



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



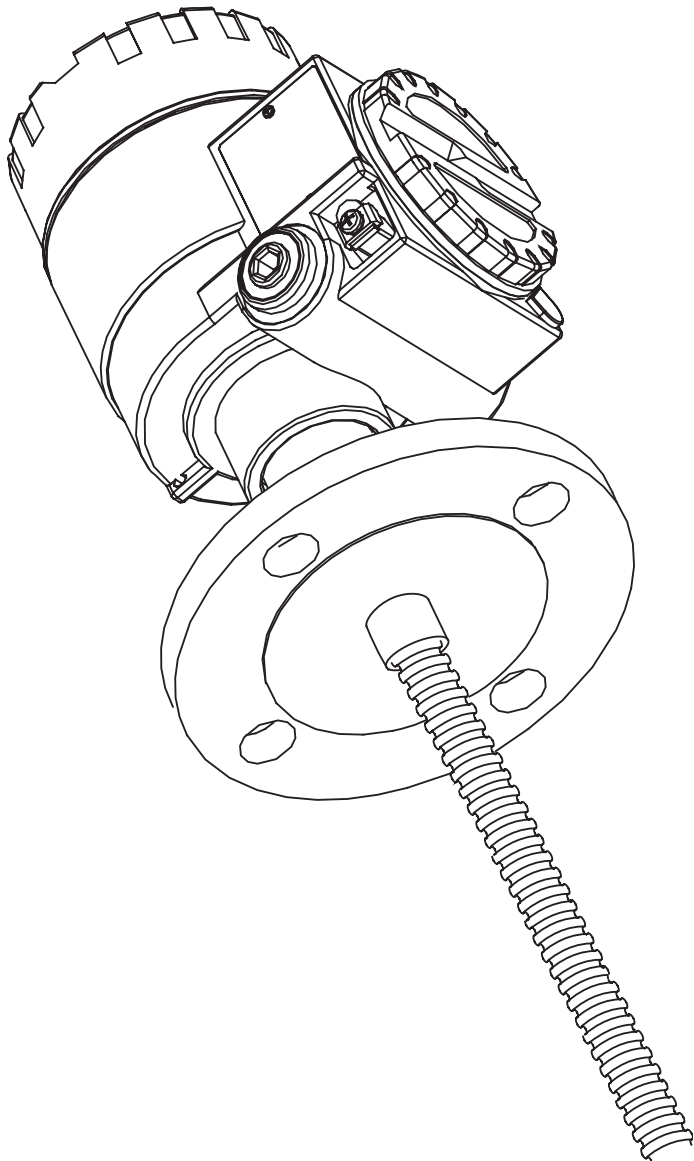
Services



Solutions

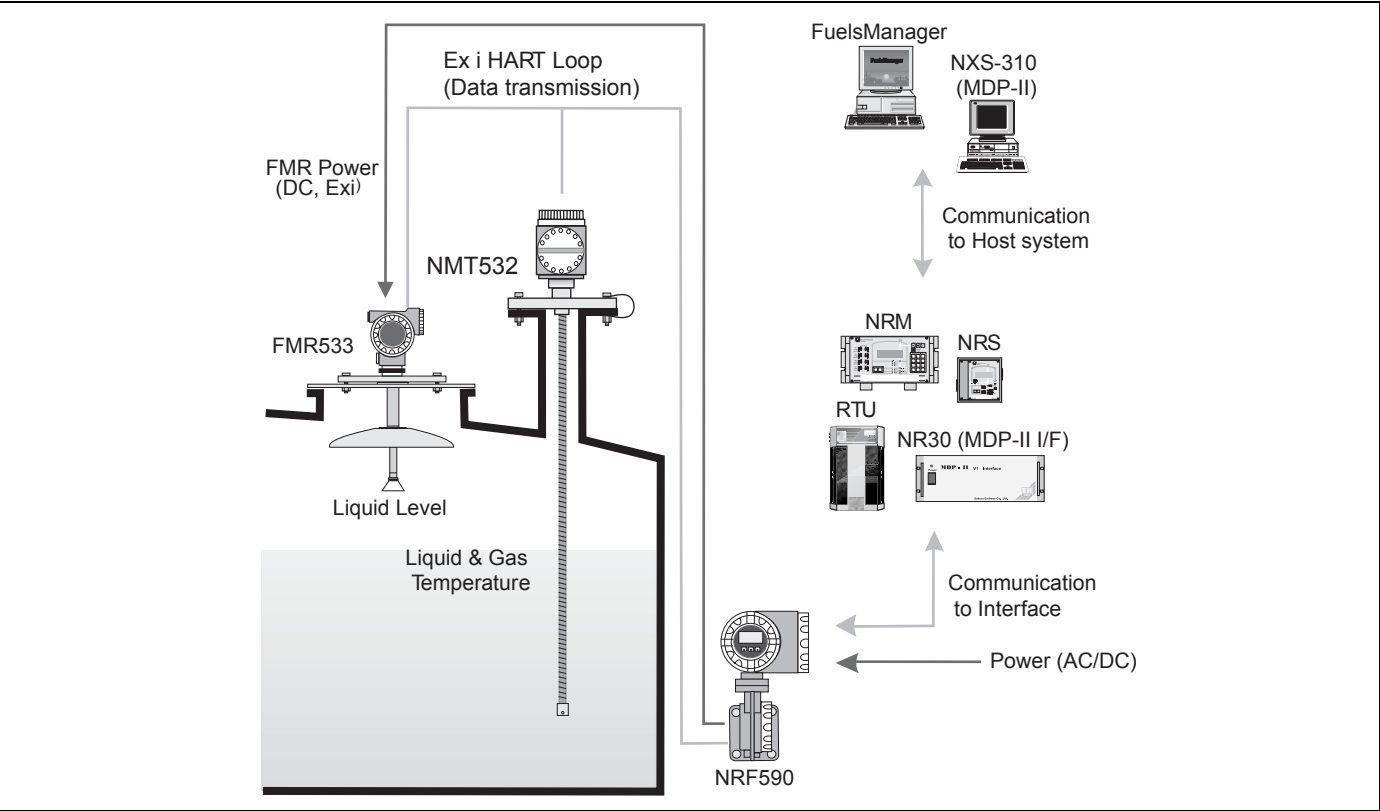
# Operating Instructions

## Prothermo NMT532

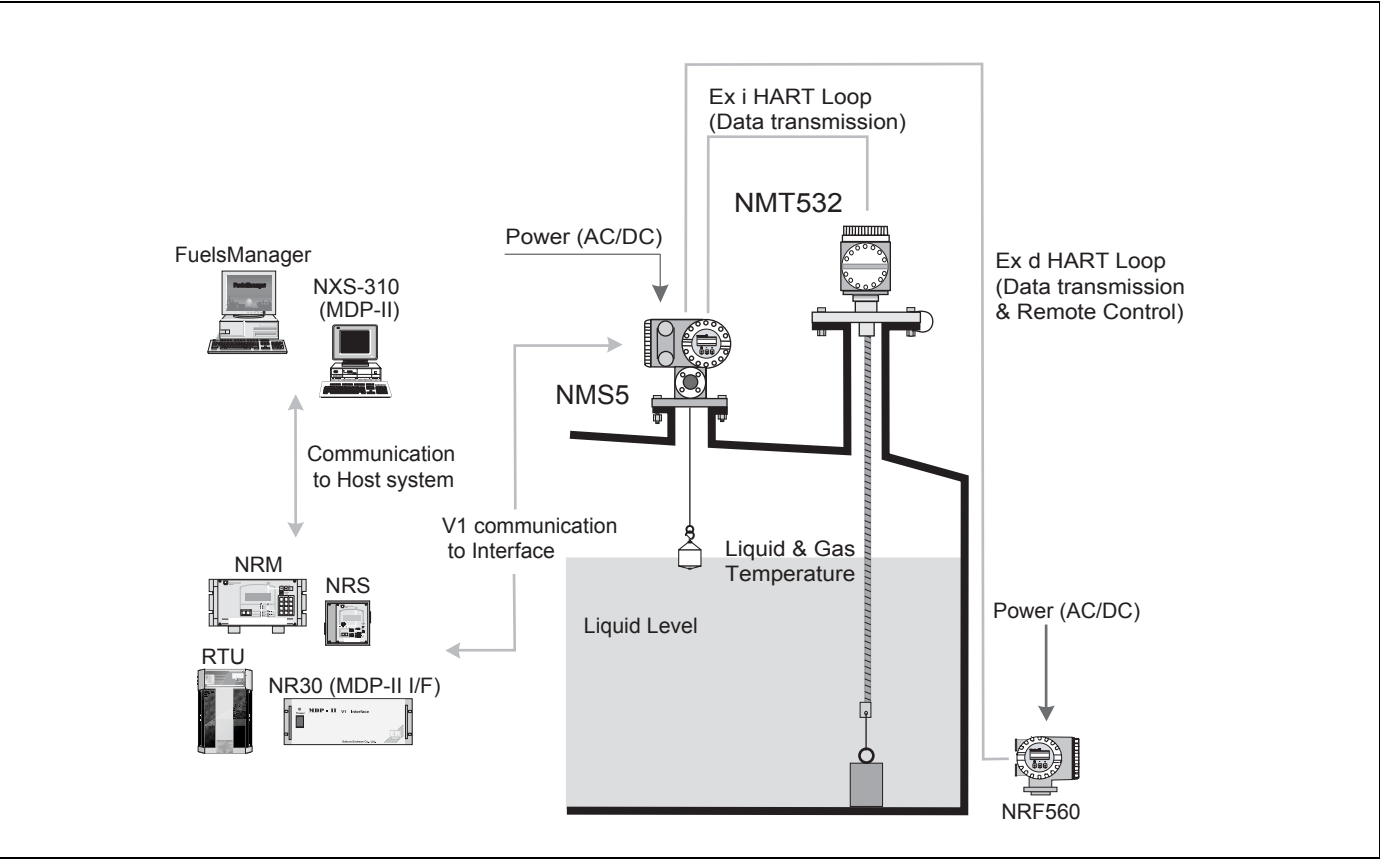


# Basic device layout of the Prothermo NMT532

## Connection with Micropilot FMR S-series



## Connection with Proservo NMS5



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# 1 Safety instructions

## 1.1 Designated use

The Prothermo NMT532 is a multi-spot Pt100 average thermometer combined with a HART signal converter to meet the demand of temperature measurement for inventory control applications. The NMT532 consists of Max. 6 temperature elements which have different length with fixed (2 m or 3 m) interval. It is best suited connected to the Proservo NMS5, or Endress+Hauser Micropilot S-series radars and the Tank Side Monitor NRF590. Mounted on the tank top, the 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 carried out by trained personnel authorized by the operator of the facility.
- Personnel must absolutely and without fail read and understand this Operating Manual before carrying out its instructions.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this manual are to be observed without fail.
- The installer must make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system is to be grounded.
- Please observe all provisions valid for your country and pertaining to the opening and repairing of electrical devices.

## 1.3 Product Requirements

### Power source

Check the voltage of the power supply before connecting it to the product. It should be the exact voltage required for proper operation of the product.

### Use in hazardous areas

When using the product in the first or second-class hazard location (Zone 1 or Zone 2) be sure to use an intrinsically safe or pressure and explosion-proof apparatus. Take the utmost care during the installation, wiring, and piping of such apparatus to ensure the safety of the system. For safety reasons, maintenance or repairs on the product while it is being used with such apparatus should only be performed by qualified personnel.

### External connection

When an external connection is required, the product should be protectively grounded before it is connected to a measurement object or an external control circuit.

## 1.4 Operational safety

### Hazardous area

Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of this Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.

- Please use the explosion-proof type for measurement in explosion-hazardous areas.
- Instruments used in explosion hazardous areas should be mounted and wired according to the explosion-proof regulations.

- Instruments mounted in explosion hazardous areas must not be opened when the power is on. Tighten the cable gland firmly.
- The maintenance and repair of the instrument is limited to fulfill the explosion proof regulations.
- Ensure that all personnel are suitably qualified.
- Observe the specifications in the certificate as well as national and local regulations.

### Power supply

Check that voltage and frequency of the local power supply are in the range of the technical data of the instrument before turning on the power. Please refer to Sect. 11.

### Grounding

- Do not remove the grounding of the instrument when the power supply is turned on. This may set the instrument in a dangerous condition.

### Wiring



Make sure of the grounding of the instrument before connecting input and output to another system.

### Caution!



Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## 1.5 Return

The following procedures must be carried out before the instruments is sent to Endress+Hauser for repair:

- Always enclose a duly completed "Declaration of Contamination" form. Only then can Endress +Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example, safety data sheet as per EN 91/155/EEC.
- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.

A copy of the "**Declaration of Contamination**" is included at the end of this operating manual.

### Caution!



- No instrument should be sent back for repair without all dangerous material being completely removed first, e.g. in scratches or diffused through plastic.
- Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the operator of the instrument.

## 1.6 Disposal












In case of disposal, please separate the different components according to their material consistency.

## 1.7 Software history

Software version / Date	Software changes	Documentation changes
V1.45/04.2006	Original software -	

## 1.8 Notes on safety conventions and symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding symbol in the margin.

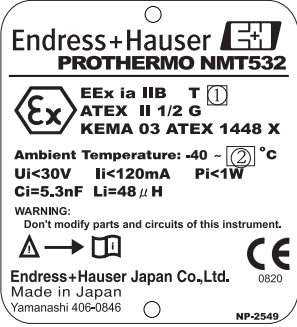
Safety conventions	
	<b>Warning!</b> A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument
	<b>Caution!</b> Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument
	<b>Note!</b> A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned
Explosion protection	
	<b>Device certified for use in explosion hazardous area</b> If the device has this symbol embossed on its name plate, it can be installed in an explosion hazardous area
	<b>Explosion hazardous areas</b> Symbol used in drawings to indicate explosion hazardous areas. – Devices located in and wiring entering areas with the designation “explosion hazardous areas” must conform with the stated type of protection
	<b>Safe area (non-explosion hazardous area)</b> Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. – Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas
Explosion protection	
	<b>Direct voltage</b> A terminal to which or from which a direct current or voltage may be applied or supplied
	<b>Alternating voltage</b> A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied
	<b>Grounded terminal</b> A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system
	<b>Protective grounding (earth) terminal</b> A terminal which must be connected to earth ground prior to making any other connection to the equipment
	<b>Equipotential connection (earth bonding)</b> A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice

## 2 Identification

### 2.1 Device designation

#### 2.1.1 Nameplate

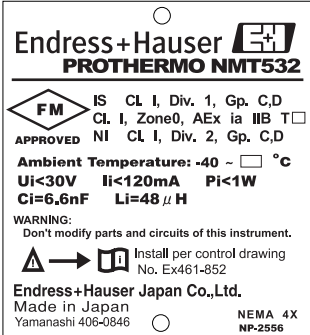
The following technical data are given on the instrument nameplate:



①	Temperature Class
②	Ambient Temperature

①&② depending on medium temperature

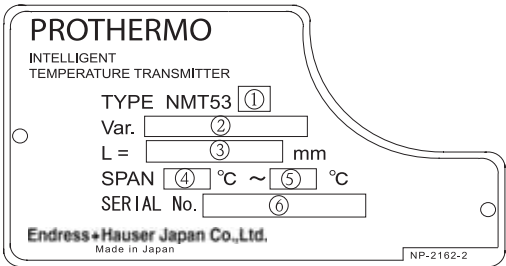
Fig. 1: ATEX Approval Type EEx ia



①	Temperature Class
②	Ambient Temperature

①&② depending on medium temperature

Fig. 2: FM Approval Type



①	Type code
②	Type structure code
③	Flexible tube length
④	Measuring temperature range
⑤	Measuring temperature range
⑥	Serial number

Fig. 3: Prothermo Model name plate

## 2.2 Product structure

### 2.2.1 Prothermo NMT532

<b>10</b>		<b>Protection class</b>	
	7	FM, IS class1, Div.1, Gr. A-D	
	8	CSA, Class1, Div.1, Gr. A-D....pending	
	B	ATEX, EEx [ia] IIB T4 -T6	
<b>20</b>		<b>Cable entry</b>	
	B	Thread NPT 1/2	
	D	Thread M20	
<b>30</b>		<b>Process connection (SUS304)</b>	
	1	2" 150lbs RF, 304 flange ANSI B16.5	
	2	DN50 PNO B1, 304 flange EN1092-1 (DIN2527 C)	
	9	Special version, to be specified	
<b>40</b>		<b>Element #, Interval, Probe range (Below flange to end of probe)</b>	
	022	...mm; 2x Pt100; 2 m (min 2,500 mm, max 4,500 mm)	
	032	...mm; 3x Pt100; 2 m (min 4,500 mm, max 6,500 mm)	
	042	...mm; 4x Pt100; 2 m (min 6,500 mm, max 8,500 mm)	
	052	...mm; 5x Pt100; 2 m (min 8,500 mm, max 10,500 mm)	
	062	...mm; 6x Pt100; 2 m (min 10,500 mm, max 12,500 mm)	
	023	...mm; 2x Pt100; 3 m (min 3,500 mm, max 6,500 mm)	
	033	...mm; 3x Pt100; 3 m (min 6,500 mm, max 9,500 mm)	
	043	...mm; 4x Pt100; 3 m (min 9,500 mm, max 12,500 mm)	
	053	...mm; 5x Pt100; 3 m (min 12,500 mm, max 15,500 mm)	
	063	...mm; 6x Pt100; 3 m (min 15,500 mm, max 18,500 mm)	
<b>50</b>		<b>Specific probe length, Length within selected item at Pos. 040(UP to max. 18,500)</b>	
	A	Not selected	
	B	Anchor weight, tall profile	
	C	Anchor weight, low profile	
	D	Tensioning wire, wire hook, top anchor	
<b>NMT532-</b>		Complete product designation	

## 2.3 Scope of delivery

- Instrument according to the version ordered
- ToF Tool (CD-ROM)
- Accessories (as ordered)

## 2.4 Supplied documentation

Document	Designation	Content/Remarks
BA 032N	Operating manual	describes installation, commissioning operating and maintenance of the Prothermo NMT532.
XA 008N	Safety Instructions	only for instrument versions approved for use in explosion hazardous areas; the nameplate specifies, which of these documents is relevant for your instrument version



## 2.5 CE marks, declaration of conformity

The instrument 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 instrument complies with the applicable standards and regulations in accordance with EN 50014 "Electrical apparatus for potentially explosive atmospheres-General requirements". The instrument described in this manual thus complies with the statutory requirements of the EG directives. Endress+Hauser confirms the successful testing of the instrument by affixing to it the CE mark.

## 2.6 Registered trademarks

HART®

Registered trademark of HART Communication Foundation, Austin, USA

ToF®

Registered trademark of the company Endress+HauserHART GmbH+Co. KG, Maulburg Germany

### 3 Installation

#### 3.1 Design, dimensions

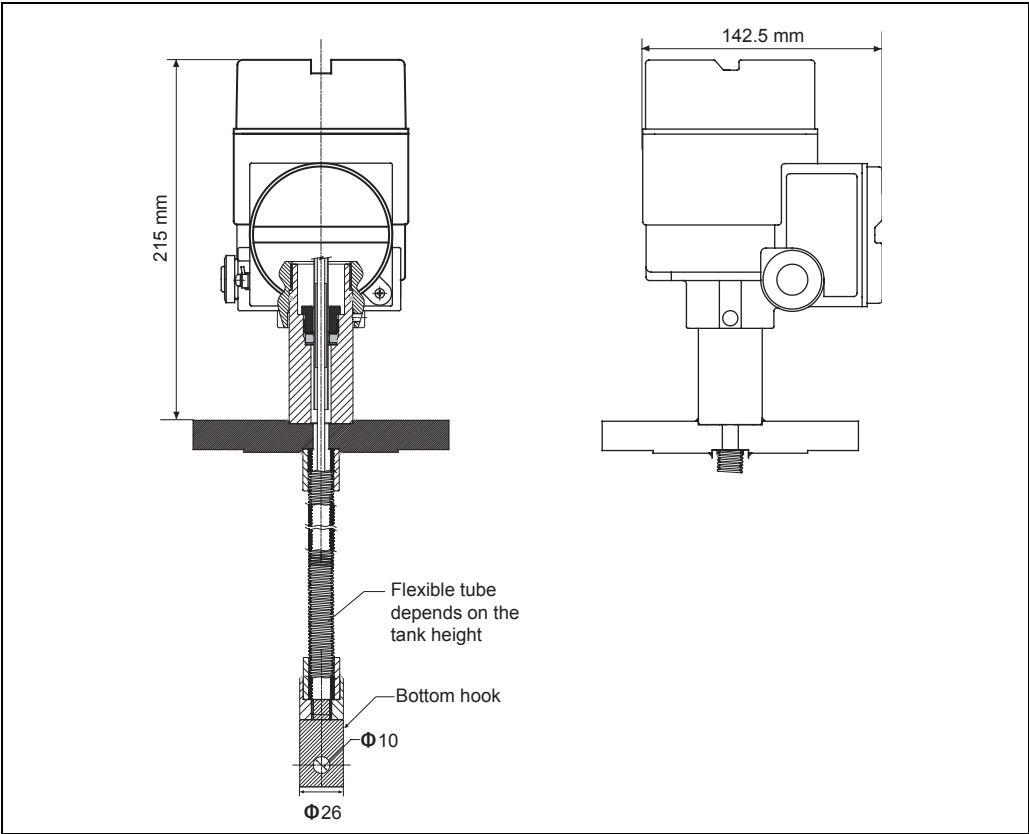
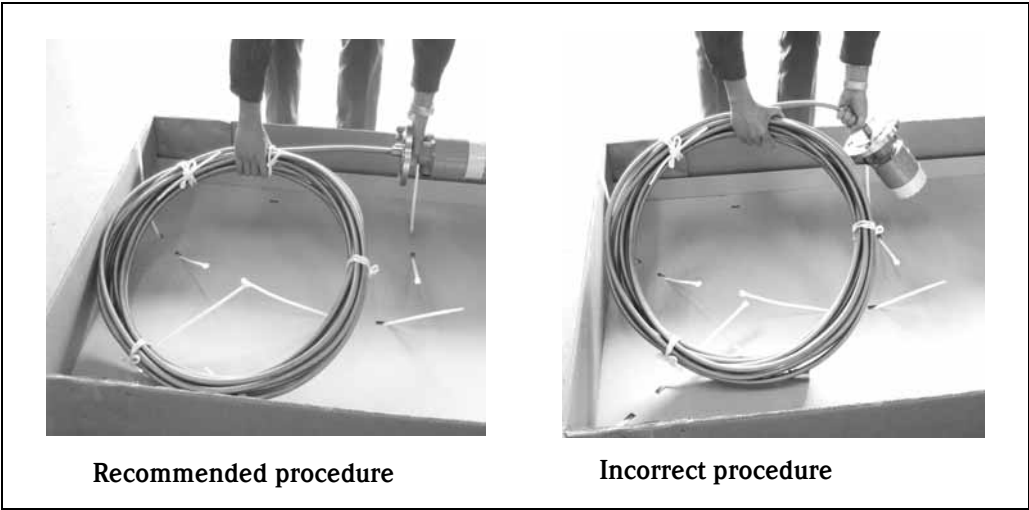


Fig. 4: NMT532 dimension

#### 3.2 Unpacking

Note!  
When unpacking, be careful not to bend, fold or twist the flexible tube. Please refer to the recommended procedure below.



### 3.3 Flexible tube

When attaching and bending the flexible tube, the radius of curvature must be at least 300 mm (11.8") at any bend portion.

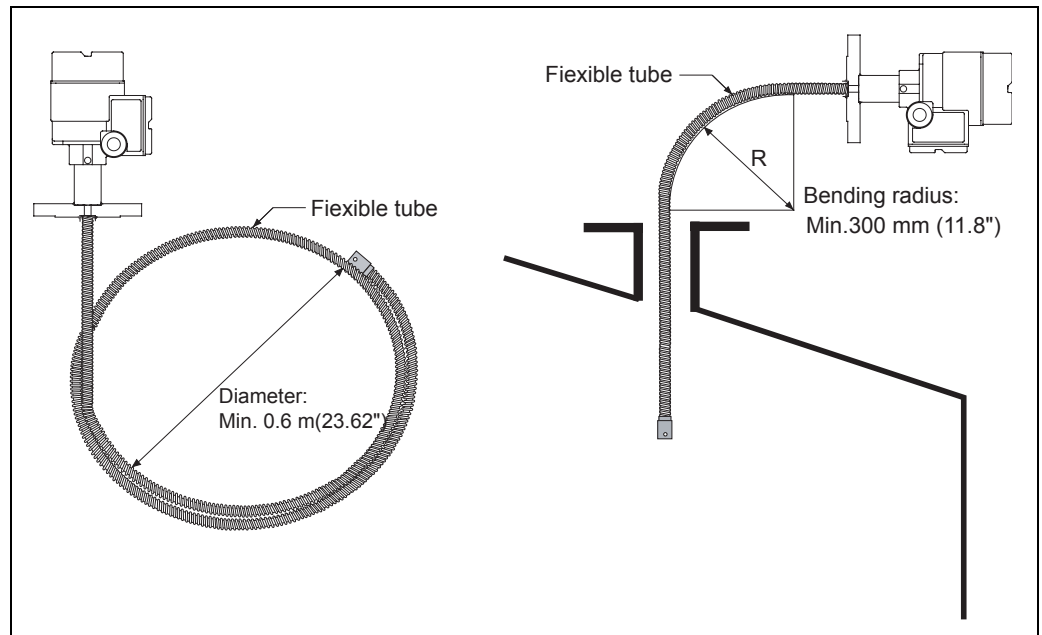


Fig. 5: Flexible tube

Note!

If a flexible tube is bent with a radius of curvature less than 300 mm (11.8"), the flexible tube or the measuring element may be seriously damaged or broken.

## 4 Mounting

### 4.1 Mounting instruction

Note!

1. The flexible tube length of the Prothermo NMT532 is defined for the customer's specifications.  
Before mounting, please check as follows:
  - The tag number (if available) on the body of the Prothermo NMT532
  - The length of the flexible tube
  - The number of measuring points
  - The intervals between measuring point
2. Mounting the Prothermo NMT532 at a minimum of 500 mm (19.67") away from the tank shell.  
This will ensure that the measurement is not influenced by changes in ambient temperature.
3. The procedure for mounting the Prothermo NMT532 on a tank depends on the type of tank. Here we shall explain the procedures for a fixed roof tank and for a floating roof tank.  
In any case, the flexible tube head is mounted on the tank top as show in fig. 5.  
The mounting nozzle should have a diameter of 50 mm (2") as standard.

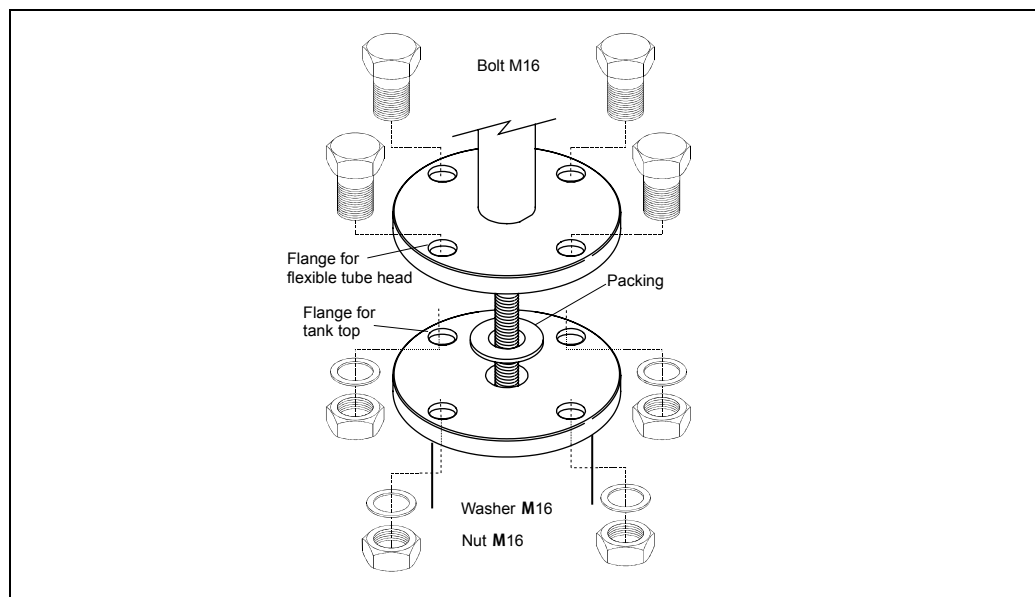


Fig. 6: The Prothermo NMT532 mounting

## 4.2 Mounting on a fixed roof tank

There are three methods for mounting the Prothermo NMT532 on a fixed roof tank:

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

Note!

If the tank bottom has a heating coil, the clearance from the flexible tube bottom hook to the tank bottom may increase depending on the heating coil type.

### 4.2.1 Top anchor method

The flexible tube is stabilized by a wire hook and a top anchor.

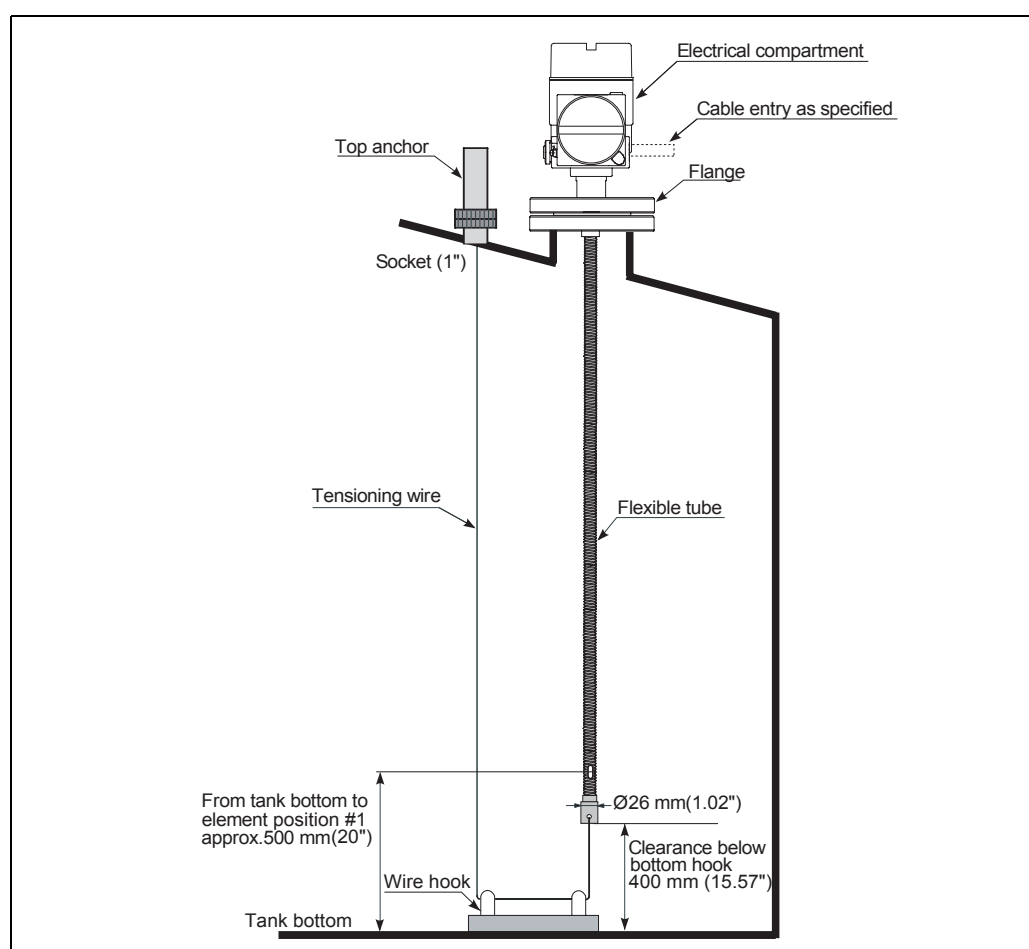


Fig. 7: Top anchor application

- Insert a gasket and lower the flexible tube from the nozzle on the tank top.

Caution!

The flexible tube must be lowered carefully without bending too much and scratching at the inner edge of the nozzle hole.

- Rotate the Prothermo NMT532 so that you can set up the cabling in the most convenient way.
- Straighten the tensioning wire, fix the wire end to the top anchor temporarily and lower the wire.
- Draw the tensioning wire through the wire hook on the tank bottom.
- Wrap the tensioning wire twice around the hole on the bottom hook, tighten it and wrap the provided wire around it (see fig. 7).

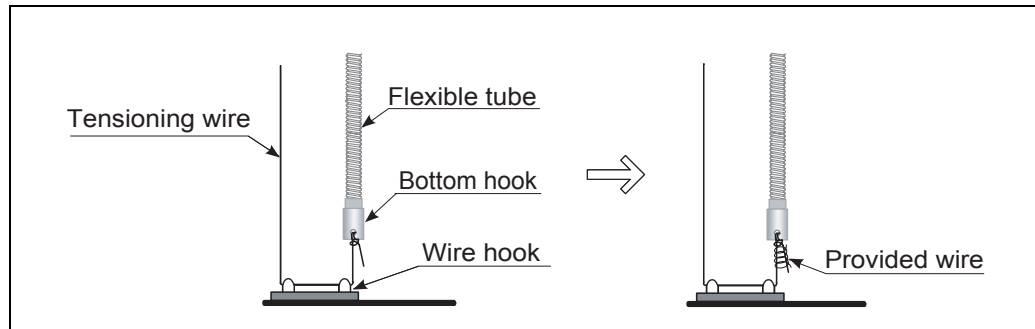


Fig. 8: Tensioning wire mounting

- Fix the mounting flange of the Prothermo to the nozzle on the tank top using bolts.

Note!

Please keep the compression of the spring at 35 to 37 mm (1.38 to 1.47).

If you compress the spring over 35 to 37 mm, it may cause damage to the sensor.

- Draw the end of the tensioning wire as much as possible by hand and foot (see fig.8)
- Bend the wire and fix it using the nut.
- Cut the excess wire.
- Screw the nut to compress down the spring of the top anchor 35 to 37 mm.
- Cover the top anchor.

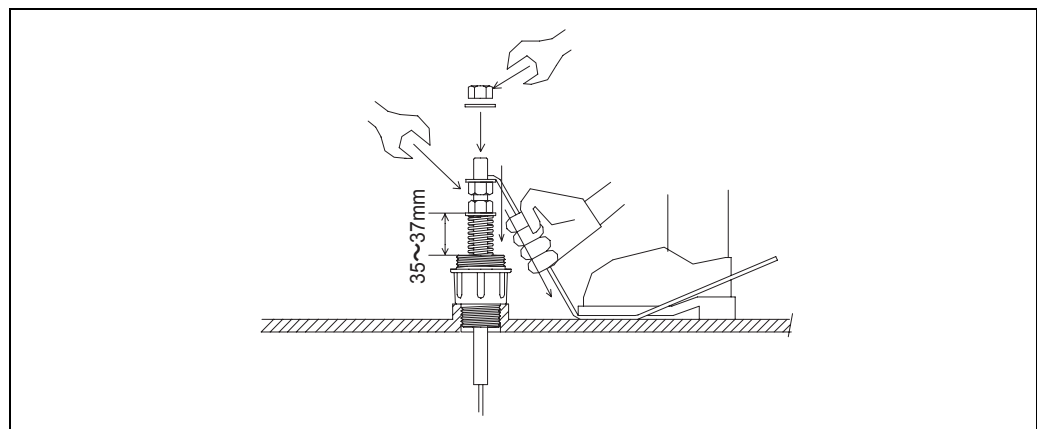


Fig. 9: Top anchor mounting

### 4.2.2 Thermo well method

The flexible tube is inserted into a thermo well with a diameter of 2" or more.

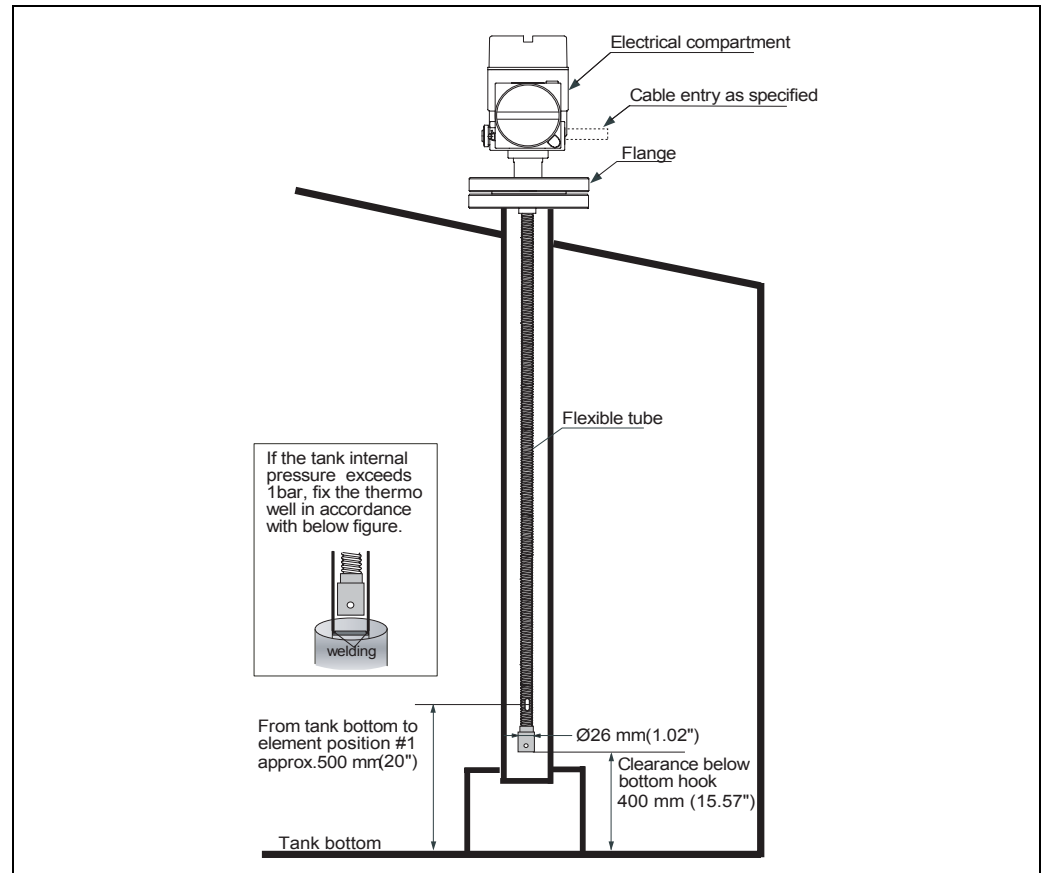


Fig. 10: Thermo well application

#### Caution!

The flexible tube must be lowered carefully without bending too much or scratching at the inner edge of the nozzle hole.

- Insert a gasket and lower the flexible tube into the inlet of the stilling well.
- Rotate the Prothermo NMT532 so that you can set up the cable in the most convenient way.
- Fix the mounting flange of the Prothermo NMT532 to the nozzle on the tank top using bolts.

### 4.2.3 Anchor weight method

The flexible tube is stabilized by an anchor weight:

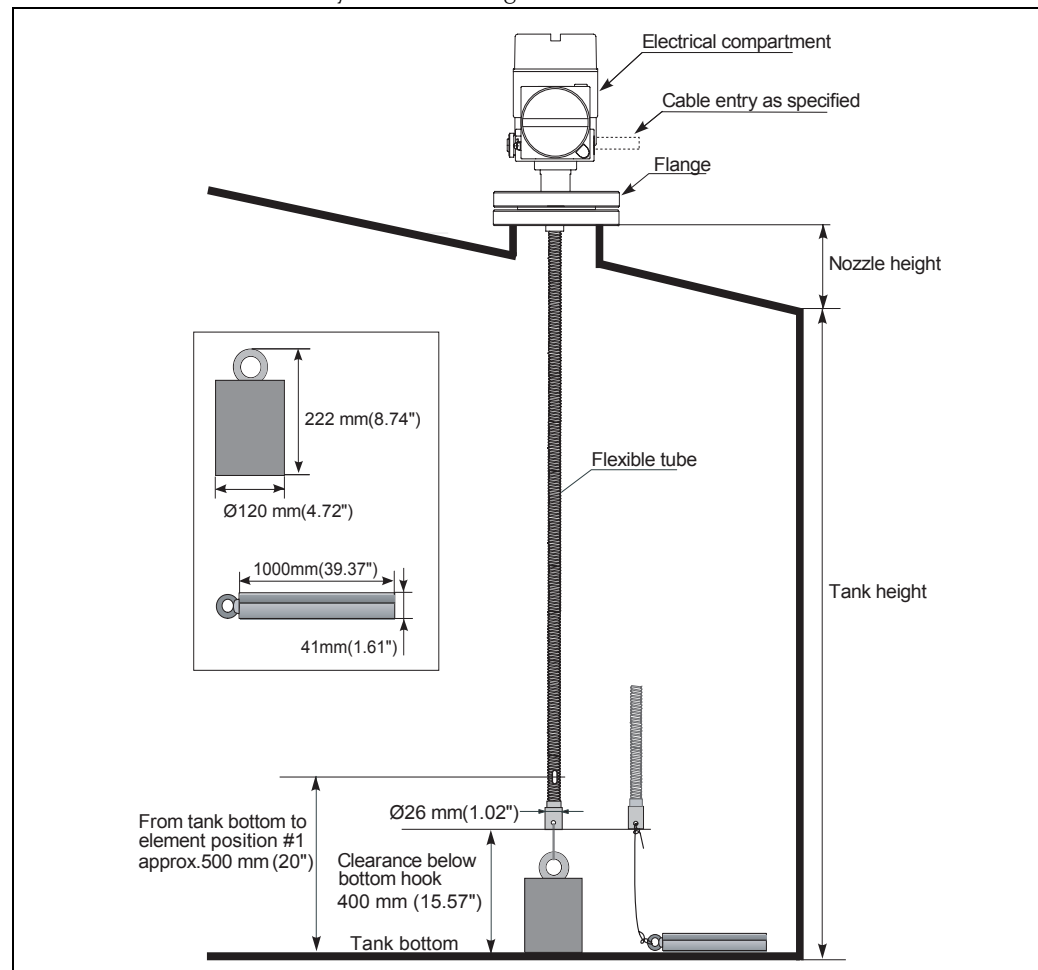


Fig. 11: Anchor weight application

#### Note!

Make sure to put the anchor weight on the tank bottom. When installing with the suspended anchor weight, please use the anchor weight at a maximum of 16 kg. More weight may cause internal breaking in the flexible tube.

#### Caution!

The flexible tube must be lowered carefully without bending too much and scratching at the inner edge of the nozzle hole.

- Insert a gasket and lower the flexible tube from the nozzle on the tank top.
- Rotate the Prothermo NMT532 so that you can set up the cabling in the most convenient way.
- Tighten the tensioning wire between the lower end of the flexible tube and the anchor weight.
- Wrap the tensioning wire twice around a hole on the bottom hook, tighten it and wrap a provided wire around it (see fig.11 ).
- Fix the mounting flange of the Prothermo NMT532 to the nozzle on the tank top using bolts.



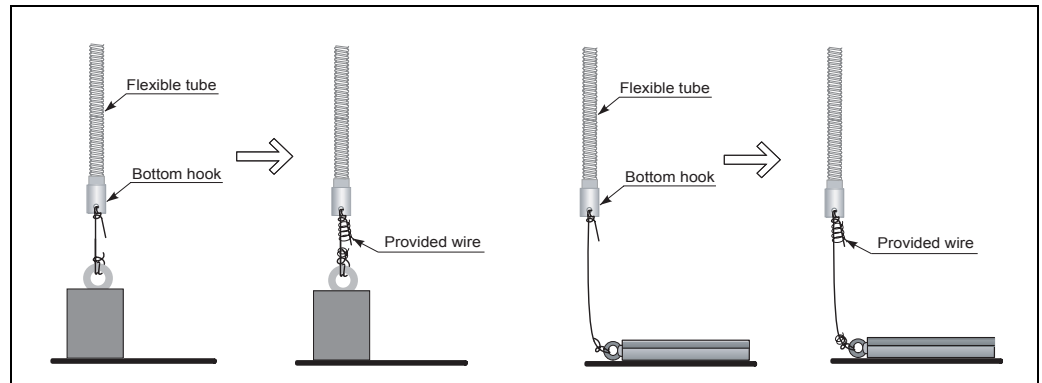


Fig. 12: Anchor weight mounting

### 4.3 Mounting on a floating roof tank

There are three methods of mounting the Prothermo NMT532 on a floating roof tank:

- 1) Top anchor method
- 2) Thermo well method
- 3) Guide wire ring method

Note!

If the tank bottom has a heating coil, the clearance from the flexible tube or probe bottom hook to the tank bottom must increase according to the heating coil type.

#### 4.3.1 Top anchor method

The flexible tube is installed in a fixed pipe and stabilized by a top anchor. The Proservo NMS5 and Prothermo NMT532 can be mounted in the same fixed pipe.

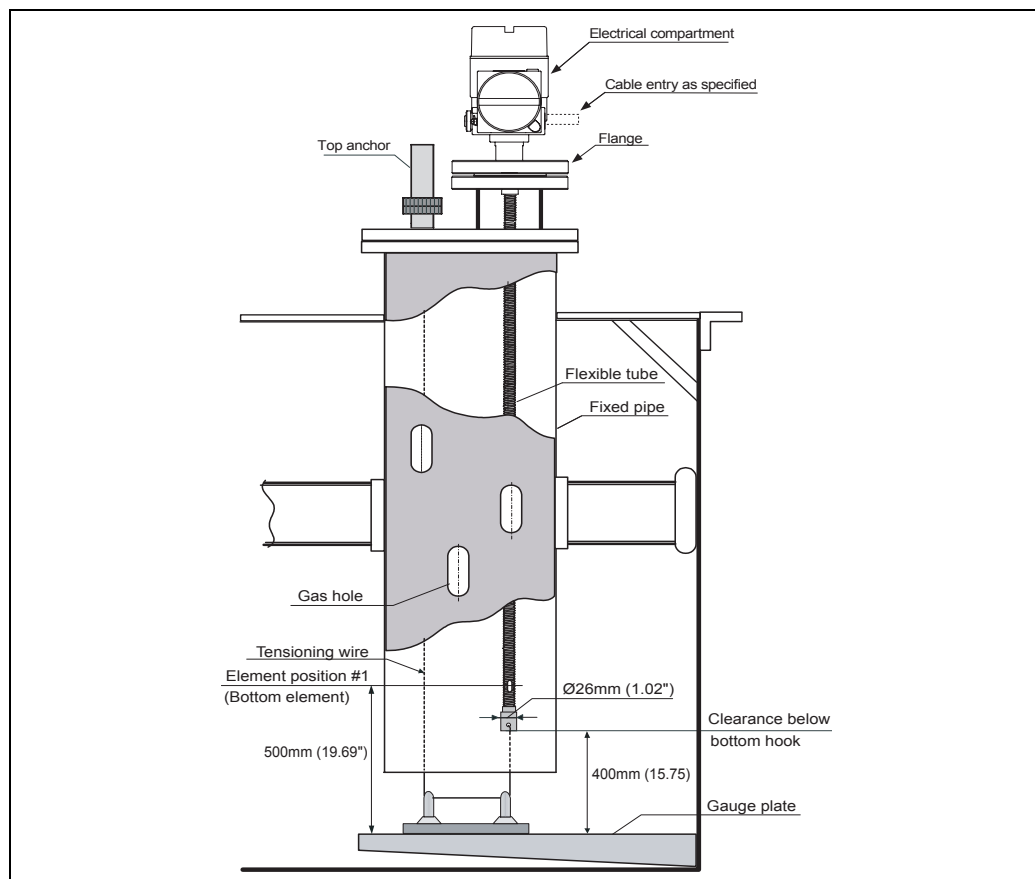


Fig. 13: Top anchor application

The installation procedure is the same as for mounting on a fixed roof tank using the top anchor.

### 4.3.2 Thermo well method

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

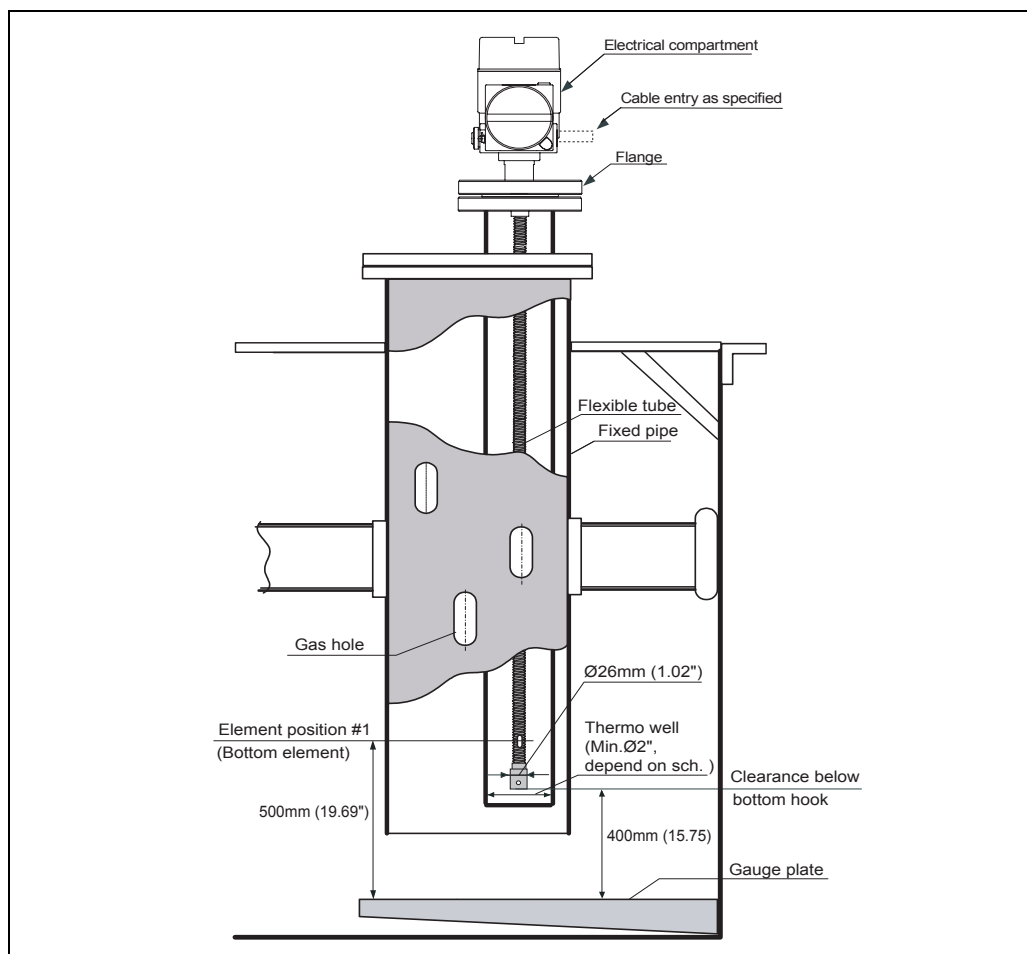


Fig. 14: Thermo well application

The installation procedure is the same as for mounting on a fixed roof tank using the thermo well.

### 4.3.3 Guide ring and anchor weight method

The flexible tube is stabilized by a guide ring and anchor weight.

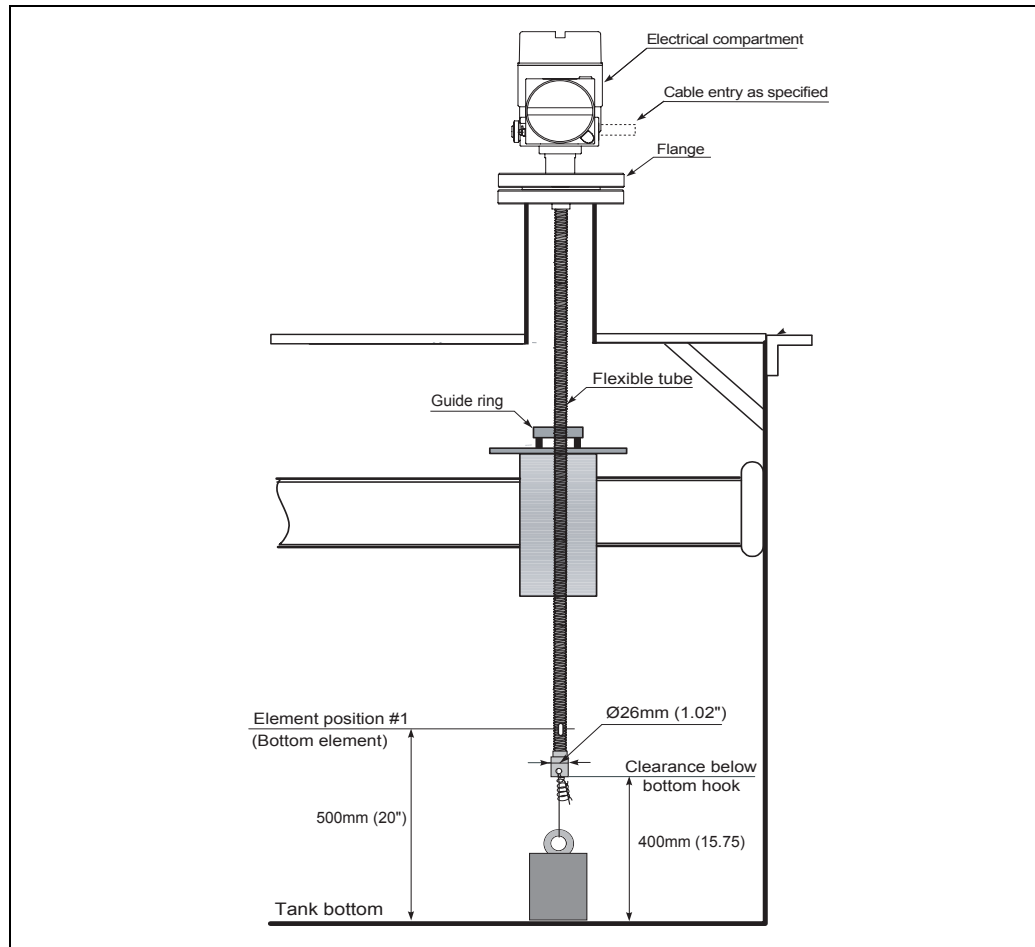


Fig. 15: Guide ring and anchor weight application

#### Caution!

Make sure to put the anchor weight on the tank bottom. When installing with the suspended anchor weight, please use the anchor weight at a maximum of 16kg. More weight may cause internal breaking in the flexible tube.

#### Caution!

The flexible tube must be lowered carefully without bending too much and scratching at the inner edge of the nozzle hole.

- Set the guide ring to the floating roof.
- Insert a gasket and lower the flexible tube from the nozzle on the tank top.
- Rotate the Prothermo NMT532 so that you can set up the cabling in the most convenient way.
- Tighten the tensioning wire between the lower end of the flexible tube and the anchor weight.  
Wind the tensioning wire twice around each of the hitches and wrap a wire around it (see fig.11).
- Fix the mounting flange of the Prothermo NMT532 to the nozzle on the tank top using bolts.

## 5 Wiring

### 5.1 Terminal Connection

#### 5.1.1 NMT532 terminal

Note!

The NMT532 allows an intrinsically safe HART connection only. Please refer to the i.s. regulation for establishing wiring and field device layout.

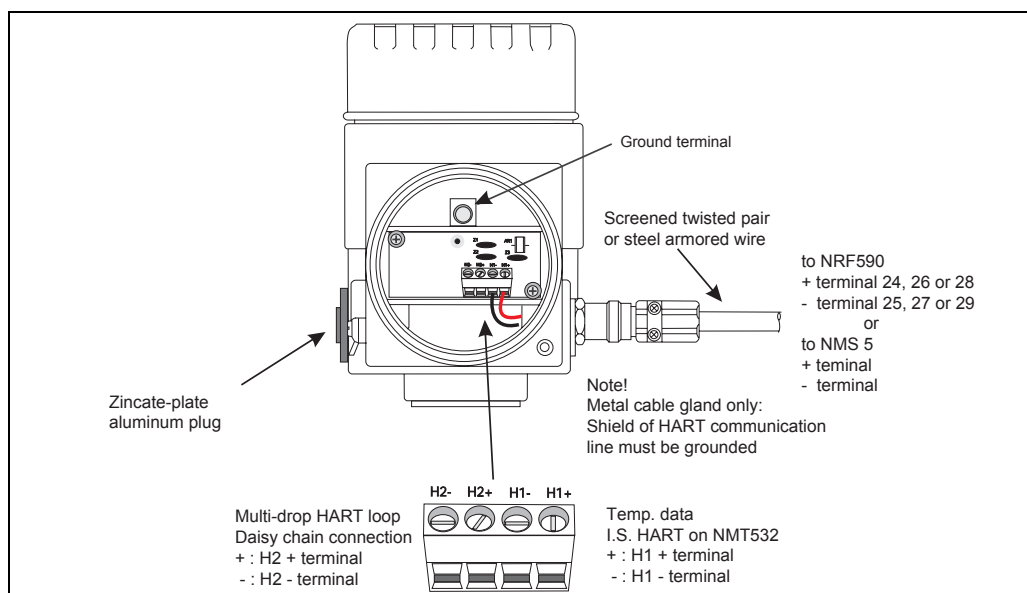


Fig. 16: NMT532 terminal

The NMT532 has convenient DG chain HART loop terminals that enable the NMT532 to be a terminal junction for HART multi-drop instruments.

#### 5.1.2 Proservo NMS5 terminal

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

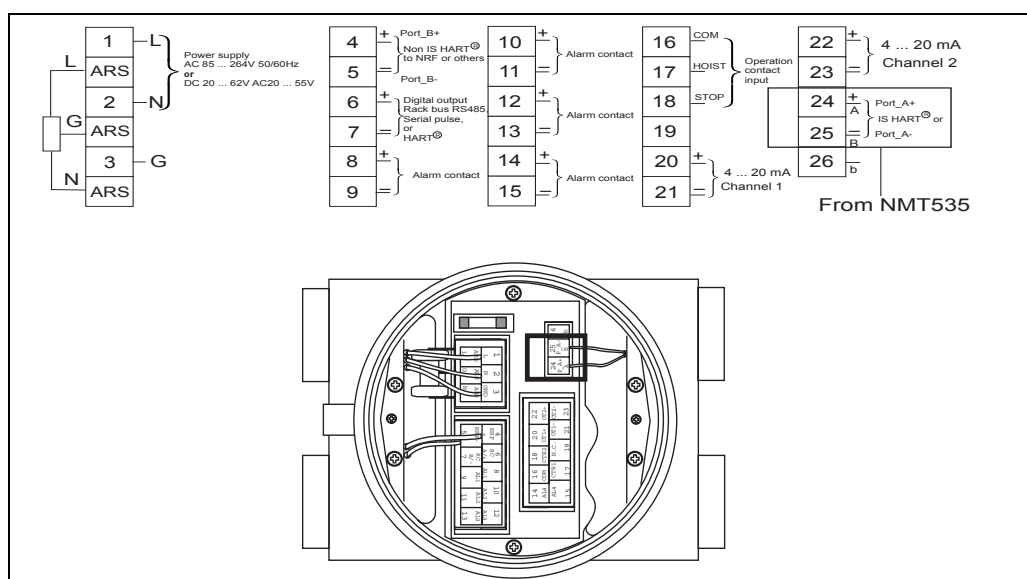


Fig. 17: NMS5 terminal

Note!

Do not connect the NMT532 HART communication on terminals 4 and 5 on the Proservo NMS5. These terminals are designed to connect Ex d HART communication.

### 5.1.3 Tank Side Monitor NRF590 i.s. terminal

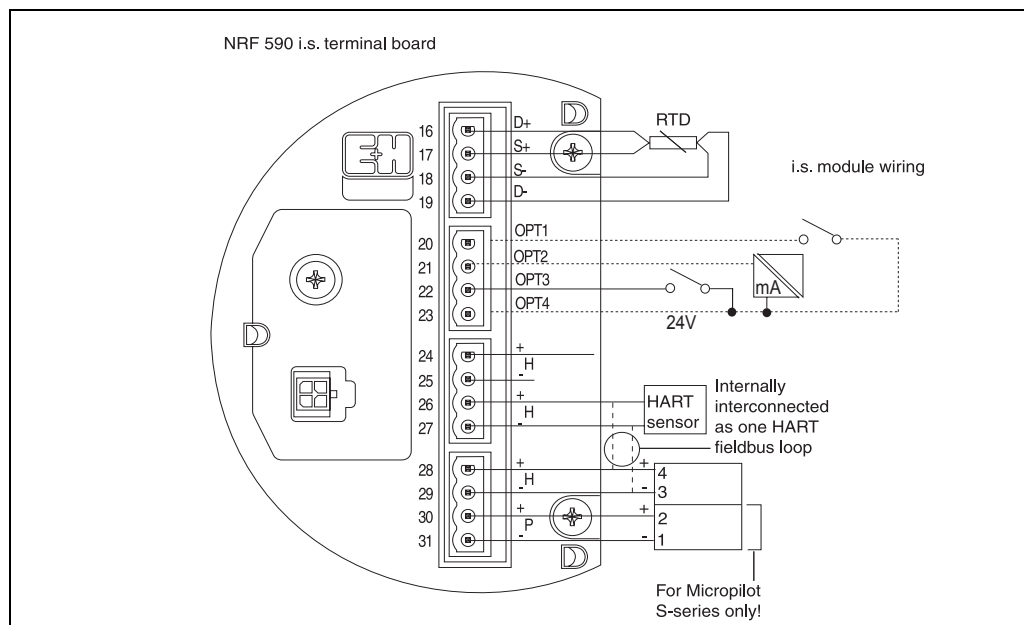


Fig. 17: NRF590 terminal

Note!

The Tank Side Monitor NRF590 has three sets of i.s. HART terminals. These three pairs are looped internally.

Caution!

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

## 5.2 Grounding

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

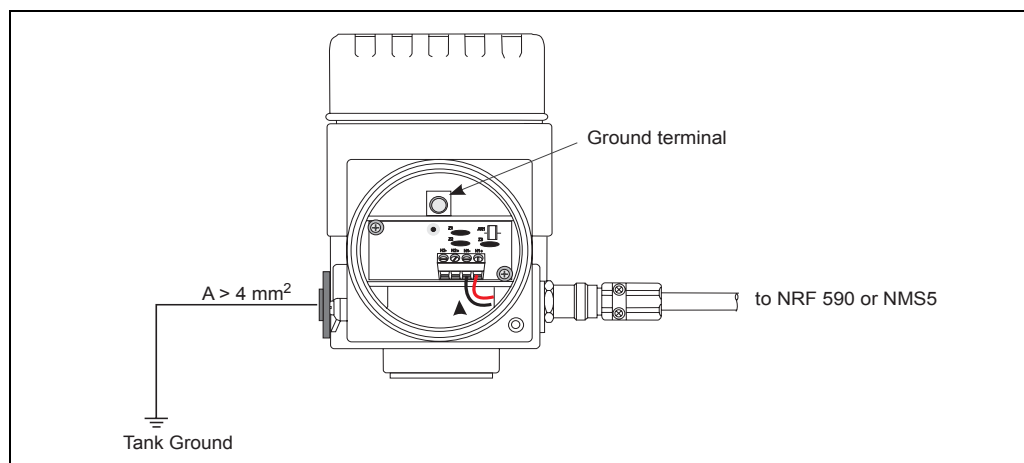


Fig.18 : The NMT532 Grounding

## 6 Operating

### 6.1 Local HART connection

#### 6.1.1 As an Endress+Hauser tank gauging instrument

The NMT532 has been developed and designated primarily to work with the Endress+Hauser tank gauging host instruments Tank Side Monitor NRF590 or Proservo NMS5. Temperature information is transmitted on a two wire i.s HART loop to the host instrument. Since both the NRF590 and NMS5 have a pre-configured menu for NMT series functionality as default, simple wiring to the NMT532 will complete the initial setup for the NMT532.

#### 6.1.2 As a standalone generic HART instrument

The NMT532 is a HART foundation registered intrinsically safe loop powered device. The NMT532 provides four basic types of data as standard and parameter information via HART protocol, command 3. Configuration to host communication can be performed by a HC (Hand Communicator) or the Endress+Hauser ToF field service tool to set a specific HART address.

#### 20: Measurement function

0: Converter only

1: Temperature + converter

These four basic data are available as standard.

- Average liquid temperature
- Average gas phase temperature
- Level (entered liquid level at "VH02 measured distance")
- Device status

### 6.2 Device set up: tank Side Monitor NRF590

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

Since the Tank Side Monitor NRF590 has been designed to recognize the NMT532 as a specific Endress+Hauser HART instrument, set up is easy.

#### 6.2.1 HART scanner

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

Caution!

Not all Tank Side Monitor NRF590 have fully accessible compatibility to recognize the NMT532. Consult with your Endress+Hauser representative to cross check the software and hardware version of the NRF590.

The NMT532 specific parameter set up on the NRF590

### 6.2.2 The NMT532 specific parameter set up on the NRF590

Configuration of NMT532 parameters on the display of the NRF590 is dependent on the installed software and hardware version of the NRF590. Please refer to the operating manual of the Tank Side Monitor NRF590 to determine accessible parameters.

All required initial setup and configuration can be performed by the ToF field service tool. Detailed information will be described in the following operation related chapters.

## 6.3 Device set up: Proservo NMS5

The Proservo NMS5 is also specifically designed to recognize the NMT532. Connect local HART cabling between the NMT532 and the NMS5 on terminals 24 and 25.

### 6.3.1 Preparation of Proservo NMS5

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

#### GVH362: NMT connection

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

Caution!

To change this parameter, an access code is required. Please refer to the BA001 NMS5 operation manual for further information.

### 6.3.2 NMT532 configuration on Proservo NMS5

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

Caution!

Typical NMT532 parameters (equivalent to the NMT 535) are displayed on the matrix of the Proservo NMS5.

#### G0 Static matrix

##### GVH010: Liquid Temp

Calculated average liquid temperature value, determined by the NMT532

##### GVH013: Gas Temperature

Calculated average gas phase temperature value, determined by the NMT532

##### GVH440: Liquid Temp

The same value indicated on GVH010 Liquid Temp

##### GVH441: Gas Temperature

The same value indicated on GVH013 Gas Temperature

##### GVH442: Measured Level

Liquid level value established in the Proservo NMS5. The NMT532 must have liquid level data in order to calculate both liquid and gas phase average temperature.



**GVH447: Reference Zero**

Indication of the converted 100 Ohm reference resistor deviation value compared to the actual inserted element value in the temperature probe. The reading value of reference resistor and its deviation are continuously monitored during operation to prevent from performing an incorrect calculation. Indicated tolerance should be within  $\pm 0.15^{\circ}\text{C}$  ( $\pm 0.27^{\circ}\text{F}$ ) depending on element characteristics, e.g. Pt100 elements have 100 Ohm resistance at  $0^{\circ}\text{C}$  ( $32^{\circ}\text{F}$ ); therefore, the reading value should be within  $0^{\circ}\text{C} \pm 0.15^{\circ}\text{C}$  ( $32^{\circ}\text{F} \pm 0.27^{\circ}\text{F}$ ) or less.

**GVH449: Reference 150**

Indication of the converted 200 Ohm reference resistor deviation value compared to the actual inserted element value in the temperature probe. The reading value of reference resistor and its deviation are continuously monitored during operation to prevent from performing an incorrect calculation. Indicated tolerance should be within  $\pm 0.15^{\circ}\text{C}$  ( $\pm 0.27^{\circ}\text{F}$ ) depending on element characteristics.

**GVH450~459; Temp No.1~10**

The temperature reading value from each inserted element in the probe. The reading element temperature above 11~16 must be selected at the GVH470 "Select Point", then the read value at the GVH473 "Element Temp."

**GVH460~49; Element Position No.11~16 (not available with NMT532)****GVH470: Select Point**

A matrix to select the desired element data on GVH471 "Zero Adjust", GVH473 "Element Temp" and GVH474 "Element Position."

**GVH480: Diagnostic**

Display of error code message. Please refer to the error code chart in a later chapter of this manual. (see P 37)

**GVH482: Total No. Element**

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

**GVH485: Type of Interval**

Select type of element interval.

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

**GVH486: Bottom Point**

The lowest inserted element position in the average temperature probe.

Note!

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

## 7 Operation and Description of Instrument Function

### 7.0.1 HART Device designation

**HART device code "190":**

Device code for temperature measurement function in NMT532 only.

### 7.0.2 Device Data

**Tag Number: read and write**

Default: 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.

## 7.1 Temperature measurement

### 7.1.1 Primary values: VH00 ~ VH09

**VH00 Liquid Temp**

Item type: read only

Range: -200°C ~ 240°C

Note!

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

**VH01 Gas Temp**

Item type: read only

Range: -200°C ~ 240°C

Display of measured gas (vapor) phase average temperature.

Note!

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

**VH02 Measured Distance**

Item type: read and write

Range: 0mm ~ 99999mm

Display of provided liquid level by connected level gauge. Manual level input, directly entering desired level value, is also available for the device test purpose.

**VH07 Temperature 0**

Item type: read only

Display of converted 100 Ohm reference resistor deviation value compared to actual inserted element value in temperature probe. The reading value of reference resistor and its deviation are continuously monitored during operation to prevent from performing an incorrect calculation.

**VH09 Temperature 17**

Item type:read only

Display of the converted 200 Ohm reference resistor deviation value compares to the actual inserted element value in the temperature probe. The reading value of reference resistor and its deviation are continuously monitored during operation to prevent from performing an incorrect calculation. Indicated tolerance should be within  $\pm 0.15^{\circ}\text{C}$  ( $\pm 0.27^{\circ}\text{F}$ ) depending on element characteristics.

**7.1.2 Element Temperature 1: VH10 ~ VH15  
(VH16~19 is used only in NMT 539)****VH10 ~ 19 Temperature 1 ~ 10**

Item type:read only

Range:-200°C ~ 240°C

Display of individual measured element temperature.

**7.1.3 Element Temperature 2: VH20 ~ VH29  
( not available in NMT532)****VH26 Selec. Ave Method**

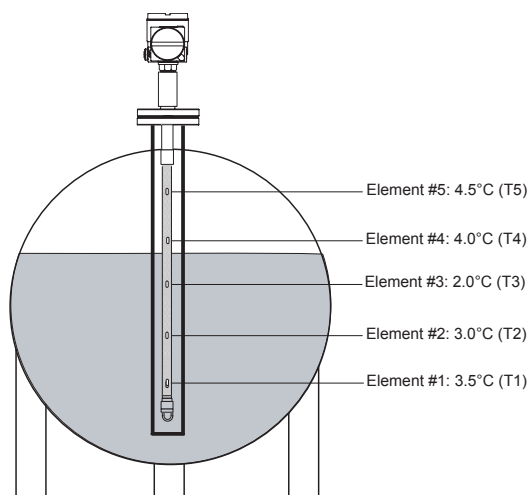
Item type:select

Selection:Standard, Advanced

Selection of average calculation method.

**Standard:**

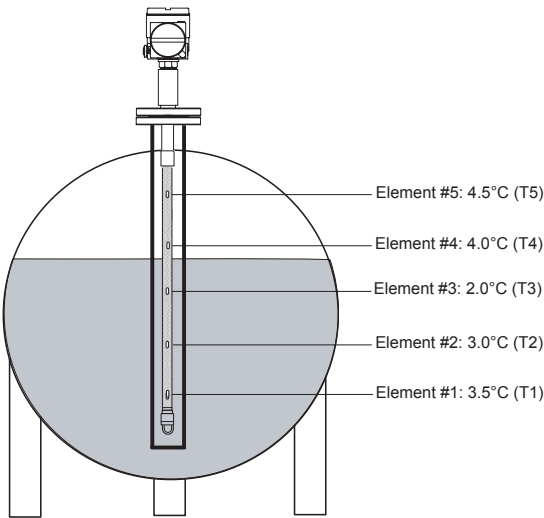
A Conventional calculation method. Regardless of tank shape, average temperature calculation will be performed based on following example (example: liquid temperature)



Formula:  $(T1 + T2 + T3) / \# \text{ of element in liquid phase}$   
 = Average temperature  $(3.5^{\circ}\text{C} + 3.0^{\circ}\text{C} + 2.0^{\circ}\text{C}) / 3 = 2.83^{\circ}\text{C}$

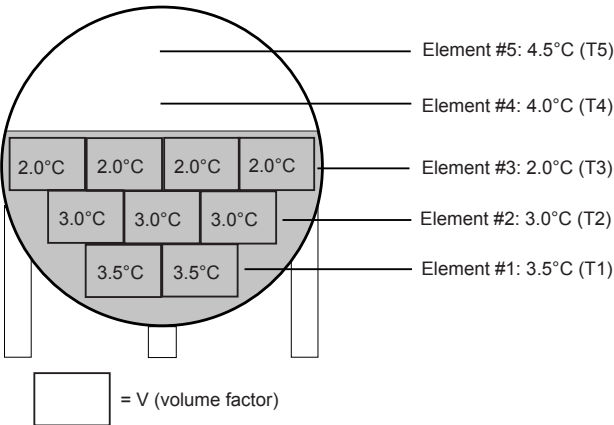
**Advanced:**

Average temperature calculation with additional factor to compensate unequal volume distribution (example: liquid temperature)



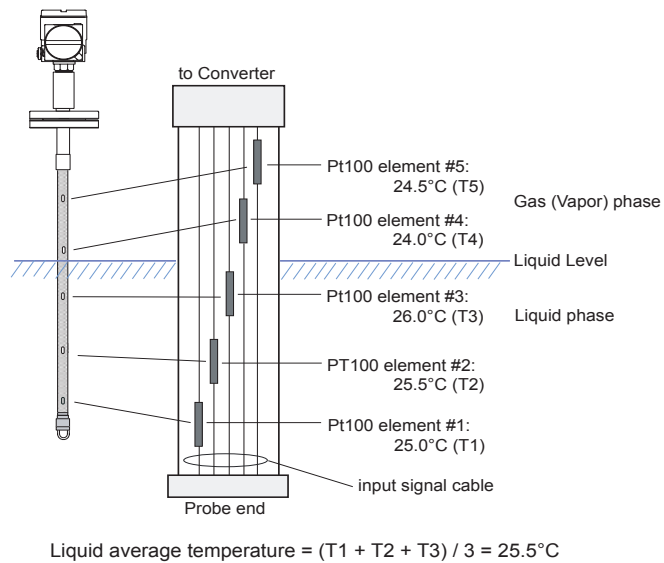
Formula:  $(T1 \cdot V1 + T2 \cdot V2 + T3 \cdot V3) / (V1 + V2 + V3) = \text{Average temperature}$

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



$$(3.5^{\circ}\text{C} \times 2 + 3.0^{\circ}\text{C} \times 3 + 2.0^{\circ}\text{C} \times 4) / (2 + 3 + 4) = 2.67^{\circ}\text{C}$$

**Spot:**  
Same number of element (resistance and material) locates in each input cable in the probe. Average calculation is performed based on sum of submerged element temperature value / total number of element submerged.

**VH28 Lower Limit**

Item type:read and write

Default value:-20.5°C

RANGE:-999.9°C ~ 999.9°C

Low limit temperature alarm parameter when measurement detects below design and approved temperature.

**VH29 Upper Limit**

Item type:read and write

Default value:245°C

Range:-999.9°C ~ 999.9°C

Hi limit temperature alarm parameter when measurement detects above design and approved temperature.

### 7.1.4 Element Position 1: VH30 ~ VH35 (VH36~VH39 is used only in NMT 539)

**VH30 ~VH39 Position 1 ~ 6 (7~10 is used only in NMT 539)**

Item type:read and write

Range:0mm ~ 99999mm

Individual element position from tank bottom. Calculation is automatically performed when element spacing "Even" is selected at VH85.

### 7.1.5 Element Position 2: VH40 ~ VH45 are not available in NMT532

**VH46 Hysteresis Width**

Item type:read and write

Default:10mm

Range:0mm ~ 99999mm

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.

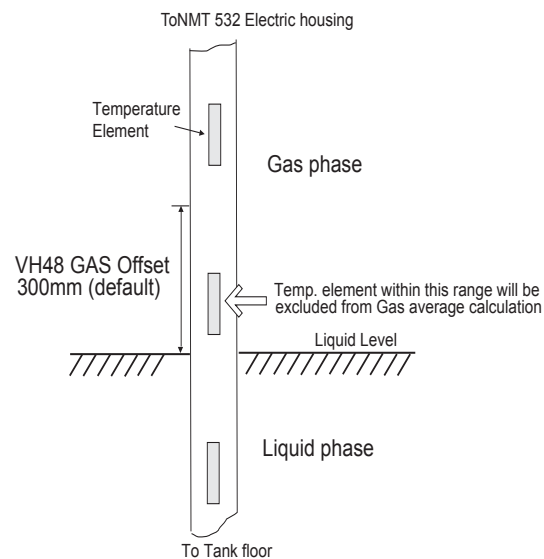
**VH48 Gas Offset**

Item type:read and write

Default:300mm

Range:0mm ~ 99999mm

A function to exclude specific element(s) from gas (vapor) phase average temperature calculation when element(s) stay within entered value from given liquid level.

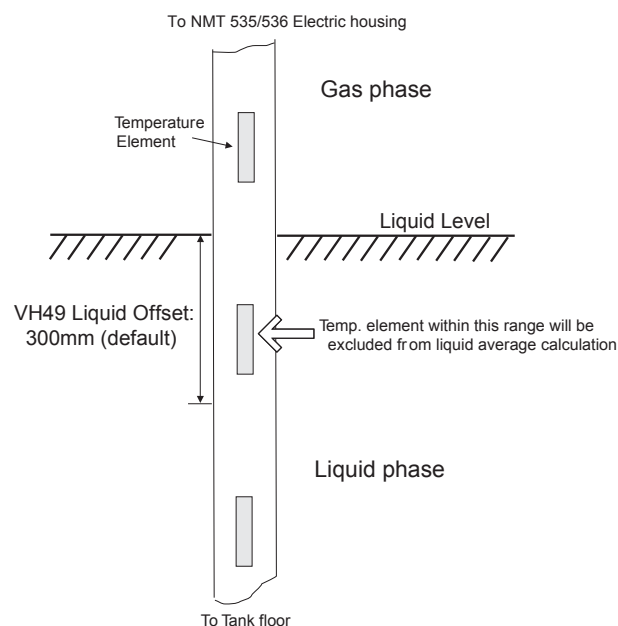
**VH49 Liquid Offset**

Item type:read and write

Default:300mm

Range:0mm ~ 99999mm

A function to exclude element (s) from liquid phase average temperature calculation when element (s) stays within entered value from given liquid level



### 7.1.6 WB primary and Advanced temp: VH50 ~ VH59

#### VH53 Element Point

Item type:select

Default:0

Selection:0 ~ 15 (element #1 = 0, element #6 = 5)

Select element number for "Advanced" average calculation at VH26. Selected 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:0m ~ 99999mm

A display of selected element position on VH53.

#### VH55 Element Volume

Item type:read and write

Range:1 ~ 99999.9

Setting additional factor on selected element at VH53. Extra volume can be added on specific element for advanced average temperature calculation. (Details, please refer to the description of VH26 "Select Average Method" on page 27)

### 7.1.7 WB Adjustment and Operation Power: VH60 ~ VH69

#### VH67 Common Voltage

Item type:read only

Range:0 ~ 255 (0 ~ 3V)

A display of temperature element line (both signal and common) running voltage. Detected voltage across common line (shall be between 0 ~ 3V) is converted to range of 0 ~ 255 count when it is displayed.

#### VH68 Output Current

Item type:read and write

Default:16000 at 6mA

Range:0 ~ 65535

Adjustment of NMT532 current consumption. In order to prevent current over shoot within multidrop HART loop, this function limits the NMT532 power consumption based on set parameter. Normally, NMT532 with temperature measurement function is operated within 6mA of current consumption. Use a tester to check the current flow in the loop. Reducing the value makes NMT532 to consume smaller current.

#### VH69 Ref Voltage

Item type:read and write

Default:200

Range:0 ~ 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.

### 7.1.8 Temperature Adjustment: VH70 ~ VH79

#### VH70 Element Select

Item type:select

Range:0 ~ 19

Selection of "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 ~ 1000.0

Zero adjustment of individual element that is selected at VH70. The reading value can be adjusted when the measured temperature indicates minor offset value compare to precision reference thermometer.

Note!

Selected element #2 indicates 25.4°C, then reference thermometer indicates 25.2°C, then set "-0.2" in this matrix. #2 element now has constant artificial -0.2°C offset based on raw measurement.

#### **VH72 Adjust Span**

Item type:read and write

Default:1

Range:0.8 ~ 1.2

The span adjustment that applies to all of installed temperature element. A linearized factor of given parameter is multiplied to raw element measurement for final calculation.

Note!

All of displayed individual temperature value are calculated based on following formula.

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

#### **VH73 Temperature X**

Item type:read only

Specified element temperature selected at VH70. Shown value is also indicated at individual element temperature at VH10 ~ VH25. The value is calculated based on formula indicated on above VH72.

#### **VH74 Position X**

Item type:read and write

Range:0mm ~ 99999mm

A position of specified element at VH70. Each element positions are also determined when "Not Even" element spacing is selected at VH85.

#### **VH75 Resistance X**

Item type:read only

A display of specified element resistance selected at VH70.

#### **VH76 Resistance Adj.**

Item type:read and write

Default: 0

Range:-1000.0 ~ 1000.0

Adjustment of specified element resistance at VH70. Minor resistance adjustment can be applied on the reading value.

Note!

e.g. If selected element #5 indicates 100.3 Ohm, and reference precision resistor indicates 100.0 Ohm at the same environmental condition, then set "-0.3" in this matrix. #5 element now has constant artificial -0.3°C offset resistance based on raw measurement.

#### **VH77 Element Type**

Item type:select

Selection:Pt100 (must be selected in NMT532)



Note!

The NMT532 always consists "Pt100" element with "Spot" element layout. Do not attempt to change these parameters.

### **VH78 Average Number**

Item type:read and write

Default:1

Range;1 ~ 10

Number of sampling for average calculation prior to determine final display value. Increasing number of sampling will 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 elements (6 temp elements and 5 times for 3 reference resistors)}

### **NH79 Protect Code**

Item type:read and write

Default:0

Range:0 ~ 999

Access code 530 to enable select and write command available.

### **Device setting 1: VH80 ~ VH89**

VH80:Present Error

Item type:read only

Display of error message presence. Following code will be indicated.

#### **Error code**

0:No error presence

1:Common line open

2: undetermined

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)

30:undetermind

31:undetermind

41:Memory defect (RAM)

42:Memory defect (EEROM)

### **VH81 Temperature Unit**

Item type:select

Default:°C

Selection:C, F, K

Selection of temperature display unit. Based on universal HART setting, °C(HART code: 32), °F(HART code: 33) and °K(HART code: 35) are available.

Note!

Selection of temperature display unit only applies to reply data from NMT532. Data transmission from host gauge (NRF590 or NMS5) to NMT532 must be performed by °C unit only (terminology of HART command 133)

**VH82 Element Number**

Item type:read and write

Default: 2

Range:1 ~ 6

Entering # of available temperature element.

Do not change the default parameter on the NMT532. # of 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 ~ 20

Setting # of preamble for HART communication.

**VH84 Distance Unit**

Item type:select

Default:mm

Selection:ft., m, inch, mm

Selection of level display unit. It applies to liquid level display on VH02 "Liquid Level". "Level units are coded based on universal 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 Interval

Selection:Even Interval (always "Even" for NMT532)

Selection of element interval depending on spacing layout.

**Caution!**

Do not change its parameter on NMT 539 Converter + Temperature version unless repairing. Kind of Interval and individual element positions are physically determined at factory.

**VH86 Bottom Point**

Item type:read and write

Default:500mm

Range:0mm ~ 99999mm

Position of #1 element that is also called "Bottom Point." #1 element position becomes critically important when "Even Interval" is selected at VH85 because remaining element positions rely on this location of Bottom Point.

**VH87 Element Interval**

Item type:read and write

Default:1000mm

Range:0mm ~ 99999mm

Designated to Even Interval spacing.

**Caution!**

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

**VH88 Short Error**

Item type:read and write

Default:-49.5

Range:-49.5 ~ 359.5

A type of error message when any of element has short circuit. Method of display can be configured at VH92 "Error Display Select."

**VH89 Open Error**

Item type:read write

Default:359.9

Range:-49.5 ~ 359.5

A type of error message when any of element has open circuit. Method of display can be configured at VH92 "Error Display Select."

**7.1.9 Device setting 2: VH90~VH99****Device setting 2: VH90 ~ VH99**

VH90 Device ID Number

Item type:read and write

Default:0

Range:0 ~ 16777214

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

Caution!

Changing device ID may lead to communication error because of mismatched pre-registered device ID and 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

Type of VH88 "Short Error Value" and VH89 "Open Error Value" display selection.

0\_OFF:These 2 error messages will not be transmitted to the connected host gauge. This function automatically excludes defect 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.

**VH94 Polling Address**

Item type:read and write

Default:2

Range:1 ~ 15

Polling address for 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 recognized 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 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.

## 8 Maintenance

### 8.1 Maintenance

The NMT532 Prothermo Average temperature instrument requires no special maintenance.

#### Exterior cleaning

When cleaning the NMT532, always use cleaning agents that do not attack the surface of the housing and the seals.

#### Repairs

The Endress+Hauser repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves. Spare parts are contained in suitable kits. They contain the related replacement instructions. All the spare parts kits which you can order from Endress+Hauser for repairs to the NMT532 Prothermo are listed with their order numbers on later pages. Please contact Endress+Hauser Service for further information on service and spare parts.

#### Repairs to Ex-approved devices

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

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

#### Replacement

After a complete Prothermo electronic module has been replaced, 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 carry out a new setup.

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

GVH	Contents
443	Level Data Selection
460-469	Element Position No. 1-9
470	(to select elements 10-15)
474	(to adjust position of element selected at GVH=470)
482	Total No. elements
485	Kind of Interval
486	Bottom point
487	Element Interval (If GVH=485 is "Equal")

## 9 Trouble-shooting

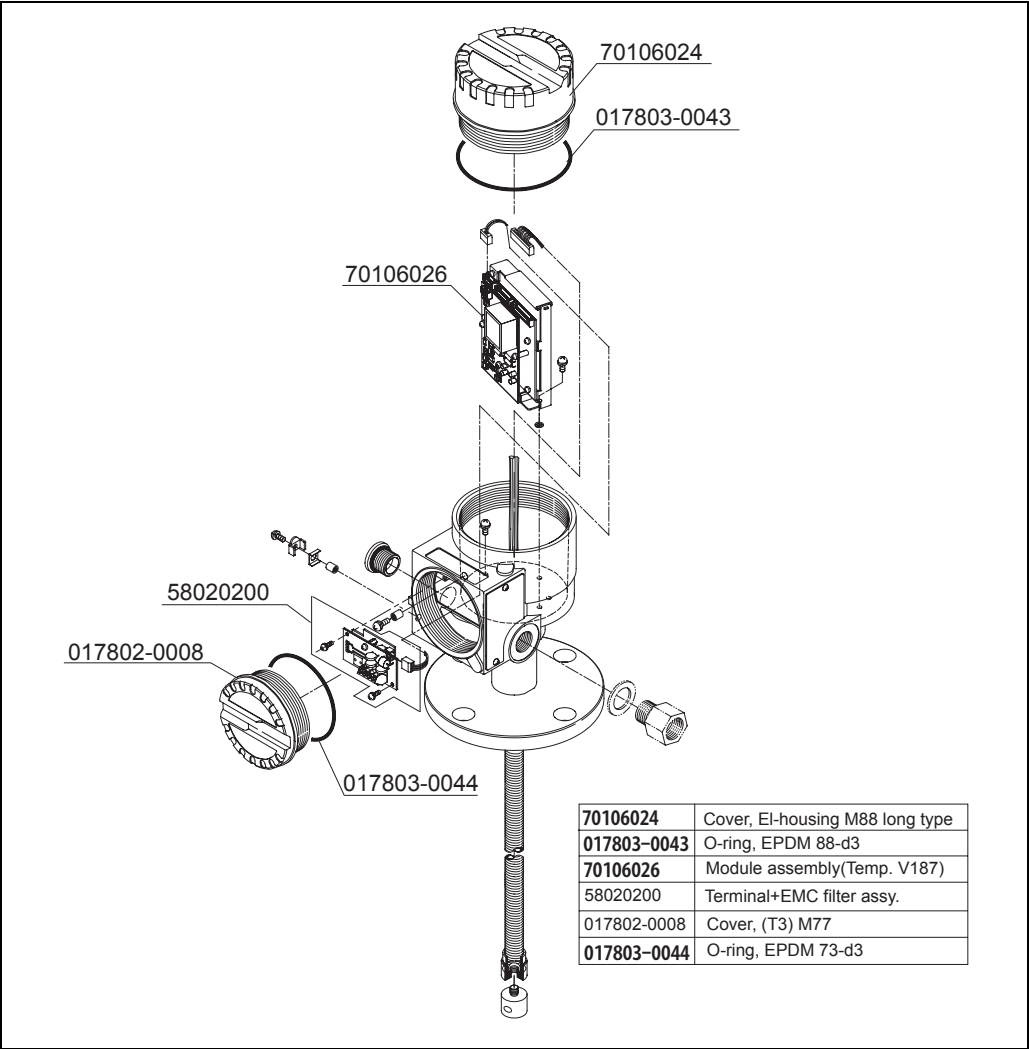
### 9.1 System error messages

Code	Description	Possible cause	Remedy
1	Common line open	Ground (common) line has open circuit. All of temperature element signal will be disabled or defected.	Check connector attachment on the module; then check continuity on common (black & white) cable
3~39	Element open	Temperature element signal cable ( #1 ~ 6) has open circuit.	Check connector attachment on the module; then check continuity on pointed signal cable (#1 ~ 6)
4~40	Element short	Temperature element signal cable ( #1 ~ 6) has short circuit.	Disengage connector from the module; then check continuity on pointed signal cable (#1 ~ 6)
23	#0 element over range	When reference #0 element has more than $\pm 1.1^{\circ}\text{C}$ deviation from $0^{\circ}\text{C}$ .	Check power supply voltage on NMT532 HART terminal H+ and H-
24	Memory defect (ROM)	When a defect was discovered during whole memory parameter check. Cyclic data comparison between previous check sum to current one.	Replace main CPU board
29	Element exposed	Liquid level dropped below #1 element position.	No liquid temperature measurement is available.
32	Low power supply	Supply voltage on multi drop HART loop to NMT532 is withdrawn below 16VDC from designated host instrument.	Check power supply on the host instrument and consumption of connected loop powered HART device
41	Memory defect (RAM)	Fault during Write and Read sequence, not completed.	Replace main CPU board
42	Memory defect (EEROM)	Fault during Write and Read sequence, not completed.	Check the write command itself that is acceptable to NMT532; if command is OK, replace main CPU board

These error code will be mainly displayed on ToF tool display when the tool is properly connected. Method and description of error display on host instrument, please refer to documentation of Tank Side monitor NRF590 or Proservo NMS5.

## 9.2 Spare parts

Spare parts are contained in kits. Spare parts which you can order from Endress+Hauser for the Prothermo are shown with their order numbers in the diagram below. For more information on service and spare parts, contact Endress+Hauser.



# 10 Accessories

## Anchor weight (Tall profile)

Caution!  
Installation of anchor weight will cause element position #1 (the lowest temperature measurement position) to be raised approximately 500 mm (20") from the tank floor.

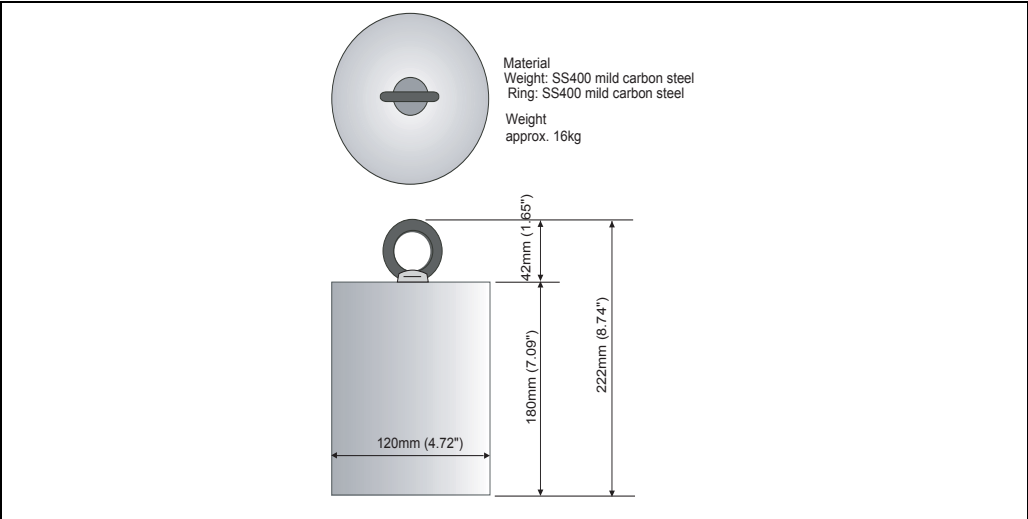


Fig.19 : Anchor weight dimension

Different dimension, weight, and material anchor are also available. Consult your Endress+hauser representative for further details.

## 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.

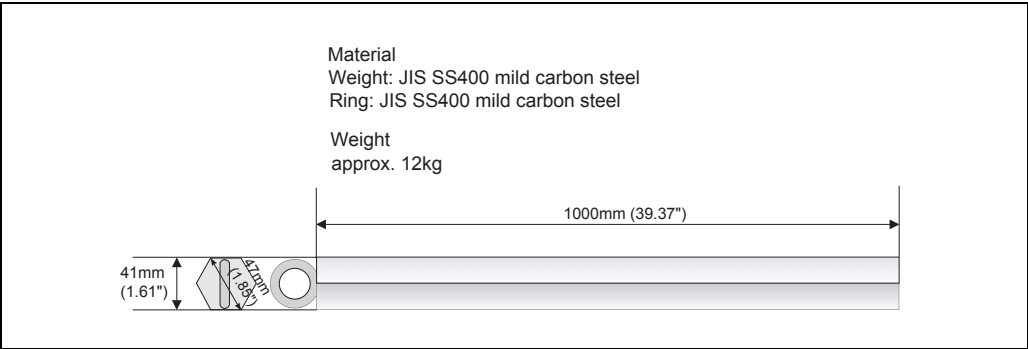


Fig.20 : Low plofile anchor weight dimension



### Wire hook, Top anchor

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

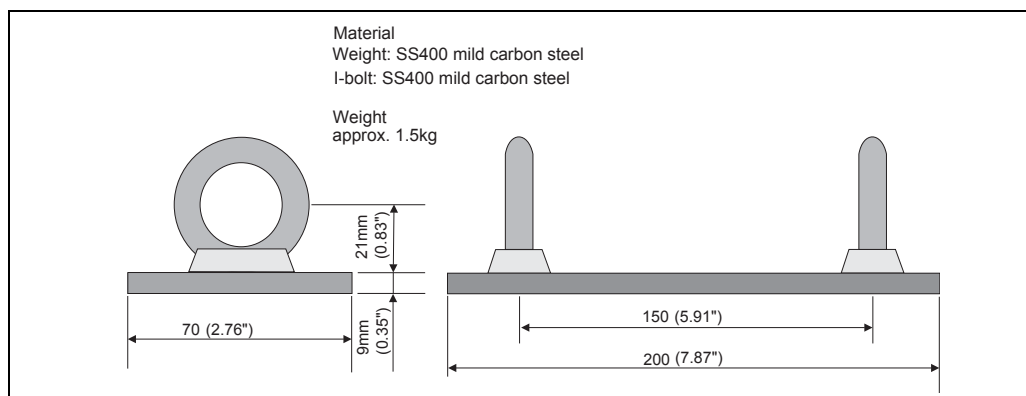


Fig. 21: Wire hook dimension

Actual tensioning can be completed with SUS316 stranded 3 mm diameter tension wire between Wire hook and Top anchor. Based on the application and installation variable, type of wire & size, material, and special coatings are available. Please consult your Endress+Hauser representative for further details.

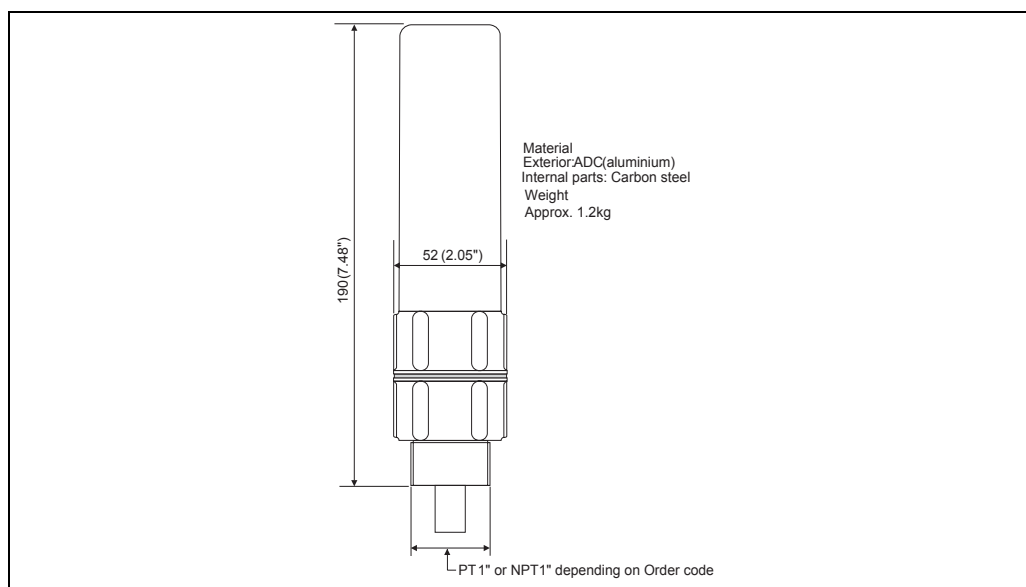


Fig. 22 : Top anchor dimension

### Note!

The standard process connection of the Top anchor is NPT1" threaded connection. Different thread size, material, and specification are available. Flange type connection is also available.

## 11 Technical data

### 11.1 Technical data at a glance

Application	
Application	<p>The Prothermo NMT532 performs precise liquid and gas phase average temperature measurement in bulk storage tank applications.</p> <ul style="list-style-type: none"> <li>■ Standard 2" flange installation</li> <li>■ Overall 18.5m temperature measurement range</li> </ul>
Function and system design	
Measuring principle	<p>Temperature measurement</p> <ul style="list-style-type: none"> <li>■ Up to 6 elements spaced evenly over the length of the flexible tube.</li> <li>■ Pt100, Class A elements</li> </ul>
Input	
Measured variable	<p>Temperature measurement</p> <p>Temperature conversion range: -20 ~ +100°C</p>
Measuring range	-20 ~ +100°C (-4 ~ 212°F)
Output	
Output signal	<ul style="list-style-type: none"> <li>■ HART protocol (multi drop HART loop connection)</li> </ul>
Signal on alarm	<p>Error information can be accessed via the following interfaces and transmitted digital protocol (refer to the operation manuals on following instruments)</p> <ul style="list-style-type: none"> <li>■ Tank Side monitor NRF590</li> <li>■ Proservo NMS5</li> </ul>
Auxiliary energy	
Load HART	Minimum load for HART communication: 250 W
Cable entry	see Technical Information TI049N/08/en
Supply voltage	16 ~ 30VDC (on multi drop HART loop)
Current consumption	Less than 6mA
Performance characteristics	
Reference operating conditions	<ul style="list-style-type: none"> <li>■ temperature = +25 °C (77 °F) ±5 °C (9 °F)</li> <li>■ pressure = 1013 mbar abs. (14.7 psia) ±20 mbar (0.3 psi)</li> <li>■ relative humidity (air) = 65 % ± 20%</li> </ul>
Maximum measured error	<p>Typical statements for reference conditions, include linearity, repeatability, and hysteresis:</p> <ul style="list-style-type: none"> <li>■ Linearity: <ul style="list-style-type: none"> <li>– Temperature: ±0.15°C (0.27°F) + number of element deviation (based on IEC class A standard)</li> </ul> </li> </ul>
Operating conditions	
<b>Operating conditions</b>	
Installation instructions	(this manual)

<b>Environment</b>	
Storage temperature	-40 °C ... +85 °C
Climate class	DIN EN 60068-2-38 (test Z/AD)
Degree of protection	<ul style="list-style-type: none"> <li>housing: IP 65, (Converter only, open housing: IP20)</li> </ul>
Electromagnetic compatibility	When installing the probes in metal and concrete tanks and when using a coax probe: <ul style="list-style-type: none"> <li>Interference Emission to EN 61326, Electrical Equipment Class B</li> <li>Interference Immunity to EN 61326, Annex A (Industrial)</li> </ul>
<b>Mechanical construction</b>	
Design, dimensions	see Technical Information TI049N/08/en
Material	see Technical Information TI049N/08/en
Process connection	see Technical Information TI049N/08/en
<b>Certificates and approvals</b>	
CE approval	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	<b>EN 60529</b> Protection class of housing (IP-code) <b>EN 61010</b> Safety regulations for electrical devices for measurement, control, regulation and laboratory use. <b>EN 61326</b> Emissions (equipment class B), compatibility (appendix A – industrial area)
Ex approval	see Ordering information
<b>Ordering Information</b>	
	The E+H service organisation can provide detailed ordering information on information on the order codes on request.
<b>Accessories</b>	
	see Technical Information TI049N/08/en
<b>Supplementary Documentation</b>	
Supplementary Documentation	<ul style="list-style-type: none"> <li>Technical Information (TI 049N/08/en)</li> </ul>

# Declaration of contamination

Dear customer,

Because of legal determinations and for the safety of our employees and operating equipment, we need this "Declaration of contamination" with your signature before your order can be handled. Please, include the completely filled in declaration with the device and the shipping documents in any case. Add also safety sheets and / or specific handling instructions if necessary.

Type of device / sensor:	_____	Serial no.:	_____
Medium / concentration:	_____	Temperature:	_____ Pressure: _____
Cleaned with:	_____	Conductivity:	_____ Viscosity: _____

**Warning hints for medium used** (mark the appropriate hints)



☐  
radioactive



☐  
explosive



☐  
caustic



☐  
poisonous



☐  
harmful to  
health



☐  
biologically  
hazardous



☐  
inflammable



☐  
safe

**Reason for return**

\_\_\_\_\_  
\_\_\_\_\_

**Company data**

Company:	_____	Contact person:	_____
	_____		_____
	_____	Department:	_____
Address:	_____	Phone:	_____
	_____	Fax / e-mail:	_____
	_____	Your order no.:	_____

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

\_\_\_\_\_  
(Place, date)

\_\_\_\_\_  
(Company stamp and legally binding signature)

[WWW.endress.com/worldwide](http://WWW.endress.com/worldwide)

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**Endress+Hauser**   
People for Process Automation