

Level Plus®

Magnetostrictive Liquid-Level Sensors
with Temposonics® Technology



M-Series Model MG Transmitter with Digital Output

Document Part Number
550784 Revision G

Product Specification

FEATURES

- Modbus and FOUNDATION™ fieldbus Output
- 3-in-1 Measurement
 - Product
 - Interface
 - Temperature
- 100 point Strap Table
- No Scheduled Maintenance or Recalibration
- API Temperature Corrected Volumes
- Non-linearity 0.008% F.S.
- Explosion-proof and/or Intrinsically Safe

APPLICATIONS

- Custody Transfer
- Inventory Control
- Bulk Storage
- Sanitary Process Control

MARKETS

- Petroleum and Petrochemical
- LPG Terminals
- Biotech and Pharmaceuticals
- Food and Beverage
- Water and Wastewater

Product overview

The Level Plus® M-Series Model MG level transmitter satisfies the demand for a digital communication interface that offers the liquid-level marketplace unsurpassed flexibility to meet most process application conditions. The Level Plus Model MG transmitter provides 3-in-1 measurement using one process opening for product level, interface level, and temperature measurements. Once the transmitter is installed and calibrated there is no requirement for scheduled maintenance or recalibration. **Set it and forget it!**

Level Plus Model MG transmitters are modular in design, offering you a selection of electronic housing styles, transmitter pipe styles and wetted materials. The Level Plus Model MG transmitter features a removable sensing element and can also incorporate 1, 5, or 12 temperature measurement points depending on the output. Subject to local electrical codes, the sensing element and electronics housing can be removed from the transmitter pipe without disrupting the operation of your process saving you time and money.

Outputs for the Level Plus Model MG transmitter include Modbus, FOUNDATION™ fieldbus, and DDA (a proprietary ASCII protocol). Modbus and DDA outputs are communicated via a 4-wire multi-drop power and data bus (EIA 485), whereas FOUNDATION™ fieldbus has a specified 3-wire bus. Utilizing the bus network eliminates the requirements for individual cable runs from each tank and these three data formats provide a direct interface to most types of computers and digital communication equipment. Both Modbus and FOUNDATION™ fieldbus outputs also allow a user to measure volume from a 100 point strap table with the option for temperature correction.



Model MG Sanitary Transmitter
NEMA Type 4X Enclosure



Model MG Rigid Transmitter
Single-Cavity Housing



Model MG Flexible Transmitter
Dual-Cavity Housing




All specifications are subject to change. Contact MTS for specifications and engineering drawings that are critical to your application. Drawings contained in this document are for reference only. Go to <http://www.mtssensors.com> for the latest support documentation and related media.

Product specifications

Parameters	Specifications
LEVEL OUTPUT	
Measured variable:	Product level and interface level
Output signal / Protocol:	Modbus RTU, DDA or FOUNDATION™ fieldbus
Order length:	<p>Flexible hose: 3048 mm (120 in.) to 22000 mm (866 in.) Δ \S</p> <p>Rigid pipe: 508 mm (20 in.) to 7620 mm (300 in.) Δ \S</p> <p>Sanitary pipe: 508 mm (20 in.) to 7620 mm (300 in.) Δ \S</p> <p>Δ Contact factory for longer lengths. \S Order length equals the measurement range plus the inactive zone.</p>
Non-linearity:	0.008% F.S. or 0.794 mm (1/32 in.)* * Whichever is greater
Hysteresis:	0.002% F.S. or 0.397 mm (1/64 in.)* * Whichever is greater
Resolution:	0.025 mm (0.001 in.)
Calculated variables:	GOVP GOVI GOVT GOVU NSVP
TEMPERATURE OUTPUT	
Measured variable:	Average and multi-point temperatures Up to 12 Modbus ∞ Up to 5, DDA and FOUNDATION™ fieldbus ∞ Minimum length of 2032 mm (80 in.) for 12 temperature positions.
Temperature accuracy:	± 0.28 °C (± 0.5 °F)
ELECTRONICS	
Input voltage:	<p>Modbus and DDA: 10.5 to 30.1 Vdc 28 Vdc maximum for I.S. ATEX approval</p> <p>FOUNDATION™ fieldbus: 9 to 32 Vdc bus powered</p>
Fail safe:	High, full scale
Reverse polarity protection:	Series diode
Lightning/Transient protection:	<p>Stage 1: Line-to-ground surge suppression; IEC 61000-4-5</p> <p>Stage 2: Line-to-line and line-to-ground transient suppressors; IEC 61000-4-4</p>

Parameters	Specifications
CALIBRATION	
Zero adjust range:	Anywhere within the active length
Span adjust range:	Full scale to 152 mm (6 in.) from zero
ENVIRONMENTAL	
Enclosure rating:	NEMA Type 4X
Humidity:	0 to 100% relative humidity, non-condensing
Operating temperatures:	<p>Electronics: -40 °C (-40 °F) to 71 °C (160 °F)</p> <p>Sensing element: -40 °C (-40 °F) to 125 °C (257 °F) \diamond</p> <p>Temperature element: -40 °C (-40 °F) to 105 °C (221 °F)</p> <p>\diamond Contact factory for specific temperature ranges.</p>
Vessel pressure:	Dependent on float pressure, contact factory for more information
Materials:	<p>Wetted parts: 316L stainless steel \dagger</p> <p>Non-wetted parts: 316L stainless steel, Epoxy coated aluminum</p> <p>\dagger Contact factory for alternative materials.</p>
FIELD INSTALLATION	
Housing dimensions:	<p>Single cavity, explosion proof (XP): 127 mm (5 in.) by 123 mm (4.85 in.) 121 mm (4.75 in.) O.D.</p> <p>Dual cavity, explosion proof (XP): 127 mm (5 in.) by 177 mm (6.95 in.) 121 mm (4.75 in.) O.D.</p> <p>NEMA Type 4X: 81 mm (3.2 in.) by 123 mm (4.85 in.) O.D.</p>
Mounting:	<p>Rigid pipe: $\frac{3}{4}$ in. Adjustable NPT fitting, Flange and Tri-Clamp® Mounts</p> <p>Flexible hose: 1 in. Adjustable NPT fitting, Flange mount</p>
Wiring:	<p>Modbus and DDA: 4-wire connections plus earth ground Daniel Woodhead 6-pin male connector</p> <p>FOUNDATION™ fieldbus: Type A fieldbus cable</p>
ELECTRICAL CONNECTIONS	
Explosion proof:	$\frac{3}{4}$ in. conduit opening
NEMA Type 4X:	$\frac{1}{2}$ in. conduit opening

Agency Approvals

Modbus and DDA Explosion proof		FOUNDATION™ fieldbus Explosion proof	
FM 3615 C22.2 No. 30	Class I, Division 1, Groups B, C and D •• Class II, Division 1, Groups E, F and G •• Division 1, NEMA Type 4X	FM 3615 C22.2 No. 30	Class I, Division 1, Groups B, C and D Δ Class II, Division 1, Groups E, F and G Δ Division 1, NEMA Type 4X Δ Explosion-proof housing required
Intrinsically Safe		Intrinsically Safe	
FM3610 C22.2 No. 157	Class I, Division 1, Groups A, B, C and D Class II, Division 1, Groups E, F and G Class III, T4 Division 1, NEMA Type 4X	FM3610 C22.2 No. 157 CSA E60079-11 EN 50020	PENDING
EN 50020	PTB 04 ATEX 2028X  II 1/2 G bzw. II 2 G EEx ia IIB T4 bzw. EEx ia IIA T4 **		
	•• Explosion-proof housing required ** Contact factory for model numbers		

MTS Digital Setup Software interface

Modbus and DDA programming

MTS has developed the MTS Setup Software to help customers program and customize their Modbus and DDA transmitters.

Both Modbus and DDA Setup Software allow the user to change addresses, calibrate current tank levels, and create a backup/restore file of current settings. In addition, the Modbus Setup Software allows the user to program alarms, change the units of the output, and setup the temperature correction method and volume calculation method.

MTS setup software is shipped with each transmitter order. However, if you require an additional copy or an upgrade to your currently installed setup software, updates are available for download from the following MTS Level Products support page.

<http://www.mtssensors.com/support/liquid-level-product-data-sheets-manuals-drawings/index.html>

FOUNDATION® fieldbus programming

Please note that the MTS Setup Software does not include any software installation program for setting up the Level Plus Model MG transmitter for FOUNDATION™ fieldbus output. All programming for FOUNDATION™ fieldbus output must be performed by using a host or handheld device such as the *Rosemount® 375*.

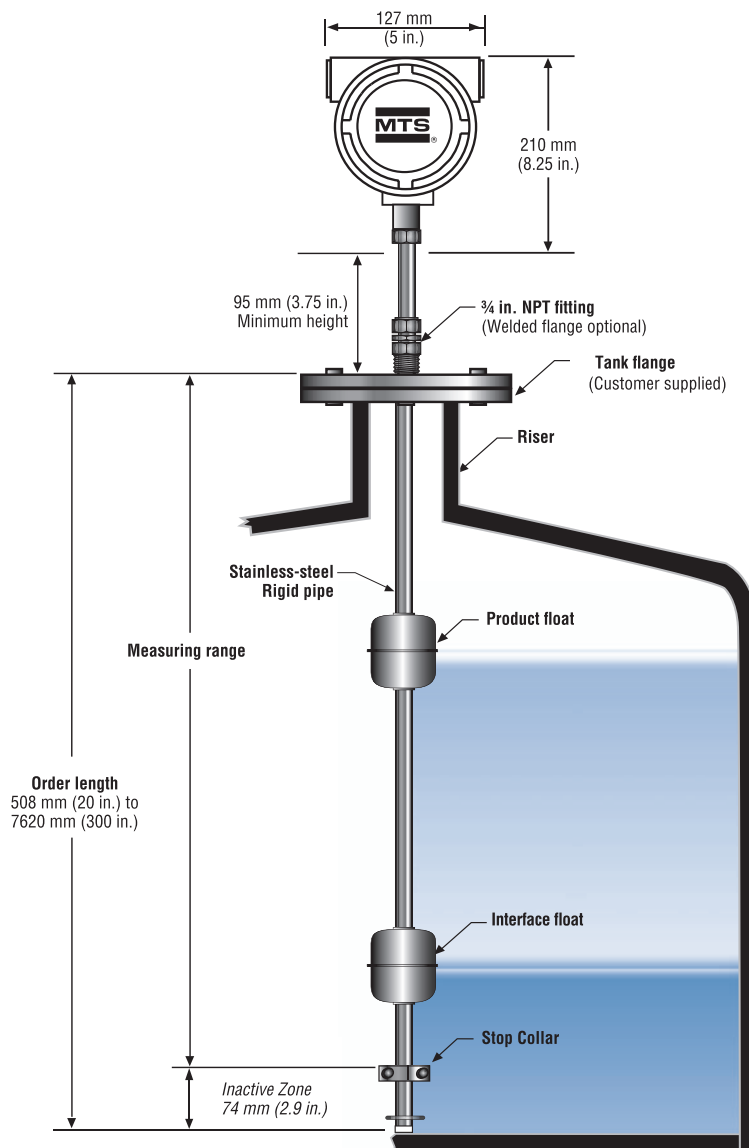
MTS has developed a DD file for the *Rosemount® 375* which includes all of the required programming capabilities.

Product dimensions and mounting

MTS offers the Level Plus Model MG transmitter configured with a rigid pipe constructed of 316L stainless steel (*see illustration below*). The rigid pipe configuration can be ordered in lengths from 508 mm (20 in.) to 7620 mm (300 in.). The Model MG is typically ordered with a ¾ in. NPT Adjustable fitting which allows the transmitter order length to be adjusted (within a few inches) if the tank height and order length are not exactly equal.

The ‘*Measuring range*’ of the M-Series transmitter is equal to the ‘*Order length*’ minus the ‘*Inactive zone*’ as of 74 mm (2.9 in.). The transmitter can be ordered with a single product float or can include the optional interface float (*Refer to the Level Plus Accessories Catalog, document no. 551103 for optional float selections*). If required, temperature measurement is also an option.

A stop collar is also included which is designed to keep the float out of the inactive zone. The placement of the stop collar is dependent on the float and placement of the magnet. If your application requires measuring to the bottom of your vessel, ask MTS about our *low liftoff* float option which can measure less than 25 mm (1 in.) of liquid.



Product dimensions and mounting

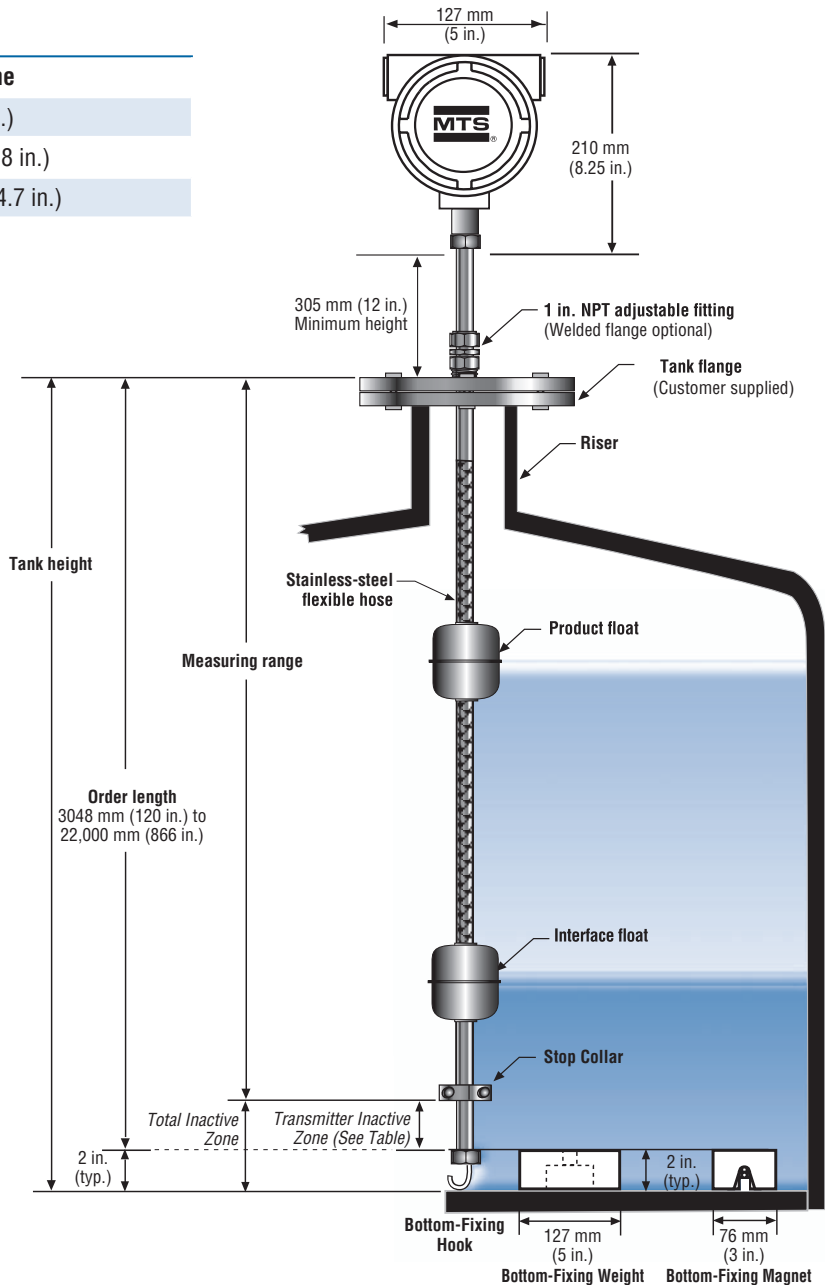
MTS offers the Level Plus Model MG transmitter configured with a Flexible hose constructed of 316L stainless steel (see illustration below). The flexible hose configuration can be ordered in lengths from 3048 mm (120 in.) to 22,000 mm (866 in.). The Level Plus Model MG transmitter for flexible hose applications is typically ordered with a 1 in. adjustable NPT fitting. This fitting allows the transmitter to be adjusted (within a few inches) if the order length is not exact.

The Model MG transmitter ‘Measuring range’ is equal to the ‘Order length’ minus the ‘Inactive zone’ (refer to the Transmitter Inactive Zone Reference table below). The ‘Order length’ should equal the ‘Tank height’ minus 51 mm (2.0 in.). The transmitter can be ordered with a single product float or can include the optional interface float (Refer to the Level Plus Accessories Catalog, document no. 551103 for optional float selections). If required, temperature measurement is also an option.

A stop collar is also included which is designed to keep the float out of the inactive zone. The placement of the stop collar is dependent on the float and placement of the magnet. If your application requires measuring to the bottom of your vessel, ask MTS about our low liftoff float option which can measure less than 25 mm (1 in.) of liquid.

TRANSMITTER INACTIVE ZONE REFERENCE

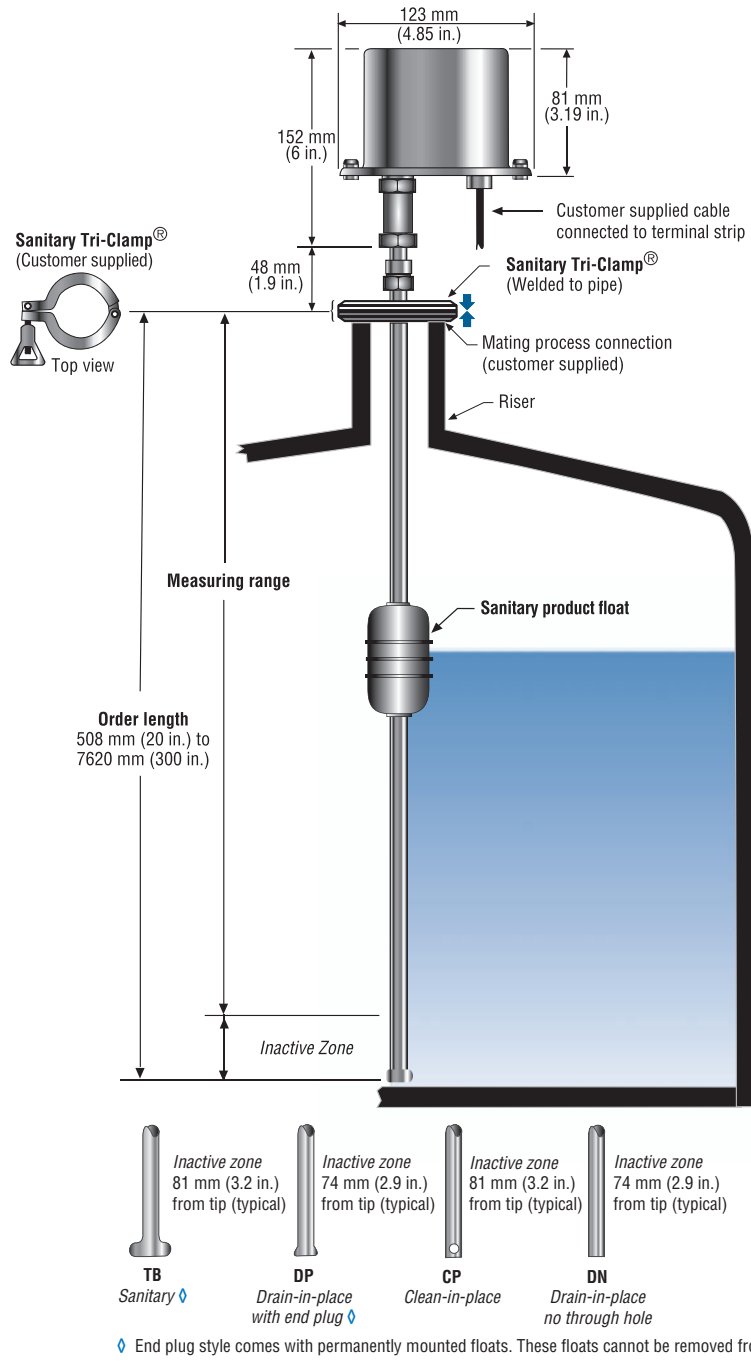
Length	Inactive Zone
< 25 ft.	76 mm (3 in.)
< 40 ft.	96.5 mm (3.8 in.)
< 72.2 ft.	119.5 mm (4.7 in.)



Product dimensions and mounting

MTS offers the Level Plus Model MG transmitter configured with a Sanitary pipe constructed of 316L stainless steel (*see illustration below*). The sanitary pipe configuration can be ordered in lengths from 508 mm (20 in.) to 7620 mm (300 in.). The 316L sanitary pipe comes standard with a Ra 25 finish, however an electropolish option is also available with a Ra 15 finish. The standard process fitting is a welded Tri-Clamp®. Because the Tri-Clamp is welded, it is imperative that the correct order length is provided. The order length should be equal to the height from the bottom of the tank to the top of the process connection on the tank.

The Model MG transmitter ‘*Measuring range*’ is equal to the ‘*Order length*’ minus the ‘*Inactive zone*’. The inactive zone measurement is dependent on the end plug style chosen (*shown in the table below*). The standard sanitary float magnet is offset to ensure the magnet does not enter the inactive zone despite the end plug. The transmitter can be ordered with a single product float or can include the optional interface float (*Refer to the Level Plus Accessories Catalog, document no. 551103 for optional float selections*). If required, temperature measurement is also an option.



Ordering information


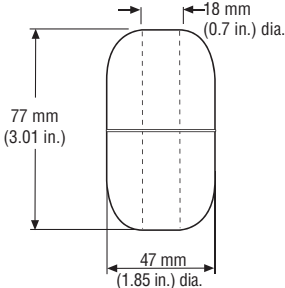
TRANSMITTER MODEL		=	M	1
M	= Magnetostrictive transmitter			
TYPE		=	G	2
G	= Digital output level transmitter			
INPUT POWER		=	A	3
A	= 24 Vdc			
OUTPUT POWER		=		4
M	= Modbus RTU data format			
D	= MTS DDA			
F	= FOUNDATION™ fieldbus			
HOUSING TYPE		=		5
3	= NEMA Type 4X, 316L stainless steel with NPT and internal terminal blocks (Intrinsically safe only)			
B	= Single cavity (explosion-proof and intrinsically safe)			
C	= Dual cavity (explosion-proof and intrinsically safe)			
L	= NEMA Type 4X, 316L with 6-pin connector (Intrinsically safe only)			
ELECTRONICS MOUNTING		=		6
1	= Integral electronics			
TRANSMITTER PIPE/HOSE		=		7
B	= Industrial end-plug with 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 hook (stainless steel only)			
N	= Flexible w/bottom fixing weight (stainless steel only)			
P	= Flexible w/bottom fixing magnet (stainless steel only)			
MATERIALS OF CONSTRUCTION (WETTED PARTS) (Note: contact factory for other materials)		=		8
1	= 316L stainless steel			
2	= Electropolished 316L stainless steel Ra 15			
A	= Teflon			
C	= CRN Approved			
PROCESS CONNECTION TYPE		=		9
1	= NPT, Adjustable fitting			
5	= Sanitary, adjustable fitting			
7	= 300 lbs. Welded RF flange			
X	= None			
4	= Sanitary, welded			
6	= 150 lbs. welded RF flange			
8	= 600 lbs. welded RF flange			
PROCESS CONNECTION SIZE		=		10
A	= ¾ in. (NPT for 5/8 in. pipe)			
C	= 1½ in.			
E	= 2½ in.			
G	= 4 in.			
J	= 6 in.			
B	= 1 in. (NPT for 7/8 in. hose)			
D	= 2 in.			
F	= 3 in.			
H	= 5 in. (except sanitary)			
X	= None			
TEMPERATURE (DIGITAL THERMOMETERS)		=		11
0	= None			
1	= One DT, fixed position at 203 mm (8 in.) from end of transmitter if the order length is less than 8128 mm (360 in.). If the length greater, 1 DT at 813 mm (360 in.) from the end of the pipe.			
2	= One DT, customer defined position #			
5	= Five DTs, evenly spaced as API			
K	= Twelve DTs, evenly spaced per API			
6	= Five DTs, customer defined position #			
L	= Twelve DTs, customer defined position #			
Note: #If this DT option is selected, option '18 E' must also be selected				
UNIT OF MEASUREMENT		=		12
M	= Metric (millimeters) Encode length in millimeters if using metric (XXXXX mm)			
U	= US Customary (inches) Encode length in inches if ordering in US Customary (XXX.XX in.)			
LENGTH (Order length based on unit of measurement)		=	<input type="text"/>	13-17
	= Rigid or Sanitary transmitter: 508 mm (20 in.) to 7620 mm (300 in.)			
	= Flexible transmitter: 3050 mm (120 in.) to 22,000 mm (866 in.)			
SPECIAL		=		18
S	= Standard product			
E	= Engineering special (not affecting agency controlled parts or features)			


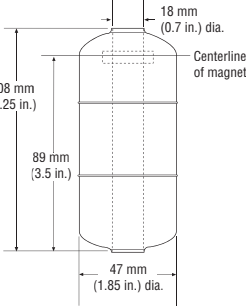
Standard Product Floats


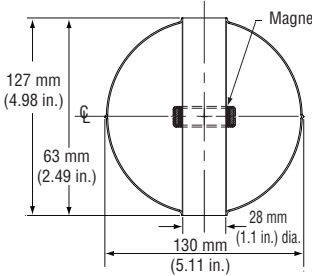
Listed below are standard floats for general applications. Please consult the factory for help in selecting the correct float for your application. For detailed information about all liquid-level product accessories, refer to the 'Level Plus Accessories Catalog, document No. 551103' available in PDF format at <http://www.mtsensors.com/products/liquid-level-sensors/accessories/index.html>

General Notes (for all applications):





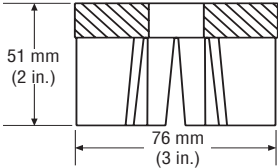

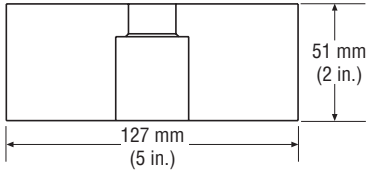

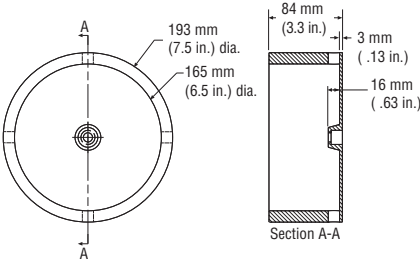
1. Be sure that the float specific gravity is at least 0.05 less than that of the measured liquid as a safety margin at ambient temperature.
2. For interface measurement: A minimum of 0.05 specific gravity differential is required between the upper and lower liquids.
3. Sanitary polish is available for stainless-steel floats up to 200 Grit/Ra 25.
4. Electropolish is available for stainless-steel floats up to 240 Grit/Ra 15.
5. When the magnet is not shown, the magnet is positioned at the center line of float.
6. Offset weight option: A weight is installed in the float to bias, or tilt, the float installed on the transmitter tube so that the float remains in contact with the transmitter tube at all times. The offset option is required for installations that must conform to ATEX standards.
7. Drawings contained in this document are for reference only. Contact the factory for engineering drawings.
8. *Call for specific lead times. Typical lead time exceeds lead time of the transmitter.

STANDARD PRODUCT FLOAT		Pressure	Temp.	Magnet Offset	Specific Gravity	Material	Weight Offset	Part Number
		29.3 bar (425 psi)	149 °C (300 °F)	No	0.65	SS	No	251981-1
					0.67	SS	Yes	251981-2*
					0.68	Hastelloy C	No	251981-3
					0.71	Hastelloy C	Yes	251981-4*

SANITARY FLOAT		Pressure	Temp.	Magnet Offset	Specific Gravity	Material	Weight Offset	Part Number
		10.3 bar (150 psi)	149 °C (300 °F)	Yes	0.66	SS 200 Grit/ Ra 25	No	401513-1
						SS 200 Grit/ Ra 25	Yes	401513-2*
						SS 240 Grit/ Ra 15	No	401513-3*
						SS 240 Grit/ Ra 15	Yes	401513-4*

LONG GAUGE FLOAT		Pressure	Temp.	Magnet Offset	Specific Gravity	Material	Weight Offset	Part Number
		37.9 bar (550 psi)	149 °C (300 °F)	No	0.44	SS	No	250709-1*
					0.52	Hastelloy C	No	250709-3*
					0.90 - 0.96	SS	No	250714-1*
						Hastelloy C	No	250714-3*
					1.03 - 1.10	SS	No	250855-1*
						Hastelloy C	No	250855-3*

Programming and Hardware Accessories

PROGRAMMING ACCESSORIES		PART NUMBER	
	<p>HT100 Hand Held Terminal M-Series Model MG Transmitter with DDA output Remote setup, troubleshooting, and maintenance</p>	251259	
SETUP SOFTWARE		PART NUMBER	
	<p>M-Series Model MG with Modbus PC setup software on CD Includes RS-485 to RS-232 adapter, part no. 380075</p>	625051	
	<p>M-Series Model MG with Modbus PC setup software on CD</p>	625052	
HARDWARE		PART NUMBER	
	<p>RS-485 to RS-232 adapter converter (B & B Electronics)</p>	380075	
MAGNET AND WEIGHT ASSEMBLIES		PART NUMBER	
	 <p>51 mm (2 in.)</p> <p>76 mm (3 in.)</p>	<p>150 lb. Pull Magnet For LDF long transmitter and M-Series transmitters. (Top ring must be removed before installation)</p>	560604
	 <p>127 mm (5 in.)</p> <p>51 mm (2 in.)</p>	<p>Standard 11 lb. Weight for M-Series transmitters.</p>	401059
	 <p>193 mm (7.5 in.) dia.</p> <p>165 mm (6.5 in.) dia.</p> <p>84 mm (3.3 in.)</p> <p>3 mm (.13 in.)</p> <p>16 mm (.63 in.)</p> <p>Section A-A</p>	<p>Low Liftoff 11 lb. Weight Assembly Use with float part no. 252999</p>	402364



Part Number: 550784 Revision G 05-09

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All Temposonics sensors are covered by US patent number 5,545,984. Additional patents are pending.
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**MTS Systems Corporation
Sensors Division**

3001 Sheldon Drive
Cary, North Carolina
27513, USA
Tel.: +1-800-633-7609
Fax: +1-919-677-2343
+1-800-498-4442
e-mail: sensorsinfo@mts.com
<http://www.mtssensors.com>

**MTS Sensor Technologie
GmbH & Co. KG**

Auf dem Schüffel 9
D - 58513 Lüdenscheid, Germany
Tel.: +49-2351-9587-0
Fax: +49-2351-56491
e-mail: info@mtssensor.de
<http://www.mtssensor.de>

**MTS Sensors Technology
Corporation**

737 Aihara-cho, Machida-shi
Tokyo 194-0211, Japan
Tel.: +81-42-775-3838
Fax: +81-42-775-5516
e-mail: info@mtssensor.co.jp
<http://www.mtssensor.co.jp>