

Technical Description

706010En, Ed. 1, Rev A

April 2009

Multiple Spot and Single Spot Temperature Sensors for Rosemount Tank Gauging Systems



ROSEMOUNT[®]
Tank Gauging

www.rosemount-tg.com


EMERSON[™]
Process Management

Temperature Sensors

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Available documentation for temperature and water level sensors

- TankRadar Rex Technical Description (703010)
- TankRadar Rex Installation Manual (308014)
- TankMaster WinSetup Reference Manual (303027)
- Multispot Thermometers Product Sheet (106014)
- Water Level Sensor Product Sheet (109526)

Standard Drawings:

- Dimensional Drawing, flanged thermowell, Single Spot Temperature Sensor (9242 132-001)
- Dimensional Drawing Pt-100, Single Spot Temperature Sensor (9242 131-001)
- Electrical Installation Drawing. JB 36/42, temperature connection box, intrinsically safe cables (9150 072-096)
- Electrical Installation Drawing. Temperature sensor connection to radar gauge (W12/X12). (9150 072-941)
- Electrical Installation Drawing. WLS and temperature sensor connection to radar gauge (W12/X12). (9150 072-944)
- Electrical Installation Drawing. DAU, Pt-100, 3-wire, WLS. (9240 003-940)
- Electrical Installation Drawing. DAU, Pt-100, common return. (9240 003-912)
- Mechanical Installation Drawing. Recommended temperature sensor positions. (9240 003-942)
- Mechanical Installation Drawing. Multiple Spot Temperature Sensor in nylon. (9240 002-948)
- Mechanical Installation Drawing. Multiple Spot Temperature Sensor in stainless steel, Ø=20 mm. (9240 002-949)

- Mechanical Installation Drawing. Multiple Spot Temperature Sensor in stainless steel, Ø=29 mm. (9240 002-949)
- Mechanical Installation Drawing. 12 kg temperature sensor weight. (9240 003-008)
- Mechanical Installation Drawing. 4 kg temperature sensor weight. (9240 003-007)
- Mechanical Installation Drawing. Single Spot Temperature Sensor with flanged thermowell. (9242 133-001)
- Mechanical Installation Drawing. Single Spot Temperature Sensor, type BF. (9261 090-151)
- Mechanical Installation Drawing. Single Spot Temperature Sensor, type OPE. (9261 090-153)
- Mechanical Installation Drawing. Multiple Spot Temperature Sensor. (9150 044-905)
- Mechanical Installation Drawing. Multiple Spot Temperature Sensor in thermowell / LPG, 2-in. Sch.80. (9240 003-928),
- Mechanical Installation Drawing. Multiple Spot Temperature Sensor in thermowell, 2-in. Sch.40. (9240 003-906)
- Electrical Installation Drawing. Junction Box for WLS. (9261 090-232)
- Mechanical Installation Drawing. 5 kg WLS anchor weight. (9261 065-080)
- Mechanical Installation Drawing. WLS, closed version, for light products. (9261 090-235)
- Mechanical Installation Drawing. WLS, closed version, for sticky products, Crude, HFO etc. (9261 065-040)
- Dimensional Drawing Water Level Sensor (WLS). (9261 090-150)
- Mechanical Installation Drawing. WLS in still-pipe. (9261 090-154)

Abbreviations

- DAU (Data Acquisition Unit)
- DU (Display Unit)
- JB (Junction Box)
- MST sensor (Multiple Spot Temperature sensor)
- MSTW (Multiple Spot Temperature sensor with integrated WLS)
- SST (Single Spot Temperature sensor)
- WLS (Water Level Sensor)

Temperature Sensors

Temperature Measurement

Product temperature is an important parameter for accurate custody transfer and inventory measurement in liquid bulk storage tanks. High quality temperature sensors can be included in the Rex system delivery as an essential part.

Temperature sensors can be connected in two ways to the Radar Tank Gauge (RTG):

- Directly into the RTG (up to six temperature elements)
- Via the Data Acquisition Unit (DAU), with up to 14 temperature elements

This publication covers a selection of temperature sensors. For special requirements, call your supplier or Emerson Process Management / Rosemount Tank Gauging.

Spot Element Principle and Electrical Properties

Resistance Temperature Detectors (RTD) are sensors used to measure temperature.

The RTD element is made from a pure material, which has a predictable change in resistance as the temperature changes. This change is used to determine temperature.

It is a passive resistance element, which means the RTD does not create any electromotive force itself.

By using a known current, the voltage across the RTD is measured, which gives the resistance, and consequently also the temperature.

Standard RTD types

Platinum RTD's, made according to EN 60751/ IEC751, is today's common standard.

In the past, nickel RTD's were common. Such RTD's had higher resistance output with less linearity, and less long time stability.

Since instruments have become much more sophisticated, platinum has become the main sensor material due to the high stability.

RTD's can be wire-wound or made on substrate, and encapsulated in different ways.

Wire-wound platinum elements are used for the petrochemical industry.

The platinum elements are coiled from a wire with the length and the diameter to give exactly 100 ohm at 0 °C (32 °F) .

RTDs temperature dependance and tolerance classes

In EN 60751 the relationship between resistance and temperature is defined:

$$R(t) = R_0 * (1 + A * t + B * t^2 + C * (t - 100) * t^3)$$

where $A = 3.90802E-3 \text{ } ^\circ\text{C}^{-1}$, $B = -5.80200E-7 \text{ } ^\circ\text{C}^{-2}$

t is the temperature in °C

$$C = 0 \text{ } ^\circ\text{C}^{-4} \text{ if } t > 0$$

$$C = -4.27350E-12 \text{ } ^\circ\text{C}^{-4} \text{ if } t < 0$$

$R_0 = 100 \text{ } \Omega$ for Pt-100 (500 Ω for Pt-500 etc.)

Two grades or classes are stated for temperature element tolerances:

$$\text{Grade A: } \pm (0.15 + 0.002 * | t |)$$

$$\text{Grade B: } \pm (0.30 + 0.005 * | t |)$$

Grade B is used for temperatures close to 0 °C, and grade A is used for temperatures far away from 0 °C.

For many users Classes A and B are not sufficient. For this reason, suppliers deliver 1/3, 1/5, 1/6 and 1/10 of Class B, which are slightly better than Class A. When a platinum element is found to be 1/6 or 1/10 of Class B at 0 °C, the reason is a pure platinum wire.

For the relevant case, at temperatures close to 0 °C, only the fixed part is divided in the expression for the DIN B tolerance.

$$1/6 \text{ DIN B: } \pm (0.05 + 0.005 * | t |)$$

$$1/10 \text{ DIN B: } \pm (0.03 + 0.005 * | t |)$$

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Tolerances for temperature sensors in Rosemount Tank Gauging systems

The temperature sensors supplied by Emerson Process Management / Rosemount Tank Gauging, are made from a very pure platinum material with predictable and stable characteristics for very accurate temperature measurement. These sensors can be ordered as 1/6 and 1/10 DIN B, with an even better temperature tolerance than previously stated.

The temperature dependent part in the expression is more similar to the one for Grade A, which means that Grade B delivered by Emerson has $\pm (0.30 + 0.002 * |t|)$ tolerance. The following applies:

$$1/6 \text{ DIN B: } \pm (0.05 + 0.002 * |t|)$$

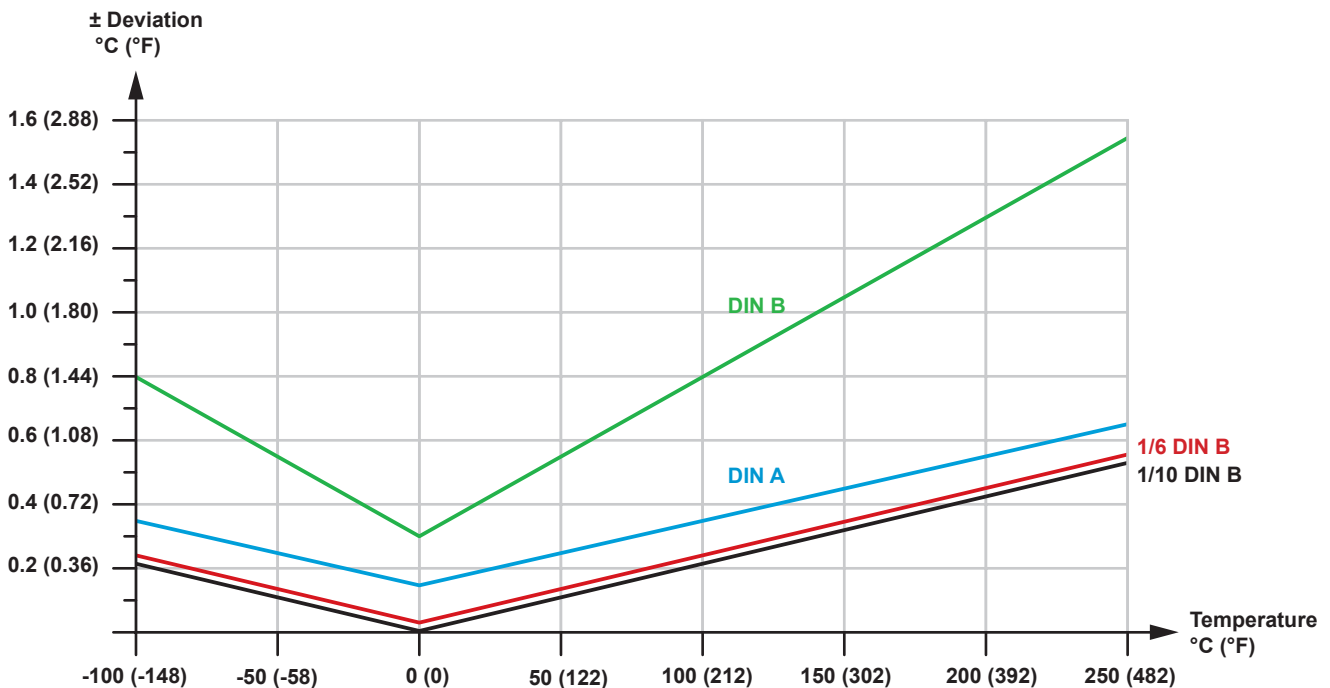
$$1/10 \text{ DIN B: } \pm (0.03 + 0.002 * |t|)$$

Calibration

Further verification than the described tolerance classes can be needed, in order to:

- achieve a higher accuracy than possible with such a tolerance class
- verify the sensors tolerance class
- satisfy quality systems

In these occasions calibration is needed. During calibration the sensor is compared in liquid thermostats with a traceable reference sensor in one or several temperature points. A certificate is issued with the exact reading of the sensor and the calculated uncertainty. Calibration is time consuming with a lot of waiting for stability and is not normally needed. Recalibration of sensors in service for 5 years in cryogenic tanks has shown negligible drift (few m°K) compared with the initial certificates.



Comparison between DIN A and DIN B according to the standard and 1/6 and 1/10 of DIN B delivered by Emerson.

$$\text{DIN A} = \pm (0.15 + 0.002 * |t|)$$

$$\text{DIN B} = \pm (0.30 + 0.005 * |t|)$$

$$1/6 \text{ DIN B: } \pm (0.05 + 0.002 * |t|)$$

$$1/10 \text{ DIN B: } \pm (0.03 + 0.002 * |t|)$$

Temperature Sensors

Multiple Spot Temperature (MST) Sensor

The easily installed MST sensor measures temperature with one to fourteen Pt-100 spot elements placed at different heights to provide a tank temperature profile and an average temperature. Up to six elements can be connected directly to the gauge. If more, the temperature sensor is connected to the gauge via a Data Acquisition Unit (DAU).

Temperature sensors are often used for volume measurement in oil or bitumen tanks, or for estimating the accumulated energy in bulk storage tanks. Only the fully immersed elements are used to determine the product temperature.

The MST sensor is mounted with a flange or a thread at the top of the tank.

The spot elements are placed in a flexible gas tight protection tube, made from convoluted stainless steel, for easier handling during installation.

All spot elements are attached to a 1.5 mm (0.06 in.) wire, which runs from the top to the bottom of the sensor. An anchor weight can be hung at the bottom, or the tube can be clamped to the bottom, to keep the sensor vertical, and avoid floating when the tank is filled.

API chapter 7 recommends minimum one element per 10 feet (3 m) tank height for custody transfer applications.

The protective tube is not designed for pressurized tanks, but the MST sensor can be installed in a closed thermowell, enabling service or inspection while the tank is in operation.

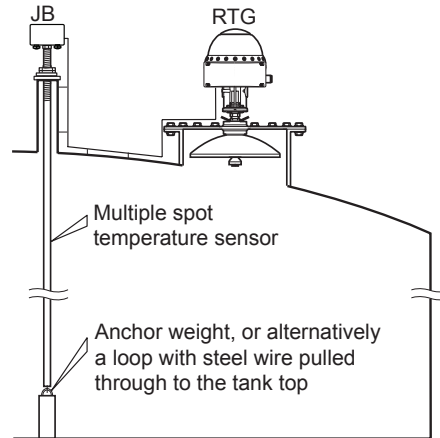
On fixed roof tanks the MST sensor is attached to a flange mounted on a suitable nozzle.

On floating roof tanks the MST sensor can be installed in a still-pipe.

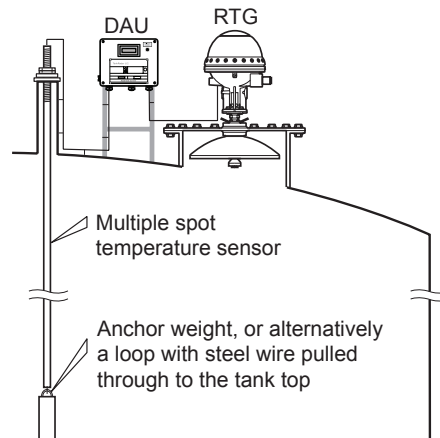
A water level sensor can be integrated in the MST sensor, see page 7.

The MST sensor may also be delivered with an Exe / Exi or UL approved junction box (premounted or bundled cables).

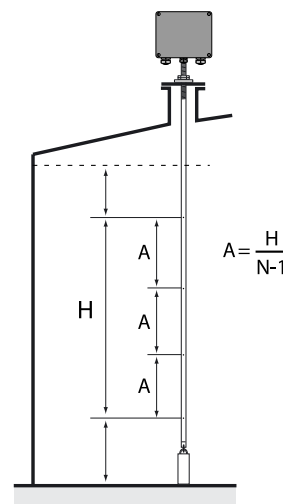
Multiple spot temperature sensor.



Up to 6 temperature elements can be connected directly to the radar gauge (here via a junction box – JB).



When the number of temperature elements is above 6 they are connected via a Data Acquisition Unit. Maximum 14 temperature elements can be connected.



Recommended temperature sensor positions for custody transfer according to API. Example: 4 spot elements, H=9 m. A=3 m.

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MST sensor for cryogenic applications

This version, NL-Cryo, is used for temperature measurements in LNG tanks. The spot elements are encapsulated in a stainless steel tube, filled with Argon gas to prevent condensation of water inside the sensor at low temperatures. Temperature stable type A elements are used for low temperatures. If the sensor is used in pressurized tanks, it must be protected by a thermowell with ambient pressure inside. The recommended minimum inner diameter of the thermowell is 49.8 mm (1.96 in.).



NL-cryo, supplied with a non-adjustable flange.



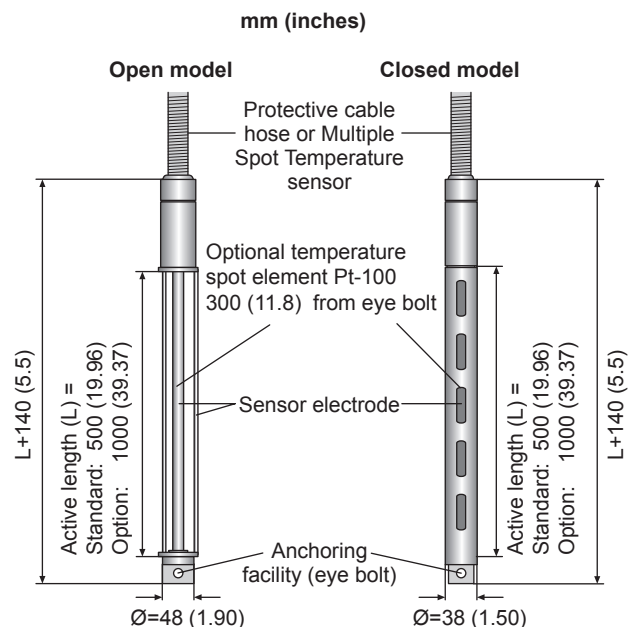
WLS integrated with MST sensor (MSTW), open model to the left and closed model to the right. It is hung vertically from the top of the tank, and the position/length is chosen according to the actual bottom water range. The WLS should be anchored to the tank bottom to ensure a fixed position in case of turbulence.

Water level sensor integrated with multiple spot temperature sensor (MSTW)

The capacitive Water Level Sensor (WLS) continuously measures free water level below the oil surface and provides input for on-line net inventory. The WLS is delivered in a stainless steel (AISI 316) housing, welded to the MST flexible tube. It has a heavy duty design with no moving parts. The WLS outputs an analog 4-20 mA signal, which is connected directly to a radar gauge. There can be a Pt-100 temperature sensor inside the probe allowing temperature measurements at low levels. The WLS is welded to the MST sensor to get a hermetic design. The open model WLS is suitable for crude oil applications and the closed model is suitable for lighter fuels such as diesel oil etc.

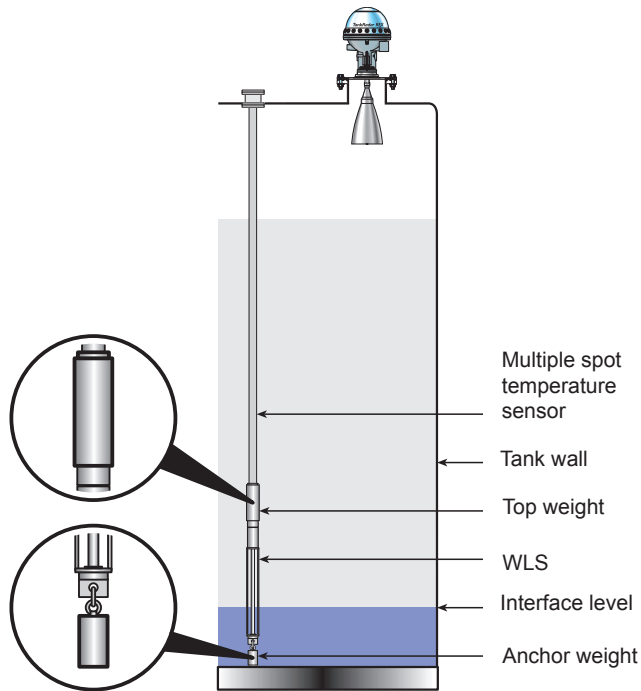
It is also possible to have an Exe / Exi or UL approved junction box connected to the MSTW.

Offset calibration can be done via HART® communication.



Water Level Sensor

Temperature Sensors



A weight can be mounted in the bottom eye bolt and / or above the WLS, in which case the weight is hollow and fitted on the MST.

Single Spot Temperature (SST) Sensor

The single spot version is available in three models:

- Type B, with extension length and removable insert
- Type BF, with/without extension length and fixed insert.
- Type OPE, with Ex-approved head, extension length and removable insert

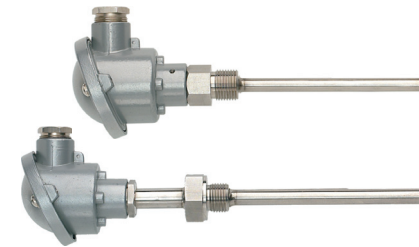
It can be used for measurements of fluid temperature (in sealed pipes), in refineries, chemical plants and other hazardous installations.

The spot element is placed in a gas tight protection tube made from stainless steel, either directly or in an insert tube (removable for service). The single spot temperature sensor is often mounted in a thermowell.

A stainless steel housing is available on request.



Single spot temperature sensor, type B.



Single spot temperature sensor, type BF.



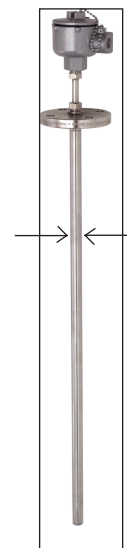
Single spot temperature sensor, type OPE.

Stainless steel thermowell with flange connection

Single spot temperature sensors in thermowells are used for pressurized tanks and when there is a requirement to be able to replace a sensor without having to drain or evacuate the process. It can be connected with a flange or a thread (see ordering information for details).

Immersion sheath:
 $\varnothing=16$ mm (0.63 in.) x 3 mm (0.12 in.)
 or
 21.3 mm (0.84 in.) x 2.65 mm (0.10 in.)

The length of the thermowell needs to be 15 mm (0.59 in) longer than the temperature sensor.



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Installation Considerations

Mechanical connection

Temperature and water level sensors should be located as far away as possible from heating coils and swing arms. If possible they should be located on the shaded side of the tank.

MST Note:

Be careful with the flexible MST protection tube. Avoid sharp bendings / tools.

If any leaks of the flexible tube should occur during mounting of the temperature sensor you should never try to fix it with seals or other materials. Leaks may damage the functionality of the wires inside.

If the wires are stripped of insulation there is always a risk of short-circuit or malfunctions.

Do never extend or in any other way rebuild the temperature sensor since this may cause serious malfunctions.

If any damages should occur please contact your supplier for further information.

WLS Note:

The open WLS version must be handled carefully since the PTFE coated inner core is fragile, and may be damaged if mistreated. This is why the WLS is delivered in a plastic tube for protection of the sensor during transportation and handling. Leave this protection on until the final positioning of the sensor in the tank.

Fixed roof tank installation

The MST/MSTW sensor must be equipped with a bottom weight to keep it in position (10 kg recommended for tanks up to 15 m, and 15 kg for higher tanks). The MSTW can also be installed with a top weight.

Floating roof tank installation

The MST/MSTW sensor is installed in a still-pipe and should be equipped with a bottom weight to keep it in position.

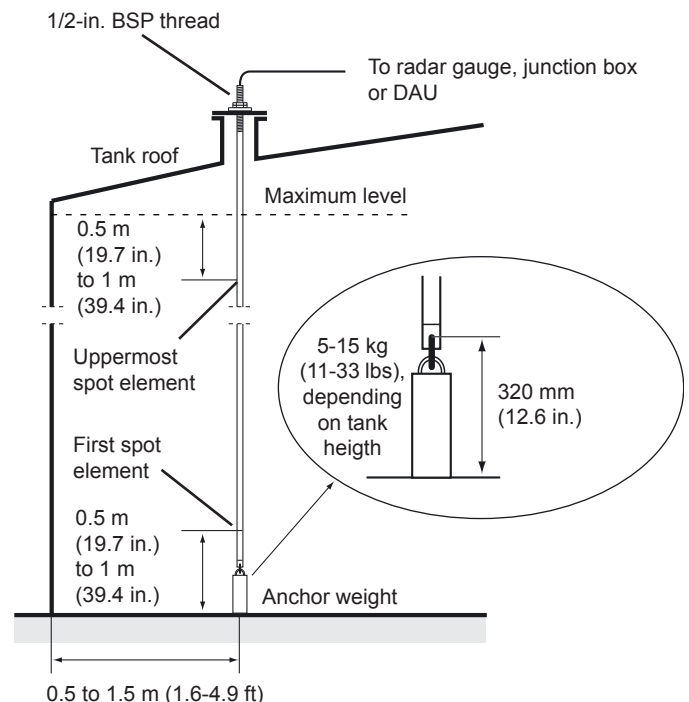


The MSTW can in addition be installed with a top weight.

It is important that the still-pipe is cut above the active part of the water level sensor.

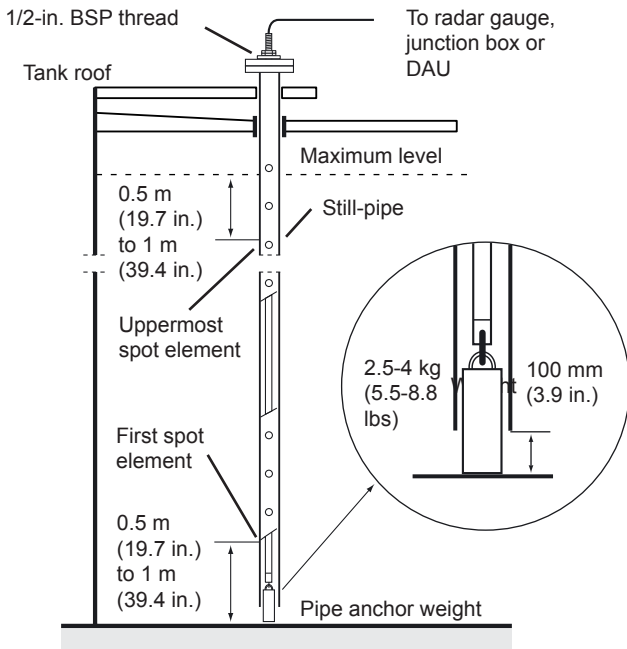
To measure water level close to the tank bottom, a top weight can be used instead of a bottom weight.

To get the active part of the sensor even closer to the tank bottom it is also possible to remove the MSTW eye bolt (see page 11).



Fixed roof tank.

Temperature Sensors

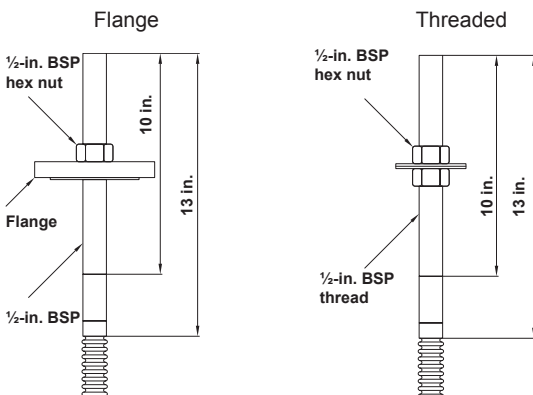


Floating roof tank.

Installation procedure for temperature sensors with / without integrated water level sensor – SST, MST and MSTW sensors

After bringing the sensor and necessary tools to the tank top, follow steps 1, 3, and 5-7 for the MST sensor, steps 1-7 for the MSTW, and steps 5-6 for the SST sensor:

1. Mount the anchor weight on the MST / MSTW sensor.



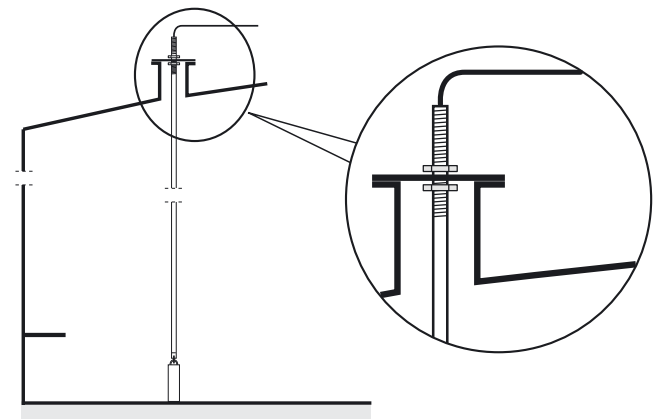
The MST sensor is mounted with a flange or a thread at the tank top.

2. To measure water level close to the tank bottom, the eye bolt on the MSTW can be removed. If so, a special 5 kg top weight (see Accessories) is carefully pulled down from the top of the MST sensor to the position just above the WLS. The top weight can be combined with an anchor weight if the eyebolt is used. See page 8.
3. If using a flange, mount it at the lowest threaded part on the top end of the temperature sensor.
4. If installing an MSTW, the protective tube may carefully be removed from the WLS.
5. Carefully lower the temperature sensor, with weights and an integrated junction box if applicable, into the tank through the nozzle.

Note:

It is very important to make sure the weight is properly placed at the tank bottom, and that the MST / MSTW sensor is in an upright position. If not, measurement data might not be as expected.

6. When the temperature sensor is placed correctly, it is connected to the tank via a flange / thread.



Use the lock nuts to adjust the protection tube with temperature spot elements so that the weight barely touches the tank bottom.

7. Mount the hose kit for protection of wires. The hose kit is ordered for MST/MSTW sensors without an integrated junction box.

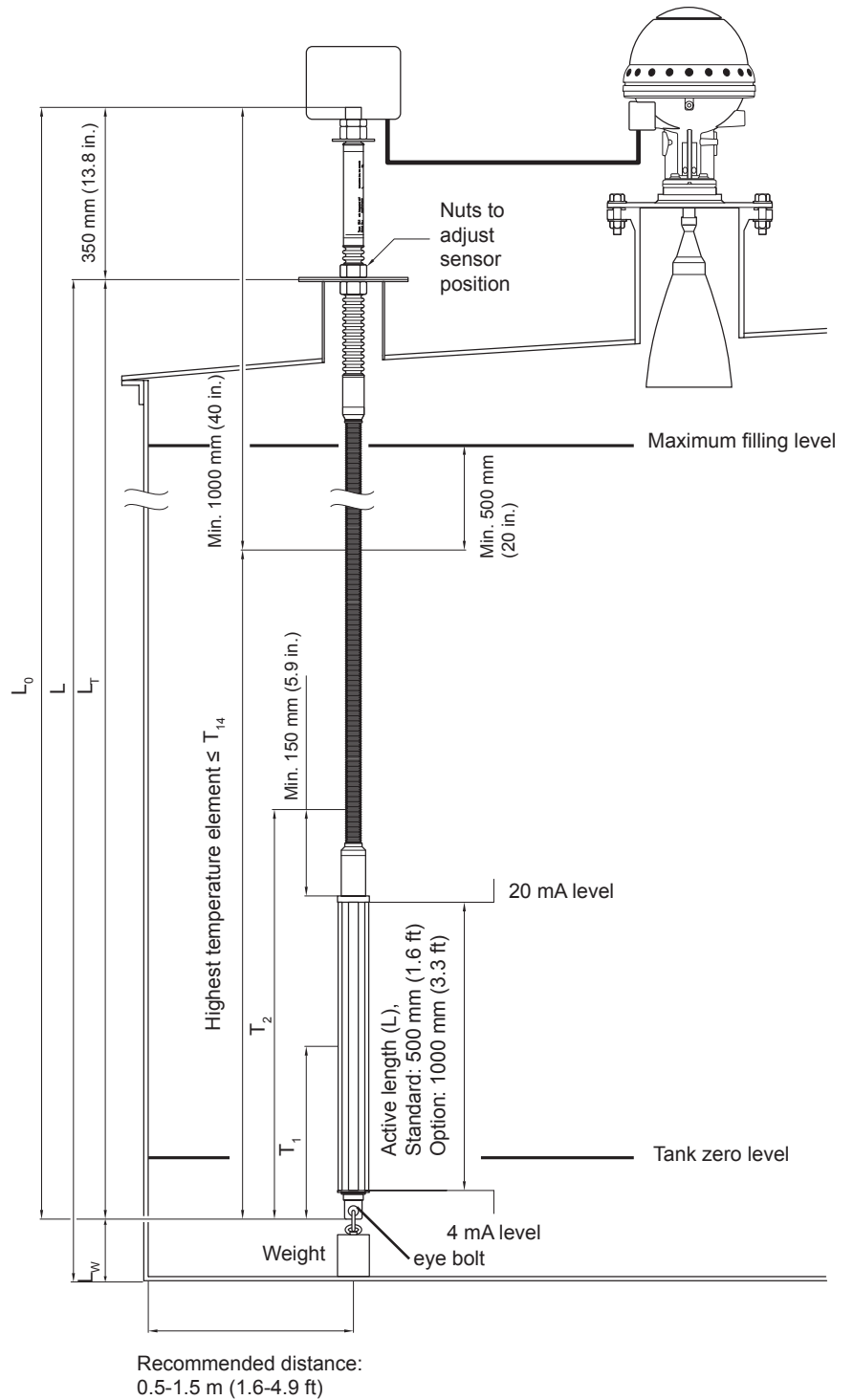
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For more information, see the mechanical installation drawings listed on page 3.

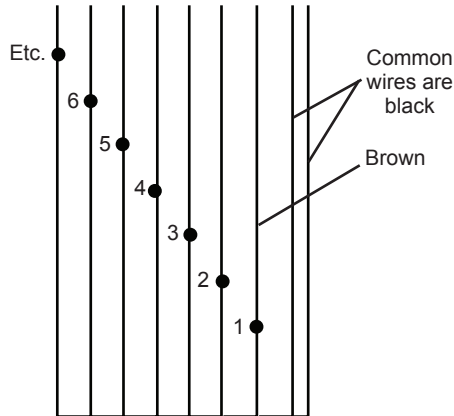


Installation of a multiple spot temperature sensor with integrated water level sensor.

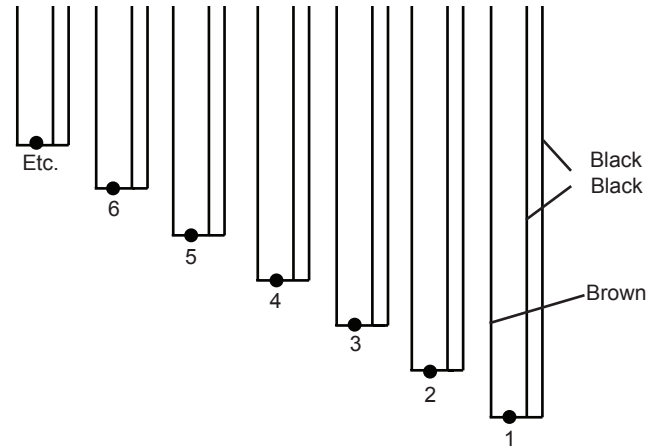
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Electrical connection

Electrical connections have to be done after any mechanical mounting. At the top of the multiple spot temperature sensor the lead out wires have to be connected either to the TankRadar Rex gauge, the DAU, or a junction box.



Common return wiring (see color code table below to identify spot element numbering).



Independent 3-wire (see color code table below to identify spot element numbering).

Element number	Insulation color codes	
	Common return	Independent 3-wire
1	brown	brown; black, black
2	red	red; black, black
3	orange	orange; black, black
4	yellow	yellow; black, black
5	green	green; black, black
6	blue	blue; black, black
7	violet	violet; black, black
8	grey	grey; black, black
9	white	white; black, black
10	pink	pink; black, black
11	brown/black	brown/black; black, black
12	red/black	red/black; black, black
13	orange/black	orange/black; black, black
14	yellow/black	yellow/black; black, black

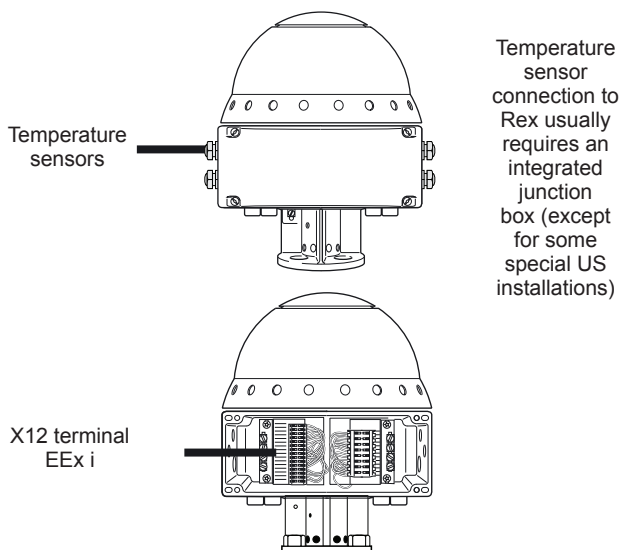
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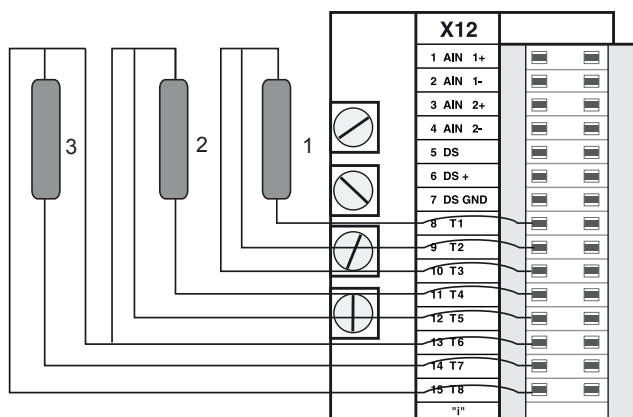
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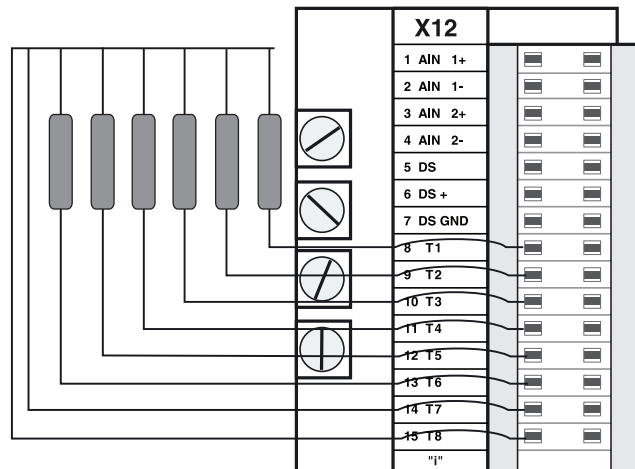
Up to 6 temperature spot elements can be connected directly to a TankRadar Rex gauge (up to 14 elements if using a DAU, sometimes together with a junction box if required due to the distance). Up to 6 temperature spot elements can be connected to a TankRadar Pro gauge via the 2210 DU (Display Unit). For more information, see TankRadar Rex Installation Manual (308014En) and TankRadar Pro Reference Manual (306010En).



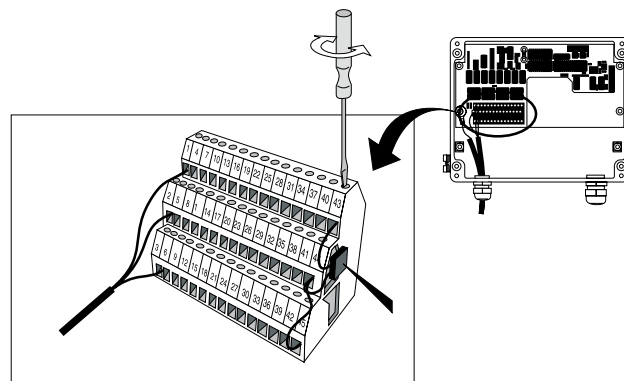
Connection of temperature sensors to TankRadar Rex with integrated junction box (JBi). The X12 terminal, slots 8-15 are used for temperature (X12:8-15).



It is possible to connect a temperature sensor with up to 3 elements to Tankradar Rex if using independent wiring. X12:8-10 for the first spot, X12:11-13 for the second spot, and X12:13-15 for the third spot. A single spot temperature sensor is connected to X12:8-10.



It is possible to connect a temperature sensor with up to 6 elements to TankRadar Rex if using common return wiring. Spot 1-6, should be connected to X12:8-13 respectively, and the common wires to X12:14-15.



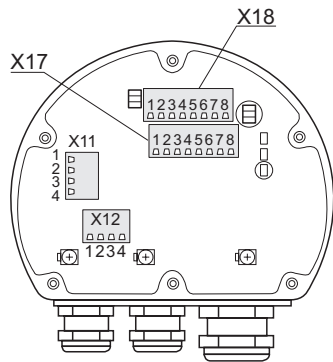
It is possible to connect a temperature sensor with up to 14 elements to TankRadar Rex if using a DAU:

For independent wiring, spot 1 should be connected to X21:1-3, spot 2 to X21:4-6 etc. See electrical installation drawing 9240002-910.

If a temperature sensor with integrated WLS is used, the spot elements and WLS are connected via a junction box (JB140-15 or JB36/42); The WLS to slot 1-2 on the JB and further on to the Tank Radar Rex gauge, spot 1 to slot 3-5 on the JB to X21:1-3 on the DAU, spot 2 to slot 6-8 on the JB to X21:4-6 etc. See electrical installation drawing 9240003-940.

For common return wiring, spot 1 should be connected to X21:3, spot 2 to X21:4 etc. The common wires should be connected to X21:1-2. See electrical installation drawing 9240003-912.

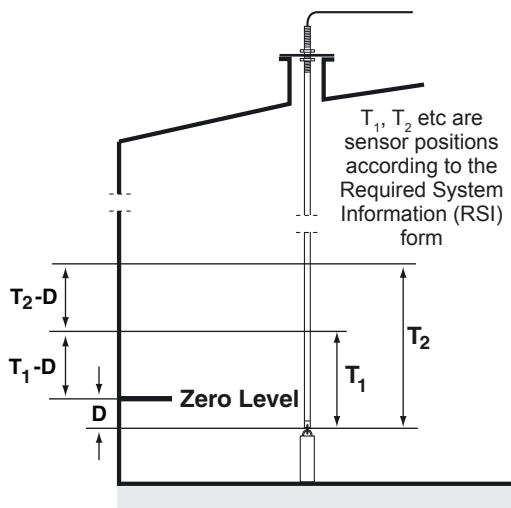
Temperature Sensors



Temperature sensors can also be connected to TankRadar Pro via the the 2210 DU (display unit), with up to 3 spot elements if using independent wiring. X17:2-4 for the first spot, X17:6-8 for the second spot, and X18:2-4 for the third spot. It is possible to connect a temperature sensor with up to 6 elements if using common return wiring. For more information, see electrical installation drawing 9150074-928.

Configuration

The temperature sensor positions to be configured in TankMaster WinSetup are measured from the tank Zero Level as illustrated below.



The configuration distance in TankMaster refers to the distance above the Zero Level.

It is important that the 4 mA and the 20 mA levels are properly configured in order to obtain correct water level readings from the WLS.

The distance “X” between the Tank Zero Level and the Water Zero Level has to be considered when configuring the WLS. “X” can be calculated from known tank distances as illustrated.

The distance X can be calculated with the following formula:

$$X = (R - L_1) - (L - L_2)$$

X=distance between the Tank Zero Level and the Water Zero Level.

L=distance between Water Zero Level and the mark on the upper part of the WLS.

R= Tank Reference Height. This is the distance between the Tank Reference Point and the Tank Zero Level.

L₁=distance between the Tank Reference Point and the temperature sensor flange.

L₂=distance between the mark on the top of the WLS and the temperature sensor flange.

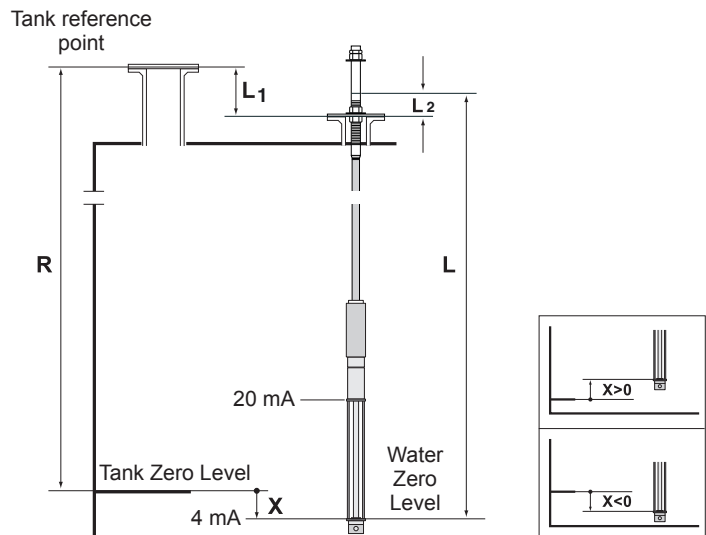
The Lower Range Value (4 mA) and the Upper Range Value (20 mA) are given by the following formulas:

$$\text{Upper Range Value (20 mA)} = L_A + X$$

$$\text{Lower Range Value (4 mA)} = X$$

where L_A is the active length of the water level sensor, and X is the distance between the Water Zero Level and the Tank Zero Level.

The configuration of the WLS can basically be divided into three cases as illustrated onwards:



Tank geometry for the water level sensor.

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Temperature Sensors

The water zero level is below the tank zero level

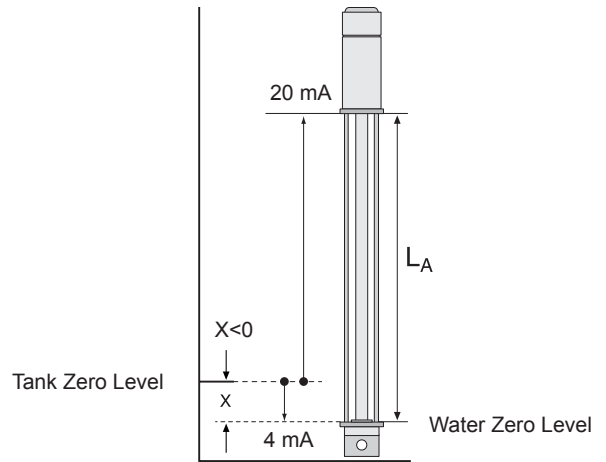
In this case the 4 mA point on the WLS is below the Tank Zero Level.

Note that when the 4 mA point is below the Tank Zero Level the 4 mA value is negative, i.e. $X < 0$.

Example: $L_A = 500$ mm, $X = -50$ mm.

4 mA value = -50 mm.

20 mA value = $500 + (-50) = 450$ mm.



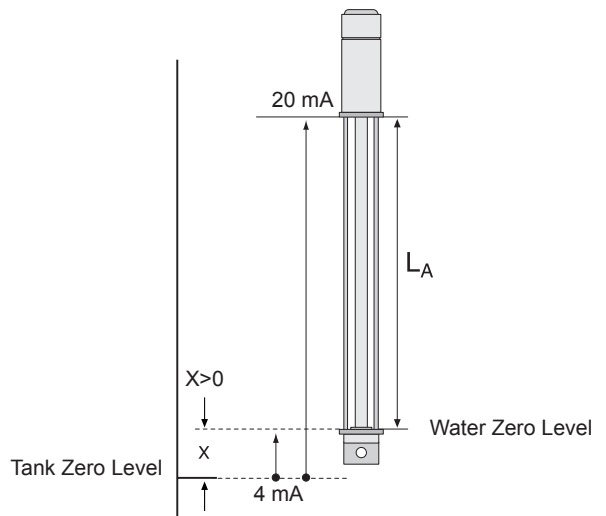
The water zero level is equal to the tank zero level

In this case the 4 mA point on the WLS corresponds to the Tank Zero Level. The 4 mA value = 0 .

Example: $L_A = 500$ mm, $X = 0$ mm.

4 mA value = 0 mm.

20 mA value = 500 mm.



The water zero level is above the tank zero level

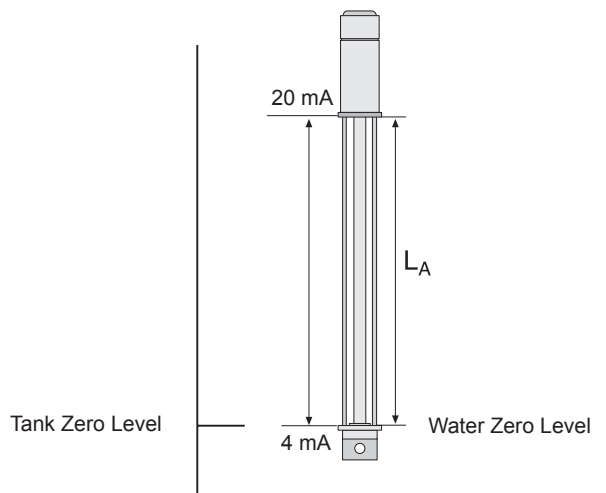
In this case the 4 mA point on the WLS is above the Tank Zero Level.

Note that when the 4 mA point is above the tank Zero Level the 4 mA value is positive, i.e. $X > 0$.

Example: $L_A = 500$ mm, $X = 70$ mm.

4 mA value = 70 mm.

20 mA value = $500 + 70 = 570$ mm.



For more information, see TankRadar Rex Installation Manual and TankMaster WinSetup Reference Manual.

Temperature Sensors

Specification

Multiple Spot Temperature Sensor	
Element type:	Pt-100 spot elements according to EN 60751. 3-wire design
Accuracy:	1/6 DIN Class B (standard), 1/10 DIN Class B (option). See diagram on page 5. MST sensor for cryogenic use: DIN Class A. DIN Class A and B are specified in EN 60751
Pressure range:	0-7 Bar
Overall temp range (standard):	-50 to 120 °C (-58 to 248 °F)
Overall temp range (optional):	-20 to 250 °C (-4 to 482 °F) -170 to 100 °C (-274 to 212 °F) for cryogenic use
Number of elements and connection to Rex system:	6 elements per MST sensor as standard. Max. 14 elements for each MST sensor. Max. 14 elements via DAU (common return or independent wires) , or max 6 elements with common return directly to Rex Gauge (max. 3 elements with independent wires)
Overall length:	Standard is 5-70 m (16.4-230 ft). Other lengths on request
Protective Sheath:	Wall thickness 0.3 mm (0.012 in.) stainless steel, AISI 316. Ø=¾-in. (standard), 1-in. (always with WLS)
Top fitting / Mounting thread:	Steel pipe with 1/2-in. BSP thread or M33 x 1.5. Thread length 253 mm (10.0 in.)
Tank opening:	Minimum Ø= 2 in. (50.8 mm)
Flange (option):	1½ to 4 in. according to standards. Stainless steel (AISI 304 is standard, AISI 316 on request)
Immersed material:	Stainless steel (AISI 316)
Lead wire length:	3 m (9.8 ft). Longer wires optional, maximum 10 m (32.8 ft)
No of wires:	3 independent wires per element or 1 wire per element plus 2 common return wires
Bottom weight:	2.5-15 kg (5.5-33 lbs). 2.5-4 kg (5.5-9 lbs) for still-pipe installation. Stainless steel (AISI 304)
Minimum distance from the bottom of the sensor to the first spot element:	150 mm (5.9 in.)
Minimum distance from the top of the sensor to the uppermost spot element:	850 mm (33.5 in.)
Designed according to:	EN 60751 and ATEX Directive 94/9/EC. Accuracy approved by PTB

Water Level Sensor	
Open model:	Suitable for crude oil applications
Closed model:	Suitable for lighter fuels such as diesel oil
Active measuring range:	500 mm (20 in.), 1000 mm (40 in.)
Analog output:	2-wire, 4 - 20 mA with $I_{max} = 23$ mA Resolution: D/A= 16 bits Linearity: ± 0.2% of full scale
Accuracy:	± 2 mm (0.08 in.) [500 mm active length] ± 4 mm (0.16 in.) [1000 mm active length]
Repeatability:	± 0.5 mm (0.02 in.), digital calibration
Measuring principle:	Capacitive
Factory calibration:	Calibrated under the following conditions: $\epsilon_r = 1.0$ (air) via 2-wire loop. (Other calibrations on request). A Rosemount Field Communicator (HART) can be used for configuration
Storage temperature:	-40 to +80 °C (-40 to +180 °F)
Operating temperature:	0 to +120 °C (+32 to +250 °F). Maximum temperature at mounting flange is 80 °C (180 °F)
Operating pressure:	Max. 6 Bar
Mechanical dimensions:	Connection thread M33x1.5 mm
Immersed material:	Stainless steel (AISI 316), FEP, PTFE, and PEEK with 30% glass
Length of WLS:	Active length + 140 mm (5.5 in.)
Outer diameter of WLS:	closed: Ø=38 mm (1.5 in.) open: Ø=48 mm (1.9 in.)
Ex approvals:	DEMKO 01 ATEX 131128X, CE 0539 II 1 G, EEx ia IIB T4, and UL approval
EMC approvals:	EN50081-1 and EN50082-2

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Temperature Sensors

Sensor Type ⁽¹⁾	Connection	Conductors	Maximum number of spot elements	Temperature Range
MST	¾-in.	3-wire independent	10	-50 to 120 °C (-58 to 248 °F) or -20 to 250 °C (-4 to 482 °F)
MST	¾-in.	common return	14	-50 to 120 °C (-58 to 248 °F) or -20 to 250 °C (-4 to 482 °F)
MST	1-in.	3-wire independent	14	-50 to 120 °C (-58 to 248 °F) or -20 to 250 °C (-4 to 482 °F)
MST	1-in.	common return	14	-50 to 120 °C (-58 to 248 °F) or -20 to 250 °C (-4 to 482 °F)
MSTW	1-in.	3-wire independent	14	-50 to 120 °C (-58 to 248 °F)
MSTW	1-in.	common return	14	-50 to 120 °C (-58 to 248 °F)
NL-cryo	1-in.	3-wire independent or common return	6 14	-170 to 100 °C (-274 to 212 °F)

(1) All types have: Pt-100 spot elements. Protective sheath made of stainless steel (AISI 316). Maximum 70 m (230 ft) length.

Multiple spot temperature sensor overview.

Medium	Suitability for tube material (stainless steel AISI 316) immersed in medium
Acetic acid	Good, material unaffected
Acetylene	Good, material unaffected
Butane	Good, material unaffected
Ethanol	Good, material unaffected
Fuel oil	Good, material unaffected
Gas oil	Good, material unaffected
Grease	Good, material unaffected
Hydrochloric acid	Avoid use
Methane	Good, material unaffected
Methanol	Good, material unaffected
Natural Gas	Good, material unaffected
Nitric acid	Avoid use
Petrol	Good, material unaffected
Petroleum oil	Good, material unaffected
Propane	Good, material unaffected
Sea water	Good, material unaffected
Sulphuric acid	Good, material unaffected
Water	Good, material unaffected

Temperature Sensors

Single Spot Temperature Sensor	
Element type:	Pt-100 spot elements according to EN 60751. 3-wire design
Versions:	<ul style="list-style-type: none"> • Threaded immersion thermometer, type B, with extension length and removable insert • Threaded immersion thermometer, type BF, fixed insert, with or without extension length • Threaded immersion thermometer, type OPE, with removable insert and extension length B and BF types are used for intrinsically safe installations; Type OPE for explosionproof installations (EExdIIC. ATEX approval). Type BF requires thermowell installation. Versions according to DIN 43765
Accuracy:	1/6 DIN Class B (standard), 1/10 DIN Class B (option). See diagram on page 5
Pressure range:	0-50 Bar
Temperature range (standard):	-50 to 260 °C (-58 to 500 °F)
Temperature range (optional):	-50 to 400 °C (-58 to 752 °F)
Removable Insert:	Type B: Removable, type MI60. Stainless steel immersion sheath according to DIN 43762, 6 mm (0.24 in.) in diameter Type BF: Fixed insert Type OPE: Removable, type MMI. Stainless steel immersion sheath according to DIN 43762, 6 mm (0.24 in.) in diameter
Protective Sheath:	Stainless steel (AISI 316) Type B: Ø=9 mm (0.35 in.) x 1 mm (0.04 in.) Type BF: Ø=8 mm (0.31 in.) x 1 mm (0.04 in.) or Ø=9 mm (0.35 in.) x 1 mm (0.04 in.) Type OPE: Ø=9 mm (0.35 in.) x 1 mm (0.04 in.)
Mounting thread:	½-in. NPT or BSP thread. In addition, ¾-in. BSP for type B and BF Rated torque: max 50 Nm
Immersion length (standard):	200 mm (7.87 in.) to 2000 mm (78.7 in.). 500 mm (20 in.) as standard
Extension length:	80 mm (3.15 in.) or 145 mm (5.71 in.). Stainless steel (AISI 316) Type B: Ø=12 mm (0.47 in.) for 9 mm protective sheath Type BF: Ø=12 mm (0.47 in.) Type OPE: Ø=12 mm (0.47 in.)
Housing:	B and BF types: Form B connection head of light alloy according to DIN 43729, IP 65 protection, M20 cable gland Type OPE: EExdIIC Ex-Approved connection head of light alloy, IP65 protection. ½-in. NPT or BSP threads
Recommended measuring current:	Maximum 2 mA
Minimum distance from bottom of sensor to spot element:	50 mm (5.9 in.)
Designed according to:	IEC 751 and ATEX Directive 94/9/EC
Approvals:	B & BF: Det Norske Veritas, Bureau Veritas, Germanischer Lloyd. Intrinsically safe installations. OPE: ITS09ATEX46239X II 1/2 G Ex d IIC T4 (T _{amb} -40 to 100 °C) II 1/2 D Ex tD A20/21 IP66 T135 °C
Thermowell	
Thermowell:	16 mm (0.63 in.) outer diameter as standard, 21.3 mm (0.84 in.) optional. 3 mm (0.12 in.) wall thickness
Thermowell material:	Stainless steel (AISI 316)
Pressure:	Maximum 50 Bar

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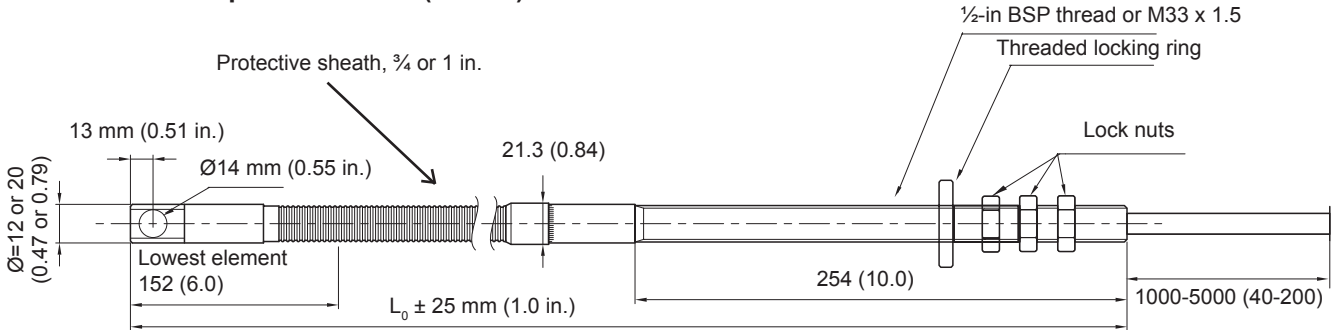
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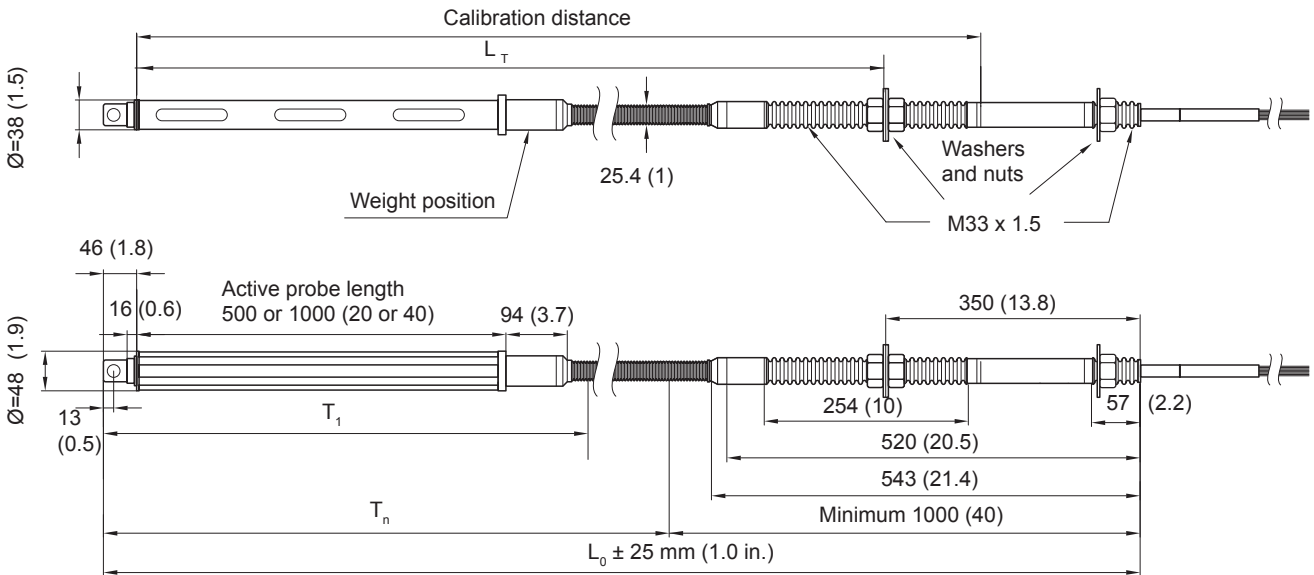
Temperature Sensors

Drawings - MST

Dimensions are specified in mm (inches).



Multiple spot temperature sensor in stainless steel - MST.



L = Distance from the top of the nozzle to the tank bottom.

L_T = Total length of the WLS and temperature sensor.

$L_0 = L_T + 350$ mm, where 350 = Distance from the top of the sensor to the lower thread.

Lowest temperature spot (T_1):

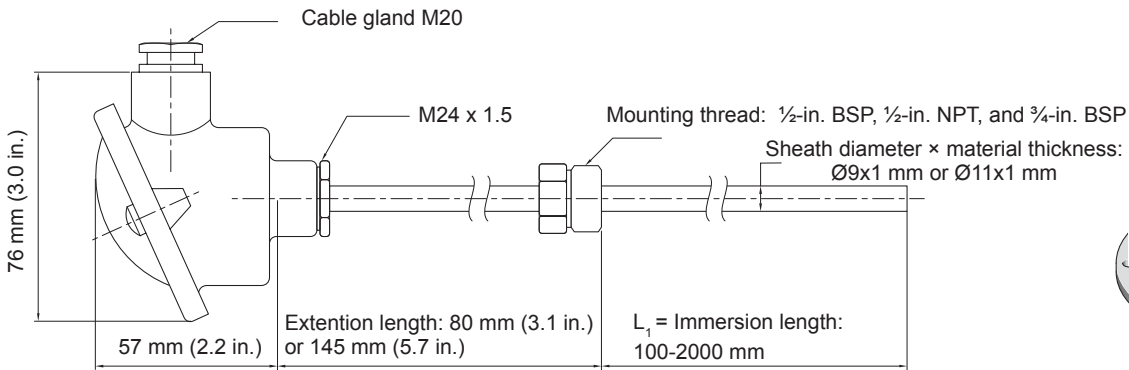
0.5–1.0 m above the tank bottom, minimum 300 mm (11.8 in.) from the eye bolt at the water level sensor to the first spot element.

Highest temperature spot: (T_n/T_{14})

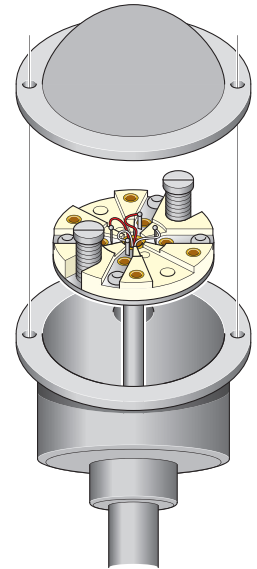
0.5–1.0 m below the maximum level, minimum 1000 mm (40 in.) from the top of the sensor.

Multiple spot temperature sensor with integrated, closed respectively open model, water level sensor.

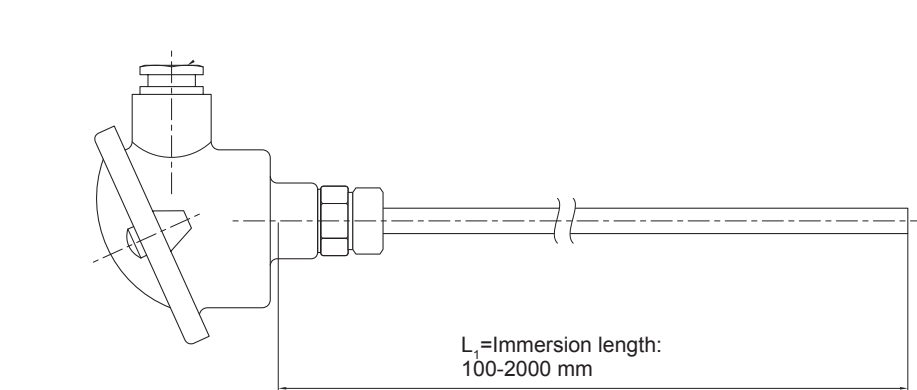
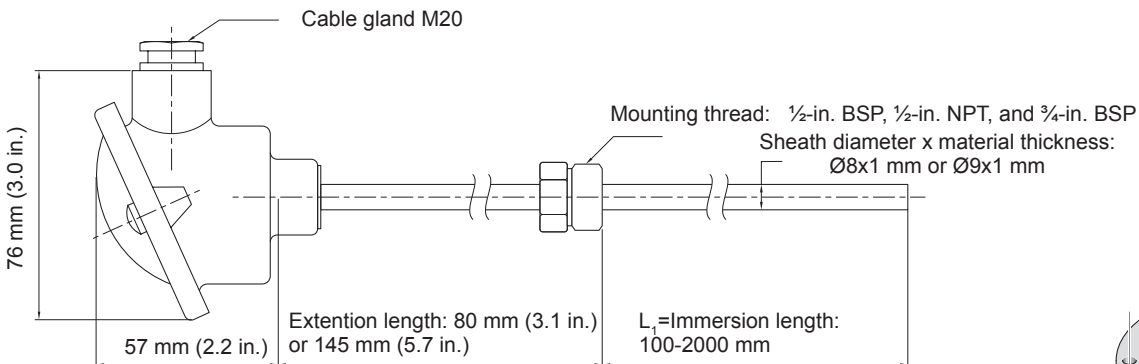
Temperature Sensors



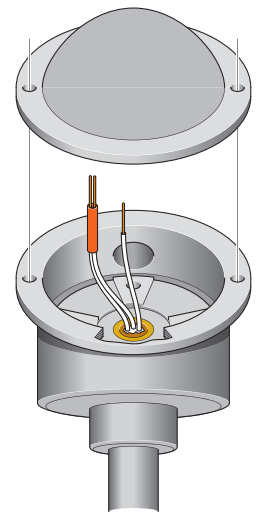
Single spot temperature sensor, type B, with extension length and removable insert.



Removable insert



Single spot temperature sensor, type BF, with/without extension length and fixed insert.

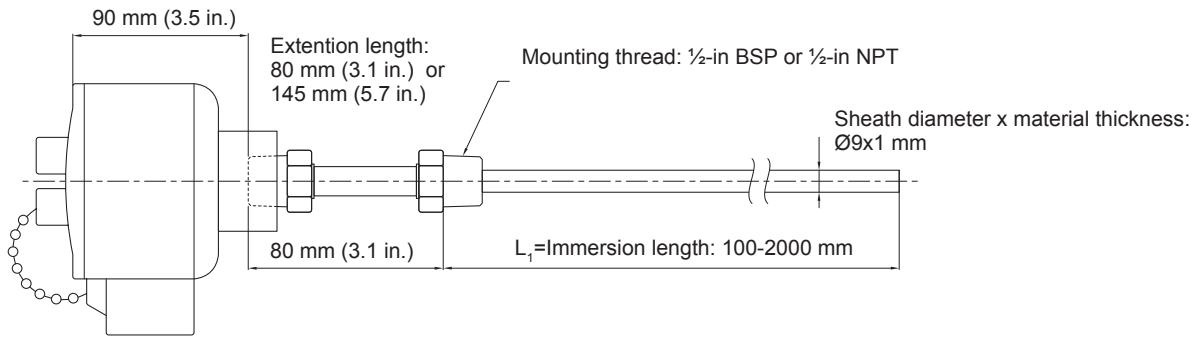


Fixed insert

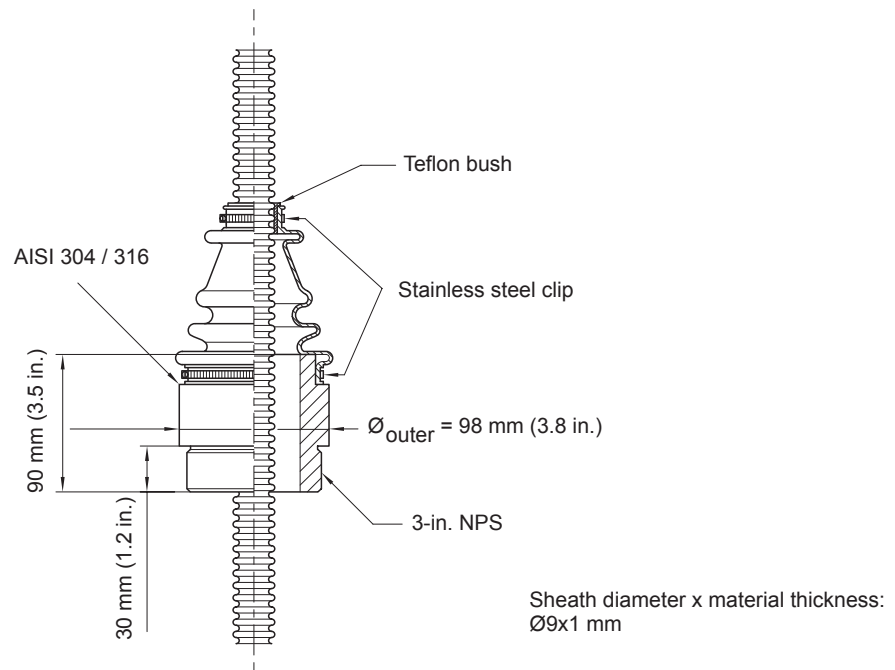
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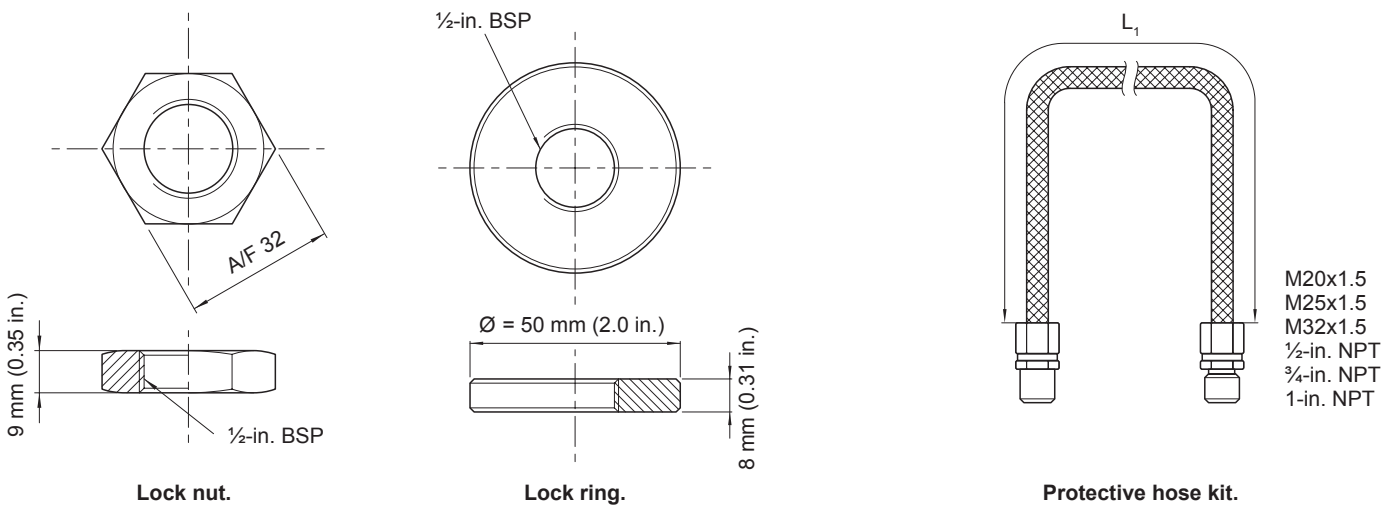
Temperature Sensors



Single spot temperature sensor, type OPE, with Ex-approved head, extension length and removable insert.



Multiple spot temperature sensor in vapor boot.



Temperature Sensors

Accessories

For a complete list of options, see “Ordering Information” on page 24.

Vapor boot

The vapor boot is used to guide and protect a sensor installed on a floating roof tank.



Anchor weights

Anchor weights are available from 2.5-15 kg (5-33 lbs), with different shapes, suitable for both free-hanging and still-pipe installations.



Protective hose kit

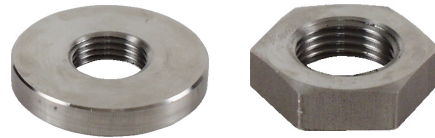
PVC and stainless steel (AISI 316)

A hose kit can be used for protection of the spot element wires. It is available in versions for different junction box connections. A hose kit is not used if the temperature sensor has an integrated junction box. The hose kit is delivered with teflon tape for sealing of the end connections, to ensure no moisture comes into contact with the wiring.



Lock rings and lock nuts

Lock rings and lock nuts are available in stainless steel (type AISI 316).

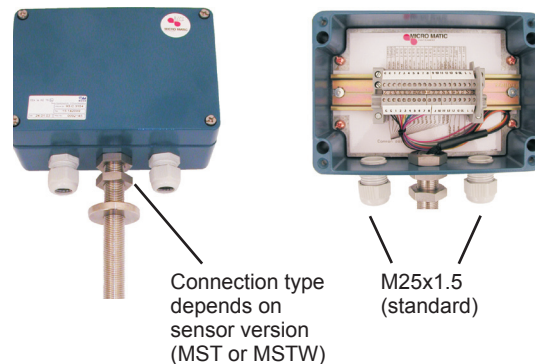


Junction boxes

A series of junction boxes, with housings made of epoxy coated aluminium, can be delivered with the Rosemount Tank Gauging system. These are used to connect various units such as the temperature sensors with the level gauges.

Junction box integrated with a temperature sensor or a water level sensor

There is a junction box available which is delivered pre-mounted at the top of the MST/MSTW sensor.



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Temperature Sensors

JB 36 and JB 42 for connection of temperature sensors

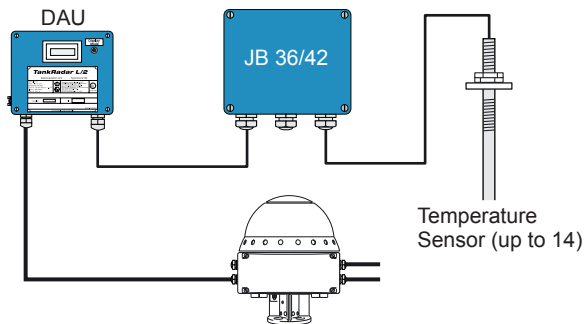
JB 36 and JB 42 are used for intrinsically safe connection of up to 14 temperature sensors to a Data Acquisition Unit (12 for JB 36 if 3-wire connection is used).

JB 36 and JB 42 have as standard three openings for M25 glands, suitable for 9-16 mm cable diameter.

There are two alternative connections of temperature sensors to the junction box:

- Connection via cable
- Direct connection

If the DAU is situated on the tank top, temperature sensors can be connected directly to the DAU.



Junction box for connection of temperature sensors via cable.

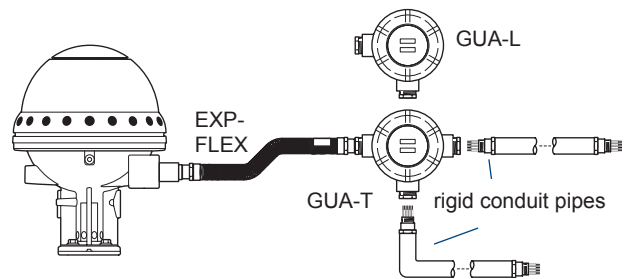
Junction boxes with conduit outlets



In the US, wires from the transmitter head must be enclosed in a protective steel braided hose.

Further connection to conduit pipes requires an explosion proof junction box with L or T-shaped outlets, both variants available with 12 or 15-pin terminal blocks for wiring.

The three-foot hose, EXP-FLEX, and junction boxes (GUA-L and GUA-T) can be supplied together with a level gauge.



Connection to rigid pipes via a junction box with conduit outlets.

Temperature Sensors

Ordering Information

If you require other options than listed in the Ordering Information, please consult your local Emerson / Rosemount Tank Gauging sales representative.

For the US and Canadian markets, see page 29.

Note: Spot element positions should be specified separately in Required System Information (RSI), document number GSP-2009-0002.

Single Spot Temperature (SST) Sensor

Pos	Item	Code	Description	Note
1	Resistance Thermometer Type	1	Type B, with extension length & removable insert	
		2	Type BF, with extension length & fixed insert	
		3	Type OPE, with EExdIIC head, extension length & removable insert	
2	Immersion Length	0500	500 mm (1.6 ft) as standard	
		0100-2000	Customized. Specify length in millimetres	
3	Sheath Dimension	A	Ø=8 mm (0.31 in.), 1 mm (0.04 in.) thickness ⁽¹⁾	Type BF only
		B	Ø=9 mm (0.35 in.), 1 mm (0.04 in.) thickness	
		C	Ø= 11 mm (0.43 in.), 1 mm (0.04 in.) thickness ^{(2) (3)}	Type B only
4	Extension Length	000	None ⁽⁴⁾	Type B, BF only
		080	80 mm (3.15 in.)	
		145	145 mm (5.71 in.) ⁽⁴⁾	Type B, BF only
5	Mounting Thread	1	½-in. BSP	Type B, BF only
		2	¾-in. BSP ^{(3) (4)}	Type B, BF only
		4	½-in. NPT	
6	Number of Wires	3	Three	
7	Number of Elements	1	1xPt	
		2	2xPt	
8	Element Type	P	Pt-100	
9	Temperature Accuracy Class	1	1/6 DIN ± 0.05 °C (± 0.09 °F)	
10	Temperature Range	1	-50 to +260 °C (-58 to +500 °F) ⁽⁴⁾	
		2	-50 to +400 °C (-58 to +752 °F)	
11	Cable Outlet	1	½-in. NPT ⁽⁵⁾	
		2	½-in. BSP ⁽⁵⁾	
		3	M20x1.5 ⁽⁴⁾	

- (1) Requires Pos 1 "Resistance Thermometer Type" code 2.
- (2) Requires Pos 1 "Resistance Thermometer Type" code 1.
- (3) Can not be combined with Thermowell.
- (4) Requires Pos 1 "Resistance Thermometer Type" code 1 or 2.
- (5) Requires Pos 1 "Resistance Thermometer Type" code 3.

Model Code Example: SST - 3 1500 B 080 4 3 1 1 1 2 1

Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos 7	Pos 8	Pos 9	Pos 10	Pos 11
3	1500	B	080	4	3	1	1	1	2	1

Note:
Stainless steel housing is available on request.

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Temperature Sensors

Thermowell for Single Spot Temperature Sensor (SSTW), pressurized tanks

Pos	Item	Code	Description	Note
1	Thermowell Length	0250-2000	Specify length in millimetres	Made of 316 SST
2	Thermowell Sheath Dimension	A	Ø=16 mm (0.63 in.), 3 mm (0.12 in.) thickness	
		B	Ø=21.3 mm (0.84 in.), 2.65 mm (0.10 in.) thickness	
3	Thermowell Flange Connection	1	1 ½ -in. ANSI 150 Psi	
		2	2-in. ANSI 150 Psi	
		3	1 ½ -in. ANSI 300 Psi	
		4	2-in. ANSI 300 Psi	
		5	DN50 / PN10 - PN16	
		6	DN50 / PN40	
4	Mounting Thread	1	½-in. NPT	
		2	½-in. BSP	

Model Code Example: SSTW - 1515 A 2 1

Pos 1	Pos 2	Pos 3	Pos 4
1515	A	2	1

Temperature Sensors

Multiple Spot Temperature (MST) Sensor

Pos	Item	Code	Description	Note
1	Overall Length, Temperature Sensor	05000-70000	Specify length in millimetres	
2	Sheath Type	A	1-in. AISI 316	
		B	Standard. ¾-in. AISI 316 ⁽¹⁾	
3	Connection Type	1	Threaded, ½-in. BSP	
		5	Flange, 1 ½-in. ANSI 150 psi	
		6	Flange, 2-in. ANSI 150 psi	
		7	Flange, 3-in. ANSI 150 psi	
		8	DN 100 / PN 10	
4	Temperature Sensor Wiring	3	3-wire, Individual	
		C	Common return	
5	Number of Temperature Spot Elements	01 to 14	Specify number	
6	Element Type	P	Pt-100	
7	Temperature Accuracy Class	1	1/6 DIN Class B	
		2	1/10 DIN Class B	
8	Temperature Range	1	- 50 to +120 °C (-58 to +248 °F)	
		2	-20 to +250 °C (-4 to +482 °F)	
9	Lead Wire, Temperature Sensor	01	500 mm (1.6 ft) for Junction Box connection	
		03	Standard. 3 m (10 ft)	
		04 to 10	Specify other length in metres	Max 10 m (33 ft) is recommended
10	Anchor Weight	0	None	
		A	2.5 kg (5.5 lbs), Ø= 40 mm (1.6 in.), 200 mm (7.9 in.) height	For still-pipes
		B	3 kg (6.6 lbs), Ø= 50 mm (2.0 in.), 200 mm (7.9 in.) height	For still-pipes
		C	4 kg (8.8 lbs), Ø= 45 mm (1.8 in.), 330 mm (13.0 in.) height	For still-pipes
		D	5 kg (11 lbs), Ø= 100 mm (3.9 in.), 85 mm (3.3 in.) height	For free-hanging
		E	10 kg (22 lbs), Ø= 95 mm (3.7 in.), 175 mm (6.9 in.) height	For free-hanging
11	Junction Box	0	None	
		1	Junction Box integrated with temperature sensor ⁽²⁾	198x138x90 mm (7.8x5.4x3.5 in.)
		3	JB 42	277x227x110 mm (10.9x8.9x4.3 in.)
12 a	Hose Kit	0	None	
		A	Hose kit including glands, 3 m (10 ft) as standard	
		B	Hose kit including glands, 10 m (33 ft)	
12 b	Hose Kit Connection	0	None	
		1	M20 x 1.5	
		2	M25 x 1.5	
		3	M32 x 1.5	
		4	½-in. NPT	
		5	¾-in. NPT	
13	Vapor Boot	0	None	
		1	Vapor boot for a 2-in. NPS threaded tank connection	
		2	Vapor boot for a 3-in. NPS threaded tank connection	
		3	Vapor boot, which fits a 3-in. ANSI 150 psi flange	
		4	Vapor boot, which fits a 4-in. ANSI 150 psi flange	
		6	Vapor boot, which fits a 6-in. ANSI 150 psi flange	
		8	Vapor boot, which fits an 8-in. ANSI 150 psi flange	

(1) Requires Pos 4 "Temperature Sensor Wiring" code C (common return) for more than 8 spot elements.

(2) Requires Pos 9 "Lead Wire, Temperature Sensor" code 01.

Model Code Example: MST - 18000 A 1 C 06 P 1 1 01 E 1 0 0 0

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Temperature Sensors

Multiple Spot Temperature Sensor for cryogenic use (NL-Cryo)

Pos	Item	Code	Description	Note
1	Overall Length, Temperature Sensor	05000-70000	Specify length in millimetres	
2	Sheath Type	A	1-in. AISI 316	
		B	Standard. ¾-in. AISI 316	
3	Connection Type	A	M33x1.5 with flange, 2-in. ANSI 150 psi	
		B	M33x1.5 with flange, 2-in. ANSI 300 psi	
		C	M33x1.5 with flange, 3-in. ANSI 300 psi	
4	Temperature Sensor Wiring	3	3-wire, Individual	Maximum 6 spot elements
		C	Common return	Maximum 16 spot elements
5	Number of Temperature Spot Elements	01 to 14	Specify number	
6	Element Type	P	Pt-100	
7	Temperature Accuracy Class	A	DIN Class A	
8	Temperature Range	3	-170 to +100 °C (-274 to +212 °F)	
9	Lead Wire, Temperature Sensor	01	500 mm (1.6 ft) for Junction Box connection	
		03	Standard. 3 m (10 ft)	
		04 to 10	Specify other length in metres	Max 10 m (33 ft) is recommended
10	Anchor Weight	0	None	
		A	2.5 kg (5.5 lbs), Ø= 40 x 200 mm (1.6 x 7.9 in.)	For still-pipes
		B	3 kg (6.6 lbs), Ø= 50 x 200 mm (2.0 x 7.9 in.)	For still-pipes
		C	4 kg (8.8 lbs), Ø= 45 x 330 mm (1.8 x 13.0 in.)	For still-pipes
		D	5 kg (11 lbs), Ø= 100 x 85 mm (3.9 x 3.3 in.)	For free-hanging
		E	10 kg (22 lbs), Ø= 95 x 175 mm (3.7 x 6.9 in.)	For free-hanging
11	Junction Box	0	None	
		1	Junction Box integrated with temperature sensor ⁽¹⁾	198x138x90 mm (7.8x5.4x3.5 in.)
		3	JB 42	277x227x110 mm (10.9x8.9x4.3 in.)
12 a	Hose Kit	0	None	
		A	Hose kit including glands, 3 m (10 ft) as standard	
		B	Hose kit including glands, 10 m (33 ft)	
12 b	Hose Kit Connection	0	None	
		1	M20 x 1.5	
		2	M25 x 1.5	
		3	M32 x 1.5	
		4	½-in. NPT	
		5	¾-in. NPT	
13	Drain Nipple	0	None	
		9	Drain nipple on flange	

(1) Requires Pos 9 "Lead Wire, Temperature Sensor" code 01. Can have up to 6 spots with 3-wire return, or 14 spots with common return.

Model Code Example: NL-Cryo - 45000 A A C 14 P A 3 01 E 1 A 1 0

Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos 7	Pos 8	Pos 9	Pos 10	Pos 11	Pos 12 a	Pos 12 b	Pos 13
45000	A	A	C	14	P	A	3	01	E	1	A	1	0

Temperature Sensors

Water Level Sensor Integrated with Multiple Spot Temperature Sensor (MSTW)

Pos	Item	Code	Description	Note
1	Overall Length, Temperature Sensor	05000-70000	Specify length in millimetres	
2	Sheath Type	A	1-in. AISI 316	
3	Top Connection Type	4	M33x1.5	
		5	Flange, 1 ½-in. ANSI 150 psi	
		6	Flange, 2-in. ANSI 150 psi	
		7	Flange, 3-in. ANSI 150 psi	
		8	DN 100 / PN 10	
4	Temperature Sensor Wiring	3	3-wire, Individual	
		C	Common return	
5	Number of Temperature Spot Elements	00	No temperature sensor – Water Level Sensor only	
		01 to 14	Specify number	
6	Element Type	0	None	
		P	Pt-100	
7	Temperature Accuracy Class	0	None	
		1	1/6 DIN Class B	
		2	1/10 DIN Class B	
8	Temperature Range	0	None	
		1	- 50 to +120 °C (-58 to +248 °F)	
9	Lead Wire, Temperature Sensor / WLS	01	500 mm (1.6 ft) for Junction Box connection	
		03	Standard. 3 m (10 ft)	
		04 to 10	Specify other length in metres	Max 10 m (33 ft) is recommended
10	Anchor Weight	0	None	
		D	5 kg (11 lbs), Ø=100x85 mm (3.9 x 3.3 in.)	For free-hanging installation
		E	10 kg (22 lbs), Ø=95x175 mm (3.7 x 6.9 in.)	For free-hanging installation
		X	Customized	
11	Junction Box	0	None	
		1	Junction Box integrated with temperature sensor ⁽¹⁾	198x138x90 mm (7.8x5.4x3.5 in.)
		3	JB 42	277x227x110 mm (10.9x8.9x4.3 in.)
12 a	Hose Kit	0	None	
		A	Hose kit including glands, 3 m (10 ft) as standard	
		B	Hose kit including glands, 10 m (33 ft)	
12 b	Hose Kit Connection	0	None	
		1	M20 x 1.5	
		2	M25 x 1.5	
		3	M32 x 1.5	
		4	½-in. NPT	
		5	¾-in. NPT	
13	Vapor Boot	0	None	
		1	Vapor boot for a 2-in. NPS threaded tank connection	
		2	Vapor boot for a 3-in. NPS threaded tank connection	
		3	Vapor boot, which fits a 3-in. ANSI 150 psi flange	
		4	Vapor boot, which fits a 4-in. ANSI 150 psi flange	
		6	Vapor boot, which fits a 6-in. ANSI 150 psi flange	
		8	Vapor boot, which fits an 8-in. ANSI 150 psi flange	
14	Water Level Sensor	C05	Closed; for light products, 500 mm (19.7 in.) range	
		C10	Closed; for light products, 1000 mm (39.4 in.) range	
		H05	Open; for heavy products, 500 mm (19.7 in.) range	
		H10	Open; for heavy products, 1000 mm (39.4 in.) range	
15	Water Level Sensor, Top Weight	0	None	
		T	5 kg (11 lbs)	

(1) Requires Pos 9 "Lead Wire, Temperature Sensor" code 01. Can have up to 10 spots with 3-wire return, or 14 spots with common return.

Model Code Example: MSTW - 21000 A 4 C 06 P 1 1 03 D 0 A 1 0 C05 T

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Temperature Sensors

Temperature and Water Level Sensors for the US and Canada

Single Spot Temperature Sensor for the US and Canada (SSTUS)

Pos	Item	Code	Description	Note
1	Resistance Thermometer Type	3	Type OPE, with Ex head and extension length plus fixed insert. Standard.	
2	Immersion Length	U036	36 in.	
		U008-U080	Customized. Specify length in even inches only	
3	Sheath Dimension	D	Ø=0.24 in.	
4	Extension Length	080	3.15 in.	
		145	5.71 in.	
5	Mounting Thread	4	½-in. NPT	
6	Number of Wires	3	Three	
7	Number of Elements	1	1xPt	
		2	2xPt	
8	Element Type	P	Pt-100	
9	Temperature Accuracy Class	1	1/6 DIN ± 0.09 °F	
10	Temperature Range	4	-58 to +932 °F	
11	Cable Outlet	1	½-in. NPT	

Model Code Example: SSTUS - 3 U036 D 080 4 3 1 P 1 4 1

Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos 7	Pos 8	Pos 9	Pos 10	Pos 11
3	U036	D	080	4	3	1	P	1	4	1

Thermowell for Single Spot Temperature Sensor, pressurized tanks, for the US and Canada (SSTWUS)

Pos	Item	Code	Description	Note
1	Thermowell Length	U008-U080	Specify length in even inches only	Made of 316 SST
2	Thermowell Sheath Dimension	B	Ø=0.84 in, 0.10 in. thickness	
3	Thermowell Flange Connection	1	1 ½-in. ANSI 150 Psi	
		2	2-in. ANSI 150 Psi	
		3	1 ½-in. ANSI 300 Psi	
		4	2-in. ANSI 300 Psi	
		5	DN50 / PN10 - PN16	
		6	DN50 / PN40	
		7	1-in. NPT	
4	Mounting Thread	1	½-in. NPT	

Model Code Example: SSTWUS - U036 B 2 1

Pos 1	Pos 2	Pos 3	Pos 4
U036	B	2	1

Temperature Sensors

Multiple Spot Temperature Sensor for the US and Canada (MSTUS)

Pos	Item	Code	Description	Note
1	Overall Length, Temperature Sensor	U0038- U2756	Specify length in even inches only	
2	Sheath Type	A	1-in. AISI 316	
		B	¾-in. AISI 316 ⁽¹⁾	
3	Connection Type	A	Threaded, ¾-in. NPS	
		5	Flange, 1 ½-in. ANSI 150 psi	
		6	Flange, 2-in. ANSI 150 psi	
		7	Flange, 3-in. ANSI 150 psi	
		C	Flange, 4-in. ANSI 150 psi	
		D	Flange, 6-in. ANSI 150 psi	
		E	Flange, 8-in. ANSI 150 psi	
		F	Flange, 10-in. ANSI 150 psi	
4	Temperature Sensor Wiring	3	3-wire, individual	
		C	Common return	
5	Number of Temperature Spot Elements	01 to 14	Specify number	
6	Element Type	P	Pt-100	
7	Temperature Accuracy Class	1	1/6 DIN Class B	
		2	1/10 DIN Class B	
8	Temperature Range ⁽²⁾	1	-58 to +248 °F	
		2	-4 to +482 °F	
9	Lead Wire, Temperature Sensor	01	1.6 ft for Junction Box connection	
		03	Standard. 10 ft	
		13 to 33	Specify other length in even feet only	Maximum 33 ft is recommended
10	Anchor Weight	00	None	
		01	5 lbs, for still-pipes and 2 in. openings	
		02	20 lbs, for still-pipes and 2 in. openings	
		03	30 lbs, for still-pipes and 2 in. openings	
		04	6 lbs (Ø=2 in.), for free-hanging	
		05	11 lbs (Ø=3.9 in.), for free-hanging	
		06	22 lbs (Ø=3.7 in.), for free-hanging	
		07	33 lbs (Ø=5.5 in.), for free-hanging	
11	Junction Box	0	None	
		4	Junction Box integrated with temperature sensor ⁽³⁾	
12	Hose Kit	00	None	
13	Vapor Boot	0	None	
		1	Vapor boot for a 2-in. NPS threaded tank connection	
		2	Vapor boot for a 3-in. NPS threaded tank connection	
		3	Vapor boot, which fits a 3-in. ANSI 150 psi flange	
		4	Vapor boot, which fits a 4-in. ANSI 150 psi flange	
		6	Vapor boot, which fits a 6-in. ANSI 150 psi flange	
		8	Vapor boot, which fits an 8-in. ANSI 150 psi flange	

(1) Requires Pos 4 "Temperature Sensor Wiring" code C (common return) for more than 8 spot elements.

(2) Version available for -274 to +212 °F. This temperature sensor (NL-Cryo) is specified separately, see page 27.

(3) Requires Pos 9 "Lead Wire, Temperature Sensor" code 01. Can have up to 11 spots with 3-wire return, or 14 spots with common return

Model Code Example: MSTUS - U0480 B 5 C 06 P 1 2 01 06 4 00 0

Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos 7	Pos 8	Pos 9	Pos 10	Pos 11	Pos 12	Pos 13
U0480	B	5	C	06	P	1	2	01	06	4	00	0

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Temperature Sensors

Water Level Sensor Integrated with Multiple Spot Temperature Sensor for the US and Canada (MSTWUS)

Pos	Item	Code	Description	Note
1	Overall Length, Temperature Sensor	U0038-U2756	Specify length in even inches only	
2	Sheath Type	A	1-in. AISI 316	Maximum 20 spot elements
3	Top Connection Type	5	Flange, 1 ½-in. ANSI 150 psi	
		6	Flange, 2-in. ANSI 150 psi	
		7	Flange, 3-in. ANSI 150 psi	
		C	Flange, 4-in. ANSI 150 psi	
		D	Flange, 6-in. ANSI 150 psi	
		E	Flange, 8-in. ANSI 150 psi	
		F	Flange, 10-in. ANSI 150 psi	
4	Temperature Sensor Wiring	3	3-wire, Individual	
		C	Common return	
5	Number of Temperature Spot Elements	00	No temperature sensor – Water Level Sensor (WLS) only	
		01 to 14	Specify number	
6	Element Type	P	Pt-100	
7	Temperature Accuracy Class	1	1/6 DIN Class B	
		2	1/10 DIN Class B	
8	Temperature Range	1	-58 to +248 °F	
9	Lead Wire, Temperature Sensor	01	1.6 ft for Junction Box connection	
		03	Standard. 10 ft	
		13 to 33	Specify other length in even feet only	Maximum 33 ft is recommended
10	Anchor Weight	00	None	
		01	5 lbs, for still-pipes and 2-in. openings	
		04	6 lbs (Ø=2 in.), for free-hanging	
		05	11 lbs (Ø=3.9 in.), for free-hanging	
11	Junction Box	0	None	
		4	Junction Box integrated with temperature sensor ⁽¹⁾	
12	Hose Kit	00	None	
13	Vapor Boot	0	None	
		1	Vapor boot for a 2-in. NPS threaded tank connection	
		2	Vapor boot for a 3-in. NPS threaded tank connection	
		3	Vapor boot, which fits a 3-in. ANSI 150 psi flange	
		4	Vapor boot, which fits a 4-in. ANSI 150 psi flange	
		5	Vapor boot, which fits a 6-in. ANSI 150 psi flange	
		6	Vapor boot, which fits a 8-in. ANSI 150 psi flange	
14	Water Level Sensor (integrated)	C05	Closed; for light products, 19.7 in. range	
		C10	Closed; for light products, 39.4 in. range	
		H05	Open; for heavy products, 19.7 in. range	
		H10	Open; for heavy products, 39.4 in. range	
15	Water Level Sensor, Top Weight	0	None	
		1	10 lbs	

(1) Requires Pos 9 "Lead Wire, Temperature Sensor" code 01. US version for up to 10 spots with 3-wire return + WLS, or 14 spots with common return + WLS.

Model Code Example: MSTWUS - U0480 A 5 C 06 P 1 1 01 00 4 00 0 C05 1

Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos 7	Pos 8	Pos 9	Pos 10	Pos 11	Pos 12	Pos 13	Pos 14	Pos 15
U0480	A	5	C	06	P	1	1	01	00	4	00	0	C05	1

Temperature Sensors

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Temperature Sensors

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Emerson Process Management
Rosemount Tank Gauging
Box 13045
S-402 51 Göteborg
SWEDEN

Phone: +46 31 337 00 00
Fax: +46 31 25 30 22
E-mail: sales.rtg@Emerson.com
www.rosemount-tg.com

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