

# Level Plus®

Magnetostrictive Liquid Level Transmitters  
with Temposonics® Technology

## RefineME® Data Sheet

- 4-IN-1 Measurement
- Inherent Accuracy  $\pm 1$  mm
- API Temperature Corrected Volumes
- No Scheduled Maintenance or Recalibration
- Hazardous Area Certified



## MEASURING TECHNOLOGY

The absolute, linear position sensors provided by MTS Sensors rely on the company's proprietary Temposonics® magnetostrictive technology, which can determine position with a high level of precision and robustness. Each Temposonics® position sensor consists of a ferromagnetic waveguide, a position magnet, a strain pulse converter and supporting electronics. The magnet, connected to the object in motion in the application, generates a magnetic field at its location on the waveguide. A short current pulse is applied to the waveguide. This creates a momentary radial magnetic field and torsional strain on the waveguide. The momentary interaction of the magnetic fields releases a torsional strain pulse that propagates the length of the waveguide. When the ultrasonic wave reaches the end of the waveguide it is converted into an electrical signal. Since the speed of the ultrasonic wave in the waveguide is precisely known, the time required to receive the return signal can be converted into a linear position measurement with both high accuracy and repeatability.

## RefineME®

The Level Plus® RefineME® liquid level transmitter satisfies the demand for an accurate and robust liquid-level sensor with unsurpassed flexibility to meet most process application conditions. The RefineME® transmitter provides 4-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!**

Standard	Rating
FM 3610 ISA 60079-11:2014	Class I, Div. 1, Groups A, B, C, D T4 Class I, Zone 0/1, AEx ia IIC T4 Ta= -50 to 71°C: IP65
C22.2 No. 157 C22.2 No. 60079-11:2014	Class I, Div. 1, Groups A, B, C, D T4 Class I, Zone 0/1, Ex ia IIC T4 Ta= -50 to 71°C: IP65
EN 60079-11:2012	FM14ATEX0068X Ex II ½ G Ex ia IIC T4 Ta= -50 to 71°C: IP65
IEC 60079-11:2011	IECEX FMG 14.0032X II ½ G Ex ia IIC T4 Ga/Gb Ta= -50 to 71°C: IP65
FM 3615 ISA 60079-1	Class I, Div. 1, Groups A, B, C, D T6...T3 Class I, Zone 0/1, AEx db IIB+H2 T6...T3 Ga/Gb Ta= -40 to 71°C: IP65
C22.2 No. 30 C22.2 No. 60079-1	Class I, Div. 1, Groups B, C, D T6...T3 Ex db IIB+H2 T6...T3 Ga/Gb Ta= -40 to 71°C: IP65
EN 60079-1:2014	FM16ATEX0068X Ex II ½ G Ex db IIB+H2 T6...T3 Ga/Gb Ta= -40 to 71°C: IP65
IEC 60079-1:2011	IECEX FMG 16.0033X Ex db IIB+H2 T6...T3 Ga/Gb Ta= -40 to 71°C: IP65

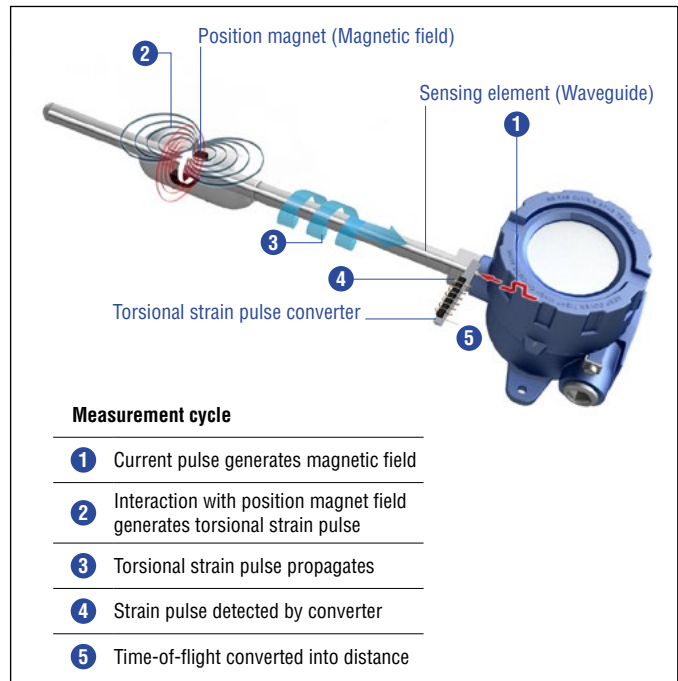


Fig. 1: Time-of-flight based magnetostrictive position sensing principle

### Features:

- 4-in-1 Measurement:
  - Product Level
  - Interface Level
  - Temperature
  - Volume
- No scheduled maintenance or recalibration
- Field Repairable
- Inherent Accuracy ±1mm
- 200 Point Strap Table
- API Temperature Corrected Volumes

### Applications:

- Fuel Additive Tanks
- Sump Tanks
- Bullet Tanks
- Separator Tanks
- Battery Tanks
- Storage Tanks
- Solvent Extraction

### Industries:

- Petroleum
- Liquid Petroleum Gas
- Food & Beverage
- Chemical
- Mining

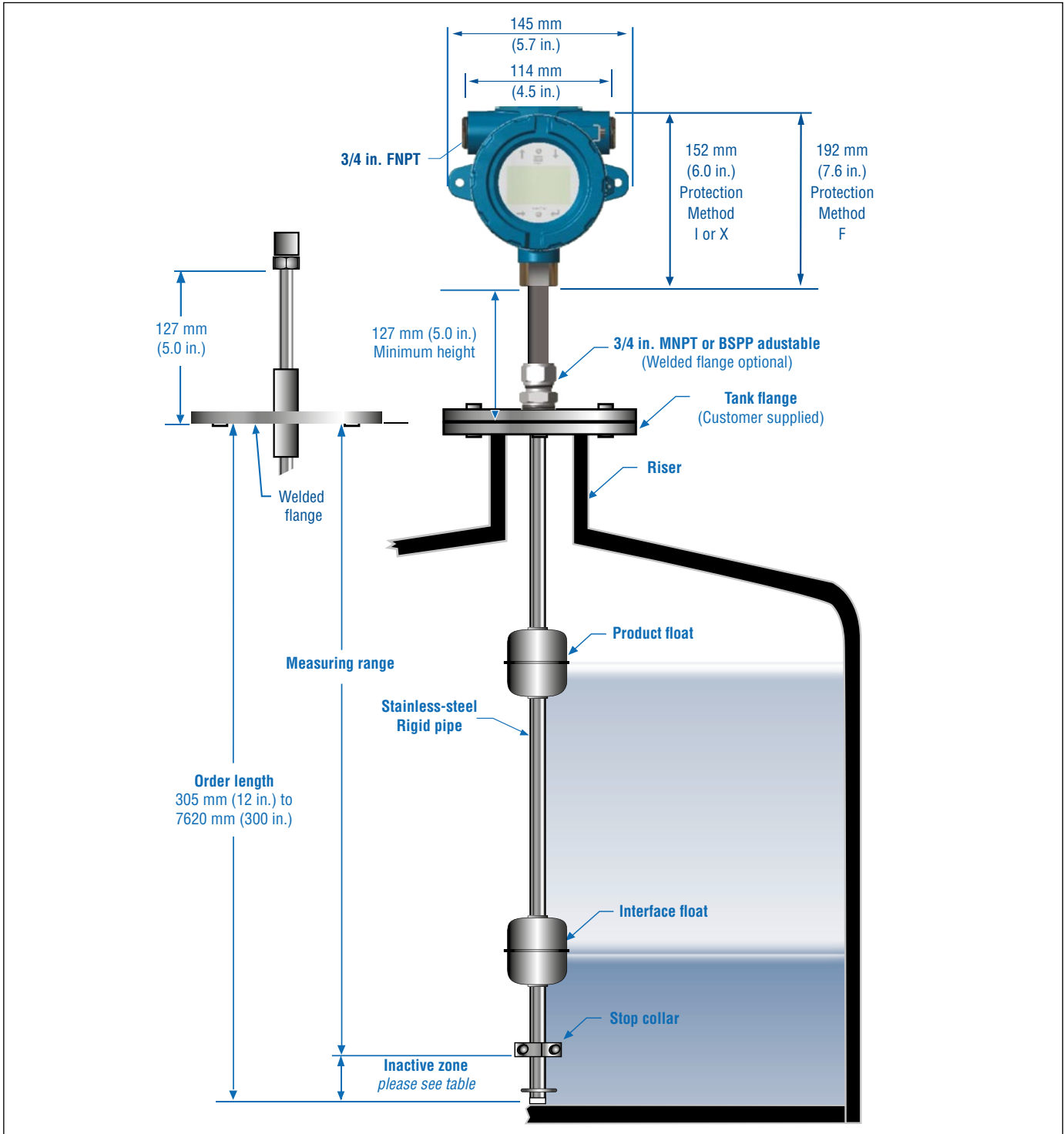


Fig. 2: Example of product and interface level measurement

## TECHNICAL DATA

Level Output	
Measured Variable	Product level and interface level
Output Signal /Protocol	Modbus RTU, DDA, Analog (4...20 mA), HART®
Order Length	Rigid Pipe: 305 mm (12 in.) to 7620 mm (300 in.) (Order length equals the measurement range plus the inactive zone. Contact factory for longer lengths)
Inherent Accuracy	±1 mm (0.039 in.)
Repeatability	0.001% F.S. or 0.381 mm (0.015 in.) whichever is greater (any direction)
Temperature Output	
Measured Variable	Average and multipoint temperatures (Modbus, DDA) Single point temperature (Analog, HART®)
Temperature Accuracy (Modbus, DDA)	±0.2 °C (0.4 °F) range -40...-20 °C (-40...-4 °F), ±0.1 °C (0.2 °F) range -20...+70 °C (-4...+158 °F), ±0.15 °C (0.3 °F) range +70...+100 °C (+158...+212 °F), ±0.5 °C (0.9 °F) range +100...+105 °C (+ 212 ...221 °F)
Temperature Accuracy (Analog, HART®)	±0.28 °C (0.5 °F) range -40...+105 °C (-40...+221 °F)
Electronics	
Input Voltage	10.5...28 VDC
Fail Safe	High, Full scale (Modbus, DDA) Low, 3.5 mA default or High, 22.8 mA (Analog, HART®)
Reverse Polarity Protection	Series diode
EMC	EN 61326-1, EN 61326-2-3, EN 61326-3-2, EN 61000-6-2, EN 61000-6-3, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11
Environmental	
Enclosure Rating	NEMA Type 4X, IP65
Humidity	0...100% relative humidity, non-condensing
Operating Temperatures	Electronics: -40...+71 °C (-40...+160 °F) Sensing element: -40...+125 °C (-40...+257 °F) (Contact factory for specific temperature ranges) Temperature element: -40...+105 °C (-40...+221 °F)
Vessel Pressure	Rigid Pipe: 1,000 psi (68.9 bar) / Teflon® Pipe: 25 psi (1.75 bar)
Materials	Wetted parts: 316L stainless steel (Contact factory for alternative materials) Non-wetted parts: 316L stainless steel, Epoxy coated aluminum
Field Installation	
Housing Dimensions	Single cavity: 145 mm (5.7 in.) W × by 127 mm (5 in.) D × 109 mm (4.3 in.) H Dual cavity: 117 mm (4.6 in.) W × by 127 mm (5 in.) D × 206 mm (8.1 in.) H Stainless steel single cavity: 178 mm (7.1 in.) W × by 135 mm (5.3 in.) D × 153 mm (6 in.) H NEMA Type 4X: 87 mm (3.4 in.) W × by 124 mm (4.9 in.) D × 132 mm (5.2 in.) H
Mounting	
Flexible hose	¾ in. Adjustable MNPT or BSPP fitting, Flange mount
Wiring	
Connections	4-wire shielded cable or twisted pair, Daniel Woodhead 6-pin male connector 4570 mm (180 in.) integral cable with pigtail
Electrical connections	
Single and dual cavity	¾ in. FNPT conduit opening, M20 for ATEX/IECEX version
NEMA Type 4X	½ in. FNPT conduit opening
Display	
Measured variables	Product level, interface level and temperature

TECHNICAL DRAWING



TRANSMITTER INACTIVE ZONE REFERENCE

Material	Order Length 1219 mm (<48 in.)	Order Length 1220 mm (>48 in.)
316L stainless steel, Hastelloy® C	74 mm (2.9 in.)	74 mm (2.9 in.)
Teflon	115 mm (4.5 in.)	132 mm (5.2 in.)

## ORDER CODE

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
L	P	R																			
a			b	c	d	e	f	g	h	i	j	k	l	m	n	o					p

<b>a</b>	<b>Sensor model</b>		
L	P	R	RefineME® Level Transmitter

<b>b</b>	<b>Output</b>
M	Modbus
D	DDA
1	1 Loop with HART®
2	2 Loop with HART®
5	1 Loop with HART® and SIL 2
7	2 Loop with HART® and SIL 2 (loop 1 only)

<b>c</b>	<b>Housing type</b>
A	NEMA housing w/cable
B	NEMA housing w/terminal
C	NEMA housing w/connector
D	Single cavity with display
E	Dual cavity with display
L	Stainless steel single cavity w/display

<b>d</b>	<b>Electronics mounting</b>
1	Standard

<b>e</b>	<b>Sensor pipe</b>
B	5/8" OD Rigid Pipe

<b>f</b>	<b>Materials of construction (Wetted parts)*</b>
1	316L stainless steel
3	Hastelloy® C
A	Teflon®
C	CRN-Canadian Registration Number (FMC approval only)

<b>g</b>	<b>Process connection type</b>
1	NPT adjustable (¾ in. only)
2	BSPP adjustable (¾ in. only)
6	150 lb. welded RF flange
7	300 lb. welded RF flange
8	600 lb. welded RF flange
A	PN16, DIN 2572 welded flange
B	PN40, DIN 2572 welded flange
C	PN64, DIN 2572 welded flange
D	PN100, DIN 2572 welded flange

<b>h</b>	<b>Process connection size</b>
A	¾ in. - NPT or BSPP only
D	2 in. (DN50)
E	DN65
F	3 in. (DN80)
G	4 in. (DN100)
H	5 in. (DN125)
J	6 in. (DN150)
X	None

<b>i</b>	<b>Number of Digital Thermometers (DT's)</b>
0	None
1	One DT
5	5 DTs (Modbus or DDA)
K	Twelve DTs (Modbus only)
M	Sixteen DTs (Modbus only)

<b>j</b>	<b>Digital Thermometer placement</b>
F	Evenly spaced per API
C	Custom
X	None

Continued on next page...

**Level Plus® RefineME®**

Data Sheet

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
L	P	R																			
a			b	c	d	e	f	g	h	i	j	k	l	m	n	o					p

<b>k</b>	<b>Notified body</b>
C	CEC (FMC)
E	ATEX
F	NEC (FM)
I	IEC
X	None
B	INMETRO
N	NEPSI
P	CCOE
T	CML/TIIS
K	KC

<b>l</b>	<b>Protection method</b>
F	Explosion proof / Flameproof (only for housing type D, E, or L)
I	Intrinsically Safe
X	No approval

<b>m</b>	<b>Gas group</b>
A	Group A (not available with “C = CEC (FMC)” notified body and “F = Flameproof/Explosion” proof protection method)
B	Group B
C	Group C
D	Group D
3	IIC (Intrinsically Safe only)
4	IIB + H2 (Explosion Proof / Flameproof only)
X	None

<b>n</b>	<b>Unit of measure</b>
M	Metric - Millimeters
U	US customary - Inches

<b>o</b>	<b>Length (no decimal spaces)</b>				
X	X	X	X	X	Rigid sensor pipe: 305...7620 mm (code as 00305 to 07620)
X	X	X	X	X	Rigid sensor pipe: 12...300 in. (code as 01200 to 30000)

<b>p</b>	<b>Special</b>
S	Standard product

**NOTICE**  
 Accessories such as floats, cables, and remote displays have to be ordered separately. All accessories are shown in the [Accessories Catalog \(551103\)](#).

**FREQUENTLY ORDERED ACCESSORIES** – Additional options available in our [Accessories Guide](#) 551103

**General Notes**

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. When the magnet is not shown, the magnet is positioned at the center line of float.
4. Drawings contained in this document are for reference only. Contact the factory for engineering drawings.

Standard floats	Pressure	Temperature	Magnet offset	Specific gravity	Material	Part number
	29.3 bar (425 psi)	149 °C (300 °F)	No	0.67	Stainless steel	251 981-2
				0.71	Hastelloy® C	251 981-4

Standard floats	Pressure	Temperature	Magnet offset	Specific gravity	Material	Part number
	29.3 bar (425 psi)	149 °C (300 °F)	No	0.93	Stainless steel	251 982-2
					Hastelloy® C	251 982-5

Teflon® floats	Pressure	Temperature	Magnet offset	Specific gravity	Material	Part number
	1.7 bar (25 psi)	38 °C (100 °F)	Yes	0.86	Teflon®	201 109-2
				0.93	Teflon®	251 115-2
				1.06	Teflon®	251 116-2

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