Technical Information
Tankside Monitor NRF81

Tank Gauging

Application

Tankside Monitor NRF81 is a robust gateway for collecting and integrating tank gauging data in storage and process applications. It fulfills the exacting demands of tank inventory management, inventory control, custody transfer, loss control, total cost saving, and safe operation.

Typical areas of application

- Hydrostatic Tank Gauging
- Hybrid Tank Measurement Systems

Your benefits

- SIL2 certified (Min, Max, Continuous level)
- SIL3 (in preparation)
- Up to 6 SIL relay outputs
- Wide range of output signals including V1, Modbus RS 485, and HART protocol
- Integration of e.g. temperature, water level, pressure, overfill prevention sensor
- Robust IP66/68, NEMA Type 4x/6P enclosure
- Operation and display in a wide variety of local languages

Endress+Hauser

People for Process Automation

Table of contents

Document information

Symbols

Safety symbols

Symbol	Meaning
⚠ **DANGER**	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
⚠ **WARNING**	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
⚠ **CAUTION**	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

Electrical symbols

Symbol	Meaning
⎓	Direct current
∼	Alternating current
⎓∼	Direct current and alternating current
⏚	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
⏚	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
▽	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols for certain types of information

Symbol	Meaning
✓	**Permitted** Procedures, processes or actions that are permitted.
✓✓	**Preferred** Procedures, processes or actions that are preferred.
✗	**Forbidden** Procedures, processes or actions that are forbidden.
🛈	**Tip** Indicates additional information.
📖	Reference to documentation
📄	Reference to page
🖼	Reference to graphic
👁	Visual inspection

Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
/EX\	**Hazardous area** Indicates a hazardous area.
⊠	**Safe area (non-hazardous area)** Indicates the non-hazardous area.

Symbols at the device

Symbol	Meaning
⚠→📖	**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.

Function and system design

Integration of tank sensors   The Tankside Monitor is a field device for the integration of tank sensors into tank inventory systems. It is typically installed at the bottom of the tank and allows access to all connected tank sensors. All measured and calculated values can be displayed at the on-site display. Via a field communication protocol, they can be transferred to an inventory control system.
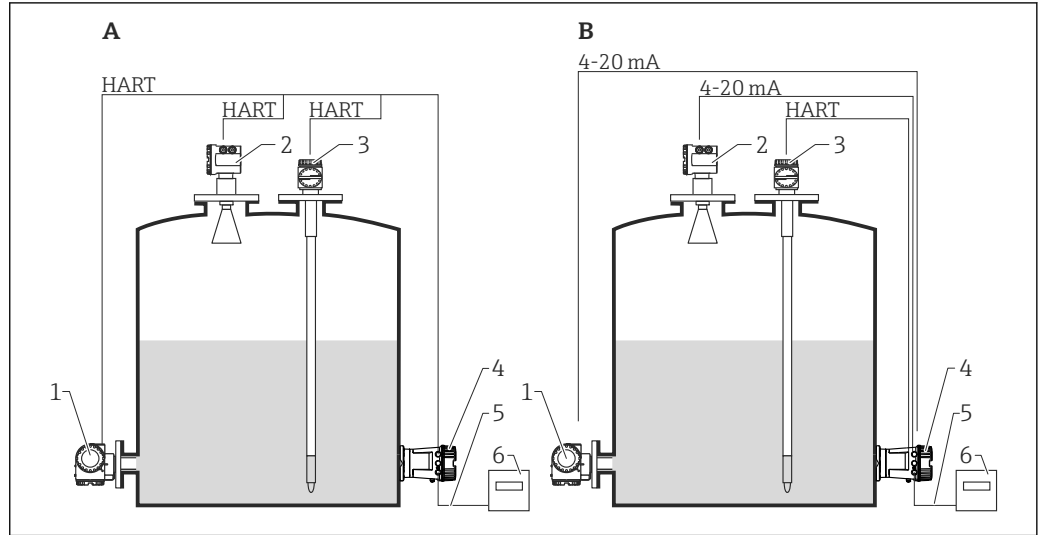
1   Integration of tank sensors with Tankside Monitor (Example)

A   HART multidrop mode
B   HART and analog mode
1   Pressure transmitter
2   Level radar
3   Average temperature transmitter
4   Tankside Monitor
5   Field protocol transmits data to an inventory control system
6   Inventory control system (e.g. Tankvision NXA820 or Tankvision Professional NXA85)

Typical values measured by the sensors are:
• Level
• Spot temperature
• Average temperature
• Water level
• Pressure
• Secondary level value (for critical applications)

Input/output

HART Ex ia/IS active input

A0027364
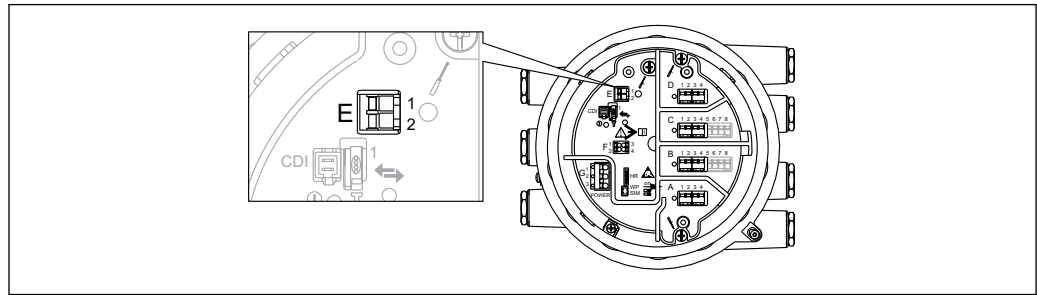
⊡ *2   HART Ex ia/IS active input*

E1   HART +
E2   HART -

The device has a HART Ex ia/IS active input. Additional features are provided if the following Endress+Hauser devices are connected:

- **Prothermo NMT**
  The measured level is transmitted to the Prothermo. Prothermo uses this level to calculate the average temperature of the product.
- **Micropilot S FMR53x**
  The calculated distance correction factor or distance correction value is sent to the Micropilot. Micropilot uses this value to indicate the corrected level at its local display.

Technical data

Transmitter power supply voltage	$23.0\ V - 380\ \Omega \cdot I_{load}$
Maximum load	500 Ω including signal line
Maximum current of all connected devices	24 mA

ⓘ   The HART Ex ia/IS active input is available by default. It needs not to be chosen explicitly when ordering a device.

I/O modules	Overview
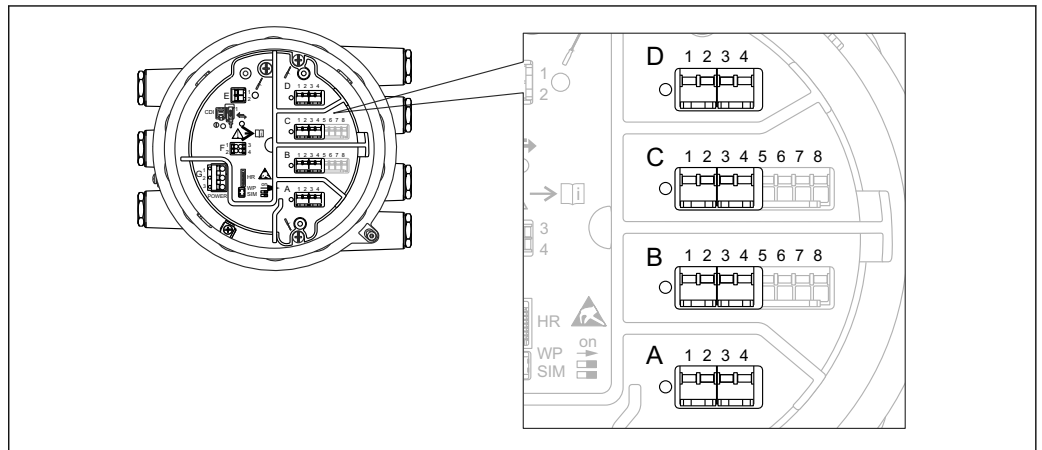
🖾 3   *Position of the I/O modules in the terminal compartment*

The terminal compartment contains 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.

ℹ️ The exact assignment of the modules to the slots is dependent on the device version. For a detailed description refer to the Operating Instructions of the device in question.

ℹ️ The following restrictions apply when selecting the modules:
- The device may contain a maximum of four I/O modules.
- A maximum of two I/O modules with 8 terminals is possible.

Ordering feature 040: "Primary Output"

NRF81 – xxxx XX̲ xx xx ...
         040

Option	Number of I/O modules	Type of I/O module	Number of terminals	Technical data
A1	1	Modbus RS485	4	→ 🖺 8
B1	1	V1	4	→ 🖺 9
E1	1	4-20mA HART Ex d/XP	8	→ 🖺 10
H1	1	4-20mA HART Ex i/IS	8	→ 🖺 10

Ordering feature 050: "Secondary IO Analogue"

NRF81 – xxxx xx XX̲ xx ...
          050

Option	Number of I/O modules	Type of I/O module	Number of terminals	Technical data
A1	1	1 x "Ex d/XP 4-20mA HART + RTD input"	1 x 8	→ 🖺 10
A2	2	2 x "Ex d/XP 4-20mA HART + RTD input"	2 x 8	→ 🖺 10
B1	1	1 x "Ex i/IS 4-20mA HART+ RTD input"	1 x 8	→ 🖺 10
B2	2	2 x "Ex i/IS 4-20mA HART+ RTD input"	2 x 8	→ 🖺 10
C2	2	1 x "Ex i/IS 4-20mA HART + RTD input" 1 x "Ex d/XP 4-20mA HART + RTD input"	2 x 8	→ 🖺 10
X0	0	none	0	-

Ordering feature 060: "Secondary IO Digital Exd"

NRF81 – xxxx xx xx <u>XX</u> ...
          060

Option	Number of I/O modules	Type of I/O module	Number of terminals	Technical data
A1	1	1 x "2x relay + 2x discrete I/O"	1 x 4	→ 🕮 12
A2	2	2 x "2x relay + 2x discrete I/O"	2 x 4	→ 🕮 12
A3	3	3 x "2x relay + 2x discrete I/O"	3 x 4	→ 🕮 12
B1	1	1x "Modbus RS485"	1 x 4	→ 🕮 8
B2	2	1x "Modbus RS485" 1 x "2x relay + 2x discrete I/O"	2 x 4	→ 🕮 8 → 🕮 12
B3	3	1x "Modbus RS485" 2 x "2x relay + 2x discrete I/O"	3 x 4	→ 🕮 8 → 🕮 12
X0	0	none	0	-

"Modbus RS485": Technical data

No. of units	Maximum 15 instruments per loop
Baud rate	Selectable: • 600 bit/s • 1 200 bit/s • 2 400 bit/s • 4 800 bit/s • 9 600 bit/s • 19 200 bit/s
Parity	Selectable: • Odd • Even • None
Cable	Three-wire cable with screening. The screening must be connected inside the housing.
Termination resistors	To be set as required in specific environments
Topology	• Serial bus • Tree structure
Transmission distance	Maximum 1 200 m (3 900 ft) including limbs or branches; branches under 3 m (9.8 ft) are negligible
Instrument address	Each transmitter has an individual bus address configured in the software of the transmitter.
Isolation	Bus inputs are electrically isolated from the other electronics.
Error on alarm	Error message classified according to NAMUR NE 107

"V1": Technical data

No. of units	Maximum 10 instruments per loop
Baud rate	3 300 bit/s
Parity	Selectable: • Odd • Even • None
Cable	• Two-wire twisted pair; screening recommended • Two-wire unscreened
Termination resistors	Not required
Topology	• Serial bus • Tree structure
Transmission distance	Maximum 6 000 m (19 700 ft)
Instrument address	Each transmitter has an individual bus address configured in the software of the transmitter.
Isolation	Serial communication circuit isolated from other circuits
Error on alarm	Error message classified according to NAMUR NE 107

"4-20mA HART" I/O module (Ex d/XP or Ex i/IS): Technical data

General data

No. of units	Max. 6 instruments per loop
Baud rate	1 200 bit/s
Cable	Two-wire, twisted pair screened cable; Core cross section: 0.2 to 2.5 mm^2 (24 to 13 AWG)
Topology	• Serial bus • Tree structure
Transmission distance	Maximum 1 200 m (3 900 ft)
Instrument address	Each transmitter on a signal loop has an individual bus address. This is defined within the transmitter software and / or auxiliary configuration environment such as host system or Field Communicator 475.
Isolation	Bus inputs are electrically isolated from the other electronics

Input data

Input operating modes	• 4..20mA input (1 external device) • HART master+4..20mA input (1 external device) • HART master (up to 6 external devices)
Internal load (to ground)	400 Ω
Measuring range	0 to 26 mA
Accuracy	±15 µA (after linearization and calibration)
Connection of a Prothermo NMT	The measured level is transmitted to the Prothermo. Prothermo uses this level to calculate the average temperature of the product.
Connection of a Micropilot S FMR5xx	• The auxiliary energy for the Micropilot S can be supplied by the analogue I/O module • The calculated distance correction factor or distance correction value is sent to the Micropilot. Micropilot uses this value to indicate the corrected level at its local display.
Connection of a RTD temperature probe	2-, 3- or 4-wire connection

Output data

Output operating modes	• 4..20mA output • HART slave +4..20mA output
Output current	3 to 24 mA
Accuracy	±15 µA (after linearization and calibration)
Error on alarm	HART error message classified according to NAMUR NE 107

Data for passive usage (input or output)
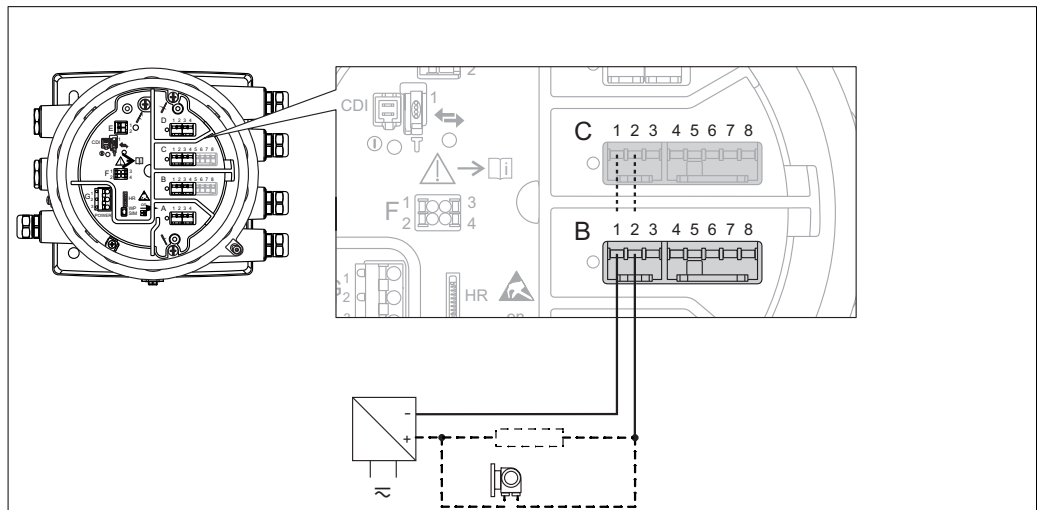
🖼 *4   Passive input or output: Use terminals 1 and 2*

Minimum terminal voltage	10.4 V
Maximum terminal voltage	29 V

Data for active usage (input or output)
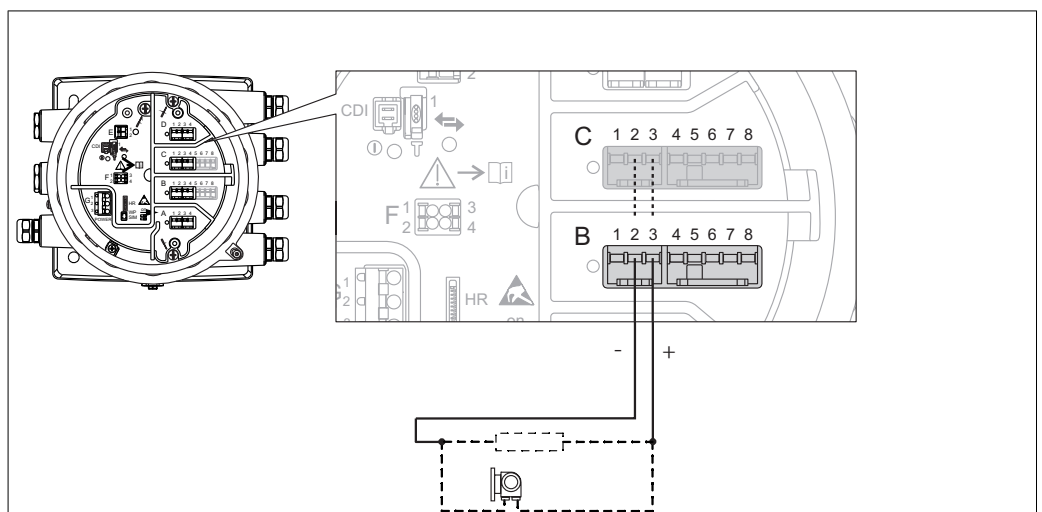
🖼 *5   Active input or output: Use terminals 2 and 3*

Transmitter power supply voltage (Ex d/XP)	18.5 V - 360 Ω · I_{load}
Transmitter power supply voltage (Ex i/IS)	20.0 V - 360 Ω · I_{load}
Output load	max. 500 Ω including signal line

"Digital I/O module": Technical data

Output	
Relay switching power for resistive load	• 30 V$_{DC}$ @ 2 A • 250 V$_{DC}$ @ 0.1 A • 250 V$_{AC}$ @ 2 A
Relay type	normally open; can be set to "normally closed" by a software option [1]
Input	
Maximum pick-up voltage	• 250 V$_{AC}$ • 250 V$_{DC}$
Minimum pick-up voltage	• 25 V$_{AC}$ • 5 V$_{DC}$
Current consumption at maximum voltage	• ≤ 1 mA (DC) • ≤ 2 mA (AC)

[1]   In case of a power supply failure, the switching state is always "open", irrespectiv of the selected software option.

Power supply

Terminal assignment
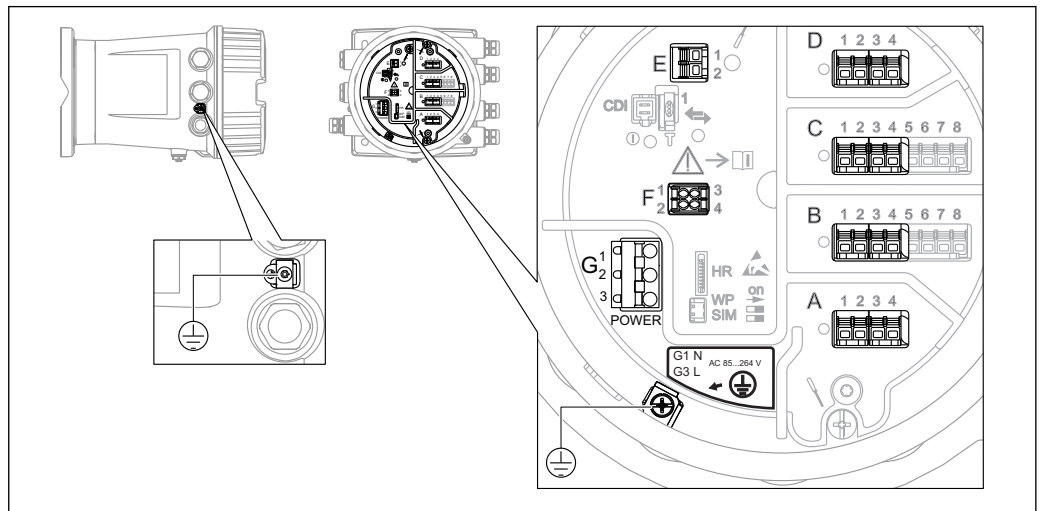
⊞ 6   *Terminal compartment (typical example) and ground terminals*

Terminal area	Module
A/B/C/D (slots for I/O modules)	Up to four I/O modules, depending on the order code • Modules with four terminals can be in any of these slots. • Modules with eight terminals can be in slot B or C. ℹ The exact assignment of the modules to the slots is dependent on the device version. For a detailed description refer to the Operating Instructions of the device in question.
E	HART Ex i/IS interface • E1: H+ • E2: H-
F	Remote display (in preparation)
G	Power supply: 85 to 264 V_{AC} • G1: N • G2: not connected • G3: L
⏚	Protective ground connection

Supply voltage   85 to 264 V_{AC}, 50/60 Hz, 28.8 VA [1]

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1)   maximum value; actual value depending on modules installed

Cable entries	Ordering feature 090 "Electrical Connection" [1]	Cable entries (with blind plugs)
	A	7 x thread M20
	B	7 x thread M25
	C	7 x thread G1/2
	D	7 x thread G3/4
	E	7 x thread NPT1/2
	F	7 x thread NPT3/4

1) Position 13 of the order code, e.g. NMx8x-xxxxxxxxxxxxA...

> For the following devices with TIIS Ex d approval, cable glands are attached to the device (see position 1 and 2 of the order code). These cable glands must be used.
> Tankside Monitor NRF81-TA...

Cable specification	**Terminals**

Terminal	Wire cross section
Signal and power supply • Spring terminals (NRF81-xx1...) • Screw terminals (NRF81-xx2...)	0.2 to 2.5 mm^2 (24 to 13 AWG)
Ground terminal in the terminal compartment	max. 2.5 mm^2 (13 AWG)
Ground terminal at the housing	max. 4 mm^2 (11 AWG)

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

• Two wire (twisted pair) screened or un-screened cable
• Resistance in one cable: ≤ 120 Ω
• Capacitance between lines: ≤ 0.3 µF

Overvoltage protection	On the communication and power lines; according to IEC 60060-1 /DIN 60079-14:

10 kA, 8/20 µs, 10 pulses according to IEC 60060-1 / DIN 60079-14

Installation

Installation conditions   Wall mounting
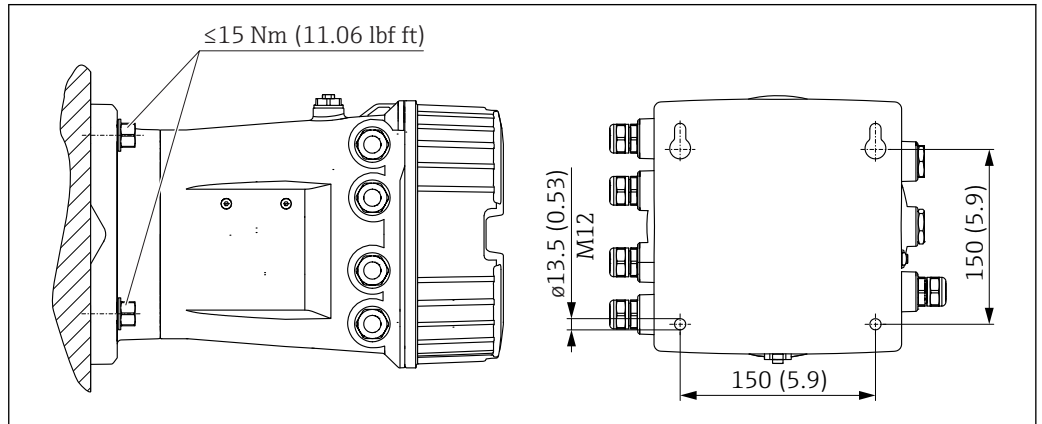
◻ 7 *Wall mounting of the Tankside Monitor*

Pipe mounting

A mounting kit consisting of two brackets and four nuts can be ordered with the device. It can be used for mounting the Tankside Monitor on horizontal or vertical pipes.

Ordering feature 620 "Accessory enclosed"	Mounting kit
PV	Mounting kit, pipe, DN32-50 (1-1/4" - 2")
PW	Mounting kit, pipe, DN80 (3")
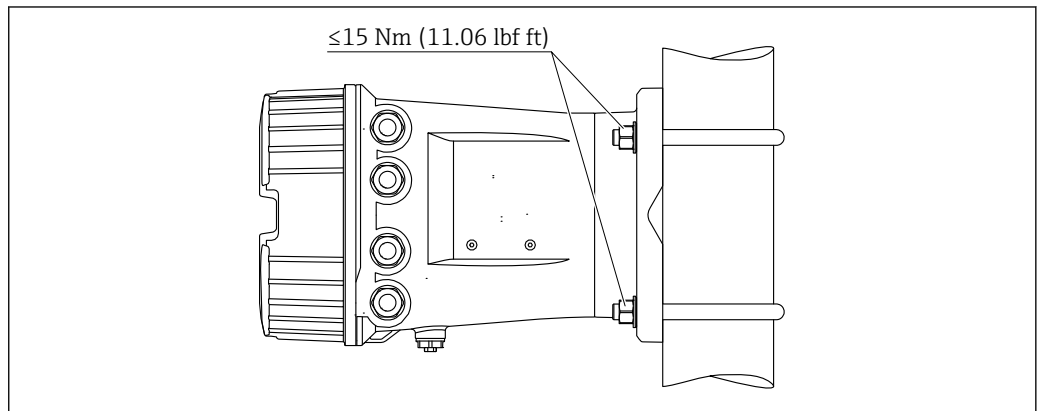
◻ 8 *Mounting of the Tankside Monitor at a vertical pipe*

≤15 Nm (11.06 lbf ft)
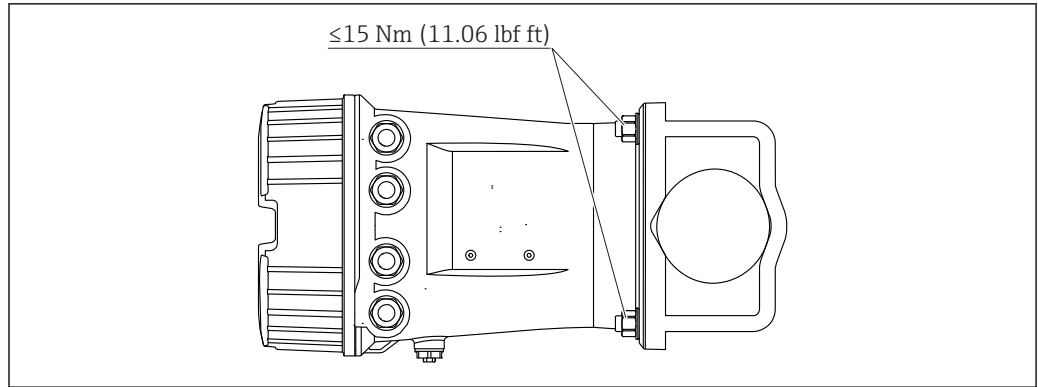
A0029900

 9   *Mounting of the Tankside Monitor at a horizontal pipe*

Environment

Ambient temperature range	Device	−40 to +60 °C (−40 to +140 °F)
	Display module	−20 to +70 °C (−4 to +158 °F)
		The readability of the display may be impaired at temperatures outside this temperature range.

Classification of environmental conditions according to DIN EN 60721-3-4

4K5, 4K6, 4B1, 4M7, 4Z2, 4Z3, 4Z8

Storage temperature

−50 to +80 °C (−58 to +176 °F)

Humidity

≤ 95 %

Degree of protection

- IP68/66 according to DIN EN 60529
- Type 6P/4x according to NEMA 250

Shock resistance

- 30 g (18 ms) according to DIN EN 60068-2-27 (1993)
- Classification according to DIN EN 60721-3-4: 4M7

Vibration resistance

- 20 to 2 000 Hz, 1 $(m/s^2)^2/Hz$ according to DIN EN 60068-2-64 (1994)
- This corresponds to an acceleration value of 4.5 g and fulfills class 4M7 of DIN EN 60721-3-4 (1995)

Electromagnetic compatibility (EMC)

- Transient emissions according to DIN EN 61326, class B
- Interference resistance according to DIN EN 61326, Appendix A (Industry use) and NAMUR recommendation NE21

Custody transfer approval

Ordering feature 150 "Weight + Measure Approval" [1]	Accuracy properties (compared to the connected level gauge as defined in OIML R85)
ICR	Standard version, without calibration certificate
NTC	Custody transfer type approval according to NMi, OIML R85, API 3.1B, ISO4622, factory calibration certificate
PTC (in preparation)	Custody transfer type approval per PTB, factory calibration certificate

1) Position 14 to 16 in the order code (e.g. NRF8x-xxxxxxxxxxxxxICR...)

Mechanical construction

Dimensions

Housing
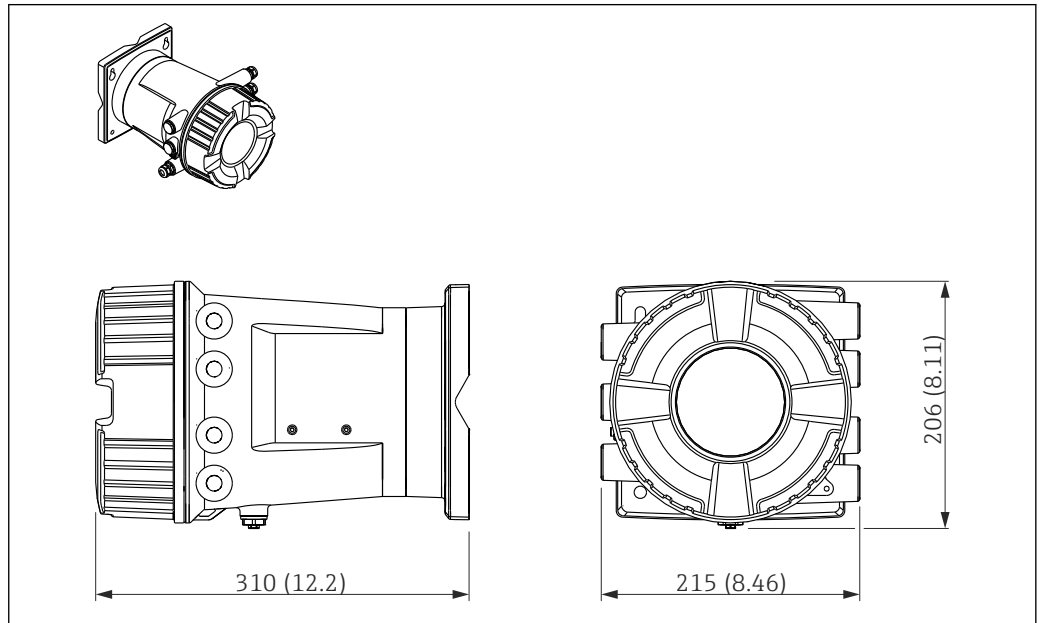
⌨ *10   Dimensions of Tankside Monitor NRF81; unit of measurement: mm(in); adapters for cable entries are not taken into account in this drawing.*

Weight

Housing with electronics: approx. 12 kg (26 lb)

Materials

Materials of housing

A0026339

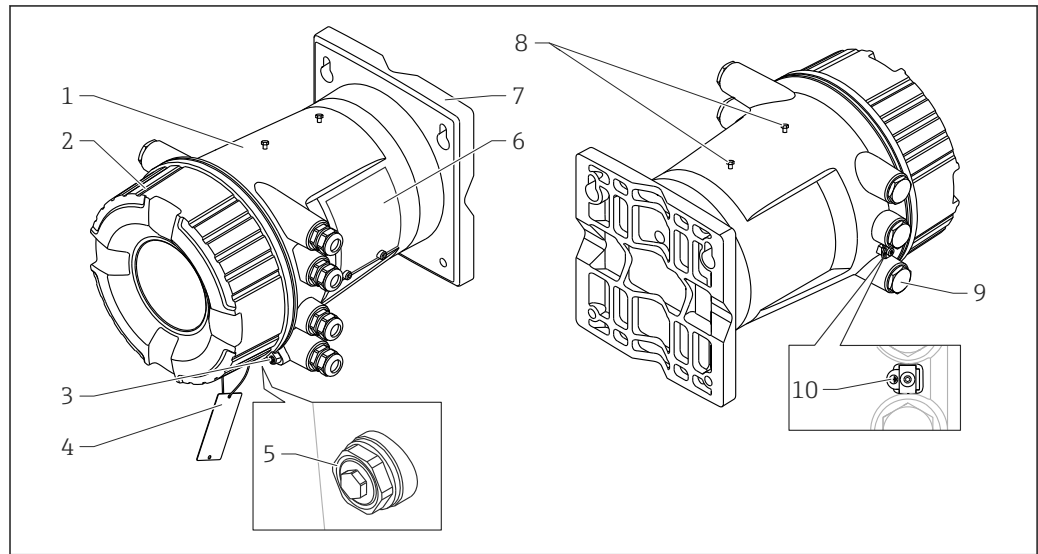| Pos.	Part	Materials for Aluminum version [1]	Materials for stainless steel version [2]
1	Housing	AC 43000 T6	316L (1.4404)
2	Cover	• Cover: AC 43000 T6 • Window: Glass • Seal: FVMQ • Thread-coating: Graphite-based lubricant varnish	• Cover: 316L (1.4404) • Window: Glass • Seal: FVMQ • Thread-coating: Graphite-based lubricant varnish
3	Cover lock	• Capstan screw: 316L (1.4404) • Clamp: 316L (1.4435)	• Capstan screw: 316L (1.4404) • Clamp: 316L (1.4435)
4	Tag for measuring point label	316L (1.4404)	316L (1.4404)
5	Pressure release stopper	• Stopper: 316L (1.4404) • O-ring: EPDM	• Stopper: 316L (1.4404) • O-Ring: EPDM
6	Nameplate	• Sticker: Plastic • Sealing screw: A4 • O-ring: FKM	• Nameplate: 316L (1.4404) • Groove pins: 316Ti (1.4571) • Sealing screw: A4 • O-ring: FKM
7	Mounting plate	AC 43000 T6	316L (1.4404)
8	Dummy screws for weather protection cover	• Screw: A4-70 • O-ring: EPDM	• Screw: A4-70 • O-ring: EPDM

9	Dummy plug, cable gland or adapter [3]	• Dummy plug
		  – 1.4435
		  – LD-PE
		• Adapter:
		  – Ms/Ni (TIIS)
		  – 1.4404 (other versions)
		• Seal:
		  – EPDM
		  – NBR
		  – PTFE tape
			• Dum my plug
			  – 1.4435
			  – LD-PE
			• Adapter:
			  – Ms/Ni (TIIS)
			  – 1.4404 (other versions)
			• Seal:
			  – EPDM
			  – NBR
			  – PTFE tape

10	Ground terminal	• Screw: A4-70 • Spring washer: A4 • Clamp and holder: 316L (1.4404)	• Screw: A4-70 • Spring washer: A4 • Clamp and holder: 316L (1.4404)

1) Ordering feature 070 "Housing", Option "AA"; position 11/12 of the order code: NXXXX-xxxxxxxxxxAA...
2) Ordering feature 070 "Housing", Option "BA"; position 11/12 of the order code: NXXXX-xxxxxxxxxxBA...
3) Depending on device version

Operability

|	
Operating concept	**Operator-oriented menu structure for user-specific tasks** • Commissioning • Operation • Diagnostics • Expert level **Operating languages** • English • German • Japanese ℹ️ Feature 500 of the product structure determines which of these languages is preset on delivery. **Quick and safe commissioning** • Guided menus ("Make-it-run" wizards) for applications • Menu guidance with brief explanations of the individual parameter functions **Reliable operation** Standardized operation at the device and in the operating tools **Efficient diagnostics increase measurement reliability** • Remedy information is integrated in plain text • Diverse simulation options

Operating options	• Local display; operation via the local display is possible without opening the device.
	• Tank Gauging system
	• Plant Asset Management tool (e.g. FieldCare); connected via
	   – HART
	   – Service port (CDI)

Local operation	
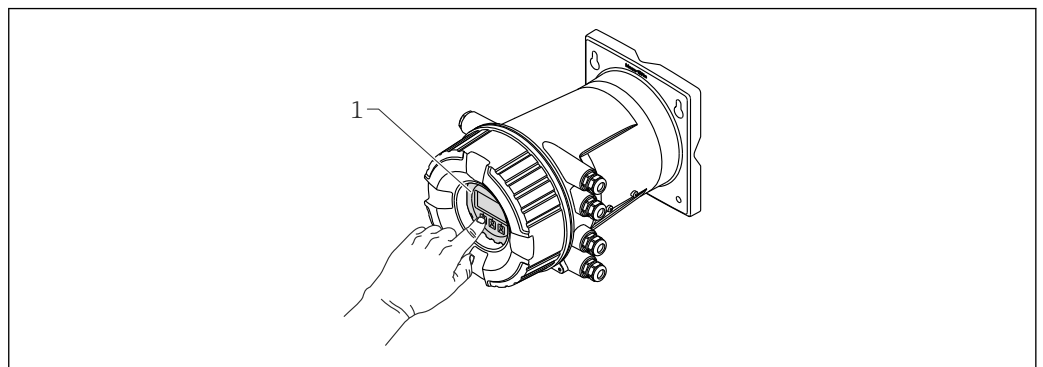
🔲 *11   Local operation of the Tankside Monitor NRF81*

1   Display and operating module

Display elements
• 4-line display
• White background lighting; switches to red in event of device errors
• Format for displaying measured variables and status variables can be individually configured
• Permitted ambient temperature for the display: −20 to +70 ℃ (−4 to +158 ℉)
  The readability of the display may be impaired at temperatures outside the temperature range.

Operating elements
• External operation via touch control; 3 optical keys: ⊕, ⊖, ⑥
• Operating elements also accessible in various hazardous areas

Remote operation
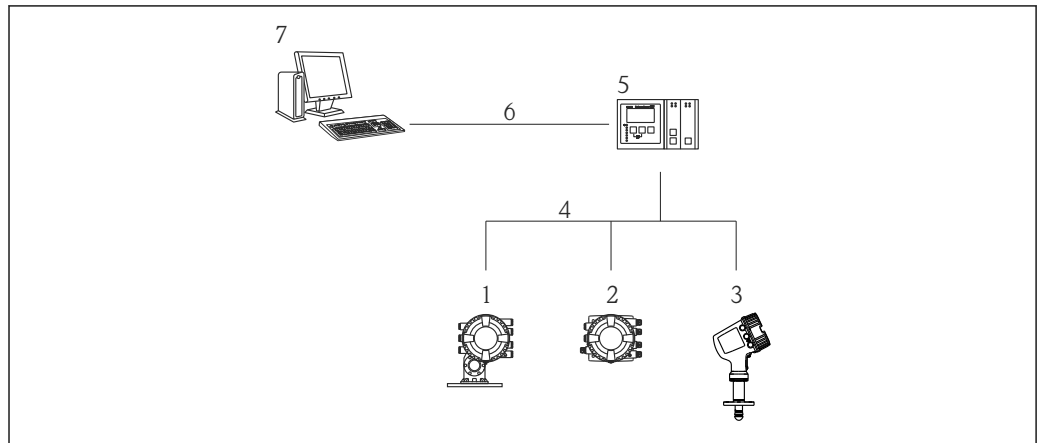
🔲 *12   Remote operation of Tank Gauging devices*

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 operating tool (e.g. FieldCare)

Operation via service interface
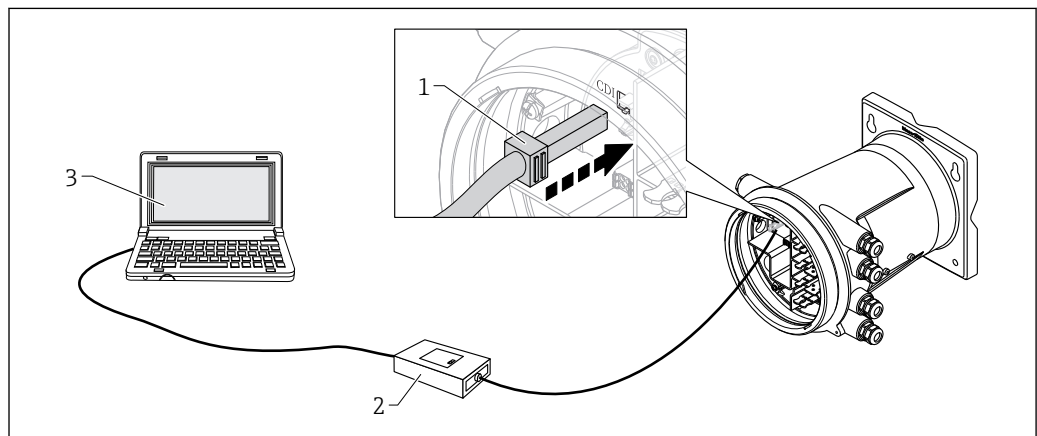
🔲 *13   Operation via service interface*

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

Certificates and approvals

CE mark	The measuring system meets the legal requirements of the applicable EC guidelines. These are listed in the corresponding EC Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
RCM-Tick marking	The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products are labelled with the RCM- Tick marking on the name plate.

A0029561

Ex approval	The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
Single seal according to ANSI/ISA 12.27.01	The devices have been designed according to ANSI/ISA 12.27.01 as single seal devices, allowing the user to waive the use and save the cost of installing external secondary process seals in the conduit as required by the process sealing sections of ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC) These instruments comply with the North-American installation practice and provide a very safe and cost-saving installation for pressurized applications with hazardous fluids. Further information can be found in the Safety Instructions (XA) of the relevant devices.
Functional Safety (SIL)	Use for level monitoring (MIN, MAX, range) up to SIL 2 according to IEC 61508:2010. For details refer to the "Functional Safety Manual": SD01929G (NRF81)
WHG	in preparation
Weight & Measure approval	• OIML R85 (2008) • NMi • PTB (in preparation) • PAC • LNE (in preparation) • WELMEC • GOST (in preparation) The device has a sealable locking switch according to the Weight & Measure requirements. This switch locks all software parameters related to the measurement. The switching status is indicated on the display and via the communication protocol.
Non-ionizing radiation protection	According to guideline 2004/40/EG-ICNIRP Guidelines EN50371
Other standards and guidelines	**Industry standards** • Directive 2002/95/EC: "Restriction of Hazardous Substances Directive" (RoHS) • Directive 2004/22/EC: "Measuring Instruments Directive" (MID) • IEC61508: "Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems" (SIL) • NACE MR 0175, NACE MR 0103: "Sulfide stress cracking resistant metallic materials for oilfield equipment" • API Recommended Practice 2350: "Overfill Protection for Storage Tanks in Petroleum Facilities" • API MPMS: "Manual of Petroleum Measurement Standards" • EN 1127: "Explosive atmospehres - Explosion prevention and protection" • IEC 60079: "Equipment protection"

- EN 1092: "Flanges and their joints"
- EN 13463: "Non-electrical equipment for use in potentially explosive atmospheres"
- TIA-485-A: "Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems "
- IEC61511: "Functional safety - Safety instrumented systems for the process industry sector"
- IEEE 754: "Standard for Binary Floating-Point Arithmetic for microprocessor systems "
- ISO4266: "Petroleum and liquid petroleum products - measurement of level and temperature in storage tanks by automatic methods"
- ISO6578: "Refrigerated hydrocarbon liquids - Static measurement - Calculation procedure"
- ISO 11223: "Petroleum and liquid petroleum products - Determination of volume, density and mass of the contents of verical cylindrical tanks by Hybrid Tank Measurement Systems"
- ISO15169: "Petroleum and liquid petroleum products - Direct static measurement - Measurement of content of vertical storage tanks by hydrostatic tank gauging"
- JIS K2250: "Petroleum Measurement Tables"
- JIS B 8273: "Bolted flange for pressure vessels"
- G.I.I.G.N.L.: "LNG Custody transfer handbook"
- NAMUR NE043: "Standardization of the Signal Level for the Failure Information of Digital Transmitters"
- NAMUR NE107: "Self-Monitoring and Diagnosis of Field Devices"
- PTBA-A-4.2: "Volume measuring devices for liquids in a stationary condition - Storage containers and their measuring devices"ur

Metrological standards

- OIML R85 (2008) "Requirements for ambient temperature low −25 ℃ (−13 ℉) and ambient temperature high +55 ℃ (+131 ℉)
- "Mess- und Eichverordnung" (Calibration regulations for the Federal Republic of Germany)
- Directive 2004/22/EC of the European Parliament and of the Council of 31 March 2004 on measuring instruments

Ordering information

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Marking

Option of ordering feature 895 "Marking"	Meaning
Z1	Tagging (TAG)
Z2	Bus address

Optionally, the device can be ordered with a specific tagging and/or bus address according to the table above. When the respective option is selected, the tag or bus address must be defined in an additional specification.

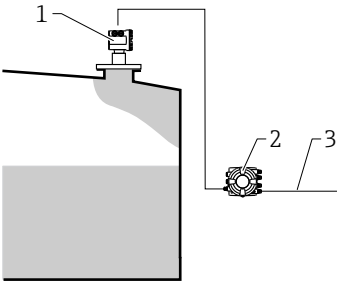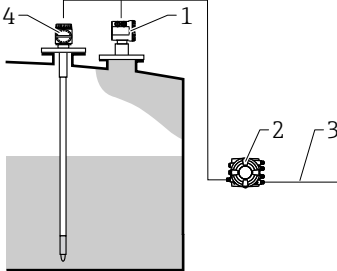# Application packages

Advanced tank measurement methods

The device software provides the following tank measurement methods:
- Direct level measurement → 📄 26
- Hybrid tank measurement system (HTMS) → 📄 27
- Hydrostatic tank gauging (HTG) → 📄 28
- Hydrostatic tank shell correction (HyTD) → 📄 30
- Thermal tank shell correction (CTSh) → 📄 30

Direct level measurement

If no advanced tank measurement methods have been selected, level and temperature are measured directly.
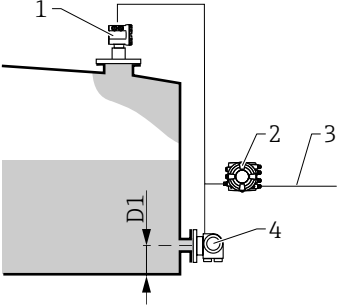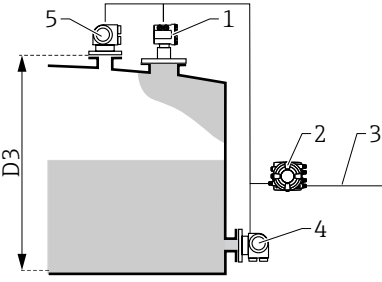
Direct level measurement modes

Measuring mode	Installation example	Measured variables	Calculated variables
Level only	 A0023756 *1 Level transmitter (e.g. typically FMR540, FMR51,.. but not NMR8x or NMS8x)* *2 Tankside Monitor* *3 To inventory management system*	Level	None
Level + temperature	 A0023757 *1 Level transmitter (e.g. typically FMR540, FMR51,.. but not NMR8x or NMS8x)* *2 Tankside Monitor* *3 To inventory management system* *4 Temperature transmitter (point or average)*	• Level • Temperature (point or average)	None

Hybrid tank measurement system (HTMS)

HTMS uses level and pressure measurements to calculate the contents of the tank and (optionally) the density of the medium.
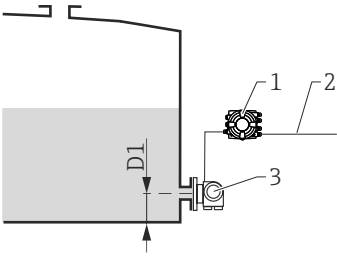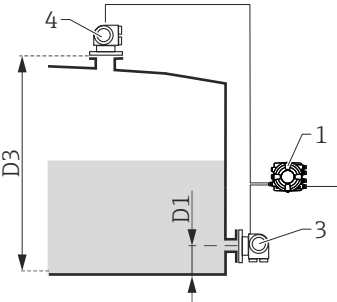
HTMS measuring modes
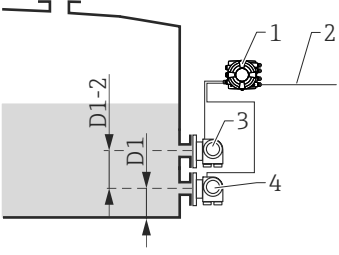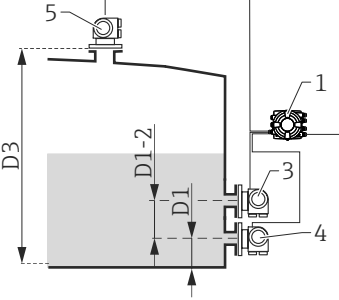
Measuring mode	Installation example	Measured variables	Calculated variables
HTMS + P1 ⓘ This mode should be used in atmospheric (i.e. non-pressurized) tanks	 A0023758 *1 Level transmitter (e.g. typically FMR540, FMR51,.. but not NMR8x or NMS8x)* *2 Tankside Monitor* *3 To inventory management system* *4 Pressure transmitter (bottom)*	• Level • Bottom pressure (at position *D1*)	Density of the medium
HTMS + P1 + P3 ⓘ This mode should be used in non- atmospheric (i.e. pressurized) tanks	 A0023759 *1 Level transmitter (e.g. typically FMR540, FMR51,.. but not NMR8x or NMS8x)* *2 Tankside Monitor* *3 To inventory management system* *4 Pressure transmitter (bottom)* *5 Pressure transmitter (top)*	• Level • Bottom pressure (at position *D1*) • Top pressure (at position *D3*)	Density of the medium

Hydrostatic tank gauging (HTG)

HTG uses one, two or three pressure measurements at different positions to calculate the tank contents and (optionally) the density of the medium.

HTG measuring modes

Measuring mode	Installation example	Measured variables	Calculated variables
HTG P1 ℹ️ This mode should be used in atmospheric (i.e. non-pressurized) tanks	 *1 Tankside Monitor* *2 To inventory management system* *3 Pressure transmitter (bottom)*	Bottom pressure (at position *D1*) ℹ️ The density of the medium must be entered manually.	Level
HTG P1 + P3 ℹ️ This mode should be used in non-atmospehric (i.e. pressurized) tanks	 *1 Tankside Monitor* *2 To inventory management system* *3 Pressure transmitter (bottom)* *4 Pressure transmitter (top)*	• Bottom pressure (at position *D1*) • Top pressure (at position *D3*) ℹ️ The density of the medium must be entered manually.	Level

Measuring mode	Installation example	Measured variables	Calculated variables
HTG P1 + P2 ℹ️ This mode should be used in atmospheric (i.e. non-pressurized) tanks	 A0023762 *1 Tankside Monitor* *2 To inventory management system* *3 Pressure transmitter (middle)* *4 Pressure transmitter (bottom)*	• Bottom pressure (at position *D1*) • Middle pressure (at position *D2*)	• Level • Density of the medium
HTG P1 + P2 + P3 ℹ️ This mode should be used in non-atmospehric (i.e. pressurized) tanks	 A0023763 *1 Tankside Monitor* *2 To inventory management system* *3 Pressure transmitter (middle)* *4 Pressure transmitter (bottom)* *5 Pressure transmitter (top)*	• Bottom pressure (at position *D1*) • Middle pressure (at position *D2*) • Top pressure (at position *D3*)	• Level • Density of the medium

Hydrostatic tank shell correction (HyTD)

The hydrostatic tank shell correction can be used to compensate for vertical movement of the Gauge Reference Height 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.
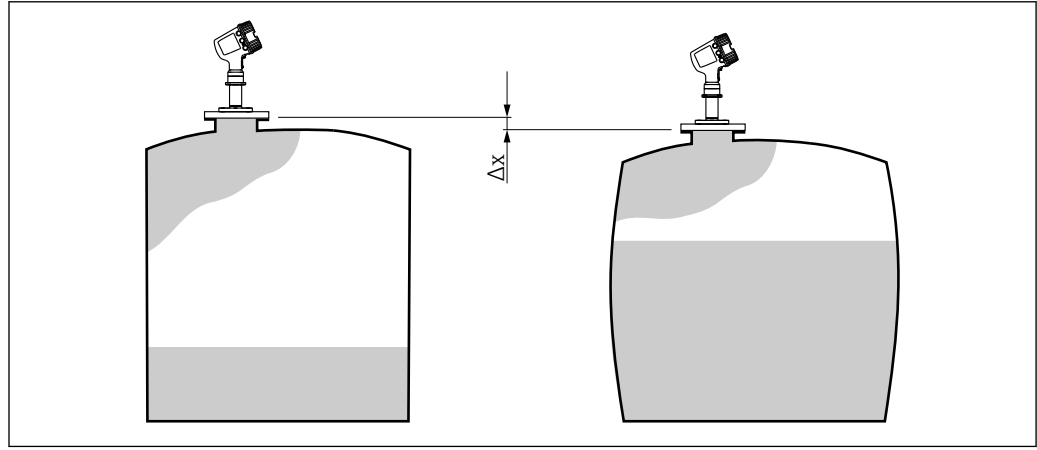
🖾 14   Movement Δx of the Gauge Reference Height due to the bulging of the tank shell caused by hydrostatic pressure

Thermal tank shell correction (CTSh)

The thermal tank shell correction can be used to compensate for vertical movement of the Gauge Reference Height due to temperature effects on the tank shell or stilling well. The calculation is based on the thermal expansion coefficients of steel and on insulation factors for both the dry and wetted part of the tank shell.

ℹ️ This correction is recommended for any tank gauge operating at conditions deviating considerably from the conditions during calibration and for extremely high tanks. For refrigerated, cryogenic and heated applications this correction is highly recommended.

Accessories

Device-specific accessories   **Weather protection cover**
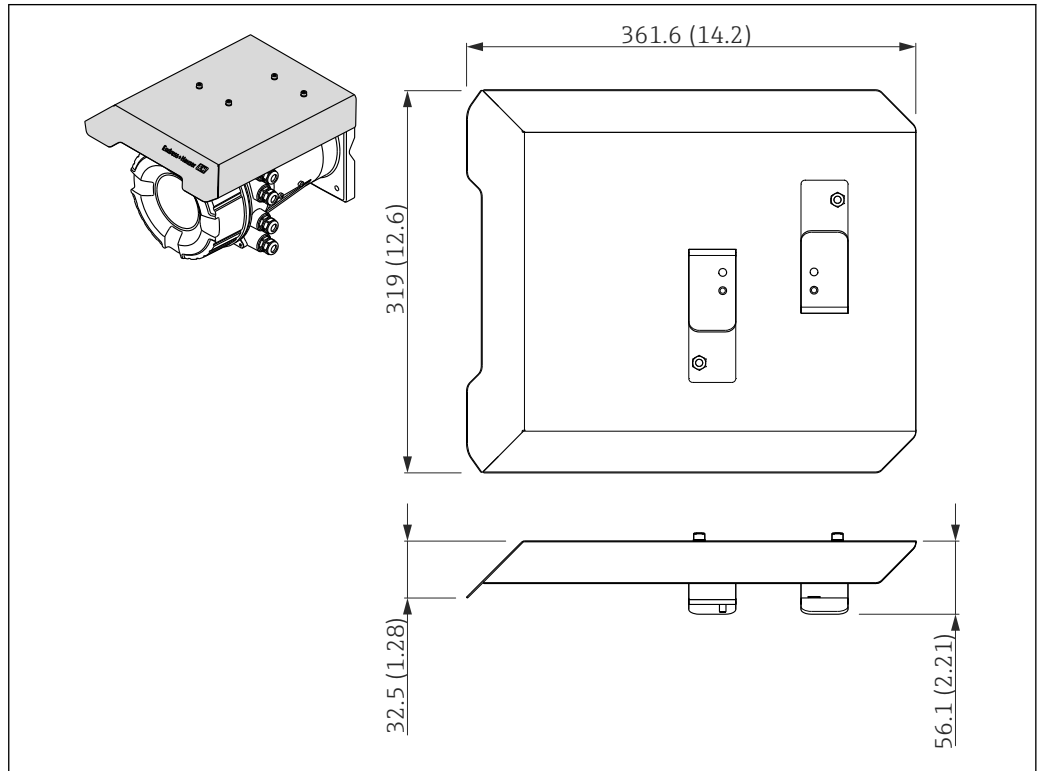
🖼 15   Weather protection cover; dimensions: mm (in)

Materials

Part	Material
Protection cover and mounting brackets	316L (1.4404)
Screws and washers	A4

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

Communication-specific accessories

Accessory	Description
WirelessHART Adapter SWA70	Connects field devices to a WirelessHART network. The WirelessHART adapter can be mounted directly at a HART device and is easly integrated into an existing HART network. It ensures safe data transmission and can be operated in parallel with other wireless networks. 📖 For details refer to Operating Instructions BA00061S

Service-specific accessories

Accessory	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. 📖 For details refer to Technical Information TI00404F

Accessory	Description
Commubox FXA291	Connects Endress+Hauser field devices with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a computer. 📖 For details refer to Technical Information TI00405C

Accessory	Description
FieldCare	Endress+Hauser's FDT-based Plant Asset Management tool. Helps to configure and maintain all field devices of your plant. By supplying status information it also supports the diagnosis of the devices. 📖 For details refer to Operating Instructions BA00027S and BA00059S.

System components

Accessory	Description
RIA15	Compact process display unit with very low voltage drop for universal use to display 4 to 20 mA/HART signals 📖 For details refer to Technical Information TI01043K.
Tankvision • Tank Scanner NXA820 • Data Concentrator NXA821 • Host Link NXA822	Inventory Management System with completely integrated software for operation via standard web browser 📖 For details refer to Technical Information TI00419G.

Documentation

Technical Information (TI)

The Technical Information 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.

Device	Technical Information
Tankside Monitor NRF81	TI01251G

Brief Operating Instructions (KA)

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

Device	Brief Operating Instructions
Tankside Monitor NRF81	KA01209G

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.

Device	Operating Instructions
Tankside Monitor NRF81	BA01465G

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.

Device	Description of Device Parameters
Tankside Monitor NRF81	GP01083G (in preparation)

Safety instructions (XA)

Ordering feature 010 "Approval"	Meaning	XA
BA	ATEX II 2 (1)G Ex db [ia Ga] IIC T6 Gb	XA01531G
FD	FM C/US XP-AIS Cl.I Div.1 Gr.BCD T6 AEx d[ia] IIC T6	XA01532G
GA	EAC Ex db[ia Ga] IIC T6 Gb	in preparation
IA	IEC Ex db [ia Ga] IIC T6 Gb	XA01531G
KA	KC Ex db[ia Ga] IIC T6 Gb	in preparation
MA	INMETRO Ex db[ia Ga] IIC T6 Gb	in preparation
NA	NEPSI Ex db[ia Ga] IIC T6 Gb	in preparation
TA	TIIS Ex d[ia] IIC T6 Ga/Gb	in preparation

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MODBUS®
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