pull the wire ring out through the calibration window.	4
i	Handle the measuring wire with care.	
10.	Insert the wire drum [4] temporarily into the drum housing.	A0030115
11.	Hook the displacer [3] on the wire ring.	4
12.	Secure the displacer to the measuring wire using the securing wire $\[2\]$ .	
13.	Install the ground wire [1] for the displacer (for details of displacer ground wire installation $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $	
i	<ul> <li>Take special care to not hit the wire drum against the housing due to strong magnet force.</li> <li>Handle the measuring wire with care. It may kink.</li> </ul>	2 - A0030116

Proservo NMS80 Installation

### **Procedures** Figures Remove the wire drum from the drum housing and unwind the measuring wire approximately 500 mm (19.69 in). Hold the wire drum [1] up and place the displacer [2] into the calibration window. Hold the displacer at the center of the calibration 16. window. Hold the other hand (wire drum) up to add tension to the measuring wire in order not to drop the displacer rapidly. A0030117 18. Let go of the displacer [2]. Remove the tape from the wire drum [5]. Insert the wire drum into the drum housing. Mount the bracket [4]. Be sure that the wire is wound correctly in the grooves. Turn on the power of NMS8x and move the displacer up using the Move displacer→ 87 until the wire ring can be seen in the calibration window. $\begin{tabular}{c} \bullet \end{tabular}$ Confirm that there are no kinks or other defects in the measuring wire. • Confirm that the displacer does not touch the inner wall of the nozzle. Perform sensor calibration. For sensor calibration, $\rightarrow$ $\blacksquare$ 88 Perform reference calibration. A0030118 i Mount the drum housing cover [3] and the calibration window cover [1]. Perform drum calibration.

Installation Proservo NMS80

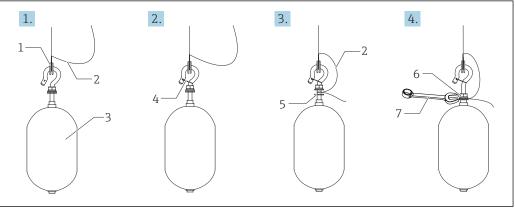
#### 5.2.7 Displacer ground wire installation

Depending on the application and Ex requirements, electrical grounding of the displacer is required. There are different procedures depending on the displacer type, which are described below.

#### Standard displacer installation

- 1. Mount the displacer [3] on the wire ring [1].
- 2. Wind the securing wire [4] on the wire hook.
- 3. Wind the ground wire [2] between the washers [5] twice.
  - └ If grounding is not required for non-explosion-proof applications, skip this step.
- 4. Secure the nut [6] with a wrench [7].

This completes the displacer installation procedure.



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■ 15 Displacer installation

- 1 Wire ring
- 2 Ground wire
- 3 Displacer
- 4 Securing wire
- 5 Washer
- 6 Nut
- 7 Wrench

#### PTFE displacer installation

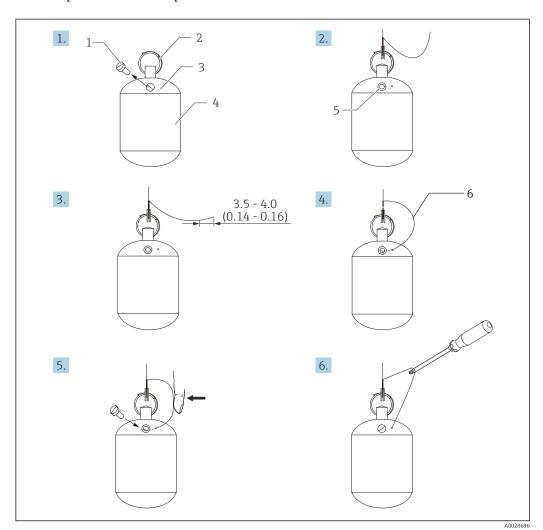
- 1. Remove the screw [1] using a flathead screwdriver.
- 2. Mount the displacer [4] on the Teflon ring [2].
- 3. Remove the PFA covered wire approximately 3.5 to 4.0 mm (0.14 to 0.16 in) for conductivity.
  - ► PTFE wire: Install the ground wire [6] onto the displacer from the wire insertion slot [3] until the ground wire touches to the wall of the screw hole [5].

    SUS wire: Install the ground wire [6] onto the displacer from the wire insertion slot [3] until the ground wire touches to the wall of the screw hole [5]. Then install the ground wire 10 mm (0.39 in) farther.
- 4. Install the ground wire [6] onto the displacer from the wire insertion slot [3] until the ground wire contacts to the wall of the screw hole [5].
- 5. Tighten the screw [1].
  - Hold the ground wire with finger tips so that the wire does not come out from the slot.

Proservo NMS80 Installation

6. Lift the displacer using a screwdriver and confirm that the ground wire does not come out from the slot.

This completes the PTFE displacer installation.



 $\blacksquare$  16 PTFE displacer installation; dimensions mm (in)

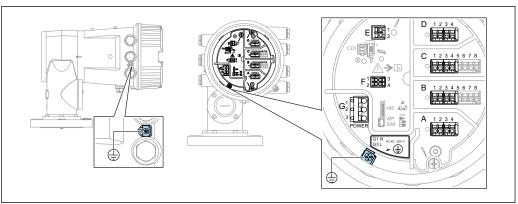
- 1 Screw
- 2 PFA covered ring
- 3 Wire insertion slot
- 4 Displacer
- 5 Screw hole
- 6 Ground wire

### 5.3 Post-installation check

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

### 6 Electrical connection

### 6.1 Terminal assignment



■ 17 Terminal compartment (typical example) and ground terminals

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### Housing thread

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

The following applies for all housing materials:

No not lubricate the housing threads.

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

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

- Modules with four terminals can be in any of these slots.
- Modules with eight terminals can be in slot B or C.
- The exact assignment of the modules to the slots is dependent on the device version  $\Rightarrow \triangle 45$ .

#### 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+

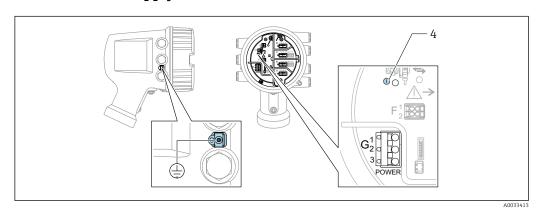
#### Terminal area: Protective ground

Module: Protective ground connection (M4 screw)



■ 18 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  $V_{AC}$  (-20 % + 15 %) = 52 to 75  $V_{AC}$ , 50/60 Hz

#### Low voltage DC power supply:

Operational value:

24 to 55  $V_{DC}$  (- 20 % + 15 %) = 19 to 64  $V_{DC}$ 

#### Power consumption

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

### High voltage AC power supply:

28.8 VA

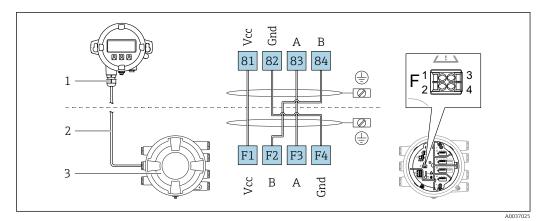
### Low voltage AC power supply:

21.6 VA

#### Low voltage DC power supply:

13.4 W

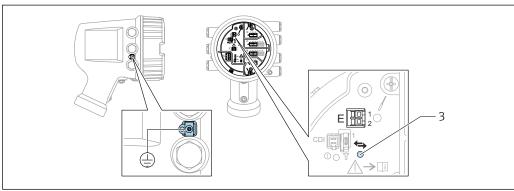
### 6.1.2 Remote display and operating module DKX001



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

- 1 Remote display and operating module
- 2 Connecting cable
- 3 Tank Gauging device (NMR8x, NMS8x or NRF8x)
- The remote display and operating module DKX001 is available as an accessory. For details refer to SD01763D.
- The measured value is indicated on the DKX001 and on the local display and operating module simultaneously.
  - The operating menu cannot be accessed on both modules at the same time. If the operating menu is entered in one of these modules, the other module is automatically locked. This locking remains active until the menu is closed in the first module (back to measured value display).

### 6.1.3 HART Ex i/IS interface



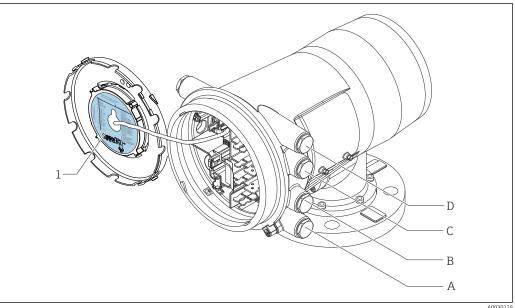
A003341

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

#### 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.



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

0 1)			T <sup>2)</sup>			
NMx8x	- xxxx XX XX 040 05					
040 <sup>3)</sup>	050 <sup>4)</sup>	060 <sup>5)</sup>	A 1234	B 12345678	C 1 2 3 4 5 6 7 8	1 2 3 4 A0023888
A1	X0	X0	М	-	-	-
A1	X0	A1	M	-	-	D
A1	X0	A2	M	-	D	D
A1	X0	A3	М	D	D	D
A1	X0	B1	M	M	-	-
A1	X0	B2	M	M	-	D
A1	X0	В3	M	M	D	D
A1	X0	C1	M	V1	-	-
A1	X0	C2	M	V1	-	D
A1	X0	C3	M	V1	D	D
A1	X0	E1	М	W	-	-
A1	X0	E2	М	W	-	D
A1	X0	E3	М	W	D	D
A1	A1	X0	M	A/XP	-	-
A1	A1	A1	М	A/XP	-	D
A1	A1	A2	М	A/XP	D	D
A1	A1	B1	М	M	A/XP	-
A1	A1	B2	М	M	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	M	W	A/XP	D
A1	A2	X0	М	A/XP	A/XP	-
A1	A2	A1	М	A/XP	A/XP	D
A1	A2	B1	М	A/XP	A/XP	M
A1	A2	C1	M	A/XP	A/XP	V1
A1	A2	E1	М	A/XP	A/XP	W
A1	B1	X0	М	A/IS	-	-
A1	B1	A1	М	A/IS	-	D
A1	B1	A2	M	A/IS	D	D

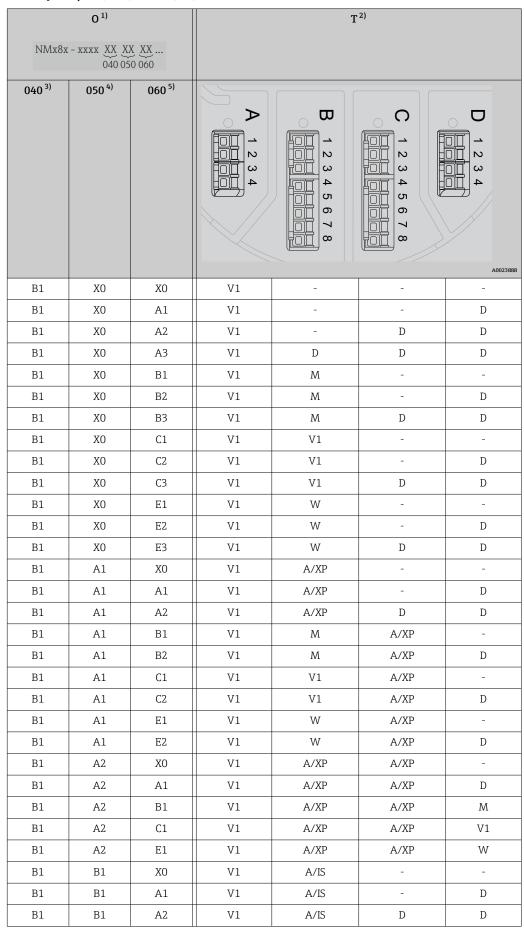
O 1)			T <sup>2)</sup>			
NMx8x - xxxx <u>XX</u> <u>XX</u> <u>XX</u> 040 050 060						
040 3)	050 <sup>4)</sup>	060 5)	A 1234	B 12345678	C 1 2 3 4 5 6 7 8	D 1 2 3 4
A1	B1	B1	M	M	A/IS	-
A1	B1	B2	M	M	A/IS	D
A1	B1	C1	М	V1	A/IS	-
A1	B1	C2	M	V1	A/IS	D
A1	B1	E1	M	W	A/IS	-
A1	B1	E2	M	W	A/IS	D
A1	B2	X0	M	A/IS	A/IS	-
A1	B2	A1	M	A/IS	A/IS	D
A1	B2	B1	M	A/IS	A/IS	M
A1	B2	C1	M	A/IS	A/IS	V1
A1	B2	E1	M	A/IS	A/IS	W
A1	C2	X0	М	A/IS	A/XP	-
A1	C2	A1	M	A/IS	A/XP	D
A1	C2	B1	M	A/IS	A/XP	M
A1	C2	C1	M	A/IS	A/XP	V1
A1	C2	E1	M	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)



	O 1)			T <sup>2)</sup>			
NMx8x	NMx8x - xxxx <u>XX XX XX</u> 040 050 060						
040 3)	050 <sup>4)</sup>	060 5)	A 1234	B 12345678	C 12345678	1 2 3 4 A0023888	
B1	B1	B1	V1	M	A/IS	-	
B1	B1	B2	V1	M	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	X0	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)

	O 1)		T <sup>2)</sup>			
NMx8x	- xxxx XX XX 040 05	X XX 0 060				
040 <sup>3)</sup>	050 <sup>4)</sup>	060 <sup>5)</sup>	A 1234	B 12345678	C 1 2 3 4 5 6 7 8	2 3 4 A0023888
C1	X0	X0	W	-	-	-
C1	X0	A1	W	-	-	D
C1	X0	A2	W	-	D	D
C1	X0	A3	W	D	D	D
C1	X0	B1	W	M	-	-
C1	X0	B2	W	M	-	D
C1	X0	В3	W	M	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	X0	E2	W	W	-	D
C1	X0	E3	W	W	D	D
C1	A1	X0	W	A/XP	-	-
C1	A1	A1	W	A/XP	-	D
C1	A1	A2	W	A/XP	D	D
C1	A1	B1	W	M	A/XP	-
C1	A1	B2	W	M	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	X0	W	A/XP	A/XP	-
C1	A2	A1	W	A/XP	A/XP	D
C1	A2	B1	W	A/XP	A/XP	M
C1	A2	C1	W	A/XP	A/XP	V1
C1	A2	E1	W	A/XP	A/XP	W
C1	B1	X0	W	A/IS	-	-
C1	B1	A1	W	A/IS	-	D
C1	B1	A2	W	A/IS	D	D

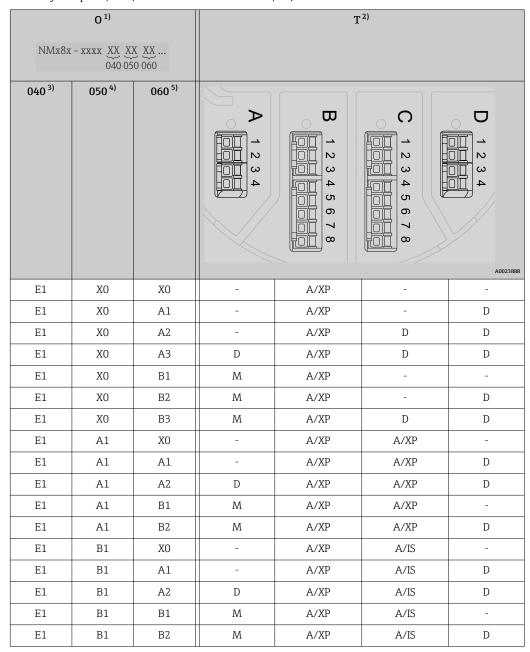
O 1)			T <sup>2)</sup>			
NMx8x - xxxx <u>XX</u> <u>XX</u> <u>XX</u> <u>XX</u> 040 050 060						
040 3)	050 <sup>4)</sup>	060 5)	A 1234	B 12345678	C 12345678	1 2 3 4 A0023888
C1	B1	B1	W	M	A/IS	-
C1	B1	B2	W	M	A/IS	D
C1	B1	C1	W	V1	A/IS	-
C1	B1	C2	W	V1	A/IS	D
C1	B1	E1	W	W	A/IS	-
C1	B1	E2	W	W	A/IS	D
C1	B2	X0	W	A/IS	A/IS	-
C1	B2	A1	W	A/IS	A/IS	D
C1	B2	B1	W	A/IS	A/IS	M
C1	B2	C1	W	A/IS	A/IS	V1
C1	B2	E1	W	A/IS	A/IS	W
C1	C2	X0	W	A/IS	A/XP	-
C1	C2	A1	W	A/IS	A/XP	D
C1	C2	B1	W	A/IS	A/XP	M
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)



- 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 i" (H1)

0 1)			T <sup>2)</sup>			
NMx8x - xxxx <u>XX XX XX</u> 040 050 060						
040 3)	050 <sup>4)</sup>	060 5)	A 1234	B 12345678	C 1 2 3 4 5 6 7 8	D 1 2 3 4
H1	X0	X0	-	A/IS	-	-
H1	X0	A1	-	A/IS	-	D
H1	X0	A2	-	A/IS	D	D
H1	X0	A3	D	A/IS	D	D
H1	X0	B1	M	A/IS	-	-
H1	X0	B2	M	A/IS	-	D
H1	X0	В3	M	A/IS	D	D
H1	A1	X0	-	A/IS	A/XP	-
H1	A1	A1	-	A/IS	A/XP	D
H1	A1	A2	D	A/IS	A/XP	D
H1	A1	B1	M	A/IS	A/XP	-
H1	A1	B2	M	A/IS	A/XP	D
H1	B1	X0	-	A/IS	A/IS	-
H1	B1	A1	-	A/IS	A/IS	D
H1	B1	A2	D	A/IS	A/IS	D
H1	B1	B1	M	A/IS	A/IS	-
H1	B1	B2	M	A/IS	A/IS	D

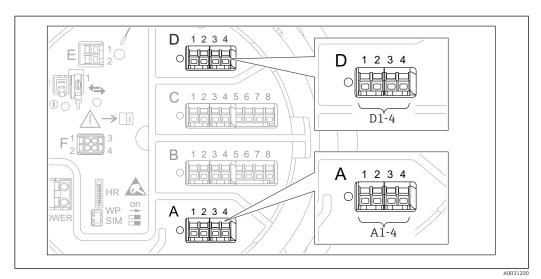
- 1) Ordering feature
- 2) Terminal area
- 3) Primary Output
- 4) Secondary IO Analog
- 5) Secondary IO Digital Ex d/XP

### 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

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



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

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

#### Terminals of the "Modbus" module

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

- X1<sup>1)</sup>
  - Terminal name: S
  - Description: Cable shielding connected via a capacitor to EARTH
- X2 1)
  - 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

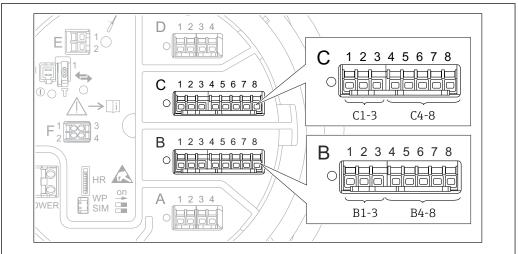
<sup>1)</sup> Here, "X" stands for one of the slots "A", "B", "C", or "D".

#### 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)



A003116

#### Terminal: B1-3

Function: Analog input or output (configurable)

- Passive usage: → 🖺 58
- Active usage: → 🖺 60

#### Terminal: C1-3

Function: Analog input or output (configurable)

- Passive usage: → 🖺 58
- Active usage: → 🖺 60
- Designation in the operating menu: Analog I/O C1-3 (→ 

  221)

#### Terminal: B4-8

Function: Analog input

- RTD: → 🖺 61

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

Terminal: C4-8

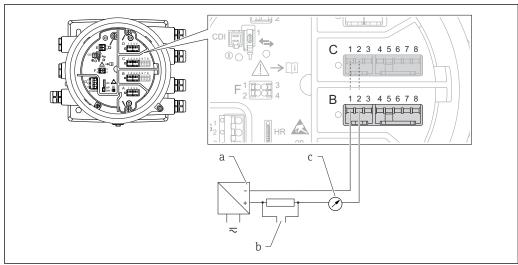
Function: Analog input

■ RTD: → 🖺 61

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

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

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

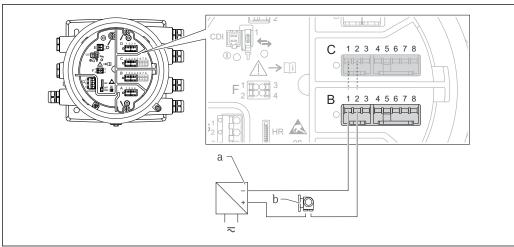


 $\blacksquare$  21 Passive usage of the Analog I/O module in the output mode

A00279

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

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



 $\blacksquare$  22 Passive usage of the Analog I/O module in the input mode

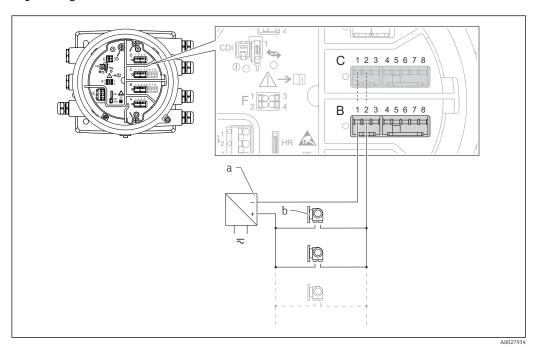
a Power supply

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

58 Endress+Hauser

A00279

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



 $\blacksquare$  23  $\,$  Passive usage of the Analog I/O module in the HART master mode

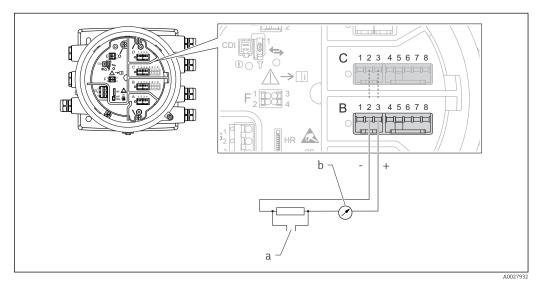
a Power supply

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.
- 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

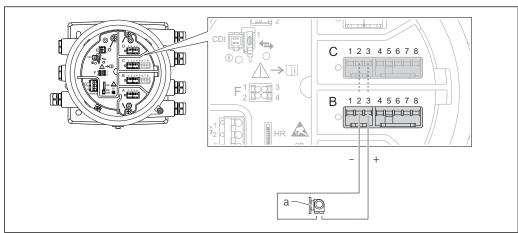
#### "Operating mode" = "4..20mA output" or "HART slave +4..20mA output"



■ 24 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"



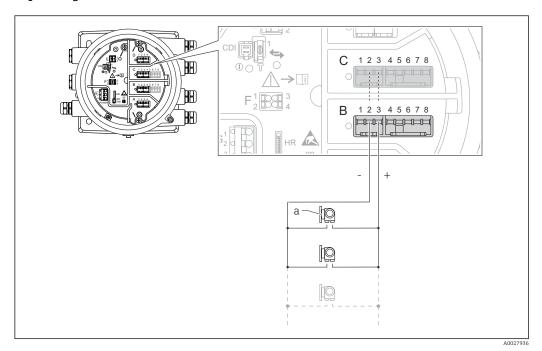
■ 25 Active usage of the Analog I/O module in the input mode

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

60 Endress+Hauser

A002793

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

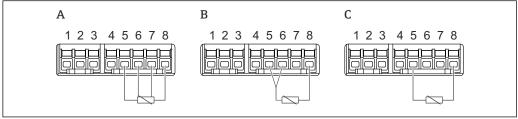


 $\blacksquare$  26 Active usage of the Analog I/O module in the HART master mode

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



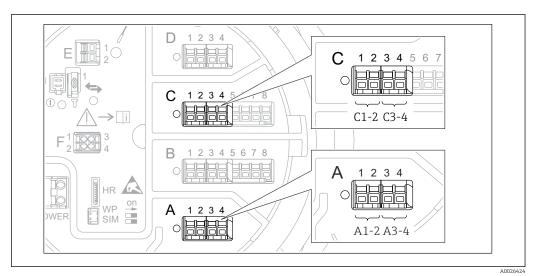
A0026371

A 4-wire RTD connection

B 3-wire RTD connection

2 -wire RTD connection

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



■ 27 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.

#### HART communication line

- Standard device cable is sufficient if only the analog signal is used.
- Shielded cable is recommended if using the HART protocol. Observe the grounding concept of the plant.

#### Modbus communication line

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

#### V1 communication line

- 2-wire twisted pair, screened or unscreened cable
- Resistance in one cable:  $\leq 120 \Omega$
- Capacitance between lines: ≤ 0.3 µF

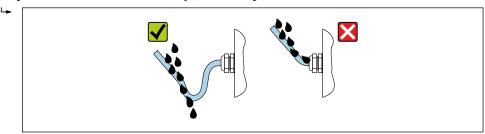
#### WM550 communication line

- 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?
О	Do the cables have adequate strain relief?
О	Are all cable glands installed, firmly tightened and correctly sealed?
О	Does the supply voltage match the specifications on the transmitter nameplate?
О	Is the terminal assignment correct → 🖺 42?
0	If required: Is the protective earth connected correctly ?
0	If supply voltage is present: Is the device ready for operation and do values appear on the display module?
О	Are all housing covers installed and firmly tightened?
О	Is the securing clamp tightened correctly?

Proservo NMS80 Operability

# 7 Operability

### 7.1 Overview of the operation options

The device is operated via an operating menu ( $\rightarrow \stackrel{\triangle}{=} 66$ ). This menu can be accessed by the following interfaces:

- The display and operating module at the device or the remote display and operating module DKX001 ( $\rightarrow \cong 67$ ).
- FieldCare connected through the service interface in the terminal compartment of the device ( $\rightarrow \boxminus 79$ ).
- FieldCare connected through Tankvision Tank Scanner NXA820 (remote operation;  $\rightarrow$  🖺 79).
- FieldCare connected through Commubox FXA195 (→ 🗎 159) to a HART interface of the device.

Confirm that the servo motor stops before changing parameters for safety use.

Operability Proservo NMS80

# 7.2 Structure and function of the operating menu

Menu	Submenu / parameter	Meaning
Operation	Proservo parameters	Contains parameters to operate Proservo (e.g. Gauge command).
	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	Standard parameters	Standard commissioning parameters
	Calibration	Calibration of the measurement
	Advanced setup	Contains further parameters and submenus:  • to adapt the device to special measuring conditions.  • to process the measured value.  • to configure the signal output.
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.
Expert <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.  The parameter of the <b>Expert</b> menu are	Sensor	Contains all parameters needed to configure the measurement.
described in: GP01074G (NMS80)	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  the tank gauging application the tank calculations the alarms.

Proservo NMS80 Operability

Menu	Submenu / parameter	Meaning
	Tank values	Shows measured and calculated tank values
	Diagnostics	Contains all parameters needed to detect and analyze operational errors.

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

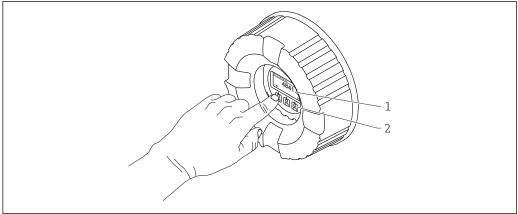
#### 7.3 Access to the operating menu via the local or remote display and operating module

- Operating via the remote display and operating module DKX001 ( $\rightarrow$   $\stackrel{\triangle}{=}$  44) 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").

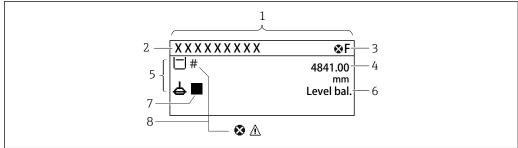


**■** 28 Display and operating elements

- Liquid crystal display (LCD)
- 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.

Operability Proservo NMS80

### 7.3.2 Standard view (measured value display)



A002870

 $eal_2$  29 Typical appearance of the standard view (measured value display)

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

### Status symbols

Symbol	Meaning
A0013956	"Failure" A device error is present. The measured value is no longer valid.
<b>C</b> A0013959	<b>"Function check"</b> The device is in service mode (e.g. during a simulation).
<b>S</b> A0013958	"Out of specification" The device is operated:  Outside of its technical specifications (e.g. during startup or a cleaning)  Outside of the configuration carried out by the user (e.g. level outside configured span)
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
<b>T</b>	A0027990	Vapor temperature
<b>T</b>	A	Air temperature
A0027993	A0027991	■ Tank ullage ■ Tank ullage %
<b>A</b> 0028150		Observed density value

Proservo NMS80 Operability

Symbol 1	Symbol 2	Measured value
P	Δ	Average profile density
A0028150	A0027991	
p	(1)	P1 (bottom)
A0028151	A0028141	
p	<b>(2</b> )	P2 (middle)
A0028151	A0028142	
р	(3)	P3 (top)
A0028151	A0028146	
G	(1)	GP 1 value
A0027992	A0028141	This is used for an external device.
G	<b>(2</b> )	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.
	U	Upper I/F level
A0028149	A0028529	
		Lower I/F level
A0028149	A0027989	
P	U	Upper density
A0028150	A0028529	Middle density
P	M	Middle density
A0028150	A0013957	Lower density
A0028150		
1 1	A0027989	Bottom level
A0028145		Bottom tever
<u></u>		Displacer position
A0027994		

## Gauge command and gauge status symbols

Symbol 1	Symbol 2	Meaning
A0028139		Gauge command This shows current command.
A0028143 A0028144	A0027995 A0028138 A002	Gauge status  d: Displacer is unbalanced (Level/Interface not found yet). d: Displacer is balanced (Level/Interface measurement valid). 1: Displacer is moving up. 1: Displacer is moving down. 1: Displacer stopped.

Operability Proservo NMS80

### 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.
A0031169	Calibration to regulatory standards disturbed  Is displayed in the following situations:  ■ The write protection switch is OFF. → 🖺 77  ■ The write protection switch is ON but the level value can currently not be guaranteed because the displacer is not balanced.

### Locking state symbols

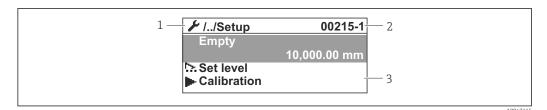
	Symbol	Meaning	
	A0011978	<b>Display parameter</b> Marks display-only parameters which cannot be edited.	
Device locked		Device locked	
	A0011979	<ul> <li>In front of a parameter name: The device is locked via software and/or hardware.</li> <li>In the header of the measured value screen: The device is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

### Meaning of the keys in the standard view

<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:</li> </ul>	Key	Meaning
<ul> <li>Level (visible if the keylock is inactive):</li></ul>	لمًا لمًا لمًا	<ul> <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></ul></li></ul>

Proservo NMS80 Operability

### 7.3.3 Navigation view



■ 30 Navigation view

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

### Navigation symbols

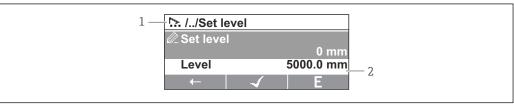
Symbol	Meaning
A0011975	Operation Is displayed:  in the main menu next to the selection Operation in the header, if you are in the Operation menu.
A0011974	Setup Is displayed:  in the main menu next to the selection Setup  in the header, if you are in the Setup menu
A0011976	Expert Is displayed:  in the main menu next to the selection Expert in the header, if you are in the Expert menu
<b>Q</b> A0011977	Diagnostics Is displayed:  ■ in the main menu next to the selection Diagnostics  ■ in the header, if you are in the Diagnostics menu
A0013967	Submenu
A0013968	Wizard
A0013963	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked.

Operability Proservo NMS80

### Meaning of the keys in the navigation view

Key	Meaning
<b>◎</b> -	Minus key Moves the selection bar upwards in a picklist.
— — — — — — — — — — — — — — — — — — —	Plus key Moves the selection bar downwards in a picklist.
	<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>
— — — — — — — — — — — — — — — — — — —	Escape key combination (press keys simultaneously)  ■ Pressing the keys briefly ■ Exits the current menu level and takes you to the next higher level. ■ If help text is open, closes the help text of the parameter. ■ Pressing the keys for 2 s returns you to the measured value display ("standard view").

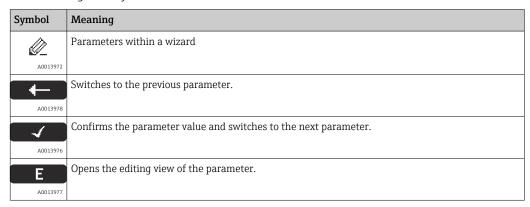
### 7.3.4 Wizard view



A00471

- 31 Wizard view on the display module
- 1 Current wizard
- 2 Display area for navigation

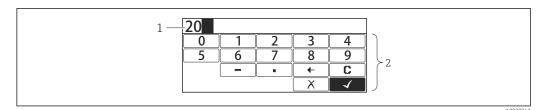
#### Wizard navigation symbols



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

Proservo NMS80 Operability

## 7.3.5 Numeric editor



 $\blacksquare$  32 Numeric editor on the display module

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

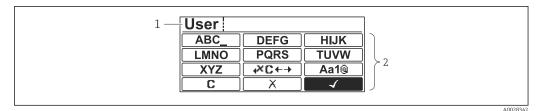
Symbol	Meaning	
0	Selection of numbers from 0 to 9.	
9		
A0013998		
	Inserts decimal separator at the input position.	
A0016619		
	Inserts minus sign at the input position.	
A0016620		
4	Confirms selection.	
A0013985		
<b>←</b>	Moves the input position one position to the left.	
A0016621		
X	Exits the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

## Meaning of the keys in the numeric editor

Кеу	ı	Meaning
	A0028324	Minus key In the input mask, moves the selection bar to the left (backwards).
	A0028325	Plus key 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>
	•	Escape key combination (press keys simultaneously) Closes the text or numeric editor without applying changes.

Operability Proservo NMS80

## 7.3.6 Text editor



 $\blacksquare$  33 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> A0013997	
<b>Aa1</b> @	Toggle  Between upper-case and lower-case letters  For entering numbers  For entering special characters
A0013985	Confirms selection.
<b>4× C ←→</b>	Switches to the selection of the correction tools.
X A0013986	Exits the input without applying the changes.
A0014040	Clears all entered characters.

#### Correction symbols under $\nearrow c \leftrightarrow$

A0013989	Clears all entered characters.
A0013991	Moves the input position one position to the right.
A0013990	Moves the input position one position to the left.
<b>*</b> ×	Deletes one character immediately to the left of the input position.
A0013988	

Proservo NMS80 Operability

#### Meaning of the keys in the text editor

Key	Meaning
—————————————————————————————————————	Minus key In the input mask, moves the selection bar to the left (backwards).
— ⊕ ⊕ E	Plus key In the input mask, moves the selection bar to the right (forwards).
— ⊕ ⊕ ■ A00289	Enter key  Pressing the key briefly Opens the selected group. Carries out the selected action. Pressing the key for 2 s confirms the edited parameter value.
—————————————————————————————————————	Escape key combination (press keys simultaneously) 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.

Operability Proservo NMS80

#### 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.
  - 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

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

#### Switching to the "Maintenance" role

If the n-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 a-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

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

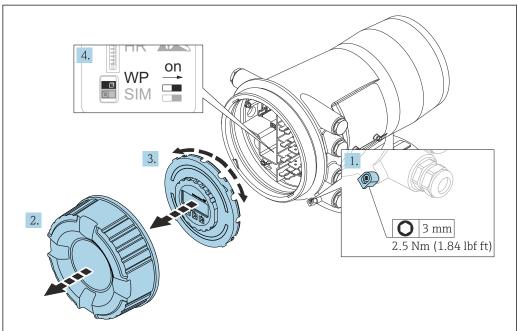
The user automatically switches back to the **Operator** role:

- 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).

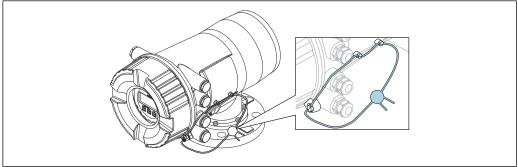
Proservo NMS80 Operability

## 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.



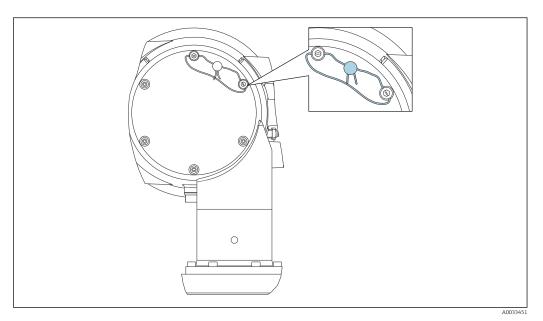
- A0030122
- The display module can be attached to the edge of the electronics compartment. This makes it easier to access the lock switch.
- 1. Loosen the securing clamp.
- 2. Unscrew the housing cover.
- 3. Pull out the display module with a gentle rotation movement.
- 4. Using a flat blade screwdriver 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.



A0033284

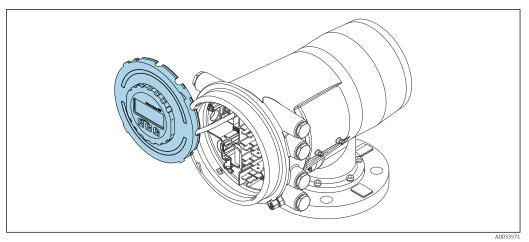
☑ 34 Sealing of the cover of the connection compartment

Operability Proservo NMS80



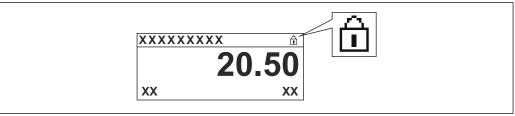
Sealing of the rear cover (e.g. NMS80)

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



NMS80: Display module attached to the edge of the terminal compartment

#### Indication of the locking state



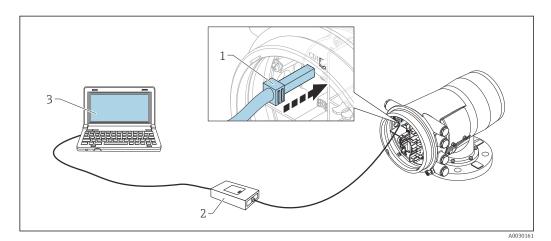
**■** 37 Write protection symbol in the header of the display

Write protection via locking switch is indicated as follows:

- Locking status (→ 🖺 206) = Hardware locked
- 🗈 appears in the header of the display.

Proservo NMS80 Operability

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



■ 38 Operation via service interface

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

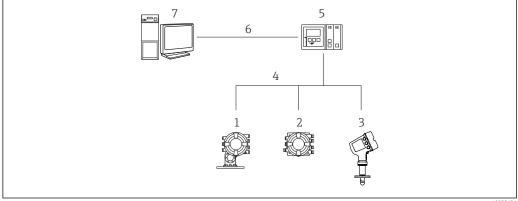
### The "Save/Restore" function

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



A002562

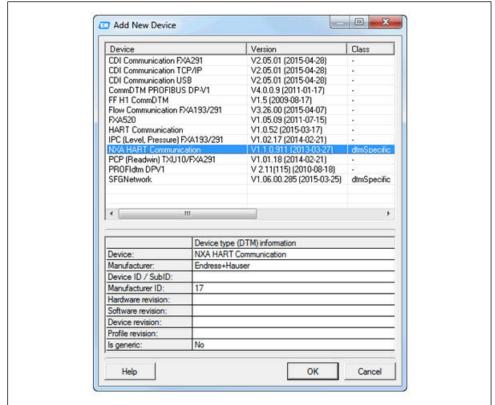
- ightharpoonup 39 Connection of Tank Gauging devices to FieldCare via the Tankvision Tank Scanner NXA820
- 1 Proservo NMS8x
- 2 Tankside Monitor NRF81
- 3 Micropilot NMR8x
- 4 Field protocol (e.g. Modbus, V1)
- 5 Tankvision Tank Scanner NXA820
- 6 Ethernet
- 7 Computer with FieldCare installed

Operability Proservo NMS80

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

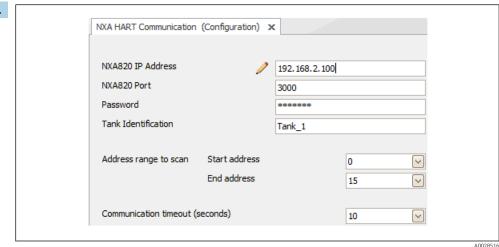
- 1. Make sure the **HART CommDTM NXA** is installed and update the DTM catalogue if required.
- 2. Create a new project in FieldCare.

3.



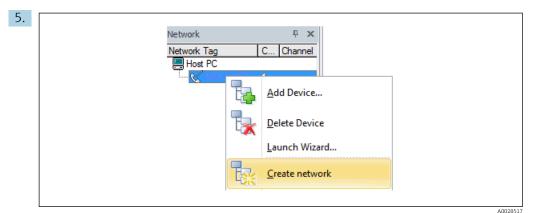
#### Add a new device: NXA HART Communication

4.



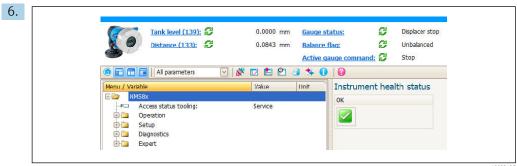
Open the configuration of the DTM and enter the required data (IP address of the NXA820; "Password" = "hart"; "Tank identification" only with NXA V1.05 or higher)

Proservo NMS80 Operability



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

► The device is detected and the DTM is assigned.



A0032427

► The device can be configured.

## 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.

System integration Proservo NMS80

## 8 System integration

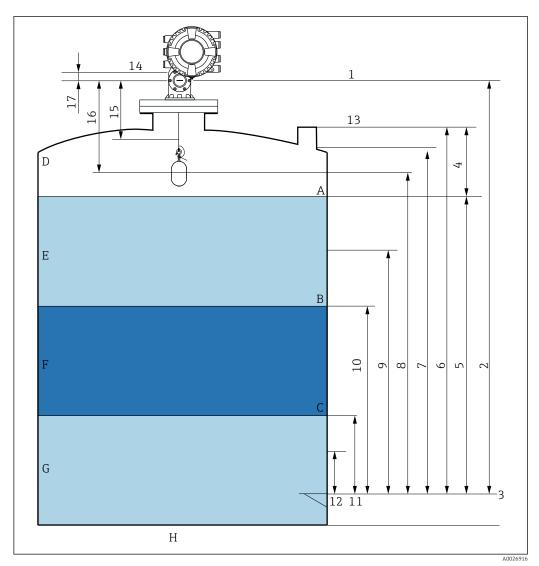
## 8.1 Overview of the Device Description files (DTM)

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 (NMS8x)	0x112D	
HART specification	7.0	
DD files	For information and files see: www.endress.com	

#### Commissioning 9

#### 9.1 Terms related to tank measurement



Terms concerning NMS8x installation (e.g. NMS81)

- Α Liquid level
- В Upper interface
- С Lower interface
- Gas phase
- Е Upper phase
- Middle phase
- G Lower phase
- Н Tank bottom
- Gauge reference height
- Empty 2
- Datum plate
- Tank ullage
- Tank level
- Tank reference height
- High stop level
- Displacer position
- Standby level
- 10 Upper interface level
- Lower interface level 11
- Low stop level
- Dipping reference

- 14 Mechanical stop
- 15 Slow hoist zone
- 16 Distance
- 17 Reference position

## 9.2 Initial settings

Depending on NMS8x specification, some of the initial settings described below may not be required.

#### 9.2.1 Setting the display language

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

- - The Language appears.
- 2. Open the Language and select the display language.

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

- 1. Navigate to: Setup → Advanced setup → Display → Language
- 2. Select the display language.
- This setting only affects the language on the display module. To set the language in the operating tool use the language setting functionality of FieldCare or DeviceCare, respectively.

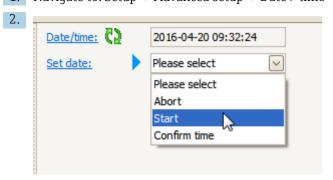
## 9.2.2 Setting the real-time clock

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

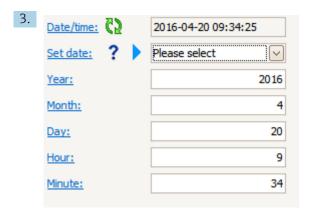
- 1. Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  Set date
- 2. Use the following parameters to set the real-time clock to the current date and time: Year, Month, Day, Hour, Minutes.

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

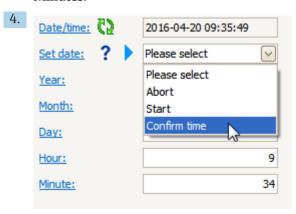
1. Navigate to: Setup → Advanced setup → Date / time



Go to the Set date and select the Start.



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



Go to the Set date and select the Confirm time.

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

## 9.3 Calibration

After installing or replacing NMS8x or its parts (sensor module, detector unit, wire drum, or measuring wire), Perform the following calibrations in this order.

- 1. Sensor calibration
- 2. Reference calibration
- 3. Drum calibration

All calibration steps may not be required, depending on whether the device is being installed, adjusted, or replaced (see the table below).

Type of installation/replacement		Calibration step		
		1. Sensor calibration	2. Reference calibration	3. Drum calibration
All-in one		Not required	Not required	Not required
Displacer shipp	ed separately	Required	Required	Required
Displacer installation through calibration window		Required	Required	Required
Replacement/	Wire drum	Required	Required	Required
maintenance	Displacer	Not required	Required	Required
	Sensor module/ Detector unit	Required	Required	Required

## 9.3.1 Verification of displacer and wire drum

Prior to installation of NMS8x, confirm that all of the following data of the displacer and the wire drum on the nameplate match with those programmed into the device.

#### Parameters to be confirmed

Parameters	Navigate to:	
Displacer diameter	$Setup \to Advanced \ setup \to Sensor \ config \to Displacer \to Displacer \ diameter$	
Displacer weight	Setup $\rightarrow$ Advanced setup $\rightarrow$ Sensor config $\rightarrow$ Displacer $\rightarrow$ Displacer weight	
Displacer volume	Setup $\rightarrow$ Advanced setup $\rightarrow$ Sensor config $\rightarrow$ Displacer $\rightarrow$ Displacer volume	
Displacer balance volume	$Setup \to Advanced \ setup \to Sensor \ config \to Displacer \to Displacer \ balance \\ volume$	
Drum circumference	$Setup \to Advanced \ setup \to Sensor \ config \to Wiredrum$	
Wire weight	Expert $\rightarrow$ Sensor $\rightarrow$ Sensor config $\rightarrow$ Wiredrum $\rightarrow$ Wire weight	

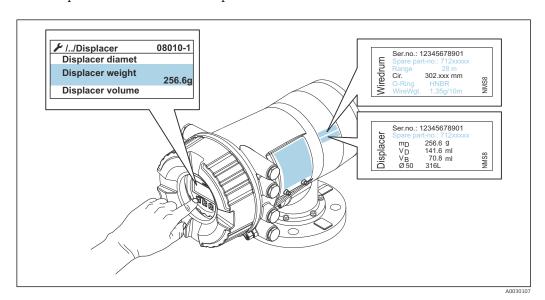
#### Data verification

#### Data verification procedure

1. Check the displacer diameter, weight, volume, and balance volume for the Displacer diameter, the Displacer weight, the Displacer volume, and the Displacer balance volume.

2. Check the drum circumference and wire weight for the Drum circumference and Wire weight.

This completes the data verification procedure.



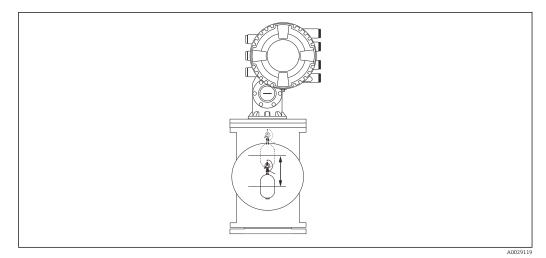
■ 41 Data verification

## 9.3.2 Move displacer

The move displacer operation is optional and can be used to change the current position of the displacer in order to perform the calibration steps more easily.

- 1. Make sure that the wire drum stopper has been removed.
- 2. Navigate to: Setup  $\rightarrow$  Calibration  $\rightarrow$  Move displacer  $\rightarrow$  Move distance
- 3. Input the relative moving distance for the Move distance.
- 4. Select the Move down or the Move up
- 5. Select the **Yes**.

This completes move displacer commands procedure.



■ 42 Move displacer

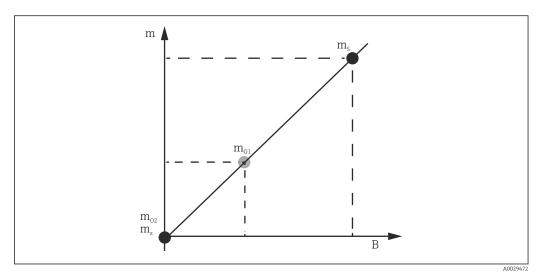
#### 9.3.3 Sensor calibration

Sensor calibration adjusts the weight measurement of the detector unit. The calibration consists of three steps as follows.

- ADC zero calibration
- ADC offset calibration
- ADC span calibration

For the ADC offset weight calibration, either 0 g or an offset weight (0 to 100 g) can be used.

 $\blacksquare$  Using an offset weight other than 0 g is recommended for density measurement.



■ 43 Concept of sensor calibration

m Weight of displacer

B Binary value of AD-Converter

 $m_S$  Span weight

 $m_{o1}$  Offset weight in case of 0 to 100 g (50 g is recommended.)

 $m_{o2}$  Offset weight in case of 0 g

 $m_z$  Zero weight

## **Calibration procedure**

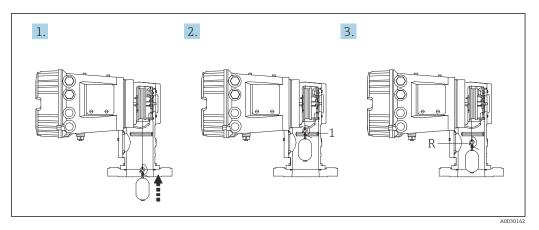
Step	Using displacer	Using offset weight	Description
1.	A0028000	A0028000	<ul> <li>Navigate to: Setup → Calibration → Sensor calibration → Sensor calibration</li> <li>Input the offset weight for the Offset weight used in step 3 (0.0 g in case of using the displacer only).</li> <li>Input the value for the Span weight used in step 4 (weight of displacer indicated on nameplate).</li> </ul>
2.	A0027999	A0028001	<ul> <li>Hold up or remove the displacer.</li> <li>Select  for next parameter.</li> <li>Measuring zero weight is shown on the display.</li> <li>Wait until the Zero calibration shows the Finished and calibration status shows Idle.</li> <li>When the displacer is being held up, do not release it until this step is completed.</li> </ul>
3.	A0027999	A0028002	<ul> <li>Confirm that the Offset calibration shows the Place offset weight.</li> <li>Hold up the displacer or attach the offset weight.</li> <li>Select  for next parameter.</li> <li>Measuring offset weight is shown on the display.</li> <li>Wait until the Offset calibration shows the Finished and Calibration status shows Idle.</li> <li>When the displacer is being held up, do not release it until this step is completed.</li> </ul>
4.	A0028000	A0028000	<ul> <li>Release the displacer or mount it on the measuring ring if an offset weight was used in the previous step.</li> <li>Select for next parameter.</li> <li>Measuring span weight is shown on the display.</li> <li>Confirm that the Span calibration shows the Finished and Calibration status shows Idle.</li> <li>Select the Next.</li> <li>Confirm that the Sensor calibration shows the Finished and Calibration status shows Idle.</li> <li>This completes sensor calibration procedure.</li> <li>Do not swing the displacer and keep it in as stable a position as possible.</li> </ul>

#### 9.3.4 Reference calibration

The reference calibration defines the zero distance position of the displacer from the mechanical stop.

- 1. Navigate to: Setup  $\rightarrow$  Calibration  $\rightarrow$  Reference calibration  $\rightarrow$  Reference calibration
- 2. Select the Start
- 3. Check the reference position (e.g. 70 mm (2.76 in)).
  - └ The reference position is preset prior to delivery.
- 4. Confirm that the displacer is correctly attached to the measuring wire.
- 5. The reference calibration starts automatically.

This completes the reference calibration.



**■** 44 Reference calibration sequence

1 Mechanical stop

R Reference position

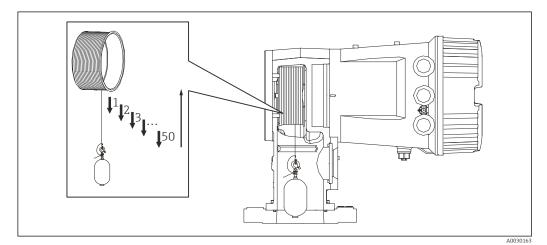
#### 9.3.5 Drum calibration

- 1. Navigate to: Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum calibration  $\rightarrow$  Drum calibration
- 2. Ensure a distance of 500 mm (19.69 in) or more from the bottom of the displacer to the liquid level.
- 3. Confirm that the displacer weight is correct for the Set high weight.
- 4. Select the Start.
  - The drum calibration starts automatically.

    The drum calibration records fifty points which will take approximately eleven minutes.
- 5. Select the No as usual for the Make low table.
  - ► To make a low table for special applications, select the **Yes** and use 50 g weight.

This completes drum calibration procedure.

To cancel any calibration, press  $\Box$  +  $\oplus$  simultaneously. If the drum calibration is canceled while making the new table, the old table remains effective. If making a new table fails due to an obstruction, NMS8x will not accept the new table and shows an error message.



■ 45 Making drum table

## 9.3.6 Commissioning check

This procedure is to confirm that all calibration steps have been completed appropriately.

The commissioning check starts at the position where the previous drum calibration was performed. Perform drum calibration if the reference position was changed.

When skipping the drum calibration, it is necessary to ensure that there are no obstructions or interfering objects prior to the commissioning check.

The commissioning check has a total of eleven steps as follows.

The check items for the commissioning check should be performed in the following order.

- The displacer weight at the first point is within the threshold (within the specified value: 5 g (0.01 lb)).
- Ten points out of fifty, when the previous drum table was created, are selected and compared with the result of the current weight table and detected weight will be confirmed.
- Confirm the displacer weight is within the threshold (within specified value: 5 g (0.01 lb)) at each point.

If the displacer weight exceeds the threshold in the ten steps, the commissioning check stops and the gauge status changes to Stop.

To continue the level measurement, perform the gauge command.

The following three items are confirmed in the last step.

- The difference of the neighboring two points is within the threshold (within the specified value: 2 g (0.004 lb)).
- Peak-to-peak of the compensation value in the drum table is within 20 g (0.04 lb).
- The maximum compensation value in the drum table is within 40 q (0.09 lb).

Overtension is not confirmed during execution of the commissioning check.

Prior to drum calibration, ensure that there is nothing interfering with where the previous drum calibration was performed.

- 1. Navigate to: Diagnostics → Device check → Commissioning check → Commissioning check
- 2. Select the Start.
  - Executing is shown on the verify drum table.
- 3. Select the Start.
- 4. Confirm that the Commissioning check shows the Finished.
- 5. Confirm that the Result drum check is passed.

This completes the commissioning check procedure.

## 9.4 Configuring the measuring device

Configuration task		Description
Configuring the level and interface	Setting density	→ 🖺 93
measurement	Setting tank height	→ 🖺 94
	Setting high and low stop	→ 🖺 95
Level calibration	Setting for open tank with liquid	→ 🗎 96
	Setting for open tank without liquid	→ 🖺 97
	Setting for closed tank	→ 🖺 98
	Setting process condition	→ 🖺 100
Configuring the density measurement	Setting spot density	→ 🖺 101
	Setting tank profile	→ 🖺 103
	Setting interface profile	→ 🖺 104
	Setting manual profile	→ 🖺 105

## 9.4.1 Configuring the level and interface measurement

The level measurement is to measure the position where the displacer is balanced (immersion point) in the liquid. When the liquid surface level changes, the displacer continuously follows the position to measure the liquid level. To define the appropriate level measurement, the following settings are required prior to operation.

The interface measurement can determine the interface between different liquids in a tank (e.g. water and oil). Up to two different interfaces can be determined within a maximum of three phases in a tank.

#### Setting the density of application

Density values for three liquid phases are set as follows prior to delivery.

Upper density: 800 kg/m³
 Middle density: 1000 kg/m³
 Lower density: 1200 kg/m³

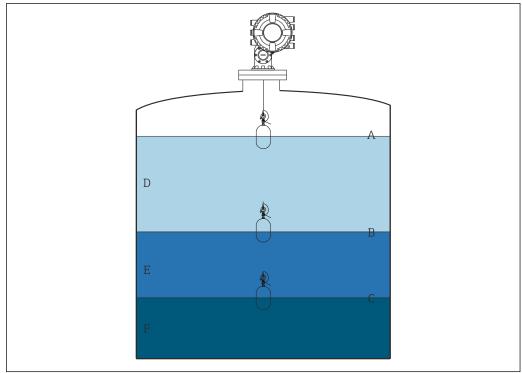
Change the data to reflect the actual density values. For tanks with only one liquid phase, set the upper density. For tanks with two or three phases, set middle and bottom densities as well.

Number of phases	Parameters to be set
1 phase	Upper density
2 phases	Upper/middle density
3 phases	Upper/middle/lower density

When performing an interface measurement, the minimum density difference between phases should be at least  $100 \text{ kg/m}^3$ .

#### Setting the density

- Navigate to: Setup → Upper density , Setup → Middle density and Setup → Lower density
- 2. Input the value to Upper, Middle, and Lower densities accordingly.



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■ 46 Tank configuration

- A Liquid level
- B Upper interface
- C Lower interface
- D Upper phase (density)
- E Middle phase (density)
- F Lower phase (density)

#### Setting the tank height

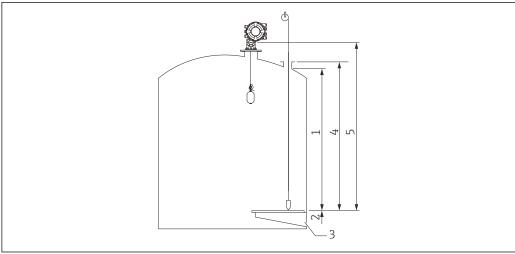
To measure the tank level correctly, the tank reference height and empty (distance from reference point to datum plate) must be set in advance.



- Tank reference height: Set by the customer to represent the height of the tank. Distance between the dipping reference and the datum plate. Used for percentage calculation and as reference for the ullage level.
- Empty: Distance between the zero point of device and datum plate. Empty is automatically adjusted by the Set level.

#### Setting the tank reference height and empty

- 1. Navigate to: Setup → Empty
- 2. Input the empty value.
- 3. Navigate to: Setup → Tank reference height
- 4. Input the value of tank reference height.



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■ 47 Tank height

- 1 High stop
- 2 Low stop
- 3 Datum plate
- 4 Tank reference height
- 5 Empty

#### Setting the high stop and low stop

The high stop and low stop determine the highest and lowest points of displacer movement. Set these data to the desired actual upper and lower limit values.

If the displacer should be able to determine a tank bottom that is below the datum plate, set the low stop to a negative value. To make sure that the displacer travels up to the reference position, set the high stop to a value greater than or equal to empty.

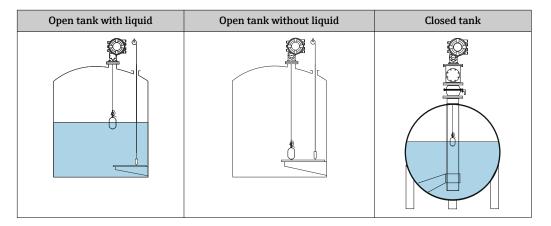
#### High stop and low stop setting procedure

- 1. Navigate to: Setup → High stop level
- 2. Input the actual value for high stop.
- 3. Navigate to: Setup → Low stop level
- 4. Input the actual value for low stop.

This completes upper and lower stop setting procedure.

#### 9.4.2 Level calibration

The following table shows the most likely options for setting the level calibration.

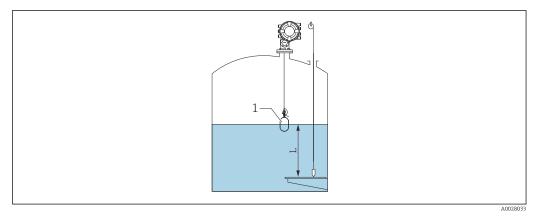


#### Setting for an open tank with liquid

#### Level setting procedure

- 1. Navigate to: Setup → Gauge command
- 2. Select the Level for the Gauge command.
  - └ The displacer automatically searches for the point where it balances.
- 3. Wait until the displacer is balanced on the liquid.
- 4. Perform dipping to determine the liquid level (L) in the tank.
- 5. Navigate to: Setup → Set level
- 6. Input the determined level value for the Set level.
- The Set level adjusts the Empty to reflect the new level value.

This completes setting for open tank with liquid procedure.



■ 48 Set level for opened tank

- 1 Displacer
- L Measured value

#### Setting for an open tank without liquid

If there is no liquid in the tank, the following procedure can be used to set the tank bottom or datum plate to 0 mm for the tank level.

#### Level setting procedure

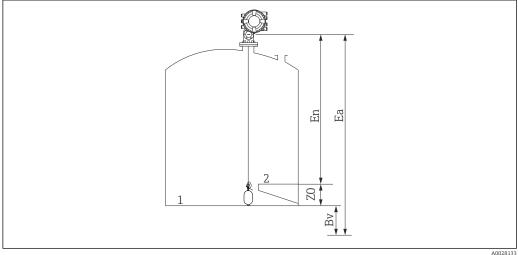
- 1. Navigate to: Operation  $\rightarrow$  Gauge command  $\rightarrow$  Gauge command
- 2. Select the Bottom level to measure the tank bottom.
- 3. Navigate to: Operation → One-time command status
- 4. Wait until the Finished is shown.
- 5. Navigate to: Operation  $\rightarrow$  Level  $\rightarrow$  Bottom level
- 6. Read the Bottom level (Bv).
- 7. Navigate to: Setup  $\rightarrow$  Empty
- 8. Read the actual empty value (Ea).
- 9. Calculate the new empty value using following formula.

10. Input the calculated value for the Empty.

Example: Ea = 28m, Bv = 10.5m, Z0 = 0.5mEn = 28m - 10.5m = 17m

- The parameter ZO defines the distance between the desired 0mm level value and the physical tank bottom (if displacer measures the datum plate, ZO = 0 mm (0 in)).
  - Bottom level operation considers the immersion depth of the displacer in the measurement.

This completes the level setting for open tank without liquid procedure.



- ₩ 49 Open tank without liquid
- Tank bottom
- 2 Datum plate
- Еа Initial empty setting
- Βv Initial bottom level
- En New empty
- Distance from tank bottom to datum plate
- It is recommended to repeating the level calibration when there is liquid in the tank  $(\rightarrow \triangleq 96)$ .

#### Setting for a closed tank

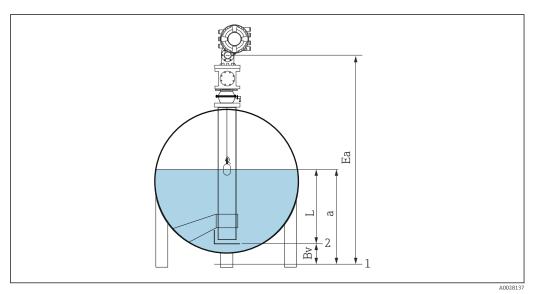
For tanks that cannot be hand-dipped, follow the procedure shown below.

#### Level setting procedure

- 1. Navigate to: Operation  $\rightarrow$  Gauge command  $\rightarrow$  Gauge command
- 2. Select the Bottom level to measure the tank bottom.
  - NMS8x measures the tank bottom and returns to level if the post gauge command is set to level (default).
- 3. Navigate to: Operation  $\rightarrow$  One-time command status
- 4. Wait until the Finished is shown.
- 5. Navigate to: Operation  $\rightarrow$  Level  $\rightarrow$  Bottom level
- 6. Read the bottom value (Bv).
- 7. Navigate to: Operation → Level → Tank level (a)
- 8. Calculate the level value (L) by using following formula.
  - L = a Bv
- 9. Navigate to: Setup → Set level
- 10. Input the value L for the Set level.

This completes the level setting procedure.

If the datum plate is not zero (e.g. Z mm), adjust the set level value (L) by subtracting Z from the value L (L= a-Bv-Z).



■ 50 Closed tank for NMS80 and NMS81

1 Initial zero level position

2 Datum plate

Ea Initial setting of Empty

Bv Bottom level

a Tank level

L Set level value

#### Setting for a closed tank without datum plate

For tanks that cannot be hand-dipped and have no datum plates, follow the procedure shown below.

#### Procedure for setting level by empty

In cases where a manual dip cannot be carried out and there are no flat datum plates to reference the bottom, empty can be used instead of set level . In this particular case, empty needs to be adjusted as it is not the gauge reference height but the displacer immersion depth.

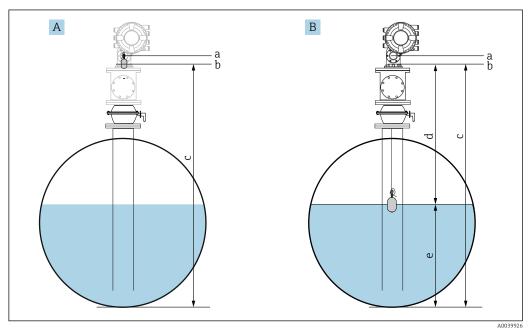
Level is automatically calculated by the following formula.

#### **Empty - Distance = Level**

The absolute value of distance is updated according to the displacer movement and level can be determined.

- 1. Navigate to: Setup → Empty
- 2. Set empty to be the displacer immersion depth.
- 3. Navigate to: Setup → Gauge command
- 4. Select the **Level** for the Gauge command parameter.
  - The displacer automatically searches for the point where it balances.
- 5. Wait until the displacer is balanced on the liquid surface.

This completes the level setting procedure.



■ 51 Level setting in case of empty (NMS80/81)

- A Set empty
- B How level is determined
- a Gauge reference height
- b Empty adjusted to the displacer immersion depth = distance 0 mm
- c Empty
- d Distance
- e Level

#### Selecting the process condition

The process condition is used to adjust the device to the application. By changing this parameter, several balancing parameters are adjusted automatically to make setup easier.

- 1. Navigate to: Setup → Process condition
- 2. Select an appropriate condition for the Process condition.
- The default setting of the process condition varies depending on your order.

Parameter name	Process condition		
Parameter setting	Universal	Calm surface	Turbulent surface
Description			
	Provides reliable results in various applications and for various liquids.	For storage tanks with a calm surface and focus on highest accuracy measurement.	For applications where the surface is turbulent.

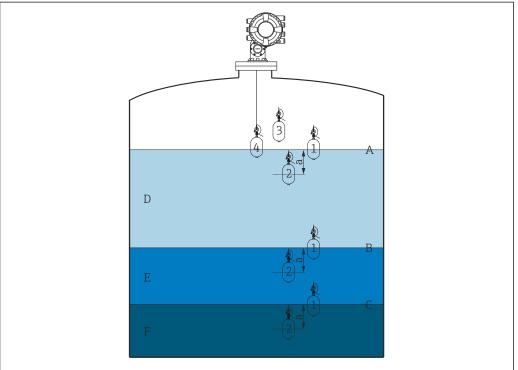
#### 9.4.3 Configuring the density measurement

The density measurement is performed to confirm and maintain the quality of the liquid. The density measurement is largely divided into two methods as shown below.

Density methods	Gauge command	Description
Spot density	Upper density Middle density Lower density	One spot density measurement for designated layer
		<ul><li>Upper density is for upper layer.</li><li>Middle density is for middle layer.</li><li>Lower density is for lower layer.</li></ul>
Profile density	Tank profile	Profile between the bottom of the tank and the level position
		<ul><li>Normal mode</li><li>Compensation mode</li></ul>
	Interface profile	Profile between the upper interface (I/F) and the level position
		<ul><li>Normal mode</li><li>Compensation mode</li></ul>
	Manual profile	Profile between the desired start point and the level position
		<ul><li>Normal mode</li><li>Compensation mode</li></ul>

#### Spot density measurement

Three different spot density gauge commands are available as shown below.



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**■** 52 Spot density (The numbers show the order of displacer movement.)

- A Liquid level
- B Upper interface
- C Lower interface
- D Upper density
- E Middle density
- F Lower density
- a Submersion depth

The submersion depth (a) is set to 150 mm (5.91 in) prior to delivery. To change the submersion depth, perform the following steps.

- 1. Navigate to: Setup → Advanced setup → Sensor config → Spot density → Submersion depth
- 2. Input the desired value for the Submersion depth.

#### Setting the spot density

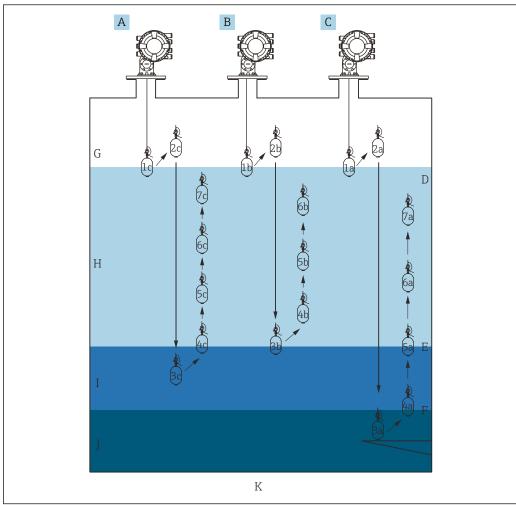
- 1. Navigate to: Operation  $\rightarrow$  Gauge command  $\rightarrow$  Gauge command
- 2. Select the Upper density, the Middle density, or the Lower density for the Gauge command.
- 3. Verify that the value that was examined in a laboratory and the actual value that was measured in the tank are the same or within an allowable range.
- 4. Adjust the value if necessary.
  - Navigate to: Setup → Advanced setup → Sensor config → Spot density Select the Upper density offset , the Middle density offset, and the Lower density offset and input the desired values for each offset.

This completes the setting spot density procedure.

#### Profile density measurement

Profile density has three gauge commands as shown below.

NMS8x measures a density profile according to a defined interval of up to 50 points.



■ 53 Overview of profile density (1a, 2a, 3a...show the order of displacer movements.)

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- A Manual profile
- B Interface profile
- C Tank profile
- D Liquid level
- E Upper interface
- F Lower interface
- G Gas phase
- H Upper density
- I Middle density
- Lower density
- K Tank bottom
- Page 1 Density measurement has two types of modes.
  - Normal measure mode: Profile points are measured at exactly configured positions.
  - Compensation mode: Profile points are measured at multiples of the wire drum circumference to further improve accuracy.

Select normal mode as usual. However, when selecting compensation mode, NMS8x automatically adjusts the measurement positions to where the density measurement can be the most accurate.

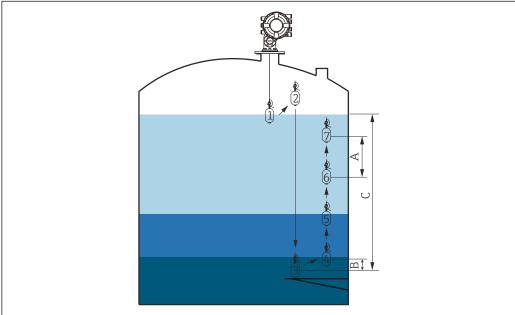
#### Tank profile measurement

#### Setting tank profile procedure

The tank profile operation measures a profile starting at the physical tank bottom up to the liquid level.

- 1. Navigate to: Setup → Advanced setup → Sensor config → Profile density → Profile density offset distance
- 2. Input the desired value for the Profile density offset distance.
  - The value of the profile density offset distance defines the distance between the start point (datum plate or bottom of the tank) and the first measurement point.
- 3. Navigate to: Setup → Advanced setup → Sensor config → Profile density → Profile density interval
- 4. Input the desired value for the Profile density interval.
- 5. Set Tank profile in the Gauge command to start measurement.

This completes the setting tank profile procedure.



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■ 54 Tank profile movement (The numbers show the order of the displacer movement.)

- A Profile density interval
- B Profile density offset distance
- C Datum plate
- D Tank profile range

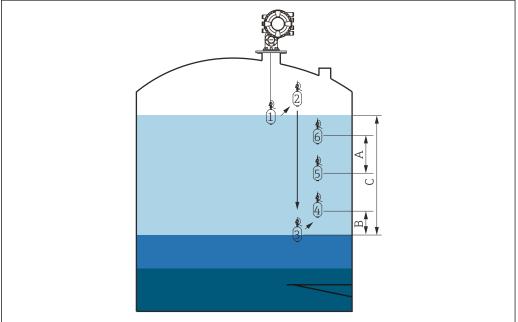
#### Interface profile measurement

#### Setting interface profile procedure

The interface profile operation measures a profile starting at the upper interface level up to the liquid level.

- 1. Navigate to: Setup → Advanced setup → Sensor config → Profile density → Profile density offset distance
- 2. Input the desired value for the Profile density offset distance.
  - The value of the profile density offset distance defines the distance between the start point (upper interface) and the first measurement point.
- 3. Navigate to: Setup → Advanced setup → Sensor config → Profile density → Profile density interval
- 4. Input the desired value for the Profile density interval.
- 5. Set Interface profile in the Gauge command to start measurement.

This completes the setting interface profile procedure.



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■ 55 Interface profile movement (The numbers show the order of the displacer movement.)

- A Profile density interval
- B Profile density offset distance
- C Tank profile range

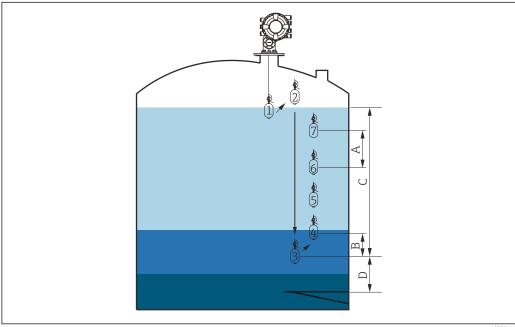
#### Manual profile measurement

#### Setting manual profile procedure

The manual profile operation measures a profile starting at a manually specified level up to the liquid level.

- 1. Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density  $\rightarrow$  Manual profile level
- 2. Input the desired value for the Manual profile level.
- 3. Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density  $\rightarrow$  Profile density offset distance
  - ► For the manual profile, the level offset can be set to 0 so that the first point can be measured at the manual profile level.
- 4. Input the desired value for the Profile density offset distance.
  - The value of the profile density offset distance defines the distance between the start point (manual profile) and the first measurement point.
- 5. Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density  $\rightarrow$  Profile density interval
- 6. Input the desired value for the Profile density interval.
- 7. Set Manual profile in the Gauge command to start measurement.

This competes the setting manual profile.



Manual profile movement (The numbers show the order of the displacer movement.)

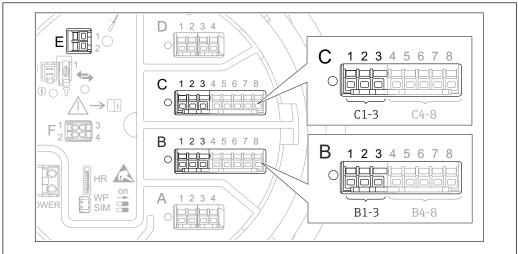
- Α Profile density interval
- Profile density offset distance
- Manual profile range
- Manual profile level

## 9.5 Configuring the tank gauging application

Configuration of the inputs:	Description
HART inputs	→ 🖺 107
NMT532/539/81 connected via HART	→ 🖺 109
4-20mA inputs	→ 🖺 111
RTD input	→ 🖺 112
Digital inputs	→ 🖺 114
Configuration of the data processing in the device:	Description
Linking input values to tank variables	→ 🖺 115
Tank calculation: Direct Level Measurement	→ 🖺 116
Tank calculation: Hybrid Tank Measurement System (HTMS)	→ 🖺 117
Tank calculation: Correction of the Hydrostatic Tank Deformation (HyTD)	→ 🖺 118
Tank calculation: Thermal Tank Shell Correction (CTSh)	→ 🖺 119
Alarms (limit evaluation)	→ 🖺 123
Configuration of the signal output:	Description
4-20mA output	→ 🖺 124
HART slave + 4-20mA output	→ 🖺 125
Modbus	→ 🖺 126
V1	→ 🖺 127
Digital outputs	→ 🖺 128
WM550	→ 🖺 127

## 9.5.1 Configuration of the HART inputs

#### Connecting and addressing HART devices



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- 57 Possible terminals for HART loops
- B Analog I/O module in slot B (availability depending on device version  $\rightarrow \triangleq 45$ )
- *C* Analog I/O module in slot C (availability depending on device version  $\rightarrow \triangleq 45$ )
- *E* HART Ex is output (available in all device versions)
- HART devices must be configured and given a unique HART address in the range from 1 to 15 via their own user interface before they are connected to the Proservo NMS8x <sup>3)</sup>. Make sure they are connected as defined by the terminal assignment → 56. Devices with an address larger than 15 are not recognized by the Proservo.

### 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 → Advanced setup → Input/output → Analog I/O X1-3
- 2. Go to the Operating mode ( $\rightarrow \square$  221).
- 3. If only one HART device is connected to this loop:

  Select the HART master+4..20mA input. In this case the 4-20mA signal can be used in addition to the HART signal. For the configuration of the 4-20mA input:

  → 111.
- 4. If up to 6 HART devices are connected to this loop: Select the HART master.

<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 NMT53x and NMT8x as the type of measured value is automatically recognized by the Proservo NMS8x 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:

- Navigate to: Setup → Advanced setup → Input/output → 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 (→ 🗎 211) 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 (→ 

  211) 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 (→ 🗎 212) 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 (→ 🖹 212) and specify which of the four HART variables contains the measured vapor temperature. Only a HART variable with a temperature unit may be selected.
- 7. If the device measures a level:

  Go to the Output level (→ 

  213) and specify which of the four HART variables contains the measured level. Only a HART variable with a level unit (not "%") may be selected.

#### Disconnecting HART devices

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

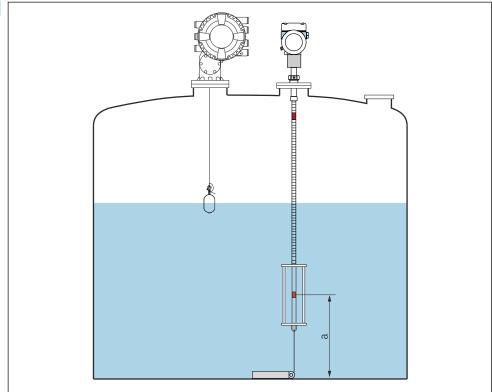
- Navigate to Setup → Advanced setup → Input/output → HART devices → Forget device → Forget device
- 2. Select the HART device to be removed.
- This procedure is also necessary if a defective device is exchanged.

# 9.5.2 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  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)  $\rightarrow$  NMT device config; here, **HART Device(s)** is the name of the connected Prothermo.
- 2. Go to the Configure device? and select **Yes**.





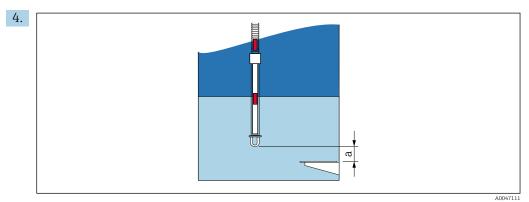
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■ 58 Prothermo NMT53x: Position of the bottom temperature element

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

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

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



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

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

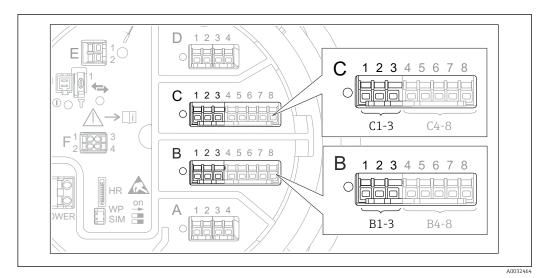
To configure a **Prothermo NMT8x**: Go to the Bottom point and enter the distance between the physical end of the probe and the zero level value in the tank (tank bottom or datum plate).

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

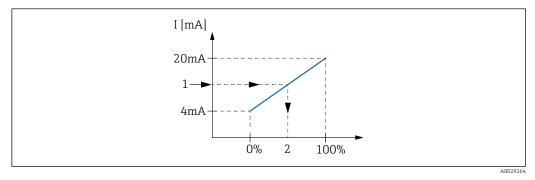
There is a Element temperature X for each element of the Prothermo.

## 9.5.3 Configuration of the 4-20mA inputs



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

- 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 ( $\rightarrow \triangleq 221$ ) and select **4..20mA input** or **HART master** +**4..20mA input**.
- 5. Go to the Analog input 0% value ( $\rightarrow \triangleq 227$ ) 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 ( $\rightarrow \triangleq$  227) 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 ( $\Rightarrow \triangleq 228$ ) and check whether the indicated value matches the actual value of the process variable.



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

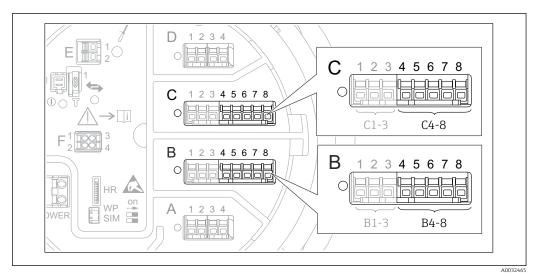
- 1 Input value in mA
- Process value

The **Analog I/O** submenu contains additional parameters for a more detailed configuration of the Analog Input. For a description refer to :  $\rightarrow \stackrel{\triangle}{=} 221$ 

Endress+Hauser 111

ΔC

#### 9.5.4 Configuration of a connected RTD



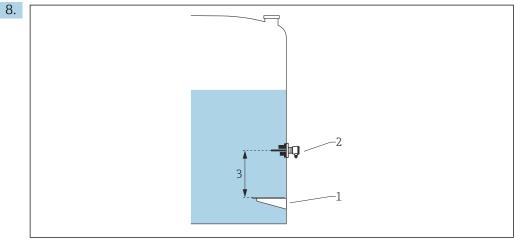
- Possible locations of the Analog I/O modules, to which an RTD can be connected. The order code of the device determines which of these modules is actually present  $\rightarrow \triangleq 45$ .
- 1. Make sure the RTD is connected as defined by the terminal assignment  $\rightarrow \triangleq 61$ .
- 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.

4. 123 45678 123 45678 123 45678

- **■** 63 RTD connection types
- 4 wire RTD connection
- 3 wire RTD connection
- 2 wire RTD connection

Go to the RTD connection type ( $\rightarrow$   $\stackrel{\triangle}{=}$  216) and specify the type of connection of the RTD (2-, 3- or 4-wire).

- 5. Go to the Input value ( $\rightarrow \stackrel{\triangle}{=} 218$ ) and check whether the indicated temperature matches the actual temperature.
- 6. Go to the Minimum probe temperature ( $\rightarrow \implies 218$ ) and specify the minimum approved temperature of the connected RTD.
- 7. Go to the Maximum probe temperature ( $\rightarrow \triangleq 219$ ) and specify the maximum approved temperature of the connected RTD.



- 1 Datum plate
- 2 RTD
- Probe position ( $\rightarrow$   $\cong$  219)

Go to the Probe position (  $\Rightarrow riangleq rian$ (measured from the datum plate).

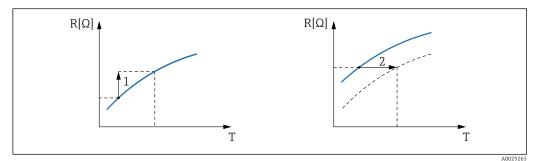
This parameter, in conjunction with the measured level, determines whether the measured temperature refers to the product or to the gas phase.

### 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.

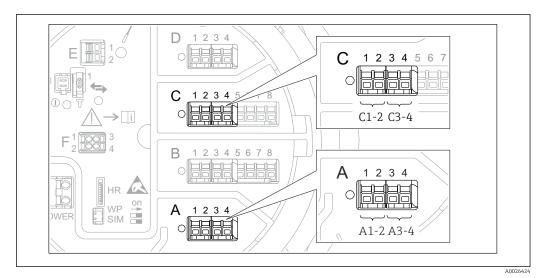
- Ohms offset is added to the measured resistance before the calculation of the temperature.
- **Temperature offset after conversion** is added to the measured temperature.



Ohms offset

Temperature offset after conversion

## 9.5.5 Configuration of the digital inputs

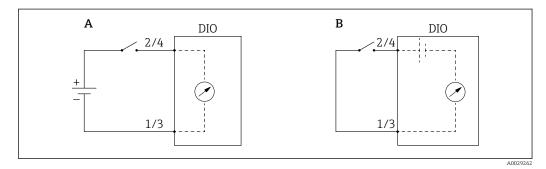


■ 64 Possible locations of the Digital I/O modules (examples); the order code defines the number and location of digital input modules 
→ 
□ 45.

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

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

Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x  $\rightarrow$  Contact 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.
  - The **Digital Xx-x** submenu contains additional parameters for a more detailed configuration of the Digital Input. For a description refer to  $\rightarrow$   $\cong$  231.

#### 9.5.6 Linking input values to tank variables

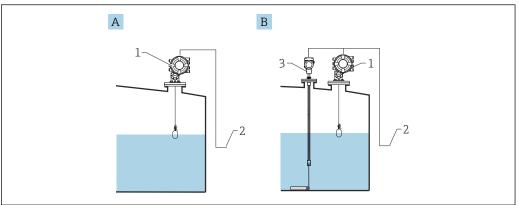
Measured values must be linked to tank variables before they can be used in the Tank Gauging application. This is done by defining the source of each tank variable in the following parameters:

Tank variable	Parameter defining the source of this variable
Product level	<ul> <li>Setup → Level source</li> <li>Setup → Advanced setup → Application → Tank configuration → Level → Level source</li> </ul>
Bottom water level	
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	
Temperature of the vapor above the product	$\mbox{Setup} \rightarrow \mbox{Advanced setup} \rightarrow \mbox{Tank configuration} \rightarrow \mbox{Temperature} \rightarrow \mbox{Vapor} \\ \mbox{temp source}$
Density of the product	
Bottom pressure (P1)	
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.

### 9.5.7 Tank calculation: Direct level measurement

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



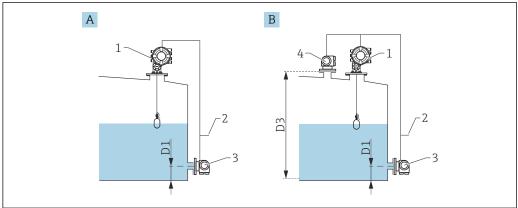
A002927

- A Direct level measurement (without temperature)
- B Direct level and temperature measurement
- 1 NMS8x
- 2 To inventory management system
- 3 Temperature transmitter
- 1. Navigate to: "Setup  $\rightarrow$  Level source" and specify from which device the level is obtained.
- If a temperature transmitter is connected:
   Navigate to: "Setup → Liquid temp source" and specify from which device the temperature is obtained.

### 9.5.8 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.



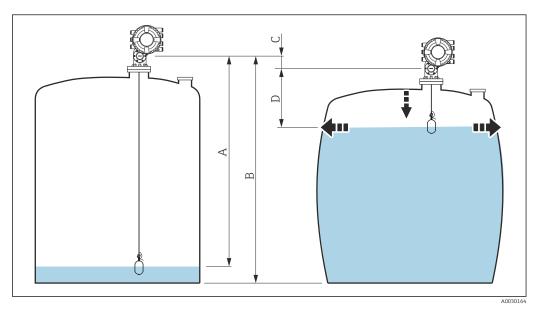
Δ0029277

- A The "HTMS P1" measurement mode
- B The "HTMS P1+P3" measurement mode
- D1 P1 position
- D3 P3 position
- 1 NMS8x
- 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  $\rightarrow$  Level
- 2. Go to **Level source** ( $\rightarrow \triangleq 195$ ) and specify from which device the level is obtained.
- 3. Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank configuration  $\rightarrow$  Pressure
- 4. Go to **P1 (bottom) source (\rightarrow \implies 272)** and specify from which device the bottom pressure (P1) is obtained.
- 5. If a top pressure transmitter (P3) is connected:
  Go to P3 (top) source (→ 🖺 274) and specify from which device the top pressure (P3) is obtained.
- 6. Navigate to: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  HTMS
- 7. Go to **HTMS mode** ( $\rightarrow \triangle$  **289**) and specify the HTMS mode.
- 8. Navigate to Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank configuration  $\rightarrow$  Density
- 9. Go to **Observed density source** (→ 🗎 **270**) and select **HTMS**.
- 10. Use the other parameters of the HTMS to configure the calculation. For a detailed description: → 

  287

## 9.5.9 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.



**■** 65 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)

The Correction of the Hydrostatic Tank Deformation is configured in the HyTD  $(\rightarrow \boxminus 279)$ 

## 9.5.10 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 ( $\Delta T > 10 \,^{\circ}\text{C} \, (18 \,^{\circ}\text{F})$ )
  - 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.

### 9.5.11 Configuration of the level reference check (LRC) function

For tanks where a manual dipping cannot be performed the level gauge can be verified by means of the LRC function.

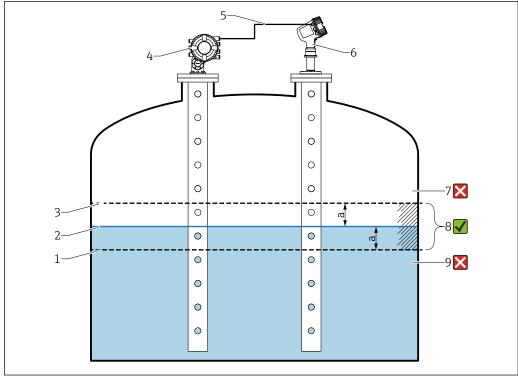
This reference check is recommended for liquefied gas applications.

There are different options for this function:

- LRC with reference level
- LRC with reference switch

### LRC with reference level

The radar device compares it's own level reading with the level reading of another level gauge (e.g. Proservo NMS8x). Based on a configurable deviation value (**Allowed difference** parameter), a continuous check is performed.



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■ 66 Application example with Proservo NMS8x

- 1 Lower limit of deviation value "a" as configured in radar level gauge
- 2 Reference value: Measured level as provided by level gauge Proservo NMS8x
- 3 Upper limit of deviation
- 4 Proservo NMS8x provides the reference value
- 5 Level gauges are interconnected via HART interface
- 6 Radar level gauge with configured deviation value "a" for "Allowed difference" parameter
- 7 The measured level is greater than reference value plus deviation value "a": Level value is not verified
   8 The measured level is within or equal to the limits defined by the deviation value "a": Level value is verified
- 9 The measured level is less than reference value minus deviation value "a": Level value is not verified

### Properties

- Frequency: The reference check is performed continuously every 60 seconds.
- Tolerance: Via the **Check fail threshold** parameter, a configurable number of failures is allowed before the status switches to failed.
- Connection: The level reference device is connected via an optional HART I/O board.

### Configuration of LRC with reference level

1. Navigate to Diagnostics  $\rightarrow$  LRC  $\rightarrow$  LRC 1 to 2





Go to the **LRC Mode** parameter and select the **Compare with level device** option.

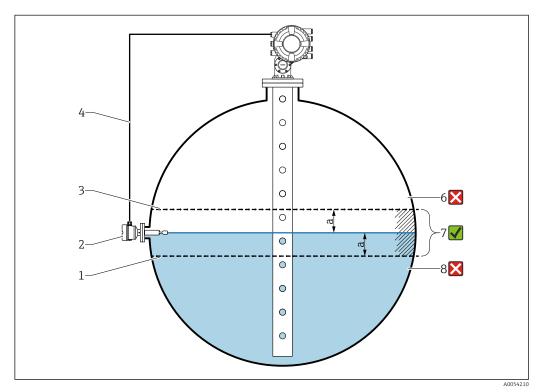
3. Go to the **Allowed difference** parameter and specify the value for the allowed difference between the tank level and the reference.

4. Go to the **Check fail threshold** parameter and set the tolerated amount of failures before an alarm is triggered. As the reference check is performed continuously every 60 seconds, this resembles the number of minutes until an alarm is triggered.

5. Go to the **Reference level source** parameter and define the source for the reference level.

#### LRC with reference switch

A level switch (e.g. Liquiphant FTLx) can be mounted within the tank. The check can be performed continuously, each time the level switch is activated or deactivated. The measured level should remain within a configurable deviation.



■ 67 Application example with level switch

- 1 Lower limit of deviation value "a" as configured in radar level gauge
- 2 Reference value: The switching point of an installed level switch represents the reference value for verification
- 3 Upper limit of deviation
- 4 Level switch and level gauge are interconnected via a digital I/O board
- 5 Radar level gauge with configured deviation value "a" for "Allowed difference" parameter
- 6 The measured level is greater than reference value plus deviation value "a": Level value is not verified
- 7 The measured level is within or equal to the limits defined by the deviation value "a": Level value is verified
- 8 The measured level is less than reference value minus deviation value "a": Level value is not verified

### Properties

- Modes: The device can be set to monitor the switching point while filling or draining the tank.
- Connection: The level switch is connected via a digital I/O board.

### Configuration of LRC with reference switch

1. Navigate to Diagnostics  $\rightarrow$  LRC  $\rightarrow$  LRC 1 to 2

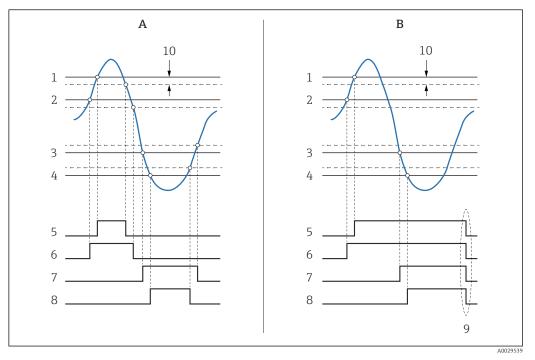


Go to the **LRC Mode** parameter and select the **Compare with level switch** option.

- 3. Go to the **Allowed difference** parameter and specify the value for the allowed difference between the tank level and the reference.
- 4. Go to the **Reference switch source** parameter and select the source for the reference switch.
- 5. Go to the **Reference switch mode** parameter. Select the **Active -> Inactive** option to define the switch direction for the reference check to be executed when the switch status changes from **Active** to **Inactive**. Or select the **Inactive -> Active** option to define the switch direction for the reference check to be executed when the switch status changes from **Inactive** to **Active**.
- 6. Go to the **Reference switch level** parameter and enter the position of the reference switch by entering a value with a unit of length. This parameter depends on the choice made for the **Distance unit** parameter.
  - This defines the position of the reference switch as level.

## 9.5.12 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.



■ 68 Principle of the limit evaluation

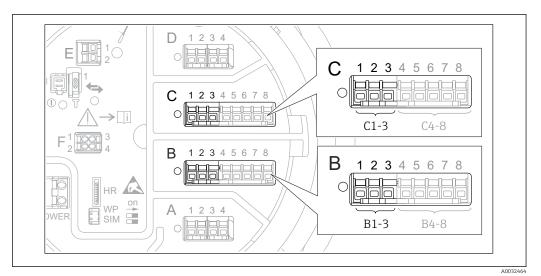
- A Alarm mode = On
- B Alarm mode = Latching
- 1 HH alarm value
- 2 H alarm value
- 3 L alarm value
- 4 LL alarm value
- 5 HH alarm
- 6 H alarm7 L alarm
- / Lalarm
- 8 LL alarm
- 9 "Clear alarm" = "Yes" or power off-on
- 10 Hysteresis

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

Navigation path: Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Alarm 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** accordingly, depending on tank variable and unit used.

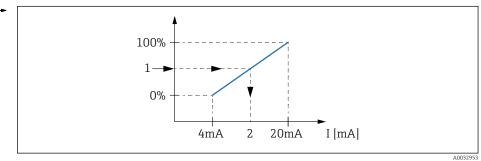
#### 9.5.13 Configuration of the 4-20mA output



₩ 69 Possible locations of the Analog I/O modules, which can be used as a 4-20mA output. The order code of the device determines which of these modules is actually present  $\rightarrow \blacksquare 45$ .

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 and select 4..20mA output or HART slave +4..20mA output 4).
- 3. Go to the Analog input source and select the tank variable which is to be transmitted via the 4...20mA output.
- Go to the 0 % value and enter the value of the selected tank variable which will be mapped to 4 mA.
- 5. Go to the 100 % value 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

- Tank variable
- 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 contains more parameters which can be used for a more detailed configuration of the analog output. For a description see  $\rightarrow \stackrel{\triangle}{=} 221$

<sup>4)</sup> "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: → 🖺 125

### 9.5.14 Configuration of the HART slave + 4 to 20 mA 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 to 20 mA signal can be used in this case, too. For its configuration:  $\rightarrow \stackrel{\triangle}{=} 124$ 

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

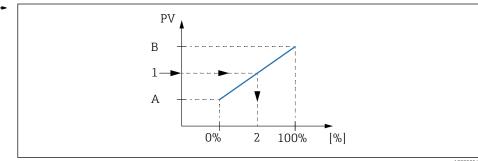
By default, the Primary Variable (PV) is identical to the tank variable transmitted by the 4-20mA output. To define the other HART variables and to configure the HART output in more detail, proceed as follows:

- Navigate to: Setup → Advanced setup → Communication → HART output
   Configuration
- 2. Go to the System polling address 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 to 20 mA 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.

- Navigate to: Setup → Advanced setup → Communication → HART output
   Configuration
- 2. Go to the PV source 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 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 indicates the percentage for the actual value of the PV. It is included in the cyclical output to the HART master.



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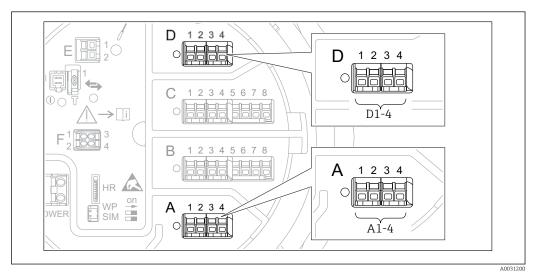
■ 71 Scaling of the tank variable to the percentage

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

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 PV mA selector 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.

## 9.5.15 Configuration of the Modbus output



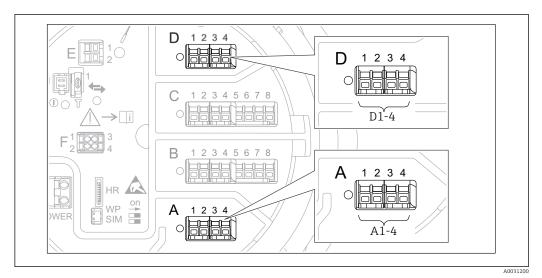
 $\blacksquare$  72 Possible locations of the Modbus modules (examples); depending on the device version these modules may also be in slot B or C  $\Rightarrow$   $\blacksquare$  45.

The Proservo NMS8x 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 ( $\rightarrow$   $\stackrel{\triangle}{=}$  242)

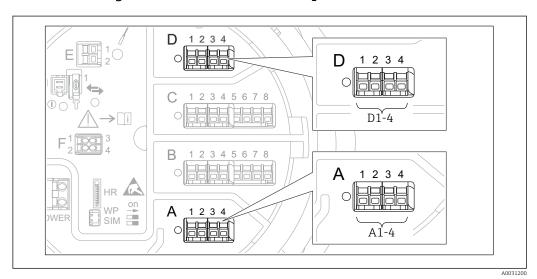
## 9.5.16 Configuration of the V1 output



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

- Setup → Advanced setup → Communication → V1 X1-4 → Configuration → 🖺 245
- Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4  $\rightarrow$  V1 input selector  $\rightarrow$  🗎 248

### 9.5.17 Configuration of the WM550 output

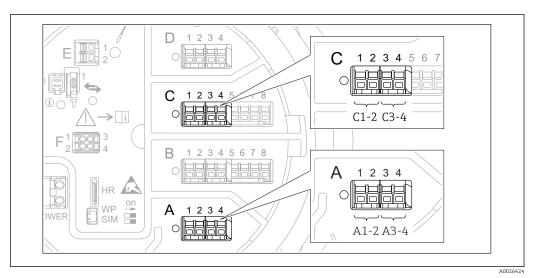


 $\blacksquare$  74 Possible locations of the WM550 modules (examples); depending on the device version these modules may also be in slot B or C  $\Rightarrow$   $\blacksquare$  45.

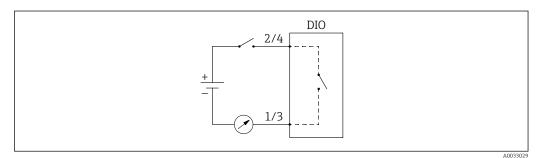
The following submenus are used to configure the WM550 communication between the device and the control system:

- Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  WM550 X1-4  $\rightarrow$  Configuration  $\rightarrow$  🗎 241
- Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  WM550 X1-4  $\rightarrow$  WM550 input selector  $\rightarrow$   $\stackrel{ op}{=}$  250

## 9.5.18 Configuration of the digital outputs



■ 75 Possible locations of the Digital I/O modules (examples); the order code defines the number and location of Digital I/O modules 
→ 
■ 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  $\rightarrow \triangleq 123$ )

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 and select the Output passive.
- 3. Go to the Digital input source and select the alarm or digital input to be transmitted.
- 4. Go to the Contact type 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.

## 9.6 Advanced settings

For a more detailed configuration of the signal inputs, the tank calculations and the signal outputs refer to the Advanced setup ( $\rightarrow \triangleq 206$ ).

### 9.7 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 ( $\rightarrow \equiv 336$ ) for details.

## 9.8 Protecting settings from unauthorized access

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

- By the protection switch (→ ₱ 77)
   This locks the access to W&M-related parameters by any user interface (display and operating module, FieldCare, other configuration tools).

Operation Proservo NMS80

## 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.	→ 🖺 77
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.	→ 🗎 77
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:



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## 10.2 Reading off measured values

Tank values can be read off in the following submenus:

- Operation → Level
- Operation → Temperature
- Operation → Density
- Operation → Pressure

Proservo NMS80 Operation

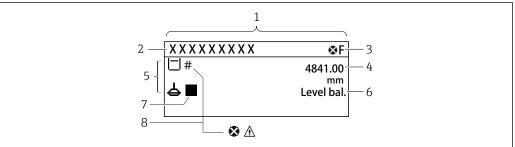
## 10.3 Gauge commands

### 10.3.1 Overview of available device functions

Gauge commands are mainly divided into two categories.

- Continuous gauge command
- One-time gauge command (non-continuous)
- One-time gauge commands have a defined end state. After a one-time gauge command is completed, another gauge command is executed which is defined by the Post gauge command. If **Post gauge command** is set to **None**, the operation will stop.

The gauge command can be chosen by navigating to Operation  $\rightarrow$  Gauge command. The status of the gauge command execution is shown in the Gauge status. The gauge status is displayed on the home screen by default.



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 $\blacksquare$  77 Typical appearance of the standard view (measured value display)

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

For details of status symbols  $\rightarrow \triangleq 67$ 

When a one-time gauge command is executed, additional information is shown in the One-time command status in the operation menu.

Operation Proservo NMS80

## 10.3.2 Descriptions of gauge commands

The following table shows the available gauge commands and functions of NMS8x.

The numbers in the figures show the sequence of displacer movement.

Gauge command	Descriptions		Post gauge command
Stop	Displacer stops.	*	Not available
Level	The displacer searches for the liquid level surface and balances there.		Not available
Up	The displacer moves up to the reference position.	R Reference position	Not available
Bottom level	The displacer searches for the tank bottom. After determining the bottom value, the post gauge command is executed.		Customer setting value
Upper I/F level	The displacer searches for the upper interface level and balances there.		Not available
Lower I/F level	The displacer searches for the lower interface level and balances there.		Not available
Upper density	NMS8x performs a spot density measurement in the upper phase of the tank. After completing the measurement, the post gauge command is executed.	re 1 3	Customer setting value
		a Immersion depth	

Proservo NMS80 Operation

Gauge command	Descriptions		Post gauge command
Middle density	NMS8x performs a spot density measurement in the middle phase of the tank. After completing the measurement, the post gauge command is executed.	a Immersion depth	Customer setting value
Lower density	NMS8x performs a spot density measurement in the lower phase of the tank. After completing measurement, the post gauge command is executed.	a Immersion depth	Customer setting value
Repeatability	The displacer moves upwards from the liquid. After that, the displacer returns to the level measurement. This can be used for a function check.  This gauge command should only be executed if the current gauge command is level.		Level
Water dip	The displacer searches for the upper interface level. After balancing on the liquid, the post gauge command is executed.		Customer setting value
Release overtension	When the displacer hits any obstacle in the tank and gets stuck (Error message: Overtension) this command will release the tension on the wire by moving down a short distance.  During an overtension error, no other gauge command will be executed.		Stop
Tank profile	Density profile measurement of the tank (tank bottom to level)		Customer setting value
Interface profile	Density profile measurement of the upper interface (upper I/F level to level)		Customer setting value
Manual profile	Density profile measurement from a manually set position to level		Customer setting value

Operation Proservo NMS80

Gauge command	Descriptions	Post gauge command	
Level standby	The displacer moves to a set position and stays there until the tank level reaches this position. After that, gauge command is changed back to level.		Level
	This function can be used when supplying or discharging liquid.		
Offset standby	The displacer moves upwards for the distance which is set from the current position and stays there until the tank level reaches this position. After that, gauge command is changed back to level.  This function can be used when supplying or discharging liquid.		Level

Proservo NMS80 Operation

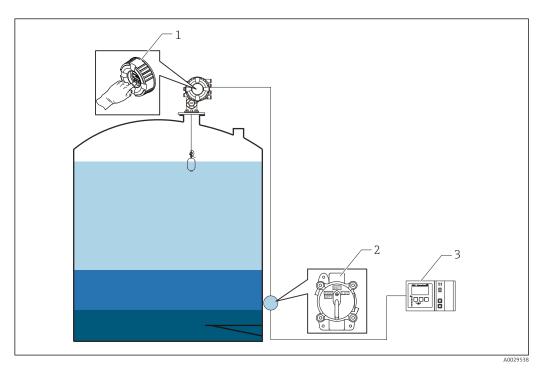
### 10.3.3 Sources for gauge commands

Gauge commands can be sent via various sources.

- Displays or CDI (e.g. FieldCare)
- Digital input (e.g. control switch)
- Fieldbus (Modbus, V1, HART)

The last received gauge command via any sources will be executed as usual.

During calibration, gauge commands are not accepted from any sources.



Display operation

2 Digital input (e.g. control switch)

3 Tankvision

### Gauge command priorities

The priority of the gauge command for NMS8x is very simple. The last received gauge command via any sources will be executed to take of the former gauge command. However the priority varies depending on the devices. When replacing the device with the NMS8x, check the priorities shown below.

### NOTICE

### Undesired gauge command will be executed.

If the setting is not changed, an undesired gauge command will be executed (e.g. Level command via Fieldbus would overwrite Stop command for maintenance.).

► If the system has been automatically or semi-automatically programmed for operation, maintenance or other purposes, the setting should be changed corresponding to use.

### Proservo NMS8x

By display		From digital input		From Fieldbus	
Command	Priority	Command	Priority	Command	Priority
Level	1	Level	1	Level	1
Interface	1	Interface	1	Interface	1
Tank bottom	1	Tank bottom	1	Tank bottom	1

Operation Proservo NMS80

By display		From digital input		From Fieldbus		
Spot density	1	Spot density 1		Spot density	1	
Profile density	1	Profile density 1 Profile density		Profile density	1	
Up	1	Up	1	Up	1	
Stop	1	Stop	1	Stop	1	

### Proservo NMS5/NMS7

By display		From NRF560		From digital input		From Fieldbus	
Command	Priority	cy Command Priority Command Priority Command		Command	Priority		
Level	4	Level	4	Level	4	Level	4
Interface	2	Interface	3	Interface	1	Interface	4
Tank bottom	2	Tank bottom	3	N/A	N/A	Tank bottom	4
Spot density	2	Spot density	3	N/A	N/A	Spot density	4
Profile density	2	Profile density	3	N/A	N/A	Profile density	4
Up	2	Up	3	Up	1	Up	4
Stop	2	Stop	3	Stop	1	Stop	4

## Servo level gauge TGM5

By display		From NRF560		From DRM9700		From digital input		From Fieldbus	
Command	Priority	Command	Priority	Command	Priority	Command	Priority	Command	Priority
Level	4	Level	4	Level	4	Level	4	Level	4
Interface	2	Interface	3	N/A	N/A	N/A	N/A	Interface	4
Tank bottom	2	Tank bottom	3	N/A	N/A	N/A	N/A	Tank bottom	4
Spot density	2	Spot density	3	N/A	N/A	N/A	N/A	Spot density	4
Profile density	2	Profile density	3	N/A	N/A	N/A	N/A	Profile density	4
Up	2	Up	3	Up	1	Up	1	Up	4
Stop	2	Stop	3	N/A	N/A	Stop	1	Stop	4

## Servo level gauge TGM4000

By display		From DRM9700		From digital input		From Fieldbus	
Command	Priority	Command	Priority	Command	Priority	Command	Priority
Level	4	Level	4	Level	4	Level	4
Interface	2	Interface	1	N/A	N/A	Interface	4
Tank bottom	2	N/A	N/A	N/A	N/A	Tank bottom	4
Spot density	2	N/A	N/A	N/A	N/A	Spot density	4
Profile density	2	N/A	N/A	N/A	N/A	Profile density	4
Up	2	Up	1	Up	1	Up	4
Stop	2	Stop	N/A	Stop	1	Stop	4

# 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 → Advanced setup → Display → Contrast display to a value ≥ 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.	

## 11.1.2 Measurement specific errors

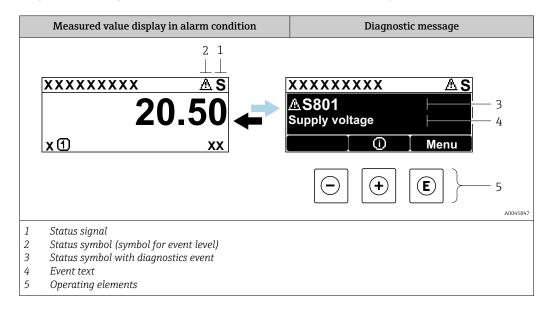
Error	Possible case	Remedy	
Displacer not balancing	No water in the tank		
	Liquid surface unstable	Change Process condition.	
	Incorrect density setting	Check density setting.	
Displacer not traveling to	High stop level	Check gauge status.	
reference position	Over tension	Check gauge status and gauge command.	
		The function, Release overtension, can only be performed.	
Displacer not measuring the	Low stop level	Check gauge status.	
bottom level	Under tension	Check gauge status.	
	Bottom detection weight wrong	Check Bottom detection weight in Service mode.	
Gauge status not working under the following levels.  • Upper/lower interface  • Middle/lower density  • IF (Interface) profile  • Water dip	Those setting of Upper, Middle, and Lower density are set to same value.	Upper density < Middle density < Lower density The difference of value 0.2 g/ml or more is required for setting as follows. <e.g>  0.8 g/ml 1.0 g/ml 1.2 g/ml</e.g>	
After turning on the power, the previous gauge command is not effective.	Digital input gauge status is effective.	Check the Digital input mapping.	

Error	Possible case	Remedy	
Invalid level setting	Gauge command of Balanced is not valid when Set level was issued.	Check the gauge command and set level again.	
Invalid liquid temperature	Incorrect liquid temperature source	Check Liquid temp source.	
	HART device disconnected	Check HART device	
Invalid vapor temperature	Incorrect liquid temperature source	Check Liquid temp source.	
	HART device disconnected	Check HART device	
Invalid liquid level	Incorrect water level source	Check Water level source	
	HART device disconnected	Check HART device	
Status is not SIL mode	The status of Gauge command is not on Level mode.	Check gauge command is on Level.	
	Incorrect AIO parameter setting	Check the Operating mode, 4 to 20 mA output	
		Check the Use for SIL is valid.	
	Incorrect DIO parameter setting	Check the Operating mode, Output passive.	
		Check the Contact type is Normally closed.	
		Check the Use for SIL is valid.	

## 11.2 Diagnostic information on local display

### 11.2.1 Diagnostic message

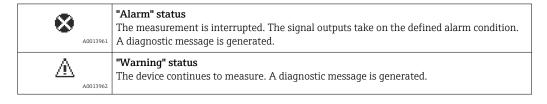
Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the measured value display.



### Status signals

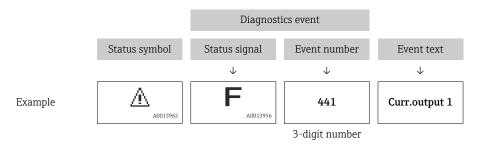
A0013956	<b>"Failure"</b> A device error is present. The measured value is no longer valid.
<b>C</b>	<b>"Function check"</b> The device is in service mode (e.g. during a simulation or a warning).
<b>S</b>	<ul> <li>"Out of specification"</li> <li>The device is operated:</li> <li>Outside of its technical 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.

### Status symbol (symbol for event level)



### 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.

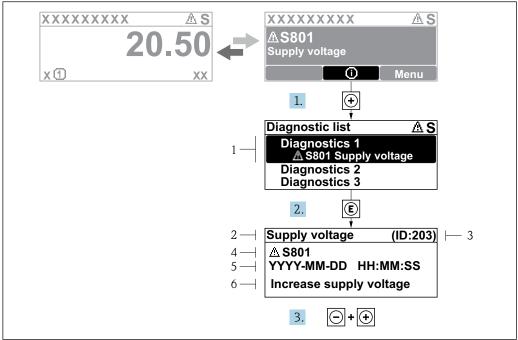


If two or more diagnostic messages are pending simultaneously, only the message with the highest priority is shown. Additional pending diagnostic messages can be shown in **Diagnostic list** submenu ( $\rightarrow \boxtimes 332$ ).

### **Operating elements**

Operating functions in menu, submenu		
A0013970	Plus key Opens the message about the remedial measures.	
A0013952	Enter key Opens the operating menu.	

## 11.2.2 Calling up remedial measures



A0045845

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

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

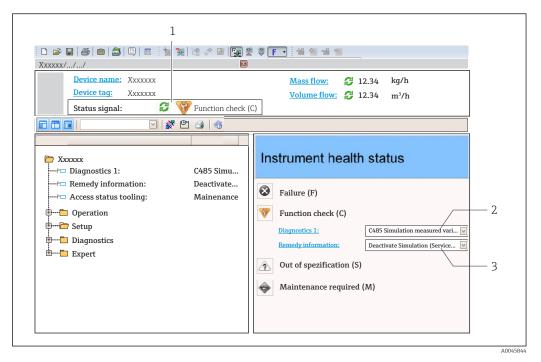
- 1. Press ± (i) symbol).
  - **└** The **Diagnostic list** submenu opens.
- 2. Select the desired diagnostic event with  $\pm$  or  $\Box$  and press  $\Box$ .
  - ► The message for the remedial measures for the selected diagnostic event opens.
- 3. Press  $\Box$  +  $\pm$  simultaneously.
  - ► The 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  $\Box$  +  $\pm$  simultaneously.
  - ightharpoonup 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

### 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	Restart device     Contact service	F	Alarm
150	Detector error	Restart device     Check electrical connections of detector     Replace detector unit	F	Alarm
151	Sensor electronic failure	Replace sensor electronic module	F	Alarm
Diagnostic of	electronic		-	1
242	Software incompatible	Check software     Flash or change main electronic module	F	Alarm
252	Modules incompatible	Check if correct electronic module is plugged     Replace electronic module	F	Alarm
261	Electronic modules	Restart device     Check electronic modules     Change I/O module or main electronics	F	Alarm
262	Module connection	Check module connections     Replace electronic modules	F	Alarm
270	Main electronics failure	Replace main electronics	F	Alarm
271	Main electronics failure	Restart device     Change main electronic module	F	Alarm
272	Main electronics failure	Restart device	F	Alarm
272	Main electronics failure	Restart device     Contact service	F	Alarm
273	Main electronics failure	Emergency operation via display     Change main electronics	F	Alarm
275	I/O module failure	Restart device     Change I/O module	F	Alarm
276	I/O module faulty	Restart device     Change I/O module	F	Alarm
282	Data storage	Restart device     Contact service	F	Alarm
283	Memory content	Transfer data or reset device     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	Calibrate sensor     Restart device     Replace sensor electronics	F	Alarm
382	Sensor communication	Check connection of sensor electronics     Restart device     Replace sensor electronics	F	Alarm
Diagnostic of o	configuration			'
400	AIO simulation output	Deactivate simulation AIO output	С	Warning
401	DIO simulation output	Deactivate simulation DIO output	С	Warning
403	Calibration AIO	Restart device     Change I/O module	F	Alarm
404	Calibration AIP	Restart device     Change I/O module	F	Alarm
405	COMM timeout DIO 1 to 8	Check wiring     Change I/O module	F	Alarm
406	IOM offline	Check wiring     Change I/O module	F	Alarm
407	COMM timeout AIO 1 to 2	Check wiring     Change I/O module	F	Alarm
408	Invalid range AIO 1 to 2	Check device configuration.     Check wiring.	С	Warning
409	RTD temp out of range 1 to 2	Check electronic modules     Change I/O or main electronic module	С	Warning
410	Data transfer	Retry data transfer     Check connection	F	Alarm
411	Hart device 1 to 15 has malfunction	Check HART device     Change HART device	F	Alarm 1)
412	Processing download	Download active, please wait	С	Warning
413	NMT 1 to 15: element is open or short	Check NMT wiring connection     Replace NMT	С	Warning
415	Hart device 1 to 15 offline	Check HART device     Change HART device	С	Warning
416	Warning occurred for HART device 1 to 15	Check connected HART device	M	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	Restart device     Contact service	F	Alarm
438	Dataset	Check dataset file     Check device configuration     Up- and download new configuration	M	Warning
441	AIO 1 to 2 current output alarm	Check process     Check current output settings	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
442	AIO 1 to 2 current output warning	1		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

525 One time cmd sour longer valid 526 Alarm 1 to 4 source longer valid 527 AIO B1-3 source nivalid 528 CTSh 529 HTG 530 HTMS	e no o longer	Change input source  Change input source  Change input source  1. Check device configuration. 2. Check wiring.  1. Check device configuration. 2. Check wiring.  1. Check device configuration. 2. Check wiring.	C C C C	Warning Warning Warning Warning Warning
longer valid  527 AIO B1-3 source n valid  528 CTSh  529 HTG  530 HTMS	o longer	Change input source  1. Check device configuration. 2. Check wiring.  1. Check device configuration. 2. Check wiring.  1. Check device configuration.	C C	Warning Warning Warning
valid  528 CTSh  529 HTG  530 HTMS		Check device configuration.     Check wiring.     Check device configuration.     Check wiring.     Check device configuration.	C	Warning Warning
529 HTG 530 HTMS	ılue	<ol> <li>Check wiring.</li> <li>Check device configuration.</li> <li>Check wiring.</li> <li>Check device configuration.</li> </ol>	С	Warning
530 HTMS	ılue	<ol> <li>Check wiring.</li> <li>Check device configuration.</li> </ol>		
	ılue		С	Warning
	ılue		1	
531 HyTD correction va		<ol> <li>Check device configuration.</li> <li>Check wiring.</li> </ol>	С	Warning
532 HART output: PV s valid	ource not	Change input source	С	Warning
533 HART output: SV s valid	ource not	Change input source	С	Warning
534 HART output: QV s	source not	Change input source	С	Warning
535 HART output: TV s valid	ource not	Change input source	С	Warning
536 Display: source no valid	longer	Change input source	С	Warning
537 Trend: source no lo	nger valid	Change input source	С	Warning
538 HART output: PV r	atput: PV mA source Change input source		С	Warning
539 Modbus 1-4 SP sou	ırce invalid	Set valid SP input selector	С	Warning
540 V1 1-4 SP source is	nvalid	Set valid SP input selector	С	Warning
541 Modbus 1-4 alarm invalid	source	Set valid alarm input selector	С	Warning
542 V1 1-4 alarm sour	ce invalid	Set valid alarm input selector	С	Warning
543 Modbus 1-4 analoginvalid	g source	Set valid analog input selector	С	Warning
544 V1 1-4 analog sou	rce invalid	Set valid analog input selector	С	Warning
545 Modbus 1-4 user v source invalid	alue	Set valid user value input selector	С	Warning
546 Modbus 1-4 discre source invalid	te value	Set valid user discrete input selector	С	Warning
547 V1 1-4 user value invalid	source	Set valid user value input selector	С	Warning
548 V1 1-4 discrete val	ue source	Set valid user discrete input selector	С	Warning
549 Modbus 1-4 percei invalid	nt source	Set valid percentage input selector	С	Warning
550 V1 1-4 percent sou	ırce invalid	Set valid percentage input selector	С	Warning

Diagnostic number			Status signal [from the factory]	Diagnostic behavior [from the factory]
560	Calibration mandatory	Carry out weight calibration     Carry out reference     calibration     Carry out drum calibration	С	Alarm
564	DIO B1-2 source no longer valid	ource no longer Change input source		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
572	LRC 1 to 2 not possible	Check device configuration.     Check wiring.	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	process		1	1
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	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	Check process value     Check application	S	Warning 1)
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	Check device configuration.     Check wiring.	F	Alarm
904	Digital output 1 to 8	Check device configuration.     Check wiring.	F	Alarm
941	Echo lost	Check process value     Check application     Check sensor	S	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
942	In safety distance	<ol> <li>Check level</li> <li>Check safety distance</li> <li>Reset self holding</li> </ol>	S	Warning
943	In blocking distance	Reduced accuracy Check level	S	Warning
950	Advanced diagnostics	Maintain your diagnostic event	M	Warning
961	Alarm 1 to 4 HighHigh	Check alarm source     Check configuration settings	С	Warning
962	Alarm 1 to 4 High	Check alarm source     Check configuration settings	С	Warning
963	Alarm 1 to 4 Low	Check alarm source     Check configuration settings	С	Warning
964	Alarm 1 to 4 LowLow	Check alarm source     Check configuration settings		Warning
965	Alarm 1 to 4 HighHigh	Check alarm source     Check configuration settings	F	Alarm
966	Alarm 1 to 4 High	Check alarm source     Check configuration settings	F	Alarm
967	Alarm 1 to 4 Low	Check alarm source     Check configuration settings	F	Alarm
968	Alarm 1 to 4 LowLow	Check alarm source     Check configuration settings	F	Alarm
970	Overtension	Check displacer and process conditions     Release overtension	С	Alarm
971	Undertension	Check displacer and process.	С	Alarm
974	LRC 1 to 2 failed	Check process value     Check application     Check sensor	С	Warning

<sup>1)</sup> 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 → 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  $\Box$  +  $\pm$  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 ( $\rightarrow \triangleq 327$ ).

### 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 ( $\Rightarrow \triangleq 333$ ).

# 11.8 Firmware history

Date	Software	Modifications	Documentation (NMS80)				
	version		Operating Instructions	<b>Description of Parameters</b>	Technical Information		
04.2016	01.00.zz	Original software	BA01456G/00/EN/01.16	GP01074G/00/EN/01.16	TI01248G/00/EN/01.16		
12.2016	01.02.zz	Bugfixes and improvements	BA01456G/00/EN/02.17	GP01074G/00/EN/02.17	TI01248G/00/EN/02.17		
07.2018	01.03.zz	Software update	BA01456G/00/EN/04.18	GP01074G/00/EN/02.18	TI01248G/00/EN/04.18		
10.2020	01.04.zz	Software update	BA01456G/00/EN/05.20	GP01074G/00/EN/03.18	TI01248G/00/EN/05.20		
09.2022	01.06.zz	Software update	BA01456G/00/EN/06.22	GP01074G/00/EN/04.22	TI01248G/00/EN/06.22		
10.2023	01.07.zz	Software update	BA01456G/00/EN/ 07.23-00		TI01248G/00/EN/07.23-00		

Proservo NMS80 Maintenance

# 12 Maintenance

### 12.1 Maintenance tasks

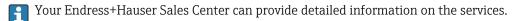
No special maintenance work is required.

# 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.



Repair Proservo NMS80

# 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

### **A** WARNING

### Incorrect repair can compromise electrical safety!

Explosion hazard!

- ► Only specialist personnel or the manufacturer's service team may carry out repairs on Ex-certified devices in accordance with national regulations.
- ► Relevant standards and national regulations on hazardous areas, safety instructions and certificates must be observed.
- ▶ Only use original spare parts from the manufacturer.
- ► Please note the device designation on the nameplate. Only identical parts may be used as replacements.
- Carry out repairs according to the instructions.
- ► Only the manufacturer's service team is permitted to modify a certified device and convert it to another certified version.

### 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.

### 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.

Proservo NMS80 Repair

# 13.2 Spare parts

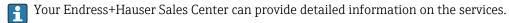
Some interchangeable measuring device components are listed on an overview sign in the connection compartment cover.

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.



### 13.4 Return

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

- 1. 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



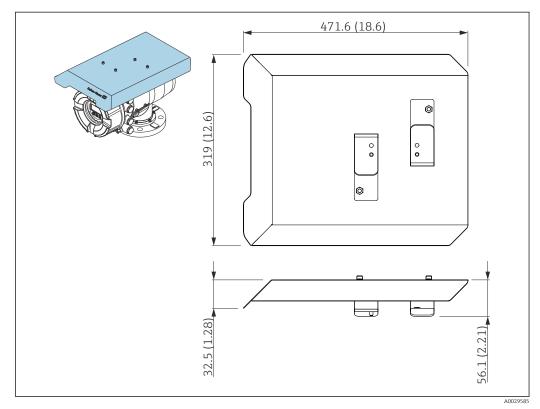
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return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

Accessories Proservo NMS80

# 14 Accessories

# 14.1 Device-specific accessories

# 14.1.1 Weather protection cover



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: 71305035 (for NMS8x)

Proservo NMS80 Accessories

### 14.1.2 Maintenance chamber

A maintenance chamber is recommended for use with tank level gauges in order to allow maintenance (removing the 70 mm (2.76 in) displacer or larger), while the tank is in service. Contact your Endress+Hauser Sales Center if necessary.

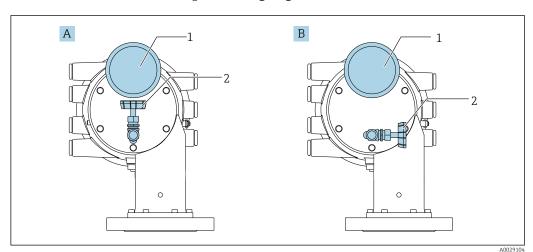
### 14.1.3 Ball valve

Ball valves are recommended for use with tank level gauges in order to allow maintenance such as removing displacers while tank is in service. Contact your Endress+Hauser Sales Center if necessary.

### 14.1.4 Control switch

A control switch is used for field mounted tank gauges. This provides additional gauge operation contact switching in order to control the gauge's operation, such as hoisting up the displacer. Contact your Endress+Hauser Sales Center if necessary.

# 14.1.5 Relief valve and pressure gauge



■ 80 Mounting position of relief valve and pressure gauge

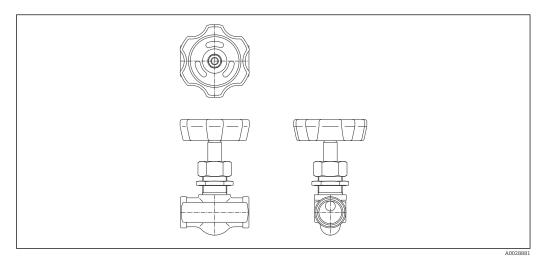
- A Standard version
- B 90 °-degree rotation (optional)
- 1 Pressure gauge
- 2 Relief valve

Accessories Proservo NMS80

### Relief valve

A relief valve is used to release pressure inside the housing of NMS8x before maintenance.

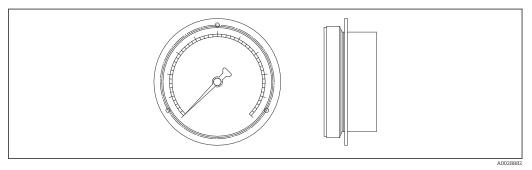
Contact your Endress+Hauser Sales Center when applying pressure in an ammonia atmosphere.



■ 81 Relief valve

### Pressure gauge

A pressure gauge is used to check process pressure inside the housing.



■ 82 Pressure gauge

The range of the scale for the pressure gauge varies depending on the pressure.

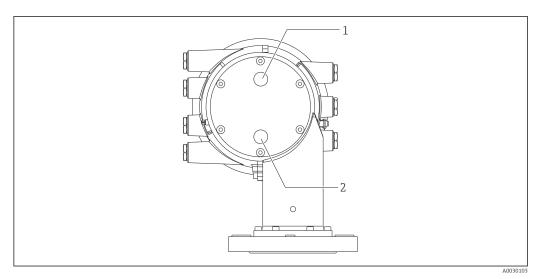
Low pressure: 0 to 1 MPaHigh pressure: 0 to 4 MPa

Proservo NMS80 Accessories

# 14.1.6 Cleaning nozzle and gas purging nozzle

A cleaning nozzle used for washing inside housing is especially recommended for F&B or alcohol applications.

A gas purging nozzle used for purging gas inside the housing is especially recommended for a nitrogen blanket for petrochemical or chemical applications.

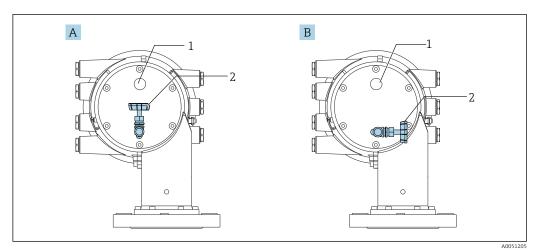


 $\blacksquare$  83 Holes for cleaning nozzle and gas purging nozzle

- 1 Cleaning nozzle
- 2 Gas purging nozzle

# 14.1.7 Other combinations for relief valve, pressure gauge, cleaning nozzle, and gas purging nozzle

### Cleaning nozzle and relief valve

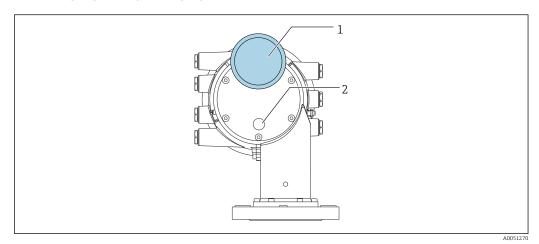


■ 84 Cleaning nozzle and relief valve

- A Standard version
- B 90 °-degree rotation (optional)
- 1 Cleaning nozzle
- 2 Relief valve

Accessories Proservo NMS80

# Pressure gauge and gas purging nozzle



 $\blacksquare$  85 Pressure gauge and gas purging nozzle

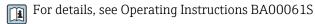
- Pressure gauge Gas purging nozzle

Proservo NMS80 Accessories

# 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



#### 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
- $\bullet$  Separate power supply: 100 to 240  $V_{AC}$ , 50 to 60 Hz, 0.375 A, 15 W
- Several approvals for the hazardous area

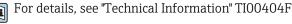
### Gauge Emulator, Modbus to TRL/2

- 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
- $\bullet$  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



# 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 <a href="https://www.software-products.endress.com">www.software-products.endress.com</a>. You need to register in the Endress+Hauser software portal to download the application.



Technical Information TI01134S

#### 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

Accessories Proservo NMS80

#### **System components** 14.4

### 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 ( $\rightarrow$  🗎 173)
- Setup (→ 🗎 191)
- Diagnostics ( $\rightarrow$  🖺 329)
- 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 Operating tool

Operation				→ 🖺 173
	Gauge comma	nd		→ 🖺 174
	Distance			→ 🖺 174
	Net weight			→ 🖺 175
	Gauge status			→ 🖺 175
	Balance flag			→ 🖺 175
	Standby level			→ 🖺 175
	Offset standby	distance		→ 🖺 176
	One-time com	mand status		→ 🖺 177
	► Level			→ 🖺 177
		Dip Freeze		→ 🖺 177
		Tank level		→ 🖺 178
		Tank Level %		→ 🖺 178
		Tank ullage		→ 🖺 178
		Tank ullage %		→ 🖺 179

	Upper interface leve	el		→ 🖺 179
	Upper interface leve	el timestamp		→ 🖺 179
	Lower interface leve	el		→ 🖺 179
	Lower interface leve	el timestamp		→ 🖺 180
	Bottom level	•		→ 🖺 180
	Bottom level timest	ramn		→ 🖺 180
		anip		
	Water level			→ 🖺 180
	Measured level			→ 🖺 181
	Distance			→ 🖺 174
	Displacer position			→ 🖺 181
► Temperature				→ 🖺 181
	Air temperature			→ 🖺 181
	Liquid temperature			→ 🖺 182
	Vapor temperature			→ 🖺 182
	► NMT element va	alues		→ 🖺 182
		► Element temper	ature	→ 🖺 182
			Element temperature 1 to 24	→ 🖺 182
		► Element position	ı	→ 🖺 183
			Element position 1 to 24	→ 🗎 183
► Density		]		→ 🖺 183
	Observed density	-		→ 🖺 183
	Observed density te	emperature		→ 🖺 183
	Vapor density			→ 🖺 184
	Air density		]	→ 🖺 184
			]	
	Measured upper de	nsity		→ 🗎 184

	Upper density timestamp	→ 🖺 184
	Measured middle density	→ 🖺 185
	Middle Density Timestamp	→ 🖺 185
	Measured lower density	→ 🖺 185
	Lower density timestamp	→ 🖺 185
	Profile point	→ 🖺 186
	Profile average density	→ 🖺 186
	Profile density timestamp	→ 🖺 186
	➤ Profile density	→ 🖺 187
	Profile density 0 to 49	→ 🖺 187
	Profile density position 0 to 49	→ 🖺 187
▶ Pressure		→ 🖺 187
	P1 (bottom)	→ 🖺 187
	P3 (top)	→ 🗎 188
► GP values		→ 🖺 189
	GP 1 to 4 name	→ 🖺 189
	GP Value 1	→ 🖺 189
	GP Value 2	→ 🖺 189
	GP Value 3	→ 🖺 189
	GP Value 4	→ 🖺 190
<b>⊁</b> Setup		→ 🖺 191
Device tag		→ 🖺 191
Units preset		→ 🖺 191
Upper density		→ 🖺 192
Middle density		→ 🖺 192
L		

T 1		]	) <b>(3)</b> 100
Lower density			→ 🖺 192
Gauge command			→ 🖺 174
Process condition			→ 🖺 193
Empty			→ 🖺 194
Tank reference heig	yht		→ 🖺 194
Tank level			→ 🖺 178
Set level			→ 🖺 195
Level source			→ 🖺 195
High stop level			→ 🖺 195
Low stop level			→ 🖺 196
Distance			→ 🖺 174
Liquid temp source			→ 🖺 196
► Calibration			→ 🖺 198
	► Move displacer		→ 🗎 198
		Move distance	→ 🖺 198
		Distance	→ 🖺 174
		Move displacer	→ 🖺 198
		Motor status	→ 🖺 199
		Move displacer	→ 🖺 199
	► Sensor calibratio	on	→ 🖺 200
		Sensor calibration	→ 🖺 200
		Offset weight	→ 🖺 200
		Span weight	→ 🖺 200
		Zero calibration	→ 🖺 201
		Calibration status	→ 🖺 201

		Offset calibration			→ 🗎 201
		Span calibration			→ 🖺 201
	► Reference calib	ration			→ 🖺 202
		Reference calibration	on		→ 🖺 202
		Reference position			→ 🖺 202
		Progress			→ 🖺 202
		Calibration status			→ 🖺 201
	► Drum calibratio	on	]		→ 🖺 204
		Drum calibration		[	→ 🖺 204
		Set high weight			→ 🖺 204
		Make drum table			→ 🖺 204
		Drum table point			→ 🖺 204
		Calibration status			→ 🖺 201
		Make low table			→ 🖺 205
		Set low weight			→ 🖺 205
► Advanced setup					→ 🖺 206
	Locking status				→ 🖺 206
	User role				→ 🖺 206
	Enter access code		]		→ 🖺 206
	► Input/output		]		→ 🖺 207
		► HART devices			→ 🖺 207
			Number of devices		→ 🗎 207
			► HART Device(s)		→ 🖺 208
			► Forget device		→ 🖺 214

► Analog IP	→ 🖺 215
Operating mode	→ 🖺 215
Thermocouple type	→ 🖺 216
RTD type	→ 🖺 215
RTD connection type	→ 🖺 216
Process value	→ 🖺 217
Process variable	→ 🖺 217
0 % value	→ 🖺 217
100 % value	→ 🖺 218
Input value	→ 🖺 218
Minimum probe temperature	→ 🖺 218
Maximum probe temperature	→ 🖺 219
Probe position	→ 🖺 219
Damping factor	→ 🖺 220
Gauge current	→ 🖺 220
► Analog I/O	→ 🗎 221
Operating mode	→ 🗎 221
Current span	→ 🖺 222
Fixed current	→ 🖺 223
Analog input source	→ 🖺 223
Failure mode	→ 🖺 224
Error value	→ 🖺 225
Input value	→ 🖺 225
0 % value	→ 🖺 225
100 % value	→ 🖺 226

Input value %	→ 🖺 226
Output values	→ 🖺 226
Process variable	→ 🖺 227
Analog input 0% value	→ 🖺 227
Analog input 100% value	→ 🖺 227
Error event type	→ 🖺 228
Process value	→ 🖺 228
Input value in mA	→ 🖺 228
Input value percent	→ 🖺 229
Damping factor	→ 🖺 229
Used for SIL/WHG	→ 🖺 229
Expected SIL/WHG chain	→ 🖺 230
▶ Digital Xx-x	→ 🖺 231
Operating mode	→ 🗎 231
Digital input source	→ 🗎 232
Input value	→ 🖺 233
Contact type	→ 🖺 233
Output simulation	→ 🖺 234
Output values	→ 🖺 235
Readback value	→ 🖺 235
Used for SIL/WHG	→ 🖺 235
Expected SIL/WHG chain	→ 🖺 236
▶ Digital input mapping	→ 🗎 237
Digital input source 1	→ 🖺 237
Digital input source 2	→ 🗎 237

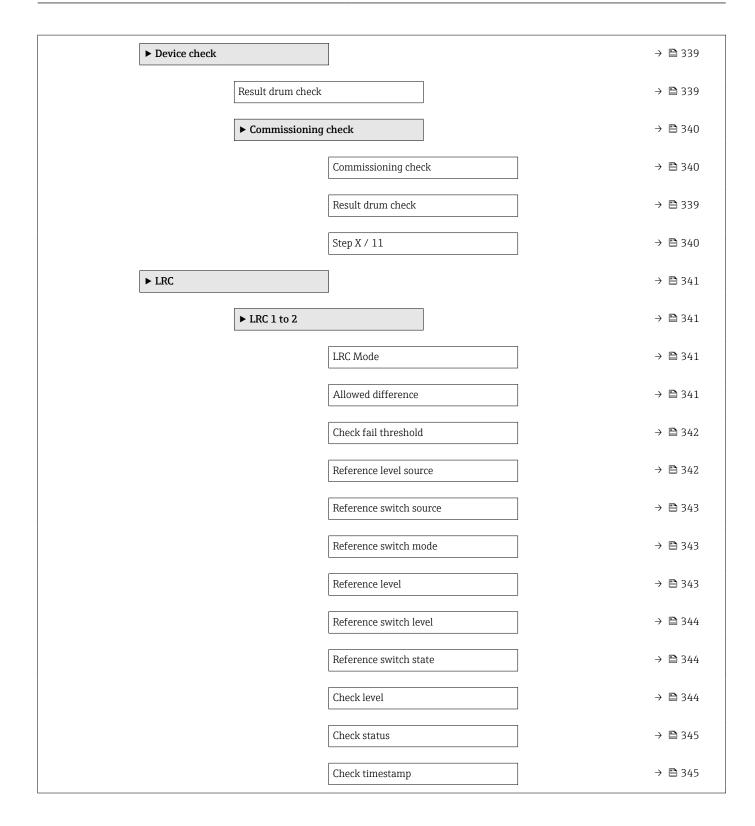
	Gauge command 0	→ 🖺 238
	Gauge command 1	→ 🖺 238
	Gauge command 2	→ 🖺 239
	Gauge command 3	→ 🖺 240
<b>▶</b> Communication		→ 🖺 241
	► Communication interface 1 to 2	
	Communication interface protocol	
	► Configuration	→ 🖺 242
	► Configuration	→ 🖺 245
	► Configuration	→ 🖺 249
	► V1 input selector	→ 🖺 248
	► WM550 input selector	→ 🖺 250
	► HART output	→ 🖺 252
	► Configuration	→ 🖺 252
	► Information	→ 🖺 260
► Application		→ 🖺 262
	► Tank configuration	→ 🖺 262
	▶ Level	→ 🖺 262
		→ 🖺 266
	► Temperature	
	► Density	→ 🖺 270
	▶ Pressure	→ 🖺 272
	► Tank calculation	→ 🖺 277
	► HyTD	→ 🖺 279

► CTSh	→ 🖺 284
► HTMS	→ 🖺 289
► Alarm	→ 🖺 292
► Alarm 1 to 4	→ 🖺 292
► Safety settings	→ 🖺 301
Output out of range	→ 🖺 301
High stop level	→ 🖺 301
Low stop level	→ 🖺 302
Slow hoist zone	→ 🖺 302
Overtension weight	→ 🖺 302
Undertension weight	→ 🖺 303
► Sensor config	→ 🖺 304
Post gauge command	→ 🖺 304
▶ Displacer	→ 🖺 305
Displacer type	→ 🖺 305
Displacer diameter	→ 🖺 305
Displacer weight	→ 🖺 305
Displacer volume	→ 🖺 306
Displacer balance volume	→ 🖺 306
Displacer height	→ 🖺 306
Immersion depth	→ 🖺 307
▶ Wiredrum	→ 🖺 308
	٦
Drum circumference	→ 🖺 308
Wire weight	→ 🖺 308

	► Spot density		→ 🖺 309
		Upper density offset	→ 🖺 309
		Middle density offset	→ 🖺 309
		Lower density offset	→ 🖺 309
		Submersion depth	→ 🖺 310
	► Profile density		→ 🖺 311
		Density measurement mode	→ 🖺 311
		Manual profile level	→ 🖺 311
		Profile density offset distance	→ 🖺 311
		Profile density interval	→ 🖺 312
		Profile density offset	→ 🖺 312
<b>▶</b> Display			→ 🖺 313
	Language		→ 🖺 313
	Format display		→ 🖺 313
	Value 1 to 4 display	7	→ 🖺 314
	Decimal places 1 to	4	→ 🖺 315
	Separator		→ 🖺 316
	Number format		→ 🖺 316
	Header		→ 🖺 317
	Header text		→ 🖺 317
	Display interval		→ 🖺 317
	Display damping		→ 🖺 318
	Backlight		→ 🖺 318
	Contrast display		→ 🖺 318

	► System units		→ 🖺 320
		Units preset	→ 🖺 191
		Distance unit	→ 🖺 320
		Pressure unit	→ 🗎 321
		Temperature unit	→ 🗎 321
		Density unit	→ 🖺 321
	▶ Date / time		→ 🖺 323
		Date/time	→ 🖺 323
		Set date	→ 🖺 323
		Year	→ 🖺 323
		Month	→ 🖺 324
		Day	→ 🖺 324
		Hour	→ 🖺 324
		Minute	→ 🖺 325
	► SIL confirmation	on	→ 🖺 326
	► Deactivate SIL/	/WHG	→ 🖺 326
	► Administration	1	→ 🖺 327
		Define access code	→ 🖺 327
		Device reset	→ 🖺 327
억 Diagnostics			→ 🖺 329
Actual diagnostics	_		→ 🖺 329
Timestamp		_ _	→ 🖺 329
Previous diagnosti	cs		→ 🖺 329
Timestamp			→ 🖺 330
Operating time fro	m restart		→ 🖺 330
- Falling and no	<del>.</del>		

Operating time	→ 🖺 330	)
Date/time	→ 🖺 323	}
▶ Diagnostic list	→ 🖺 332	
Diagnostics 1 to 5	→ 🖺 332	
Timestamp 1 to 5	→ 🖺 332	
▶ Device information	→ 🖺 333	<b>;</b>
Device tag	→ 🖺 333	3
Serial number	→ 🖺 333	3
Firmware version	→ 🖺 333	}
Firmware CRC	→ 🖺 334	ŀ
Weight and measures configuration CRC	→ 🖺 334	ł
Device name	→ 🖺 334	ŀ
Order code	→ 🖺 334	Ŀ
Extended order code 1 to 3	→ 🖺 335	,
► Simulation	→ 🖺 336	)
Device alarm simulation	→ 🖺 336	<b>.</b>
Diagnostic event simulation	→ 🖺 336	<b>.</b>
Simulation distance on	→ 🖺 336	,
Simulation distance	→ 🖺 337	,
Current output 1 simulation	→ 🖺 337	,
Simulation value	→ 🖺 337	,



# 15.2 "Operation" menu

The **Operation** menu ( $\rightarrow \implies 173$ ) shows the most important measured values and allows to issue a gauge command.

Navigation		Operation
------------	--	-----------

Gauge command			
Navigation	☐ Operation → Gau	ge command	
Description	Gauge operation comma	and to choose the measurement mode of the device.	
Selection	Stop * Level Up * Bottom level * Upper I/F level * Lower I/F level * Upper density * Middle density * Lower density * Repeatability * Water dip * Release overtension * Tank profile * Interface profile * Manual profile * Level standby * Offset standby *		<ul> <li>Stop*</li> <li>Level</li> <li>Up*</li> <li>Bottom level*</li> <li>Upper I/F level*</li> <li>Lower I/F level*</li> <li>Upper density*</li> <li>Middle density*</li> <li>Lower density*</li> <li>Repeatability*</li> <li>Water dip*</li> <li>Release overtension*</li> <li>Tank profile*</li> <li>Interface profile *</li> <li>Manual profile*</li> <li>Level standby*</li> </ul>
Factory setting	Stop		
Additional information	Read access	Operator	
	Write access	Maintenance	
Distance			
Navigation	☐ Operation → Dist	ance	
Description	Shows measured distant	ce from reference position.	
Additional information	Read access	Operator	

Read access

Write access

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Operator

Visibility depends on order options or device settings

Net weight

**Navigation**  $\blacksquare \square$  Operation  $\rightarrow$  Net weight

**Description** Shows the corrected weight data from the detector, as compensated by the drum table,

This weight is used for measurement.

Additional information

Read access	Operator
Write access	-

### Gauge status

**Description** Indicates the current status of the device gauge command.

Additional information

Read access	Operator
Write access	-

### Balance flag

**Navigation**  $\blacksquare \Box$  Operation  $\rightarrow$  Balance flag

**Description** Indicates the validity of the Measurement. If balanced, corresponding Value (Liquid Level,

Upper Interface, Lower Interface, Tank Bottom ) is updated.

Additional information

Read access	Operator
Write access	-

Standby level

**Description** Defines the position in the tank where the displacer waits for the liquid level to rise during

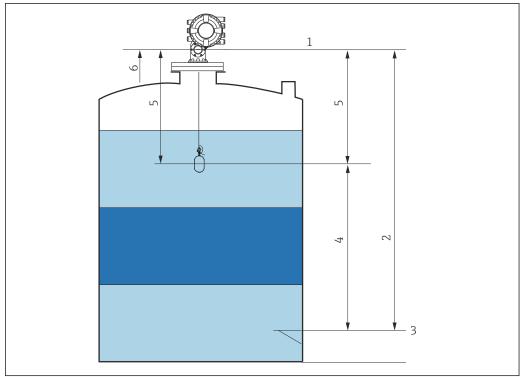
standby level gauge command.

**User entry** -999 999.9 to 999 999.9 mm

**Factory setting** 0 mm

Additional information

Read access	Operator
Write access	Maintenance



A004029

■ 86 Displacer waiting for the liquid level to rise during standby level gauge command

- 1 Gauge reference height
- 2 Empty
- 3 Datum plate
- 4 Standby level
- 5 Standby distance
- 6 Reference position

### Offset standby distance

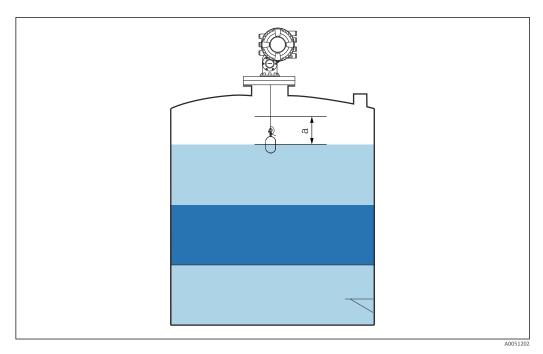
**Description** Defines the distance from the current position where the displacer waits for the liquid level

to rise during offset standby gauge command.

**User entry** 0 to 999 999.9 mm

**Factory setting** 500 mm

### Additional information



■ 87 a: Offset standby distance

### One-time command status

**Description** Indicates the status of the last executed one-time gauge command.

Additional information

Read access	Operator
Write access	-

Additional information

One-time command is available for all gauge commands, excepting Level, Stop, Up, and Interface.

### 15.2.1 "Level" submenu

Navigation  $\blacksquare \Box$  Operation  $\rightarrow$  Level

Dip Freeze

**Description** If activated the level values are frozen and a warning is shown.

Selection

Off

On

**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

**Description** Shows the distance from the zero position (tank bottom or datum plate) to the product

surface.

Additional information

Read access	Operator
Write access	-

#### Tank Level %

**Description** Shows the level as a percentage of the full measuring range.

Additional information

Read access	Operator
Write access	-

### Tank ullage

**Description** Shows the remaining empty space in the tank.

Additional information

Read access	Operator
Write access	-

### Tank ullage %

**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**  $\blacksquare \Box$  Operation  $\rightarrow$  Level  $\rightarrow$  Upper 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
Write access	-

### Upper interface level timestamp

**Description** Shows timestamp for the last measured upper interface level.

Additional information

Read access	Operator
Write access	-

### Lower interface 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
Write access	-

### Lower interface level timestamp

**Description** Shows timestamp of the last measured lower interface level.

Additional information

Read access	Operator
Write access	-

#### **Bottom level**

**Navigation**  $\blacksquare \Box$  Operation  $\rightarrow$  Level  $\rightarrow$  Bottom level

**Description** Shows the bottom level.

Additional information

Read access	Operator
Write access	-

### Bottom level timestamp

**Description** Shows the timestamp for measured bottom level.

Additional information

Read access	Operator
Write access	-

### Water level

**Description** Shows the bottom water level.

Additional information

Read access	Operator
Write access	-

### Measured level

**Navigation**  $\blacksquare \Box$  Operation  $\rightarrow$  Level  $\rightarrow$  Measured level

**Description** Shows the measured level without any correction from the tank calculations.

Additional information

Read access	Operator
Write access	-

#### Distance

**Description** Shows measured distance from reference position.

Additional information

Read access	Operator
Write access	-

## Displacer position

**Description** Shows the displacer position.

Additional information

Read access	Operator
Write access	-

# 15.2.2 "Temperature" submenu

## Air temperature

**Navigation**  $\bigcirc$  Operation  $\rightarrow$  Temperature  $\rightarrow$  Air temp.

**Description** Shows the air temperature.

Additional information

Read access	Operator
Write access	-

## Liquid temperature

Navigation

Description

Shows the average or spot temperature of the measured liquid.

Additional information

Read access	Operator
Write access	-

# Vapor temperature

Navigation

Description

Shows the measured vapor temperature.

Additional information

Read access	Operator
Write access	-

## "NMT element values" submenu

i

This submenu is only visible if a Prothermo NMT is connected.

Navigation

"Element temperature" submenu

Navigation

Operation  $\rightarrow$  Temperature  $\rightarrow$  NMT elem. values  $\rightarrow$  Element temp.

# Element temperature 1 to 24

Navigation

Description

Shows the temperature of an element in the NMT.

Additional information

Read access	Operator
Write access	-

"Element position" submenu

position

### Element position 1 to 24

 $\textbf{Navigation} \hspace{1cm} \ \ \, \hspace{1cm} \hspace{1cm}$ 

1 to 24

**Description** Shows the position of the selected element in the NMT.

Additional information

Read access	Operator
Write access	-

# 15.2.3 "Density" submenu

Navigation  $\blacksquare \Box$  Operation  $\Rightarrow$  Density

## Observed density

**Navigation**  $\blacksquare \Box$  Operation  $\rightarrow$  Density  $\rightarrow$  Observed 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 temperature

**Navigation**  $\blacksquare$  Operation  $\rightarrow$  Density  $\rightarrow$  Obs. dens. temp.

**Description** Corresponding temperature of measured density. Can be used for reference density

calculation.

**User interface** Signed floating-point number

**Factory setting**  $0 \, ^{\circ}\text{C}$ 

Vapor density

**Description** Defines the density of the gas phase in the tank.

**User entry**  $0.0 \text{ to } 500.0 \text{ kg/m}^3$ 

Factory setting  $1.2 \text{ kg/m}^3$ 

Additional information

Read access	Operator
Write access	Maintenance

Air density

**Description** Defines the density of the air surrounding the tank.

**User entry**  $0.0 \text{ to } 500.0 \text{ kg/m}^3$ 

Factory setting  $1.2 \text{ kg/m}^3$ 

Additional information

Read access	Operator
Write access	Maintenance

## Measured upper density

**Navigation**  $\bigcirc$  Operation  $\rightarrow$  Density  $\rightarrow$  Meas upper dens.

**Description** Shows the density of the upper phase.

Additional information

Read access	Operator
Write access	-

## Upper density timestamp

**Description** Shows timestamp of the last measured upper density.

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### Additional information

Read access	Operator
Write access	-

# Measured middle density

**Description** Density of the middle phase.

Additional information

Read access	Operator
Write access	-

# Middle Density Timestamp

**Navigation**  $\blacksquare$  Operation  $\rightarrow$  Density  $\rightarrow$  MidDensTimestamp

**Description** Shows the timestamp of the last measured middle density.

Additional information

Read access	Operator
Write access	-

## Measured lower density

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

**Description** Density of the lower phase.

Additional information

Read access	Maintenance
Write access	-

### Lower density timestamp

**Description** Shows timestamp of last measured lower density.

Additional information

Read access	Operator
Write access	-

## Profile point

Navigation

**Description** Shows actual number of Density Points measured so far in current operation, and the total

Number of Points after Density Profile Operation is complete.

Additional information

Read access	Operator
Write access	-

# Profile average density

Navigation

Description

Shows the average density calculated after a profile density measurement is complete.

Additional information

Read access	Operator
Write access	-

## Profile density timestamp

Navigation

Description

Shows the timestamp when the last average density profile was finished.

Additional information

Read access	Operator
Write access	-

## "Profile density" submenu

Navigation  $\square$  Operation  $\rightarrow$  Density  $\rightarrow$  Profile density

# Profile density 0 to 49

**Navigation**  $\square$  Operation  $\rightarrow$  Density  $\rightarrow$  Profile density  $\rightarrow$  Profile dens 0 to 49

**Description** Shows the density measurement at the corresponding profile density position.

Additional information

Read access	Operator
Write access	-

## Profile density position 0 to 49

**Description** Shows the position where the corresponding density was measured.

Additional information

Read access	Operator
Write access	-

# 15.2.4 "Pressure" submenu

Navigation  $\square$  Operation  $\rightarrow$  Pressure

# P1 (bottom)

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

Additional information

Read access	Operator
Write access	-

P3 (top)

**Description** Shows the pressure (P3) at the top transmitter.

Additional information

Read access	Operator
Write access	-

# 15.2.5 "GP values" submenu

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

GP 1 to 4 name

**Description** 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

Read access	Operator
Write access	Maintenance

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** 

**Description** Displays the value that will be used as general purpose value.

Additional information

Read access	Operator
Write access	-

GP Value 3

**Description** Displays the value that will be used as general purpose value.

# Additional information

Read access	Operator
Write access	-

GP Value 4

**Description** Displays the value that will be used as general purpose value.

Additional information

Read access	Operator
Write access	-

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# 15.3 "Setup" menu

Device tag

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  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 NMS8x

Additional information

Read access	Operator
Write access	Maintenance

Units preset

**Navigation**  $\blacksquare \square$  Setup  $\rightarrow$  Units preset

**Description** Defines a set of units for length, pressure and temperature.

Selection ■ mm, bar, °C

■ m, bar, °C

■ mm, PSI, °C ■ ft, PSI, °F

■ ft-in-16, PSI, °F

■ ft-in-8, PSI, °F

■ Customer value

**Factory setting** mm, bar, °C

Additional information

Read access	Operator
Write access	Maintenance

If the **Customer value** option is selected, the units are defined in the following parameters. In any other case these are read-only parameters used to indicate the respective unit:

- Distance unit ( $\rightarrow$  🗎 320)
- Pressure unit ( $\rightarrow$  🖺 321)
- Temperature unit (→ 🖺 321)

Upper density

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Upper density

**Description** Sets the density of the upper phase of the liquid.

**User entry**  $50 \text{ to } 2000 \text{ kg/m}^3$ 

**Factory setting** 800 kg/m<sup>3</sup>

Additional information

Read access	Operator
Write access	Maintenance

Middle density

**Navigation**  $\blacksquare \square$  Setup  $\rightarrow$  Middle density

**Description** Sets Density of Middle Phase in the Tank if three Phases are available. Otherwise used for

the Lower Phase in the Tank if two Phases are available.

User entry  $50 \text{ to } 2000 \text{ kg/m}^3$ 

Factory setting  $1000 \text{ kg/m}^3$ 

Additional information

Read access	Operator
Write access	Maintenance

Lower density

**Description** Sets the density of the lower Phase in the tank if three phases are available.

**User entry**  $50 \text{ to } 2000 \text{ kg/m}^3$ 

Factory setting  $1200 \text{ kg/m}^3$ 

Additional information

Read access	Operator
Write access	Maintenance

Gauge command

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Gauge command

**Description** Gauge operation command to choose the measurement mode of the device.

Selection Stop\*

- Level
- Up \*
- Bottom level \*
- Upper I/F level \*
- Lower I/F level '
- Upper density \*
- Middle density <sup>3</sup>
- Lower density
- Repeatability
- Water dip '
- Release overtension \*
- Tank profile
- Interface profile \*
- Manual profile
- Level standby '
- Offset standby \*

## **Factory setting** Stop

### Additional information

Read access	Operator
Write access	Maintenance

Process condition

**Navigation**  $\blacksquare \square$  Setup  $\rightarrow$  Process cond.

**Description** Select the liquid condition of the tank.

**Selection** • Universal

■ Calm surface

Turbulent surface

**Factory setting** Universal

Additional information

For W&M, setting to option **Calm surface** is recommended.

Read access	Operator
Write access	Maintenance

Visibility depends on order options or device settings

\_\_\_\_

Navigation

**Empty** 

Setup → Empty

Description

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 reference line of the calibration window.

Tank reference height

Navigation

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

**Navigation**  $\square$  Setup  $\rightarrow$  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 ( $\rightarrow \triangleq 194$ ) according to the entered value, such that the measured level will match the actual level.

Level source

**Description** Defines the source of the level value.

**Selection** ■ No input value

■ HART device 1 ... 15 level

Level SR \*Level \*

Displacer position \*

AIO B1-3 value

AIO C1-3 value <sup>?</sup>

AIP B4-8 value <sup>3</sup>

■ AIP C4-8 value \*

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

High stop level

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  High stop level

**Description** Position of the displacer high stop as measured from defined zero position (tank bottom or

datum plate).

Visibility depends on order options or device settings

**User entry** -999 999.9 to 999 999.9 mm

Factory setting 20000 mm

Additional information

Read access	Operator
Write access	Maintenance

Low stop level

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Low stop level

**Description** Position of the displacer low stop as measured from defined zero position (tank bottom or

datum plate).

**User entry** -999 999.9 to 999 999.9 mm

**Factory setting** 0 mm

Additional information

Read access	Operator
Write access	Maintenance

Distance

**Description** Shows measured distance from reference position.

Additional information

Read access	Operator
Write access	-

Liquid temp source

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Liq temp source

**Description** Defines source from which the liquid temperature is obtained.

**Selection** • Manual value

■ HART device 1 ... 15 temperature

AIO B1-3 valueAIO C1-3 valueAIP B4-8 valueAIP C4-8 value

Factory setting Manual value

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# Additional information

Read access	Operator
Write access	Maintenance

## 15.3.1 "Calibration" submenu

Read access Maintenance

Navigation  $\blacksquare \square$  Setup  $\rightarrow$  Calibration

# "Move displacer" wizard

Navigation  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Move displacer

Move distance

**Navigation** Setup  $\rightarrow$  Calibration  $\rightarrow$  Move displacer  $\rightarrow$  Move distance

**Description** Up or down movement of displacer in mm.

**User entry** 0 to 999 999.9 mm

**Factory setting** 0 mm

Additional information

Read access	Operator
Write access	Maintenance

Distance

**Navigation** Setup  $\rightarrow$  Calibration  $\rightarrow$  Move displacer  $\rightarrow$  Distance

**Description** Shows measured distance from reference position.

Additional information

Read access	Operator
Write access	-

Move displacer

**Navigation**  $\blacksquare \square$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Move displacer  $\rightarrow$  Move displacer

**Selection** ■ Stop

Move downMove up

Move up

**Factory setting** Stop

# Additional information

Read access	Operator
Write access	Maintenance

### Motor status

**Navigation** Setup  $\rightarrow$  Calibration  $\rightarrow$  Move displacer  $\rightarrow$  Motor status

**Description** Shows the current moving Direction of the Motor.

Additional information

Read access	Operator
Write access	-

Move displacer

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Move displacer  $\rightarrow$  Move displacer

Selection ■ No

Yes

Factory setting No

Additional information

Read access	Operator
Write access	Maintenance

#### "Sensor calibration" wizard

*Navigation*  $\blacksquare \Box$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.

Sensor calibration

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.  $\rightarrow$  Sensor cal.

**Description** This sequence calibrates the sensor of the servo.

Additional information

Read access	Operator
Write access	Maintenance

Offset weight

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.  $\rightarrow$  Offset wgt.

**Description** Sets the weight that is used for the lower point sensor calibration. Changing the value will

delete the calibration data.

**User entry** 0 to 150 g

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

For density measurement application, it is recommended to apply 50 g.

Span weight 🗈

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.  $\rightarrow$  Span wgt.

**Description** Sets the weight that is used for the middle point sensor calibration. Changing the value

will delete the calibration data.

**User entry** 10 to 999.9 g

**Factory setting** Dependent on the device version

Additional information Read access Operator
Write access Maintenance

Zero calibration

**Navigation** Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.  $\rightarrow$  Zero calibration

**Description** In this step the sensor calibration zero weight will be done.

Additional information

Read access	Operator
Write access	Maintenance

#### **Calibration status**

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.  $\rightarrow$  Status

**Description** Gives feedback on the latest status of the calibration process.

Additional information

Read access	Operator
Write access	-

Offset calibration

**Navigation** Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.  $\rightarrow$  Offset cal.

**Description** In this step the sensor calibration with offset weight will be done.

Additional information

Read access	Operator
Write access	Maintenance

Span calibration

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Sensor cal.  $\rightarrow$  Span calibration

**Description** In this step the sensor calibration with span weight will be done.

Additional information

Read access	Operator
Write access	Maintenance

## "Reference calibration" wizard

Navigation  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Reference cal.

Reference calibration			â
Navigation			
Description	This sequence will move the displacer to the mechanical stop and set the reference position.		
Additional information	Read access		Operator
	Write access		Maintenance
Reference position			â
Navigation			
Description	Defines in mm, during reference calibration, the distance between mechanical stop inside the drum housing and the middle of the wire ring.		
User entry	0 to 9 999.9 mm		
Factory setting	Dependent on the device version		
Additional information	Read access		Operator
	Write access		Maintenance
Progress			
Navigation			
Description	Gives feedback on the latest status of the reference calibration process.		
Additional information	Read access		Operator

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Maintenance

Write access

# **Calibration status**

**Description** Gives feedback on the latest status of the calibration process.

Additional information

Read access	Operator
Write access	-

#### "Drum calibration" wizard

*Navigation*  $\blacksquare \square$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.

Drum calibration

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.  $\rightarrow$  Drum cal.

**Description** This sequence will perform a drum calibration.

Additional information Read access

 Read access
 Operator

 Write access
 Maintenance

Set high weight

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.  $\rightarrow$  Set high weight

**Description** High weight that is used for a drum calibration (normally it is the displacer weight).

**User entry** 10 to 999.9 g

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

Make drum table

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.  $\rightarrow$  Make drum table

**Description** This will perform a drum calibration.

Read access	Operator
Write access	Maintenance

Drum table point

Additional information

**Navigation** Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.  $\rightarrow$  Drum table point

**Description** Shows the currently measured point of the drum calibration. Maximum number of

measured points is 50.

### Additional information

Read access	Operator
Write access	-

#### **Calibration status**

**Navigation** Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.  $\rightarrow$  Status

**Description** Gives feedback on the latest status of the calibration process.

Additional information

Read access	Operator
Write access	-

Make low table

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.  $\rightarrow$  Make low table

**Description** For additional accuracy it is possible to perform a second drum calibration with low weight.

Choose "Yes" or "No" to start/stop calibration.

Selection • No

Yes

**Factory setting** No

Additional information

Read access	Operator
Write access	Maintenance

Set low weight

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Calibration  $\rightarrow$  Drum cal.  $\rightarrow$  Set low weight

**Description** Set weight for additional drum calibration sequence.

**User entry** 10 to 999.9 g

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

# 15.3.2 "Advanced setup" submenu

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

## Locking status

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

**Description** Indicates the type of locking.

"Hardware locked" (HW)

The device is locked by the "WP" switch on the main electronics module. To unlock, set the

switch into the OFF position.

"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	-

### User role

Navigation

Description

Shows the access authorization to the parameters via the operating tool

## Additional information

Read access	Operator
Write access	-

### Enter access code

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

"HART devices" submenu

Navigation  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices

Number of devices

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  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	-

"HART Device(s)" submenu

There is a **HART Device(s)** submenu for each HART slave device found on the HART loop.

*Navigation* 

Setup → Advanced setup → Input/output → HART devices→ HART Device(s)

Device name

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ Device name

**Description** Shows the name of the transmitter.

Additional information

Read access	Operator
Write access	-

### Polling address

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

 $\rightarrow$  Polling address

**Description** Shows the polling address of the transmitter.

Additional information

Read access	Operator
Write access	-

# Device tag

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ Device tag

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

Additional information

Read access	Operator
Write access	-

Operating mode

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ Operating mode

**Prerequisite** Not available if the HART device 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** ■ PV only

PV,SV,TV & QV
 Level <sup>5)</sup>

■ Measured level 5)

Factory setting PV,SV,TV & QV

Additional information

Read access	Operator
Write access	Maintenance

#### **Communication status**

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ Comm. status

**Description** Shows the operating status of the transmitter.

**User interface** ■ Operating normally

■ Device offline

Additional information

Read access	Operator
Write access	-

## Status signal

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ Status signal

**Description** Indicates the current device status in accordance with VDI/VDE 2650 and NAMUR

Recommendation NE 107.

**User interface** ■ OK

■ Failure (F)

■ Function check (C)

Out of specification (S)

<sup>5)</sup> only visible if the connected device is a Micropilot

Maintenance required (M)

. ---

■ No effect (N)

---

**Factory setting** 

---

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

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ #blank#

**Description** Shows the first HART variable (PV).

Additional information

Read access	Operator
Write access	-

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

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ #blank#

Prerequisite For HART devices other than NMT: Operating mode (→ 🗎 209) = PV,SV,TV & QV

**Description** Shows the second HART variable (SV).

Additional information

Read access	Operator
Write access	-

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

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ #blank#

Prerequisite For HART devices other than NMT: Operating mode (→ 🗎 209) = PV,SV,TV & QV

**Description** Shows the third HART variable (TV).

Additional information

Read access	Operator
Write access	-

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

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ #blank#

Prerequisite For HART devices other than NMT: Operating mode (→ 🗎 209) = PV,SV,TV & QV

**Description** Shows the fourth HART variable (QV).

Additional information

Read access	Operator
Write access	-

Output pressure

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  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** ■ No value

Primary variable (PV)
 Secondary variable (SV)
 Tertiary variable (TV)
 Quaternary variable (QV)

**Factory setting** No value

Additional information

Read access	Operator
Write access	Maintenance

Output density

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

 $\rightarrow$  Output density

**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** ■ No value

Primary variable (PV)

■ Secondary variable (SV)

Tertiary variable (TV)

Quaternary variable (QV)

### **Factory setting**

No value

#### Additional information

Read access	Operator
Write access	Maintenance

## **Output temperature**

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

 $\rightarrow$  Output temp.

**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 temperature.

**Selection** • No value

Primary variable (PV)
Secondary variable (SV)
Tertiary variable (TV)
Quaternary variable (QV)

Factory setting No value

Additional information

Read access	Operator
Write access	Maintenance

### **Output vapor temperature**

a

Navigation

Setup → Advanced setup → Input/output → HART devices → HART Device(s)
 → Output vapor tmp

**Prerequisite** 

Description

Selection

Not available for Micropilot S FMR5xx, Prothermo NMT53x and Prothermo NMT8x. In

these cases the measured variables are allocated automatically.

Defines which HART variable is the vapor temperature.

Primary variable (PV)Secondary variable (SV)Tertiary variable (TV)

■ No value

Quaternary variable (QV)

Factory setting No value

Additional information

Read access	Operator
Write access	Maintenance

212

Output level

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  HART devices  $\rightarrow$  HART Device(s)

→ Output level

**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 level.

**Selection** ■ No value

Primary variable (PV)
 Secondary variable (SV)
 Tertiary variable (TV)
 Quaternary variable (QV)

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** ( $\rightarrow \triangleq 207$ )  $\geq 1$ .

Navigation → Forget device

Forget device

# Navigation

 $\mathsf{Setup} \to \mathsf{Advanced} \ \mathsf{setup} \to \mathsf{Input/output} \to \mathsf{HART} \ \mathsf{devices} \to \mathsf{Forget} \ \mathsf{device} \to \mathsf{Forget}$ 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 7 \*
- HART Device 8 \*
- HART Device 9
- HART Device 10
- HART Device 11
- HART Device 12 ■ HART Device 13
- HART Device 14 \*
- HART Device 15 \*
- None

# **Factory setting**

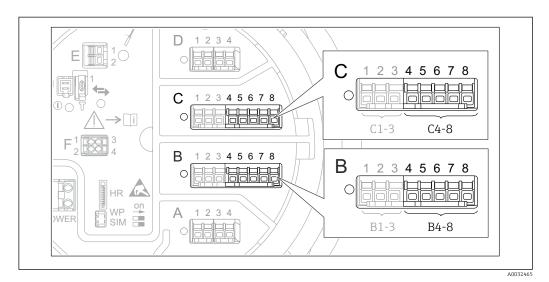
None

### Additional information

Read access	Operator
Write access	Maintenance

Visibility depends on order options or device settings

## "Analog IP" submenu



 $\blacksquare$  88 Terminals for the "Analog IP" submenu ("B4-8" or "C4-8", respectively)

Navigation  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP

 Operating mode
 Image: Setup → Advanced setup → Input/output → Analog IP → Operating mode

 Description
 Defines the operating mode of the analog input.

 Selection
 • Disabled

 • RTD temperature input
 • Gauge power supply

 Factory setting
 Disabled

 Additional information
 Read access
 Operator

Write access Maintenance

RTD type

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  RTD type

Prerequisite Operating mode ( $\rightarrow \triangleq 215$ ) = RTD temperature input

**Description** Defines the type of the connected RTD.

Selection

- Cu50 (w=1.428, GOST)
- Cu53 (w=1.426, GOST)
- Cu90; 0°C (w=1.4274, GOST)
- Cu100; 25°C (w=1.4274, GOST)
- Cu100; 0°C(w=1.4274, GOST)
- Pt46 (w=1.391, GOST)
- Pt50 (w=1.391, GOST)
- Pt100(385) (a=0.00385, IEC751)
- Pt100(389) (a=0.00389, Canadian)
- Pt100(391) (a=0.003916, JIS1604)
- Pt100 (w=1.391, GOST)
- Pt500(385) (a=0.00385, IEC751)
- Pt1000(385) (a=0.00385, IEC751)
- Ni100(617) (a=0.00617, DIN43760)
- Ni120(672) (a=0.00672, DIN43760)
- Ni1000(617) (a=0.00617, DIN43760)

**Factory setting** 

Pt100(385) (a=0.00385, IEC751)

Additional information

Read access	Operator
Write access	Maintenance

## Thermocouple type

Navigation

Description

Defines the type of the connected thermocouple.

Selection

- N type
- B type
- C type
- D type
- J type
- K type
- L type
- L GOST type
- R type
- S type
- T type
- U type

**Factory setting** 

N type

#### RTD connection type

Navigation

 $\blacksquare$  Setup → Advanced setup → Input/output → Analog IP → RTD connect type

Prerequisite

Operating mode ( $\rightarrow \triangleq 215$ ) = RTD temperature input

Description

Defines the connection type of the RTD.

216

**Selection** • 4 wire RTD connection

2 wire RTD connection3 wire RTD connection

**Factory setting** 4 wire RTD connection

Additional information

Read access	Operator
Write access	Maintenance

Process value

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  Process value

Prerequisite Operating mode (→ 🖺 215) ≠ Disabled

**Description** Shows the measured value received via the analog input.

Additional information

Read access	Operator
Write access	-

Process variable

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

Prerequisite Operating mode (→ 🖺 215) ≠ RTD temperature input

**Description** Determines type of measured value.

**Selection** • Level linearized

TemperaturePressure

Density

Factory setting Level linearized

Additional information

Read access	Operator
Write access	Maintenance

0 % value

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  0 % value

Prerequisite Operating mode (→ 🖺 215) = 4..20mA 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** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  100 % value

Prerequisite Operating mode ( $\rightarrow \triangleq 215$ ) = 4..20mA 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
Write access	Maintenance

Input value

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

Prerequisite Operating mode ( $\rightarrow \triangleq 215$ )  $\neq$  Disabled

**Description** Shows the value received via the analog input.

Additional information

Read access	Operator
Write access	-

Minimum probe temperature

**Navigation**  $\blacksquare \square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  Min. probe temp

Prerequisite Operating mode ( $\rightarrow \triangleq 215$ ) = 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 °C

Additional information

Read access	Operator
Write access	Maintenance

### Maximum probe temperature

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  Max. probe temp

Prerequisite Operating mode (→ 🗎 215) = 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**  $-213 \text{ to } 927 \,^{\circ}\text{C}$ 

**Factory setting** 250 °C

Additional information

Read access	Operator
Write access	Maintenance

**Probe position** 

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  Probe position

Prerequisite Operating mode (→ 🗎 215) = 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

Damping factor

 $\textbf{Navigation} \hspace{1cm} \hline \textbf{Setup} \rightarrow \textbf{Advanced setup} \rightarrow \textbf{Input/output} \rightarrow \textbf{Analog IP} \rightarrow \textbf{Damping factor}$ 

Prerequisite Operating mode (→ 🗎 215) ≠ 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**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog IP  $\rightarrow$  Gauge current

Prerequisite Operating mode (→ 🖺 215) = Gauge power supply

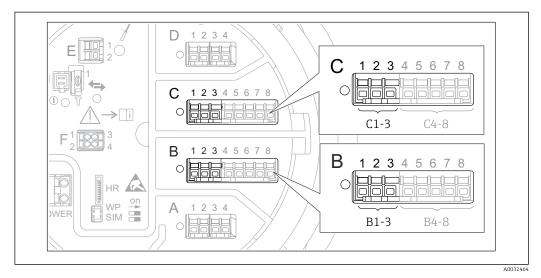
**Description** Shows the current on the power supply line for the connected device.

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  $\rightarrow$   $\cong$  215.



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

Navigation Setup → Advanced setup → Input/output → Analog I/O

Operating mode

Navigation

Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  Operating mode

Description

Defines the operating mode of the analog I/O module.

Selection

- Disabled
- 4..20mA input
- HART master+4..20mA input
- HART master
- 4..20mA output
- HART slave +4..20mA output

# **Factory setting**

Disabled

#### Additional information

Read access	Operator
Write access	Maintenance

# Meaning of the options

Operating mode (→ 🗎 221)	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 (→ 🗎 221)	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 of the 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	
Current Spari	

Navigation

Prerequisite

**Operating mode** parameter (→ 🖺 221) ≠ **Disabled** option or **HART master** option

Description

Defines the current range for the measured value transmission.

Selection

- 4...20 mA NE (3.8...20.5 mA)
- 4...20 mA US (3.9...20.8 mA)
- 4...20 mA (4...20.5 mA)
- Fixed value

**Factory setting** 

4...20 mA NE (3.8...20.5 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 (420.5 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	n the <b>Fixed curre</b> r	ı <b>t</b> parameter (→ 🖺	223).

In the case of an error, the output current assumes the value defined in the **Failure** mode parameter ( $\Rightarrow \triangleq 224$ ).

Fixed current

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

Prerequisite Current span ( $\rightarrow \stackrel{\triangle}{=} 222$ ) = Fixed 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

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

Prerequisite ■ Operating mode (→ 🖺 221) = 4..20mA output or HART slave +4..20mA output

Current span (→ \( \bigode \) 222) ≠ Fixed current

**Description** Defines the process variable transmitted via the AIO.

**Selection** ■ None

Tank level

■ Tank level %

■ Tank ullage

■ 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
- Observed density value
- Average profile density <sup>6)</sup>
- Upper density
- Middle density
- Lower density
- P1 (bottom)
- P2 (middle)
- P3 (top)
- GP 1 ... 4 value
- AIO B1-3 value <sup>6)</sup>
- AIO B1-3 value mA <sup>6)</sup>
- AIO C1-3 value 6)
- AIO C1-3 value mA <sup>6)</sup>
- AIP B4-8 value 6)
- AIP C4-8 value 6)
- Element temperature 1 ... 24 <sup>6)</sup>
- HART device 1...15 PV <sup>6)</sup>
- HART device 1 ... 15 PV mA <sup>6)</sup>
- HART device 1 ... 15 PV % <sup>6)</sup>
- HART device 1 ... 15 SV <sup>6)</sup>
- HART device 1 ... 15 TV <sup>6)</sup>
- HART device 1 ... 15 QV <sup>6)</sup>

# **Factory setting**

#### Tank level

### Additional information

Read access	Operator
Write access	Maintenance

### Failure mode

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

Prerequisite

Operating mode (→ 🗎 221) = 4..20mA output or HART slave +4..20mA output

Description

Defines the output behavior in case of an error.

Selection

- Min.
- Max.
- Last valid value
- Actual value
- Defined value

# **Factory setting**

Max.

### Additional information

Read access	Operator
Write access	Maintenance

<sup>6)</sup> Visibility depends on order options or device settings

Error value 🗎

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

Prerequisite Failure mode (→ 🖺 224) = 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

Input value

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

Prerequisite ■ Operating mode (→ 🗎 221) = 4..20mA output or HART slave +4..20mA output

■ Current span (→ 🗎 222) ≠ Fixed current

**Description** Shows the input value of the analog I/O module.

Additional information

Read access	Operator
Write access	-

0 % value

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  0 % value

Prerequisite ■ Operating mode (→ 🗎 221) = 4..20mA output or HART slave +4..20mA output

■ Current span (→ \( \bigode \) 222) ≠ Fixed 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

Prerequisite

■ Operating mode (→ 🖺 221) = 4..20mA output or HART slave +4..20mA output

■ Current span (→ 🖺 222) ≠ Fixed current

Description

Value corresponding to an output 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** 

Prerequisite

■ Operating mode (→ 🖺 221) = 4..20mA output or HART slave +4..20mA output

■ Current span (→ 🖺 222) ≠ Fixed current

Description

Shows the output value as a percentage of the complete 4...20mA range.

Additional information

Read access	Operator
Write access	-

**Output value** 

**Navigation** 

Prerequisite

Operating mode (→ 🗎 221) = 4..20mA output or HART slave +4..20mA output

Description

Shows the output value in mA.

Additional information

Read access	Operator
Write access	-

Process variable

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

Prerequisite Operating mode (→ 🗎 221) = 4..20mA input or HART master+4..20mA input

**Description** Defines the type of measuring variable.

**Selection** • Level linearized

TemperaturePressureDensity

**Factory setting** Level linearized

Additional information

Read access	Operator
Write access	Maintenance

Analog input 0% value

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  AI 0% value

Prerequisite Operating mode (→ 🖺 221) = 4..20mA input or HART master+4..20mA 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**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  AI 100% value

Prerequisite Operating mode (→ 🗎 221) = 4..20mA input or HART master+4..20mA 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

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  Error event type

Prerequisite Operating mode (→ 🗎 221) ≠ Disabled or HART master

**Description** 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** • None

WarningAlarm

**Factory setting** Warning

Additional information

Read access	Operator
Write access	Maintenance

#### Process value

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

Prerequisite Operating mode (→ 🖺 221) = 4..20mA input or HART master+4..20mA input

**Description** Shows the input value scaled to customer units.

Additional information

Read access	Operator
Write access	-

#### Input value in mA

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  Input val. in mA

Prerequisite Operating mode (→ 🗎 221) = 4..20mA input or HART master+4..20mA input

**Description** Shows the input value in mA.

Additional information

Read access	Operator
Write access	-

228

Input value percent

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  Input value [%]

Prerequisite Operating mode (→ 🗎 221) = 4..20mA input or HART master+4..20mA input

**Description** Shows the input value as a percentage of the complete 4...20mA current range.

Additional information

Read access	Operator
Write access	-

Damping factor

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

Prerequisite Operating mode (→ 🖺 221) ≠ Disabled or HART master

**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** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Analog I/O  $\rightarrow$  Used for SIL/WHG

Prerequisite ■ Operating mode (→ 🖺 221) = 4..20mA output or HART slave +4..20mA output

■ The device has a SIL approval.

**Description** Determines whether the discrete I/O module is in SIL/WHG mode.

Selection ■ Enabled ■ Disabled

Factory setting Disabled

Additional information

Read access	Operator
Write access	Maintenance

# Expected SIL/WHG chain

Navigation

Prerequisite

- Operating mode (→ 🖺 221) = 4..20mA output or HART slave +4..20mA output
- The device has a SIL approval.

# Additional information

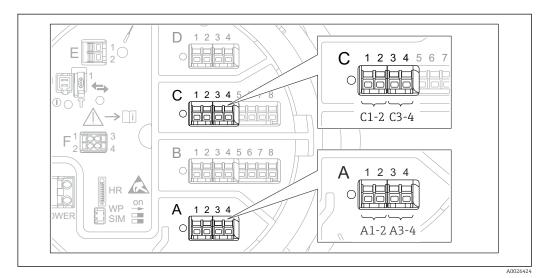
Read access	Operator
Write access	-

# "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.



■ 90 Designation of the digital inputs or outputs (examples)

Navigation

 Operating mode

 Navigation
 Setup → Advanced setup → Input/output → Digital Xx-x → Operating mode

 Description
 Defines the operating mode of the discrete I/O module.

Selection • Disabled

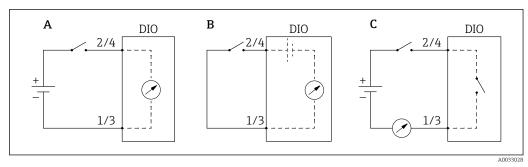
Output passive

ullet Input passive

Input active

Factory setting Disabled

#### Additional information



 $\blacksquare$  91 Operating modes of the Digital I/O module

- A Input passive
- B Input active
- C Output passive

Digital input source

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x  $\rightarrow$  Digital source

Prerequisite Operating mode ( $\rightarrow \stackrel{\triangle}{=} 231$ ) = Output passive

**Description** Defines which device state is indicated by the digital output.

**Selection** • None

- Balance flag
- 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
- Digital Xx-x
- Primary Modbus x
- Secondary Modbus x

**Factory setting** 

None

232

#### Additional information

#### Meaning of the options

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

The digital output indicates if the selected alarm is currently active. The alarms themselves are defined in the **Alarm 1 to 4** submenus.

Digital Xx-x<sup>7)</sup>

The digital signal present at the digital input **Xx-x** is passed through to the digital output.

 Modbus A1-4 Discrete x Modbus B1-4 Discrete x Modbus C1-4 Discrete x Modbus D1-4 Discrete x

The digital value written by the Modbus Master device to the **Modbus discrete x** parameter <sup>8)</sup> is passed to the digital output. For details refer to Special Documentation SD02066G.

Input value

**Navigation**  $\blacksquare$  Setup → Advanced setup → Input/output → Digital Xx-x → Input value

Prerequisite Operating mode (→ 🗎 231) = "Input passive" option or "Input active" option

Description Shows the digital input value.

Additional information

Read access	Operator	
Write access	-	

Contact type

Navigation Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x  $\rightarrow$  Contact type

**Prerequisite** Operating mode (→ 🗎 231) ≠ Disabled

Description Determines the switching behavior of the input or output.

Selection Normally open

Normally closed

**Factory setting** Normally open

Only present if "Operating mode (→ 🖺 231)" = "Input passive" or "Input active" for the respective Digital I/O module. 7)

Expert  $\rightarrow$  Communication  $\rightarrow$  Modbus  $Xx-x \rightarrow$  Modbus discrete x

Output simulation

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x  $\rightarrow$  Output sim

Prerequisite Operating mode ( $\rightarrow \stackrel{\triangle}{=} 231$ ) = Output passive

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

**Selection** • Disable

- Simulating active
- Simulating inactive
- Fault 1
- Fault 2

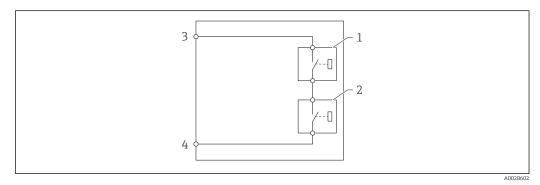
# **Factory setting**

#### Disable

#### Additional information

Read access	Operator
Write access	Maintenance

The digital output consists of two relays connected in series:



92 The two relays of a digital output

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**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x  $\rightarrow$  Output values

Prerequisite Operating mode (→ 🗎 231) = Output passive

**Description** Shows the digital output value.

Additional information

Read access	Operator
Write access	-

#### Readback value

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital  $Xx-x \rightarrow$  Readback value

Prerequisite Operating mode (→ 🗎 231) = Output passive

**Description** Shows the value read back from the output.

Additional information

Read access	Operator
Write access	-

Used for SIL/WHG

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital Xx-x  $\rightarrow$  Used for SIL/WHG

Prerequisite ■ Operating mode (→ 🗎 231) = Output passive

■ The device has a SIL certificate.

**Description** Determines whether the discrete I/O module is in SIL/WHG mode.

**Selection** • Enabled

Disabled

Factory setting Disabled

Additional information

Read access	Operator
Write access	Maintenance

# Expected SIL/WHG chain

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  Digital C3-4  $\rightarrow$  SIL/WHG chain

Prerequisite Operating mode ( $\rightarrow \stackrel{\triangle}{=} 231$ ) = Output passive

Additional information Read access

Read access	Service
Write access	-

"Digital input mapping" submenu

Navigation  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Input/output  $\rightarrow$  DI mapping

# Digital input source 1

Navigation

Setup → Advanced setup → Input/output → DI mapping → Digital source 1

Description

Selects the source of digital input #1 (for gauge command).

Selection

- None
- Digital A1-2 \*
- Digital A3-4
- Digital B1-2 <sup>\*</sup>
- Digital B3-4
- Digital C1-2
- Digital C3-4
- Digital D1-2 \*
- Digital D3-4 \*

#### Factory setting

None

Additional information

Read access	Operator
Write access	Maintenance

# Digital input source 2

Navigation

Setup → Advanced setup → Input/output → DI mapping → Digital source 2

Description

Selects the source of digital input #2 (for gauge command).

Selection

- None
- Digital A1-2 \*
- Digital A3-4
- Digital B1-2
- Digital B3-4 ÎDigital C1-2 \*
- Digital C3-4 \*
- Digital D1-2 \*
- Digital D3-4 \*

#### **Factory setting**

None

Additional information

Read access	Operator
Write access	Maintenance

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

Gauge command 0

Navigation  $\blacksquare$  Setup → Advanced setup → Input/output → DI mapping → Gauge command 0

Prerequisite Digital input source 1 ( $\rightarrow$   $\cong$  237)  $\neq$  None

Gauge command assigned to digital input combination 0 (DI2=0, DI1=0). Description

Selection Stop \* Level

- Up
- Bottom level \*
- Upper I/F level \*
- Lower I/F level
- Upper density \*
- Middle density '
- Lower density
- Repeatability
- Water dip
- Release overtension \*
- Tank profile
- Interface profile <sup>7</sup>
- Manual profile
- Level standby \*
- Offset standby \*

**Factory setting** Level

Additional information

Read access	Operator
Write access	Maintenance

Gauge command 1

**Navigation**  $\blacksquare$  Setup → Advanced setup → Input/output → DI mapping → Gauge command 1

Prerequisite Digital input source 1 ( $\rightarrow$   $\cong$  237)  $\neq$  None

Description Gauge command assigned to digital input combination 1 (DI2=0, DI1=1).

Selection Stop \* ■ Level

- Up
- Bottom level \*
- Upper I/F level \*
- Lower I/F level <sup>2</sup>
- Upper density \*
- Middle density
- Lower density
- Repeatability Water dip <sup>3</sup>

Visibility depends on order options or device settings

- Release overtension \*
- Tank profile
- Interface profile \*
- Manual profile
- Level standby \*
- Offset standby <sup>¹</sup>

#### **Factory setting**

Up

#### Additional information

Read access	Operator
Write access	Maintenance

Gauge command 2

Navigation

 $\blacksquare$  Setup → Advanced setup → Input/output → DI mapping → Gauge command 2

Prerequisite

- Description

Gauge command assigned to digital Input combination 2 (DI2=1, DI1=0).

Selection

- Stop \*
- Level
- Up
- Bottom level <sup>3</sup>
- Upper I/F level \*
- Lower I/F level
- Upper density \*
- Middle density
- Lower density
- lacktriangle Repeatability
- Water dip
- Release overtension
- Tank profile
- Interface profile \*
- Manual profile
- Level standby ^
- Offset standby \*

#### **Factory setting**

Stop

#### Additional information

Read access	Operator
Write access	Maintenance

Visibility depends on order options or device settings

#### Gauge command 3

Navigation

Setup → Advanced setup → Input/output → DI mapping → Gauge command 3

Prerequisite

■ Digital input source 1 (→ 🖺 237) ≠ None ■ Digital input source 2 (→ 🖺 237) ≠ None

Description

Gauge command assigned to digital input combination 3 (DI2=1, DI1=1).

Selection

- Stop ■ Level
- Up
- Bottom level \*
- Upper I/F level \*
- Lower I/F level <sup>7</sup>
- Upper density \*Middle density \*
- Lower density
- Repeatability
- Water dip <sup>1</sup>
- Release overtension \*
- Tank profile \*
- Interface profile \*
- Manual profile '
- Level standby \*
- Offset standby \*

**Factory setting** 

Upper I/F level

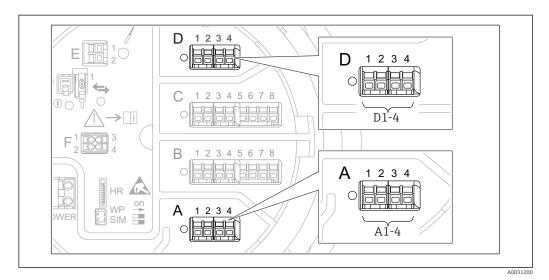
# Additional information

Read access	Operator
Write access	Maintenance

Visibility depends on order options or device settings

#### "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.



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

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

"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 Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  Modbus X1-4

Navigation  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4

Navigation Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  WM550 X1-4

#### Communication interface protocol

Navigation

Setup → Advanced setup → Communication → Modbus X1-4 / V1 X1-4 / WM550 X1-4 → Commu I/F protoc

Description

Shows the type of communication protocol.

#### Additional information

Read access	Operator
Write access	-

"Configuration" submenu

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

Navigation

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

Baudrate

 $\rightarrow$  Baudrate

Prerequisite Communication interface protocol (→ 🗎 241) = MODBUS

**Description** Defines the baud rate of the communication.

Selection ■ 600 BAUD

1200 BAUD2400 BAUD4800 BAUD

9600 BAUD \*
19200 BAUD \*

**Factory setting** 9600 BAUD

Additional information

Read access	Operator
Write access	Maintenance

Parity

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  Modbus X1-4  $\rightarrow$  Configuration

→ Parity

Prerequisite Communication interface protocol (→ 🗎 241) = MODBUS

**Description** Defines the parity of the Modbus communication.

Selection ■ Odd ■ Even

■ None / 1 stop bit

None / 2 stop bits

**Factory setting** None / 1 stop bit

Additional information

Read access	Operator
Write access	Maintenance

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

Modbus address

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  Modbus X1-4  $\rightarrow$  Configuration

→ Device ID

Prerequisite Communication interface protocol (→ 🗎 241) = MODBUS

**Description** Defines the Modbus address of the device.

**User entry** 1 to 247

Factory setting 1

Additional information

Read access	Operator
Write access	Maintenance

Float swap mode

→ Float swap mode

Prerequisite Communication interface protocol (→ 🗎 241) = MODBUS

**Description** Sets the format of how the floating point value is transferred on Modbus.

**Selection** ■ Normal 3-2-1-0

Swap 0-1-2-3WW Swap 1-0-3-2WW Swap 2-3-0-1

**Factory setting** Swap 0-1-2-3

Additional information

Read access	Operator
Write access	Maintenance

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  Modbus X1-4  $\rightarrow$  Configuration  $\rightarrow$  Bus

termination

Prerequisite Communication interface protocol (→ 🗎 241) = MODBUS

**Description** Activates or deactivates the bus termination at the device. Should only be activated on the

last device in a loop.

Selection • Off

■ On

# 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

→ Configuration

### Communication interface protocol variant

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4  $\rightarrow$  Configuration  $\rightarrow$  Protocol

variant

**Description** Determines which variant of the V1 protocol is used.

**User interface** ■ None

V1 '

Factory setting None

Additional information

Read access	Operator
Write access	Maintenance

V1 address

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4  $\rightarrow$  Configuration  $\rightarrow$  V1

address

Prerequisite Communication interface protocol variant ( $\rightarrow \triangleq 245$ ) = 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

Visibility depends on order options or device settings

V1 address

Navigation

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

address

Prerequisite

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

Navigation

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

Prerequisite

Communication interface protocol (→ 🗎 241) = 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 999 999. 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
500 001	-0.1 mm
999 999	-49 999.9 mm

Line impedance

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4  $\rightarrow$  Configuration  $\rightarrow$  Line

impedance

Prerequisite Communication interface protocol (→ 🖺 241) = 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

i

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.

Compatibility mode

 $\rightarrow$  Configuration  $\rightarrow$  Comp. mode

**Description** Defines the compatibility mode.

Selection • Nxx5xx • Nxx8x

Factory setting Nxx8x

**Additional information** In **NMS5x** mode: Only values which have also existed on NMS5x Gauge status are output on the bus.

In NMS8x mode: All Gauge status are available at this parameter.

Read access	Operator
Write access	Maintenance

"V1 input selector" submenu

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

Navigation

Setup → Advanced setup → Communication → V1 X1-4 → V1 input select.

# Alarm 1 input source

# Navigation

#### Description

Determines which discrete value will be transmitted as V1 alarm 1 status.

# Selection

- None
- Alarm 1-4 any
- Alarm 1-4 HighHigh
- Alarm 1-4 High or HighHigh
- Alarm 1-4 High
- Alarm 1-4 Low
- Alarm 1-4 Low or LowLow
- Alarm 1-4 LowLow

#### **Factory setting**

None

# Additional information

Read access	Operator
Write access	Maintenance

# Alarm 2 input source

### Navigation

Setup → Advanced setup → Communication → V1 X1-4 → V1 input select. → Alarm2 input src

# Description

Determines which discrete value will be transmitted as V1 alarm 2 status.

# Selection

- None
- Alarm 1-4 any
- Alarm 1-4 HighHigh
- Alarm 1-4 High or HighHigh
- Alarm 1-4 High
- Alarm 1-4 Low
- Alarm 1-4 Low or LowLow
- Alarm 1-4 LowLow

# **Factory setting**

None

# Additional information

Read access	Operator
Write access	Maintenance

Value percent selector

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  V1 X1-4  $\rightarrow$  V1 input select.  $\rightarrow$  Value

% select

**Description** Selects which value shall be transmitted as a 0..100% value in the V1 Z0/Z1 message.

**Selection** • None

Tank level %
Tank ullage %
AIO B1-3 value %
AIO C1-3 value %

Factory setting None

Additional information

Read access	Operator
Write access	Maintenance

"Configuration" submenu

This submenu is only present for devices with a **"WM550" option** communication interface.

Navigation

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

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  WM550 X1-4  $\rightarrow$  Configuration

→ Baudrate

Prerequisite Communication interface protocol (→ 🗎 241) = "WM550" option

**Description** Defines the baud rate of the WM550 communication.

Selection ■ 600 BAUD

1200 BAUD2400 BAUD4800 BAUD

Factory setting 2400 BAUD

Additional information

Read access	Operator
Write access	Maintenance

Visibility depends on order options or device settings

WM550 address Navigation → WM550 address Description Describes the WM550 address of the device. **User entry** 0 to 63 **Factory setting** 1 Software ID **Navigation** → Software ID Prerequisite Communication interface protocol (→ 🗎 241) = "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 2000 Factory setting "WM550 input selector" submenu This submenu is only present for devices with a "WM550" option communication interface. Navigation  $\rightarrow$  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>

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- 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" submenu

Navigation  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output

"Configuration" submenu

Navigation  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output

 $\rightarrow$  Configuration

System polling address

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration

→ Polling address

**Description** Device address for HART communication.

**User entry** 0 to 63

Factory setting 15

Additional information

Read access	Operator
Write access	Maintenance

No. of preambles

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration  $\rightarrow$  No.

of preambles

**Description** Defines the number of preambles in the HART telegram.

**User entry** 5 to 20

**Factory setting** 5

Additional information

Read access	Operator
Write access	Maintenance

PV source

**Navigation**  $\blacksquare \square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration  $\rightarrow$  PV

source

**Description** Decides, if the PV configuration is according to an analog output (HART slave) or

customized (in case of HART tunneling only).

252

Selection ■ AIO B1-3 \*

■ AIO C1-3

Custom

**Factory setting** 

Custom

Additional information

Read access	Maintenance
Write access	Maintenance

Assign PV

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration → Assign PV

Prerequisite PV source ( $\rightarrow \triangleq 252$ ) = 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 ■ 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
- 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** Tank level

Visibility depends on order options or device settings

#### Additional information

Read access	Operator
Write access	Maintenance

i Th

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

0 % value

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration  $\rightarrow$  0 %

value

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

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration  $\rightarrow$  100

% value

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

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration  $\rightarrow$  PV

mA selector

Prerequisite PV source = Custom

**Description** Assigns a current to the primary HART variable (PV).

**Selection** ■ None

AIO B1-3 value mA\*AIO C1-3 value mA\*

Factory setting None

Additional information

Read access	Operator
Write access	Maintenance

## Primary variable (PV)

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration

→ 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** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration

→ Percent of range

**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 🗈

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration

→ Assign SV

**Description** Assign a measured variable to the second dynamic variable (SV).

**Selection** • None

■ Tank level

Tank ullage

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

Read access	Operator
Write access	Maintenance

 $oldsymbol{\dot{1}}$ 

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

# Secondary variable (SV)

**Navigation** 

Setup → Advanced setup → Communication → HART output → Configuration → Second.var(SV)

Prerequisite

Assign SV (→ 🗎 255) ≠ None

Description

Shows the current measured value of the secondary dynamic variable (SV)

#### Additional information

Read access	Operator
Write access	-

Assign TV

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration

→ Assign TV

**Description** Assign a measured variable to the tertiary dynamic variable (TV).

Selection • 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
- 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** Water level

## 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.

**Tertiary variable (TV)** 

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration

→ Tertiary var(TV)

Prerequisite Assign TV (→ 🗎 257) ≠ None

**Description** Shows the current measured value of the tertiary (third) dynamic variable (TV)

#### Additional information

Read access	Operator
Write access	-

Assign QV

# Navigation

Setup → Advanced setup → Communication → HART output → Configuration → Assign QV

## Description

Assign a measured variable to the quaternary dynamic variable (QV).

#### Selection

- 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
- 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**

Observed density value

## 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.

Quaternary variable (QV)

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Configuration

 $\rightarrow$  Quaterna.var(QV)

Prerequisite Assign QV (→ 🖺 258) ≠ None

**Description** Shows the current measured value of the quaternary (fourth) dynamic variable (QV)

Additional information

Read access	Operator
Write access	-

"Information" submenu

 $\textit{Navigation} \hspace{1.5cm} \hline{\blacksquare} \hspace{1.5cm} \texttt{Setup} \rightarrow \texttt{Advanced setup} \rightarrow \texttt{Communication} \rightarrow \texttt{HART output}$ 

→ Information

HART short tag

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Information  $\rightarrow$  HART

short tag

**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 NMS8x

Additional information

Read access	Operator
Write access	Maintenance

Device tag

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Information  $\rightarrow$  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 NMS8x

Additional information

Read access	Operator
Write access	Maintenance

HART descriptor

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Information  $\rightarrow$  HART

descriptor

**Description** Enter description for the measuring point

**User entry** Character string comprising numbers, letters and special characters (16)

Factory setting NMS8x

Additional information

Read access	Operator
Write access	Maintenance

HART message

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Information  $\rightarrow$  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 NMS8x

Additional information

Read access	Operator
Write access	Maintenance

HART date code

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Communication  $\rightarrow$  HART output  $\rightarrow$  Information  $\rightarrow$  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*  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application

"Tank configuration" submenu

Navigation  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config

"Level" submenu

*Navigation*  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Level

Level source

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Level  $\rightarrow$  Level source

**Description** Defines the source of the level value.

**Selection** • No input value

■ HART device 1 ... 15 level

- Level SR
- Level <sup>3</sup>
- Displacer position \*
- AIO B1-3 value \*
- AIO C1-3 value \*
- AIP B4-8 value \*
- AIP C4-8 value

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

Empty 🔓

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Level  $\rightarrow$  Empty

**Description** 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

Visibility depends on order options or device settings

## Additional information

Read access	Operator
Write access	Maintenance

The reference point is the reference line of the calibration window.

Tank reference height		
Navigation		
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 vers	sion
Additional information	Read access	Operator
	Write access	Maintenance
Tank level		
Navigation	Setup → Advanced set	un \ Application \ Tank config \ I ovel \ Tank lovel
Navigation	Setup > Auvanteu set	up → Application → Tank config → Level → Tank level
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		
Navigation	Setup → Advanced set	up → Application → Tank config → Level → 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
		7,5500

Endress+Hauser 263

Maintenance

Write access

The device adjusts the **Empty** parameter ( $\rightarrow \implies 194$ ) according to the entered value, such that the measured level will match the actual level.

Water level source		۵
Navigation		→ Application → Tank config → Level → Water level src
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> <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		<u> </u>	
Navigation		Setup → Advanced setup → Application → Tank config → Level → Man. water level	
Prerequisite	Water level source (→ 🗎 264)	Water level source (→ 🗎 264) = 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	

Water level	
Navigation	
Description	Shows the bottom water level.

Maintenance

Write access

# Additional information

Read access	Operator
Write access	-

"Temperature" submenu

Read access	Maintenance	
-------------	-------------	--

Navigation  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Temperature

Liquid temp source

 $\textbf{Navigation} \hspace{1cm} \hline \blacksquare \hspace{1cm} \textbf{Setup} \rightarrow \textbf{Advanced setup} \rightarrow \textbf{Application} \rightarrow \textbf{Tank config} \rightarrow \textbf{Temperature} \rightarrow \textbf{Liq temp}$ 

source

**Description** Defines source from which the liquid temperature is obtained.

Selection • Manual value

 $\blacksquare$  HART device 1 ... 15 temperature

AIO B1-3 valueAIO C1-3 valueAIP B4-8 valueAIP C4-8 value

Factory setting Manual value

Additional information

Read access	Operator
Write access	Maintenance

Manual liquid temperature

liquid temp

Prerequisite Liquid temp source (→ 🖺 196) = Manual value

**Description** Defines the manual value of the liquid temperature.

**User entry**  $-50 \text{ to } 300 \,^{\circ}\text{C}$ 

**Factory setting** 25 °C

Additional information

Read access	Operator
Write access	Maintenance

## Liquid temperature

temp.

**Description** Shows the average or spot temperature of the measured liquid.

Additional information

Read access	Operator
Write access	-

Air temperature source

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Temperature  $\rightarrow$  Air temp.

source

**Description** Defines source from which the air temperature is obtained.

**Selection** • Manual value

■ HART device 1 ... 15 temperature

AIO B1-3 valueAIO C1-3 valueAIP B4-8 valueAIP C4-8 value

Factory setting Manual value

Additional information

Read access	Operator
Write access	Maintenance

Manual air temperature

 $\textbf{Navigation} \hspace{1cm} \hline \textbf{Setup} \rightarrow \textbf{Advanced setup} \rightarrow \textbf{Application} \rightarrow \textbf{Tank config} \rightarrow \textbf{Temperature} \rightarrow \textbf{Manual air}$ 

temp.

Prerequisite Air temperature source (→ 🖺 267) = Manual value

**Description** Defines the manual value of the air temperature.

**User entry**  $-50 \text{ to } 300 \,^{\circ}\text{C}$ 

**Factory setting** 25 °C

Additional information

 Read access
 Operator

 Write access
 Maintenance

# Air temperature

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Temperature  $\rightarrow$  Air temp.

**Description** Shows the air temperature.

Additional information

Read access	Operator
Write access	-

## Vapor temp source

temp src

**Description** Defines the source from which the vapor temperature is obtained.

**Selection** • Manual value

■ HART device 1 ... 15 vapor temp

AIO B1-3 valueAIO C1-3 valueAIP B4-8 valueAIP C4-8 value

Factory setting

Manual value

Additional information

Read access	Operator
Write access	Maintenance

# Manual vapor temperature

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Temperature  $\rightarrow$  Man.

vapor temp.

Prerequisite Vapor temp source (→ 🗎 268) = Manual value

**Description** Defines the manual value of the vapor temperature.

**User entry**  $-50 \text{ to } 300 \,^{\circ}\text{C}$ 

**Factory setting** 25 °C

Additional information

Read access	Operator
Write access	Maintenance

Vapor temperature

 $\textbf{Navigation} \hspace{1cm} \hline \textbf{ Setup} \rightarrow \textbf{Advanced setup} \rightarrow \textbf{Application} \rightarrow \textbf{Tank config} \rightarrow \textbf{Temperature} \rightarrow \textbf{Vapor}$ 

temp.

**Description** Shows the measured vapor temperature.

Additional information Read access

Read access	Operator
Write access	-

"Density" submenu

Navigation  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Density

## Observed density source

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Density  $\rightarrow$  Density source

**Description** Determines how the density is obtained.

Selection ■ HTG<sup>\*</sup>

■ HTMS \*

Average profile density \*

Upper densityMiddle densityLower density

**Factory setting** 

Dependent on the device version

## Additional information

Read access	Operator
Write access	Maintenance

## Observed density

Navigation

Setup → Advanced setup → Application → Tank config → Density → Observed density

Description

Shows the measured or calculated density.

# Additional information

Read access	Operator
Write access	-

#### Air density

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Density  $\rightarrow$  Air density

**Description** Defines the density of the air surrounding the tank.

**User entry**  $0.0 \text{ to } 500.0 \text{ kg/m}^3$ 

Factory setting  $1.2 \text{ kg/m}^3$ 

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

## Additional information

Read access	Operator
Write access	Maintenance

Vapor density 🗈

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Density  $\rightarrow$  Vapor density

**Description** Defines the density of the gas phase in the tank.

**User entry**  $0.0 \text{ to } 500.0 \text{ kg/m}^3$ 

Factory setting  $1.2 \text{ kg/m}^3$ 

Additional information

Read access	Operator
Write access	Maintenance

"Pressure" submenu

Navigation Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config

→ Pressure

## P1 (bottom) source

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Pressure  $\rightarrow$  P1 (bot) source

**Description** Defines the source of the bottom pressure (P1).

**Selection** • Manual value

■ HART device 1 ... 15 pressure

AIO B1-3 valueAIO C1-3 valueAIP B4-8 valueAIP C4-8 value

## **Factory setting**

Manual value

## Additional information

Read access	Operator
Write access	Maintenance

## P1 (bottom)

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

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Pressure  $\rightarrow$  P1 (bot)

manual

Prerequisite P1 (bottom) source (→ 🖺 272) = Manual value

**Description** Defines the manual value of the bottom pressure (P1).

**User entry** −1.01325 to 25 bar

**Factory setting** 0 bar

272

### Additional information

Read access	Operator
Write access	Maintenance

P1 position

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

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  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

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Pressure  $\rightarrow$  P1 absolut/

gauge

**Description** Defines whether the connected pressure transmitter measures an absolute or a gauge

pressure.

**Selection** • Absolute

Gauge

**Factory setting** Gauge

### Additional information

Read access	Operator
Write access	Maintenance

P3 (top) source

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Pressure  $\rightarrow$  P3 (top) source

**Description** Defines the source of the top pressure (P3).

**Selection** • Manual value

■ HART device 1 ... 15 pressure

AIO B1-3 valueAIO C1-3 valueAIP B4-8 valueAIP C4-8 value

Factory setting

Manual value

Additional information

Read access	Operator
Write access	Maintenance

## P3 (top)

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

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Pressure  $\rightarrow$  P3 (top)

manual

Prerequisite P3 (top) source ( $\Rightarrow \triangleq 274$ ) = Manual value

**Description** Defines the manual value of the top pressure (P3).

**User entry** -1.01325 to 25 bar

**Factory setting** 0 bar

274

### Additional information

Read access	Operator
Write access	Maintenance

P3 position

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  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 100 000 mm

Factory setting 20 000 mm

Additional information

Read access	Operator
Write access	Maintenance

P3 offset

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  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** −25 to 25 bar

**Factory setting** 0 bar

Additional information

Read access	Operator
Write access	Maintenance

P3 absolute / gauge

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Pressure  $\rightarrow$  P3 absolut/

gauge

**Description** Defines whether the connected pressure transmitter measures an absolute or a gauge

pressure.

**Selection** • Absolute

Gauge

**Factory setting** Gauge

## Additional information

Read access	Operator
Write access	Maintenance

Ambient pressure

**Navigation**  $\blacksquare \ \$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank config  $\rightarrow$  Pressure  $\rightarrow$  Ambient

pressure

**Description** Defines the manual value of the ambient pressure.

**User entry** 0 to 2.5 bar

**Factory setting** 1 bar

Additional information

Read access	Operator
Write access	Maintenance

276

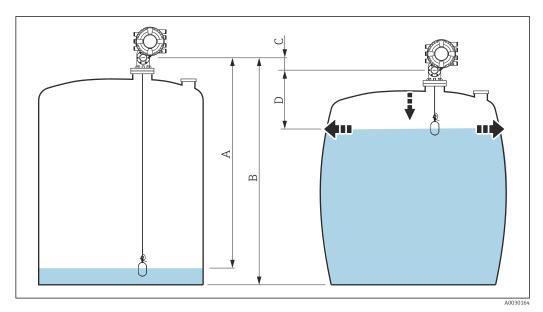
## "Tank calculation" submenu

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

## "HyTD" submenu

## Overview

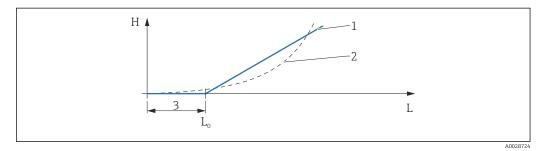
Hydrostatic Tank Deformation can be used to compensate the vertical movement of the Gauge Reference Height (GRH) due to bulging of the tank shell caused by the hydrostatic pressure exerted by the liquid stored in the tank. The compensation is based on a linear approximation obtained from manual hand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



- 94 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.



95 Calculation of the HyTD correction

- 1 Linear correction according to "Deformation factor (→ 🖺 280)"
- 2 Real correction
- 3 Starting level ( $\rightarrow \stackrel{\triangle}{=} 279$ )
- L Measured level ( $\rightarrow \square$  181)
- *H* HyTD correction value ( $\rightarrow \triangle 279$ )

# Calculation of the HyTD correction

$$L \le L_0 \qquad \Rightarrow \qquad C_{HyTD} = 0$$

$$L > L_0 \qquad \Rightarrow \qquad C_{HyTD} = - (L - L_0) \times D$$

A0028715

L	Measured level
$L_0$	Starting level
$c_{HyTD}$	HyTD correction value
D	Deformation factor

Description of parameters

 $\textit{Navigation} \hspace{1cm} \hline{\blacksquare} \hspace{1cm} \textbf{Setup} \rightarrow \textbf{Advanced setup} \rightarrow \textbf{Application} \rightarrow \textbf{Tank calculation}$ 

→ HyTD

HyTD correction value

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  HyTD  $\rightarrow$  HyTD corr.

value

**Description** Shows the correction value from the Hydrostatic Tank Deformation.

Additional information

Read access	Operator
Write access	-

HyTD mode

**Description** Activates or deactivates the calculation of the Hydrostatic Tank Deformation.

Selection ■ No

Yes

Factory setting No

Additional information

Read access	Operator
Write access	Maintenance

Starting level

**Navigation** Setup  $\rightarrow$  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

**Navigation** Setup  $\rightarrow$  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

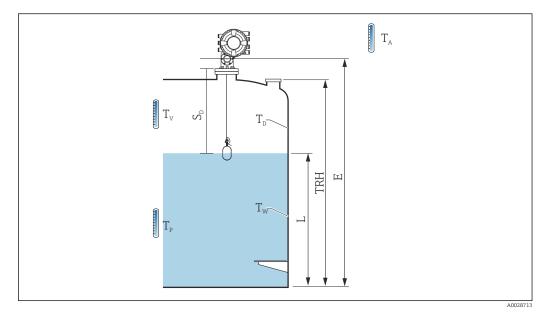
#### "CTSh" submenu

#### 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 ( $\Delta T > 10 \, ^{\circ}\text{C} \, (18 \, ^{\circ}\text{F})$ )
  - 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



■ 96 Parameters for the CTSh calculation

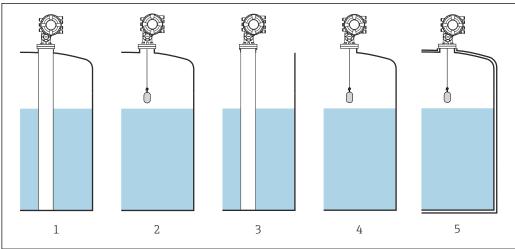
 $T_{W}$ Temperature of the wetted part of the tank shell  $T_D$ Temperature of the dry part of the tank shell  $T_{P}$ Product temperature  $T_{V}$ Vapor temperature (in the tank)  $\mathbf{T}_{\mathsf{A}}$ Ambient temperature (atmosphere surrounding the tank)  $S_d$ Measured distance (Empty to Level) TRH Tank reference height Ε **Empty** L Level

# CTSh: Calculation of the wall temperature

Depending on the parameters Covered tank ( $\rightarrow$   $\cong$  284) and Stilling well ( $\rightarrow$   $\cong$  285), the temperatures  $T_W$  of the wetted and  $T_D$  of the dry part of the tank wall are calculated as follows:

Covered tank (→ 🗎 284)	Stilling well (→ 🖺 285)	T <sub>W</sub>	T <sub>D</sub>
Covered	Yes 1)	T <sub>p</sub>	$T_V$
Covered	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>
Onenton	Yes	T <sub>P</sub>	T <sub>A</sub>
Open top	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 ( $\rightarrow$  🖺 284) = Covered; Stilling well ( $\rightarrow$  🖺 285) = Yes
- 2
- 3

## CTSh: Calculation of the correction

$$C_{\text{CTSh}} = \alpha_{\text{tank}} \left( \text{TRH - L} \right) \left( T_{\text{D}} - T_{\text{cal}} \right) + \alpha_{\text{tank}} L \left( T_{\text{W}} - T_{\text{cal}} \right) - \alpha_{\text{wire}} S_{\text{D}} \left( T_{\text{v}} - T_{\text{cal}} \right)$$

A0030497

TRH	Tank reference height
L	Level
T <sub>D</sub>	Temperature of the dry part of the tank shell (calculated from $T_P$ , $T_V$ and $T_A$ )
T <sub>W</sub>	Temperature of the wetted part of the tank shell (calculated from $T_P$ , $T_V$ and $T_A$ )
T <sub>cal</sub>	Temperature at which the measurement has been calibrated
$\alpha_{tank}$	Linear expansion coefficient of tank
$\alpha_{\mathrm{wire}}$	Linear expansion coefficient of wire
c <sub>CTSh</sub>	CTSh correction value

Description of parameters

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

 $\rightarrow$  CTSh

## CTSh correction value

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

value

**Description** Shows the CTSh correction value.

Additional information

Read access	Operator
Write access	-

CTSh mode

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  CTSh  $\rightarrow$  CTSh mode

**Description** Activates or deactivates the CTSh.

Selection • No

Yes

With wire \*

Only wire

Factory setting No

Additional information

Read access	Operator
Write access	Maintenance

# Covered tank

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

**Description** Determines whether the tank is covered.

**Selection** ■ Open top

Covered

**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** 

Stilling well

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  CTSh  $\rightarrow$  Stilling well

**Description** Determines whether the device is mounted on a stilling well.

Selection ■ No

Yes

Factory setting No

Additional information

Read access	Operator
Write access	Maintenance

Calibration temperature

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

temp

**Description** Specify temperature at which the measurement has been calibrated.

**User entry** −50 to 250 °C

**Factory setting** 25 °C

Additional information

Read access	Operator
Write access	Maintenance

## Linear expansion coefficient

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

coeff

**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  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  CTSh  $\rightarrow$  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

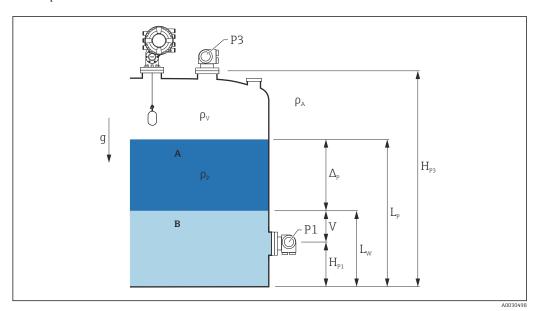
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## "HTMS" submenu

#### 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



■ 97 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 <sub>P1</sub> (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 <sub>P3</sub> (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>	
ρ <sub>V</sub> (Vapor density)	Expert $\rightarrow$ Application $\rightarrow$ Tank configuration $\rightarrow$ Density $\rightarrow$ Vapor density	
ρ <sub>A</sub> (Ambient air temperature)	$Setup \to Advanced \ setup \to Tank \ configuration \to Density \to Air \ density$	
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 → Water level	
$V = L_W - H_{P1}$		
$\Delta_{P} = L_{P} - L_{W} = L_{P} - V - H_{P1}$		

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 ( $\rightarrow \boxminus 289$ ). 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 (→ 🗎 289)	Measured variables	Required additional parameters	Calculated variables
HTMS P1	■ P <sub>1</sub> ■ L <sub>p</sub>	■ g ■ H <sub>p1</sub> ■ L <sub>W</sub> (optional)	$\rho_{P}$
HTMS P1+P3	• P <sub>1</sub> • P <sub>3</sub> • L <sub>p</sub>	$\begin{array}{c} \bullet & \rho_V \\ \bullet & \rho_A \\ \bullet & g \\ \bullet & H_{P1} \\ \bullet & H_{P3} \\ \bullet & L_W \ (optional) \end{array}$	P <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:

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

A002886

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

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

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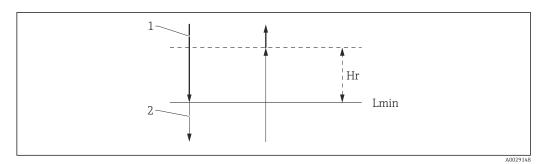
 $L_{min}$  is defined in the **Minimum level** parameter ( $\rightarrow \triangleq 290$ ). As can be seen from the formula it always must be bigger than  $H_{P1}$ .

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** ( $\rightarrow \ \, \cong \ \, 290$ )), 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.



■ 98 HTMS hysteresis

1 Value calculated

2 Value held/manual

 $L_{min}$  Minimum level ( $\rightarrow$   $\stackrel{\triangle}{=}$  290)

 $H_r$  Hysteresis ( $\rightarrow \square$  291)

## Description of parameters

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

HTMS mode

**Navigation** 

 $\blacksquare$  Setup → Advanced setup → Application → Tank calculation → HTMS → HTMS mode

Description

Defines the HTMS mode. Depending on the mode one or two pressure transmitters are used.

Selection

HTMS P1HTMS P1+P3

# **Factory setting**

HTMS P1

## Additional information

Read access	Operator
Write access	Maintenance

Meaning of the options

■ HTMS P1

Only a bottom pressure transmitter (P1) is used.

■ HTMS P1+P3

A bottom (P1) and top (P3) pressure transmitter are used. This option should be selected for pressurized tanks.

Manual density

Navigation

Description

Defines the manual density.

**User entry**  $0 \text{ to } 3000 \text{ kg/m}^3$ 

**Factory setting** 800 kg/m<sup>3</sup>

Additional information

Read access	Maintenance
Write access	Maintenance

Density value

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  HTMS  $\rightarrow$  Density value

**Description** Shows the calculated product density.

Additional information

Read access	Operator
Write access	-

Minimum level

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

 $\textbf{Navigation} \hspace{1cm} \hline \blacksquare \hspace{1cm} \exists \hspace{1cm} \mathsf{Setup} \to \mathsf{Advanced} \hspace{1cm} \mathsf{setup} \to \mathsf{Application} \to \mathsf{Tank} \hspace{1cm} \mathsf{calculation} \to \mathsf{HTMS} \to \mathsf{Minimum}$ 

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

290

Additional	inform	ation
Additional	шиопп	lation

Read access	Operator
Write access	Maintenance

Safety distance

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

distance

**Description** Defines the minimum level which must be present above the bottom pressure sensor

before its signal is used for the calculation.

**User entry** 0 to 10 000 mm

Factory setting 2 000 mm

Additional information

Read access	Operator
Write access	Maintenance

Hysteresis 🗈

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Tank calculation  $\rightarrow$  HTMS  $\rightarrow$  Hysteresis

**Description** Defines the hysteresis for the HTMS calculation. Prevents constant switching if the level is

near the switch-over point.

**User entry** 0 to 2 000 mm

**Factory setting** 50 mm

Additional information

Read access	Operator
Write access	Maintenance

Water density

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

density

**Description** Density of the water in the tank.

**User entry** Signed floating-point number

Factory setting  $1000 \text{ kg/m}^3$ 

# Additional information

Read access	Operator
Write access	Maintenance

"Alarm" submenu

Navigation  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm

"Alarm" submenu

Navigation  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm

► Alarm		
	Alarm mode	→ 🖺 293
	Error value	→ 🖺 294
	Alarm value source	→ 🖺 295
	Alarm value	→ 🖺 296
	HH alarm value	→ 🖺 296
	H alarm value	→ 🖺 296
	L alarm value	→ 🖺 297
	LL alarm value	→ 🖺 297
	HH alarm	→ 🖺 297
	H alarm	→ 🖺 298
	HH+H alarm	→ 🖺 298
	L alarm	→ 🖺 298
	LL alarm	→ 🖺 298
	LL+L alarm	→ 🖺 299
	Any error	→ 🖺 299
	Clear alarm	→ 🖺 299

Alarm mode

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

**Description** Defines the alarm mode of the selected alarm.

Selection ■ Off

■ On

Latching

**Factory setting** Off

## Additional information

Read access	Operator
Write access	Maintenance

Meaning of the options

Off

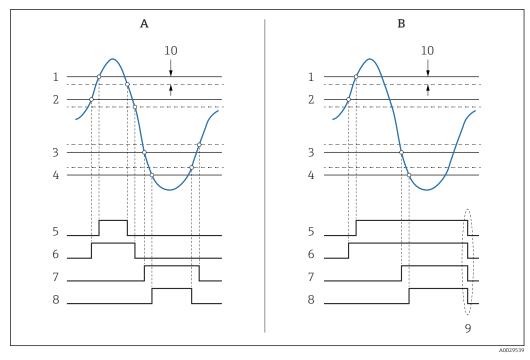
No alarms are generated.

■ 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** ( $\Rightarrow$  riangleq **299)** = **Yes** or the power is switched off and on.



■ 99 Principle of the limit evaluation

- A Alarm mode ( $\rightarrow \square 293$ ) = On
- B Alarm mode ( $\rightarrow \stackrel{.}{\cong} 293$ ) = Latching
- 1 HH alarm value ( $\rightarrow \implies 296$ )
- 2 H alarm value ( $\rightarrow \square$  296)
- 3 Lalarm value ( $\Rightarrow 297$ )
- 6 H alarm ( $\rightarrow \square 298$ )
- 7 Lalarm (→ 🖺 298)
- 8 LL alarm ( $\rightarrow \square 298$ )
- 9 "Clear alarm ( $\rightarrow \triangleq 299$ )" = "Yes" or power off-on
- 10 Hysteresis (→ 🖺 300)

Error value 🙃

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Error value

Prerequisite Alarm mode ( $\Rightarrow \triangleq 293$ )  $\neq Off$ 

**Description** Defines the alarm to be issued if the input value is invalid.

**Selection** ■ No alarm

- HH+H alarm
- H alarm
- L alarm
- LL+L alarm
- All alarms

Factory setting All alarms

Additional information Read access

Read access	Operator
Write access	Maintenance

Alarm value source 

Navigation

Prerequisite Alarm mode ( $\rightarrow \triangleq 293$ )  $\neq$  Off

Description Determines the process variable to be monitored.

■ Tank level Selection

- Liquid temperature
- Vapor temperature
- Water level
- P1 (bottom)
- P2 (middle)
- P3 (top)
- Observed density value
- Volume
- Flow velocity
- Volume flow
- Vapor density
- Middle density
- Upper density
- Correction
- Tank level % ■ GP 1...4 value
- Measured level
- P3 position
- Tank reference height
- Local gravity
- P1 position
- Manual density
- Tank ullage
- Average profile density
- Lower density
- Upper interface level
- Lower interface level
- Bottom level
- Displacer position
- HART device 1...15 PV
- HART device 1...15 SV
- HART device 1...15 TV
- HART device 1...15 QV
- HART device 1...15 PV mA
- HART device 1...15 PV %
- Element temperature 1...24
- AIO B1-3 value
- AIO C1-3 value
- AIP B4-8 value
- AIP C4-8 value
- None

#### **Factory setting** None

## Additional information

Read access	Operator
Write access	Maintenance

Alarm value

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm value

Prerequisite Alarm mode (→ 🗎 293) ≠ 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**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  HH alarm value

Prerequisite Alarm mode ( $\Rightarrow \triangleq 293$ )  $\neq Off$ 

**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**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  H alarm value

Prerequisite Alarm mode (→ 🖺 293) ≠ 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**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  Lalarm value

Prerequisite Alarm mode ( $\Rightarrow \triangleq 293$ )  $\neq Off$ 

**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

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  LL alarm value

Prerequisite Alarm mode (→ 🖺 293) ≠ 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**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  HH alarm

Prerequisite Alarm mode (→ 🖺 293) ≠ Off

**Description** Shows whether an HH alarm is currently active.

Additional information

Read access	Operator
Write access	-

H alarm

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  H alarm

Prerequisite Alarm mode (→ 🖺 293) ≠ Off

**Description** Shows whether an H alarm is currently active.

Additional information

Read access	Operator
Write access	-

#### HH+H alarm

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  HH+H alarm

Prerequisite Alarm mode (→ 🖺 293) ≠ Off

**Description** Shows whether an HH or H alarm is currently active.

Additional information

Read access	Operator
Write access	-

#### L alarm

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  L alarm

Prerequisite Alarm mode ( $\Rightarrow \triangleq 293$ )  $\neq Off$ 

**Description** Shows whether an L alarm is currently active.

Additional information

Read access	Operator
Write access	-

# LL alarm

Prerequisite Alarm mode (→ 🖺 293) ≠ Off

**Description** Shows whether an LL alarm is currently active.

#### Additional information

Read access	Operator
Write access	-

#### LL+L alarm

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  LL+L alarm

Prerequisite Alarm mode (→ 🖺 293) ≠ Off

**Description** Shows whether an LL or L alarm is currently active.

Additional information

Read access	Operator
Write access	-

## Any error

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm  $\rightarrow$  Any error

Prerequisite Alarm mode (→ 🗎 293) ≠ Off

**Description** Show whether any alarm is currently active.

**User interface** ■ Unknown

InactiveActiveError

Factory setting Unknown

Additional information

Read access	Operator
Write access	-

Clear alarm

 $\textbf{Navigation} \hspace{1cm} \hline \blacksquare \hspace{1cm} \textbf{Setup} \rightarrow \textbf{Advanced setup} \rightarrow \textbf{Application} \rightarrow \textbf{Alarm} \rightarrow \textbf{Clear alarm}$ 

Prerequisite Alarm mode (→ 🗎 293) = Latching

**Description** Deletes an alarm which is still active although the alarm condition is no longer present.

Selection ■ No ■ Yes

. .

**Factory setting** No

## Additional information

Read access	Operator
Write access	Maintenance

Alarm hysteresis

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Application  $\rightarrow$  Alarm  $\rightarrow$  Alarm hysteresis

Prerequisite Alarm mode (→ 🖺 293) ≠ 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

æ

**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  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings

Output out of range

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings  $\rightarrow$  Output out range

**Description** Selection of behavior between Alarm or Last valid value when displacer reached

HighStoplevel, LowStopLevel or ReferencePosition.

**Selection** • Last valid value

AlarmNone

Factory setting Last valid value

Additional information

Read access	Operator
Write access	Maintenance

Output out of range

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings  $\rightarrow$  Output out range

**Description** Selection of behavior when displacer reached **High stop level** (→ 🗎 195), **Low stop level** 

or **Reference position**.

**Selection** • Last valid value

AlarmNone

**Factory setting** Last valid value

Additional information

Read access	Operator
Write access	Maintenance

High stop level

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings  $\rightarrow$  High stop level

**Description** Position of the displacer high stop as measured from defined zero position (tank bottom or

datum plate).

**User entry** -999 999.9 to 999 999.9 mm

**Factory setting** 

Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

Low stop level

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings  $\rightarrow$  Low stop level

**Description** Position of the displacer low stop as measured from defined zero position (tank bottom or

datum plate).

**User entry** -999 999.9 to 999 999.9 mm

**Factory setting** 0 mm

Additional information

Read access	Operator
Write access	Maintenance

Slow hoist zone



**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings  $\rightarrow$  Slow hoist zone

**Description** Defines the interval in millimeters, measured down from the Reference Position, in which

the Displacer reduces moving speed.

**User entry** 10 to 999 999.9 mm

**Factory setting** 70 mm

Additional information

Read access	Operator
Write access	Maintenance

Overtension weight



**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings  $\rightarrow$  Overtension wgt

**Description** Sets the minimum Weight in grams when Overtension Alarm will be set.

**User entry** 100 to 999.9 q

**Factory setting** 350 g

302

# Additional information

Read access	Operator
Write access	Maintenance

Undertension weight

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Safety settings  $\rightarrow$  Undertension wgt

**Description** Defines the undertension error weight. Untertension error will be issued if displacer

weight is below this value longer than 7 seconds.

**User entry** 0 to 300 g

**Factory setting** 10 g

Additional information

Read access	Operator
Write access	Maintenance

# "Sensor config" submenu

Navigation 

Post gauge command		
Navigation	$\blacksquare$ Setup $\rightarrow$ Advanced setup $\rightarrow$ Sensor config $\rightarrow$ Post gauge cmd	

Description Defines the gauge command that will be executed after a one-time gauge command has

finished.

Selection Stop Level

■ Up

Upper I/F levelLower I/F level

None

Level

Factory setting

Additional information

Read access	Operator
Write access	Maintenance

"Displacer" submenu

*Navigation*  $\blacksquare \square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer

Displacer type

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer type

**Description** Chooses the type of displacer used.

**Selection** • Custom diameter

Diameter 30 mmDiameter 50 mmDiameter 70 mmDiameter 110 mm

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

Displacer diameter

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer diamet

Prerequisite Displacer type ( $\rightarrow \triangleq 305$ ) = Custom diameter

**Description** Sets the diameter of the cylindrical part of displacer.

**User entry** 0 to 999.9 mm

**Factory setting** See label on the device.

Additional information

Read access	Operator
Write access	Maintenance

Displacer weight

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer  $\rightarrow$  Displacer weight

**Description** Set the weight of the diplacer in air. Indicated on the displacer in grams.

**User entry** 10 to 999.9 g

**Factory setting** See label on the device.

# Additional information

Read access	Operator
Write access	Maintenance

Displacer volume

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer  $\rightarrow$  Displacer volume

**Description** Displacer volume indicated on displacer in mililiter.

User entry 10 to 999.9 ml

**Factory setting** See label on the device.

Additional information

Read access	Operator
Write access	Maintenance

Displacer balance volume

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer  $\rightarrow$  Balance volume

**Description** Defines the balance volume of the displacer as the lower part of displacer immersed in

liquid. Units in milliliters. Indicated on displacer.

**User entry** 10 to 999.9 ml

**Factory setting** See label on the device.

Additional information

Read access	Operator
Write access	Maintenance

Displacer height

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer  $\rightarrow$  Displacer height

**Description** Sets the displacer height in mm. Used for density measurement as minimum distance

between last profile point and liquid level.

**User entry** 10 to 300 mm

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

Immersion depth

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Displacer  $\rightarrow$  Immersion depth

**Description** Defines distance (mm) from displacer bottom to balancing line defined by balanced

volume. Value is needed for correct bottom level measurement.

**User entry** 0 to 99.9 mm

**Factory setting** Dependent on the device version

Additional information

Read access	Operator
Write access	Maintenance

"Wiredrum" submenu

*Navigation*  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Wiredrum

Drum circumference

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Wiredrum  $\rightarrow$  Drum circumfer

**Description** Sets the circumference of the wire drum. Indicated in Label.

**User entry** 100 to 999.9 mm

**Factory setting** See label on the device.

Additional information

Read access	Operator
Write access	Maintenance

Wire weight

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Wiredrum  $\rightarrow$  Wire weight

**Description** Defines the weight of the measuring wire in g/10m. Indicated on Label.

**User entry** 0 to 999.9 g

**Factory setting** See label on the device.

Additional information

Read access	Operator
Write access	Maintenance

"Spot density" submenu

*Navigation*  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Spot density

Upper density offset

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Spot density  $\rightarrow$  Up dens. offset

**Description** Defines an offset value which is added to the measured upper density value.

**User entry** -999.99 to 999.99 kg/m<sup>3</sup>

**Factory setting** 0 kg/m<sup>3</sup>

Additional information

Read access	Operator
Write access	Maintenance

Middle density offset

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Spot density  $\rightarrow$  Mid dens. offset

**Description** Defines an Offset Value which is added to the measured Middle Density Value.

**User entry**  $-999.99 \text{ to } 999.99 \text{ kg/m}^3$ 

**Factory setting** 0 kg/m<sup>3</sup>

Additional information

Read access	Operator
Write access	Maintenance

Lower density offset

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Spot density  $\rightarrow$  Low dens. offset

**Description** Defines an offset value which is added to the measured lower density value.

**User entry**  $-999.99 \text{ to } 999.99 \text{ kg/m}^3$ 

**Factory setting** 0 kg/m<sup>3</sup>

Additional information

Read access	Operator
Write access	Maintenance

Submersion depth

**Navigation**  $\blacksquare \ \$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Spot density  $\rightarrow$  Submersion depth

**Description** Sets the displacer submersion depth (mm) for spot density operations.

**User entry** 50 to 99 999.9 mm

**Factory setting** 150 mm

Additional information

Read access	Operator
Write access	Maintenance

"Profile density" submenu

*Navigation*  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density

# Density measurement mode

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density  $\rightarrow$  Density mode

**Description** In normal measure mode, measures at specified positions. In compensation mode

measures using next integer value of drum turns to improve accuracy.

**Selection** • Normal measure mode

Compensation mode

Factory setting Normal measure mode

Additional information

Read access	Operator
Write access	Maintenance

In normal mode, measures spot densities at requested positions. In compensations mode the Proservo measures the spot densities at multiples of the wiredrum circumference (e.g. every ~ 150 mm (5.91 in))

Manual profile level

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density  $\rightarrow$  Man profile lvl

**Description** Sets the level position in the tank where the manual profile density operation starts.

**User entry** -999 999.9 to 999 999.9 mm

Factory setting 1000 mm

Additional information

Read access	Operator
Write access	Maintenance

#### Profile density offset distance

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density  $\rightarrow$  Dens offset dist

**Description** Profile density offset distance [mm] is the distance between start point and first

measurement point.

**User entry** 0 to 999 999.9 mm

**Factory setting** 

500 mm

Additional information

Read access	Operator
Write access	Maintenance

Profile density interval

**Description** Sets the interval between two measurement points in profile density operation.

**User entry** 1 to 100 000 mm

Factory setting 1000 mm

Additional information

Read access	Operator
Write access	Maintenance

Profile density offset

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Sensor config  $\rightarrow$  Profile density  $\rightarrow$  Prof dens offset

**Description** Defines an offset value which is added to the measured profile density value.

**User entry**  $-999.99 \text{ to } 999.99 \text{ kg/m}^3$ 

**Factory setting** 0 kg/m<sup>3</sup>

Additional information

Read access	Operator
Write access	Maintenance

# "Display" submenu

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

Navigation  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display

Language

**Navigation**  $\blacksquare \blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display  $\rightarrow$  Language

**Prerequisite** The device has a local display.

**Description** Set display language.

Selection • English

Deutsch

русский язык (Russian)日本語 (Japanese)

■ Español ■ 中文 (Chinese)

Factory setting English

Additional information

Read access	Operator
Write access	Operator

# Format display

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display  $\rightarrow$  Format display

**Prerequisite** The device has a local display.

**Description** Select how measured values are shown on the display.

**Selection** ■ 1 value, max. size

■ 1 bargraph + 1 value

2 values

■ 1 value large + 2 values

4 values

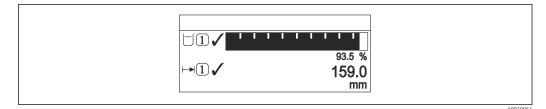
**Factory setting** 2 values

Additional information

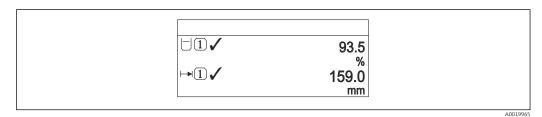
4841.000 mm

A0019963

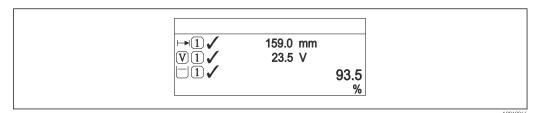
🖸 100 "Format display" = "1 value, max. size"



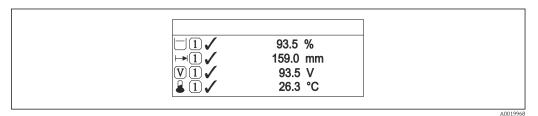
■ 101 "Format display" = "1 bargraph + 1 value"



■ 102 "Format display" = "2 values"



■ 103 "Format display" = "1 value large + 2 values"



■ 104 "Format display" = "4 values"

Read access	Operator
Write access	Operator

- The **Value 1 to 4 display (→** 🗎 **314)** 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 ( $\rightarrow \cong 317$ ).

Value 1 to 4 display

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display  $\rightarrow$  Value 1 display

**Prerequisite** The device has a local display.

# Description

Select the measured value that is shown on the local display.

Selection

- None 9)
- Tank level
- Measured level
- Level linearized
- Tank level %
- Water level 9)
- Liquid temperature <sup>9)</sup>
- Vapor temperature <sup>9)</sup>
- Air temperature <sup>9)</sup>
- Tank ullage
- Tank ullage %
- Observed density value <sup>9)</sup>
- P1 (bottom) 9)
- P2 (middle) 9)
- P3 (top) <sup>9)</sup>
- GP 1 value 9)
- GP 2 value <sup>9)</sup>
- GP 3 value <sup>9)</sup>
- GP 4 value <sup>9)</sup>
- Gauge command 9)
- Gauge status <sup>9)</sup>
- AIO B1-3 value 9)
- AIO B1-3 value mA 9)
- AIO B1-3 value % 9)
- AIO C1-3 value 9)
- AIO C1-3 value mA 9)
- AIO C1-3 value % 9)
- AIP B4-8 value <sup>9)</sup>
- AIP B4-8 value mA 9)
- AIP B4-8 value % 9)
- AIP C4-8 value 9)
- AIP C4-8 value mA 9)
- AIP C4-8 value % 9)

# **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>9)</sup> not available for the **Value 1 display** parameter

Selection

■ X

■ X.X

x.xxx.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

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display  $\rightarrow$  Separator

**Prerequisite** The device has a local display.

**Description** Select decimal separator for displaying numerical values.

Selection • .

■ ,

Factory setting

Additional information

Read access	Operator
Write access	Maintenance

**Number format** 

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display  $\rightarrow$  Number format

**Prerequisite** The device has a local display.

**Description** Choose number format for the display.

Selection ■ Decimal ■ ft-in-1/16"

Factory setting Decimal

Additional information

Read access	Operator
Write access	Maintenance

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

Header 🗈

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

**Prerequisite** The device has a local display.

**Description** Select header contents on local display.

**Selection** • Device tag

Free text

**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 ( $\Rightarrow \implies 191$ ).

Free text

The header contents is defined in the **Header text** parameter ( $\rightarrow \implies 317$ ).

Header text

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Display  $\rightarrow$  Header text

Prerequisite Header (→ 🖺 317) = Free text

**Description** Enter display header text.

**User entry** Character string comprising numbers, letters and special characters (11)

**Factory setting** TG-Platform

Additional information

Read access	Operator
Write access	Maintenance

## Display interval

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

Prerequisite The device has a local display.

Description Set display reaction time to fluctuations in the measured value.

0.0 to 999.9 s **User entry** 

**Factory setting**  $0.0 \, s$ 

Additional information

Read access	Operator
Write access	Maintenance

# **Backlight**

Navigation 

Prerequisite The device has a local display.

Description Switch the local display backlight on and off.

Selection ■ Disable

■ Enable

**Factory setting** Enable

Additional information

Read access	Operator
Write access	Operator

# Contrast display

Navigation

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 %

**Factory setting** 30 %

Additional information

Read access	Operator
Write access	Operator

# "System units" submenu

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

Units preset

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  System units  $\rightarrow$  Units preset

**Description** Defines a set of units for length, pressure and temperature.

Selection ■ mm, bar, °C

- m, bar, °C
- mm, PSI, °C
- ft, PSI, °F
- ft-in-16, PSI, °F
- ft-in-8, PSI, °F
- Customer value

**Factory setting** 

mm, bar, °C

Additional information

Read access	Operator
Write access	Maintenance

If the **Customer value** option is selected, the units are defined in the following parameters. In any other case these are read-only parameters used to indicate the respective unit:

- Distance unit ( $\rightarrow$  🖺 320)
- Pressure unit ( $\rightarrow$  🖺 321)
- Temperature unit (→ 🖺 321)

Distance unit

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  System units  $\rightarrow$  Distance unit

**Description** Select distance unit.

**Selection** SI units US units

m
 mm
 in
 cm
 ft-in-16

■ ft-in-8

Factory setting mm

Additional information

Read access	Operator
Write access	Maintenance (if <b>Units preset (→ 🖺 191) = Customer value</b> )

Pressure unit

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  System units  $\rightarrow$  Pressure unit

SelectionSI unitsUS unitsOther units

bar psi inH2O
 Pa inH2O (68°F)
 kPa ftH2O (68°F)
 MPa mmH2O
 mbar a mmHg

Factory setting bar

Additional information

Read access	Operator
Write access	Maintenance (if <b>Units preset (→ 🖺 191) = Customer value</b> )

Temperature unit

**Navigation**  $\blacksquare$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  System units  $\rightarrow$  Temperature unit

**Description** Select temperature unit.

Selection  $SI \ units$   $US \ units$   $\bullet$   $^{\circ}F$ 

• K

**Factory setting** °C

Additional information Read access Operator

Write access Maintenance (if Units preset (→ 🖺 191) = Customer value)

Density unit

**Navigation**  $\blacksquare \Box$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  System units  $\rightarrow$  Density unit

**Description** Select density unit.

SelectionSI unitsUS unitsOther units•  $g/cm^3$ •  $lb/ft^3$ •  $^\circ$ API• g/ml• lb/qal (us)• SGU

g/ml
 g/l
 lb/in³
 kg/l
 STon/yd³

■ kg/dm³
■ kg/m³

**Factory setting** kg/m<sup>3</sup>

# Additional information

Read access	Operator
Write access	Maintenance (if <b>Units preset (→ 🖺 191) = Customer value</b> )

## "Date / time" submenu

*Navigation*  $\blacksquare \square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time

Date/time

**Navigation** Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  Date/time

**Description** Displays the device internal real time clock.

**Additional information** 

Read access	Operator
Write access	-

Set date

**Navigation**  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  Set date

**Description** Controls the setting of the real-time clock.

**Selection** • Please select

Abort

Start

■ Confirm time

Factory setting

Please select

## Additional information

Read access	Operator
Write access	Maintenance

# Meaning of the options

# ■ Please select

Prompts the user to select an action.

# Abort

Discards the entered date and time.

## Start

Starts the setting of the real time clock.

## Confirm time

Sets the real-time clock to the entered date and time.

Year

Navigation

 $\blacksquare$  Setup → Advanced setup → Date / time → Year

Prerequisite Set date (→ 🗎 323) = Start

**Description** Enter the current year.

**User entry** 2 016 to 2 079

Factory setting 2 016

Additional information

Read access	Operator
Write access	Maintenance

Month

**Navigation**  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  Month

Prerequisite Set date (→ 🖺 323) = Start

**Description** Enter the current month.

**User entry** 1 to 12

Factory setting 1

Additional information

Read access	Operator
Write access	Maintenance

Day 🗈

**Navigation**  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  Day

Prerequisite Set date (→ 🗎 323) = Start

**Description** Enter the current day.

**User entry** 1 to 31

Factory setting 1

Additional information

Read access	Operator
Write access	Maintenance

Hour

**Navigation**  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  Hour

Prerequisite Set date (→ 🗎 323) = Start

**Description** Enter the current hour.

**User entry** 0 to 23

**Factory setting** 0

Additional information

Read access	Operator
Write access	Maintenance

Minute ©

**Navigation**  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Date / time  $\rightarrow$  Minute

**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

# "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

Setup → Advanced setup → Deactiv. SIL/WHG

#### "Administration" submenu

*Navigation*  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Administration

Define access code

**Navigation**  $\square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Administration  $\rightarrow$  Def. access code

**Description** Define release code for write access to parameters.

**User entry** 0 to 9 999

**Factory setting** 0

#### Additional information

Read access	Operator
Write access	Maintenance

- If the factory setting is not changed or 0 is defined as the access code, the parameters are not write-protected and the configuration data of the device can then always be modified. The user is logged on in the *Maintenance* role.
- The write protection affects all parameters marked with the 🖹 symbol in this document.
- 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  $(\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ )$

Device reset

**Navigation**  $\blacksquare \square$  Setup  $\rightarrow$  Advanced setup  $\rightarrow$  Administration  $\rightarrow$  Device reset

**Description** Reset the device configuration - either entirely or in part - to a defined state

Selection • Cancel

To factory defaultsRestart device

Factory setting Cancel

Additional information Meaning of the options

Cancel

No action

To factory defaults

All parameters are reset to the order-code specific factory setting.

Restart device

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.

Read access	Operator
Write access	Maintenance

# 15.4 "Diagnostics" menu

# **Actual diagnostics**

**Navigation** 

Description

Displays the currently active diagnostic message.

If there is more than one pending diagnostic event, the message for the diagnostic event with the highest priority is displayed.

# 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** 

Description

Displays the timestamp for the currently active diagnostic message.

# Additional information

Read access	Operator
Write access	-

# **Previous diagnostics**

Navigation

□ □ 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**

**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**  $\Box$  Diagnostics  $\rightarrow$  Time fr. restart

**Description** Indicates how long the device has been in operation since the last time the device was

restarted.

Additional information

Read access	Operator
Write access	-

# Operating time

**Navigation**  $\square$  Diagnostics  $\rightarrow$  Operating time

**Description** Indicates how long the device has been in operation.

Additional information

Read access	Operator
Write access	-

Date/time

**Description** Displays the device internal real time clock.

Additional information

Read access	Operator
Write access	-

#### "Diagnostic list" submenu 15.4.1

Navigation □ □ Diagnostics → Diagnostic list

Diagnostics 1 to 5

Navigation □ Diagnostics → Diagnostic list → Diagnostics 1 to 5

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

Navigation 

Description Timestamp of the diagnostic message.

# 15.4.2 "Device information" submenu

Navigation  $\blacksquare \square$  Diagnostics  $\rightarrow$  Device info

Device tag

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  Device info  $\rightarrow$  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**  $\blacksquare \square$  Diagnostics  $\rightarrow$  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**  $\blacksquare$  Diagnostics  $\rightarrow$  Device info  $\rightarrow$  Firmware version

**Description** Displays the device firmware version installed.

Additional information

Read access	Operator
Write access	-

# Firmware CRC

**Navigation** □□ Diagnostics → Device info → Firmware CRC

**Description** Result of the cyclic redundancy check of the firmware.

Additional information

Read access	Operator
Write access	-

# Weight and measures configuration CRC

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  Device info  $\rightarrow$  W&M config CRC

**Description** Result of the cyclic redundancy check of the weights and measure relevant parameters.

Additional information

Read access	Operator
Write access	-

#### Device name

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  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** Diagnostics  $\rightarrow$  Device info  $\rightarrow$  Order code

**Description** Shows the device order code.

Additional information

Read access	Operator
Write access	Service

Extended order code 1 to 3

**Navigation**  $\blacksquare$  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
Read access	

Device alarm simulation

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  Simulation  $\rightarrow$  Dev. alarm sim.

**Description** Switch the device alarm on and off.

Selection ■ Off

■ On

Off

**Factory setting** 

Additional information

Read access	Operator
Write access	Maintenance

# Diagnostic event simulation

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  Simulation  $\rightarrow$  Diagnostic event

**Description** Select a diagnostic event to simulate this event.

**Selection** The diagnostic events of the device

**Factory setting** Off

Additional information

Read access	Operator
Write access	Maintenance

To terminate the simulation, select **Off**.

# Simulation distance on

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  Simulation  $\rightarrow$  Sim distance on

**Description** Switches the distance simulation on or off.

Selection ■ Off

■ On

336

Factory setting

Additional information

Read access	Operator
Write access	Maintenance

Simulation distance

**Navigation**  $\blacksquare \Box$  Diagnostics  $\rightarrow$  Simulation  $\rightarrow$  Sim distance

Prerequisite Simulation distance on  $( \rightarrow \bigcirc 336) = On$ 

Off

**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 simulation**

**Navigation**  $\square$  Diagnostics  $\rightarrow$  Simulation  $\rightarrow$  Curr.outp N sim.

**Prerequisite** ■ The device has an Anlog I/O module.

■ Operating mode (→ 🖺 221) = 4..20mA output or HART slave +4..20mA output

**Description** Switches the simulation of the current on or off.

Selection ■ Off

On

**Factory setting** Off

Additional information

Read access	Operator
Write access	Maintenance

Simulation value

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  Simulation  $\rightarrow$  Simulation value

Prerequisite Current output simulation (→ 🗎 337) = 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	Operator
Write access	Maintenance

# 15.4.4 "Device check" submenu

Navigation  $\Box$  Diagnostics  $\rightarrow$  Device check

Result drum check

**Navigation**  $\Box$  Diagnostics  $\rightarrow$  Device check  $\rightarrow$  Result drum chk

**Description** Gives feedback on the latest status of the commissioning check.

Additional information

Read access	Operator
Write access	-

# "Commissioning check" wizard

Navigation Diagnostics  $\rightarrow$  Device check  $\rightarrow$  Commission check

Commissioning check			
Navigation			
Description	This sequence supports checking of the hardware on sensor side and correct installation of the sensor.		
Additional information	Read access		Operator
	Write access		Maintenance
Result drum check			
Navigation	□ □ Diagnostics → I	Device checl	$x \rightarrow Commission check \rightarrow Result drum chk$
Description	Gives feedback on the latest status of the commissioning check.		
Additional information	Read access		Operator
	Write access		-
Step X / 11			
Navigation	□□ Diagnostics → Device check → Commission check → Step X / 11		
Description	Indicates which step of the commissioning check is currently running.		
Additional information	Read access		Operator
	Write access		-

# 15.4.5 "LRC 1 to 2" submenu

Navigation  $\blacksquare \square$  Diagnostics  $\rightarrow$  LRC  $\rightarrow$  LRC 1 to 2

LRC Mode

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  LRC Mode

**Description** Activates or deactivates one of the level reference check (LRC) modes.

Selection ■ Off

Compare with level device
 Compare with level switch
 Measure reference point \*

Factory setting Off

Additional information Read access

 Read access
 Operator

 Write access
 Maintenance

**Additional information** The option of the Measure reference point is not available for NMS8x.

Allowed difference

**Navigation**  $\blacksquare \Box$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Allowed diff.

**Description** Defines the allowed difference between the tank level and the reference.

**User entry** 1 to 1000 mm

Factory setting 10 mm

Additional information

 Read access
 Operator

 Write access
 Maintenance

Visibility depends on order options or device settings

# Check fail threshold

Navigation

Description

Defines how many minutes the comparison has to fail before the check is failed. Note:

Only for mode "Compare with level device".

User entry

1 to 60

**Factory setting** 

3

Additional information

Read access	Operator
Write access	Maintenance

#### Reference level source

# **Navigation**

Description

Defines the source for the reference level. Note: Only for mode "Compare with level device".

Selection

- No input value
- HART device 1 level
- HART device 2 level \*
- HART device 3 level ]
- HART device 4 level
- HART device 5 level 3
- HART device 6 level
- HART device 7 level
- HART device 8 level
- HART device 9 level \*
- HART device 10 level \*
- HART device 11 level \*
- HART device 12 level
- HART device 13 level \*
- HART device 14 level \*
- HART device 15 level

# **Factory setting**

No input value

# Additional information

Read access	Operator
Write access	Maintenance

342

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

Reference switch source

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Reference source

**Description** Defines the source for the reference switch. Note: Only for mode "Compare with level

switch".

**Selection** • None

None
Digital A1-2
Digital A3-4
Digital B1-2
Digital B3-4
Digital C1-2

Digital C3-4Digital D1-2Digital D3-4

Factory setting None

Additional information

Read access	Operator
Write access	Maintenance

Reference switch mode

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Ref. switch mode

**Description** Defines the switch direction for which the reference check is executed. Note: Only for

mode "Compare with level switch".

**Selection** ■ Active -> Inactive

■ Inactive -> Active

**Factory setting** Active -> Inactive

Additional information

Read access	Operator
Write access	Maintenance

Reference level

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Reference level

**Description** Shows the current reference level. Note: Only for mode "Compare with level device".

**User interface** Signed floating-point number

**Factory setting** 0 mm

#### Additional information

Read access	Operator
Write access	-

Reference switch level

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Reference level

**Description** Defines the position of the reference switch as level. Note: Only for mode "Compare with

level switch".

**User entry** 0 to 10 000.00 mm

**Factory setting** 0 mm

Additional information

Read access	Operator
Write access	Maintenance

# Reference switch state

**Navigation**  $\blacksquare \Box$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Ref.switch state

**Description** Shows the current state of the reference switch (e.g. "active"). Note: Only for mode

"Compare with level switch".

**User interface** ■ Unknown

InactiveActiveError

Unknown

Factory setting

Additional information

Read access	Operator
Write access	-

# Check level

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Check level

**Description** Shows the tank level at which the reference check has been executed.

**User interface** Signed floating-point number

**Factory setting** 0 mm

# Additional information

Read access	Operator
Write access	Development

# **Check status**

**Navigation**  $\blacksquare$  Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Check status

**Description** Shows the status of the reference check execution (e.g. "passed").

**User interface** ■ not executed

PassedFailedNot possible

**Factory setting** not executed

Additional information

Read access	Operator
Write access	Development

# Check timestamp

**Navigation** Diagnostics  $\rightarrow$  LRC 1 to 2  $\rightarrow$  Check timestamp

**Description** Shows the timestamp at which the reference check has been executed.

**User interface** Character string comprising numbers, letters and special characters

Factory setting

Additional information

Read access	Operator
Write access	-

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# Index

Symbols	С
#blank# (Parameter)	Calibration
0 9	Calibration procedure
	Drum calibration
0 % value (Parameter) 217, 225, 254	Level calibration
4-20mA inputs	Reference calibration
4-20mA output	Sensor calibration
100 % value (Parameter) 218, 226, 254	Calibration (Submenu)
A	Calibration status (Parameter) 201, 203, 205
Access code	Calibration temperature (Parameter)
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