

Product Specifications

**NEMA 4X Housing,
Sanitary Gauge**

**Single Chamber Housing,
Rigid Gauge**

**Dual Chamber Housing,
Flexible Gauge**



Features

- Transmission of Product Level, Interface, Temperature, and Volume
- 100 Point Strapping Table (Modbus Only)
- Non-Linearity 0.008% F.S.
- No Scheduled Maintenance or Recalibration
- Hysteresis 0.002% F.S.
- EIA-485 Communication - 4800 Baud (Modbus or DDA Protocol)

Applications

- Process Control
- Bulk Storage
- Precision Inventory Control
- Product Level, Interface Level, and Temperature Monitoring

Markets

- Petroleum/Petrochemical
- Propane Terminals
- Biotech/Pharmaceutical
- Food and Beverage
- Municipalities/Utilities

The M-Series Digital satisfies the demand for a digital communication interface in the Liquid Level marketplace for vessels from 20 inches to 60 feet.

The microprocessor-based design features surface-mount technology and a proprietary high speed signal processing integrated circuit. In addition, the microprocessor firmware features a flexible command interface, high noise rejection capability, built-in test functions, and automatic data error checking.

Outputs from the M-Series Digital tank gauge are communicated via a 4-wire multi-drop power and data bus (EIA-485), eliminating the requirements for individual cable runs from each tank. Serial asynchronous data formats (Modbus and MTS DDA) provide a direct interface to most types of computers and digital communication equipment.

All Level Plus tank gauges use magnetostrictive technology and have only one moving part -- the float. The simple design ensures no scheduled maintenance or recalibration will be required -- ever.

PARAMETER SPECIFICATION

LEVEL OUTPUT

Measured Variable:	Product level and interface level
Full Range:	20 in. to 60 ft. (508 mm to 18.3 m) ▼❖
Non-Linearity:	0.008% F.S. or 1/16 in. (1.59 mm)*
Hysteresis:	0.002% F.S. or 0.015 in. (0.381 mm)*
Process Temperature:	-40 to 257 °F (-40 to 125 °C) ●

TEMPERATURE OUTPUT

Measured Variable:	Average and multi-point temperature (up to 5 Digital Thermometers)
Temperature Accuracy:	± 0.5 °F (± 0.28 °C)
Computed Variables:	Gross Volume
(Modbus Only)	Net Volume
	Mass
	Alarms

ELECTRONICS

Input Voltage Range:	10.5 to 30.1 VDC
Safety Approval:	FM/CSA Explosion-proof/Intrinsically Safe
(Depending on Configuration)	Non-Incendive

ENVIRONMENTAL

Operating Temperature:	Electronics: -40 to 160 °F (-40 to 71 °C)
Vessel Pressure:	(Dependent on float pressure rating) 275 psi max. (Rigid Pipe) ▲

FIELD INSTALLATION

Length (excluding housing):	20 in. to 60 ft. (508 mm to 18.3 m) ❖
Mounting:	3/4 in. NPT adjustable fitting (Rigid pipe) 1 in. NPT adjustable fitting (Flexible Pipe)

* Whichever is greater

▼ Contact factory for longer lengths.

● Length dependent. Contact factory for higher temperatures.

▲ Contact factory for higher pressure ratings.

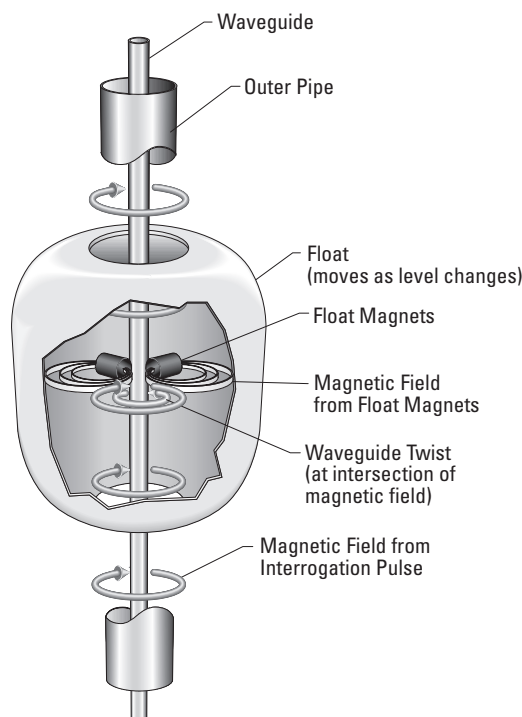
❖ Flexible sensor elements are available for rigid pipe configurations as an option.

PRINCIPLE OF MAGNETOSTRICTION

The liquid level gauge is composed of three concentric members. The outermost member is a protective, product-compatible outer pipe that withstands aggressive or harsh process industry applications. The middle member has a Digital Thermometer (DT) mounted on it for accurate temperature measuring.

The heart of the gauge design is the innermost member—the waveguide—a formed element constructed of a proprietary magnetostrictive material. A low current interrogation pulse is generated in the gauge electronics and

transmitted down the waveguide creating an electromagnetic field along the length of the waveguide. When this magnetic field interacts with the permanent magnetic field of a magnet mounted inside the float, a torsional strain pulse, or waveguide twist, results. This waveguide twist is detected as a return pulse. The time period between the initiation of the interrogation pulse and the detection of the return pulse is used to determine the level measurement with a high degree of accuracy and reliability.



ABOUT MTS

MTS Systems Corporation, Sensors Division is a global operation, with facilities in the U.S., Germany and Japan.

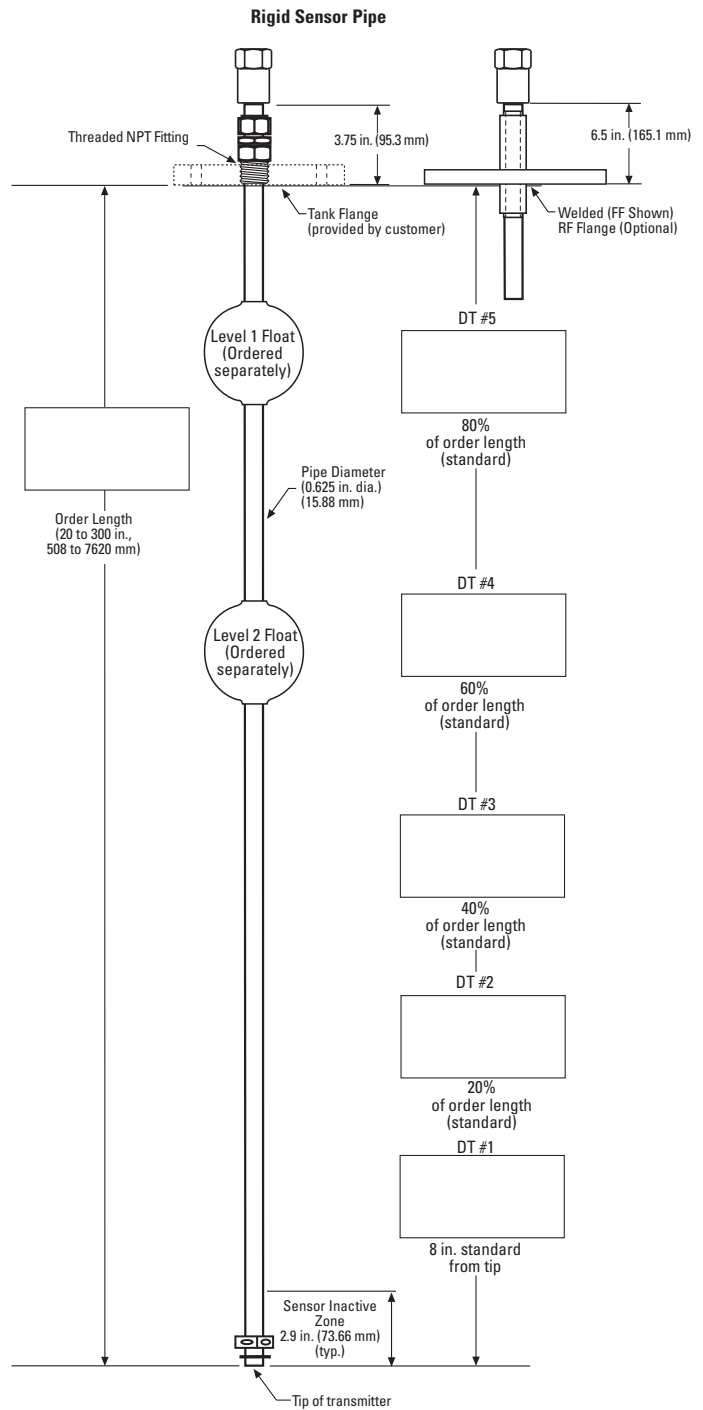
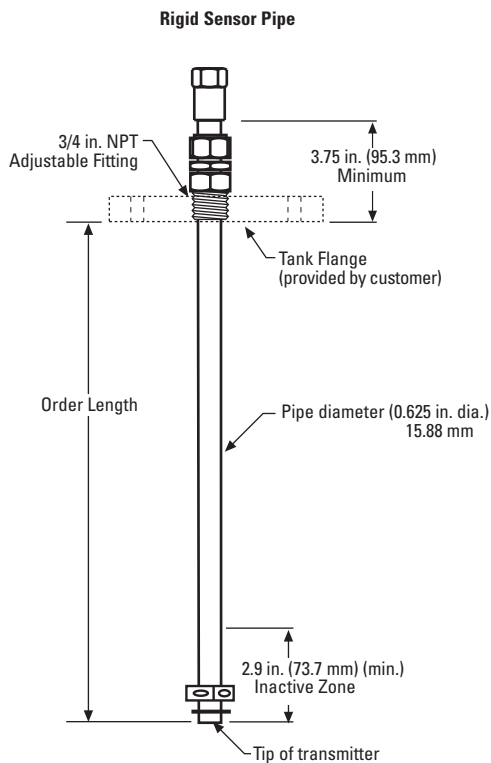
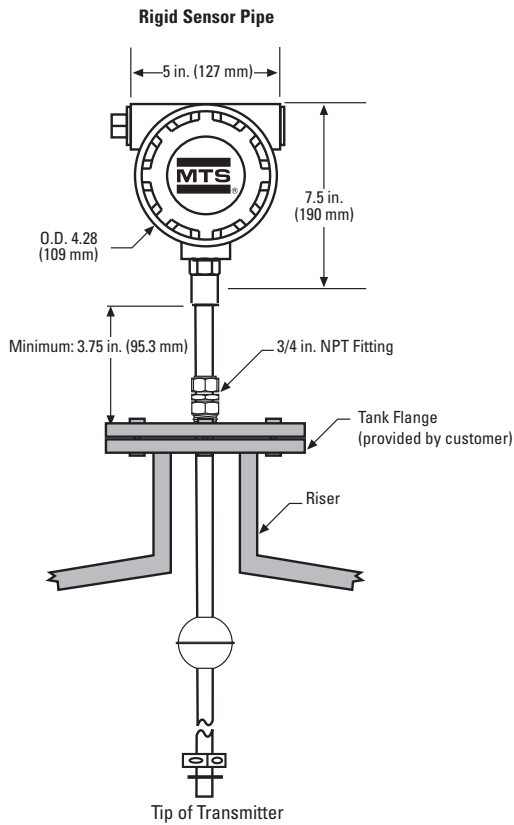
In the U.S., MTS Sensors Division is an ISO 9001 facility manufacturing highly repeatable and accurate Level Plus gauges as well as the rugged and reliable Temposonics® position sensors. With a strong commitment to research and development, product quality and customer service, Sensors Division is constantly seeking ways to bring the highest value to our customers.

MTS Sensor Technologie, located in Lüdenscheid, Germany, is also an ISO 9001 facility and manufactures both the Level Plus and Temposonics product lines. The strong technical staff at Sensor Technologie provides engineering assistance as well as sales and service to all of Europe. Constant communication between the product development team members in the U.S. and Germany assure that global market needs are addressed.

MTS Sensors Technology Corporation, opened in 1995 in Japan, supports the large Japanese market for accurate position sensors. This facility provides local distribution and application assistance for the entire Temposonics product line.

DIMENSIONS / RIGID SENSOR PIPES

TYPICAL PRODUCT INSTALLATIONS

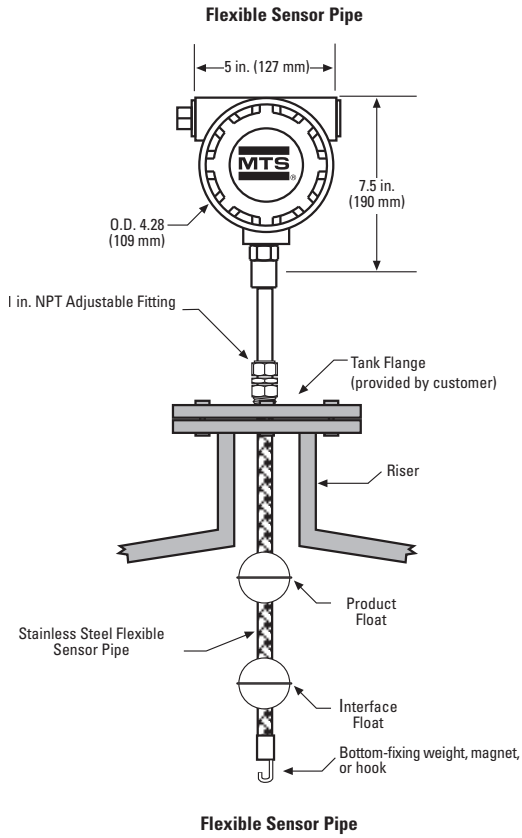


Sensor Inactive Zone: 316L SS, 2.9 in. (73.66 mm)

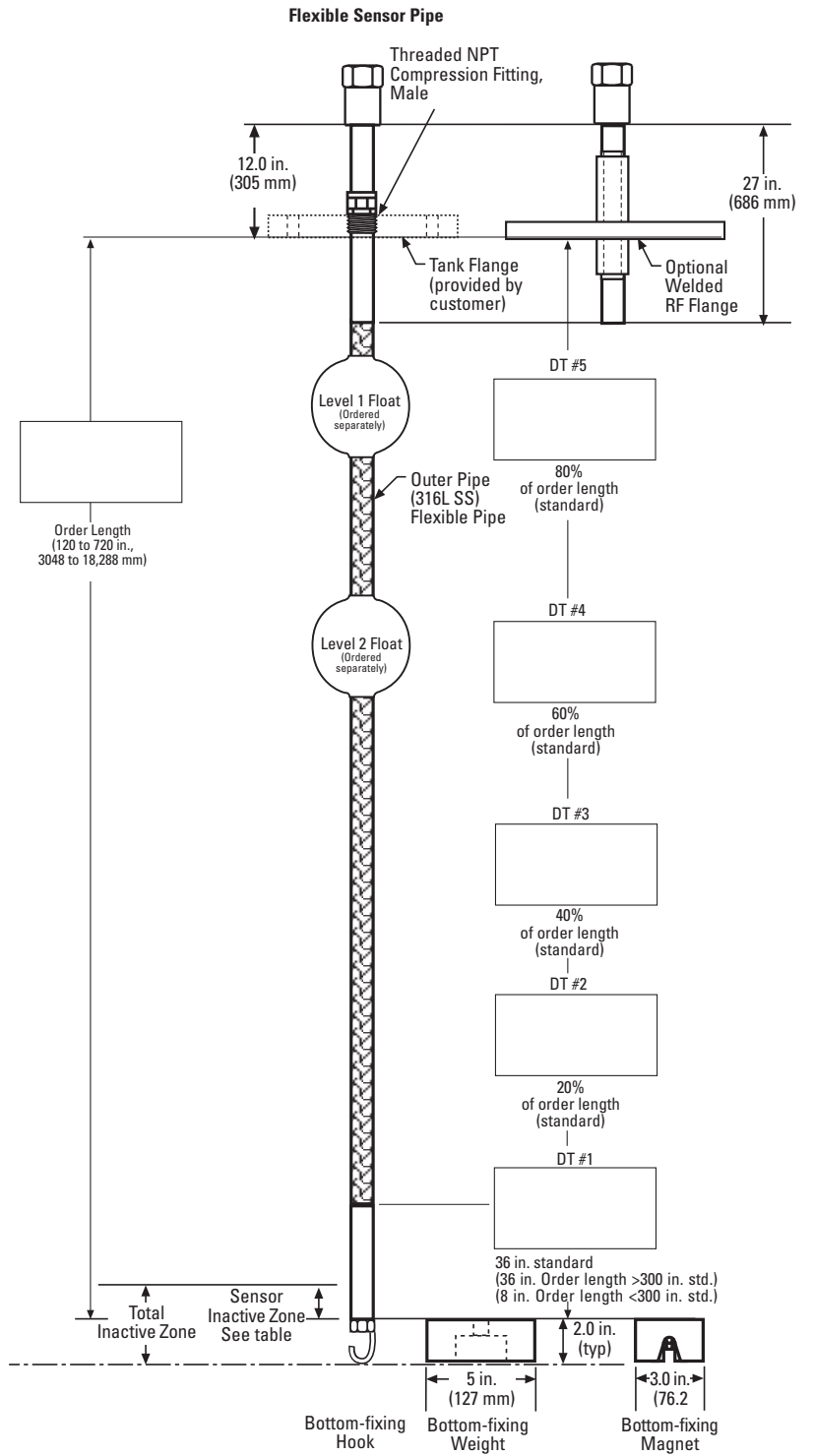
Note:
For simplified ordering, go to www.mtssensors.com and use our online Interactive Application Worksheet.

DIMENSIONS / FLEXIBLE SENSOR PIPES

TYPICAL PRODUCT INSTALLATIONS



SENSOR INACTIVE ZONES		
<25 ft.	3.0 in.	(76.2 mm)
<40 ft.	3.8 in.	(96.5 mm)
<60 ft.	4.7 in.	(119.4 mm)

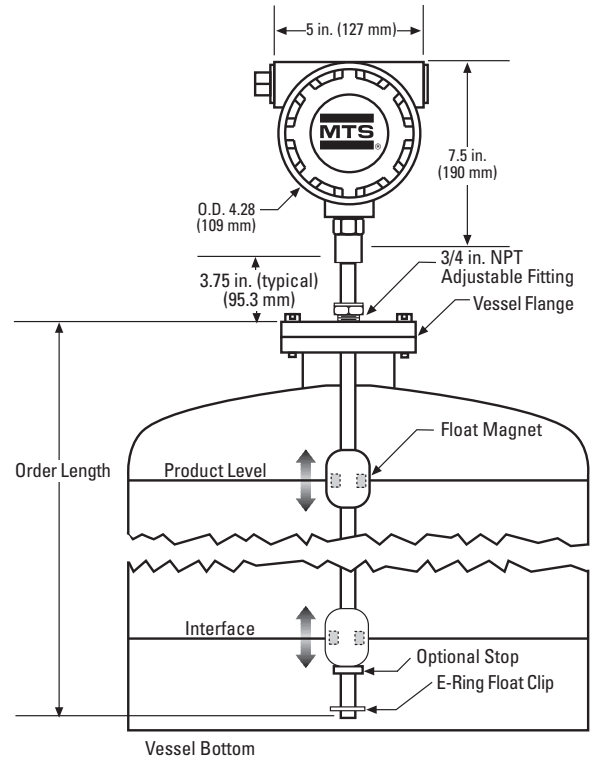


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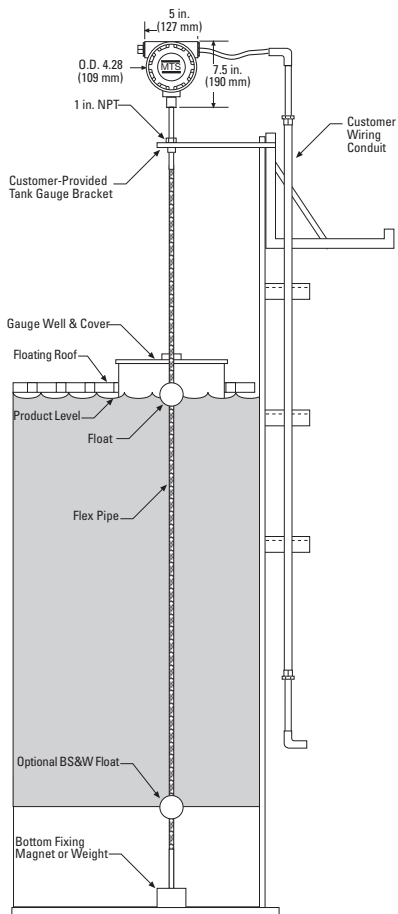
D I M E N S I O N S

TYPICAL TANK MOUNTING

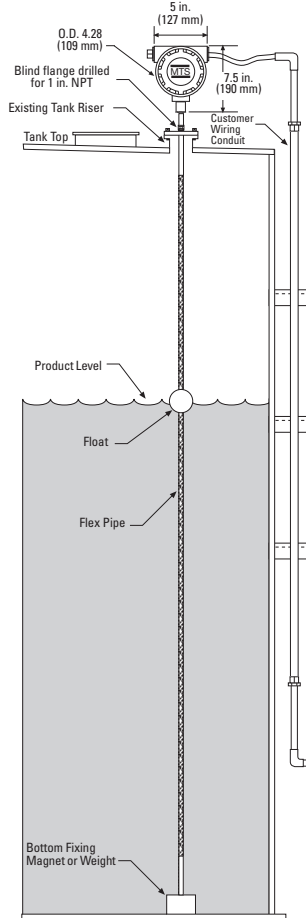
- Single Entry Into Tank
- Easy to Install
- Product Level, Interface Level (BS & W)
- Single and Multi-point Temperature
- Average Temperature of Submerged DTs
- Modbus Output Provides Gross Volumes, Net Volumes, Mass & Alarms
- DDA Output Provides Product & Interface Level, & Temperature



Typical Floating Roof Installation

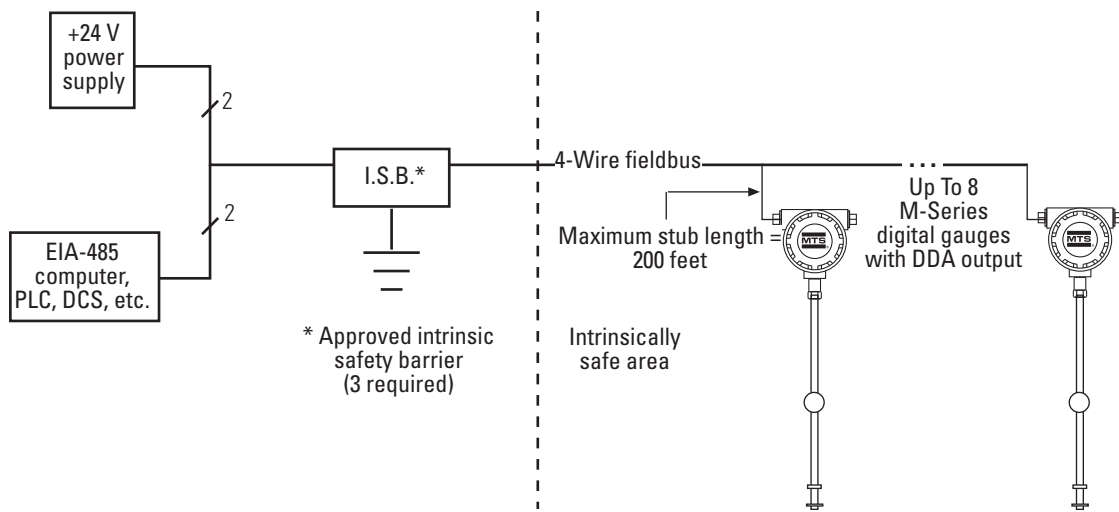


Typical Cone Roof Installation



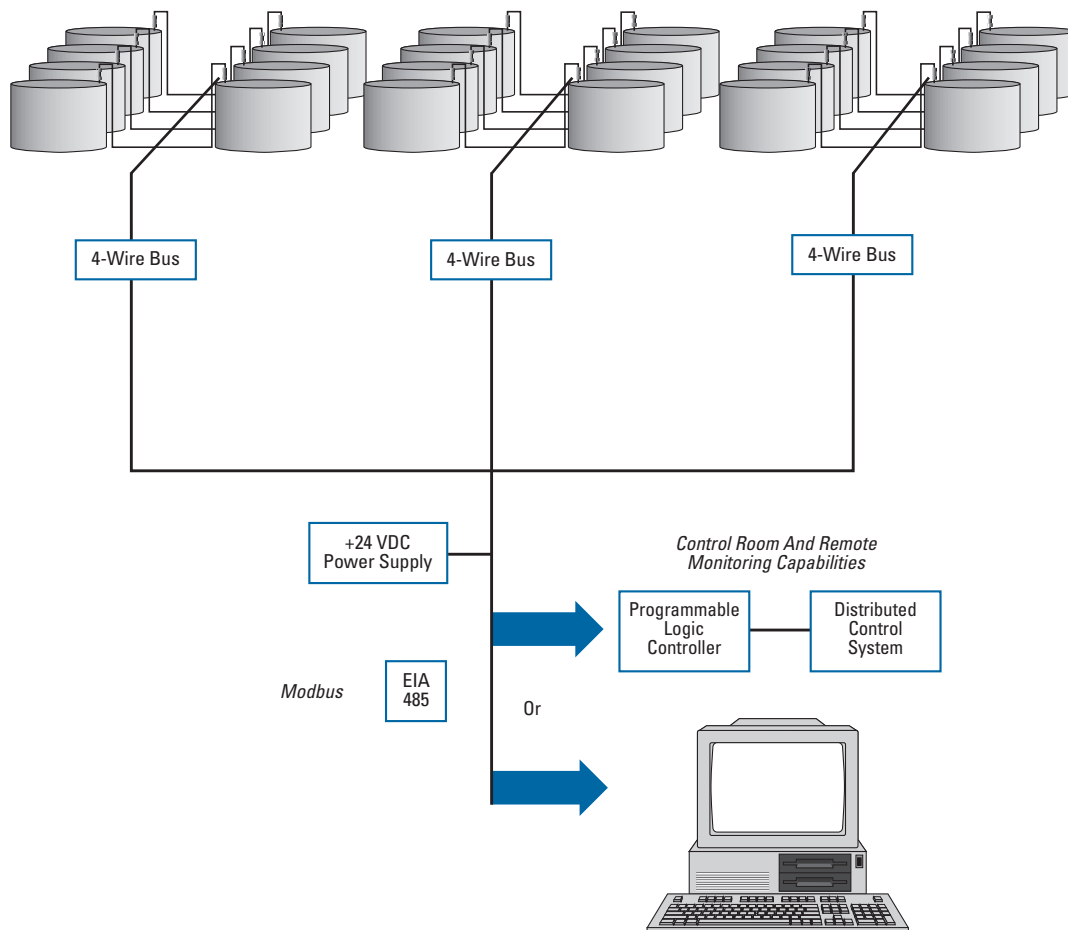
ELECTRICAL CONNECTIONS

TYPICAL ELECTRICAL CONNECTIONS - INTRINSICALLY SAFE SYSTEM



General application

TYPICAL SYSTEMS - Explosion-proof



OUTPUTS & PROTOCOLS

AVAILABLE SYSTEM INTERFACES INCLUDE:

MTS DDA

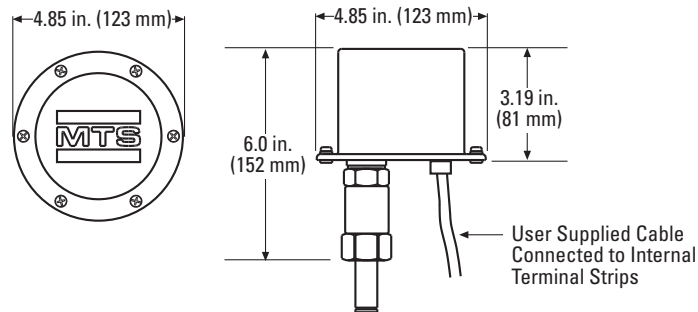
The MTS DDA is a proprietary protocol developed for use in Intrinsically Safe Areas. The M-Series Digital is backwards compatible with existing IS installations of D8/D9 and LDF MTS gauges, as long as the total number of gauges does not exceed 8. This protocol allows the gauges to be in a low power or “idle” mode while not processing commands. This protocol allows for level, interface, and temperature data to be output from the gauge.

MODBUS RTU

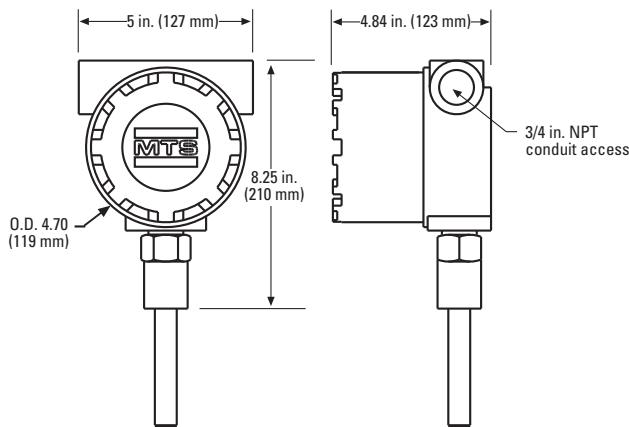
The Modbus RTU protocol is available for use in explosion-proof areas and allows the M-Series Digital gauge to communicate level, temperature, and volume information directly from the gauge head.

M-SERIES LEVEL GAUGES: ENCLOSURE DIMENSIONS

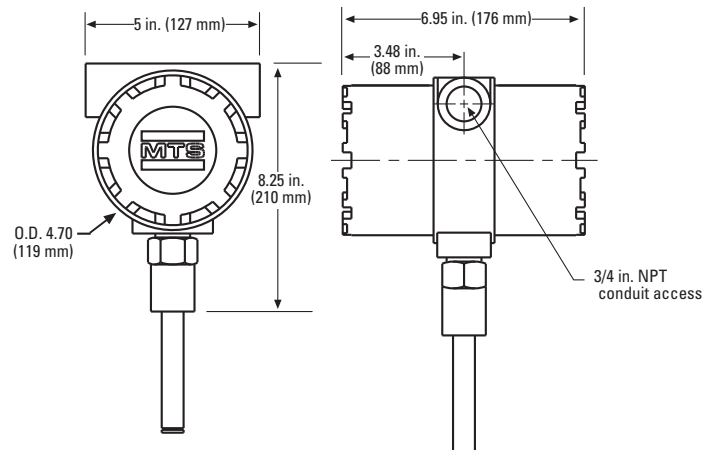
NEMA 4X Enclosure



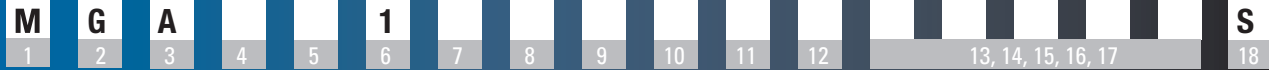
Single Cavity Enclosure



Dual Cavity Enclosure



HOW TO ORDER



1) MODEL

M = Magnetostrictive Level Sensor

2) TYPE

G = Digital Output Level Transmitter

3) INPUT POWER

A = 24 VDC

4) OUTPUT

M = Modbus RTU Data Format

D = MTS DDA Protocol

5) HOUSING TYPE

3 = NEMA 4X, 316L Stainless Steel w/ NPT and internal terminal blocks
(intrinsically safe only)

B = Single Cavity (Explosionproof and Intrinsically safe)

C = Dual Cavity (Explosionproof and Intrinsically safe)

6) ELECTRONICS MOUNTING

1 = Integral Electronics

7) SENSOR PIPE

B = Industrial end plug w/stop collar

C = Sanitary, T-bar, TB

D = Sanitary, drain-in-place, DP

E = Sanitary, clean-in-place, CP

F = Sanitary, drain-in-place, no hole, DN

M = Flexible w/ bottom fixing eye (Stainless Steel Only)

N = Flexible w/ bottom fixing weight (Stainless Steel Only)

P = Flexible w/ bottom fixing magnet (Stainless Steel Only)

8) MATERIAL OF CONSTRUCTION (Wetted Parts)

1 = 316L Stainless Steel

2 = Electro-polished 316L Stainless Steel

Note: Contact factory for additional materials

9) PROCESS CONNECTION TYPE

1 = NPT, Adjustable

4 = Sanitary, Welded

5 = Sanitary, Adjustable

6 = 150# Welded RF Flange

7 = 300# Welded RF Flange

8 = 600# Welded RF Flange

10) PROCESS CONNECTION SIZE

A = 3/4 in. (NPT. Only) (Rigid pipe only)

B = 1 in.

C = 1 1/2 in.

D = 2

E = 2 1/2 in.

F = 3 in.

G = 4 in.

H = 5 in. (except sanitary)

J = 6 in.

11) Temperature (Digital Thermometers)

0 = None

1 = One DT, fixed position (3 in. from tip of gauge)

2 = One DT, customer defined position

5 = Five DTs evenly spaced per API

6 = Five DTs customer defined position

(If option 2 or 6 is selected, then 18 E must also be selected.)

12) UNIT OF MEASUREMENT

M = Metric - Millimeters (_ _ _ _ _)

U = US Customary - (_ _ _ . _)

13, 14, 15, 16, 17) LENGTH

_ _ _ _ _ = Order length based on unit of measurement.

US Customary (XXX.XX in.),

Metric (XXXXX mm)

Rigid Sensor Pipe: 20 to 300 in. (508 to 7620 mm)

Flexible Sensor Pipe: 120 to 720 in. (3050 to 18300 mm)

Note: Contact factory for longer lengths.

18) SPECIAL

S = Standard Product

FLOATS

NOTES (for all applications):

1. MTS recommends that the float specific gravity be at least 0.05 less than that of the measured liquid as a safety margin at ambient temperature.
2. For interface measurement: A minimum of 0.1 specific gravity differential is recommended between the upper and lower liquids.

RIGID

Standard Float, Part No. 251981-X

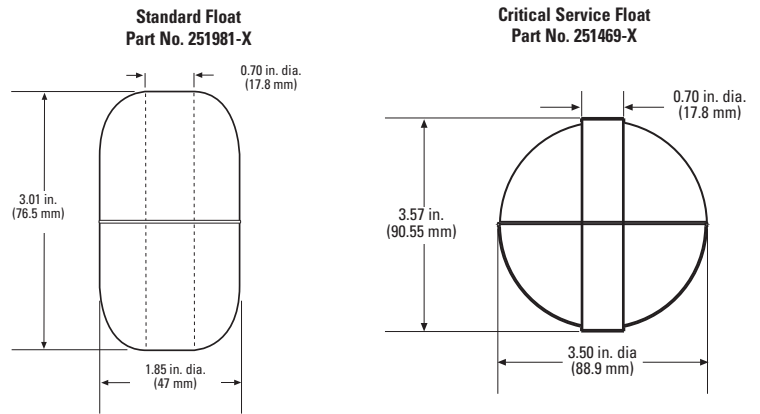
Max. Pressure: 400 psi, Max. Temperature: 300 °F

Part No. Ext.	Material	sg
X=1	316L Stainless Steel	0.67

Critical Service Float, Part No. 251469-X

Max. Pressure: 425 psi, Max. Temperature: 300 °F

Part No. Ext.	Material	sg
X=1	316L Stainless Steel	0.43
X=2	316L Stainless Steel	0.45



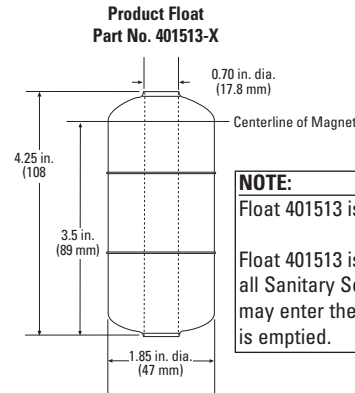
SANITARY

Product Float, Part No. 401513-X

Max. Pressure: 150 psi, Max. Temperature: 300 °F

Part No. Ext.	Material	sg	Surface Finish *
X=1	316L Stainless Steel	0.66	200 GRIT/RA25
X=3	316L SS (Electropolished)	0.66	240 GRIT/RA15

* Outside surfaces only. Contact factory for other finishes.



FLEX

Product Floats, Part No. 251223-X

Max. Pressure: 425 psi, Max. Temperature: 300 °F

Part No. Ext.	Material	sg
X=1	316L Stainless Steel	0.54

Part No. 252998/252999

Max. Pressure: 325 psi, Max. Temperature: 300 °F

Part No. Ext.	Material	sg
252998	316L Nitrophy/ Stainless Steel	0.5
252999	316L Nitrophy/ Stainless Steel	0.9 - 0.96

Part No. 201248

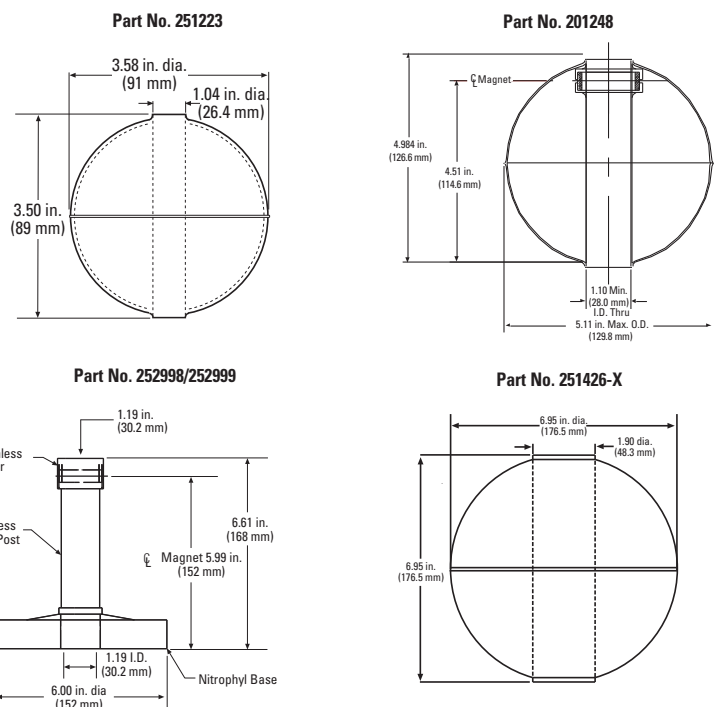
Max. Pressure: 550 psi, Max. Temperature: 300 °F

Part No. Ext.	Material	sg
X=1	316L Stainless Steel	0.44

Part No. 251426-X

Max. Pressure: 250 psi, Max. Temperature: 300 °F

Part No. Ext.	Material	sg
X=1	316L Stainless Steel	0.44
X=2	316L Stainless Steel	0.46



For more information on floats, please refer to MTS document number 550537, or contact the MTS Level Plus Applications Department.

SPECIFICATIONS

PARAMETER	SPECIFICATION	
LEVEL OUTPUT		
Measured Variable:	Product level and interface level	
Full Range:	20 in. to 60 ft. (508 mm to 18.3 m) ▼ <i>Note: Rigid sensor pipes have rigid sensor elements. Flexible sensor pipes have flexible sensor elements.</i>	
Non-Linearity:	0.008% or 1/16 in. (1.59 mm)*	
Hysteresis:	0.002% F.S. or 0.015 in. (0.381 mm)* (Any Direction)	
Resolution:	Up to ± 0.001 in. (0.025 mm)	
Time Constant:	1-3 seconds (typ.)	
TEMPERATURE OUTPUT		
Measured Variable:	Average and multi-point temperature (up to 5 Digital Thermometers)	
Temperature Range:	-40 to 221 °F (-40 to 105 °C) (Consult factory for higher temperature applications.)	
Temperature Accuracy:	±0.5 °F (±0.28 °C)	
Computed Variables:	Gross Volume	
(Modbus Only)	Net Volume Mass Alarms	
ELECTRONICS		
Input Voltage Range:	10.5 to 30.1 Vdc	
Reverse Polarity Protection:	Series diodes	
Lightning/Transient Protection**:	Stage 1: line-to-ground surge suppressors; IEC 61000-4-5 Stage 2: line-to-line and line-to-ground transient suppressors; IEC 61000-4-4	
Safety Approval:	FM/CSA: Explosion-proof Class I, Groups B,C,D Class II, Groups E,F,G Division 1, NEMA 4X Models: Explosion-proof housing req.	FM/CSA: Intrinsically Safe Class I, Groups A,B,C,D Class II, Groups E,F,G Division I, NEMA 4X Division 2, Non-Incendive
CALIBRATION		
Zero Adjust Range:	Software selectable along entire active gauge length. No field adjustment required.	
ENVIRONMENTAL		
Sealing:	O-ring sealed for outdoor use (NEMA 4X)	
Humidity:	0 to 100% R. H.	
Operating Temperature:	Electronics: -40 to 160 °F (-40 to 71 °C) Sensing Element: -40 °F to 257 °F (-40 to 125 °C) Temperature Element: -40 to 221 °F (-40 to 105 °C)	
Vessel Pressure:	Dependent on float pressure rating (275 psi max - Flexible Outer Pipe) ▲	
Materials of Construction:	Wetted: Standard -316L Stainless Steel ● Non-wetted: 316L SS, Epoxy Coated Aluminum	
FIELD INSTALLATION		
Length (excluding housing):	20 in. to 60 ft. (508 mm to 18.3 m)	
Housing Dimensions:	Single Chamber Enclosure 5 in. by 4.84 in. (4.70 O.D.). Dual Chamber Enclosure 5 in. by 6.95 in. (4.28 O.D.). NEMA 4 X Enclosure (3.2 in. by 4.85 in.)	
Mounting:	3/4 in. NPT adjustable fitting (Rigid Pipes) 1 in NPT adjustable fitting (Flexible Pipes)	
Wiring:	4 wire connections + earth ground/tank ground, 1/2 in. NPT conduit opening (NEMA 4 X), 3/4 in. NPT (Ex Housing)	

* Whichever is greater

** Must specify at time of order, not on all units

▼ Contact factory for longer lengths.

● Contact factory for other materials

▲ Contact factory for higher pressure ratings.

All Specifications are subject to change. Please contact MTS for specifications critical to your needs.

M-Series Digital Setup Software

The M-Series Setup Software will allow the setup and calibration of the M-Series digital gauges. The software communicates via a RS485 to RS232 Adaptor. Adjustments include: offset, gauge length, head adder, gradient, units of measure and temperature.

MTS Part Numbers:

- 625051 M-Series Digital PC Setup Modbus Software on CD and RS485 to RS232 Adaptor
- 625052 M-Series Digital PC Setup Modbus Software on CD
- 380075 RS485 to RS232 Adapter
- 625053 M-Series Digital PC Setup (DDA)

Level Plus HT100 Hand Held Terminal (DDA Only)

The Level Plus HT100 is a convenient and cost-effective tool for supporting MTS Level Plus Direct Digital Access (DDA) tank gauges, Side Tank Indicators, and Tank Monitors in the field. The hand-held, microprocessor-based unit performs all the operations necessary for setting up, troubleshooting, and maintaining an MTS DDA tank gauging system. Using the HT100 allows users to program and perform diagnostics on-site, saving time and money.

Magnet Assembly

MTS Part Number 560604
Magnet Assembly (150 lb. pull) for LDF Long Gauge and M-Series

Weight Assembly

Standard

MTS Part Number 401059
Weight Assembly (11 lb.) for LDF Long Gauge and M-Series

Low Lutoff

MTS Part Number 402364
Weight Assembly (11 lb.)

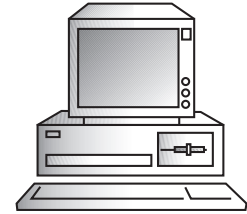
Note: Use with float, part number 252998/252999

Misc

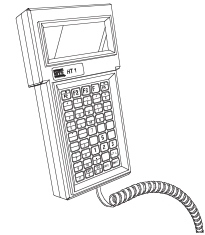
MTS Part Number 400868
Label, 3A Sanitary



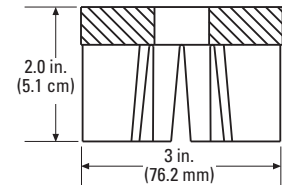
M-Series Digital Setup Software



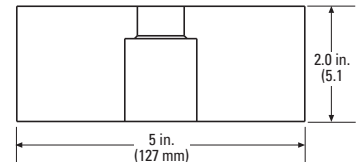
HT100



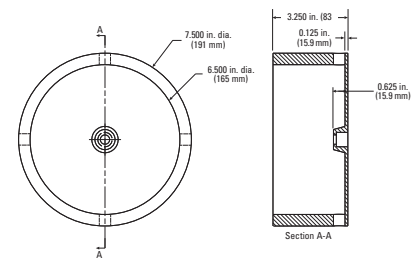
Magnet Assembly



Weight Assembly



Low Lutoff



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