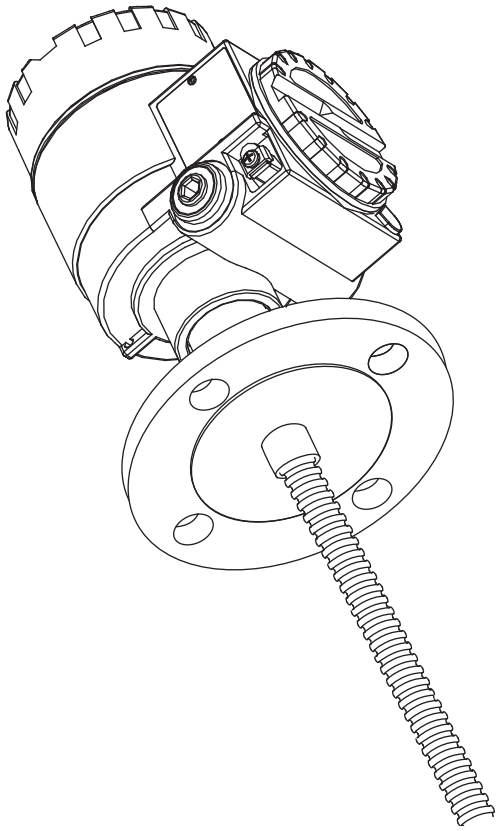
Operating Instructions
Average Temperature
Prothermo NMT532



Endress+Hauser
People for Process Automation

Basic device layout of Prothermo NMT532

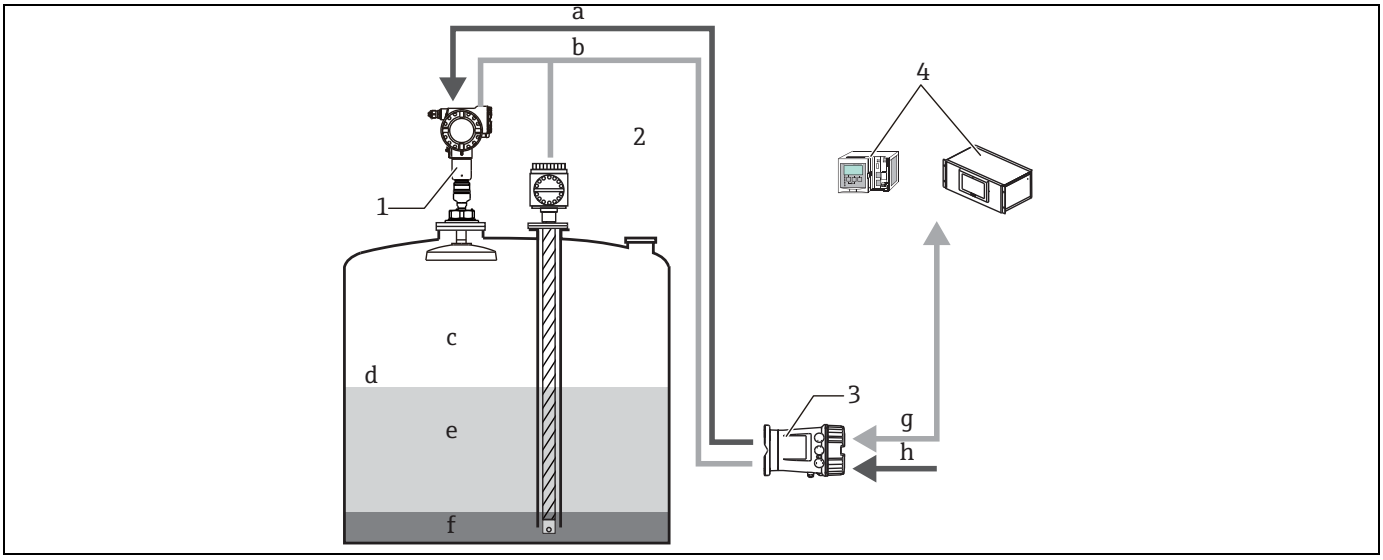


Figure 1: Connection with Micropilot FMR S-series

a *FMR power (DC, Ex i)*
b *Ex i HART loop (Data transmission)*
c *Gas temperature*
d *Liquid level*
e *Liquid temperature*
f *Water*
g *Fieldbus protocol*
h *Power*
1. *FMR 540*
2. *NMT532*
3. *NRF81*
4. *Tankvision*

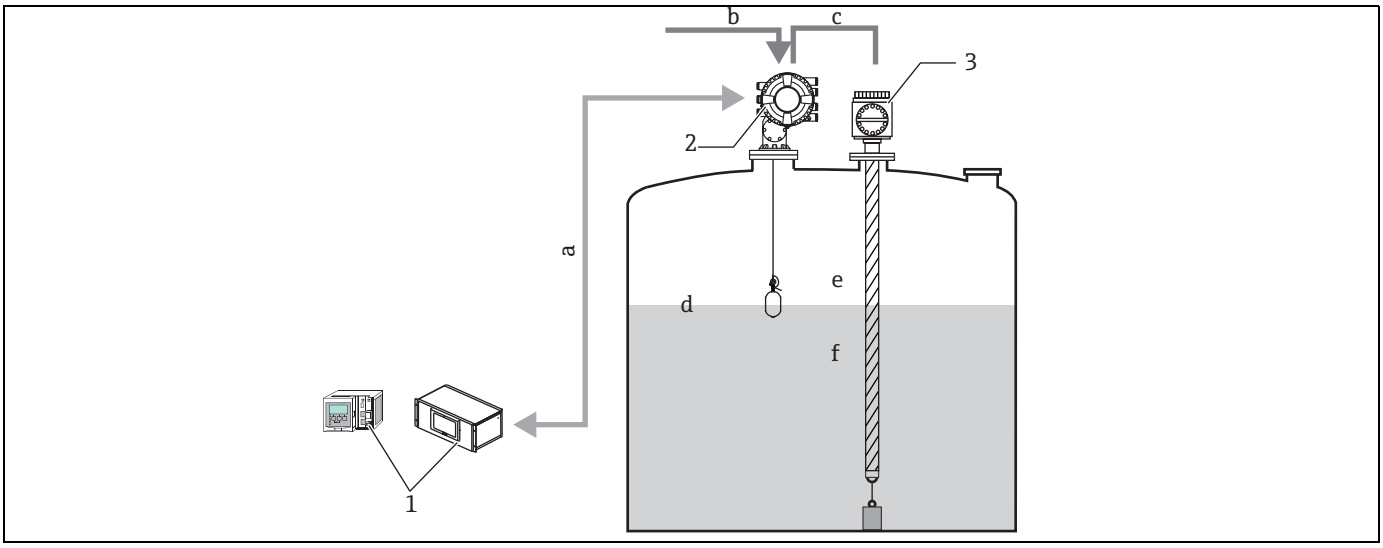


Figure 2: Connection with Proservo NMS8x

a *Fieldbus protocol*
b *Power*
c *Ex i HART loop (Data transmission)*
d *Liquid level*
e *Gas temperature*
f *Liquid temperature*
1. *Tankvision*
2. *NMS8x*
3. *NMT532*

Table of contents

1 Safety instructions 4
1.1 Designated use 4
1.2 Installation, commissioning, and operation 4
1.3 Operational safety 4
1.4 Notes on safety conventions and symbols 5
1.5 Symbols for certain types of information 5

2 Identification 6
2.1 Name tag 6
2.2 Order information 8
2.3 Scope of delivery 9
2.4 Certificates and approvals 9
2.5 Registered trademarks 9

3 Installation 10
3.1 Incoming acceptance, transport, storage 10
3.2 Installation condition 11
3.3 Installation instructions 14

4 Wiring 23
4.1 Terminal connection 23
4.2 Grounding 25

5 Operability 26
5.1 Local HART connection 26
5.2 Device setup: NRF590 26
5.3 Device setup: NMS5 27
5.4 Device setup: NMS8x, NMR8x, NRF81 28

6 Operation and description of device function 36
6.1 Local HART device designation 36
6.2 Temperature measurement 36
6.3 Input of the water bottom level from the host system 50
6.4 Temperature element around the bottom of the tank 52
6.5 Write protect switch 53

7 Maintenance 54
7.1 Periodic inspection 54
7.2 Repairs 54
7.3 Repairs to Ex-approved devices 54
7.4 Replacement 54

8 Accessories 55
8.1 Anchor weight (High profile) 55
8.2 Anchor weight (Low profile) 56
8.3 Wire hook 56
8.4 Top anchor 57

9 Troubleshooting 58
9.1 System error messages 58
9.2 Return 59
9.3 Disposal 59
9.4 Software history 59

10 Technical data 60

1 Safety instructions

1.1 Designated use

Prothermo NMT532 is a multi-spot Pt100 average thermometer combined with a local HART signal converter to meet the demand of temperature measurement for inventory control applications. NMT532 consists of Max. 6 temperature elements which have different length with fixed (2m or 3m) interval. It is best suited connected to Proservo NMS5, or Endress+Hauser Micropilot S-series radars and the Tank Side

Monitor NRF590. Mounted on the tank top, NMT532 provides temperature information on the two wire, intrinsically safe (i.s.) powered local HART loop.

1.2 Installation, commissioning, and operation

- Mounting, electrical installation, start-up, and maintenance of the instrument may only be performed by trained personnel authorized by the operator of the facility.
- Personnel must read and understand these installation instructions before performing the procedures.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual must be observed.
- The installer must make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system must be grounded.
- Observe all law and regulations applicable and valid for your country and pertaining to the opening and repairing of electrical devices.

1.3 Operational safety

Hazardous area

- Use the explosion proof type for measurement in areas where explosion hazards are present.
- Devices installed in areas having explosion hazards must not be opened when the power is on.
- Strict compliance with installation instructions and - ratings, as directed in this supplementary documentation, is mandatory.
- Device maintenance and repair is restricted to meet explosion proof regulations.
- Tighten the cable gland firmly.
- Devices employed in areas having explosion hazards should be installed and wired in keeping with explosion proof regulations.
- Ensure that all personnel are properly qualified.
- Observe the certification requirements as well as national and local regulations.

⚠ WARNING Changes or modifications other than those expressly approved by Endress+Hauser are strictly prohibited. Unauthorized modifications can cause malfunction or damage, resulting in serious injury or death.

1.4 Notes on safety conventions and symbols

To highlight safety-relevant or alternative operating procedures in this manual, the following conventions have been used, each indicated by a corresponding symbol on the left.

Symbol	Meaning
 A0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
 A0011192-EN	**NOTICE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.5 Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Recommendation** Indicates procedures, processes or actions that are recommended.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.

2 Identification

2.1 Name tag

The following technical data are given on the instrument nameplate.

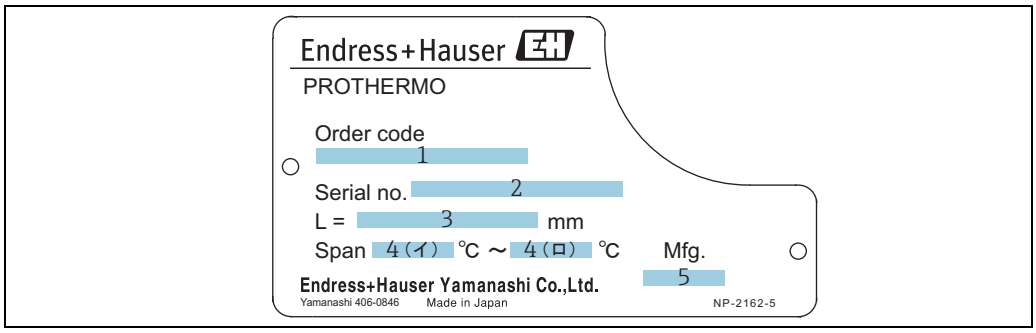


Figure 1: NMT532 model nameplate

1. *Order code*
2. *Serial number*
3. *Flexible tube length*
4. *Measuring temperature range*
5. *Date of manufacture*

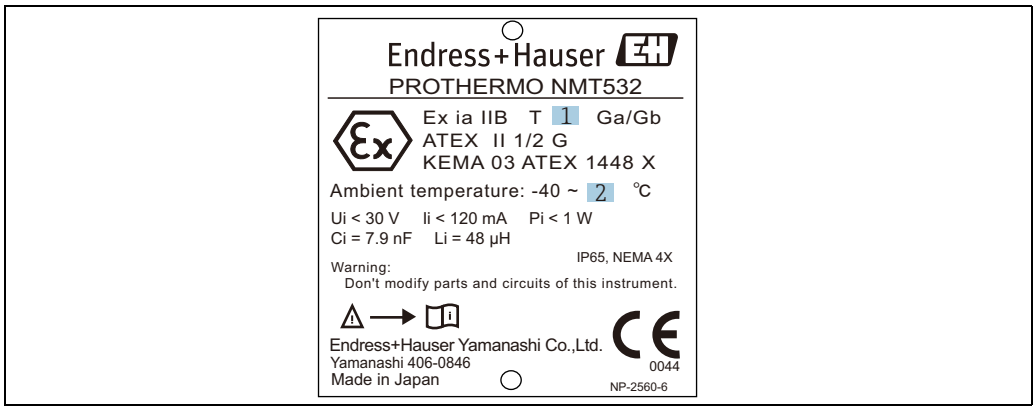


Figure 2: ATEX approval Ex ia nameplate

1. *Temperature class*
2. *Ambient temperature*

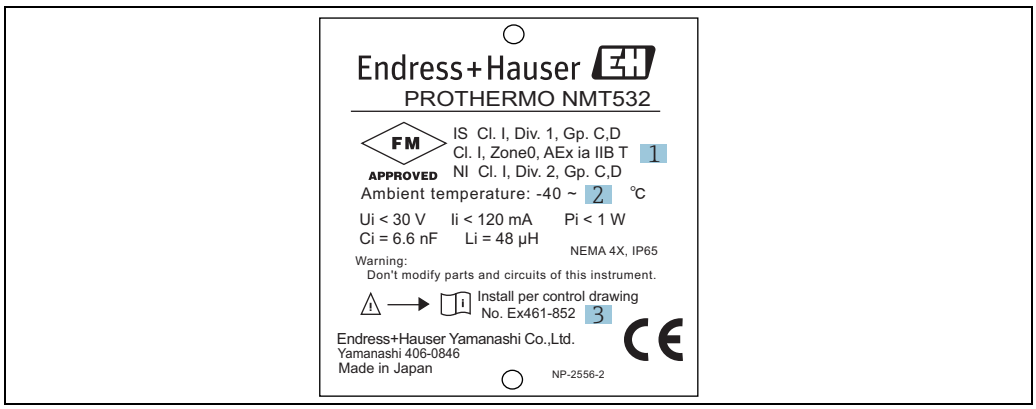


Figure 3: FM approval nameplate

1. *Temperature class*
2. *Ambient temperature*
3. *Drawing revision*

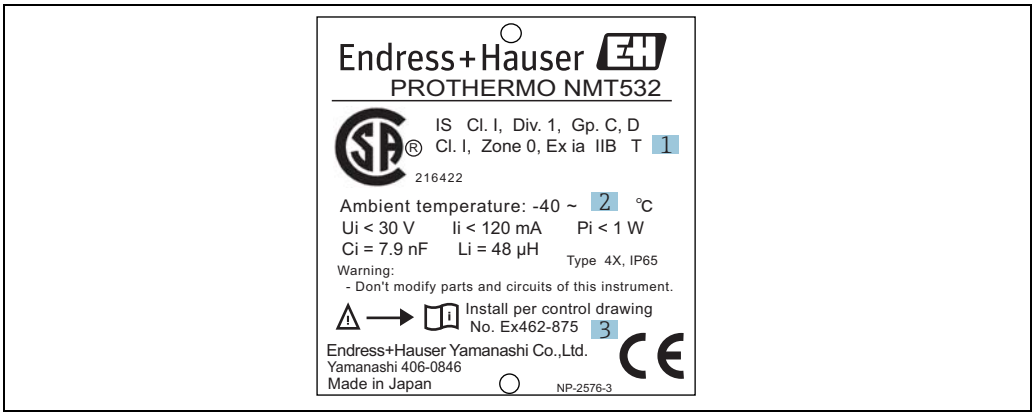


Figure 4: CSA approval nameplate

1. *Temperature class*
2. *Ambient temperature*
3. *Drawing revision*

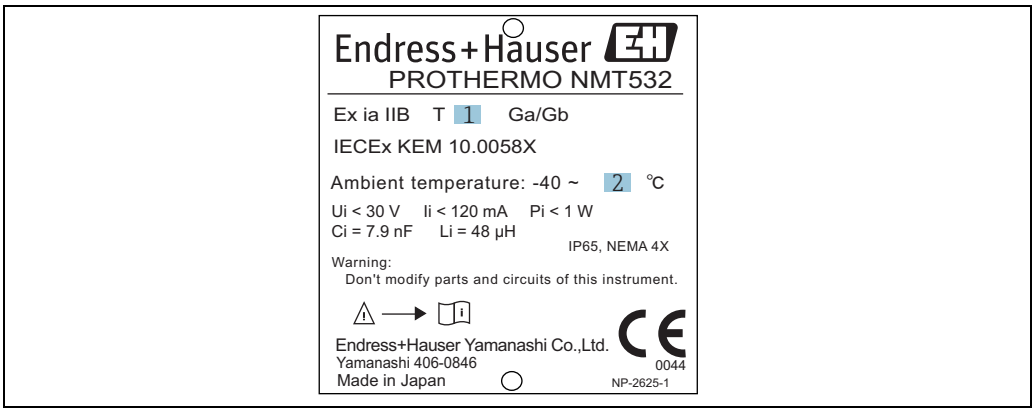


Figure 5: IEC approval nameplate

1. *Temperature class*
2. *Ambient temperature*

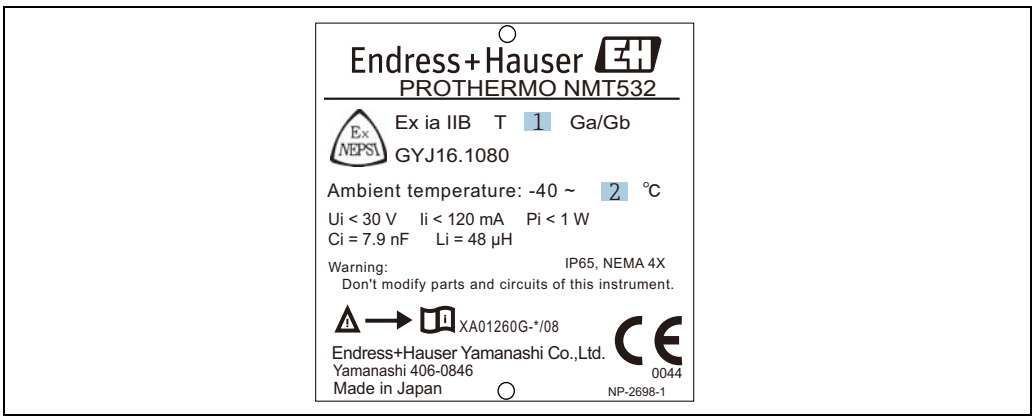


Figure 6: NEPSI approval nameplate

1. *Temperature class*
2. *Ambient temperature*

2.2 Order information

010	**Approval:**							
	7	FM IS Cl.I Div.1 Gr. C-D						
	8	CSA IS Cl.I Div.1 Gr. C-D						
	B	ATEX Ex ia IIB T4 - T6						
	F	IEC Ex ia IIB T4 - T6						
	G	NEPSI Ex ia IIB T4 - T6						
020		**Cable Entry:**						
	B	Thread NPT1/2						
	D	Thread M20						
030			**Process Connection:**					
		1	NPS 2" Cl.150 RF, 304 flange ASME B16.5					
		2	DN50 PN10 B1, 304 flange EN1092-1 (DIN2527 C)					
		9	Special version, TSP-no. to be spec.					
040				**Probe Length; Element; Interval:**				
				022	...mm; 2x Pt100; 2 m			
				032	...mm; 3x Pt100; 2 m			
				042	...mm; 4x Pt100; 2 m			
				052	...mm; 5x Pt100; 2 m			
				062	...mm; 6x Pt100; 2 m			
				023	...mm; 2x Pt100; 3 m			
				033	...mm; 3x Pt100; 3 m			
				043	...mm; 4x Pt100; 3 m			
				053	...mm; 5x Pt100; 3 m			
				063	...mm; 6x Pt100; 3 m			
050						**Additional Option:**		
						A	Not selected	
						B	Anchor weight, High profile	
						C	Anchor weight, low profile	
						D	Tensioning wire, wire hook, NPT1 top anchor	
						F	Tensioning wire, wire hook, R1 top anchor	
NMT532							**Complete product designation**	

2.3 Scope of delivery

It is extremely important to follow the instructions concerning the unpacking, transportation and storage of measuring instruments provided in the chapter "Incoming Acceptance, Transportation, Storage".

The scope of delivery consists of:

- Assembled Instrument

Delivered Items vary depending on the product specifications (refer to "3.9 General View of Standard Drawings and Order Codes").

Accompanying documentation:

- Operating Instructions (this manual)
- Safety Instructions

2.4 Certificates and approvals

CE Marks, declaration of conformity

The device is designed 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. The device complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the device by affixing to it the CE mark.

2.5 Registered trademarks

HART

Registered trademark of HART Communication Foundation, Austin, USA

FieldCare

Registered trademark of the company Endress+Hauser Flowtec AG, Rheinach, CH

3 Installation

3.1 Incoming acceptance, transport, storage

3.1.1 Incoming acceptance

Check the packing and contents for any signs of damage.

Check the shipment, and make sure that nothing is missing and that the items match your order.

3.1.2 Transportation

- Follow the safety instructions and conditions of transportation for instruments in excess of 18kg (40 lbs.).
- Do not lift the measuring instrument by its head during unpacking.

3.1.3 Storage

Pack the measuring instrument so that it is protected against impacts during storage and transportation.

The original packing material provides the optimum protection for this.
The allowed storage temperature is -40 °C to +85 °C (-40 °F to +185 °F).

3.2 Installation condition

3.2.1 Dimensions

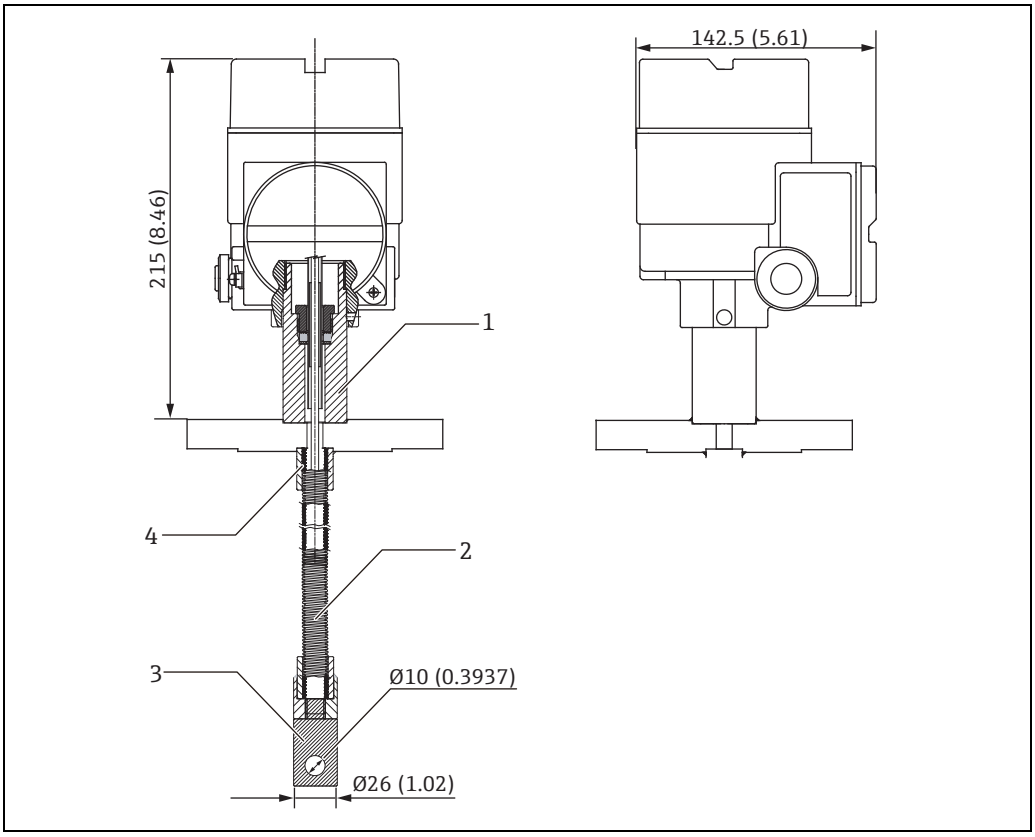


Figure 7: Dimensions, Unit of measurement: mm (in)

1. *SUS304*
2. *Temperature probe (SUS316L) (see tips below.)*
3. *Bottom hook (SUS316)*
4. *SUS316*

The specifications of temperature probe vary depending on the tank height.

3.2.2 Unpacking procedure

When unpacking, be careful not to bend, fold or twist the flexible tube. Refer to the recommended procedure below.

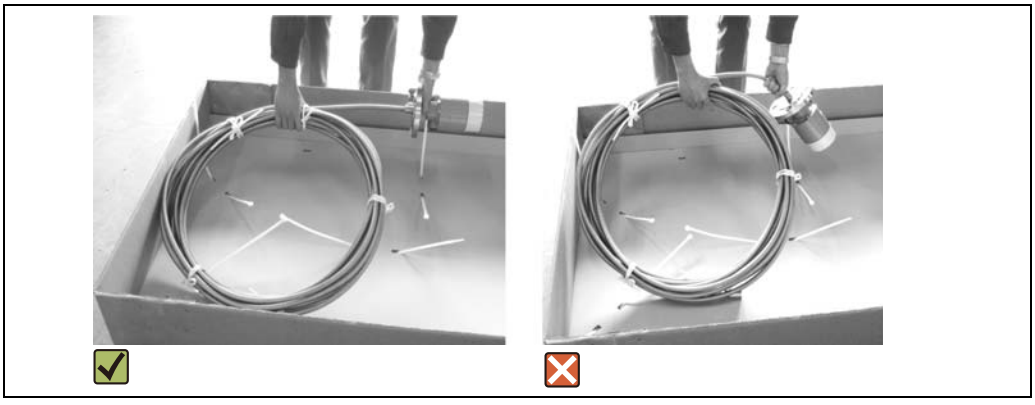


Figure 8: Unpacking procedure

3.2.3 Flexible tube handling procedure

CAUTION Do not hold the flexible tube at a single point and lift the sensor. This may cause damage to the tube.

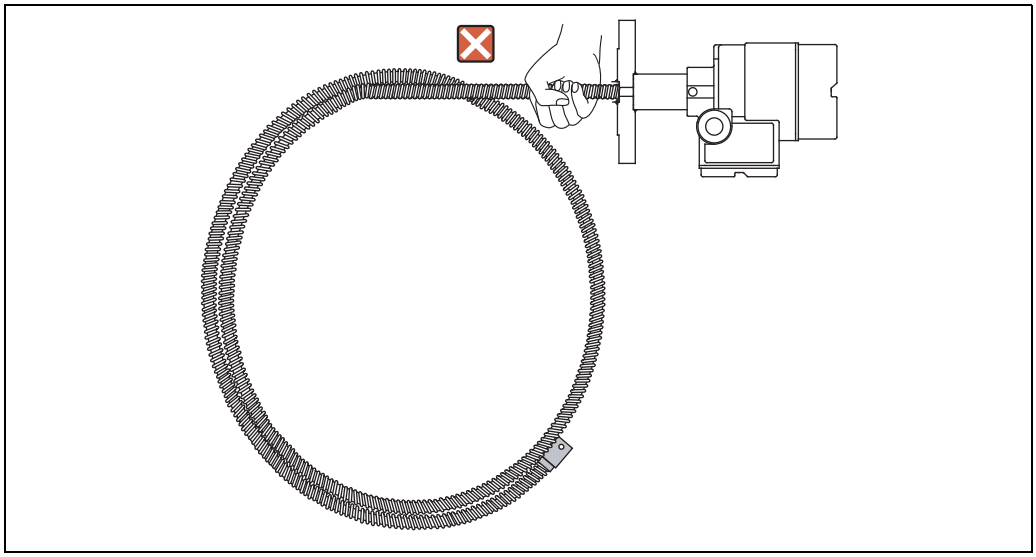


Figure 9: Flexible tube

CAUTION

- When winding the flexible tube, keep the diameter of the tube at a minimum of 0.6m (23.62 in) or more.
- When bending the flexible tube to attach to a tank, the radius of the curved area must be 300 mm (11.8 in) or more.

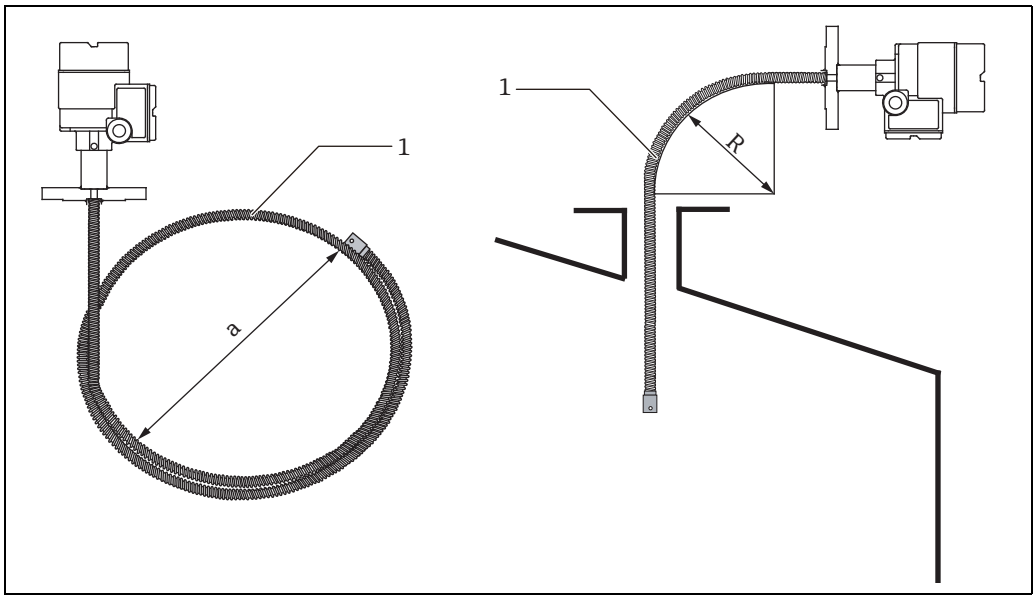


Figure 10: Flexible tube handling, Unit of measurement: mm (in)

a *Min. 600 mm (23.62 in) or more*

R *Bending Radius: min. 300 mm (11.8 in) or more*

1 *Flexible tube*

CAUTION If the radius of the curved area must be shown above becomes smaller than 300 mm (11.8 in), the flexible tube or the measuring temperature element may be seriously damaged or broken.

3.2.4 NMT532 mounting procedure

1. The length of the flexible tube of NMT532 is determined based on specifications provided by customers. Check the following prior to mounting of NMT532.
   - Tag number (if any) on body of NMT532
   - Length of flexible tube
   - Number of measuring points
   - Intervals between measuring points
2. Mount NMT532 at a place that is a minimum of 500 mm (19.67 in) away from exterior surface of tanks.
   - This will ensure that the measurement is not influenced by the temperature of tanks or surrounding environment.
3. The procedure for mounting NMT532 on a tank depends on the type of tank. Procedures for a fixed roof tank and for a floating roof tank are shown in this section as examples.
   - In any types of tanks, procedures for mounting of flexible tube head are same (mounted on the top of the tank).

CAUTION Ensure to keep the tension of 16 kg or less during setting and after setting. Exceeding the limit may cause breakage in the flexible tube.

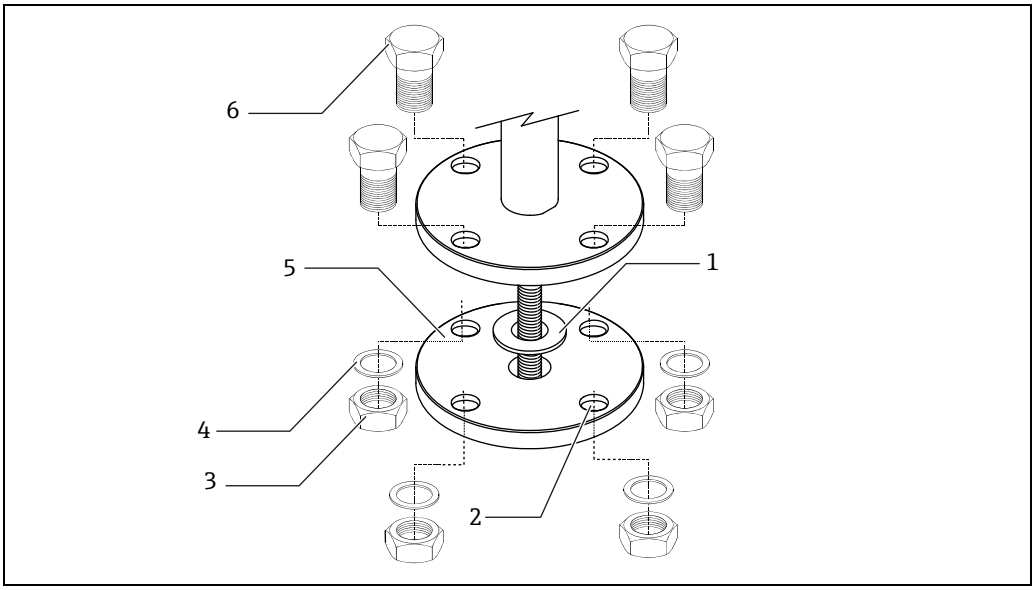


Figure 11: NMT532 flange bolts and nuts

1. *Gasket*
2. *Flange for flexible tube head*
3. *Nut M16*
4. *Washer M16*
5. *Flange for tank top*
6. *Bolt M16*

3.3 Installation instructions

When installing water bottom, check "Zero" reference position of water bottom compared with manual dipping reference.

3.3.1 Mounting NMT532 on fixed roof tank

There are three methods for mounting NMT532 on a fixed roof tank as follows.

1. Top anchor method
2. Stilling well method
3. Anchor weight method

If a heating coil is attached to the bottom of the tank, the clearance between the bottom hook of the flexible tube and the bottom of the tank may vary depending on the type of heating coil.

Top anchor method

The flexible tube is fixed with a wire hook and a top anchor.

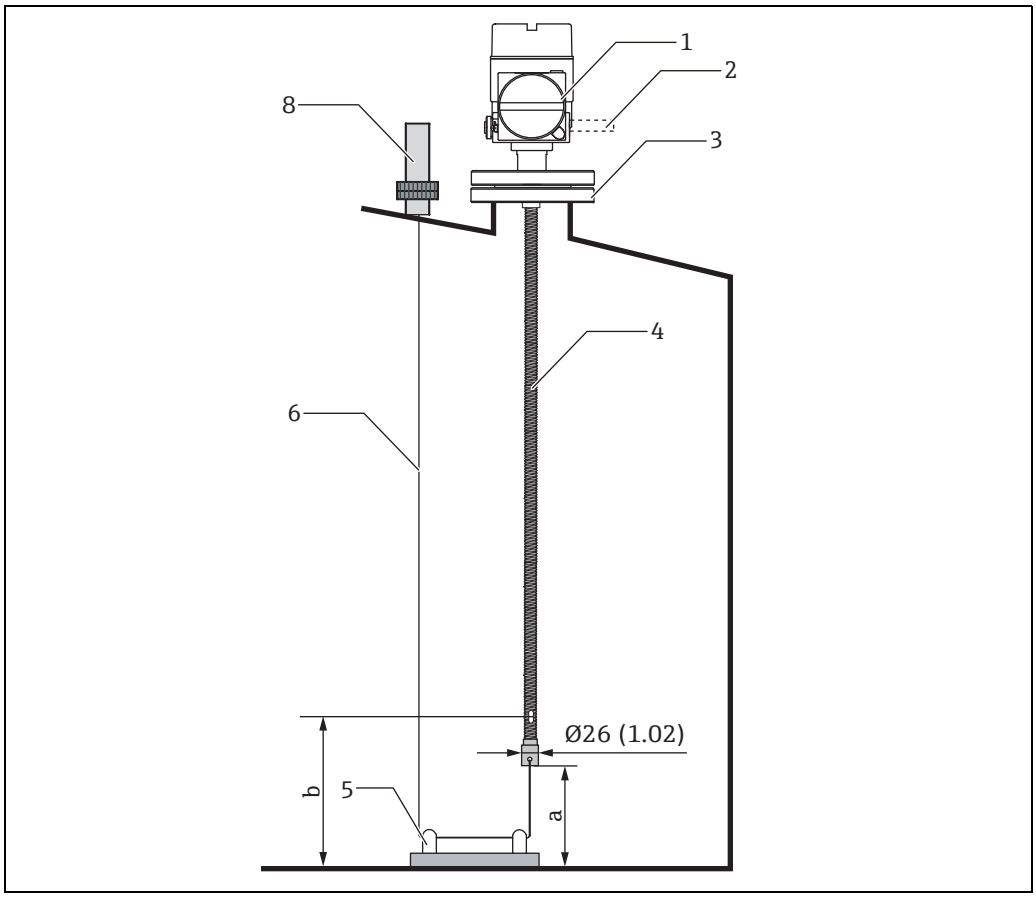


Figure 12: Fixed roof tank, Unit of measurement: mm (in)

a *400 mm (15.57 in) (Clearance below bottom hook)*
b *500 mm approx. (20 in) (From the bottom of the tank to the temperature element position #1)*
1. *Electrical compartment*
2. *Cable entry as specified*
3. *Flange*
4. *Temperature probe*
5. *Wire hook*
6. *Tensioning wire*
7. *Top anchor*

Top anchor attachment procedure

1. Insert the flexible tube into a gasket and lower the flexible tube from the nozzle at the top of the tank.

CAUTION The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

2. Rotate NMT532 for cabling in the most convenient way.
3. Straighten the tensioning wire, temporarily fix the end of the wire to the top anchor and lower the wire.
4. Put the tensioning wire into the wire hook at the bottom of the tank.
5. Secure the tensioning wire twice through the hole at the bottom hook
6. Tighten the tensioning wire.
7. Wind the provided wire around the tensioning wire to secure the tensioning wire.

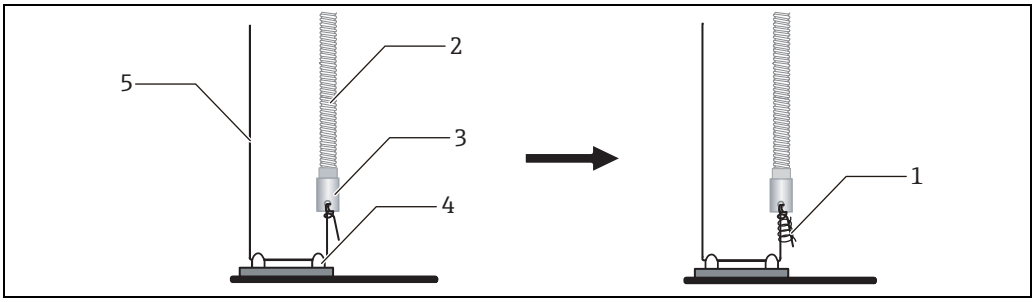


Figure 13: Top anchor attachment 1

1. *Provided wire*
2. *Temperature probe*
3. *Bottom hook*
4. *Wire hook*
5. *Tensioning wire*

6. Using bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

CAUTION

- Keep the compression of the spring of 35 to 37 mm (1.38 to 1.47 in).
- Compression exceeding the spring of 35 to 37 mm may damage the sensor.

7. Draw the end of the tensioning wire as much as possible by hand and foot.
8. Bend the wire and fix it using the nut.
9. Cut the excess wire.
10. Screw the nut to compress down the spring of the top anchor from 35 to 37 mm.
11. Cover the top anchor.

This completes the top anchor attachment procedure.

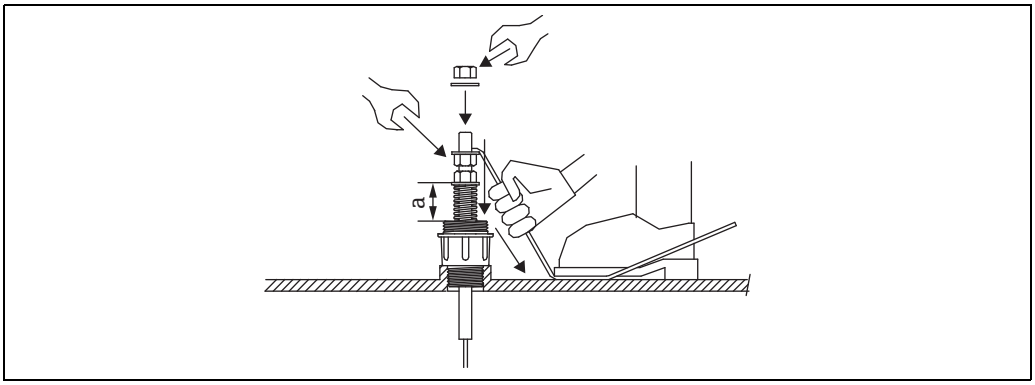


Figure 14: Top anchor attachment 2

a *35 to 37 mm (1.38 to 1.46 in)*

Stilling well method

The flexible tube is inserted into a stilling well with a diameter of 2 inches or more.

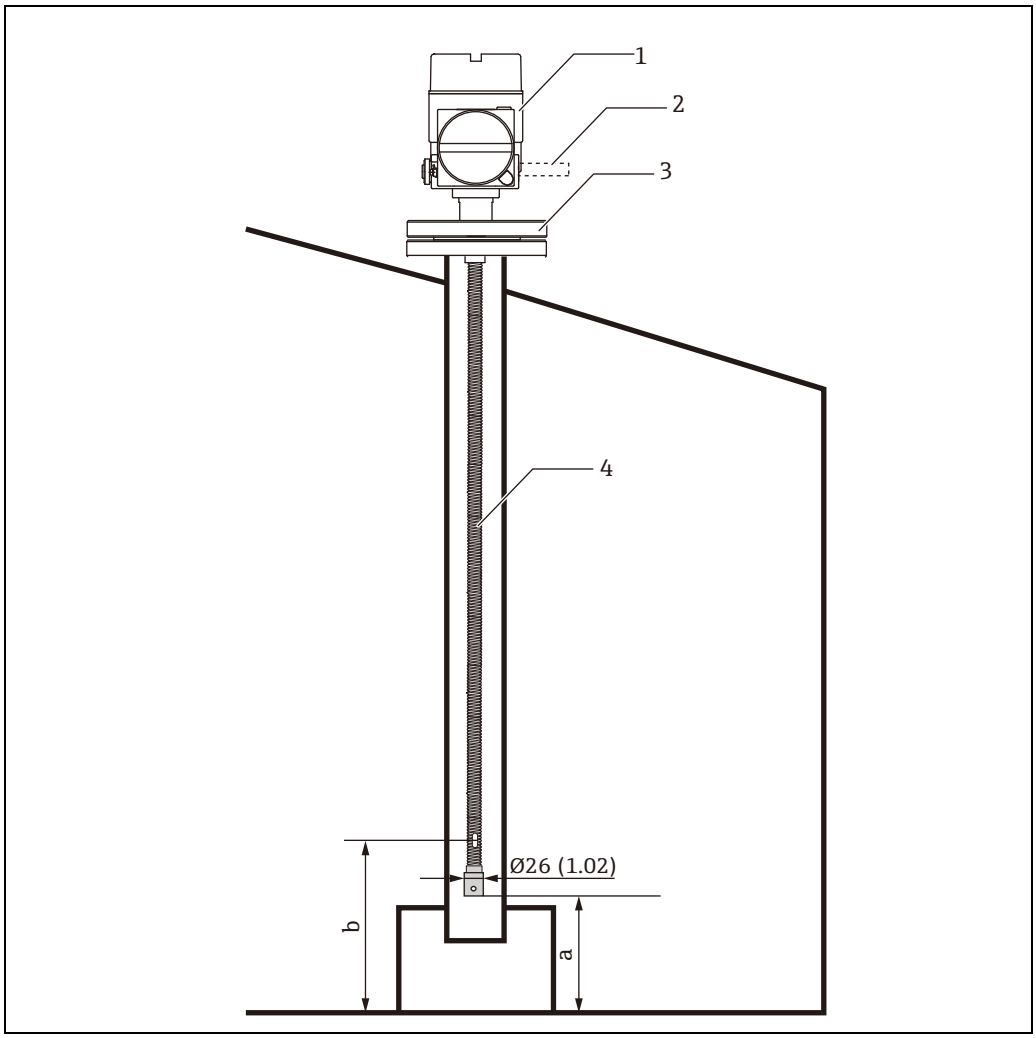


Figure 15: Stilling well, Unit of measurement: mm (in)

1. *Electrical compartment*
2. *Cable entry as specified*
3. *Flange*
4. *Temperature probe*
5. *400 mm (15.57 in) (clearance below the bottom hook)*
6. *500 mm (20 in) (from the bottom of the tank to the temperature element position #1)*

Stilling well attachment procedure

⚠ CAUTION The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

1. Insert a flexible tube into a gasket and lower the flexible tube into the inlet of the stilling well.
2. Rotate NMT532 for cabling in the most convenient way.
3. Using bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

This completes the stilling well attachment procedure.

Anchor weight method

The flexible tube is fixed with an anchor weight.

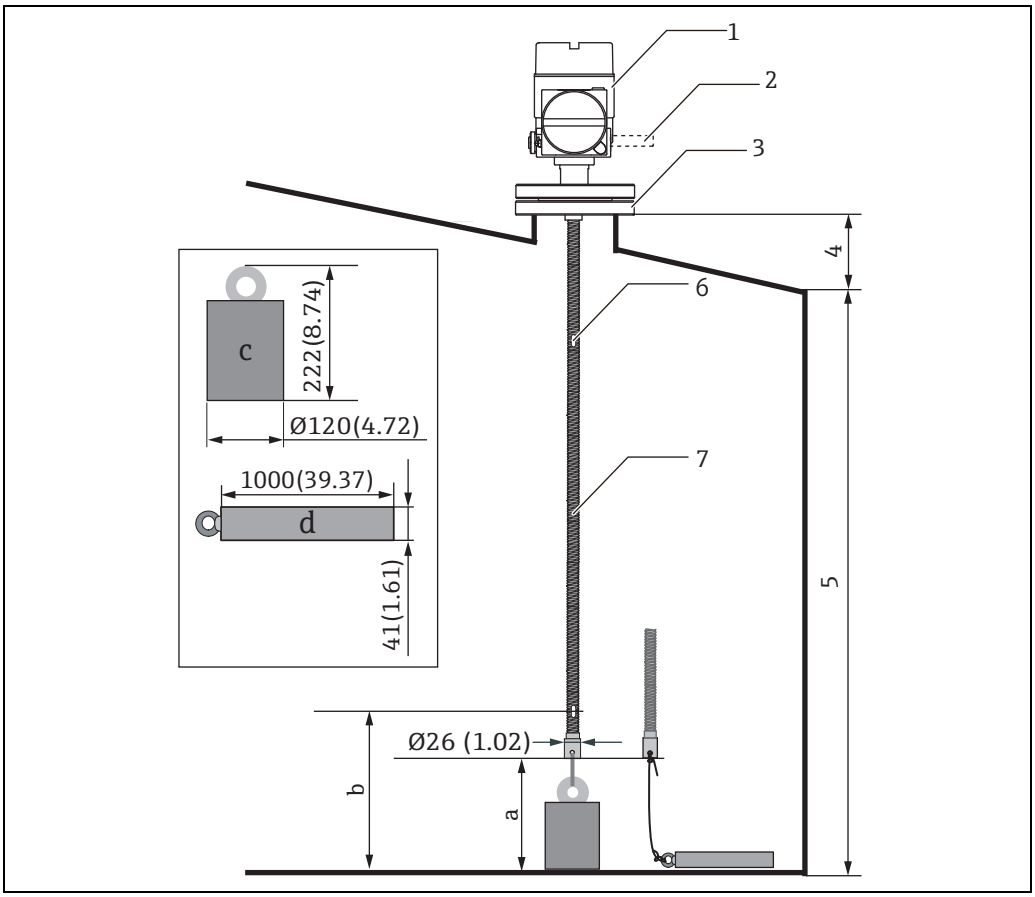


Figure 16: Anchor weight, Unit of measurement: mm (in)

a *400 mm (15.57 in) (clearance below the bottom of the hook to the bottom of the tank)*
b *500 mm (20 in) (from the bottom of the tank to the temperature element position #1)*
c *Anchor weight for high profile*
d *Anchor weight for low profile*
1. *Electrical compartment*
2. *Cable entry as specified*
3. *Flange*
4. *Nozzle height*
5. *Tank height*
6. *Upper temperature element*
7. *Flexible tube*

⚠ CAUTION

- Ensure to put the anchor weight at the bottom of the tank. When installing with the suspended anchor weight, use the anchor weight of 16 kg or less. Exceeding the limit may cause internal breakage in the flexible tube.
- The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

Anchor weight attachment procedure

1. Insert a gasket and lower the flexible tube [2] from the nozzle at the top of the tank.
2. Rotate NMT532 for cabling in the most convenient way.
3. Put the tensioning wire [4] through the anchor weight hook [5] twice and also tie the other end to the bottom hook [3].
4. Wind the provided wire [1] around both ties of the hooks to secure the tensioning wire.
5. Using the bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

This completes the mounting anchor weight procedure.

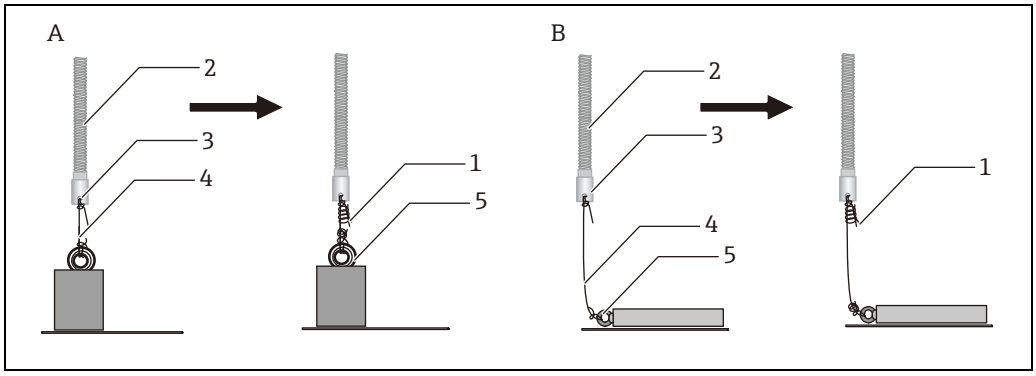


Figure 17: Anchor weight attachment

A *Anchor weight (high profile)*
B *Anchor weight (low profile)*
1. *Provided wire*
2. *Flexible tube*
3. *Bottom hook*
4. *Tensioning wire*
5. *Anchor weight hook*

3.3.2 Mounting on floating roof tank

There are three methods of mounting NMT532 on a floating roof tank as follows.

1. Top anchor method
2. Stilling well method
3. Guide wire ring method

If a heating coil is attached to the bottom of the tank, the clearance between the bottom hook of the flexible tube and the bottom of the tank may vary depending on the type of heating coil.

Top anchor method

The flexible tube is installed in a fixed pipe and fixed with the top anchor. NMS5 or NMS8x and NMT532 can be mounted in the same fixed pipe.

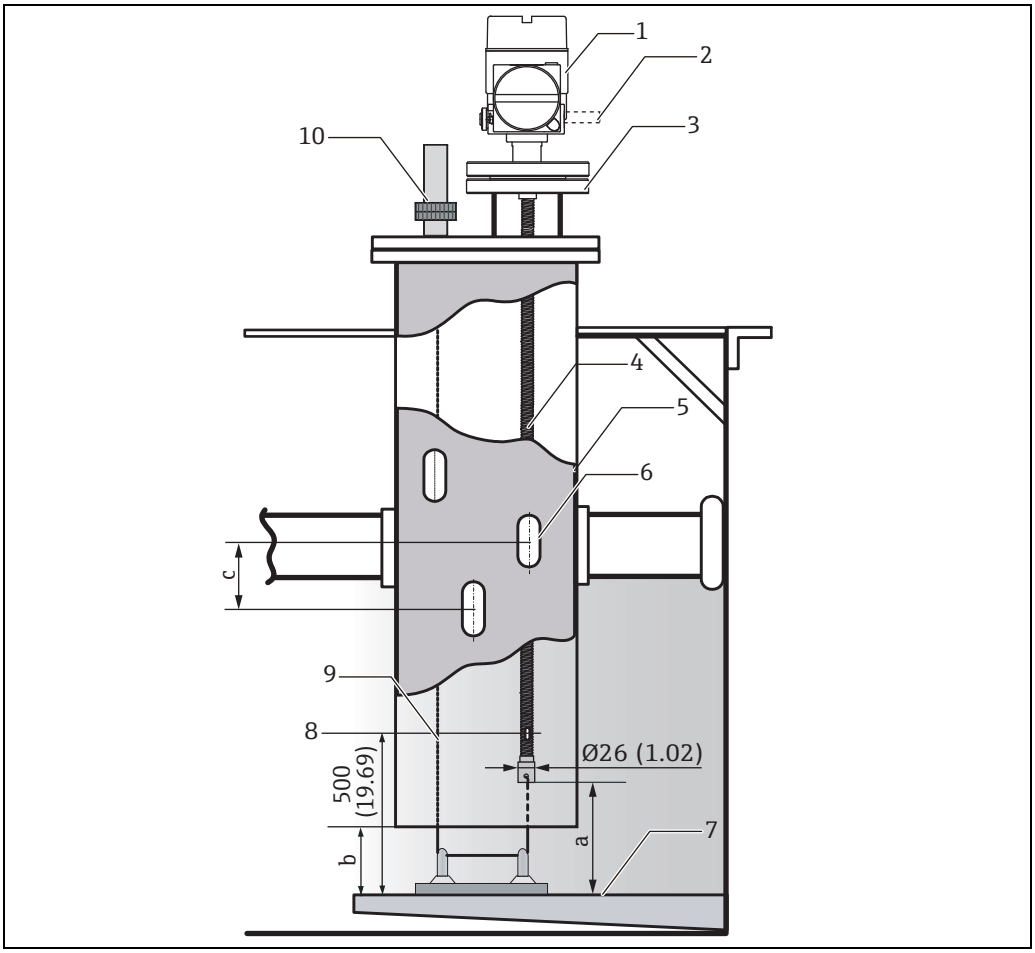


Figure 18: Floating roof tank, Unit of measurement: mm (in)

a *400 mm (15.75 in), Clearance of bottom hook*
b *100 to 150 mm (3.94 to 5.91 in)*
c *500 to 1000 mm (19.69 to 39.37 in)*
1. *Electrical compartment*
2. *Cable entry as specified*
3. *Flange*
4. *Temperature probe*
5. *Fixed pipe*
6. *Gas hole*
7. *Gauge plate*
8. *Temperature element position #1 (bottom temperature element)*
9. *Tensioning wire*
10. *Top anchor*

The installation procedure is the same as in the mounting on fixed roof tanks using the top anchor.

Stilling well method

The flexible tube is inserted into a stilling well in the fixed pipe.

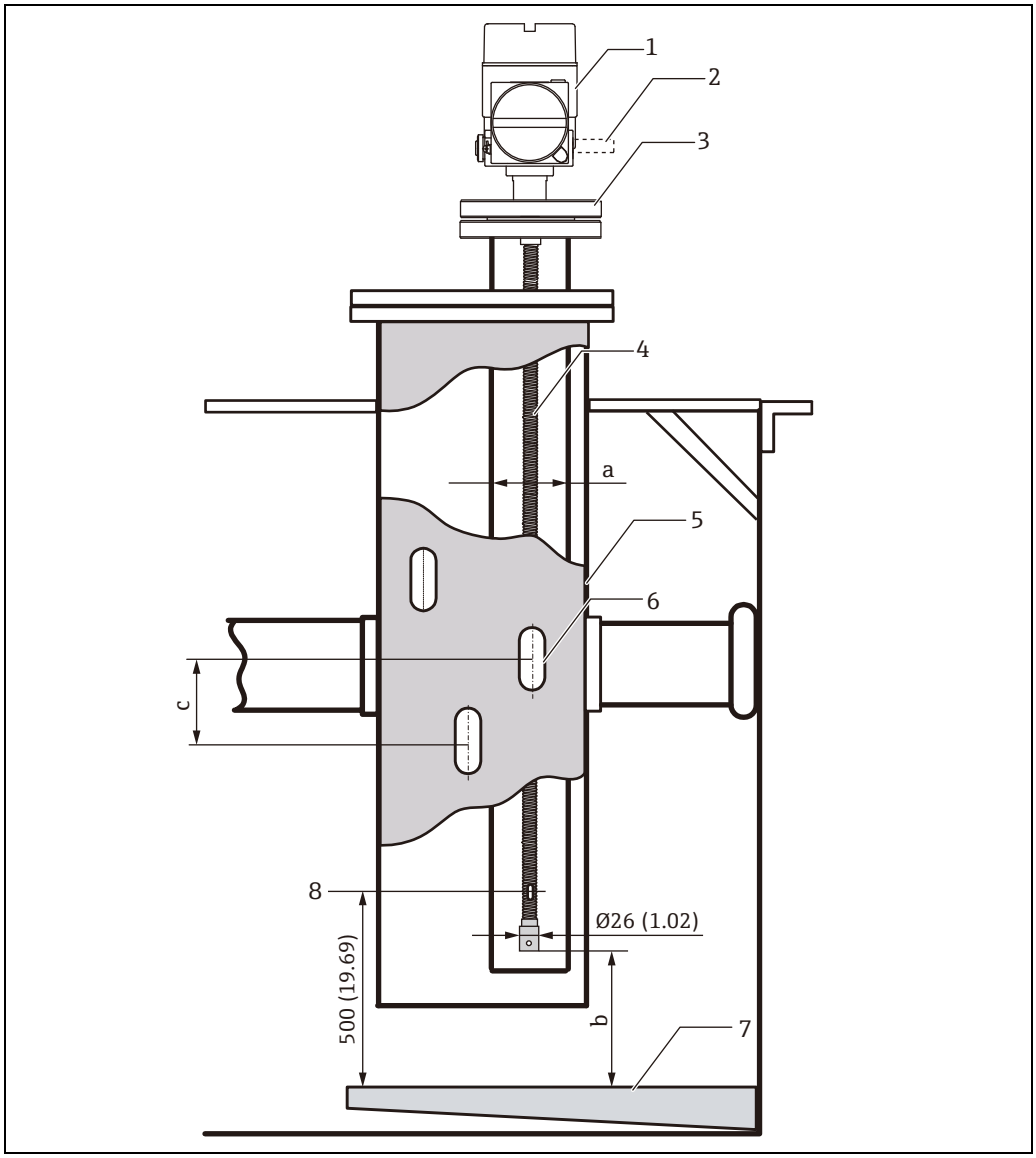


Figure 19: Stilling well method, Unit of measurement: mm (in)

a *Stilling pipe,* Ø50.8 mm (2 in) or more, depending on specifications
b *400 mm (15.75 in), Clearance of bottom hook*
c *500 to 1000 mm (19.69 to 39.37 in)*
1. *Electrical compartment*
2. *Cable entry as specified*
3. *Flange*
4. *Temperature probe*
5. *Fixed pipe*
6. *Gas hole*
7. *Gauge plate*
8. *Temperature element position #1 (bottom temperature element)*

The installation procedure is the same as in the mounting on fixed roof tanks using the stilling well.

Guide ring and anchor weight method

The flexible tube is fixed with a guide ring and an anchor weight.

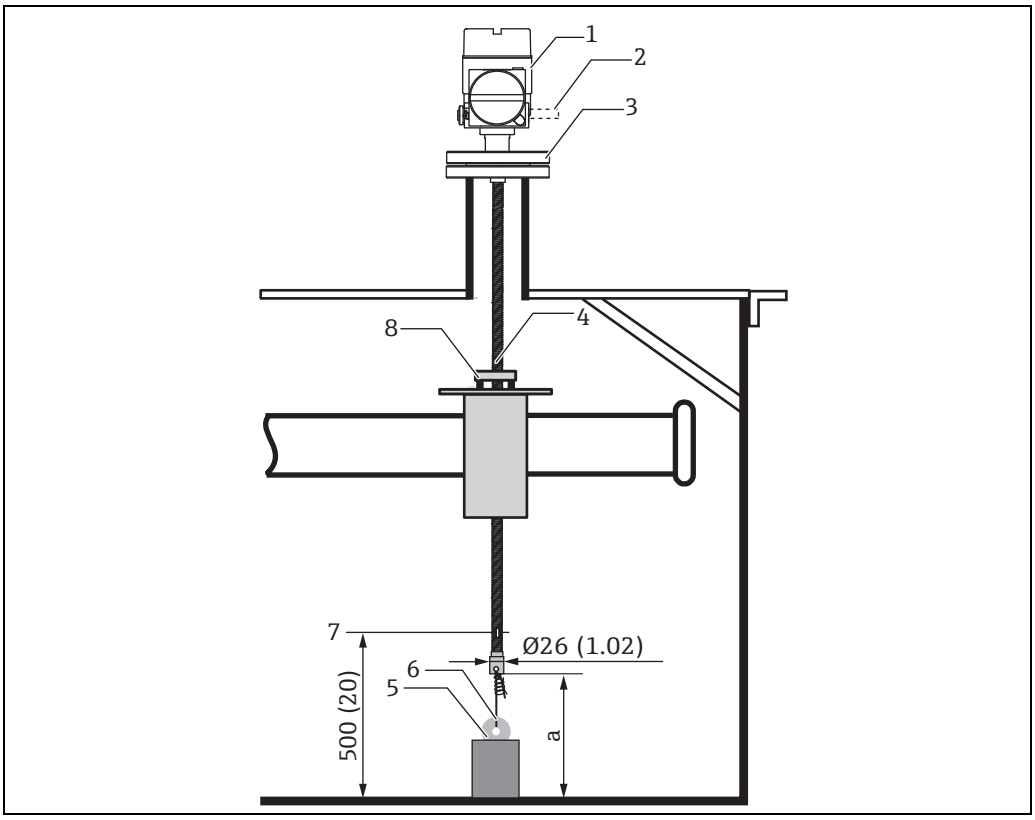


Figure 20: Guide ring and anchor weight, Unit of measurement: mm (in)

a *400 mm (15.75 in), Clearance of bottom hook*
b *500 mm (20 in)*
1. *Electrical compartment*
2. *Cable entry as specified*
3. *Flange*
4. *Temperature probe*
5. *Anchor weight hook*
6. *Tensioning wire*
7. *Temperature element position #1 (bottom temperature element)*
8. *Guide ring*

⚠ CAUTION

- Ensure to put the anchor weight at the bottom of the tank. When installing with the suspended anchor weight, use the anchor weight of 16kg or less. Exceeding the limit may cause internal breakage in the flexible tube.
- The flexible tube must be lowered carefully without overbending and scratching the inner edge of the nozzle hole.

Guide ring and anchor weight attachment procedure

1. Set the guide ring to the floating roof.
2. Insert the flexible tube into a gasket and lower the flexible tube from the nozzle at the top of the tank.
3. Rotate NMT532 for cabling in the most convenient way.
4. Put the tensioning wire through the anchor weight hook twice and also tie the other end to the bottom hook.
5. Wind the provided wire around both ties of the hooks to secure the tensioning wire.
6. Using the bolts, fix the mounting flange of NMT532 to the nozzle at the top of the tank.

This completes the mounting guide ring and anchor weight procedure.

3.3.3 Mounting on pressurized tank

Pressurized tank is required to install a thermo well to protect the probe from the pressure.

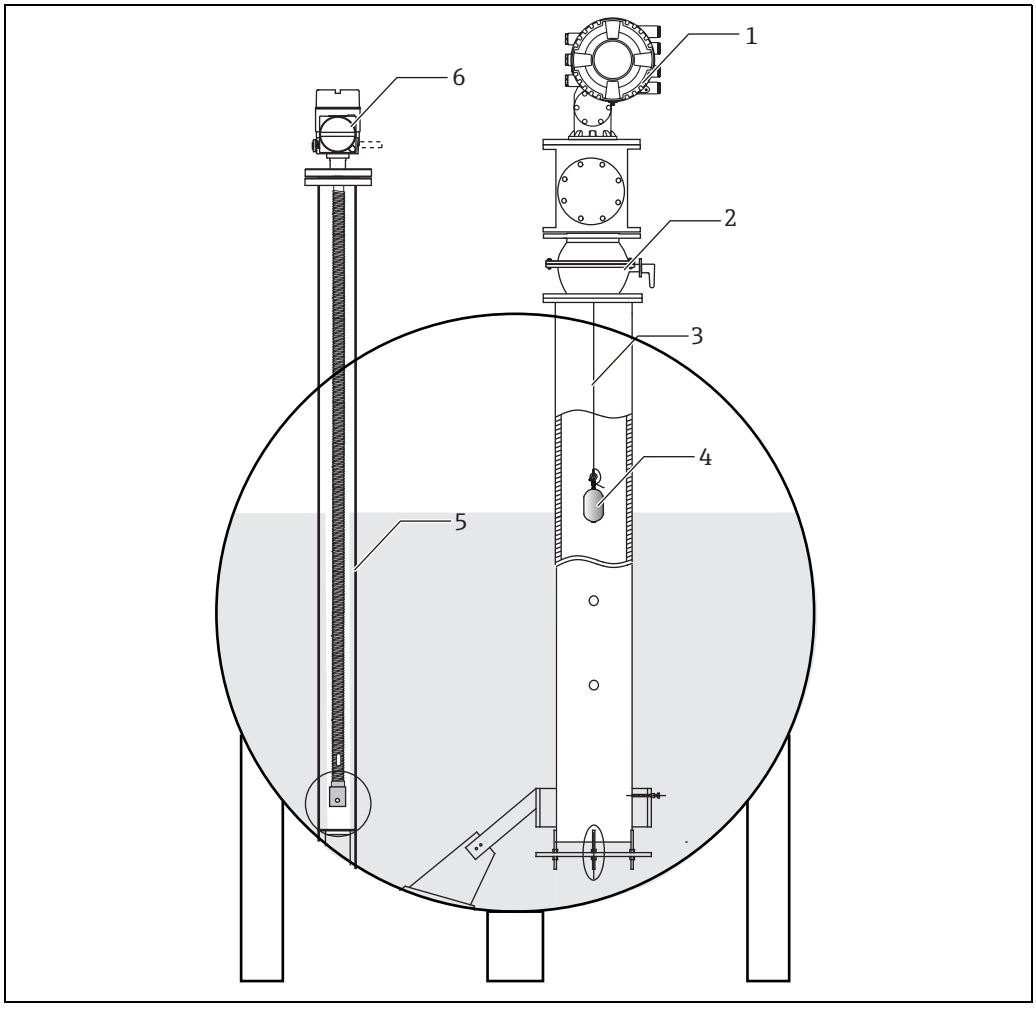


Figure 21: Pressurized Tank

1. *NMS8x / NMS5*
2. *Ball valve*
3. *Measuring wire*
4. *Displacer*
5. *Stilling well*
6. *NMT532*

⚠ CAUTION

- When the pressure inside the tank exceeds 1 bar (100 KPa, 14.5psi), a stilling well which does not have any holes or slits must be installed. However the holes or slits must be required for the still well of the NMS5 or NMS8x.
- NMT532 is installed in the stilling well from the top of the tank nozzle.
- Cover the bottom of the stilling well for NMT532 and weld it to protect the probe from the pressure.

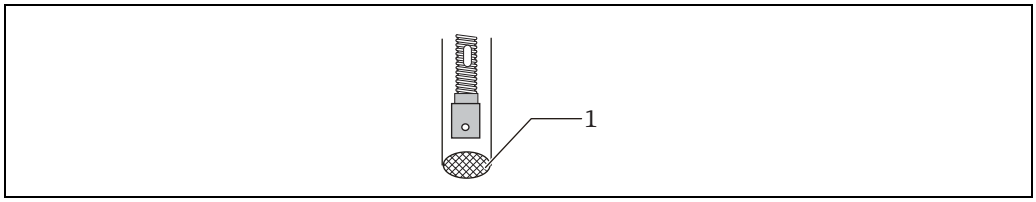


Figure 22: Welding Part of Stilling Well

1. *Welding part*

4 Wiring

4.1 Terminal connection

4.1.1 NMT532 terminal (Ex ia)

NMT532 (Ex ia) allows an intrinsically safe local HART connection only. Refer to the i.s. regulation for establishing wiring and field device layout.

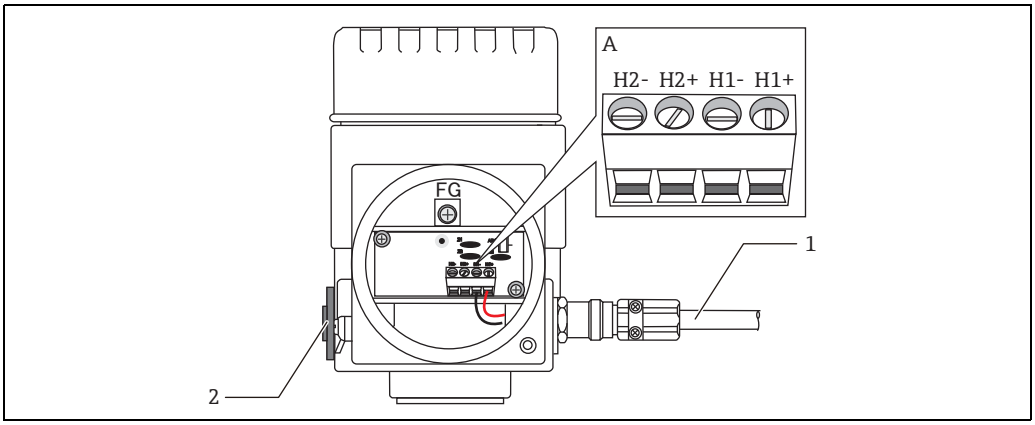


Figure 23: NMT532 terminal

A Temperature data/Intrinsically safe HART on NMT532
1. Screened twisted pair or steel armored wire
2. Blind plug

Metal gland cable can only be used. Shield cable of HART communication line must be grounded.

To NRF590		To NMS5		To NMS8x/NMR8x/NRF81	
+	24, 26, 28	+	24	+	E1
-	25, 27, 29	-	25	-	E2

+H1 and +H2 show plus (+) terminal and -H1 and -H2 show minus (-) terminal.

4.1.2 NMS5 terminal (Ex d [ia])

Since NMT532 is an intrinsically safe instrument, the terminal connection to the Ex i side on local HART connection is allowed on NMS5 terminal housing.

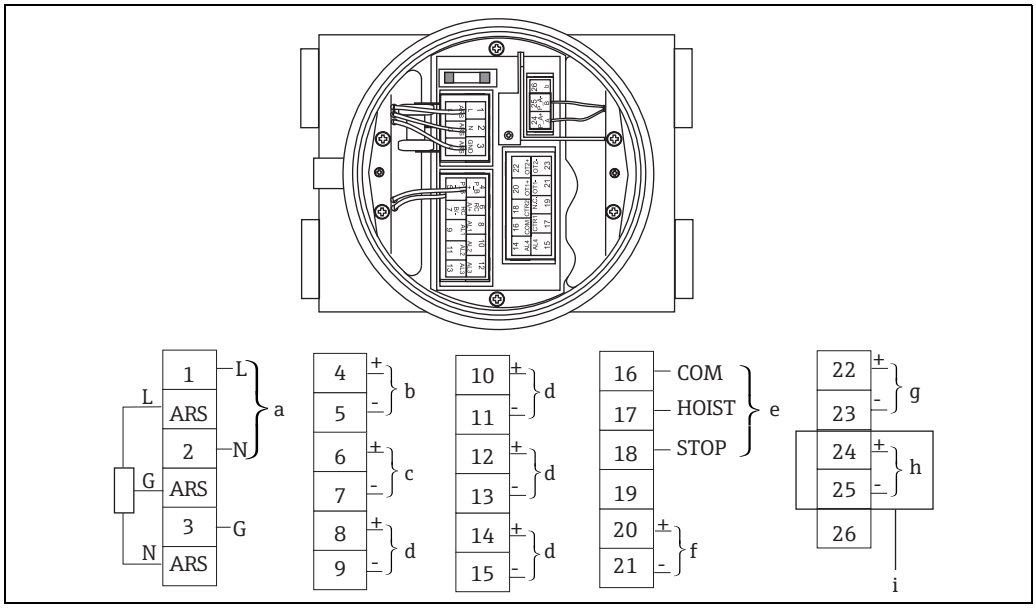


Figure 24: NMS5 terminal

a *Power supply 85 to 264 VAC 50/60 Hz or 20 to 60 VDC, 20 to 55 VAC*
b *Non IS HART to NRF or others*
c *Digital output Racbus RS485, serial pulse or HART*
d *Alarm contact*
e *Operation contact input*
f *4 to 20 mA channel 1*
g *4 to 20 mA channel 2*
h *HART Ex i*
i *from NMT532*

CAUTION Do not connect NMT532 local HART communication to terminals 4 and 5 of NMS5. These terminals are designed to connect Ex d local HART communication.

4.1.3 NMS8x, NMR8x, and NRF81 terminal (Ex d [ia])

Since NMT532 is an intrinsically safe instrument, the terminal connection to the Ex i side on local HART connection is allowed on NMS8x, NMR8x or NRF81 terminal housing.

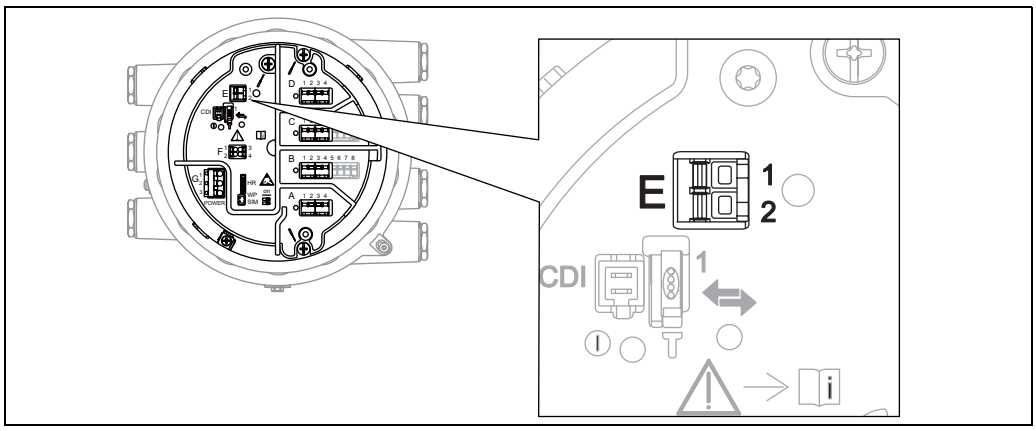


Figure 25: NMS8x terminal for NMT532

E1 *H+ terminal*
E2 *H- terminal*

4.1.4 NRF590 Intrinsically safe terminal

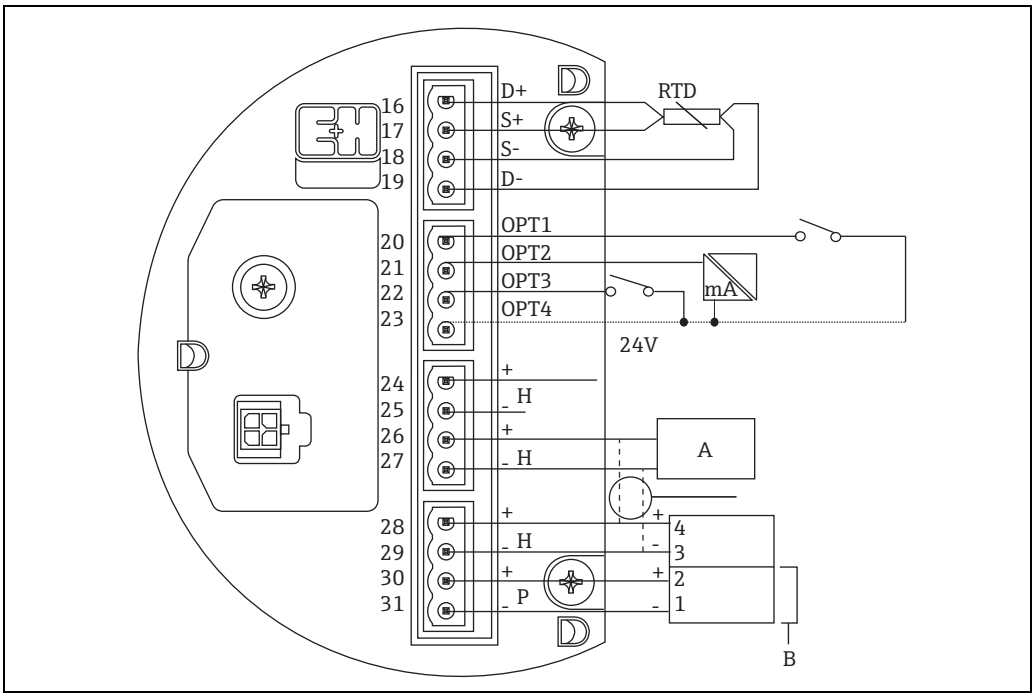


Figure 26: NRF590 terminal

A HART sensor: internally interconnected as one HART filedbus loop

B for Micropilot S-series only

NRF590 has three sets of i.s. local HART terminals. These three pairs are looped internally.

CAUTION Do not connect signal local HART lines from NMT532 to terminals 30 and 31. These terminals are designed to supply drive power for FMR 53x series only.

4.2 Grounding

NMT532 must be grounded to the tank potential before communication and power connections are made. The connections from ground terminal of NMT532 to the tank ground must be made before any other wiring connections are made. All grounding must comply with local and company regulations and must be checked before the equipment is commissioned.

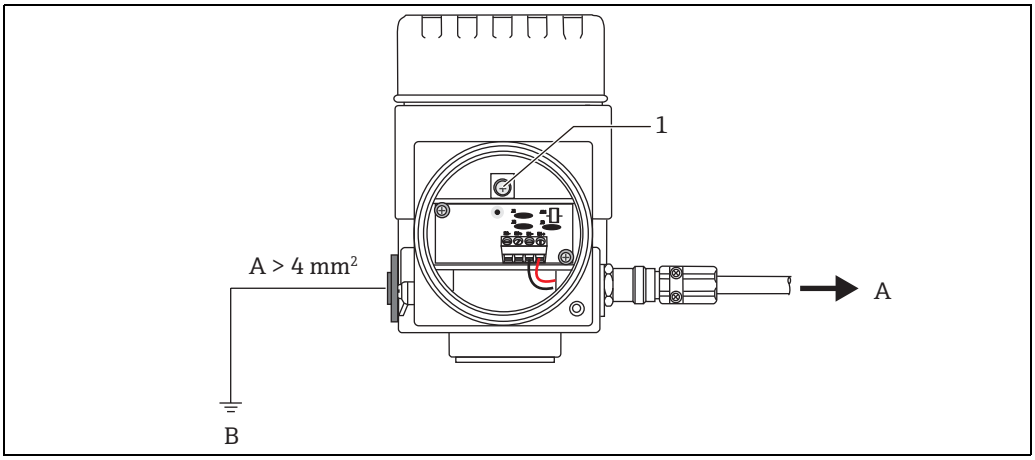


Figure 27: Grounding

A To NRF590, NMS5, NMS8x, NMR8x, or NRF81

B Tank ground

1. Ground terminal

5 Operability

5.1 Local HART connection

5.1.1 Endress+Hauser tank gauging instrument

NMT532 is developed and designated primarily to work with Endress+Hauser tank gauging host instruments NRF590, NMS5, NMS8x, NMR8x, or NRF81.

Temperature information is transmitted on a two wire intrinsically safe local HART loop to the host instrument.

Since NRF590, NMS5, NMS8x, NMR8x, and NRF81 have a pre-configured menu for NMT series functionality as default, simple wiring to NMT532 will complete the initial setup for NMT532.

Measurement function

0: Converter only

1: Temperature + converter

These four basic data are available as standard.

1. Average liquid temperature
2. Average gas Phase temperature
3. Level (entered liquid level at "VH02 measured distance")
4. Device Status

5.2 Device setup: NRF590

Connect the loop powered local HART communication cable from NRF590 (intrinsically safe side compartment) to NMT532.

Since NRF590 is designed to recognize NMT532 as a specific Endress+Hauser local HART instrument, set up is easy.

5.2.1 HART scanner

After the physical cabling between NMT532 and NRF590 is complete, scan all connected loop powered local HART devices by activating "HART SCAN" on Tank Side Monitor.

⚠ CAUTION Not all of NRF590 are equipped with fully accessible compatibility to recognize NMT532. Consult Endress+Hauser representatives to cross check the software and hardware version of NRF590. Specific parameters of NMT532 is set to NRF590

5.2.2 Specific parameters of NMT 532 for setup to NRF590

Configuration of NMT532 parameters on the display of NRF590 is dependent on the installed software and hardware version of NRF590. Refer to the operating manual of NRF590 to determine accessible parameters.

All required initial setup and configuration can be performed by FieldCare. Detailed information will be described in the following chapters relating to operation.

5.3 Device setup: NMS5

NMS5 is also specifically designed to recognize NMT532.

Terminals 24 and 25 of NMT532 and NMS5 are connected by using local HART.

5.3.1 Preparation of NMS5

NMS5 must be pre-configured to accept NMT532 connection via the multi drop local HART loop.

GVH362: NMT connection

"Average Temp." must be selected in order to configure NMT532.

NOTICE To change this parameter, an access code is required.

Refer to NMS5 operation manual (BA00401G) for further information.

5.3.2 NMT532 configuration on NMS5

Most required NMT532 parameters can be configured on G4 "Temperature" matrix as it is on the display of NMS5.

NOTICE Typical NMT532 parameters are displayed on the matrix of NMS5.

G0 Static matrix

GVH010: Liquid temp

Display average liquid temperature.

GVH013: Gas temperature

Display average gas temperature.

G4 Dynamic matrix: temperature

GVH440: Liquid temp

Display the same value indicated on GVH010 Liquid temp

GVH441: Gas temperature

Display the same value indicated on GVH013 Gas temperature

GVH442: Measured level

Display liquid level value established in NMS5

NMT532 must have liquid level data in order to calculate both liquid and gas phase average temperature.

GVH447: Reference zero

Check that temperature transforming of measuring temperature resistor is performed correctly.
Allowable Range: ± 1.0 °C (± 33.8 °F)

GVH450 to 459; Temp No.1 to 10 (No.1 to 6 for NMT532)

Display measuring values of temperature from each inserted temperature element in the probe.

GVH460 to 49; Element position No.11 to 16 (not available with NMT532)

GVH470: Select point

A matrix to select the desired temperature element data on GVH471 "Zero adjust", GVH473 "Element temp" and GVH474 "Element position."

GVH480: Diagnostic

Display error code message

Refer to the error code chart in a later chapter of this manual (refer to Page 40).

GVH482: Total No. element

Enter the number of installed temperature elements in the average temperature probe.

GVH485: Type of interval

Select type of temperature element interval

Even: temperature element spacing will be equally spaced by providing the distance at GVH487 "Element interval", and the lowest temperature element position can be set at GVH486 "Bottom point".

GVH486: Bottom point

The lowest inserted temperature element position in the average temperature probe

NOTICE This parameter setting is only used to change the theoretical temperature element position within NMT532's software for purposes of average calculation. The physical location of the temperature element position does not change.

5.4 Device setup: NMS8x, NMR8x, NRF81

NMS8x, NMR8x, and NF81 are also specifically designed to recognize NMT532 as a HART master.

Terminals E1 and E2 or B3 and C3of NMT532 and NMS8x are connected by using local HART.

The connection between NMS8x, NMR8x, or NRF81 and NMT532 is specified by the explosion-proof certification. For details of connection, refer to the chapter "4 Wiring".

5.4.1 Preparation of NMS8x, NMR8x, NRF81

Prior to connecting NMS8x, NMR8x, or NRF81 to NMT532, the initial setting is required.

Setting procedure

5. Navigate to: Expert → Input/output → HART device → HART Device (s) → NMT dev. config
6. Select **Config. device?** and select **Yes**.
7. Input the lowest temperature element from the bottom of the tank at the parameter of the **Bottom point**.

This completes the setting procedure.

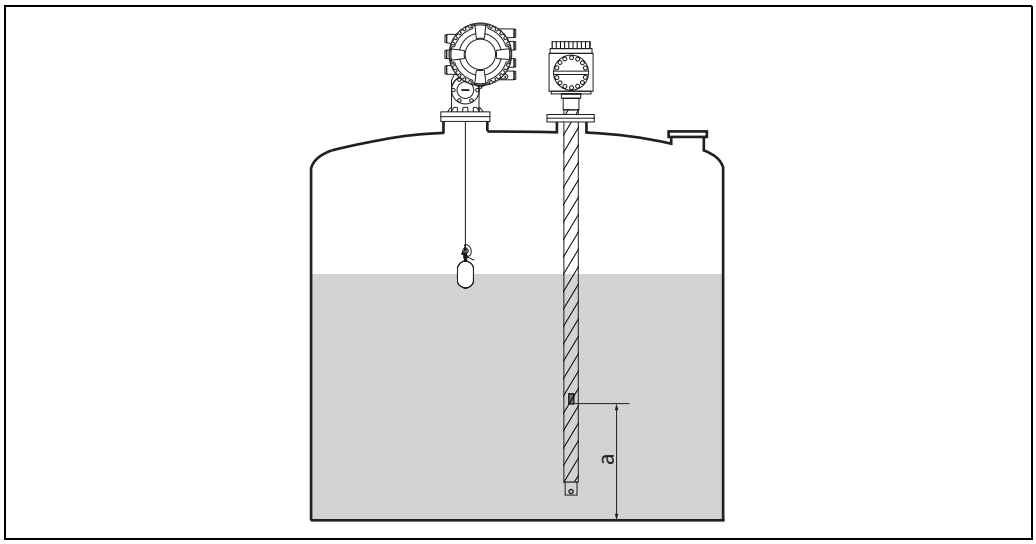


Figure 28: Position of the lowest temperature element from the bottom of the tank

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

The standard factory default setting is 500 mm (19.69 in), and it can be adjusted according to the actual installation.

Liquid temperature

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

Vapor temperature

Item	Description
Navigation	Operation → Temperature → Vapor temperature
Description	Shows the measured vapor temperature.
Additional information	Read access: Operator
	Write access: -

Element temperature 1 to 24

Item	Description
Navigation	Operation → Temperature → NMT element values → Element temperature → Element temperature 1 to 24
Description	Shows the temperature of an temperature element in the NMT.
Additional information	Read access: Operator
	Write access: -

Element position 1 to 24

Item	Description
Navigation	Operation → Temperature → NMT element values → Element temperature → Element position 1 to 24
Description	Shows the position of the selected temperature element in the NMT.
Additional information	Read access: Operator
	Write access: -

Level source

Item	Description
Navigation	Setup → Advanced setup → Application → Tank configuration → Level → Level source
Description	Defines the source of the level value.
Selection	No input value
	HART device 1 to 25 level
	Level SR (Visibility depends on order options or device settings.)
	Level (Visibility depends on order options or device settings.)
	Displacer position (Visibility depends on order options or device settings.)
	AIO B1-3 value
	AIO C1-3 value
	AIP B4-8 value
	AIP C4-8 value
Factory setting	Dependent on the device version
Additional information	Read access: Operator
	Write access: Maintenance

5.4.2 Setup NMT532 in NMS8x, NMR8x, or NRF81

The following parameters are concerned with the NMT532. For details of the NMS8x, NMR8x, or NRF81 operation, refer to the Operating manual of their devices.

The following parameters can be seen after Navigate to: Expert → Input/output → HART device → HART Device (s).

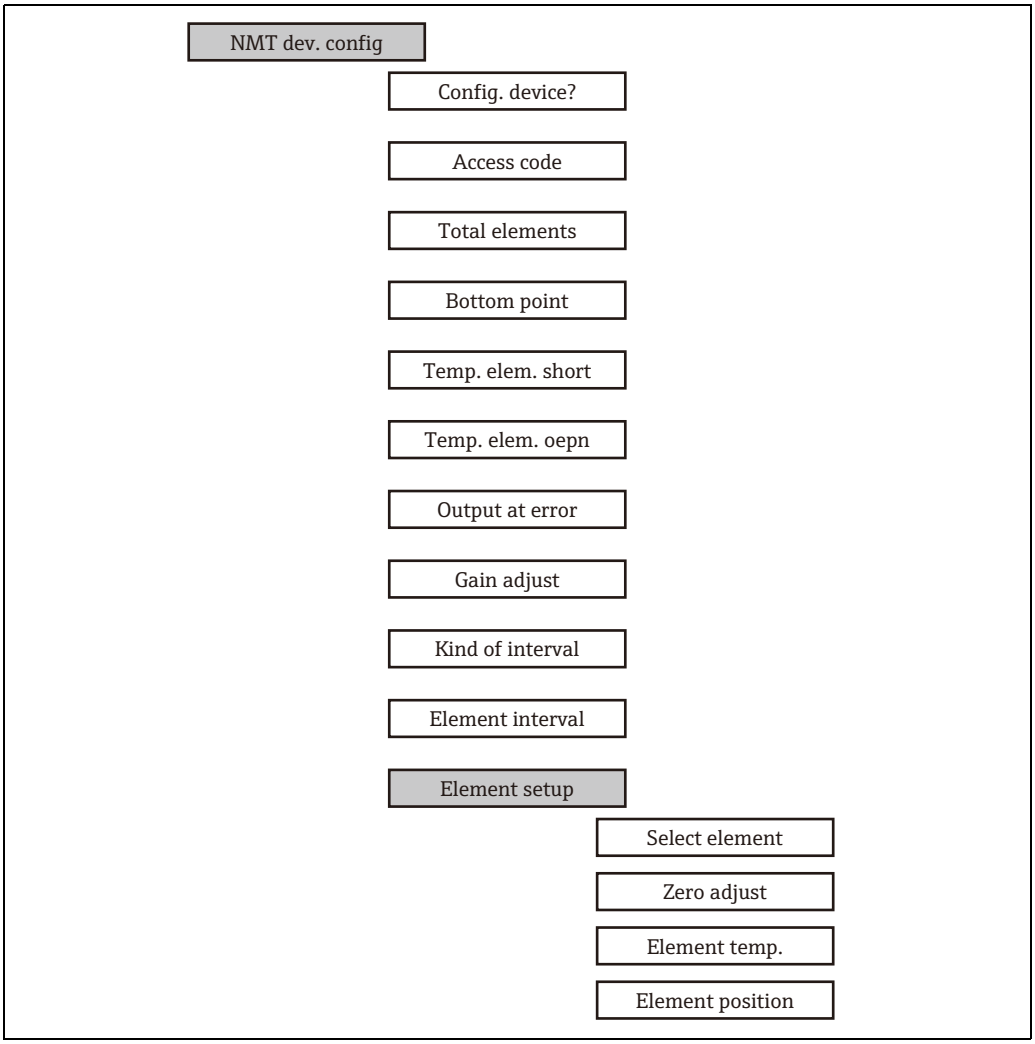


Figure 29: Parameter configuration

Config. device?

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Config. device? (14728)
Description	Enable NMT device configuration.
Selection	No (Not configurable)
	Yes (Configurable)
Factory setting	No
Additional information	Read access: Operator
	Write access: Maintenance

Access code

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Access code (14714)
Prerequisite	Config. device? = Yes
Description	Shows the access code to configure the NMT device.
User entry	0 to 65535
Factory setting	0
Additional information	Read access: Operator
	Write access: Maintenance

Total elements

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Total elements (14730)
Description	Shows the total no. of configurable temp. elements.
Additional information	Read access: Operator
	Write access: -

Bottom point

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Bottom point (14729)
Description	Shows the bottom clearance from the end of probe.
User entry	Signed floating-point number
Factory setting	0 mm
Additional information	Read access: Operator
	Write access: Maintenance

Temp elem. short

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Temp elem. short (14731)
Description	Sets the temp. if temperature element is broken (shorten).
User entry	Signed floating-point number
Factory setting	0 °C
Additional information	Read access: Operator
	Write access: Maintenance

Temp. elem. open

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Temp. elem. open (14732)
Description	Sets the temp. if temperature element is not connected.
User entry	Signed floating-point number
Factory setting	0 °C
Additional information	Read access: Operator
	Write access: Maintenance

Output at error

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Output at error (14733)
Description	Defines if error code of defective temperature elements are user configured values.
Selection	Off
	On
Factory setting	Off
Additional information	Read access: Operator
	Write access: Maintenance

Gain adjust

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Gain adjust (14736)
Description	Adjusts all temp. elements + reference 0 & 17.
User entry	Signed floating-point number
Factory setting	0
Additional information	Read access: Operator
	Write access: Maintenance

Kind of interval

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Kind of interval (14744)
Description	Determines how the temperature element positions are defined.
Selection	Even (First position bottom point + temperature element interval for every next temperature element.)
	Not even (Position of temperature elements can be set manually.)
Factory setting	Even
Additional information	Read access: Operator
	Write access: Maintenance

Element interval

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Element interval (14743)
Prerequisite	Kind of interval = Even
Description	Shows the distance between the temp. elements.
User entry	Signed floating-point number
Factory setting	0 mm
Additional information	Read access: Operator
	Write access: Maintenance

Select element

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Element setup → Select element (14734)
Description	Chooses the temp. element configured manually.
User entry	1 to 16
Factory setting	1
Additional information	Read access: Operator
	Write access: Maintenance

Zero adjust

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Element setup → Zero adjust (14735)
Description	Adjusts the offset of the selected temp. element.
User entry	Signed floating-point number
Factory setting	0 None
Additional information	Read access: Operator
	Write access: Maintenance

Element temp.

Item	Description
Navigation	Expert → Input/output → HART device → HART Device (s) → HART dev. config → Element setup →Element temp. (14737)
Description	Shows the temperature of the temperature element.
Additional information	Read access: Operator
	Write access: -

Element temp.

Item	Description
Navigation	 Expert → Input/output → HART device → HART Device (s) → HART dev. config → Element setup →Element position (14738)
Description	Shows the position of the temperature element.
User entry	Signed floating-point number
Factory setting	0 mm
Additional information	Read access: Operator
	Write access: Maintenance

6 Operation and description of device function

Description for FieldCare from this chapter

6.1 Local HART device designation

Local HART device code "184":

Device code for temperature measurement function in NMT532 only

6.1.1 Device data

Tag number: read and write

Default: Local HART

A customer specific device identification and control number (or name)

Tank name, site number, or any other ID can be entered.

Assembly number: read and write

Default: 0

Manufacture control number based on production process

6.2 Temperature measurement

6.2.1 Primary values: VH00 to VH09

VH00 Liquid temp

Item type: read only

Range: -200 to +240 °C

NOTICE

- Display measured liquid phase average temperature.
- Liquid level input must be provided by Micropilot radar level gauge (via Tank Side Monitor) or NMS5 series servo level gauge in order to calculate true liquid average temperature.

VH01 Gas temp

Item type: read only

Range: -200 to +240 °C

Display measured gas (vapor) phase average temperature.

NOTICE

- Display measured gas (vapor) phase average temperature.
- Liquid level input must be provided by Micropilot radar level gauge (via Tank Side Monitor) or NMS5 series servo level gauge in order to calculate true gas average temperature.

VH02 Measured distance

Item type: read and write

Range: 0 mm to 99999 mm

Display provided liquid level by connected level gauge.

When level gauge is not connected, inputting liquid level is also available for the device test purpose.

VH07 Temperature 0

Item type: read only

Check that temperature transforming of measuring temperature resistor is performed correctly.
Allowable range: ± 1.0 ˚C (± 33.8 ˚F)

VH09 Temperature 17

Item type: read only

This temperature is used to check at the factory.

6.2.2 Element temperature 1: VH10 to VH15 (VH16 to 19 are not available in NMT 532)

VH10 to 19 Temperature 1 to 10

Item type: read only

Range: -200 to +240 °C

Display individual measured temperature element

6.2.3 Element temperature 2: VH20 to VH25 (VH26 to 29 are not available in NMT532)

VH26 Selec. ave method

Item type: select

Selection: standard, advanced

Select average calculation method

Standard: **Conventional calculation method**

Regardless of tank shape, average temperature calculation will be performed based on the following example (ex.: liquid temperatures).

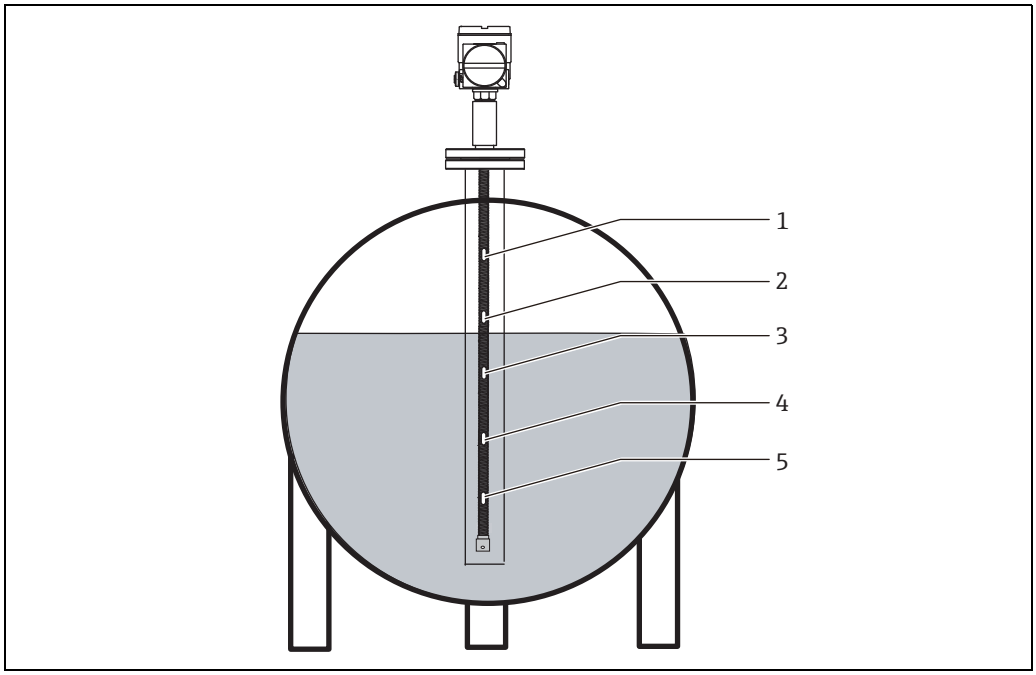


Figure 30: Conventional calculation for standard

1. *Temperature element #5: 4.5 °C*
2. *Temperature element #4: 4.0 °C*
3. *Temperature element #3: 2.0 °C*
4. *Temperature element #2: 3.0 °C*
5. *Temperature element #1: 3.5 °C*

Formula: (T1 + T2 + T3) / # of element in liquid phase

= Average temperature (3.5° C + 3.0 °C + 2.0 °C) / 3 = 2.83 °C

Advanced:

Average temperature calculation can be performed adding correction factor to compensate unequal volume distribution (example: liquid temperatures).

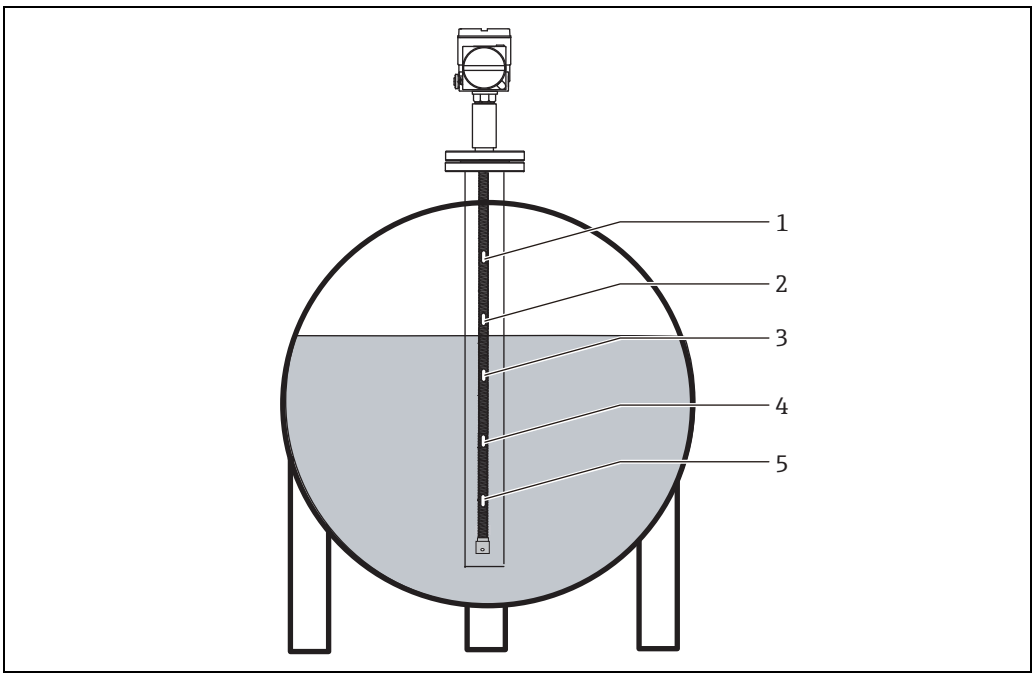


Figure 31: Conventional calculation for advanced 1

1. *Temperature element #5: 4.5 ℃*
2. *Temperature element #4: 4.0 ℃*
3. *Temperature element #3: 2.0 ℃*
4. *Temperature element #2: 3.0 ℃*
5. *Temperature element #1: 3.5 ℃*

Formula: (T1*V1 + T2*V2 + T3*V3) / (V1 + V2 + V3) = Average temperature

NOTICE V = # of additional volume factor and related parameters are determined at VH53, 54 and 55.

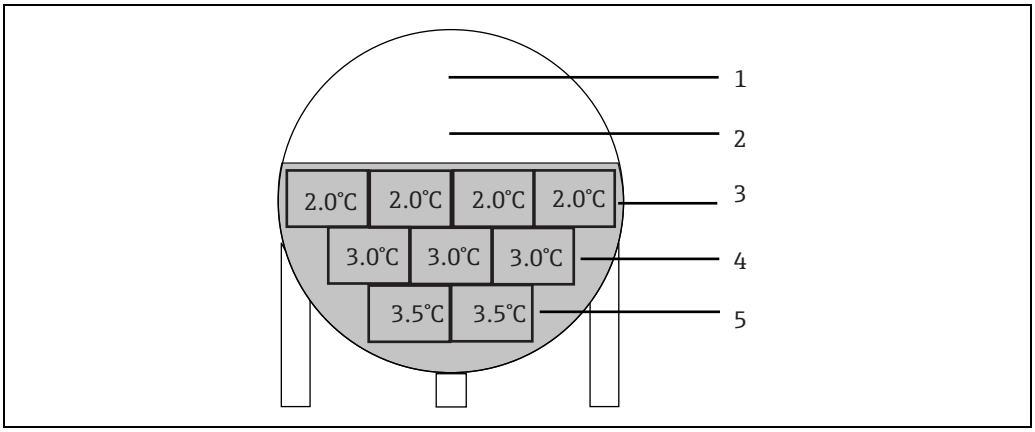


Figure 32: Conventional Calculation for Advanced 2

1. *Temperature element #5: 4.5 ℃*
2. *Temperature element #4: 4.0 ℃*
3. *Temperature element #3: 2.0 ℃*
4. *Temperature element #2: 3.0 ℃*
5. *Temperature element #1: 3.5 ℃*

☐ in the figure 32 shows V (volume factor).

Spot:

When some temperature elements (resistance and material) are located in each input cable in the probe; average calculation is performed based on sum of submerged temperature element value/total number of temperature element submerged.

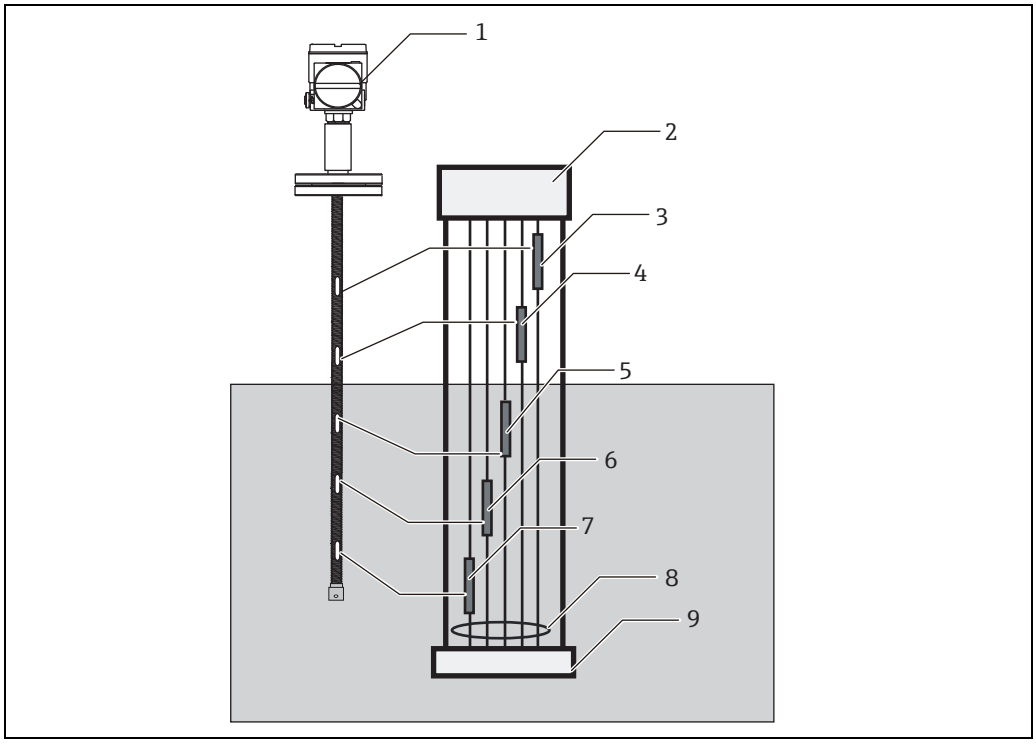


Figure 33: Spot type

1. *NMT532*
2. *To converter*
3. *Pt 100 temperature element #5: 24.5 °C (T5)*
4. *Pt 100 temperature element #4: 24.0 °C (T4)*
5. *Pt 100 temperature element #3: 26.0 °C (T3)*
6. *Pt 100 temperature element #2: 25.5 °C (T2)*
7. *Pt 100 temperature element #1: 25.0 °C (T1)*
8. *Input signal cable*
9. *Probe end*

VH28 Lower limit

Item type: read and write

Default value: -20.5 °C

Range: -999.9 to +999.9 °C

Display low limit temperature. This is used for reference of temperature element shortage.

VH29 Upper limit

Item type: read and write

Default value: 245 °C

Range: -999.9 to +999.9 °C

Display high limit temperature. This is used for reference of temperature element disconnection.

6.2.4 Element position 1: VH30 to VH35 (VH36 to VH39 are not available in NMT 532)

VH30 to VH39 Position 1 to 6 (7 to 10 are not available in NMT532)

Item type: read and write

Range: 0 to 99999 mm

Individual temperature element position from tank bottom

Calculation is automatically performed when temperature element spacing "Even" is selected at VH85.

6.2.5 Element position 2: VH46 to VH49 (VH40 to VH45 are not available in NMT532)

VH46 Hysteresis width

Item type: read and write

Default: 10 mm

Range: 0 to 99999 mm

Temperature element switching point hysteresis

Entered hysteresis as a offset value is added on the liquid level when the liquid level is raising, subtracted when lowering to prevent from hunching by unstable liquid surface condition.

VH47 Clear memory

Item type: select

Default: None (0)

Selection: None, Clear

Reset matrix parameter to default setting.

VH48 Gas offset

Item type: read and write

Default: 300 mm

Range: 0 to 99999 mm

When a temperature element in the gas (vapor) phase is within the range of 300 mm shown below, it is not used for the average temperature calculation of the gas temperature.

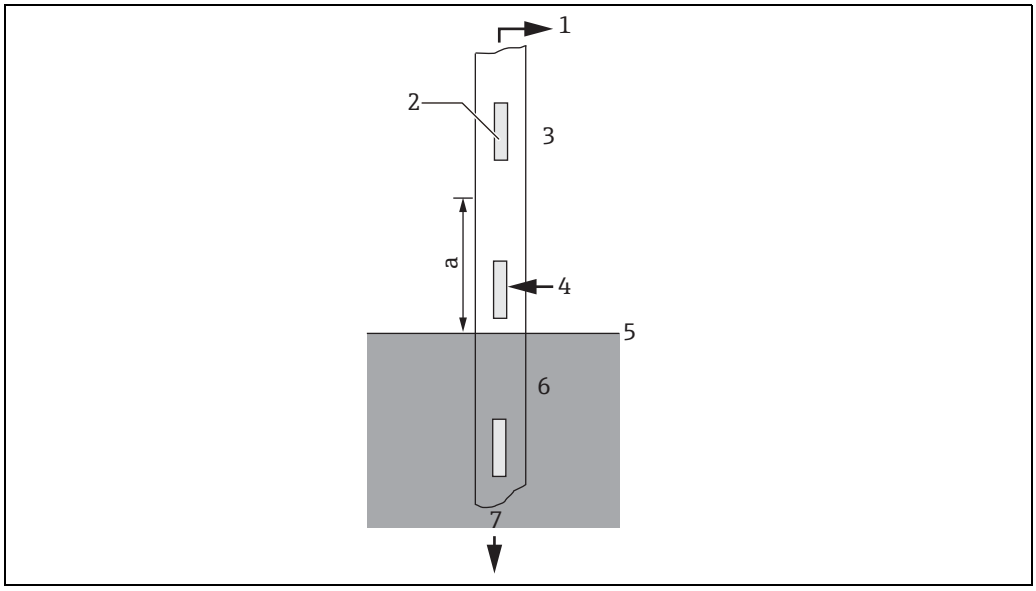


Figure 34: Gas offset

a *VH48 Gas offset (300 mm as default).*
1. *To NMT532 electric housing*
2. *Temperature element*
3. *Gas phase*
4. *Temperature element within this range will be excluded from gas average calculation.*
5. *Liquid level*
6. *Liquid phase*
7. *To tank floor*

VH49 Liquid offset

Item type: read and write

Default: 300 mm

Range: 0 to 99999 mm

When a temperature element in the liquid phase is within the range of 300 mm shown below, it is not used for the average temperature calculation of the gas temperature.

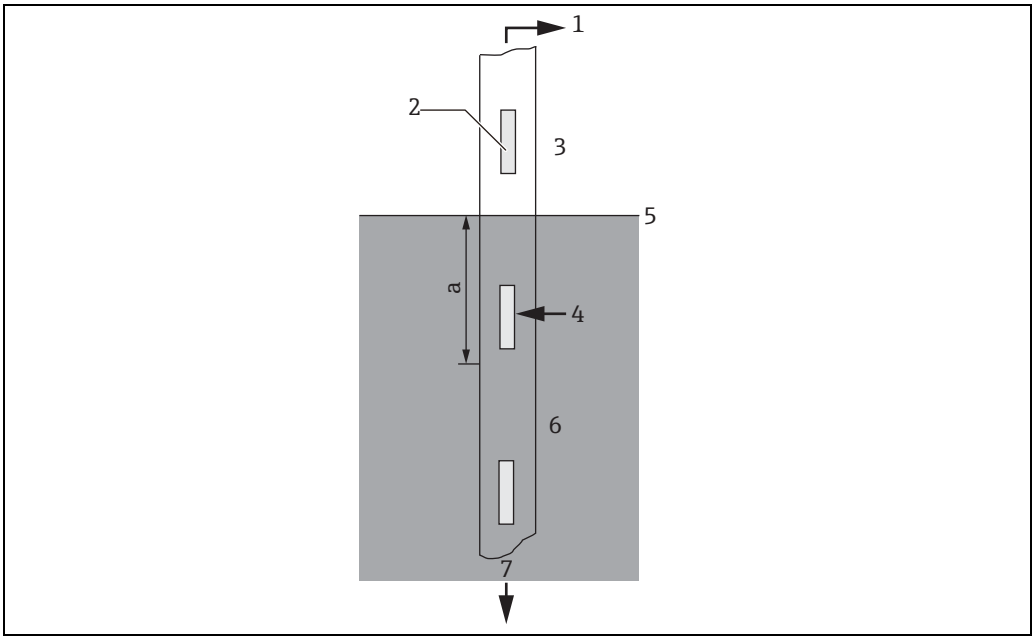


Figure 35: Liquid offset

a VH49 Liquid offset: 300 mm (default)
1. To NMT532 electric housing
2. Temperature element
3. Gas phase
4. Temperature element within this range will be excluded from liquid average calculation.
5. Liquid level
6. Liquid phase
7. To tank floor

6.2.6 WB primary and advanced temp: VH50 to VH59

VH53 Element point

Item type: select

Default: 0

Selection: 0 to 5 (element #1 = 0, element #6 = 5)

Select temperature element number for "Advanced" average calculation at VH26. Selected temperature element position will be
displayed on VH54 "Element position" and enable to change additional volume factor at VH55 "Element volume."

VH54 Element position

Item type: read only

Range: 0 to 99999 mm

Display the selected temperature element position at VH53

VH55 Element volume

Item type: read and write

Range: 1 to 99999.9

Set additional factor on the selected temperature element at VH53. Additional volume can be added to the individual temperature element for advanced average temperature calculation (refer to "Select Average method" for details on the description of VH26).

6.2.7 Operation power adjustment: VH60 to VH69

VH67 Common voltage

Item type: read only

Range: 0 to 255 (0 to 3V)

Display running voltage of the temperature element line (both signal and common).

Detected voltage across common line (shall be between 0 to 3V) is converted to the range of 0 to 255 count when it is displayed.

VH68 Output current

Item type: read only

Range: 0 to 65535

Output current is set according to customer specifications.

VH69 Ref voltage

Item type: read and write

Default: 200

Range: 0 to 255

A parameter to draw power supply failure alarm

NMT532 operates at minimum 16VDC of supply voltage via multi drop HART loop under normal operating condition. NMT532 transmits error message when supply voltage drops below 16VDC with default value setting 200.

6.2.8 Temperature adjustment: VH70 to VH79

VH70 Element select

Item type: select

Range: 0 to 19

Select "need adjustment" temperature element (0 = #1 element, 5 = #6 element, 19 = reference 100 Ohm resistor)

Detailed value and parameter of the element selected in this matrix can be shown in,

VH71 "Zero adjust"

VH73 "Temperature X"

VH74 "Position X"

VH75 "Resistance X"

VH76 "Resistance Adj"

VH71 Zero adjust

Item type: read and write

Default: 0

Range: -1000.0 to 1000.0

Zero adjustment of individual temperature element selected at VH70

Comparing to precision reference thermometer, when measuring value shows minor offset value, the reading value can be adjusted.

NOTICE Set "-0.2" in this matrix if 1) selected temperature element #2 indicates 25.4 °C and 2) reference thermometer indicates 25.2 °C. After setting the value, the offset value which is based on the actual measuring value of the temperature element #2 will be -0.2 °C.

VH72 Adjust span

Item type: read and write

Default: 1

Range: 0.8 to 1.2

The span adjustment can apply to all the installed temperature elements.

A linearized factor of given parameter is multiplied to raw temperature element measurement for final calculation.

VH73 Temperature X

Item type: read only

Specified temperature element selected at VH70

Display the temperature element selected at VH70 and display the individual temperature element shown at VH10 to VH25.

The value is calculated based on the following formula.

VH73: "Temperature X" = raw element temperature x span (VH72) + zero offset (VH71)

VH74 Position X

Item type: read and write

Range: 0 to 99999 mm

A position of specified temperature element at VH70

Each temperature element position is also determined when "Not even" temperature element spacing is selected at VH85.

VH75 Resistance X

Item type: read only

Display the temperature element resistance selected at VH70.

VH76 Resistance Adj.

Item type: read and write

Default: 0

Range: -1000.0 to 1000.0

Adjust the temperature element resistance selected at VH70

Minor resistance adjustment can be set at the reading value.

NOTICE Set "-0.3 Ohm" in this matrix if 1) selected temperature element #5 indicates 100.3 Ohm and 2) reference precision resistor indicates 100.0 Ohm under the same environment condition. After setting the value, the offset value which is based on the actual measuring value of the temperature element #5 will be -0.3 °C.

VH77 Element type

Item type: select

Selection: Pt100 (must be selected in NMT532)

NOTICE NMT532 always consists "Pt100" temperature element with "Spot" temperature element layout. Do not change these parameters.

VH78 Average number

Item type: read and write

Default: 1

Range: 1 to 10

Number of sampling for average calculation prior to determine final display value

Increasing number of sampling may prevent from faulty display.

⚠ CAUTION Additional sampling # will cause slower reaction time on value switch over. Maximum 1 sampling sequence will take approximately 2 sec {total 11 temperature elements (6 temperature elements and 5 times for 3 reference resistors)}.

NH79 Protect code

Item type: read and write

Default: 0

Range: 0 to 999

Access code 530 to enable select and write command available

6.2.9 Device setting 1: VH80 to VH89

VH80: Present error

Item type: read only

Display the error message.

The following codes will be indicated.

For detailed description, refer to "Troubleshooting".

Error code	Description
0	No error presence
1	Common line open
3	#1 element open
4	#1 element short
5	#2 element open
6	#2 element short
7	#3 element open
8	#3 element short
9	#4 element open
10	#4 element short
11	#5 element open
12	#5 element short
13	#6 element open
14	#6 element short
23	#0 element over range
24	Memory defect (ROM)
29	Element exposed (liquid level below #1 element position)
41	Memory defect (RAM)
42	Memory defect (EEROM)

VH81 Temperature unit

Item type: select

Default: °C

Selection: C, F, K

Select the unit of the temperature display

Based on universal local HART setting, °C (HART code: 32), °F (HART code: 33) and °K (HART code: 35) are available.

NOTICE Selection of temperature display unit only applies to reply data from NMT532. Data transmission from host gauge (NRF590 or NMS5) to NMT532 is performed by °C unit only.

VH82 Element number

Item type: read and write

Default: 2

Range: 1 to 6

Entering # of available temperature element

⚠ CAUTION Do not change the default parameter on NMT532. # of temperature element on this version is pre-determined by customer's choice. It may cause faulty calculation or unnecessary error display.

VH83 No. of preambles

Item type: read and write

Default: 5

Range: 2 to 20

Set # of preamble for local HART communication

⚠ CAUTION Do not change default value. Changing value may cause communication error.

VH84 Distance unit

Item type: select

Default: mm

Selection: ft., m, inch, mm

Select the unit of the level display

The unit applies to liquid level display on VH02 "Liquid level". "Level units are coded based on the universal local HART setting, ft. (HART code: 44), m (HART code: 45), inch (HART code: 47), mm (HART code: 49).

VH85 Kind of interval

Item type: select

Default: Even

Selection: Even (always "Even" for NMT532)

Select the interval of the temperature elements depending on spacing layout.

⚠ CAUTION Do not change its parameter on NMT 532 Converter + Temperature version excluding repair. Kind of Interval and individual temperature element positions are physically determined at factory.

VH86 Bottom point

Item type: read and write

Default: 500 mm

Range: 0 to 99999 mm

Position of #1 temperature element that is also called "Bottom point"

#1 temperature element position becomes critically important when "Even interval" is selected at VH85 because remaining temperature element positions rely on this location of bottom point.

VH87 Element interval

Item type: read and write

Default: 1000 mm

Range: 0 to 99999 mm

Designate Even interval spacing.

NOTICE Changing temperature element interval and setting temperature element position are only applied to reconfigure switching points for average temperature calculation. The physical temperature element position will never be changed.

VH88 Short error

Item type: read and write

Default: -49.5

Range: -49.5 to 359.5

A type of error message when any of temperature element has short circuit

Method of display can be configured at VH92 "Error Display Select."

VH89 Open error

Item type: read write

Default: 359.0

Range: -49.5 to 359.5

A type of error message when any of temperature element has open circuit

Method of display can be configured at VH92 "Error display select".

6.2.10 Device setting 2: VH90 to VH99

VH90 Device ID number

Item type: read and write

Default: 0

Range: 0 to 16777214

In order to distinguish own device ID when NMT532 is connected in multi drop local HART loop.

NOTICE Changing device ID may lead to communication error because of mismatched pre-registered device ID and local HART address.

VH91 Previous error

Item type: read only

Display of error history

Coded error message will be the same contents as VH80.

VH92 Error Dis. Sel.

Item type: select

Default: 0_OFF

Selection: 0_OFF, 1_ON

Select the type of the display of VH88 "Short error value" and VH89 "Open error value".

0_OFF: These 2 error messages will not be transmitted to the connected host gauge.

This function automatically excludes defect temperature element in average temperature calculation.

1_ON: Error message will be transmitted to the host gauge. As a result, VH88 and 89's numeric error code will be displayed on host gauge default screen and may transmit to upper receiver as well.

H93: Custody mode

Item type: read

Default: Set default setting depending on the specification at factory.

Write protection of hardware is located on main CPU board (CN3 connector).

VH94 Polling address

Item type: read and write

Default: 2

Range: 1 to 15

Polling address for local HART communication

VH95 Manufacture ID

Item type: read only

Default: 17

A manufacture ID within E+H instrumentation

VH96 Software version

Item type: read only

A display of installed software version

VH97 Hardware version

Item type: read only

A display of installed hardware version

VH98 Below bottom

Item type: select

Default: 0_OFF

Selection: 0_OFF, 1_ON

A type of error display when liquid level drops below #1 temperature element (Bottom point)

Error code "29" is displayed on VH80 and VH91 when 0_ON is selected.

VH99 Device type code

Item type: read only

Device type will be displayed.

190: Temperature measurement function only

6.3 Input of the water bottom level from the host system

For devices without a water bottom probe, the VH50 water level can be inputted manually via HART Master.

This function is available only for devices without a water bottom probe. However it cannot be applied for calculation of multiple temperature elements. When the water bottom probe is recovering from an error, the previous value of the water level is used. After turning the power on or off, the water level shows 0 mm.

Input (e.g.) 876.5 mm to the water level value procedure

1. Input 129 to the Device Specific Commands.
2. Input 047E (0x047E/VH50) to the Data (Hex).
   - 047E shows variable number address 1150.
3. Input float value 445B2000 to the Data (Hex).
   - Float value 445B2000 shows the water value 876.5 mm.

31 in the Data Hex shows millimeter (mm).

This completes the input procedure.

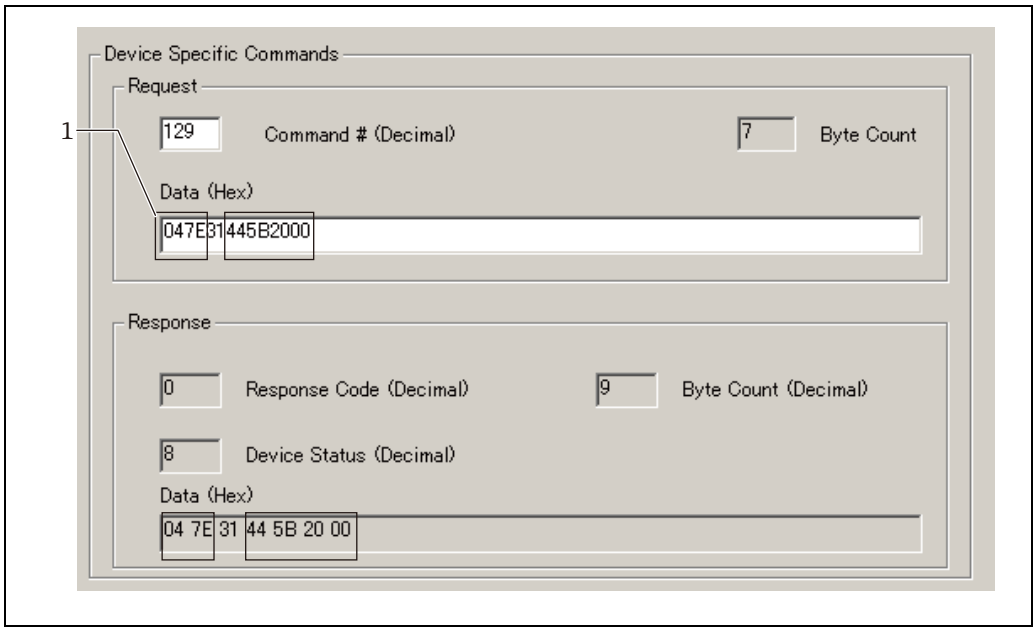


Figure 36: Screen 1

1. Variable number address

Input (e.g.) 2345.6mm to the water level procedure

1. Input 145 to the Device Specific Commands.
2. Input 50 (VH50) to the Data (Hex).
   - VH50 shows for NMT539, NMT532, and NCT530 matrix.
3. Input float value 4512999A to the Data (Hex).
   - Float value 4512999A shows the water value 2345.6 mm.

31 in the Data Hex shows millimeter (mm).

This completes the input procedure.

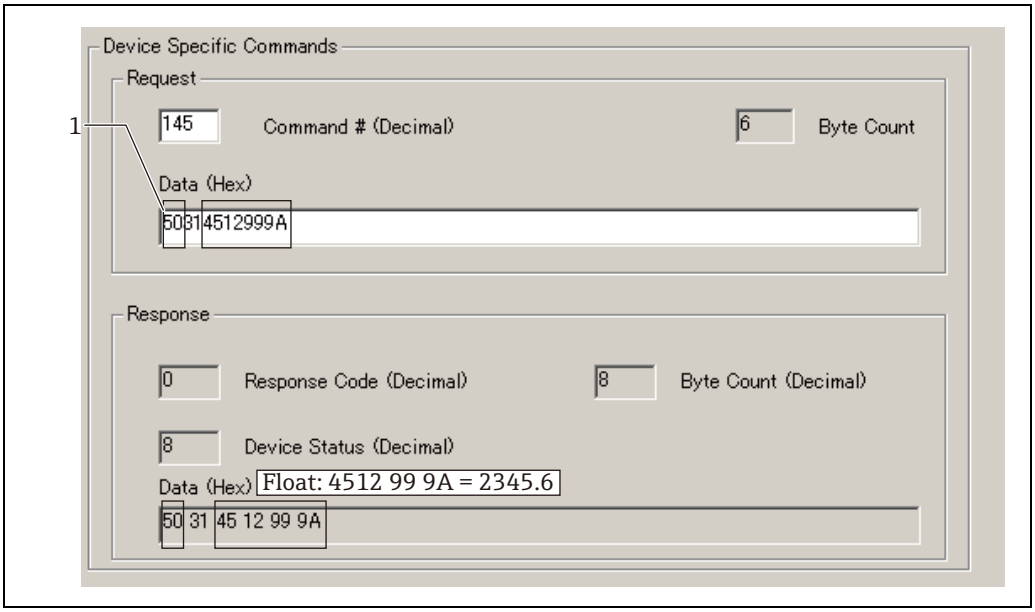


Figure 37: Screen 2

1. VH number

6.4 Temperature element around the bottom of the tank

The temperature element located lower than 1 m from the bottom of the tank is handled as follows. For the following list case 1and 2, refer to the figure 18.

Case		Application of average liquid temperature calculation of the temperature element
1	Liquid level is 1 m or more and the temperature element is above 1 and 3 in figure 18.	Not included
2	Liquid level is 1 m or more and temperature element is under 2 in figure 18.	Included
3	Liquid level is lower than 1 m and the temperature element is in the liquid.	Included
4	Temperature element is not in the liquid.	Not included

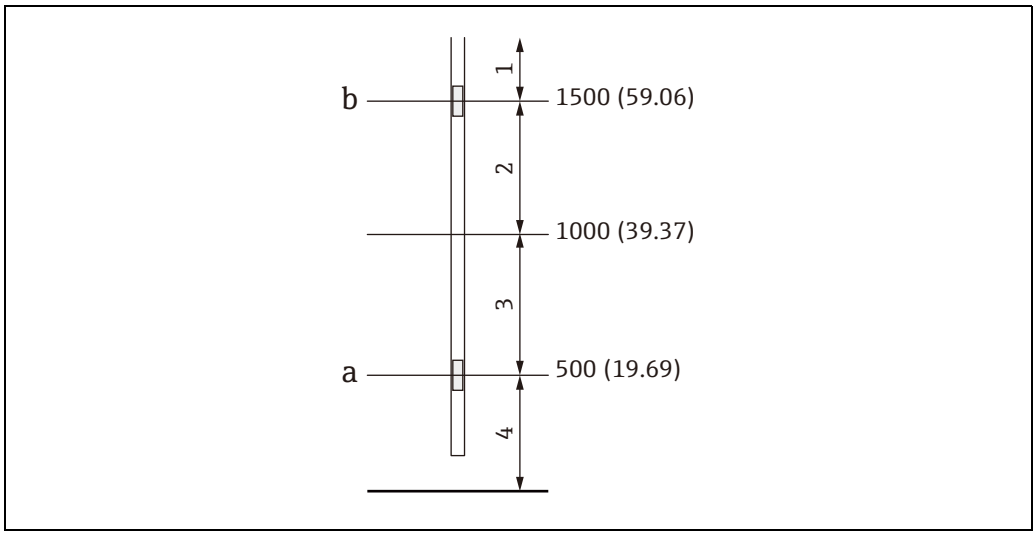


Figure 38: Example of the temperature element around the bottom of the tank

a *Temperature element 1*
b *Temperature element 2*
1. *In case 1*
2. *In case 2*
3. *In case 3*
4. *In case 4*

- In case 1: the result of the measured temperature element 1 is not used for the calculation of the average temperature for this range of liquid level.
- In case 2 and 3: the result of the measure temperature element 1 is used for the calculation of the average temperature for this range of liquid level.
- In case 4: the result of any measure temperature elements are not used for the calculation of the average temperature for this range of liquid level.

6.4.1 Temperature adjustment: VH92

The setting is as follows.

VH92 setting	With/ Without liquid in the tank	Temp. element open	Temp. element short	Error output of the average liquid temperature
ON	No	No	No	358℃
	No	Yes	No	358℃
	No	No	Yes	358℃
	Yes	No	No	Average liquid temperature
	Yes	Yes	No	Open error setting value (359℃ as factory setting)
	Yes	No	Yes	Short error setting value (-49.5℃ as factory setting)
OFF	No	No/Yes	No/Yes	Average gas temperature (Skip the failed temperature element.)
	Yes	No/Yes	No/Yes	Average liquid temperature (Skip the failed temperature element.)

6.5 Write protect switch

For the software version 1.53 or later, when this switch is used, the all parameters are write-protected. This protect switch is supplied for products with the PTB specification.

NOTICE Do not plug or unplug the protect switch while the power is on.

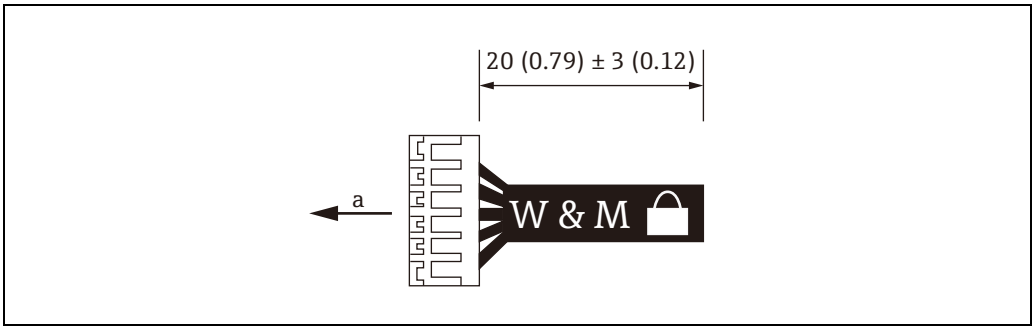


Figure 39: Write protect switch

a To NMT539 CPU CN3

7 Maintenance

7.1 Periodic inspection

NMT532 requires no special maintenance. Conduct all-round periodic inspection of equipment wiring etc. once a year as much as possible.

Periodic inspection item

- Check terminal parts and body cover loose
- Check damage or deterioration of cable and O-rings
- Check screw of adjustment parts

7.2 Repairs

The Endress+Hauser repair policy is based on the fact that the measuring devices have a modular design and that customers are able to undertake repairs themselves. Contact Endress+Hauser service representatives for further assistance regarding service and spare parts.

7.3 Repairs to Ex-approved devices

When performing repairs on Ex-approved devices, note the following:

- Repairs of Ex-approved devices may only be performed by trained personnel or by Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and other relevant rules.
- Only use original spare parts provided by Endress+Hauser.
- When ordering spare parts, note the device information on the nameplate. Replace parts only with parts that have the same device information.
- Perform repairs according to the instructions. When completing repairs, perform the specified routine test on the device.
- Only Endress+Hauser service representatives may convert a certified device into a different certified variant.
- Document all repair work and conversions.

7.4 Replacement

After NMT532 electronic module has been replaced completely, the parameters must be manually re-entered to the replaced new module in order to maintain the proper operation. Measurement can continue without having to perform a new setup.

The following matrix parameters should be confirmed after replacement of the electronics.

NMS5/NMS7 VH	FieldCare/Contents
443	Level select
460 to 469	Temperature element position No. 1to 9
470	Temperature element select (temperature element 0 to 15)
474	Position X (set temperature element position at GVH=470)
482	Temperature element Number
485	Kind of interval
486	Bottom point
487	Temperature element interval (when selecting evenly interval at GVH=485)

8 Accessories

8.1 Anchor weight (High profile)

Installation of anchor weight will cause element position #1 (the lowest temperature measurement position) to be raised approximately 500 mm (20 in) from the tank floor.
For installing the high profile anchor from a top of the tank nozzle, the nozzle opening has to be 150 mm (6 in) or more.

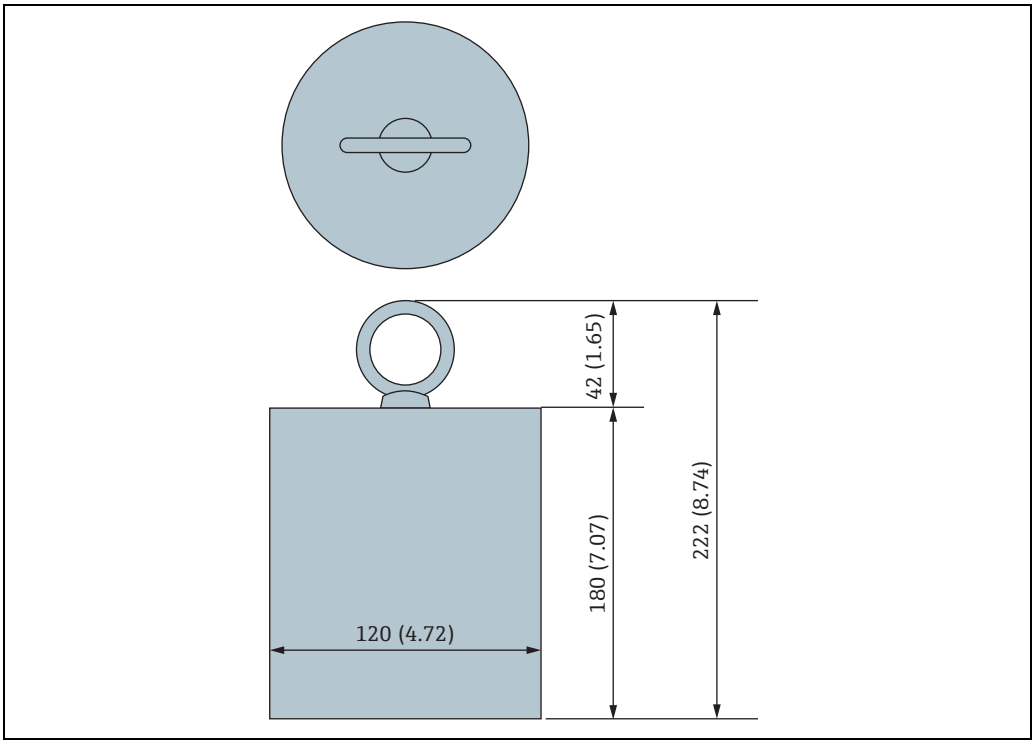


Figure 40: Anchor weight for high profile, Unit of measurement: mm (in)

Different dimension, weight, and material anchor are also available. Consult Endress+Hauser representatives for further details.

Item	Description
Weight	JIS SS400 (Mild Carbon Steel)
Ring	JIS SS400 (Mild Carbon Steel)
Total weight	16 kg

8.2 Anchor weight (Low profile)

The low profile anchor weight is a version for an existing tank installation with a small nozzle opening for converter and temperature version.

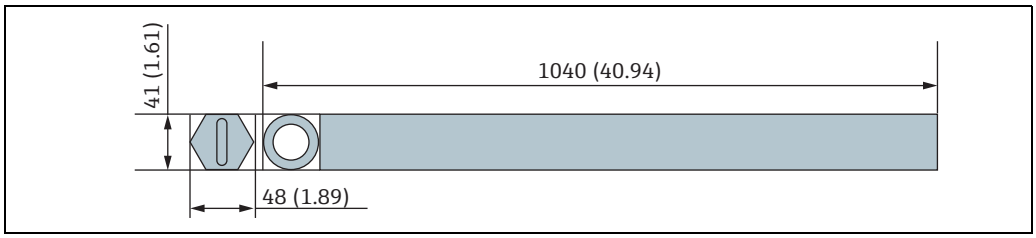


Figure 41: Anchor weight for low profile, Unit of measurement: mm (in)

Item	Description
Weight	JIS SS400 (Mild Carbon Steel)
Ring	JIS SS400 (Mild Carbon Steel)
Total weight	12 kg

8.3 Wire hook

Anchor weights are supplied with SUS316 standard 3 mm diameter tension wire for attaching anchor weight to temperature probe.

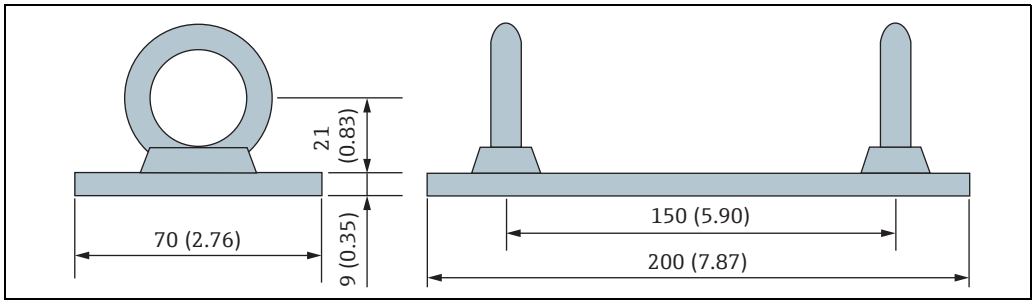


Figure 42: Wire hook, Unit of measurement: mm (in)

Item	Description
Weight	JIS SS400 (Mild Carbon Steel)
Ring	JIS SS400 (Mild Carbon Steel)
Total weight	1.5 kg

Actual tensioning can be completed with SUS316 stranded 3 mm diameter tension wire between the wire hook and the top anchor. Based on the application and installation variable, type of wire, size, material, and special coatings are available. Consult Endress+Hauser representatives for further details.

8.4 Top anchor

The standard process connection of the top anchor is R1 or NPT1" threaded connection. However other sizes and materials can be used for the process connection and the flange.

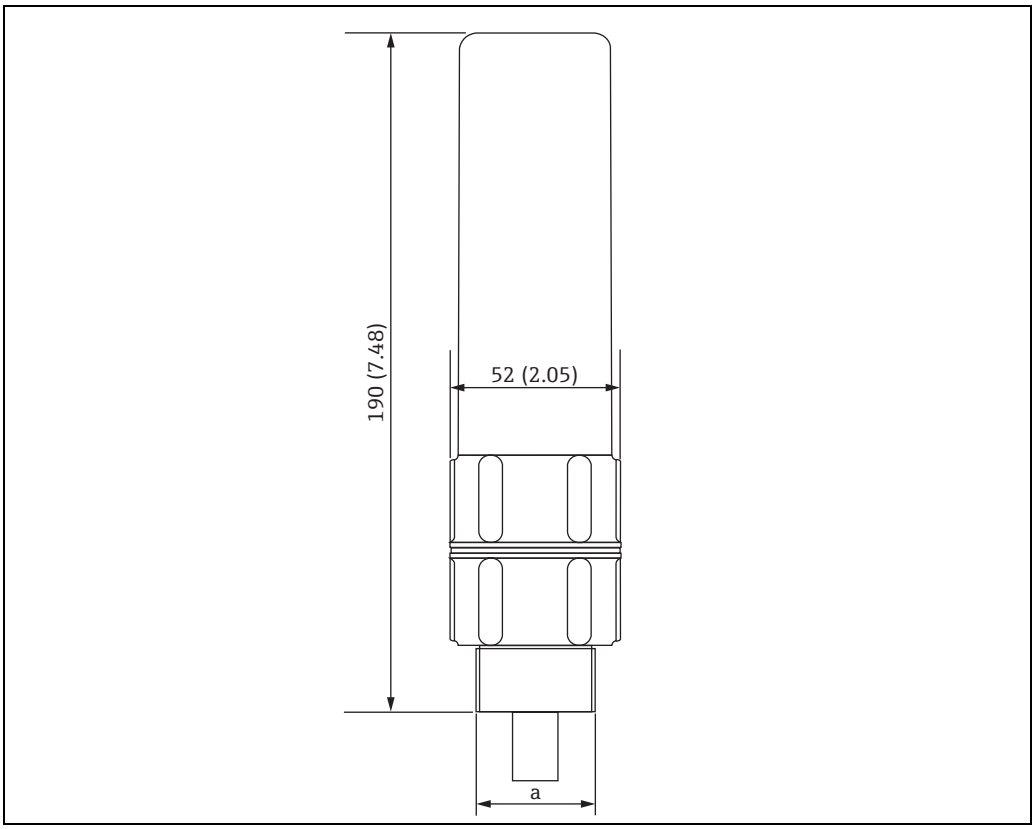


Figure 43: Top anchor dimension

Item	Description
Exterior	ADC (Aluminum)
Internal parts	SUS316, Carbon steel
Total weight	1.2 kg

9 Troubleshooting

9.1 System error messages

Code	Text	Description	Action
0	No Error presence	No error arise	Not necessary.
1	Common line open	Common line is open.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #1 element line (brown).
3	#1 element open	Temperature element signal cable (#1) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #1 element line (brown).
4	#1 element short	Temperature element signal cable (#1) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #1 element line (brown).
5	#2 element open	Temperature element signal cable (#2) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #2 element line (red).
6	#2 element short	Temperature element signal cable (#2) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #2 element line (red).
7	#3 element open	Temperature element signal cable (#3) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #3 element line (orange).
8	#3 element short	Temperature element signal cable (#3) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #3 element line (orange).
9	#4 element open	Temperature element signal cable (#4) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #4 element line (yellow).
10	#4 element short	Temperature element signal cable (#4) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #4 element line (yellow).
11	#5 element open	Temperature element signal cable (#5) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #5 element line (green).
12	#5 element short	Temperature element signal cable (#5) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #5 element line (green).
13	#6 element open	Temperature element signal cable (#6) has open circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #6 element line (blue).
14	#6 element short	Temperature element signal cable (#6) has short circuit.	Check connector attachment on the electronic module, and check resistance on common (white/black spiral or white/violet spiral) line to #6 element line (blue).
23	#0 element over range	The reference #0 element on the electronic module has malfunction.	Replace the electronic module.
24	Memory defect (ROM)	Program memory malfunction.	Replace the electronic module.
29	Element exposed	Liquid level is below #1 element position.	No liquid temperature measurement is available. When liquid level goes over #1 element position, the error disappears.
32	Low power supply	Supply voltage on multi drop HART loop to Prothermo is below specification from a connected host instrument.	Check power supply on the host instrument and consumption of connected loop powered HART devices.
41	Memory defect (RAM)	Data memory malfunction.	Replace the electronic module with new one.
42	Memory defect (EEROM)	Non-volatile data memory malfunction.	Replace the electronic module with new one.

NOTICE These error code will be mainly displayed on FieldCare display when the tool is properly connected. Method and description of error display on host instrument, refer to the documentation of NRF590 or NMS5.

9.2 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong measuring device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

9.3 Disposal

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

9.4 Software history

Software version / Date	Software changes	Documentation changes
V1.45/04.2006	Original software	BA1039N (Operating Instructions)
V01.51.00 / 2011.1	HART ID configuration, FieldCare support updated	BA01032G (Operating Instructions)
V01.52.00 / 2014.8	Software update	BA01032G (Operating Instructions)
V01.53.00 / 2017.7	Software update (improved ave. temp. calculation and right protect switch functionalities)	BA01032G (Operating Instructions)

10 Technical data

Application	
Application	NMT532 performs precise liquid and gas phase average temperature measurement in bulk storage tank applications. ▪ Standard 2" flange installation ▪ Overall 18.5 m temperature measurement range
Function and system design	
Measuring principle	Temperature measurement ▪ Up to 6 temperature elements spaced evenly over the length of the flexible tube. ▪ Pt100, IEC 60751/DIN EN 60751 Class A temperature elements
Input	
Measured variable	Temperature measurement Temperature conversion range: -20 to +100 °C
Measuring range	-20 to +100 °C (-4 to 212 °F)
Output	
Output signal	▪ Local HART protocol (multi drop local HART loop connection)
Signal on alarm	Error information can be accessed via the following interfaces and transmitted digital protocol (refer to the operation manuals on following instruments). ▪ NRF590 ▪ NMS5
Auxiliary energy	
Load HART	Minimum load for local HART communication: 250 Ω
Cable entry	Thread NPT1/2 Thread M20
Supply voltage	16 to 30VDC (on HART loop)
Current consumption	6mA
Performance characteristics	
Reference operating conditions	▪ Temperature = + 25 °C (77 °F) ± 5 (9 °F) ▪ Pressure = 1013 mbar abs. ± 20 mbar abs. (1013 hPa abs. ± 20 hPa abs.,14.7 psi abs. ± 0.3 psi abs.) ▪ Relative humidity (air) = 65 % ± 20 %
Maximum measured error	Typical statements for reference conditions, include linearity, repeatability, and hysteresis: ▪ Linearity: – Temperature: ± 0.15 °C (0.27 °F) + temperature element deviation (based on IEC 60751/DIN EN 60751class A standard)

Operating conditions	
Environment	
Ambient temperature	-40 to +85 C° (-40 to +185 °F)
Storage temperature	-40 to +85 C° (-40 to+185 °F)
Climate class	DIN EN 60068-2-38 (test Z/AD)
Degree of protection	▪ Housing: IP65, NEMA 4X (Converter only, open housing: IP20) ▪ Probe: IP68
Electromagnetic compatibility	When installing the probes in metal and concrete tanks and when using a coax probe: ▪ Interference Emission to EN 61326, Electrical Equipment Class B ▪ Interference Immunity to EN 61326, Annex A (Industrial)
Process condition	
Temperature range	Temperature probe: -20 to +100 °C (-4 to +212°F)
Pressure limit	1 bar (100 kPa, 14.5 psi) ⚠ WARNING When the pressure inside the tank exceeds 1 bar (100KPa, 14.5psi), stilling well which does not have any holes or slits must be installed.
Data transmission	Minimum dimension of cable: #24 AWG Cable type: twisted pair with shields
Mechanical construction	
Weight	Approx. 8 kg Condition: 6 temperature elements Temp. probe: 11.5 m Flange: NPS 2" Cl.150 RF, 304 flange ASME B16.5
Material	Temperature elements: Class A Pt100, IEC 60751/DIN EN 60751/ JIS C1604 Housing: Aluminum die-casting Temp. probe: SUS316, SUS316L flexible tube (refer to "Dimension")
Process connection	NPS 2" Cl.150 RF, 304 flange ASME B16.5 DN50 PN10 B1, 304 flange EN1092-1 (DIN2527 C)
Certificates and approvals	
CE mark	The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.
External standards and guidelines	**EN 60529** Protection class of housing (IP-code) **EN 61326** Emissions (equipment class B), compatibility (appendix A – industrial area)
Ex approval	ATEX: II 1/2 G Ex ia IIB T4-T6 Ga/Gb IEC: Ex ia IIB T4- T6 Ga/Gb FM: IS Class I, Div. 1, Gp. C, D, T6, T4, Class I, Zone 0, AEx ia IIB, T6, T4 CSA: Ex ia Class I, Div.1, Gp. C, D, T6, T5, T4, Ex ia IIB, T6, T5, T4 NEPSI: Ex ia IIB T4- T6 Ga/Gb

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