KA01533G/00/EN/04.25-00
71709526
2025-07-03

Brief Operating Instructions
Prothermo NMT81

Tank Gauging

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

Detailed information about the device can be found in the Operating Instructions and the other documentation:
Available for all device versions via:
- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: *Endress+Hauser Operations App*

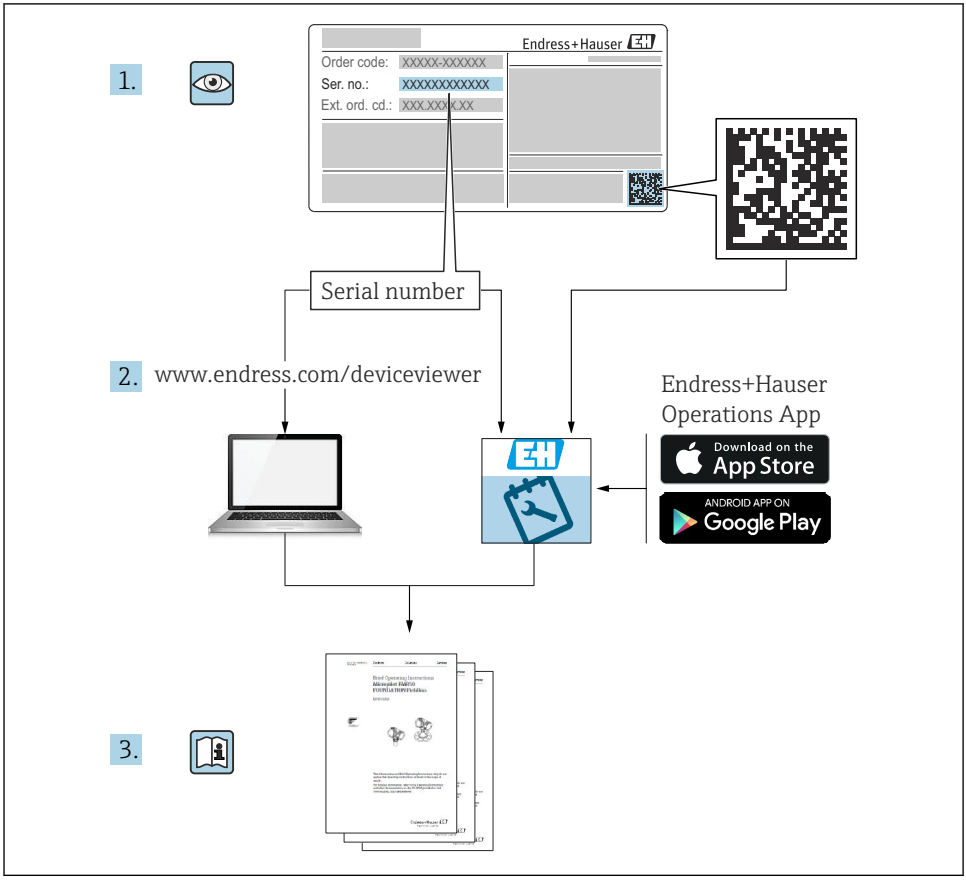
1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXX-XXX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.

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Table of contents

1 About this document

1.1 Document conventions

1.1.1 Safety symbols

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

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

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

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

1.1.2 Electrical symbols

Alternating current

Direct current and alternating current

Direct current

Ground connection

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

Protective earth (PE)

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

The ground terminals are located on the interior and exterior of the device:
- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

1.1.3 Tool symbols

Phillips head screwdriver

Flat blade screwdriver


Torx screwdriver


Allen key


Open-ended wrench

1.1.4 Symbols for certain types of information and graphics


Permitted
Procedures, processes or actions that are permitted


Preferred
Procedures, processes or actions that are preferred


Forbidden
Procedures, processes or actions that are forbidden


Tip
Indicates additional information


Reference to documentation


Reference to graphic

▶
Notice or individual step to be observed

1., 2., 3.
Series of steps


Result of a step


Operation via operating tool


Write-protected parameter

1, 2, 3, ...
Item numbers

A, B, C, ...
Views


Safety instructions
Observe the safety instructions contained in the associated Operating Instructions

1.2 Documentation

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

1.2.1 Technical Information (TI)

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

1.2.2 Brief Operating Instructions (KA)

Guide that takes you quickly to the 1st measured value
The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.2.3 Operating Instructions (BA)

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

1.2.4 Description of Device Parameters (GP)

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

1.2.5 Safety Instructions (XA)

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

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

1.2.6 Installation instructions (EA)

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

1.3 Registered trademarks

FieldCare®
Registered trademark of the Endress+Hauser Process Solutions AG, Reinach, Switzerland

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements for its tasks:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

2.2 Intended use

Application and measured materials
Measuring devices for use in hazardous areas, in hygienic applications or in applications where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area (e.g. explosion protection, pressure vessel safety).
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential.
- Protect the measuring device permanently against corrosion from environmental influences.
- Observe the limit values in the "Technical Information".

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

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

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

Hazardous area

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

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

2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. It meets general safety standards and legal requirements.

NOTICE

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

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

2.5.1 CE mark

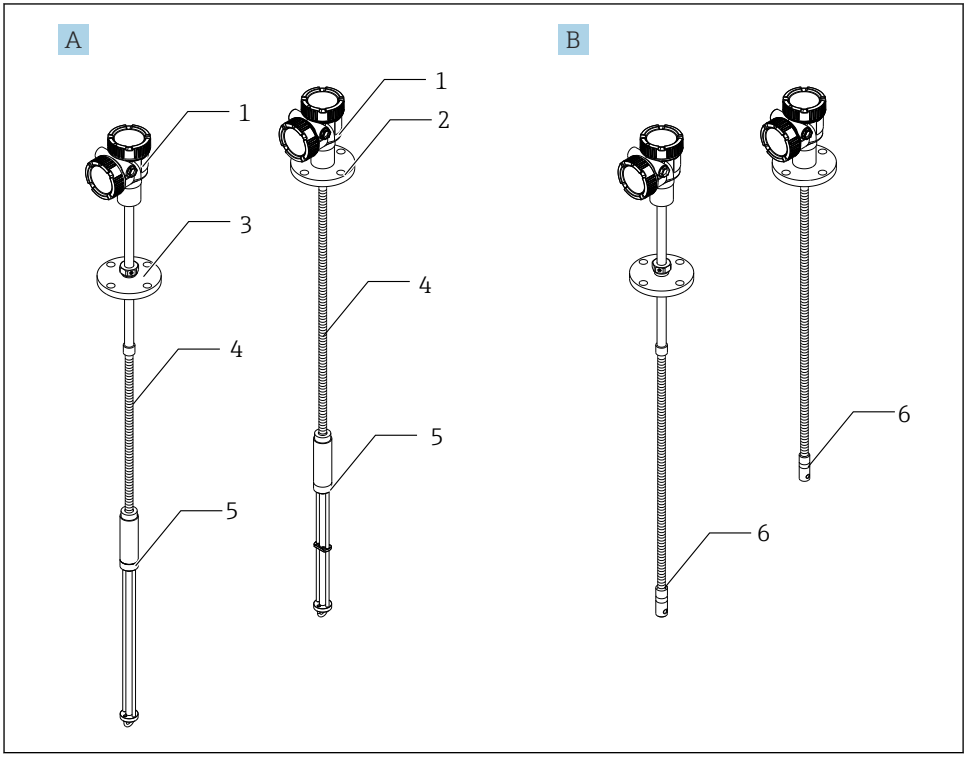
The measuring system meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied.

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

3 Product description

3.1 Product design

NMT81 converter + average temperature probe version can be equipped with class A IEC 60751/DIN EN 60751 or class 1/10B Pt100 4-wire RTD sensor elements in its protective probe for up to 24 elements. It is able to accurately measure the temperature of each element by measuring its temperature dependent resistance. NMT81 converter + temperature probe version conforms to intrinsic safety standards, and because NMT81 consumes very little power, it guarantees superior safety as an electrical device that is installed in tanks in hazardous locations, and ecological/environmentally friendly as well.



1 Design of Prothermo NMT81

A NMT81 with water bottom (WB)
B NMT81 without water bottom (WB)
1 Converter
2 Welded flange
3 Adjustable flange
4 Flexible sensor probe
5 Water bottom (WB) sensor probe
6 Flexible sensor probe without WB

4 Incoming acceptance and product identification

4.1 Incoming acceptance

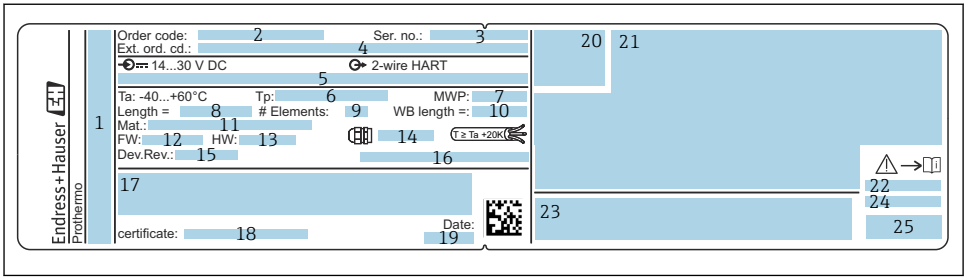
Upon receipt of the goods check the following:
- Are the order codes on the delivery note and the product sticker identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): Are the Safety Instructions (XA) enclosed?

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

4.2 Product identification

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

4.2.1 Nameplate



2 *Nameplate of Prothermo NMT81*

1 *Manufacturer address*
2 *Order code*
3 *Serial number*
4 *Extended order code*
5 *Intrinsically safe parameters*
6 *Process temperature*
7 *Maximum working pressure*
8 *Length of temperature sensor probe*
9 *Number of elements*
10 *Length of Water Bottom (WB)*
11 *Material in contact with process*
12 *Firmware version*
13 *Hardware revision*
14 *Cable entry standard*
15 *Device revision*
16 *Ingress protection*
17 *Additional information of the device version*
18 *PTB certification number (for PTB approval type)*
19 *Manufacturing date*
20 *Certificate symbol*
21 *Data concerning Ex approvals*
22 *Associated Safety Instruction (XA)*
23 *Associated Safety Instruction (XA) for Local language*
24 *Manufacturer info. for local language*
25 *Device data for local language*

4.3 Manufacturer address

Endress+Hauser Yamanashi Co., Ltd.
406-0846
862-1 Mitsukunugi, Sakaigawa-cho, Fuefuki-shi, Yamanashi

4.4 Storage and transport

4.4.1 Storage conditions

- Storage temperature: −40 to 85 °C (−40 to 194 °F)
- Store the device in its original packaging.

4.4.2 Transport

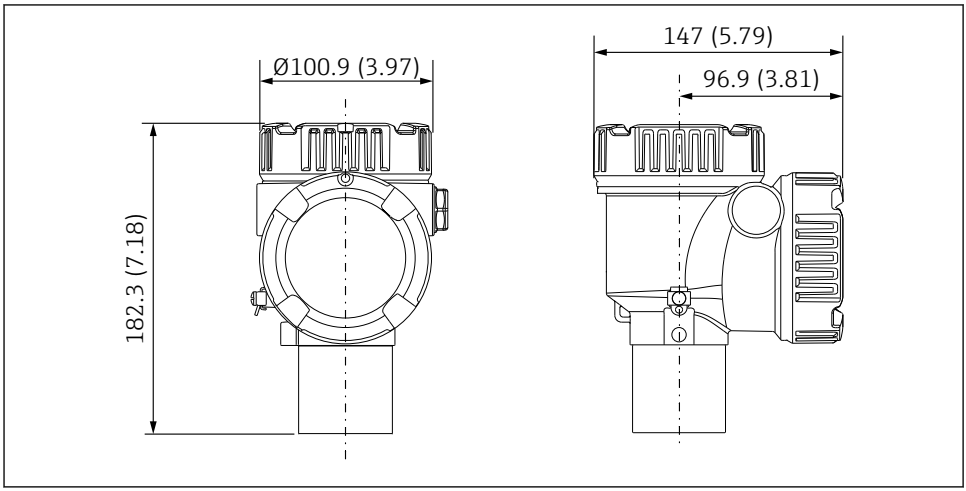
⚠ CAUTION

Risk of injury

▶ Follow the safety instructions and transport conditions for devices weighing more than 18 kg (39.69 lb).

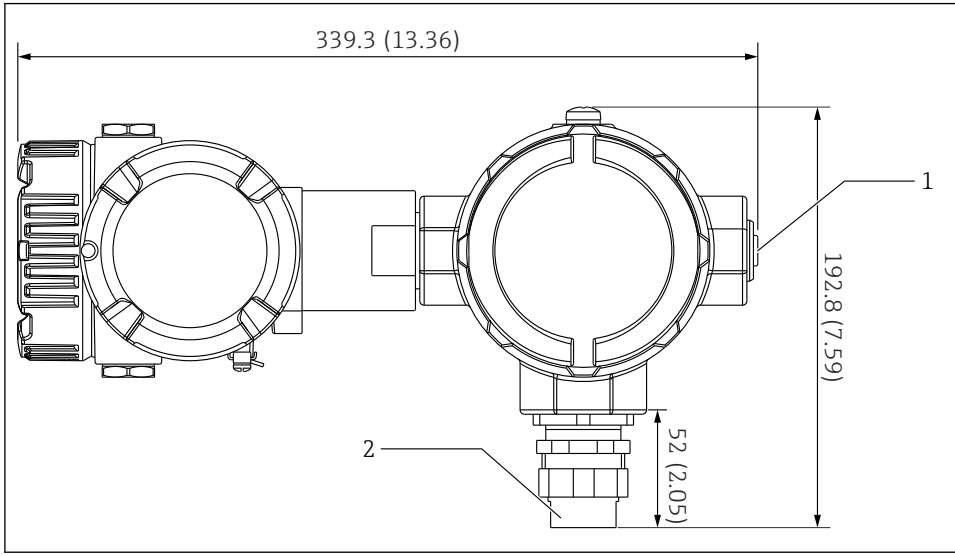
5 Installation

5.1 Converter



3 Standard converter. Unit of measurement mm (in)

5.2 Option 1: Converter with universal coupling



4 Option 1: converter (Standard G3/4 (NPT 3/4) universal coupling connection). Unit of measurement mm (in)

1 G 1/2 Stopping plug
2 G 3/4 thread

5.2.1 Option 1: Measurement functions

Because the software in the converter is equipped with a function that converts elements with different characteristics, it is possible to use other brand's temperature probes.

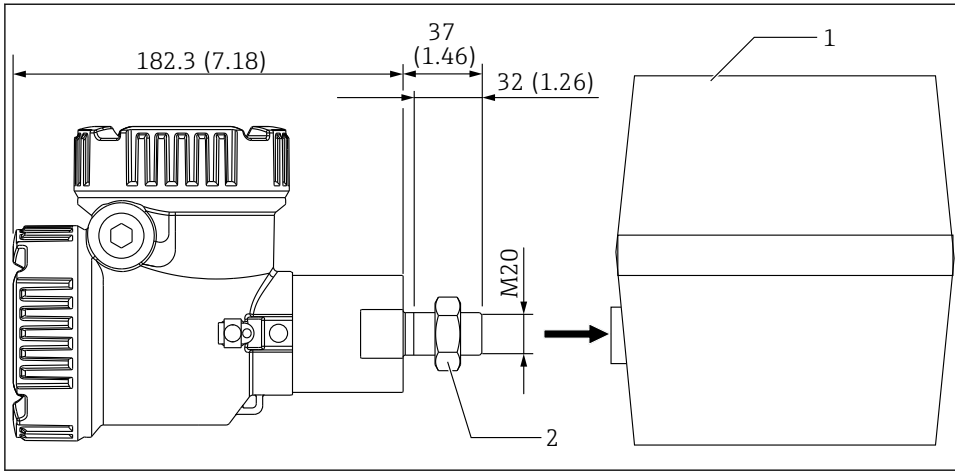
The NMT81 converter only version supports the following element types:

Elements	Standard	Temperature coefficient
Pt100	IEC60751	α=0.00385
Pt100	GOST	α=0.00391
Cu100	GOST	α=0.00428
Ni100	GOST	α=0.00617

- If elements other than the items above are required, contact your Endress+Hauser Sales Center.
- NMT81 is four-wire only with MSTs (Multi-spot thermometers), but it is not compatible with a thermocouple temperature device.
- The physical connection between a probe and NMT81 is completed by a zinc-plated carbon steel G 3/4" (NPT 3/4") universal threaded coupling. If a different thread size is required, Endress+Hauser can provide a solution by adapting a variety of coupling sizes and materials based on existing temperature probe specifications. Contact your Endress+Hauser Sales Center.
- Power supply and data transmission lines are both provided from the host gauge of NMS5, NMS8x, NMR8x, NRF81 or NRF590 through a two-wire local HART loop connection. NMT81 can be configured and operated using FieldCare.

5.3 Option 2: Converter with M20 mounting thread

This option model is designed specifically to connect with a Whessoe Varec 1700 series average temperature probe. WB data is not available because the 1700 series does not have WB.



5 Option 2: converter (Varec 1700, M20 threaded connection). Unit of measurement mm (in)

1 Existing 1700 series RT probe terminal box on-site
2 Lock nut

UK model M20 threaded type and Varec 1700 terminal housing connection procedure

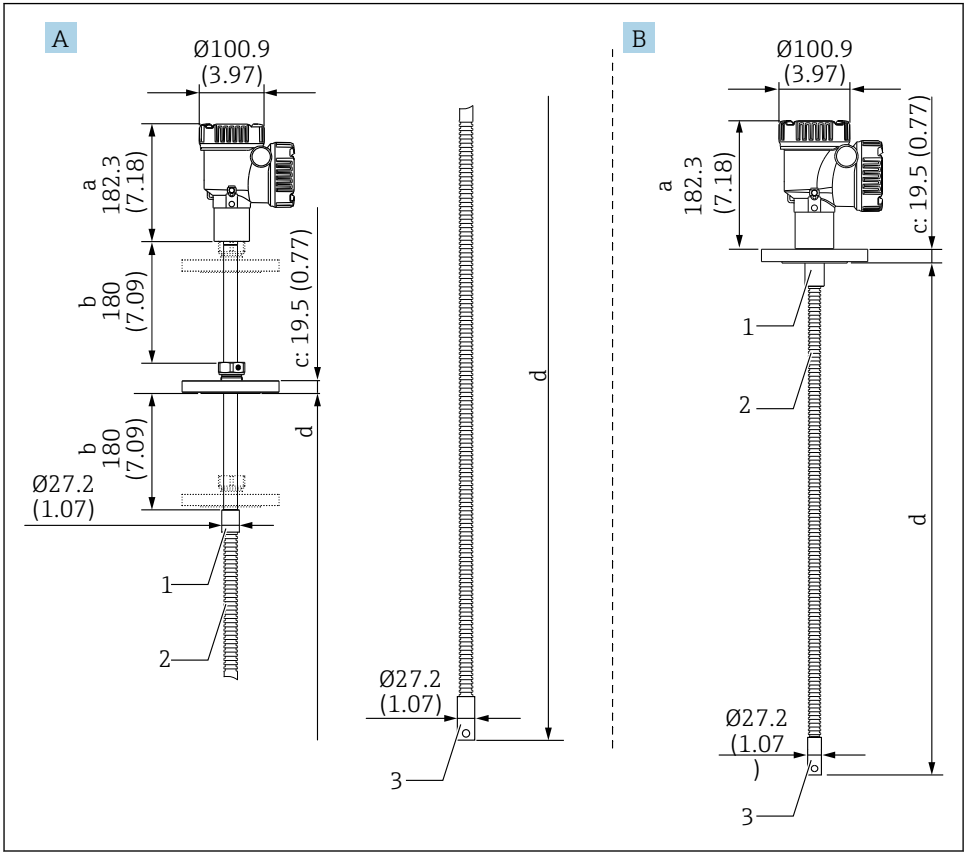
1. Use sealing tape to protect the threaded connection opening, and insert the cable bundle (RTD signal entry cable) into the female threaded connection opening on the terminal box.
2. Screw on the NMT81 converter by rotating it at least 10 times clockwise, and secure it with a lock nut.
   ↳ A loose connection between NMT81 and Varec1700 terminal housings will lead to malfunction due to ingress of flood and other factors.

This completes the procedure.

5.3.1 Option 2: Measurement functions

Option 2 has the same functions as option 1; however, option 2 is designed so that a special M20 threaded connection opening fits directly in the existing terminal housing of a Varec 1700. The wiring of RTD signals from the probe to NMT81 is done in the terminal box of the Varec 1700 and not on the NMT81 side. For this reason, there is no additional housing provided to NMT81 as in option 1.

5.4 Converter + average temperature probe version



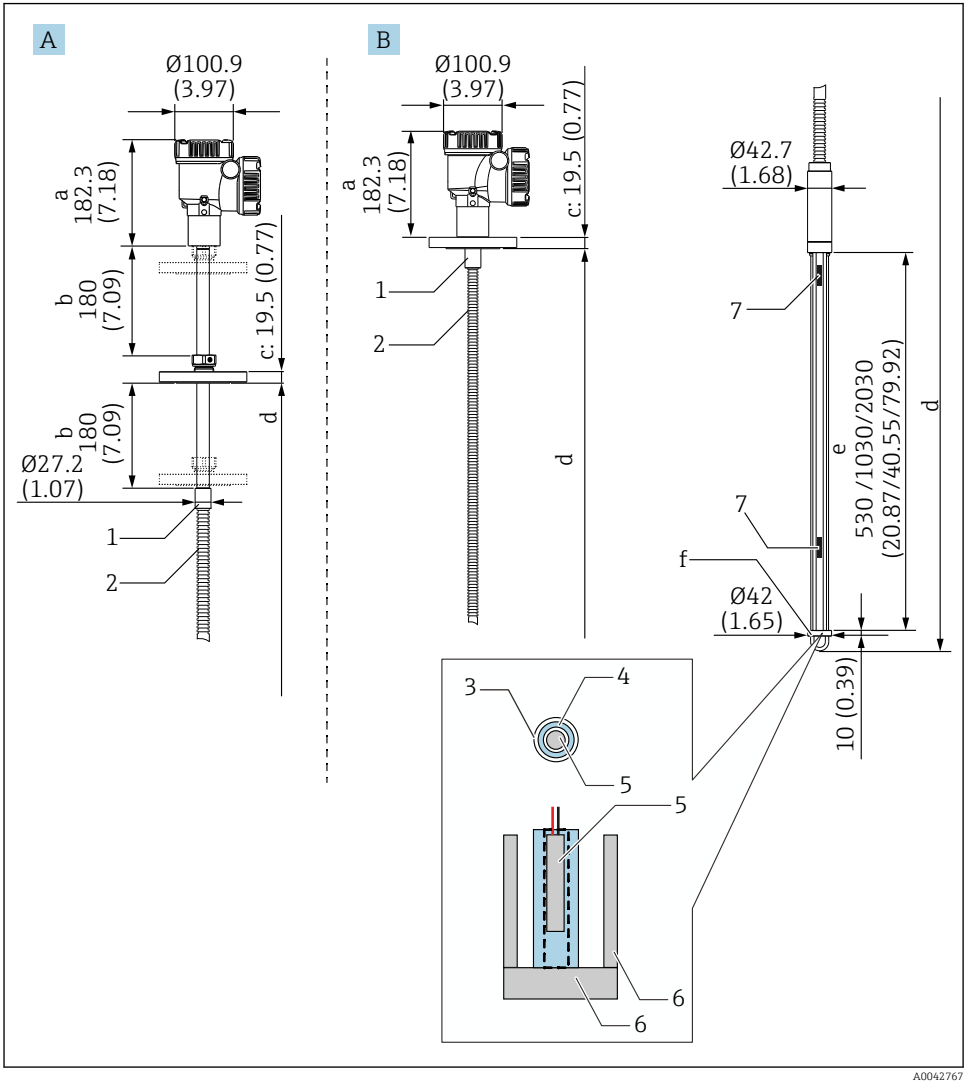
6 *Converter + average temperature probe. Unit of measurement mm (in)*

A Adjustable flange
B Welded flange
a Converter height
b Adjustable installation height
c Based on flange standards
d Temperature probe length (see below)
1 316L
2 316L
3 316L

The following tolerances are applied regardless of an optional WB probe. However, the position of the flange cannot be adjusted in a welded flange type.

Probe length	Tolerance of probe and element positions
1 000 to 25 000 mm (39.37 to 984.25 in)	± 50 mm (1.97 in)
25 001 to 40 000 mm (984.29 to 1 574.80 in)	± 50 mm (1.97 in)
40 001 to 60 000 mm (1 574.84 to 2 362.21 in)	± 100 mm (3.94 in)
60 001 to 100 000 mm (2 362.24 to 3 937.01 in)	± 300 mm (11.81 in)

5.5 Converter + average temperature probe + water bottom probe



7 *Converter + temperature probe + WB probe. Unit of measurement mm (in)*

A Adjustable flange
B Welded flange
a Converter height
b Adjustable installation height
c Based on flange standards
d Probe length (from flange bottom to the tip of WB probe) (see below)
e Capacitance WB probe

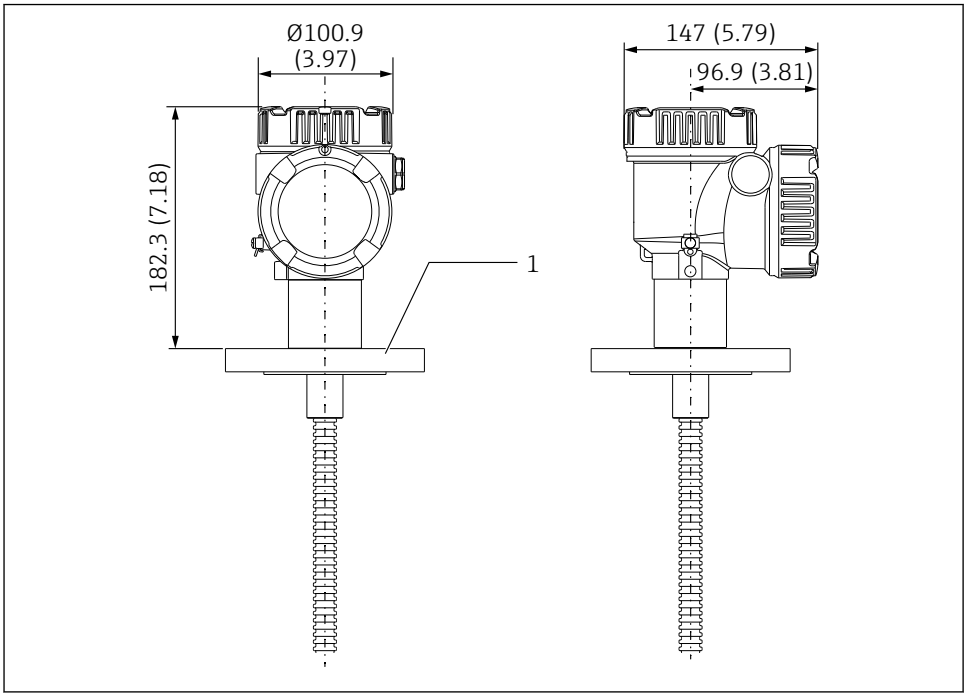
f Anchor weight hook (316L)
1 316L
2 316L
3 PFA protection tube (thickness 1 mm (0.04 in))
4 Sensor pipe (304)
5 Pt100 element
6 Base plate/side rod (316L)
7 Element

The following tolerances are applied regardless of an optional WB probe. The position of the flange cannot be adjusted in a welding flange type.

Probe length	Tolerance of probe and element positions
1 000 to 25 000 mm (39.37 to 984.25 in)	± 50 mm (1.97 in)
25 001 to 40 000 mm (984.29 to 1 574.80 in)	± 50 mm (1.97 in)
40 001 to 60 000 mm (1 574.84 to 2 362.21 in)	± 100 mm (3.94 in)
60 001 to 100 000 mm (2 362.24 to 3 937.01 in)	± 300 mm (11.81 in)

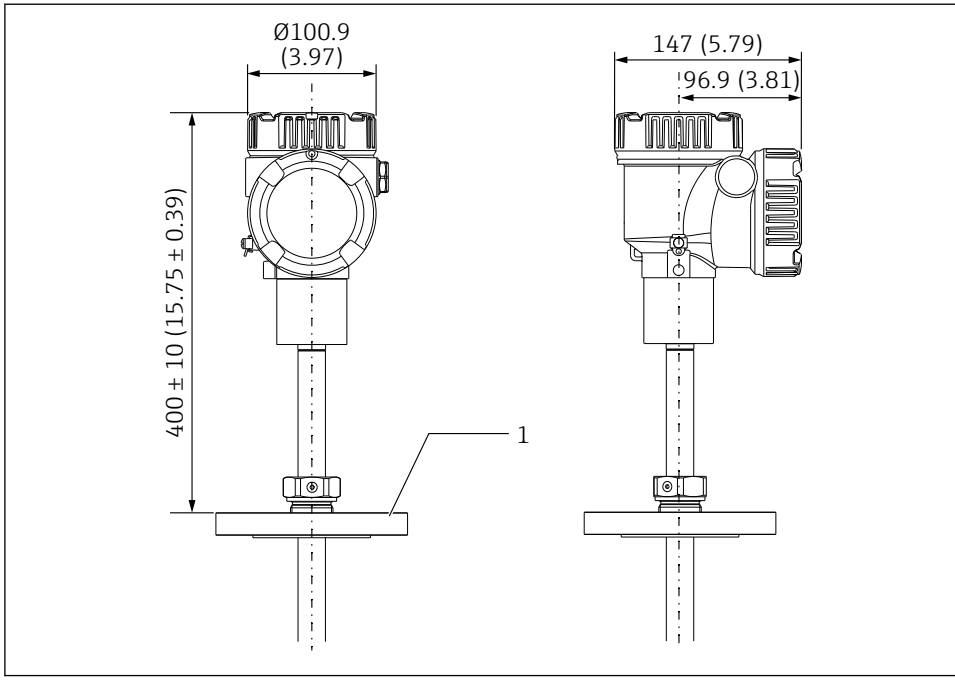
5.6 Flange

Welded flanges are more watertight because the joint is completely welded together.
However, the position of welded flanges cannot be adjusted.



8 Welded flange. Unit of measurement mm (in)

1 Flange (JIS, ASME, JPI, DIN)



9 Adjustable flange. Unit of measurement mm (in)

1 Flange (JIS, ASME, JPI, DIN)

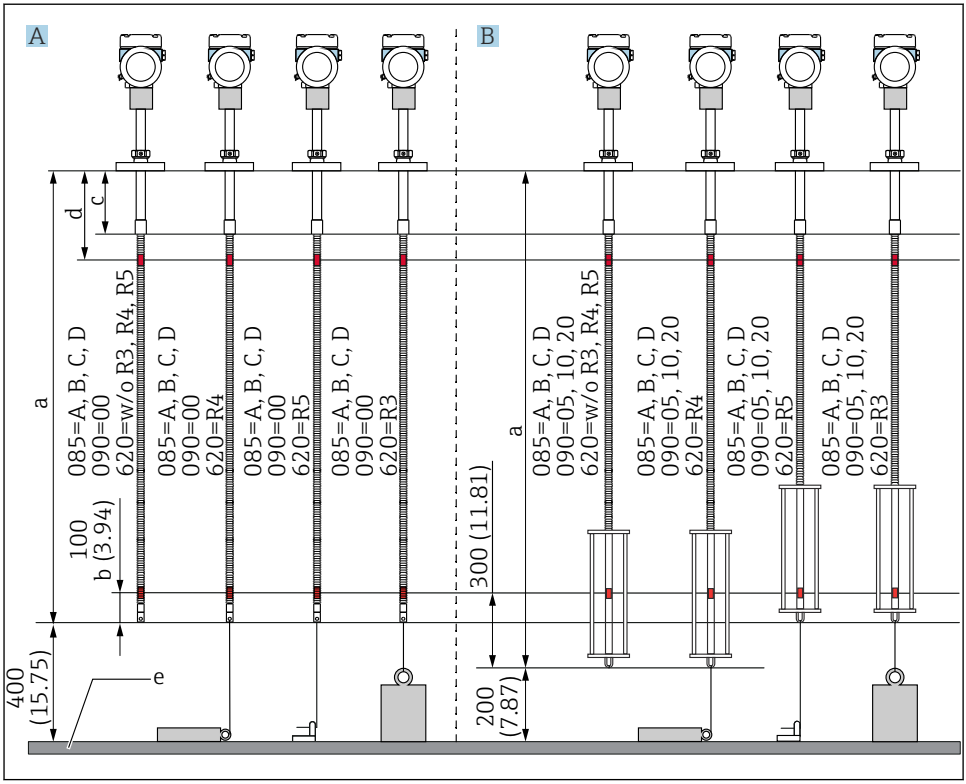
5.7 Element No. 1 position

Element No. 1 is mounted inside the probe according to the combinations of order specifications as described in the figure below. The element No. 1 is usually the element mounted in the lowest position in the tank.

When selecting 085 = E (customized positioning) the element No. 1 can be positioned in a range from: 100 mm (3.94 in) (d) measured from end of the probe up to probe length -315 mm (12.40 in) (d)

When selecting 085 = F, the element No. 1 is mounted at the position of 100 mm (3.94 in) from the bottom of the probe (b in the figure), and the element at the highest point is mounted at a position 315 mm (12.40 in) (d in the figure) from the bottom of the flange. All other elements are mounted at a spacing determined by following formula.

Element spacing = (a - b - d) / (number of measuring points - 1)

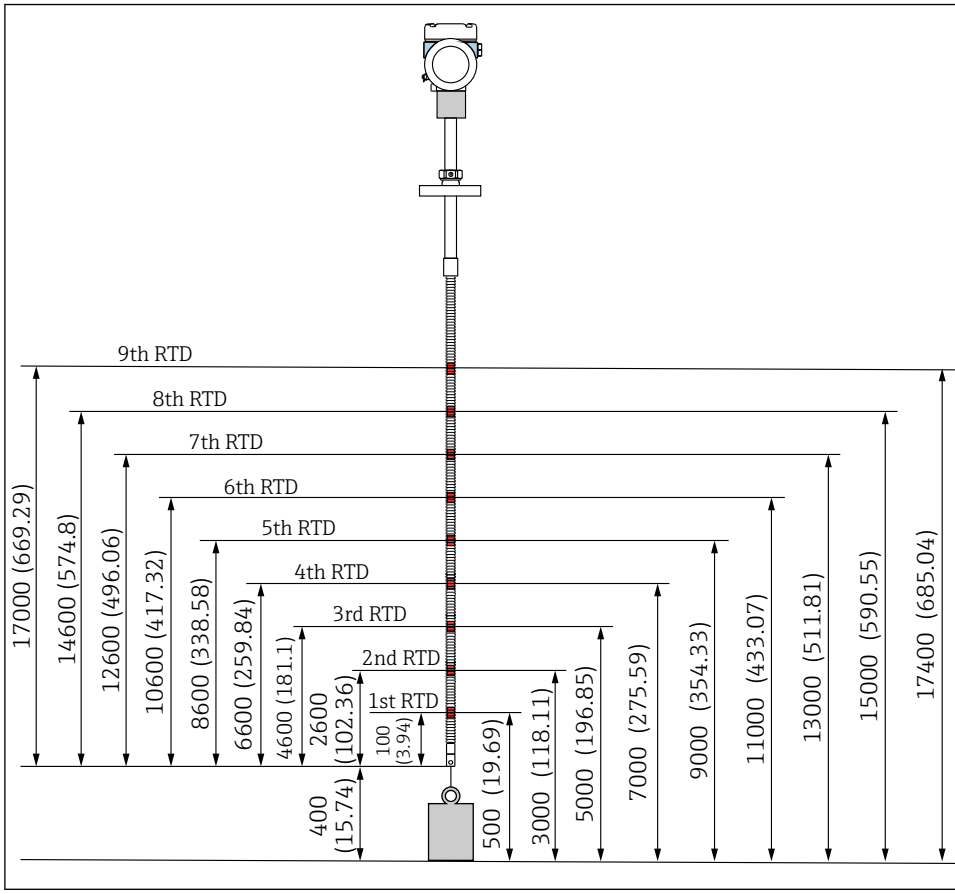


10 *Position of NMT81 element No. 1 based on the installation method*

A Converter + temperature probe
B Converter + temperature probe + WB probe
a Recommended installation (Probe length)
b Element No.1
c Factory default setting distance from flange bottom to flexible probe: 215 mm (8.46 in)
d Minimum distance from flange bottom to upper element: 315 mm (12.40 in)
e Tank bottom/Datum plate

5.8 Element positions

The order specification of 085 E shows element positions from the probe end. FC data shows element positions from the tank bottom/datum plate.

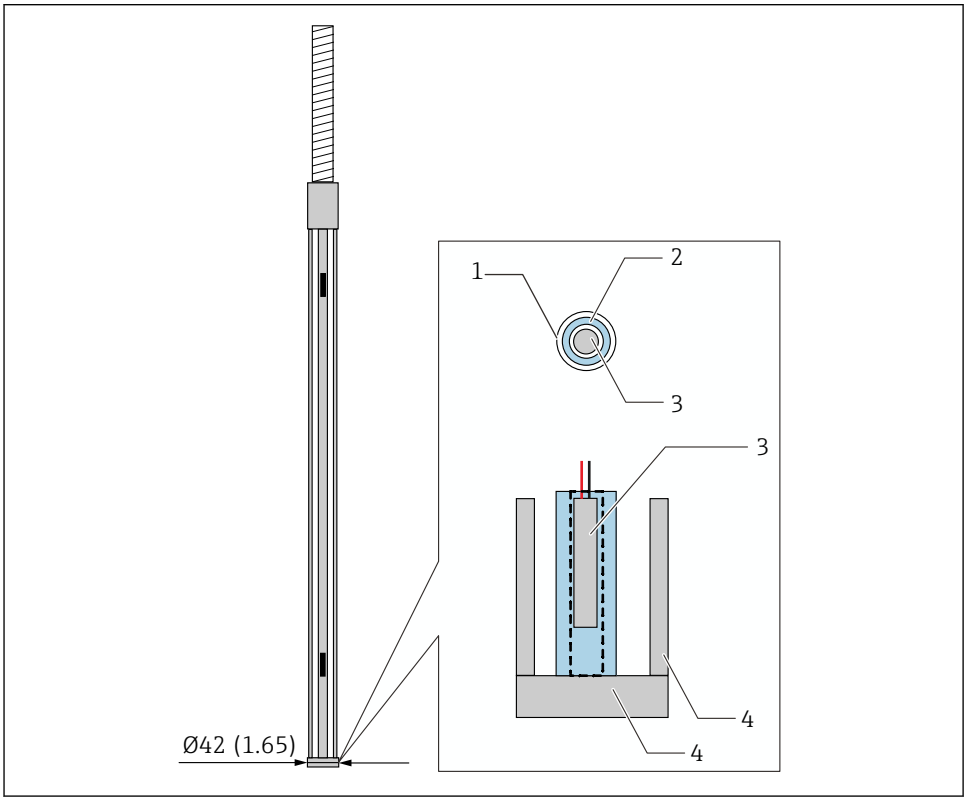


11 Element position. Unit of measurement mm (in)

5.9 WB probe design

The integrated WB sensor (capacitance water interface measurement) is set at the bottom of an average temperature probe. The standard water interface measurement ranges are 500 mm (19.69 in), 1 000 mm (39.37 in), and 2 000 mm (78.74 in). The WB probe is made of 304 stainless pipe protected by 1 mm (0.04 in) thickness PFA tube and a 316L base plate and side rods. Up to two Pt100 temperature elements can be set in the tube. This allows constant temperature measurement near the tank bottom.

- Precise initial calibration of NMT81 is performed in accordance with your options prior to shipping.
- NMT81 cannot measure the water interface if the water inside the tank is frozen. Ensure that the water in the tank does not freeze.



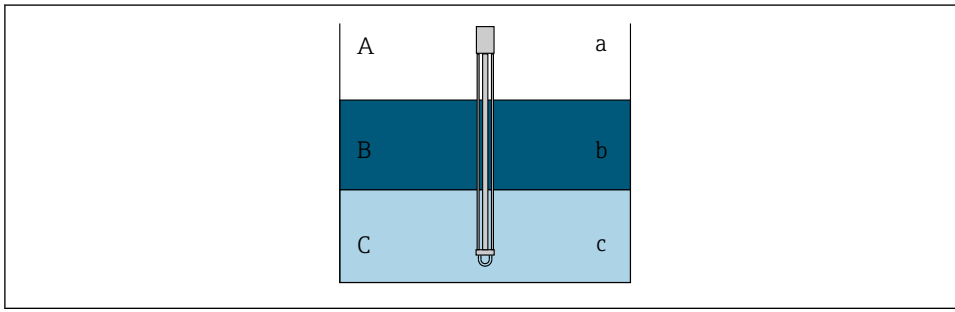
12 WB probe design. Unit of measurement mm (in)

1 *PFA protective tube (thickness: 1 mm)*
2 *Sensor pipe (304)*
3 *Pt100 element*
4 *Base plate/side rod (316L)*

5.9.1 Water level measurement in the three layers condition

When measuring the water level with three layers (air, product, and water) present in the range of the water bottom (WB), the accuracy of the water level measurement is negatively influenced by the dielectric difference between air, product, and water.

NMT81 compensates for this influence by comparing the product level from NMS8x or NMR8x. NMT81 also eliminates the influenced dielectric difference with this compensation result so that the water bottom (WB) maintains high probe accuracy and stable measurement.



13 *Water level measurement in three layers*

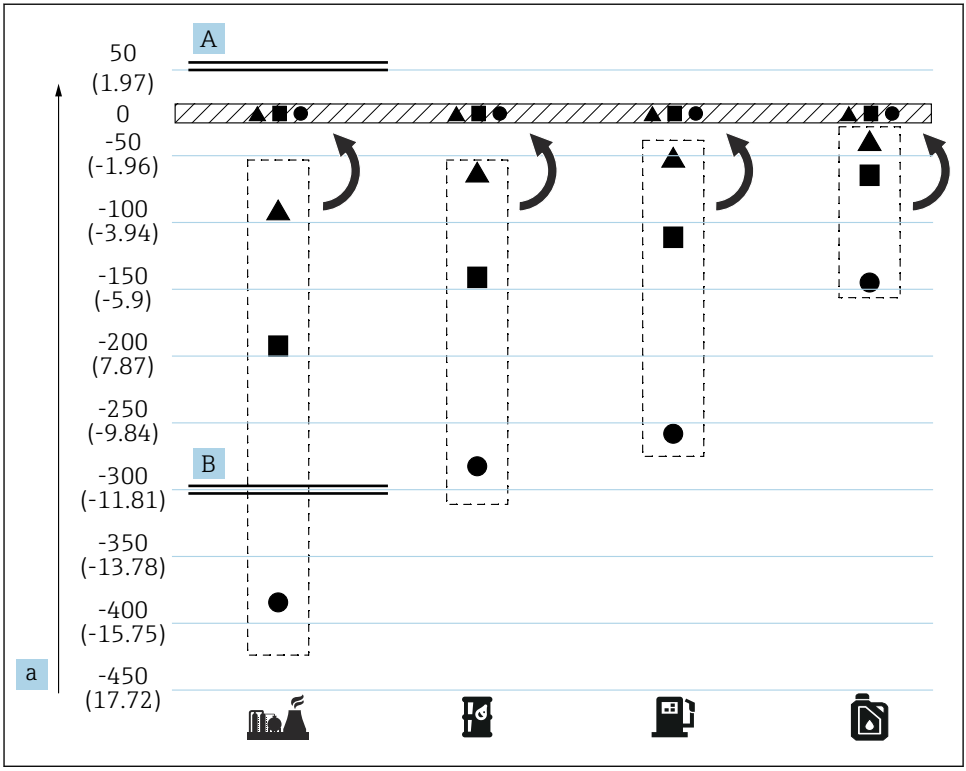
A Air
B Product
C Water
a Low dielectric
b Dielectric
c Conductivity

The relationship between the assumed relative permittivity and the application are as follows.

No	Relative permittivity	Application
1	3.0	Fuel
2	2.5	Crude
3	2.2	Gasoline
4	1.8	Diesel oil, Kerosene
5	1.0	Air

Fuel refers to biodiesel, soybean oil, and such like. By selecting an item that best represents your application from the table above, the measurement error can be approximated to 0 mm (0 in).

If the function of the three-layer compensation is not enabled (no compensation), the error appears on the minus side on the table below. However, three-layer compensation will be available only if the relative permittivity of the application is approximately 3 (fuel) or less.



14 *Effect of the three layers compensation*

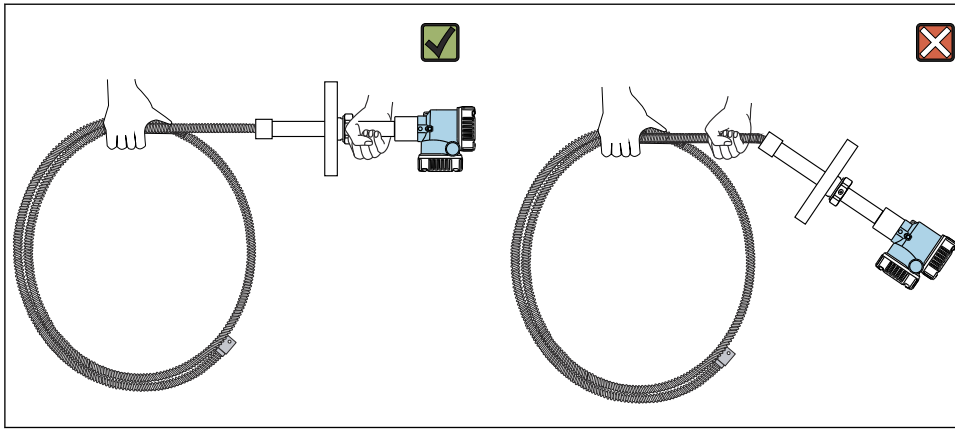
A With compensation
B Without compensation
a Maximum error of water level mm (in)

	Fuel	●	Probe length = 2.0 m (6.56 ft)
	Crude	■	Probe length = 1.0 m (3.28 ft)
	Gasoline	▲	Probe length = 0.5 m (1.64 ft)
	Diesel heating oil, Kerosene		

5.10 Pre-installation of NMT81

5.10.1 Unpacking

Unpack NMT81 with multiple people. If NMT81 is unpacked by one person alone, the temperature probe may become bent or twisted.



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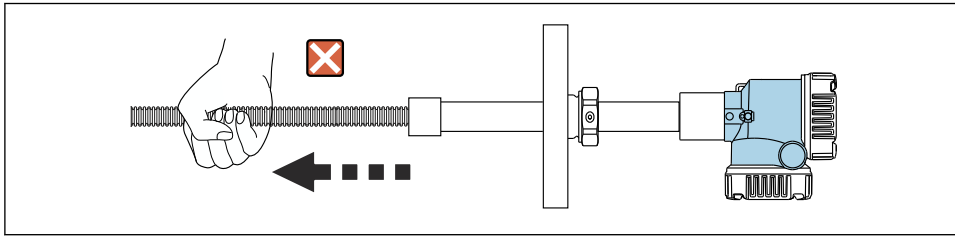
15 *Unpacking NMT81*

5.10.2 Temperature probe handling

Do not pull the converter while holding onto the temperature probe. This may cause the device to malfunction.



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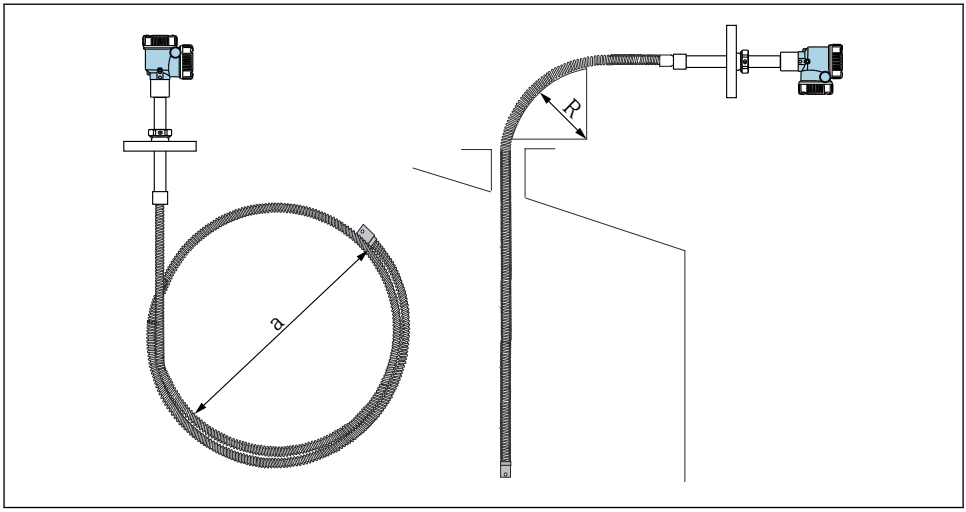
16 *Temperature probe handling*

When winding the temperature probe, keep the bending diameter at a minimum of 600 mm (23.62 in). When installing the temperature probe onto a tank or if it is necessary to bend the temperature probe, ensure that the bent portion is at least R = 300 mm (11.81 in).



17 *Installation and winding of a temperature probe*

a *600 mm (23.62 in) or more*
R *300 mm (11.81 in) or more*

CAUTION

If bending the temperature probe with R smaller than 300 mm (11.81 in), it may damage the probe and elements.

▶ Bend the probe 300 mm (11.81 in) or more.

5.10.3 Installation height adjustment

A unique feature of NMT81 is the optional ability to adjust height by approx. ±180 mm (7.09 in) from the original position.

The height adjustment feature is not available for the welded flange type and the converter-only version.

5.11 Installation procedure

The length of the NMT81 probe is predetermined by the customer. Check the following items before installing.

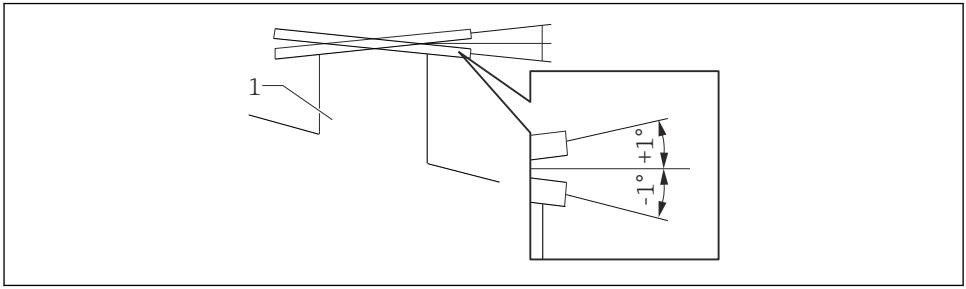
- Tag number on the device
- Length of the temperature probe
- Number of elements

- Element intervals
- The procedure for installing NMT81 will vary depending on the tank's shape and type. A cone roof tank and a floating roof tank are used for the following examples. The procedure to mount NMT81 flange on a tank nozzle flange is the same regardless of what type of tank is being used.
- The recommended diameter of the installation nozzle is:
  - Temperature only probe: 32A (1-1/4") or more
  - With WB probe: 50A (2") or more

5.11.1 NMT81 Installation

Confirm that the size of the nozzle and the flange is matched prior to mounting NMT81 on the tank. The flange size and the rating of NMT81 vary depending on the customer's specifications.

- Check the flange size of NMT81.
- Mount the flange on the top of the tank. The deviation of the flange from the horizontal plane should not exceed +/- 1 degree.
- Install NMT81 at least 300 mm (11.81 in) or API 7: 1 000 mm (39.4 in) away from the wall. This will ensure that the temperature measurement is not affected by the tank's ambient or wall temperature.



A0026889

18 *Allowable inclination of mounting flange*

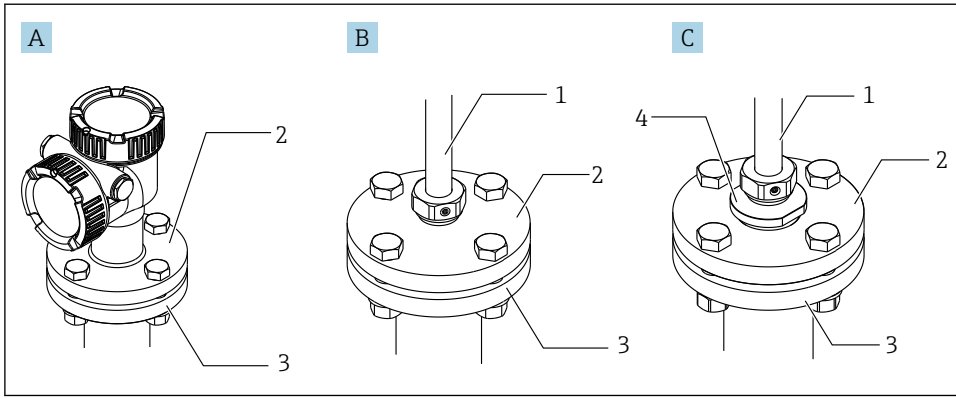
1 Nozzle

Insert the temperature probe and the optional WB probe and low profile anchor weight through the tank nozzle at the top of the tank.

To prevent damage to the temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.

Flange types

For NMT81 installation, there are three types of flange adjusters as follows.



19 *flanges*

A Non-height adjuster
B Height adjuster
C Thread type adjuster
1 Adjuster
2 Flange
3 Tank top flange (prepared by a customer)
4 Reducer

Non-height adjuster type mounting procedure

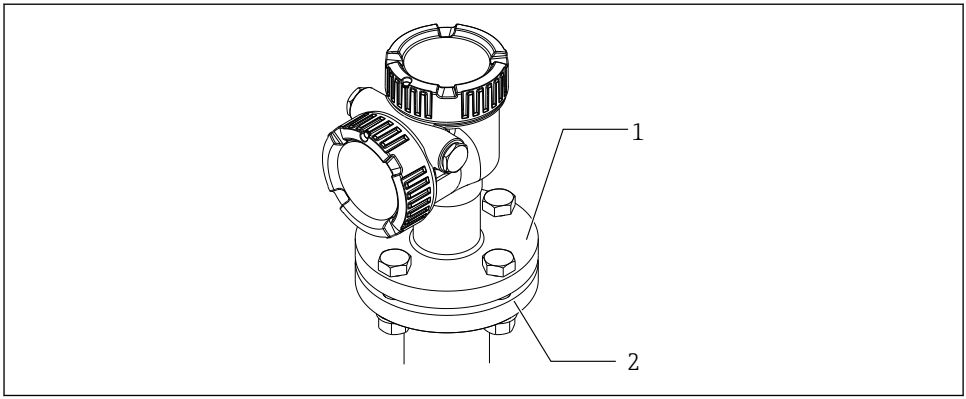
Make sure to align the correct orientation position of the device prior to tightening bolts.

CAUTION

Cable damage

It may cause the damage of the cable inside.

- Do not rotate the housing with loosening the socket head cap screw mounted on the side of the converter.



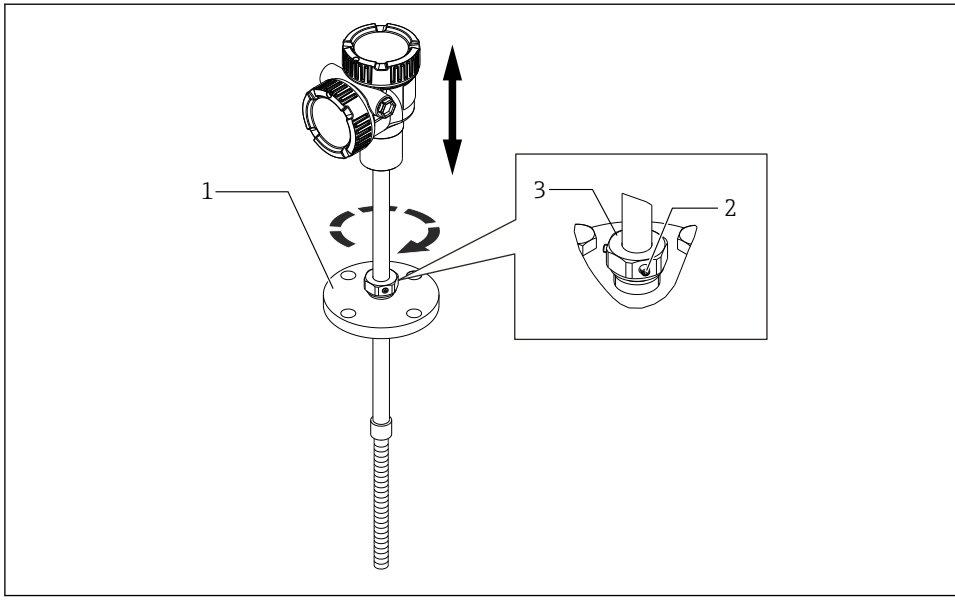
A0058128

20 Non-height adjuster type

1 Flange (NMT81 side)
2 Tank top flange (prepared by a customer)

Height adjuster type mounting procedure

1. Loosen the hexagonal socket set screws [2].
2. Loosen the bush [3].
3. Adjust the height and align the orientation position of NMT81.
4. Tighten the bush.
   ↳ Tightening torque: 60 Nm
5. Tighten the hexagonal socket set screws securely.
   ↳ Tightening torque: 4 Nm

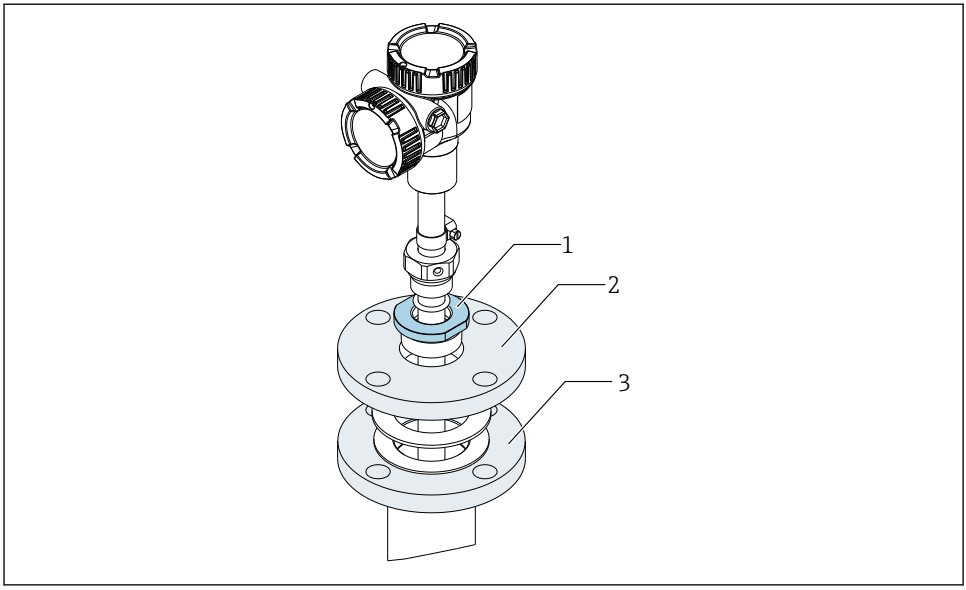


21 Height adjust type of NMT81

1 Flange
2 Hexagonal socket set screw
3 Bush

Thread type adjuster mounting procedure

- ▶ Tighten the reducer securely [1].
  - ↳ Tightening torque for NPT1-1/2: 255 Nm
    Tightening torque for NPT2: 316 Nm



22 Thread type adjuster

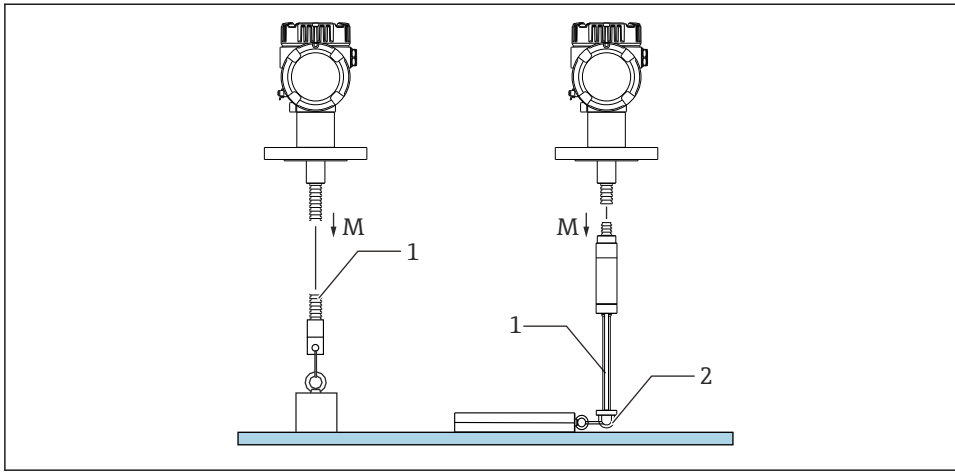
1 Reducer
2 Flange (prepared by a customer)
3 Tank top flange (prepared by a customer)

⚠ CAUTION

Precautions regarding stranded wire on anchor weight and top anchor

Applying tension of more than 6 kg (13.23 lb) may cause internal damage in the temperature probe.

► Ensure that the tension during and after installation is no more than 6 kg (13.23 lb).



23 Installation of anchor weight

M During/after installation: M ≤ 6 kg (13.23 lb)
1 Lowest temperature element position
2 Hook

5.12 Mounting NMT81 on a cone roof tank

When installing a WB probe, check "zero point" (reference position) on the WB probe by comparing it to a manual dipping reference.

There are three ways to install NMT81 onto a cone roof tank:

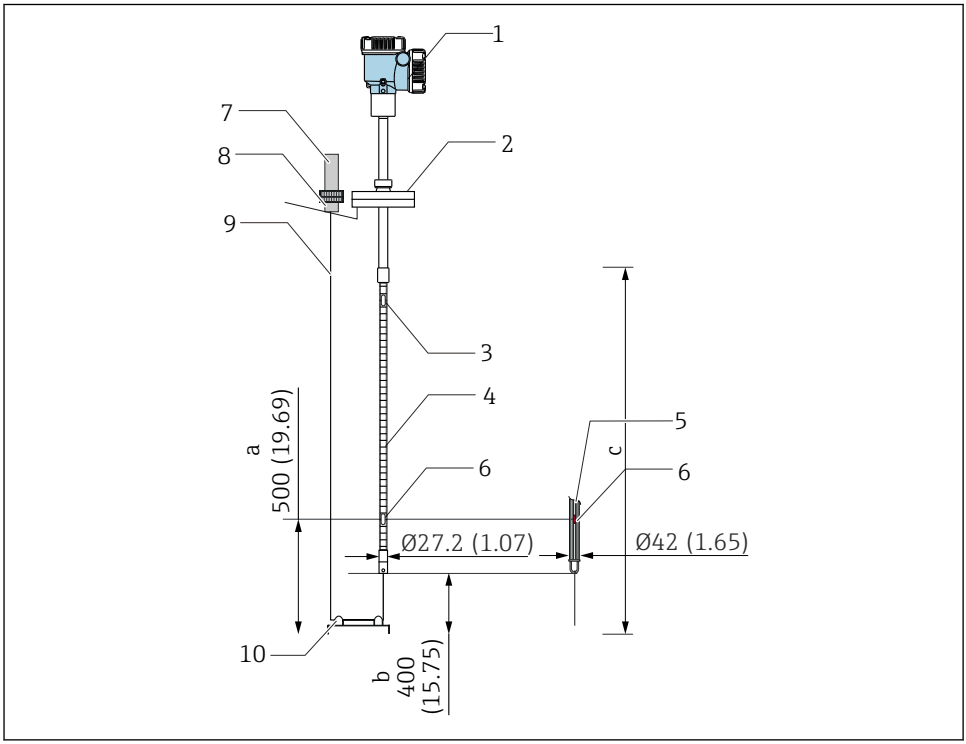
- Top anchor method
- Stilling well method
- Anchor weight method

If a heating coil is attached to the bottom of the tank, install NMT81 so that the bottom of the temperature probe or WB probe is not too close to the heating coil (distance varies depending on the type of heating coil).

5.12.1 Top anchor method

In this method, the temperature probe or the WB probe is secured using a wire hook and a top anchor.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.

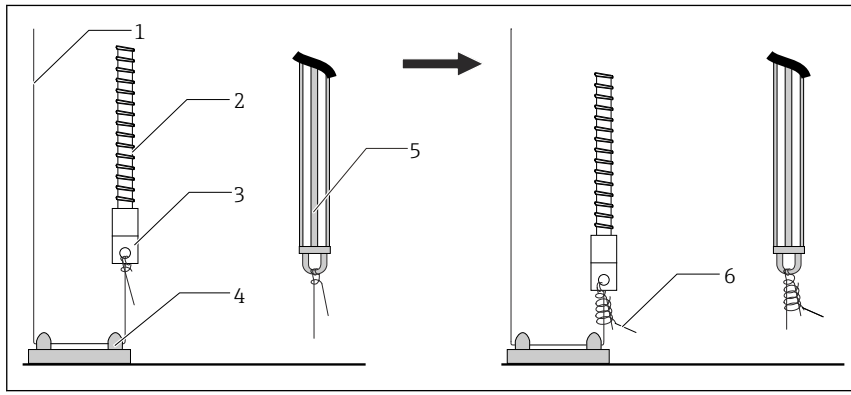


24 *Top anchor method. Unit of measurement mm (in)*

a From the tank bottom to the lowest element
b From the tank bottom to the probe bottom
c Tank height
1 Converter (electrical compartment)
2 Flange
3 Highest temperature element
4 Temperature probe
5 WB probe
6 Element position No.1 (lowest element)
7 Top anchor
8 Socket
9 Stranded wire
10 Wire hook

Top anchor installation procedure

1. Suspend the stranded wire from the top anchor at the top of the tank and temporarily secure its end to the top anchor.
2. Pass the stranded wire through the wire hook at the bottom of the tank.
3. Feed the stranded wire through the eye bolts of the bottom wire hook.
4. Tie the stranded wire, and then bundle the knot with the provided securing wire.

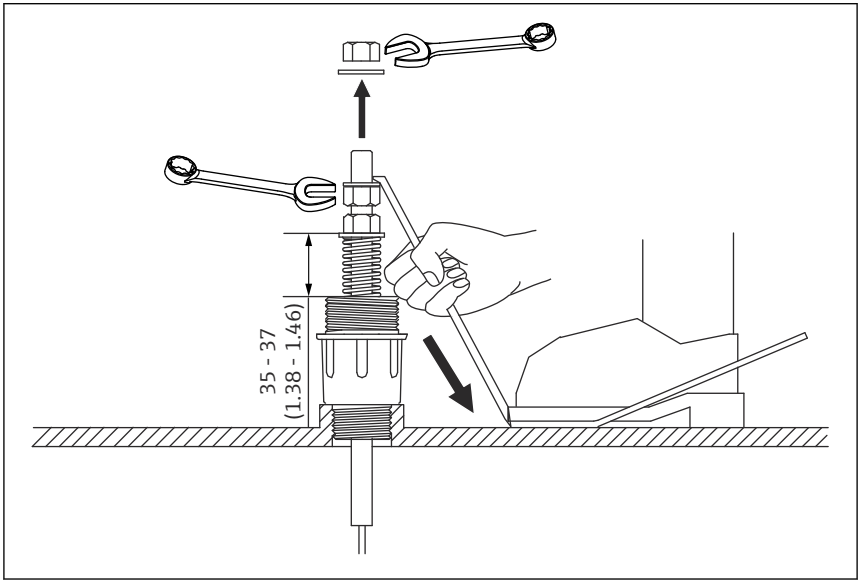


25 Top anchor installation 1

1 *Stranded wire (Specified length of the probe + 2 000 mm (78.74 in)/φ3 mm (0.12 in))*
2 *Temperature probe*
3 *Probe bottom hook (wire suspension)*
4 *Wire hook*
5 *WB probe*
6 *Provided securing wire (2 000 mm (78.74 in)/φ0.5 mm (0.02 in))*

5. Secure the stranded wire to the top anchor while drawing it by holding it down with a foot or a hand.
6. Wrap the end of the stranded wire once around the top anchor's axis, and tighten it using two nuts.
7. Cut the excess stranded wire.

8. Rotate the nuts clockwise until the top anchor's spring is 35 to 37 mm (1.38 to 1.46 in).



26 Top anchor installation 2. Unit of measurement mm (in)

9. Cover the top anchor.

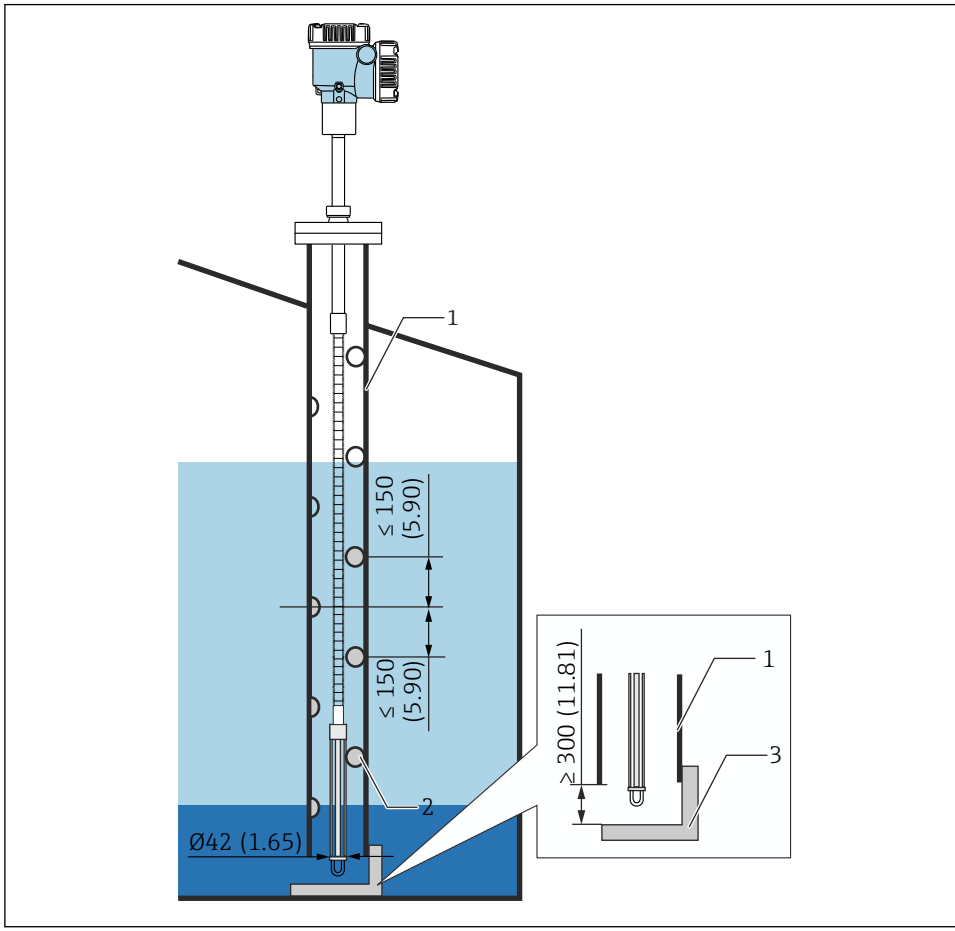
This completes the procedure for installing a top anchor.

5.12.2 Stilling well method

Prepare the stilling well that is larger than the diameter of the measuring probe when installing it.

When using an anchor weight, use a pipe that is 100A (4") (JIS, ASME) or larger. If an anchor weight is not being used in the stilling well method, install the WB probe so that its end is below the bottom of the stilling well. This will allow the pipe to be filled with liquid.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



27 *Stilling well. Unit of measurement mm (in)*

1 *Stilling well*
2 *Hole (φ 25 mm (0.98 in))*
3 *Base plate/datum plate*

Stilling well installation procedure

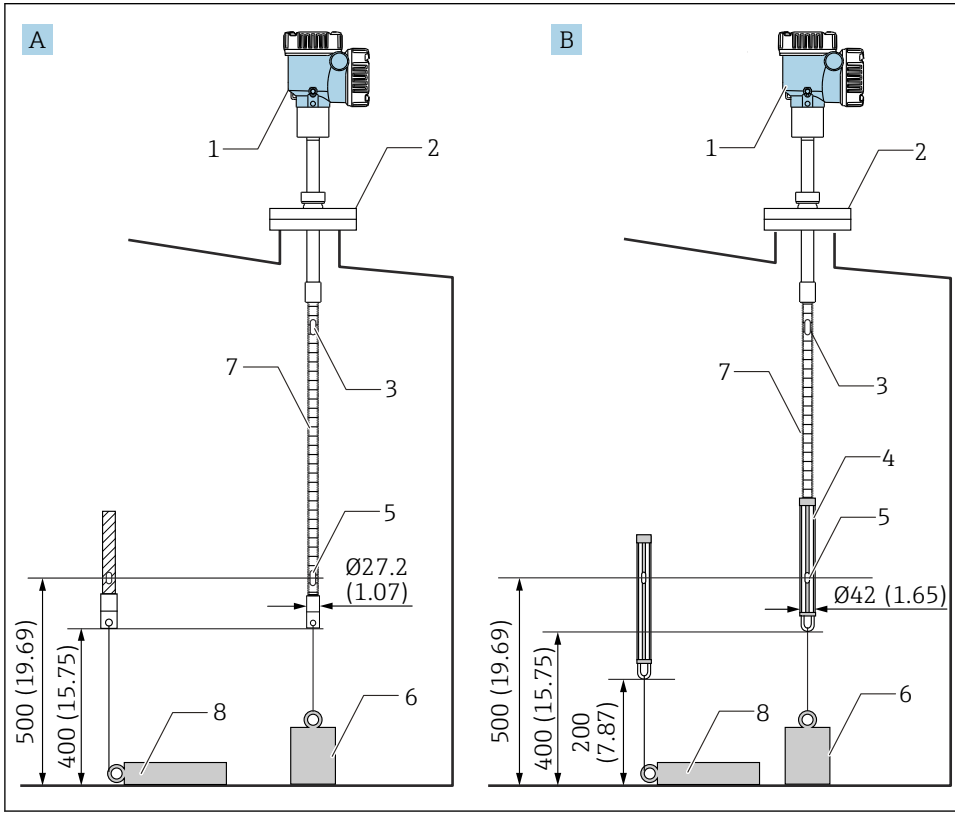
1. Pass the temperature probe and the WB probe through a gasket and insert them from the installation nozzle at the top of the tank.
2. Use bolts to secure the flange of NMT81 to the installation nozzle on top of the tank.

This completes the procedure for installing a stilling well.

5.12.3 Anchor weight method

This method secures a temperature probe using an anchor weight.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



28 *Anchor weight method. Unit of measurement mm (in)*

A Without WB probe
B With WB probe
1 Converter (electrical compartment)
2 Flange
3 Top element
4 WB probe
5 Element No.1 (lowest element)
6 Anchor weight (high profile)
7 Temperature probe
8 Anchor weight (low profile)

⚠ CAUTION

Installation of an anchor weight

Using an anchor weight that is heavier than 6 kg (13.23 lb) may cause internal damage to the temperature probe.

▶ Ensure that the anchor weight is stable at the bottom of the tank. When installing NMT81 with a suspended anchor weight, use an anchor weight that weighs 6 kg (13.23 lb) or less.

Anchor weight installation procedure

1. Tie the bottom hook of the temperature probe or the WB probe to the anchor weight's ring using a stranded wire.
2. Wrap the stranded wire twice around the bottom hook. Pull it downwards and tie it down, and then bundle it with the provided securing wire.
3. Using bolts, secure the flange of NMT81 to the nozzle at the top of the tank.

This completes the procedure for installing an anchor weight.

5.13 Mounting NMT81 on a floating roof tank

There are three ways to mount NMT81 on to a floating roof tank.

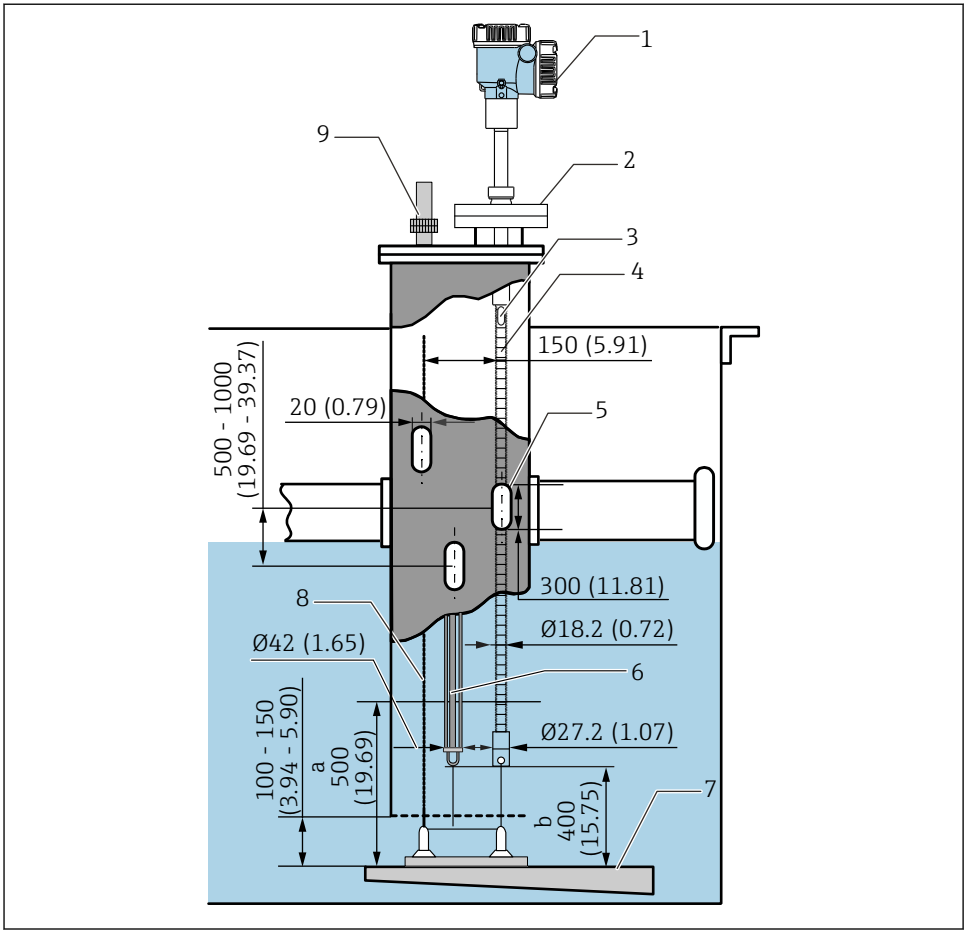
- Top anchor method
- Stilling well method
- Guide ring and anchor weight method

If a heating coil is attached to the bottom of the tank, install NMT81 so that the bottom hook of a temperature probe or a WB probe is not too close to the heating coil.

5.13.1 Top anchor method

Insert a temperature probe or a WB probe into a fixed pipe and secure it with a top anchor.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



29 *Top anchor method. Unit of measurement mm (in)*

a *Distance between the base plate and the temperature probe*
b *Distance between the base plate and the WB probe*
1 *Converter (electrical compartment)*
2 *Flange*
3 *Top element*
4 *Temperature probe (without WB probe)*
5 *Stilling well hole*
6 *Temperature probe (with WB probe)*

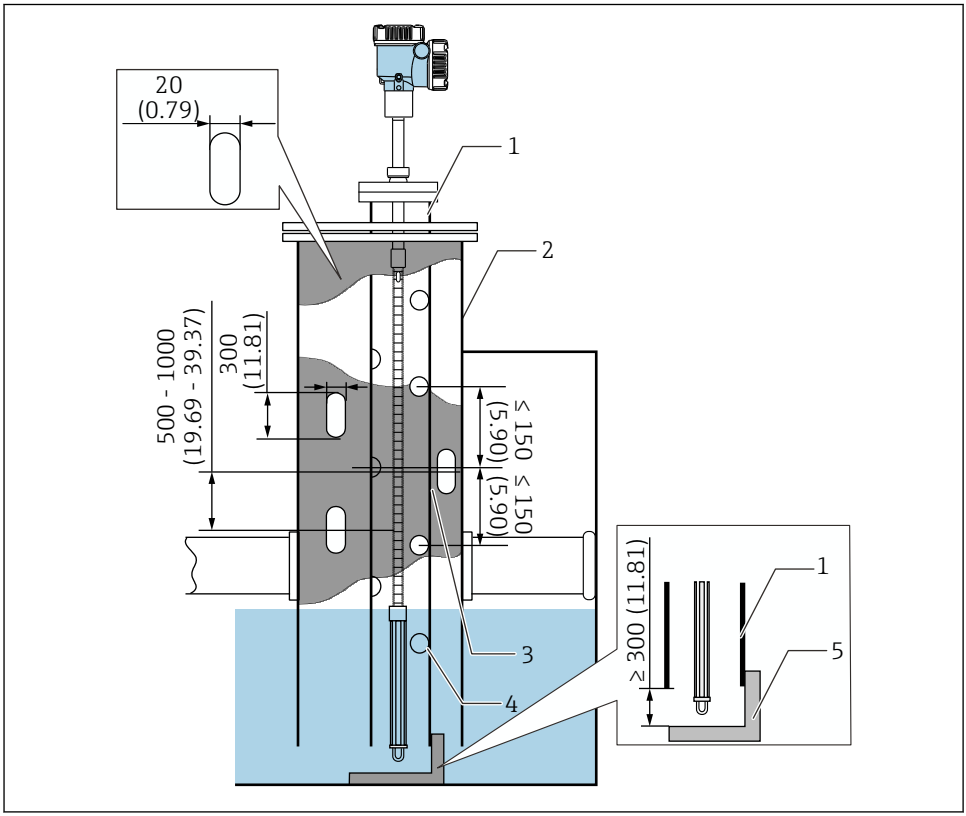
7 Base plate/datum plate
8 Stranded wire
9 Top anchor

For the detailed installation procedure of top anchor, → 37

5.13.2 Stilling well method

Insert a temperature probe and a WB probe into a stilling well that is 50A (2") or larger. The installation procedure is same for only temperature version.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



30 *Stilling well method. Unit of measurement mm (in)*

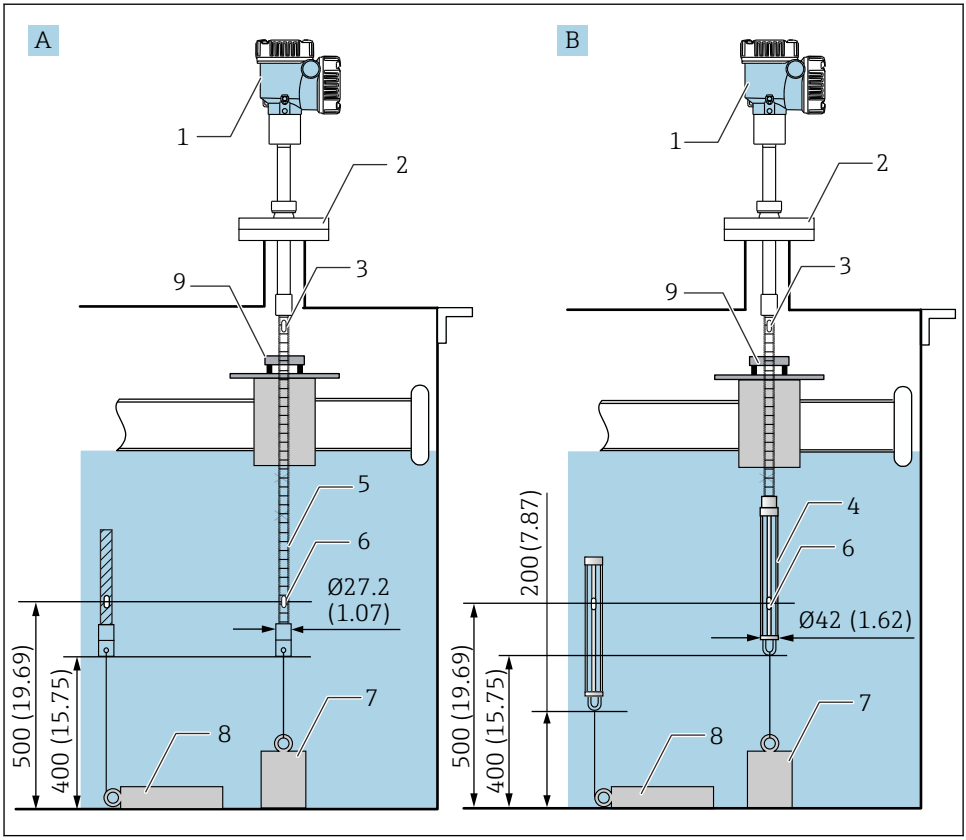
1 *Stilling well*
2 *Fixed pipe*
3 *Fixed pipe hole*
4 *Stilling well hole (φ 25 mm (0.98 in))*
5 *Base plate/datum plate*

For the detailed installation procedure of stilling well, → 37

5.13.3 Guide ring and anchor weight method

Secure a temperature probe or a WB probe using a guide ring and an anchor weight.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.



31 *Guide ring and anchor weight method. Unit of measurement mm (in)*

A Without WB probe
B With WB probe
1 Converter (electrical compartment)
2 Flange
3 Top element
4 WB probe
5 Temperature probe
6 Element No.1 (lowest element)
7 Anchor weight (high profile)
8 Anchor weight (low profile)
9 Guide ring (not supplied, see NOTE.)

Guide ring must be prepared by a customer or contact your Endress +Hauser Sales Center for further information.

⚠ CAUTION

Installation of an anchor weight

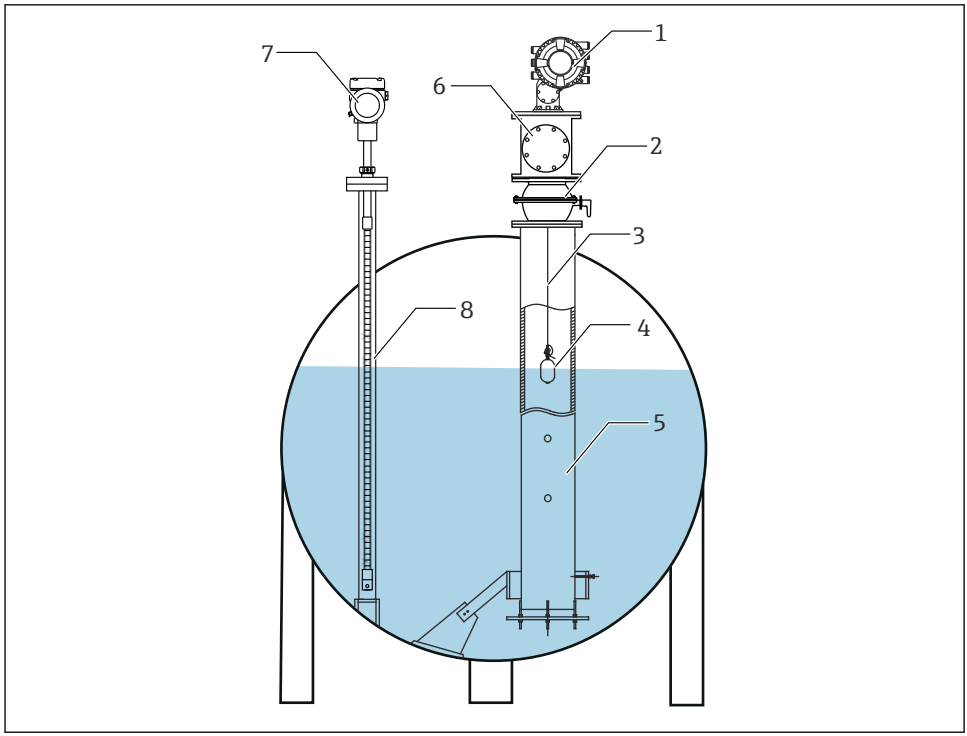
Using an anchor weight that is heavier than 6 kg (13.23 lb) may cause internal damage to the temperature probe.

- ► Ensure that the anchor weight is stable at the bottom of the tank. When installing NMT81 with a suspended anchor weight, use an anchor weight that weighs 6 kg (13.23 lb) or less.

5.14 Mounting NMT81 on a pressurized tank

In a pressurized tank, a protective pipe or a thermowell without any holes, slits, nor an open end must be installed in order to protect the probes from pressure.

To prevent damage to temperature probe and WB probe, ensure that they do not touch anything during insertion through the installation nozzle.

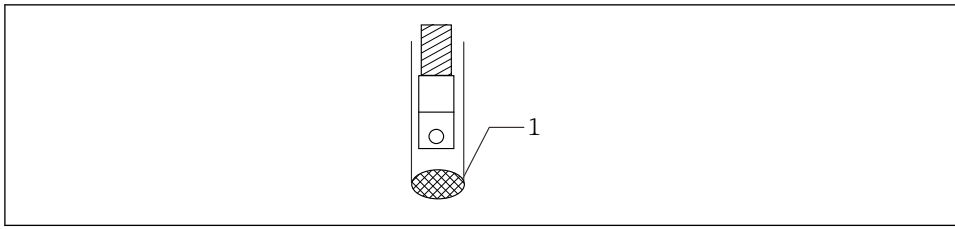


32 *Thermowell for a pressurized tank*

1 *NMS8x/NMS5*
2 *Ball valve*
3 *Measuring wire*
4 *Displacer*
5 *Stilling well*
6 *Maintenance chamber*
7 *NMT81*
8 *Thermowell*

If the pressure inside a tank exceeds the pressure limit, install a thermowell with no holes or slits surrounding NMT81 to protect NMT81 from the application (process) pressure. However, NMS8x requires a stilling well with holes and slits.

The thermowell is installed from the top of the tank nozzle. Cover the bottom of the thermowell and weld it to protect the probe from the pressure.



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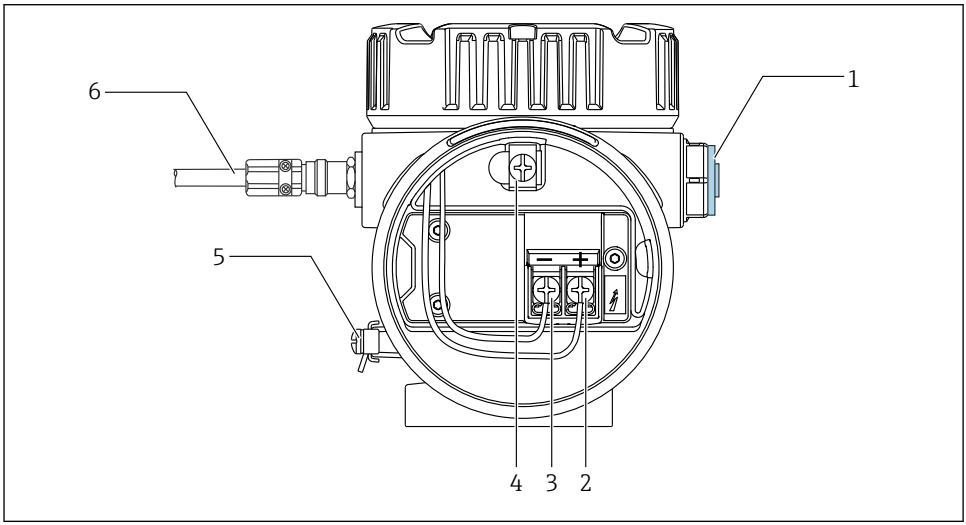
33 Thermowell welding

1 Welding point

6 Electrical connection

6.1 NMT81 (Ex ia) intrinsically safe connection

NMT81, which uses intrinsically safe HART communication, must be connected to the device's intrinsically safe terminal. Refer to the intrinsic safety regulations for establishing wiring and field device layout.



34 NMT81 terminal (ATEX • Ex ia)

1 Stopping plug (Non-Ex)
2 + terminal (see Information)
3 - terminal (see Information)
4 Internal ground terminal for the cable shield
5 External ground terminal
6 Shielded twisted pair wire or steel-armored wire

- Only a metal cable gland may be used. The shielded wire on the HART communication line must be grounded.
- The plug is also mounted at the side of [6] in the figure above prior to shipping. The material of plug (aluminum or 316L) varies depending on the type of the transmitter housing material.

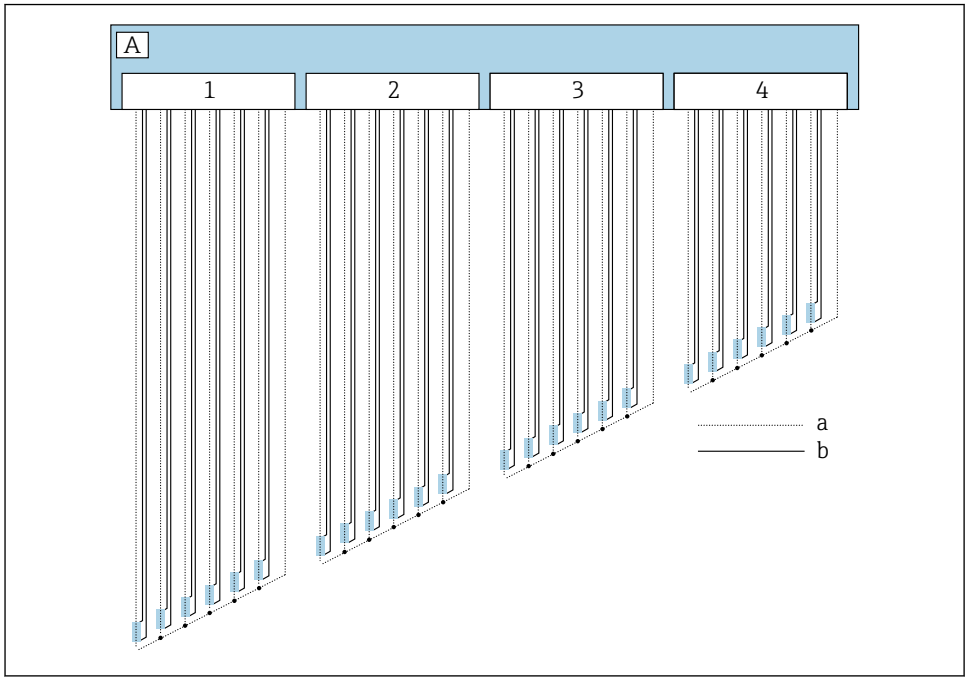
Connection table

Connection to NRF590		Connection to NMS5		Connection to NMS8x/NMR8x/NRF81 [1]	
+ Terminal	24, 26, 28	+ Terminal	24	+ Terminal	E1
- Terminal	25, 27, 29	- Terminal	25	- Terminal	E2

1) If an analog Ex i/IS 4 to 20 mA HART module is installed, NMT81 can be connected to slot B2, B3 or C2, C3.

6.2 NMT81 transmitter and element connection

Four-wire common return enables the highest accuracy in the narrowest probe in a limited tank nozzle opening. The wiring diagram shows the configuration as follows.

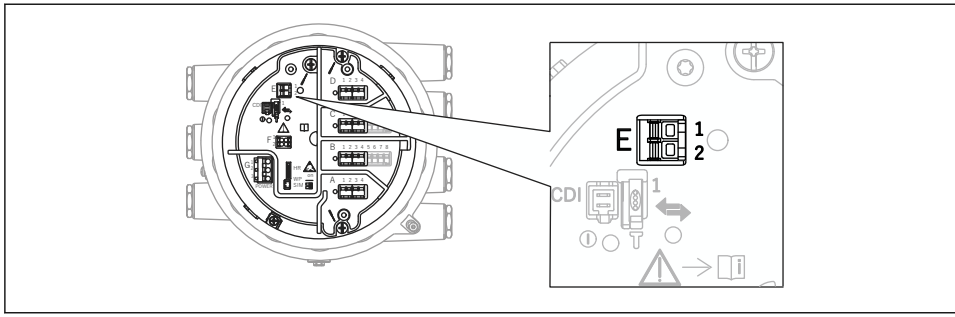


35 *Four-wire connection diagram*

A Sensor unit
a Current flow
b Voltage measurement
1 Connector 1
2 Connector 2
3 Connector 3
4 Connector 4

6.3 NMS8x/NMR8x/NRF81 (Ex d [ia]) intrinsically safe connection

To connect an intrinsically safe NMT81, E1 and E2 are used to connect with NMS8x, NMR8x and NRF81.



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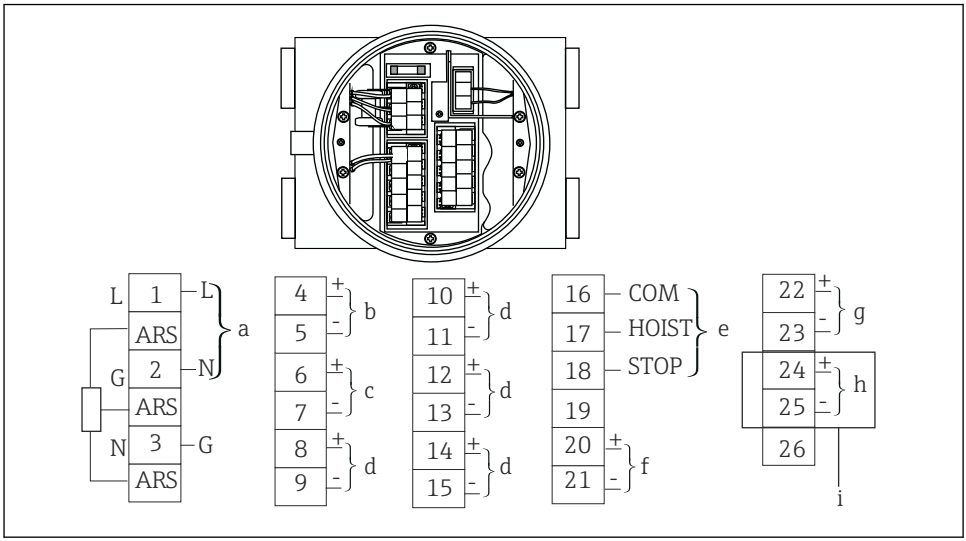
36 NMS8x terminal for NMT81

E1 + terminal
E2 - terminal

6.4 NMS5 (Ex d [ia]) intrinsically safe connection

The intrinsically safe NMT81 must be connected to the intrinsically safe HART terminal on NMS5.



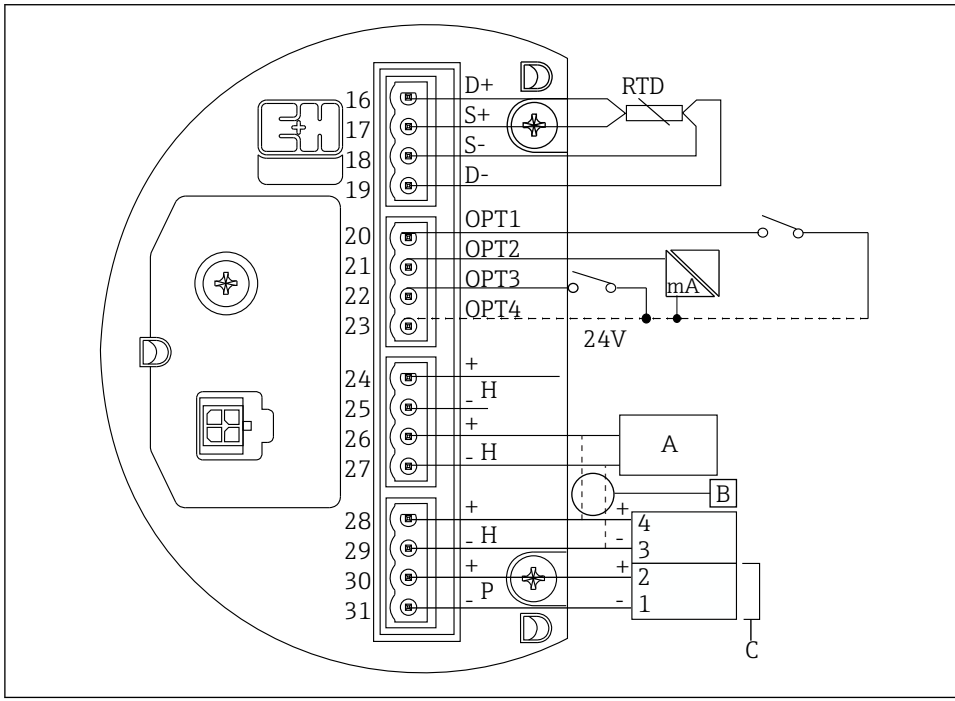
37 *NMS5 terminal*

a *Power supply*
b *Non-intrinsically safe HART communication: NRF, etc.*
c *Digital output Modbus, RS485 serial pulse or HART*
d *Alarm contact point*
e *Operation contact point input*
f *4 to 20 mA channel 1*
g *4 to 20 mA channel 2*
h *Intrinsically safe HART*
i *From NMT81 Ex ia*

Do not connect NMT81 HART communication cable to terminals 4 and 5 on NMS5/ NMS7. These terminals are designed to connect to Ex d HART communication.

6.5 NRF590 terminals

NRF590 has three sets of intrinsically safe local HART terminals.



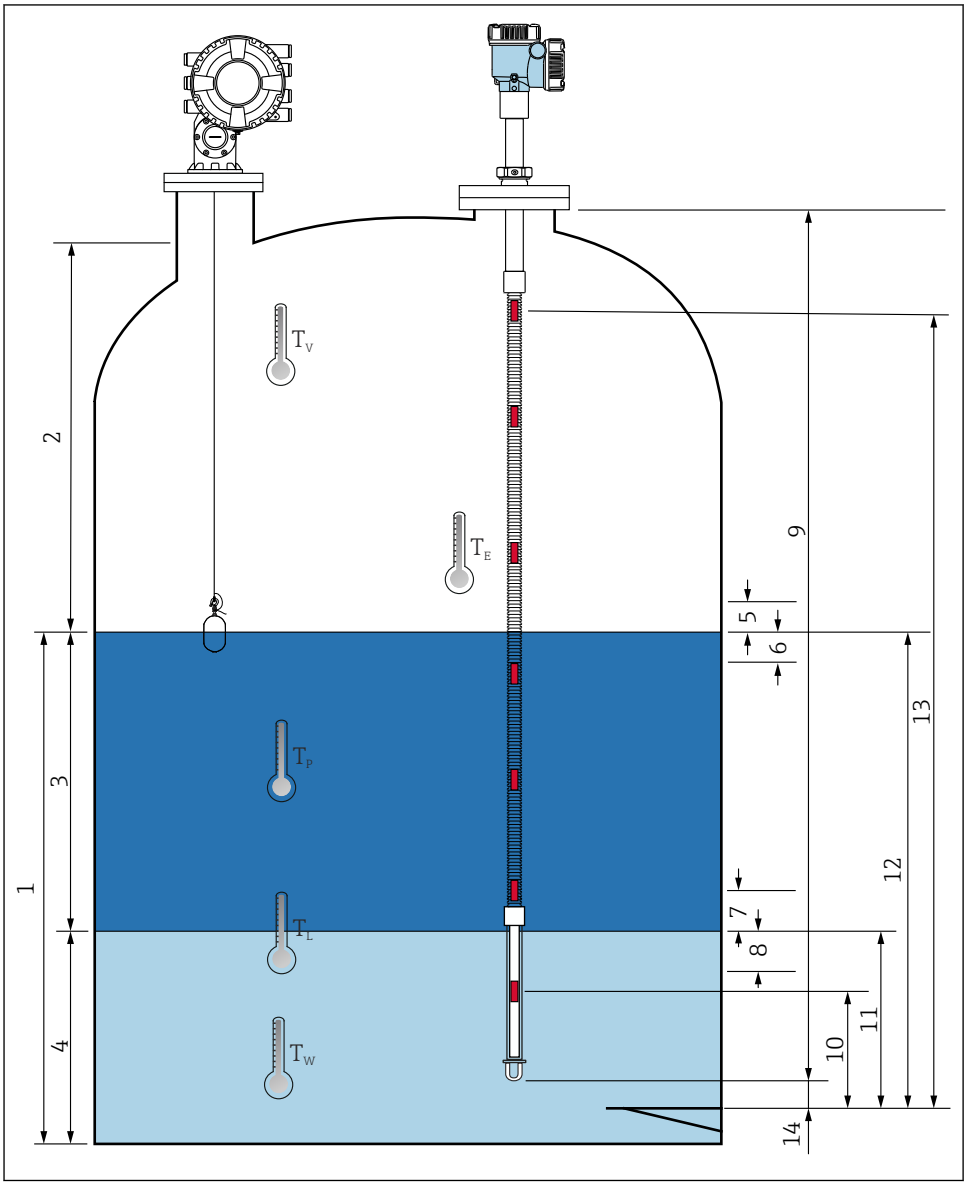
38 *NRF590 (intrinsically safe) terminals*

A HART sensor (mutually connected as a single HART fieldbus loop on the inside)
B Fieldbus loop
C Only in Micropilot S series

A signal HART line cannot be connected from NMT81 to terminals 30 and 31. These terminals are an intrinsically safe 24 V_{DC} power supply for the Micropilot S Series (FMR53x, FMR540).

7 Commissioning

7.1 Terms related to temperature measurement



39 *Terms concerning NMT81 installation*

1 Liquid temperature
2 Vapor temperature
3 Product temperature
4 Water temperature
5 Minimum height above tank level (uncovered)
6 Minimum depth below tank level (covered)
7 Minimum height above water level (uncovered)
8 Minimum depth below water level (covered)
9 Probe length
10 1st element position
11 Water level
12 Tank level
13 Element “n” position
14 End of probe to zero distance

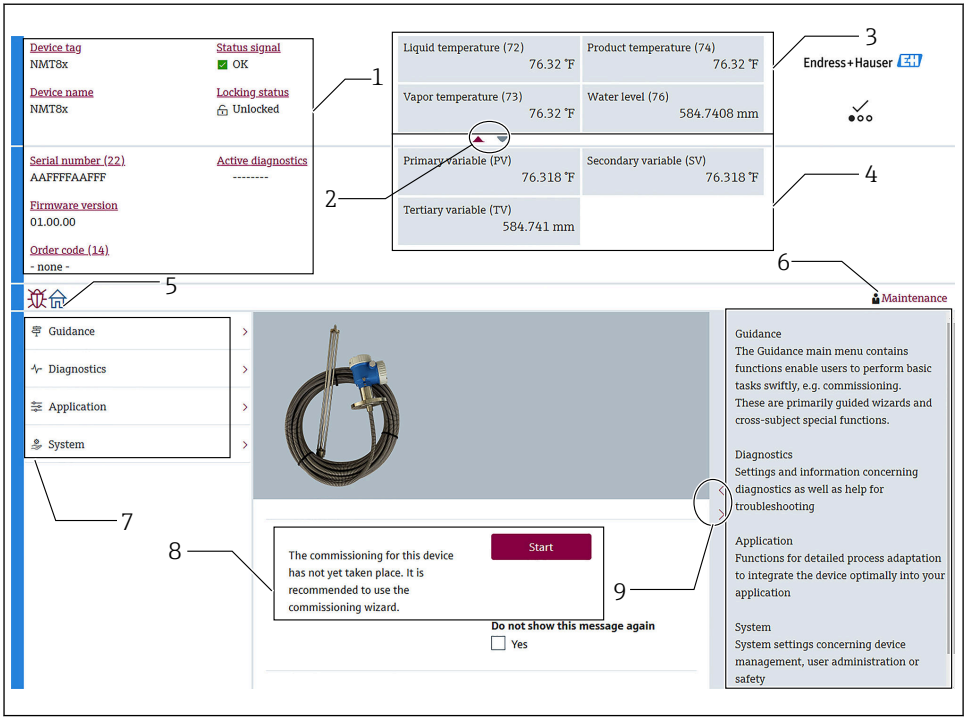
7.2 Initial setting

Depending on NMT81 specification, some of the initial settings described below may not be required.

NMT81 does not have functions for setting display language or setting the real-time clock. The only available display language is English for NMT81.

7.3 Initial screen

This section briefly describes the categories of items and their content, and operations. For further details of each description, refer to the following sections.



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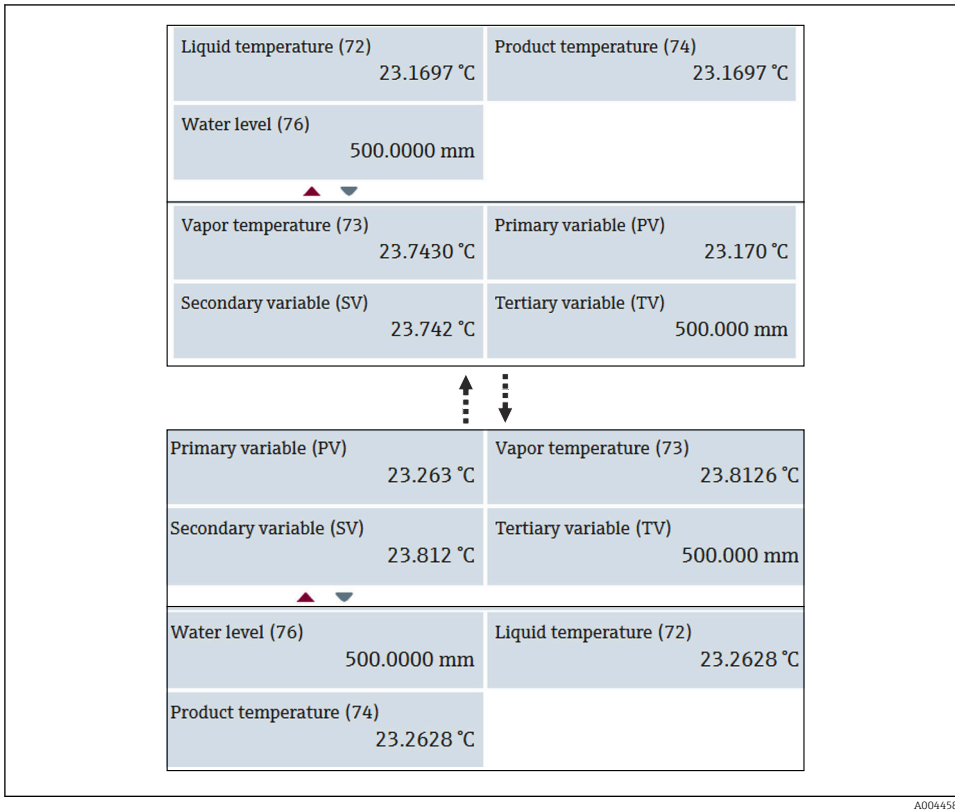
40 *Initial screen via FieldCare*

1 *Device status view area*
2 *Area enlarged view button for upper and lower views*
3 *Upper view area*
4 *Lower view area*
5 *Home button*
6 *Mode view*
7 *Operating menu list*
8 *Setting input area*
9 *Area enlarged view button for descriptions*

7.3.1 Upper and lower view areas

The layout of the items in the upper view area [3] and the lower view area [4] can be changed by dragging and dropping the desired items in the display area above.

For the category of (PV) and (QV), the desired items to be displayed in the upper or lower view area can be selected via the “Output settings” part of the commissioning procedure. For the category of (QV), the items are selectable but not displayed on either of the upper or lower view areas. For more details for setting of the upper and lower views, see next article “Commissioning”.



41 *Upper and lower view areas*

7.4 Guidance

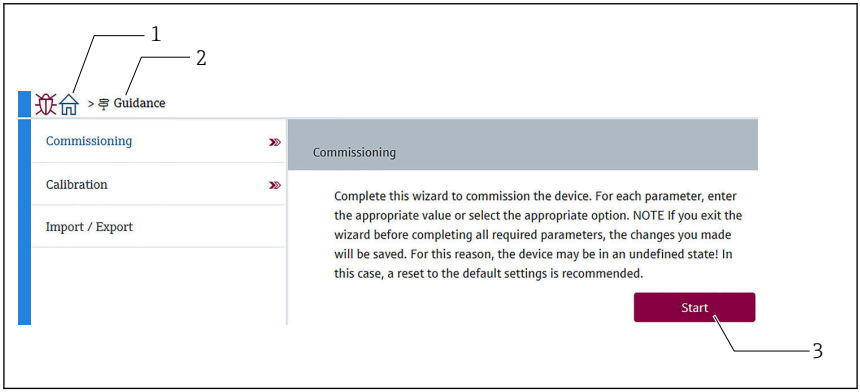
Guidance contains three items: Commissioning, Calibration, and Import / Export; however this section only describes Commissioning and Import / Export. We recommend that calibration be performed by E+H service personnel, and the procedures are therefore not listed in the operating instructions.

7.4.1 Commissioning

Commissioning means to perform the initial settings for measurement. When the DTM is opened for the first time, Commissioning of NMT81 will be required.

Commissioning procedure

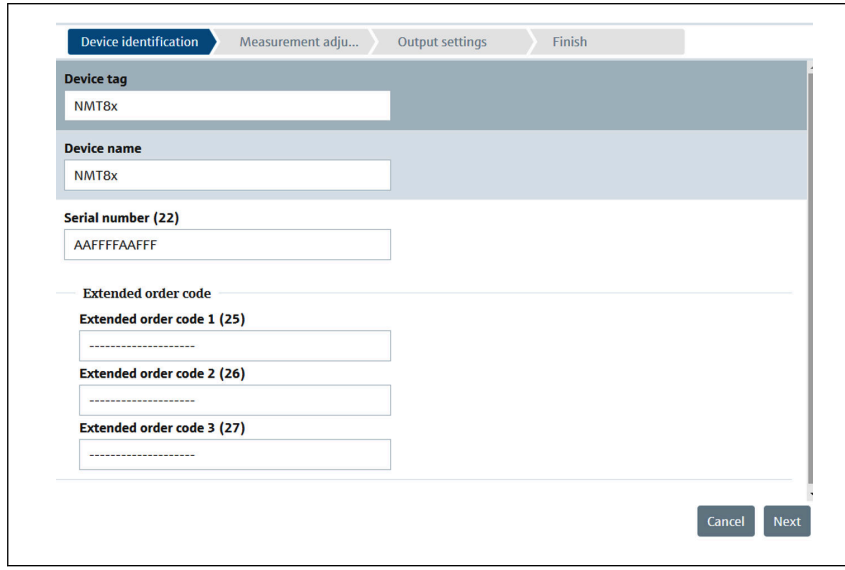
1. Navigate to: Guidance → Commissioning → Start



42 *Initial screen of Commissioning*

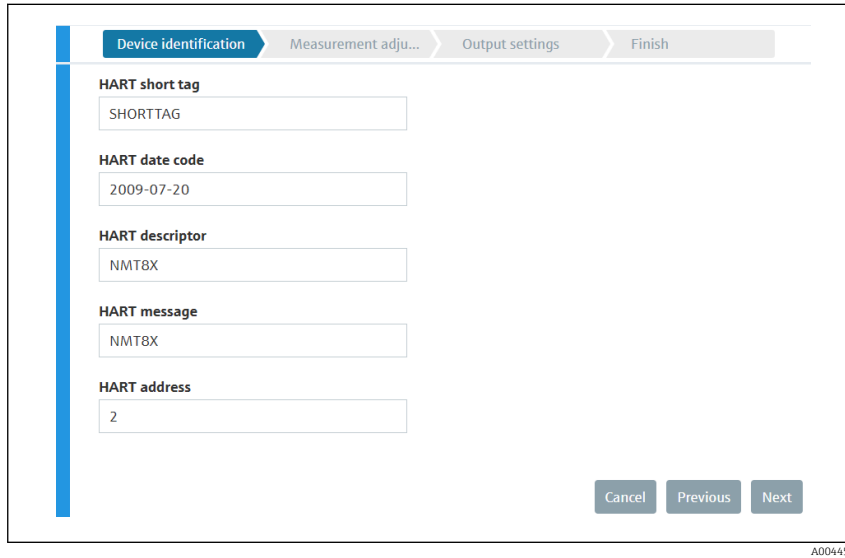
1 Home button
2 Operation menu: Guidance
3 Start button

2. Confirm that the device tag, name and serial number are correct, and select [Next].



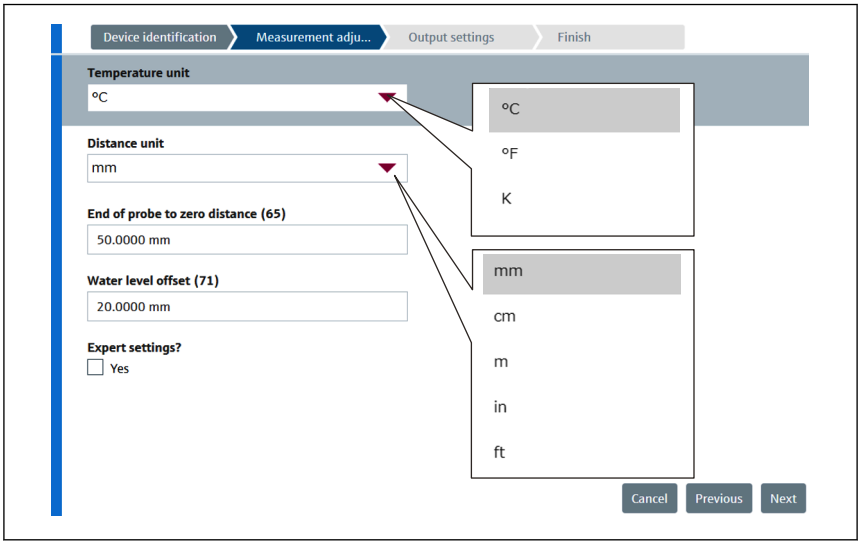
43 *Device identification screen*

3. Confirm that the HART short tag, HART date code, HART descriptor are correct, and select [Next].



44 *Device identification screen 2*

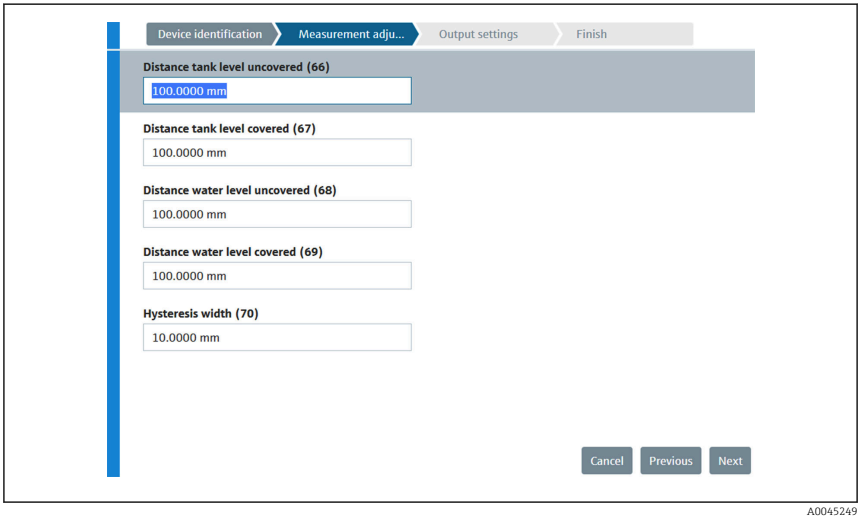
4. Select a unit of the temperature measurement: ℃, ℉, and K and a unit of the distance: mm, cm, m, in, and ft.



45 *Measurement adjustments screen*

If check [Yes] in Expert setting, go to next step and if not, skip the next step.

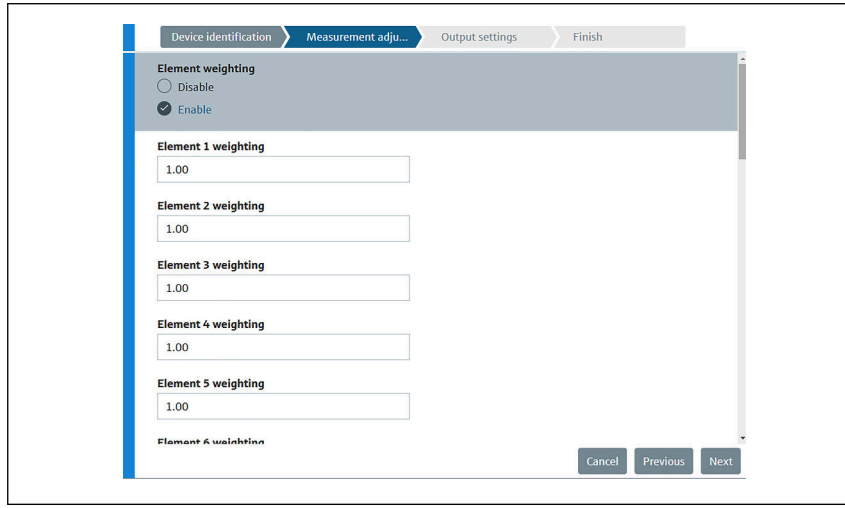
5. Set the following five values.



46 *Measurement adjustments screen 2*

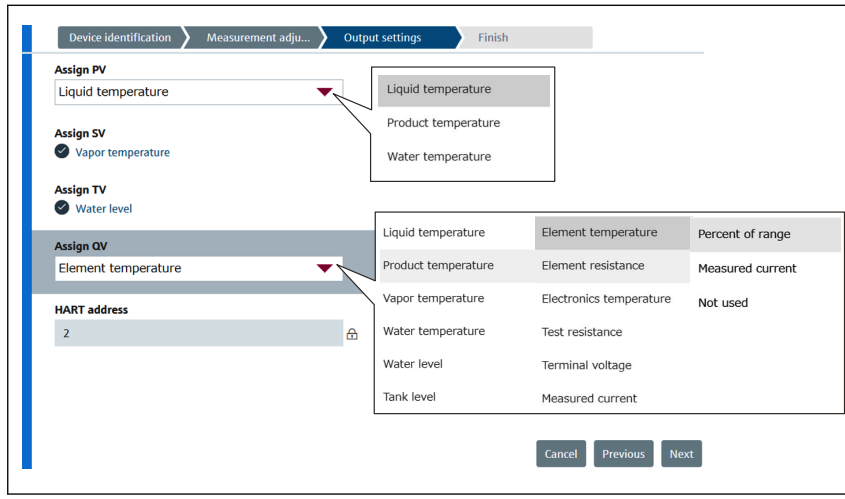
6. Select [Next].

7. Set the following values.



8. Select [Next].

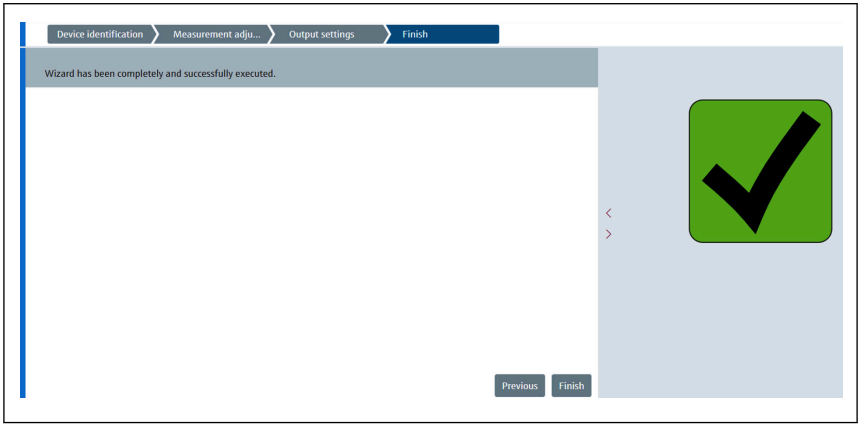
9. Select each item from the Assign PV and the Assign QV, and select [Next].



47 *Output settings screen*

The items selected in this screen will be shown at the upper or lower view area on the initial screen.

10. Select [Finish] to be completed.

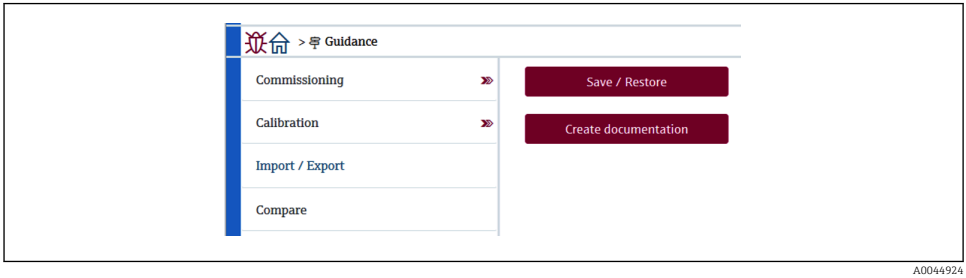


48 *Complete screen*

This completes the commissioning procedure.

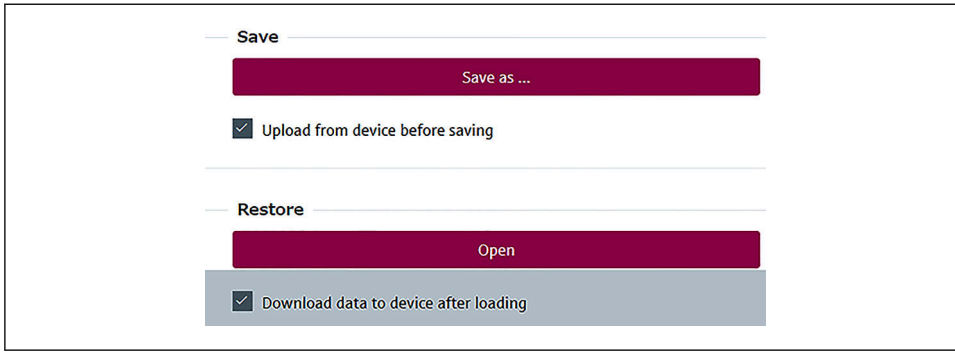
7.4.2 Import / Export

Import / Export has three items to be set or confirmed as follows.



49 *Import / Export screen*

Save / Restore



50 *Save / Restore screen*

Save: The information is sent to a PC from NMT81.

The information of writable parameters regarding device measurements can only be saved on a PC.

Saving procedure

1. Press [Save / Restore].
2. Check upload from the device before saving in order to save the values that are actually saved on the device.
3. Press [Save as].
4. Specify the saving destination.
5. Input a file name.
6. Press [Save].
   ↳ **.deh** file format is created.

This completes the saving procedure.

Restore: Information saved on a PC is sent to NMT81 again.

Restore procedure

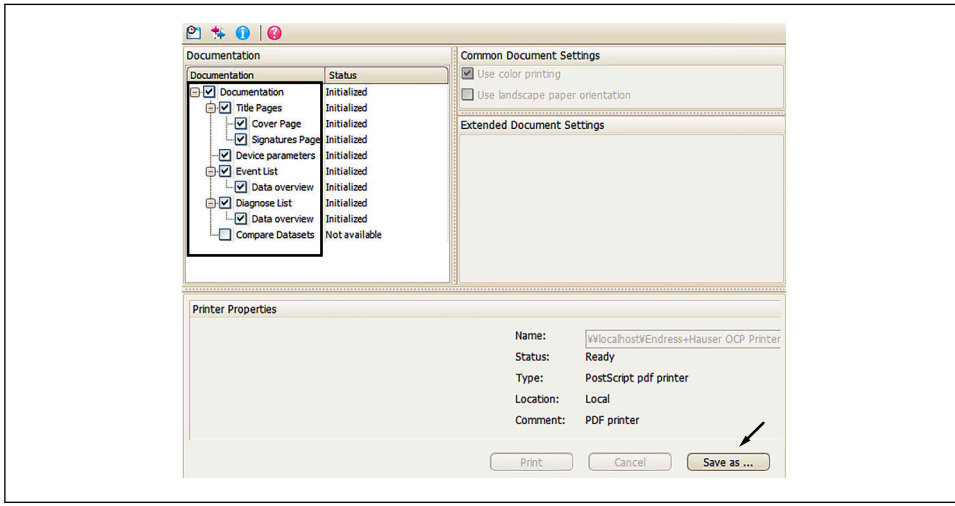
1. Press [Save / Restore].
2. Check [Download data to device after loading].
   ↳ If data is restored without performing a check, the data is only updated in FieldCare without sending to the master devices.
   The data restore operation without check is used in offline work.
3. Press [Open].

4. Select a desired file.
   ↳ Restoring starts.

This completes the restoring procedure.

Create documentation

This lists the all parameters and displays them in PDF file.



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51 *Create documentation screen*

Creating documentation procedure

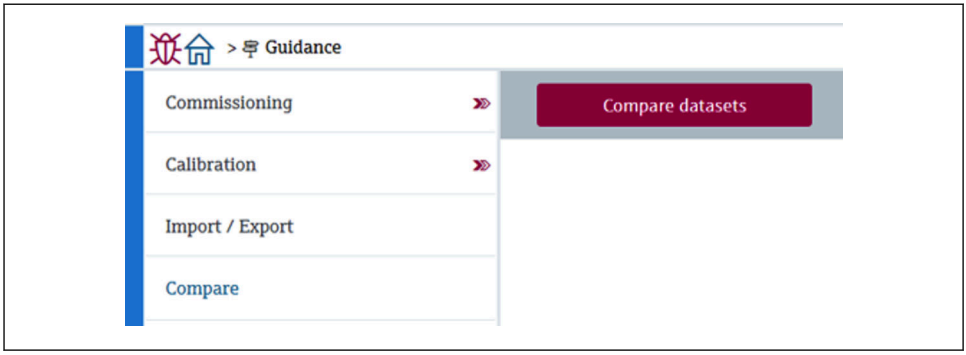
1. Press [Create documentation].
2. Check the required items in the Documentation window.
   ↳ The default setting has every item checked.
3. Press [Save as].
4. Specify the saving destination.
5. Input a file name.
6. Press [Save].
   ↳ The PDF file format is created.

This completes the creating documentation procedure.

7.4.3 Compare

Compare has four items to be set or confirmed as follows.

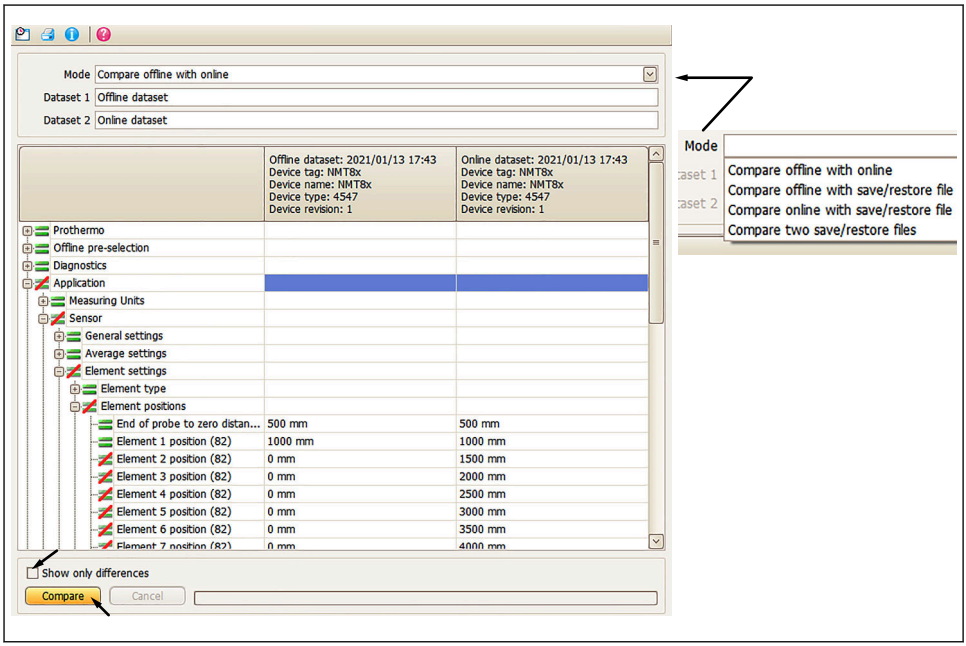
Compare datasets can simply compare the following items.



A0050336

52 *Compare screen*

- Compare offline with online
- Compare offline with save/restore file
- Compare online with save/restore file
- Compare two save/restore files



A0045013

53 *Compare datasets screen*

Comparing datasets procedure

1. Press [Compare datasets].
2. Select a mode as the list above.
3. Check [Show only differences] if necessary.
4. Press [Compare].
   ↳ The comparison analysis starts, and the result is shown on the window with a red diagonal line.

This completes the Comparing datasets procedure.

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