Product Data Sheet
October 2014
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Rosemount 565/566/765 Multiple Spot Temperature and Water Level Sensors

for tank gauging systems

- Get custody transfer net volume accuracy with 3- or 4-wire multiple spot temperature sensors for bulk liquid storage tanks
- Improve accuracy with unique sensor calibration
- Measure liquid temperature with up to 16 spot elements
- Combine with integrated water level sensor measurement
- Include specialized sensor for cryogenic tank temperature measurement in LNG applications
- Select from a wide range of accessories such as anchor weights and vapor boots

ROSEMOUNT

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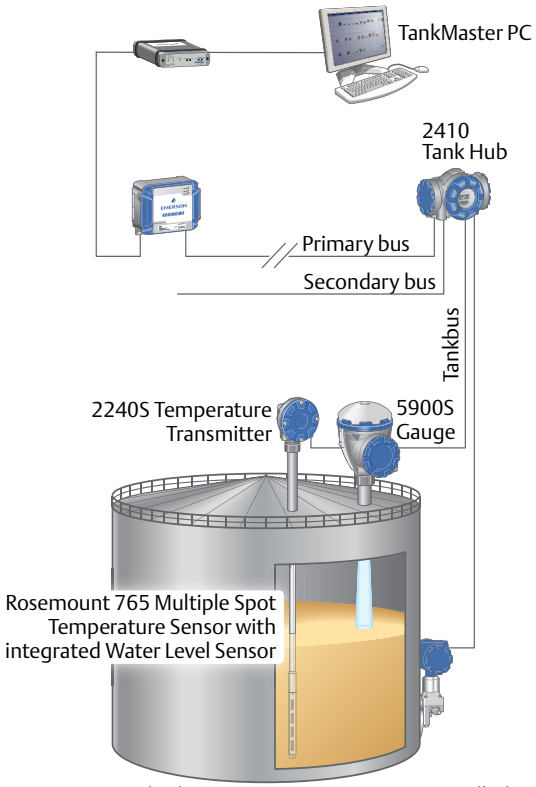
Multiple Spot Temperature and Water Level Sensors for highly accurate volume measurement



Rosemount 765 Multiple Spot Temperature Sensor installed together with a Rosemount 2240S Multi-input Temperature Transmitter, in a Tank Gauging System

Calibration station for accurate state-of-the-art sensor elements

Measure precise product temperature for custody transfer and inventory measurement in bulk liquid storage tanks.

The highly accurate 3- or 4-wire multiple spot temperature sensors in Rosemount Tank Gauging System measure liquid temperature with up to 16 spot elements.

Available versions are:

- Rosemount 565 Multiple Spot Temperature Sensor
- Rosemount 566 Multiple Spot Temperature Sensor for Cryogenic Applications such as LNG
- Rosemount 765 Multiple Spot Temperature Sensor with integrated Water Level Sensor

The multiple spot temperature sensor, with an optional integrated water level sensor, is connected to a 2240S Multi-input Temperature Transmitter. The measured values are distributed to the TankMaster Inventory Software or a DCS/host system via the 2410 Tank Hub.

New features with 4-wire connection

- Further improved accuracy
- True compensation for wiring resistance
- Use unique calibration process for individual sensor elements to get highest net volume accuracy

Contents

Rosemount 565 Multiple Spot Temperature Sensor

- Measures temperature with one to sixteen Pt-100 spot elements placed at different heights to provide a tank temperature profile and an average temperature.
- The calculated average liquid temperature, based on fully immersed elements, is used as an input for accurate volume calculations in storage tanks.

The temperature sensor is easily installed on the tank nozzle, and is then connected either directly to the 2240S multi-input temperature transmitter or via cable. The 565 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 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 fixed to the bottom, to keep the sensor vertical, and avoid floating when the tank is filled.

Rosemount 565 is designed for atmospheric tanks up to 0.5 Bar (7.3 psi). For pressurized tanks it must be installed in a closed thermowell, enabling service or inspection while the tank is in operation.

Rosemount 566 Temperature Sensor for Cryogenic Applications

- Equipped with type A elements, suitable for low temperatures.
- Used for measurements in LNG tanks and other low temperature applications.

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.

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.).

Rosemount 765 Multiple Spot Temperature Sensor with integrated Water Level Sensor

- Continuously measures free water level below the oil surface and provides an input for on-line net inventory calculations.
- Available in two versions, open and closed. The open version is suitable for crude oil applications and the closed version is suitable for lighter fuels such as diesel oil etc.

The integrated multiple spot temperature sensor is Rosemount 565 (see "Rosemount 565 Multiple Spot Temperature Sensor" on page 3).

The 765 sensor is hung vertically from the top of the tank, and the position/length is chosen according to the actual bottom water range. It should be anchored to the tank bottom to ensure a fixed position in case of turbulence.

One of the Pt-100 temperature sensor elements can be installed inside the water level probe allowing temperature measurements at low levels.

The water level sensor delivers a digital signal, and is connected to the Rosemount 2240S Multi-input Temperature Transmitter.

Rosemount 765 is delivered in a stainless steel (AISI 316) housing, welded to the flexible temperature sensor tube to get a hermetic design. It has a heavy duty design with no moving parts.

Offset calibration can be done with an integrated calibration feature in the 2240S transmitter.

The 765 Water Level Sensor open version, suitable for crude oil applications

Ordering Information

Rosemount 565 Multiple Spot Temperature Sensor

- Custody transfer accuracy
- Highest reliability
- Rugged design for harsh environments
- Wide range of accessories such as anchor weights and vapor boots
- Version with integrated water level sensor is available, see page 10

Additional information
Specifications: page 13
Certifications: page 20
Dimensional Drawings: page 22

Table 1. Rosemount 565 Multiple Spot Temperature Sensor ordering information

Model	Product Description
0565	Multiple Spot Temperature Sensor
Overall Length (L_0)	
Mxxxxx	Metric units, xxxxx in millimeters (mm). Range: 02000-70000 (Specify in steps of 10 mm. Longer on request)
Exxxxx	U.S. units, xxxxx in inches (in.). Range 00400-02700 (Longer on request)
Sheath Type	
A	1 in. AISI 316 SST
Tank Connection	
ANSI Flanges (SST AISI 316) - Raised Face	
A	1 ½-in. Class 150
B	1 ½-in. Class 300
C	2 in. Class 150
D	2 in. Class 300
E	3 in. Class 150
F	3 in. Class 300
G	4 in. Class 150
H	4 in. Class 300
EN Flanges (SST AISI 316) - Raised Face	
1	DN 50 PN 16
2	DN 50 PN 40
3	DN 65 PN 16
4	DN 65 PN 40

Table 1. Rosemount 565 Multiple Spot Temperature Sensor ordering information

5	DN 80 PN 16
6	DN 80 PN 40
7	DN 100 PN 16
Threaded Connection	
0	M33x1.5
Temperature Sensor Wiring	
4	4-wire
3	3-wire, individual
C	3-wire, common return
Number of Temperature Spot Elements	
01 to 16	Specify number
Element Type	
P	Pt-100
Performance Class	
2[(1)]	1/10 DIN Class B (IEC/EN60751)
1	1/6 DIN Class B (IEC/EN60751)
Temperature Range	
1	-50 to +120 °C (-58 to +248 °F)
2	-20 to +250 °C (-4 to +482 °F)
Lead Wires, Temperature Sensor	
00	For integrated installation with Rosemount 2240S (standard)
04-10	Specify other length in metres
13-33	Specify other length in feet
Options – none or multiple selections are possible. Specify in the same order as listed below	
Certificate	
Q4	Calibration certificate (Requires option Sensor Calibration code X4, X5, X6, X7 or X8)
Q8	Material certificate EN10204 3.1
Stabilization Weights (SST AISI 304)[(2)]	
AA[(3)]	Anchor weight. 2.0 kg (4.4 lbs), Ø= 40x200 mm (Ø=1.6 x 7.9 in.)
AB[(3)]	Anchor weight. 3 kg (6.6 lbs), Ø= 50x200 mm (Ø=2.0 x 7.9 in.)
AC[(3)]	Anchor weight. 4 kg (8.8 lbs), Ø= 45x330 mm (Ø=1.8 x 13.0 in.)
AD[(4)]	Anchor weight. 5 kg (11 lbs), Ø= 100x85 mm (Ø=3.9 x 3.3 in.)
AE[(4)]	Anchor weight. 10 kg (22 lbs), Ø= 95x175 mm height (Ø=3.7 x 6.9 in.)
AF[(4)]	Anchor weight. 15 kg (33 lbs), Ø= 140x130 mm (Ø=5.5 x 5.1 in.)
AP[(5)]	Anchor weight. 3 kg (6.6 lbs), Ø= 48.5x270 mm (1.9 x 10.6 in.)
AR[(5)]	Anchor weight. 6 kg (13.2 lbs), Ø= 48.5x570 mm (1.9 x 22.4 in.)

Table 1. Rosemount 565 Multiple Spot Temperature Sensor ordering information

AS[5]	Anchor weight. 9 kg (19.8 lbs), Ø= 48.5x870 mm (1.9 x 34.3 in.)
AT[5]	Anchor weight. 12 kg (26.4 lbs), Ø= 48.5x1170 mm (1.9 x 46.1 in.)
AU[5]	Anchor weight. 15 kg (33.1 lbs), Ø= 48.5x1470 mm (1.9 x 57.9 in.)
Vapor Boot[2]	
VA	Vapor boot with a 2-in. NPS threaded tank connection
VB	Vapor boot with a 3-in. NPS threaded tank connection
VC	Vapor boot for a 3-in. ANSI Class 150 flange
VD	Vapor boot for a 4-in. ANSI Class 150 flange
VE	Vapor boot for a 6-in. ANSI Class 150 flange
VF	Vapor boot for an 8-in. ANSI Class 150 flange
Hose Kit[2]	
HA	Hose kit including glands, 3 m (10 ft), ½-in. 14 NPT connection, (PVC, galvanized steel and nickel plated brass material)
HB	Hose kit including glands, 10 m (33 ft), ½-in. 14 NPT connection, (PVC, galvanized steel and nickel plated brass material)
Adapters	
IA[6]	Adapter M33x1.5 female to 1 in. NPT male (connecting 565 to hose, drawing number: 304-1708)
IB[6]	Adapter 1 in. NPT female to M33x1.5 male (connecting hose to remote 2240S, drawing number: 304-1709)
Sensor Calibration	
X4[7]	Sensor calibration at 0 °C (+32 °F)
X5[7]	Sensor calibration at +40 °C (+104 °F)
X6[7]	Sensor calibration at +80 °C (+176 °F)
X7[7]	Sensor calibration at 0 and +80 °C (+32 and +176 °F)
X8[7]	Sensor calibration at 0, +40 and +80 °C (+32, +104 and +176 °F), with 0, A and B Callendar-Van Dusen constants
Typical Model Number: 0565 M25000 A 0 4 16 P 2 2 00 Q8 AE VE - temperature sensor positions[8]	

(1) Temperature Sensor Wiring code 4 (4-wire) is required.

(2) Mutually exclusive options under this category.

(3) For still-pipes.

(4) For free-hanging.

(5) Installed in section(s) around sensor hose.

(6) Both adapters, IA and IB, are needed.

(7) Requires Temperature Sensor Wiring code 4 and option Certificate code Q4.

(8) Temperature sensor positions are specified in the Rosemount Tank Gauging System Configuration Data Sheet.

Rosemount 566 Multiple Spot Temperature Sensor for Cryogenic Use (NL-Cryo)

- Custody transfer accuracy
- Highest reliability
- Rugged design for harsh environments
- Equipped with type A elements, suitable for low temperatures
- Supplied with a non-adjustable flange

Additional information
Specifications: page 13
Certifications: page 20
Dimensional Drawings: page 22

Table 2. Rosemount 566 Multiple Spot Temperature Sensor for Cryogenic Use (NL-Cryo) ordering information

Model	Product Description
0566	Multiple Spot Temperature Sensor for Cryogenic Applications
Overall Length (L_0)	
Mxxxxx	Metric units, xxxxx in millimeters (mm). Range: 02000-70000 (Specify in steps of 10 mm. Longer on request)
Exxxxx	U.S. units, xxxxx in inches (in.). Range 00400-02700 (Longer on request)
Sheath Type	
A	1-in. AISI 316
Tank Connection	
ANSI Flanges (SST AISI 316) - Raised Face	
A	1 ½-in. Class 150
B	1 ½-in. Class 300
C	2 in. Class 150
D	2 in. Class 300
E	3 in. Class 150
F	3 in. Class 300
G	4 in. Class 150
H	4 in. Class 300
EN Flanges (SST AISI 316) - Raised Face	
1	DN 50 PN 16
2	DN 50 PN 40
3	DN 65 PN 16
4	DN 65 PN 40
5	DN 80 PN 16
6	DN 80 PN 40

Table 2. Rosemount 566 Multiple Spot Temperature Sensor for Cryogenic Use (NL-Cryo) ordering information

7	DN 100 PN 16
Temperature Sensor Wiring	
4	4-wire (max. 4 spot elements)
3	3-wire, individual (max. 6 spot elements)
C	3-wire, common return
Number of Temperature Spot Elements	
01 to 16[1]	Specify number
Element Type	
P	Pt-100
Temperature Accuracy Class	
A	DIN Class A (IEC/EN60751)
Temperature Range	
3	-170 to +100 °C (-274 to +212 °F)
Lead Wires, Temperature Sensor	
00	Integrated installation with Rosemount 2240S (standard)
04-10	Specify other length in metres
13-33	Specify other length in feet
Options – none or multiple selections are possible. Specify in the same order as listed below	
Certificate	
Q4	Calibration certificate (Requires option Sensor Calibration code X4 or X8)
Q8	Material certificate EN 10204 3.1
Stabilization Weights (SST AISI 304)[2]	
AA[3]	Anchor weight. 2.0 kg (4.4 lbs), Ø= 40x200 mm (Ø=1.6x7.9 in.)
AB[3]	Anchor weight. 3 kg (6.6 lbs), Ø= 50x200 mm (Ø=2.0x7.9 in.)
AC[3]	Anchor weight. 4 kg (8.8 lbs), Ø= 45x330 mm (Ø=1.8x13.0 in.)
AD[4]	Anchor weight. 5 kg (11 lbs), Ø= 100x85 mm (Ø=3.9x3.3 in.)
AE[4]	Anchor weight. 10 kg (22 lbs), Ø= 95x175 mm height (Ø=3.7x6.9 in.)
AF[4]	Anchor weight. 15 kg (33 lbs), Ø= 140x130 mm (Ø=5.5x5.1 in.)
Hose Kit[2]	
HA	Hose kit including glands, 3 m (10 ft), ½-in. 14 NPT connection, (PVC, galvanized steel and nickel plated brass material)
HB	Hose kit including glands, 10 m (33 ft), ½-in. 14 NPT connection, (PVC, galvanized steel and nickel plated brass material)
Adapters	
IA[5]	Adapter M33x1.5 female to 1 in. NPT male (connecting 565 to hose, drawing number: 304-1708)
IB[5]	Adapter 1 in. NPT female to M33x1.5 male (connecting hose to remote 2240S, drawing number: 304-1709)

Table 2. Rosemount 566 Multiple Spot Temperature Sensor for Cryogenic Use (NL-Cryo) ordering information

Sensor Calibration	
X4[6]	Sensor calibration at 0 °C (+32 °F)
X8[6]	Sensor calibration at -195, -78, 0 and 100 °C (-319, -108,+32 and +212 °F), with 0, A, B and C Callendar-van Dusen constants
Other	
DN	Drain nipple on flange
Typical Model Number: **0566 M25000 A E 4 16 P A 3 00 Q8 AA DN - temperature sensor positions[7]**	

(1) Can have up to 16 spot elements for 3-wire common return, 6 spot elements for 3-wire individual return, and 4 spot elements for 4-wire individual return.

(2) Mutually exclusive options under this category.

(3) For still-pipes.

(4) For free-hanging.

(5) Both adapters, IA and IB, are needed.

(6) Requires Temperature Sensor Wiring code 4 (4-wire) and option Certificate code Q4.

(7) Temperature sensor positions are specified in the Rosemount Tank Gauging System Configuration Data Sheet.

Rosemount 765 Multiple Spot Temperature Sensor with Water Level Sensor

- Custody transfer accuracy
- Highest reliability
- Rugged design for harsh environments
- Close to bottom measurements
- Special crude version available

Additional information
Specifications: page 13
Certifications: page 20
Dimensional Drawings: page 22

Table 3. Rosemount 765 Multiple Spot Temperature Sensor with Water Level Sensor ordering information

Model	Product Description
0765	Multiple Spot Temperature Sensor with integrated Water Level Sensor
Overall Length (L_0)	
Mxxxxx	Metric units, xxxxx in millimeters (mm). Range: 02000-60000 (Specify in steps of 10 mm. Longer on request)
Exxxxx	U.S. units, xxxxx in inches (in.). Range 00400-02300 (Longer on request)
Sheath Type	
A	1-in. AISI 316
Tank Connection	
ANSI Flanges (SST AISI 316) - Raised Face	
A	1 ½-in. Class 150
B	1 ½-in. Class 300
C	2 in. Class 150
D	2 in. Class 300
E	3 in. Class 150
F	3 in. Class 300
G	4 in. Class 150
H	4 in. Class 300
EN Flanges (SST AISI 316) - Raised Face	
1	DN 50 PN 16
2	DN 50 PN 40
3	DN 65 PN 16
4	DN 65 PN 40
5	DN 80 PN 16
6	DN 80 PN 40

Table 3. Rosemount 765 Multiple Spot Temperature Sensor with Water Level Sensor ordering information

7	DN 100 PN 16
Threaded Connection	
0	M33x1.5
Temperature Sensor Wiring	
4	4-wire (max. 10 spot elements)
3	3-wire, individual (max. 14 spot elements)
C	3-wire, common return
Number of Temperature Spot Elements	
01 to 16[(1)]	Specify number
00	No temperature sensor - Water Level Sensor only
Element Type	
P	Pt-100
0	No temperature sensor - Water Level Sensor only
Temperature Accuracy Class	
2[(2)]	1/10 DIN Class B (IEC/EN60751)
1	1/6 DIN Class B (IEC/EN60751)
0	No temperature sensor - Water Level Sensor only
Temperature Range	
1	0 to +120 °C (+32 to +248 °F)
Lead Wires, Temperature Sensor	
00	Integrated installation with Rosemount 2240S (standard)
04-10	Specify other length in metres
10-33	Specify other length in feet
Water Level Sensor	
C05	Closed; suitable for light products. 500 mm (19 in.) range
C10	Closed; suitable for light products. 1000 mm (39 in.) range
H05	Open; suitable for crude and heavy duty products. 500 mm (19 in.) range
H10	Open; suitable for crude and heavy duty products. 1000 mm (39 in.) range
Options – none or multiple selections are possible. Specify in the same order as listed below	
Certificate	
QD	Water level sensor calibration certificate
Q4	Calibration certificate (Requires option Sensor Calibration code X4, X5, X6, X7 or X8)
Q8	Material certificate EN10204 3.1
Stabilization Weights (SST AISI 304)[(3)]	
AA	Anchor weight. 2.0 kg (4.4 lbs), Ø= 40x200 mm (Ø=1.6x7.9 in.) (For still-pipes)
AB	Anchor weight. 3 kg (6.6 lbs), Ø= 50x200 mm (Ø=2.0x7.9 in.) (For still-pipes)

Table 3. Rosemount 765 Multiple Spot Temperature Sensor with Water Level Sensor ordering information

AC	Anchor weight. 4 kg (8.8 lbs), Ø= 45x330 mm (Ø=1.8x13.0 in.) (For still-pipes)
AD	Anchor weight. 5 kg (11 lbs), Ø= 100x85 mm (Ø=3.9x3.3 in.) (For free-hanging)
AE	Anchor weight. 10 kg (22 lbs), Ø= 95x175 mm height (Ø=3.7x6.9 in.) (For free-hanging)
AF	Anchor weight. 15 kg (33 lbs), Ø= 140x130 mm (Ø=5.5x5.1 in.) (For free-hanging)
BA	Top weight, water level sensor, 5 kg (11 lbs), Ø= 79x165 mm (Ø=3.1x6.5 in.) (Inside hole Ø=42 mm (1.65 in.))
Vapor Boot(3)	
VA	Vapor boot with a 2-in. NPS threaded tank connection
VB	Vapor boot with a 3-in. NPS threaded tank connection
VC	Vapor boot for a 3-in. ANSI Class 150 flange
VD	Vapor boot for a 4-in. ANSI Class 150 flange
VE	Vapor boot for a 6-in. ANSI Class 150 flange
VF	Vapor boot for an 8-in. ANSI Class 150 flange
Hose Kit(3)	
HA	Hose kit including glands, 3 m (10 ft), ½-in. 14 NPT connection, (PVC, galvanized steel and nickel plated brass material)
HB	Hose kit including glands, 10 m (33 ft), ½-in. 14 NPT connection, (PVC, galvanized steel and nickel plated brass material)
Adapters	
IA(4)	Adapter M33x1.5 female to 1 in. NPT male (connecting 565 to hose, drawing number: 304-1708)
IB(4)	Adapter 1 in. NPT female to M33x1.5 male (connecting hose to remote 2240S, drawing number: 304-1709)
Sensor Calibration	
X4(5)	Sensor calibration at 0 °C (+32 °F)
X5(5)	Sensor calibration at +40 °C (+104 °F)
X6(5)	Sensor calibration at +80 °C (+176 °F)
X7(5)	Sensor calibration at 0 and +80 °C (+32 and +176 °F)
X8(5)	Sensor calibration at 0, +40 and +80 °C (+32, +104 and +176 °F), with 0, A and B Callendar-Van Dusen constants
Typical Model Number: **0765 M25000 A 3 4 10 P 2 1 00 C05 QD Q8 AA BA VC - temperature sensor positions**(6)	

(1) Can have up to 16 spot elements for 3-wire common return, 14 spot elements for 3-wire individual return, and 10 spot elements for 4-wire individual return.

(2) Temperature Sensor Wiring code 4 (4-wire) is recommended.

(3) Mutually exclusive options under this category.

(4) Both adapters, IA and IB, are needed.

(5) Requires Temperature Sensor Wiring code 4 and option Certificate code Q4.

(6) Temperature sensor positions are specified in Rosemount Tank Gauging System Configuration Data Sheet.

Specifications

Specifications Rosemount 565, 566, 765

Elements type
Pt-100 spot elements according to EN 60751,
3-wire or 4-wire design

Accuracy
1/6 DIN Class B (standard), 1/10 DIN Class B (option),
see diagram in Figure 1 on page 15
MST sensor for cryogenic use: DIN Class A
DIN Class A and B are specified in EN 60751

Liquid pressure range
0-4 Bar (0-58 Psi). Designed for atmospheric non-pressurized tanks. Handles liquid pressure from hydrocarbons and petrochemical products equivalent to a level of 40 m (130 ft).

Liquid temperature range
- -50 to +250 °C (-58 to +482 °F)
- -170 to +100 °C (-274 to +212 °F) for cryogenic use

Number of elements
Max. 16 spot elements, see Table 4 on page 14

Overall length
Standard is 5-70 m (16.4-230 ft). Maximum 60 m (197 ft) for Rosemount 765. Other lengths on request.

Protective sheath
Stainless steel, AISI 316. Wall thickness 0.3 mm (0.012 in.).
Ø= 1 in.

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 316).

Immersed material
Stainless steel (AISI 316)

Lead wire length
0.4 m (16 in.) is standard for integrated installation with 2240S Temperature Transmitter.
Longer wires up to 10 m (32.8 ft) are available as an option.

No of wires
- Three or four independent wires per element or
- Three wires with common return

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.)

Ingress protection
IP 68

Table 4. Number of elements (Rosemount 565, 566, 765)

Sensor Type[1]	Temperature Range	Conductors	Maximum Number of Spot Elements
Rosemount 565	-50 to +120 °C (-58 to +248 °F) or -20 to +250 °C (-4 to +482 °F)	3-wire, individual wiring[2]	16
		4-wire, individual wiring[2]	16
		3-wire, common return wiring[2]	16
Rosemount 566	-170 to +100 °C (-274 to +212 °F)	3-wire, individual wiring[2]	6
		4-wire, individual wiring[2]	4
		3-wire, common return wiring[2]	16
Rosemount 765	-50 to +120 °C (-58 to +248 °F)	3-wire, individual wiring[2]	14
		4-wire, individual wiring[2]	10
		3-wire, common return wiring[2]	16

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

(2) Wire diameter is AWG 24 (0.24 mm^2).

Specifications Rosemount 765

Open model

Recommended for crude oil and heavy duty products

Closed model

Recommended for lighter fuels such as diesel oil

Active measuring range

500 mm (20 in.), 1000 mm (40 in.)

Output

High-speed RS485/Modbus communication with Rosemount 2240S

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.)

Measuring principle

Capacitive

Calibration

Zero to full range factory calibration, and on-tank calibration possibility

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

0-4 Bar (0-58 Psi). Designed for atmospheric non-pressurized tanks. Handles liquid pressure from hydrocarbons and petrochemical products equivalent to a level of 40 m (130 ft).

Mechanical dimensions

Connection thread M33x1.5 mm

Immersed material

Stainless steel (AISI 316), FEP, PTFE, and PEEK with 30% glass

Length of water level sensor

Active length + 140 mm (5.5 in.)

Outer diameter of water level sensor

Closed: Ø=38 mm (1.5 in.)
Open: Ø=48 mm (1.9 in.)

Functional specification

When measuring temperature by using PT-100 (platinum) elements there are two major factors that affect the accuracy:

- Differences in wire/connection resistance
- PT-100 element temperature related influence Ω / °C

PT-100 element characteristics

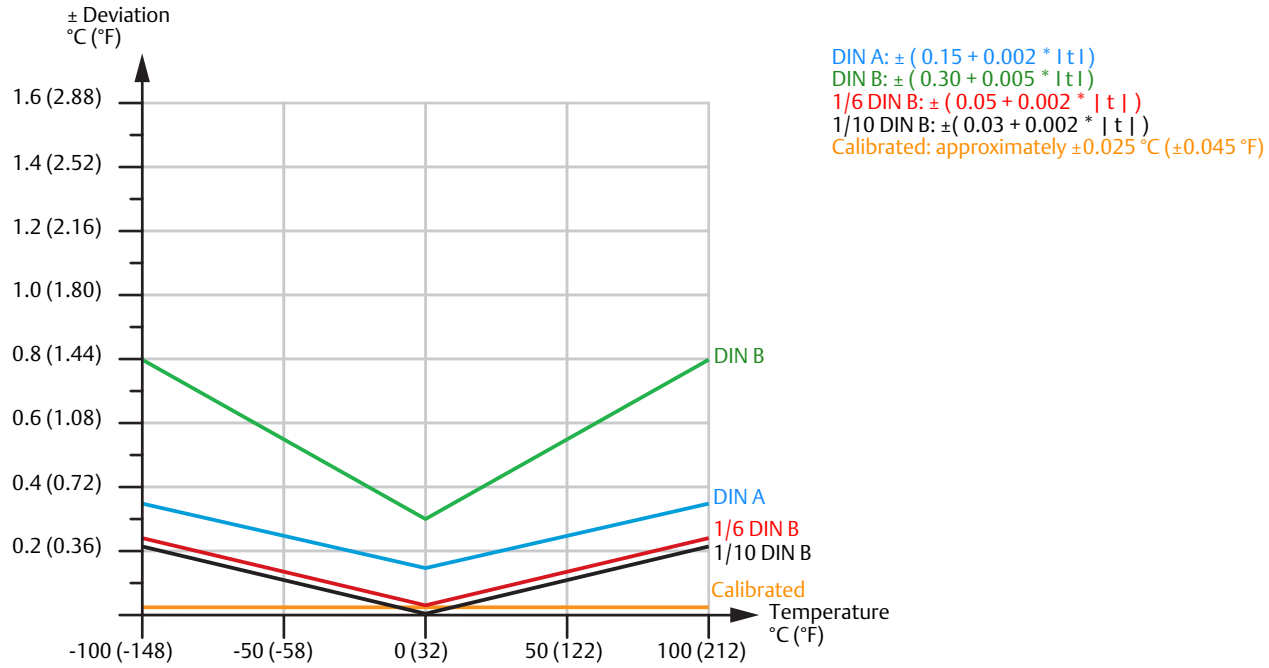
In IEC/EN 60751 and ASTM E1137, the relationship between resistance and temperature is defined. Two classes are stated for temperature element tolerances (t is the temperature in °C):
Class A: ± (0.15 + 0.002 * |t|)
Class B: ± (0.30 + 0.005 * |t|)
When Classes A and B are not sufficient, suppliers often deliver improved sensor versions; 1/3, 1/5, 1/6 and 1/10 of Class B –slightly better than Class A.

At temperatures close to 0 °C, the following applies:
1/6 DIN B: ± (0.05 + 0.005 * |t|)
1/10 DIN B: ± (0.03 + 0.005 * |t|)
In order to get a platinum element within 1/6 or 1/10 of Class B at 0 °C, the platinum wire has to be very pure.

The temperature sensors supplied by Emerson Process Management, are made from a very pure platinum material with predictable and stable characteristics for very accurate temperature measurement. The tolerance is even better than the standard states.

Class B delivered by Emerson is better than the standard and more similar to Class A:
1/6 DIN B: ± (0.05 + 0.002 * |t|)
1/10 DIN B: ± (0.03 + 0.002 * |t|)

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



3- or 4-wire temperature sensors

The accurate PT-100 elements used in Rosemount 565/566 and 765 multiple spot temperature sensors can be ordered either with three or four wires.

To eliminate wire influence, a 4-wire sensor is recommended since the resistance from wires and terminals do not effect measurement accuracy.

Unique automated factory calibration procedure for Rosemount 565 and 765

Deviations deriving from the PT-100 element itself are very repeatable and can be eliminated with a standard manufacturing calibration procedure, where the Callendar – Van Dusen equation is used. Calibration can only be done with 4-wire sensor elements.

The whole process is computer controlled and up to 16 elements in each tube are automatically calibrated at the same time.

During calibration each temperature element is compared in liquid with a very precise, traceable and certified PT-100 reference element in one or several temperature points: 0, +40 and +80 °C (+32, +104 and +176 °F)

After calibration, the Callendar – Van Dusen constants are calculated and included in the calibration certificate. These values are then entered into the 2240S Temperature Transmitter via TankMaster for superior accuracy, approximately ±0.025 °C (±0.045 °F) which is about ten times better than without calibration.

See Table 5 for accuracy comparison between different sensor options and Table 6 for the effect on Net Standard Volume calculations.

Table 5. Temperature accuracy for Rosemount 565 or 765

	Cable 20 m(1)	PT-100 [40 °C (104 °F)]	PT-100 [80 °C (176 °F)]	Total sensor accuracy [0-80 °C (32-176 °F)](2)
3-wire connection, 1/6 DIN B	± 0.24 °C (± 0.432 °F)	± 0.13 °C (± 0.234 °F)	± 0.21 °C (± 0.378 °F)	± 0.32 °C (± 0.576 °F)
4-wire connection, 1/6 DIN B	± 0.001 °C (± 0.002 °F)	± 0.13 °C (± 0.234 °F)	± 0.21 °C (± 0.378 °F)	± 0.21 °C (± 0.378 °F)
4-wire connection, 1/10 DIN B	± 0.001 °C (± 0.002 °F)	± 0.11 °C (± 0.198 °F)	± 0.19 °C (± 0.342 °F)	± 0.19 °C (± 0.342 °F)
4-wire connection, calibrated	± 0.001 °C (± 0.002 °F)	± 0.025 °C (± 0.045 °F)	± 0.025 °C (± 0.045 °F)	± 0.025 °C (± 0.045 °F)

(1) Common return wiring.

(2) Root Mean Square values for wiring error and platinum element error at 80 °C (176 °F).

Table 6. Net Standard Volume (NSV) uncertainty in a 20 m (66 ft) diameter tank at a level of 18.5 m (60.7 ft)

	Total accuracy [0-80 °C (32-176 °F)]	NSV uncertainty in a 20 m (66 ft) tank and a level at 18.5 m (60.7 ft)
3-wire connection, 1/6 DIN B	± 0.32 °C (± 0.576 °F)	7.0 m^3 (44.0 bbl)
4-wire connection, 1/6 DIN B	± 0.21 °C (± 0.378 °F)	4.6 m^3 (28.9 bbl)
4-wire connection, 1/10 DIN B	± 0.19 °C (± 0.342 °F)	4.2 m^3 (26.4 bbl)
4-wire connection, calibrated	± 0.025 °C (± 0.045 °F)	0.5 m^3 (3.1 bbl)

Individual calibration procedure for Rosemount 566

To get highest accuracy at low temperatures, such as in LNG applications, the 566 DIN A spot elements are calibrated individually in four temperature points:
-195, -78, 0 and +100 °C (-319, -108, +32 and +212 °F)

See Table 7 for accuracy comparison between different sensor options.

Table 7. Temperature accuracy for Rosemount 566

	Cable 20 m[(1)]	PT-100 [-195 °C (-319 °F)]	PT-100 [-78 °C (-108 °F)]	Total sensor accuracy [-195 °C (-319 °F)][(2)]
3-wire connection, DIN A	± 0.24 °C (± 0.432 °F)	± 0.54 °C (± 0.972 °F)	± 0.31 °C (± 0.558 °F)	± 0.59 °C (± 1.062 °F)
4-wire connection, DIN A	± 0.001 °C (± 0.002 °F)	± 0.54 °C (± 0.972 °F)	± 0.31 °C (± 0.558 °F)	± 0.54 °C (± 0.972 °F)
4-wire connection, calibrated	± 0.001 °C (± 0.002 °F)	± 0.023 °C (± 0.041 °F)	± 0.012 °C (± 0.022 °F)	± 0.023 °C (± 0.041 °F)

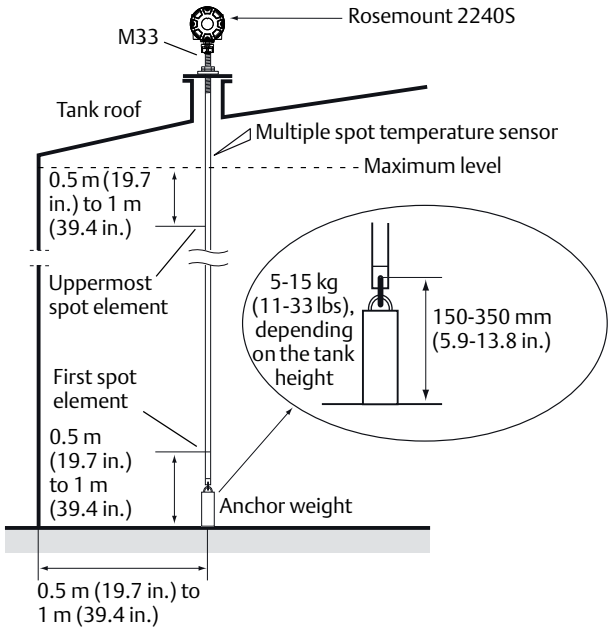
(1) Common return wiring.

(2) Root Mean Square values for wiring error and platinum element error at -195 °C (319 °F).

Physical specifications

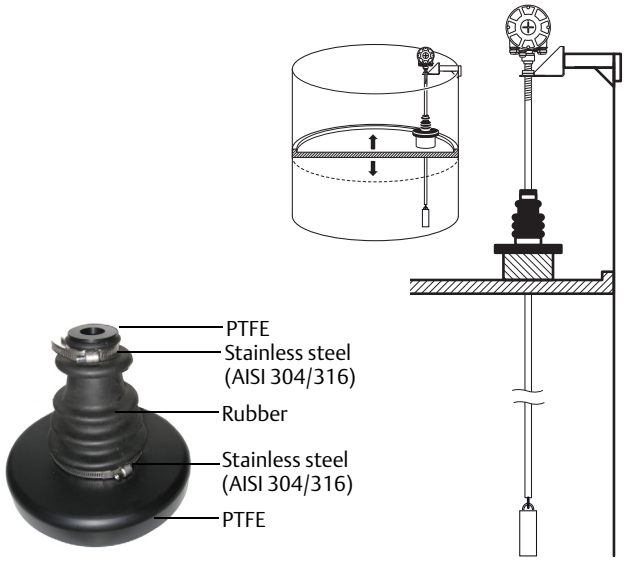
Fixed roof tanks

The sensor is attached to a flange mounted on a suitable nozzle. The multiple spot temperature sensor can be equipped with 16 spot elements.



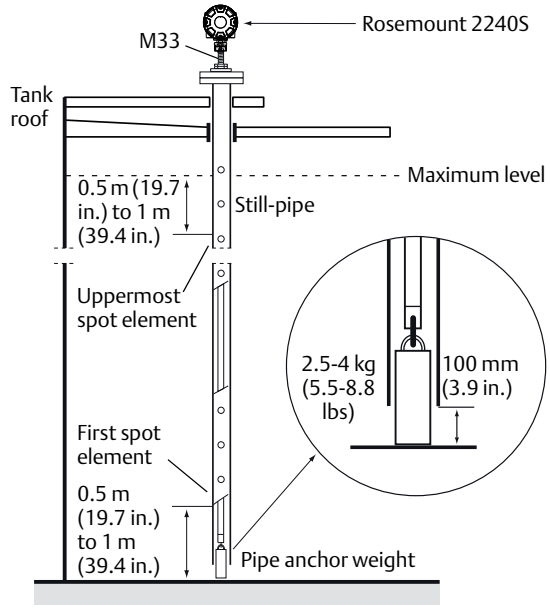
Vapor boot

A vapor boot is used to guide and protect the multiple spot temperature sensor if installed on a floating roof tank.



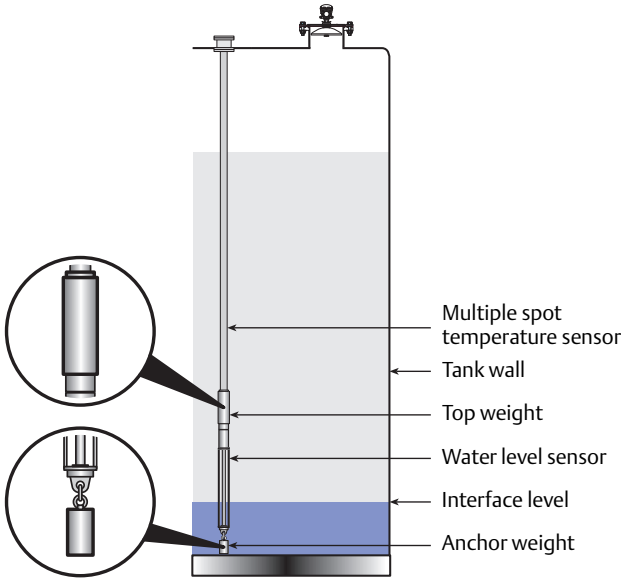
Floating roof tanks

The sensor can be installed in a still-pipe.



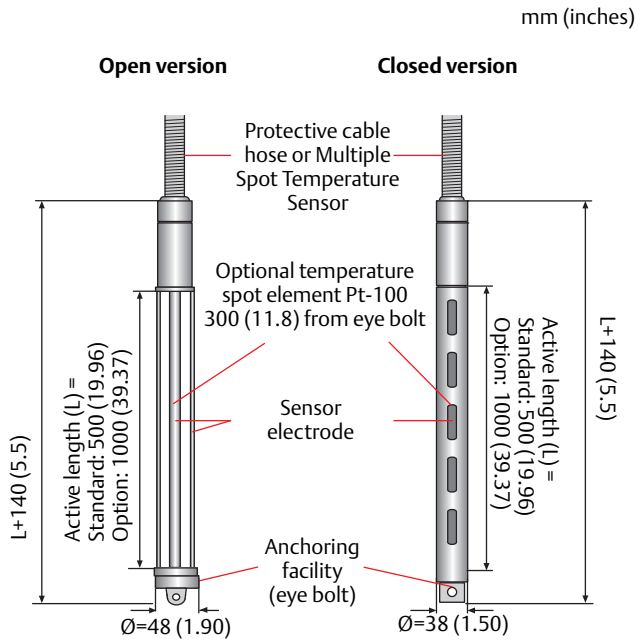
Weight

An anchor weight can be used for any of the 565/566/765 sensors to keep it in position. It can alternatively be clamped to the tank bottom. For Rosemount 765, a weight can be mounted in the bottom eye bolt and / or above the water level sensor, in which case the weight is hollow and fitted on the temperature sensor. The eye bolt can be removed for close bottom measurements.



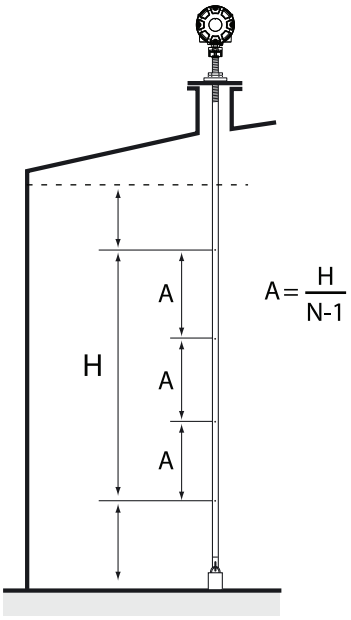
Open and closed water level sensor versions (Rosemount 765)

The Rosemount 765 sensor is available in two versions, open and closed. The open version is suitable for crude oil applications and the closed version is suitable for lighter fuels such as diesel oil etc.



Temperature sensor positions (Rosemount 565,566)

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



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

Product Certifications

Special conditions for safe use (x):

The WLS and the RTDs are intrinsically safe circuits. At connection facilities the requirements in clause 6.2.1 in EN 60079-11 for separation between intrinsically safe circuits and possibly non-intrinsically safe circuits shall be strictly followed.

The WLS and the RTDs are two separate intrinsically safe circuits. They must not be interconnected and the requirements for separation listed in clause 6.2.1 in EN 60079-11 shall be followed.

Terminating and connecting the WLS cable and the wires from the RTDs, requirements in the local installation codes shall be followed.

Connecting WLS and junction box adequate the strain relief shall be provided.

Declaration of Conformity

Designed according to EN 60751. Accuracy approved by PTB.

- ISO 15156-06-2009 (NACE MR0175) for all wetted parts

CE-mark

- ATEX Directive 94/9/EC
- Low voltage directive (LVD): 2004/108 EC
- EMC directive: 2006/95/EC

European ATEX Directive Information

EC-Type Examination Certificate Number: FM08ATEX0060X
Control Drawing: 800-9020-FM

Rosemount 765

II 1 G Ex ia IIC T4/T6[(1)]
Temperature element parameters: U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF
Communication/transmitter parameters: U_i=7.2 VDC, I_i=250 mA, P_i=700 mW, L_i=130 µH, C_i=0 nF

Rosemount 565

II 1 G Ex ia IIC T2/T4[(2)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

Rosemount 566

II 1 G Ex ia IIC T5[(3)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

US Factory Mutual (FM-US) certification

Certificate of Compliance: 3032389
Control Drawing: 800-9020-FM

Rosemount 765

Intrinsically safe for Class I, Division 1, Groups A, B, C, and D and Class I, Zone 0 Group IIC hazardous locations;
Temperature class T4 below the flange at an ambient temperature range of -50 °C ≤ T_a ≤ +120 °C, and T6 above the flange at an ambient temperature range of -50 °C ≤ T_a ≤ +70 °C.
Temperature element parameters: U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF
Communication/transmitter parameters: U_i=7.2 VDC, I_i=250 mA, P_i=700 mW, L_i=130 µH, C_i=0 nF

Rosemount 565

Intrinsically safe for Class I, Division 1, Groups A, B, C, and D and Class I, Zone 0 Group IIC hazardous locations;
Temperature class as indicated[(2)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

Rosemount 566

Intrinsically safe for Class I, Division 1, Groups A, B, C, and D and Class I, Zone 0 Group IIC hazardous locations;
Temperature class as indicated[(3)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

Canadian Factory Mutual (FM-C) certification

Certificate of Compliance: 3032389C
Control Drawing: 800-9020-FM

Rosemount 765

Intrinsically safe for Class I, Zone 0, Group IIC hazardous locations;
Temperature class T4 below the flange at an ambient temperature range of -50 °C ≤ T_a ≤ +120 °C, and T6 above the flange at an ambient temperature range of -50 °C ≤ T_a ≤ +70 °C.
Temperature element parameters: U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF
Communication/transmitter parameters: U_i=7.2 VDC, I_i=250 mA, P_i=700 mW, L_i=130 µH, C_i=0 nF

Rosemount 565

Intrinsically safe for Class I, Zone 0 Group IIC hazardous locations;
Temperature class as indicated[(2)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

Rosemount 566

Intrinsically safe for Class I, Zone 0 Group IIC hazardous locations;
Temperature class as indicated[(3)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

(1) Below flange: T4: -50 °C ≤ T_a ≤ +120 °C
Above flange: T6: -50 °C ≤ T_a ≤ +70 °C

(2) T2: -50 °C ≤ T ≤ +70 °C above flange,
-50 °C ≤ T ≤ +250 °C below flange
T4: -50 °C ≤ T ≤ +70 °C above flange,
-50 °C ≤ T ≤ +130 °C below flange

(3) T5: -50 °C ≤ T ≤ +70 °C above flange,
-200 °C ≤ T ≤ +95 °C below flange

IECEx certification

Certification of Conformity Number: IECEx FME 08.0007X
Control Drawing: 800-9020-FM

Rosemount 765

Ex ia IIC T4/T6[(1)]
Temperature element parameters: U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF
Communication/transmitter parameters: U_i=7.2 VDC, I_i=250 mA, P_i=700 mW, L_i=130 µH, C_i=0 nF

Rosemount 565

Ex ia IIC T2/T4[(2)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

Rosemount 566

II 1 G Ex ia IIC T5[(3)]
U_i=7.2 VDC, I_i=400 mA, P_i=700 mW, L_i=40 µH, C_i=500 nF

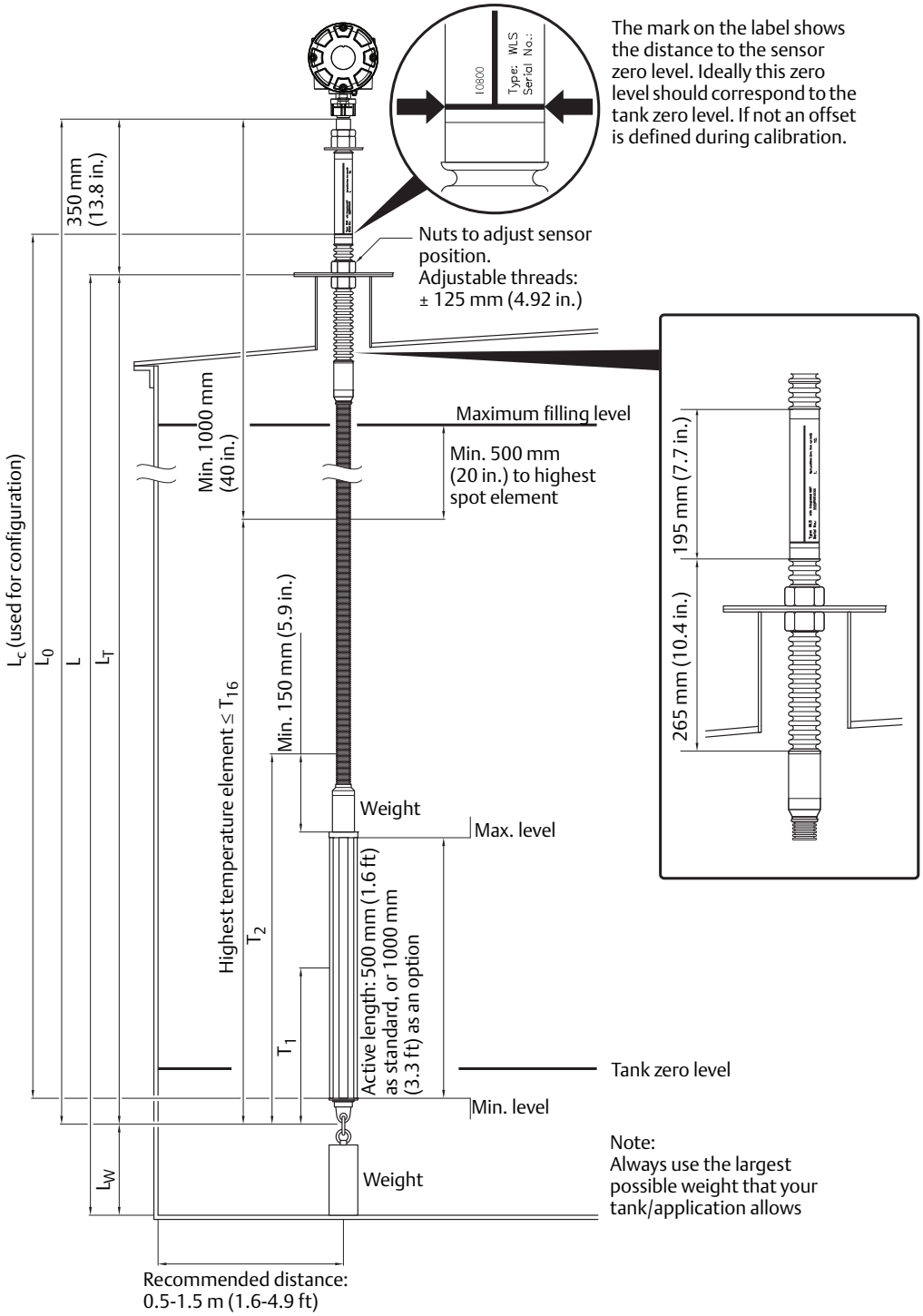
(1) Below flange: T4: -50 °C ≤ T_a ≤ +120 °C
Above flange: T6: -50 °C ≤ T_a ≤ +70 °C

(2) T2: -50 °C ≤ T ≤ +70 °C above flange, -50 °C ≤ T ≤ +250 °C below flange
T4: -50 °C ≤ T ≤ +70 °C above flange, -50 °C ≤ T ≤ +130 °C below flange

(3) T5: -50 °C ≤ T ≤ +70 °C above flange, -200 °C ≤ T ≤ +95 °C below flange

Dimensional Drawings

Figure 2. Rosemount 765 Multiple Spot Temperature Sensor with Water Level Sensor dimensions



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