

Specifications

MagMaster MFE Series Electromagnetic Sensors

- **Unrivalled flow performance**
– $\pm 0.2\%$ accuracy.
- **Pulsed DC Technology Incorporates Benefits of AC Systems**
- **Operable flow range of 1000:1.**
- **For all process liquids, slurries, pulps and pastes.**
- **Two-year warranty.**
- **Submersible and buriable sensors.**
- **FM approved and CSA certified for hazardous locations.**
- **Variety of corrosion and abrasion resistant construction materials.**
- **Bi-directional flow metering system.**
- **Designed, manufactured and calibrated to internationally accepted standards**
 - ISO 9001/NAMAS/NIST/NATA
 - insures reliable, maintenance-free operation



***MagMaster - bringing
unsurpassed flowmetering
performance***

ABB Instrumentation



INTRODUCTION

MAGMASTER flowmeters provide new levels of flow measurement and performance with an exclusive sensor design featuring ultra-linear magnetics and a patented signal processing system. The MagMaster utilizes pulsed dc technology coupled with the benefits of ac design.

Two modes— Process MAGMASTER and Slurry MAGMASTER are available in a wide range of sizes and options including electrode materials, liner materials and transmitter capabilities.

SPECIFICATIONS

Configuration:

Transmitter may be integral with sensor for sizes 1/2 to 16-inches (400mm) or remote from sensor for all sizes.

Separation (remote transmitters):

The maximum cable length in feet is the lower of 330 feet (100m) or 15 x the conductivity ($\mu\text{S}/\text{cm}$). Longer lengths are special order.

Accuracy (under forward flow reference conditions) with MagMaster transmitter

Flanged sensors:

Display, Serial comms, Frequency output:

$\pm 0.2\%$ of reading or $\pm 0.003 \text{ ft/sec}$ (0.001 m/s) (whichever is greater) up to a maximum velocity of $>49 \text{ ft/sec}$ (15 m/s). See Figure below.

Analog output:

As Frequency output plus $\pm 0.008 \text{ mA}$.

Wafer sensors:

As for flanged meters plus $\pm 0.3\%$ of reading.

Pressure effect:

Less than 0.15% over the operating range of the instrument.

Temperature effect:

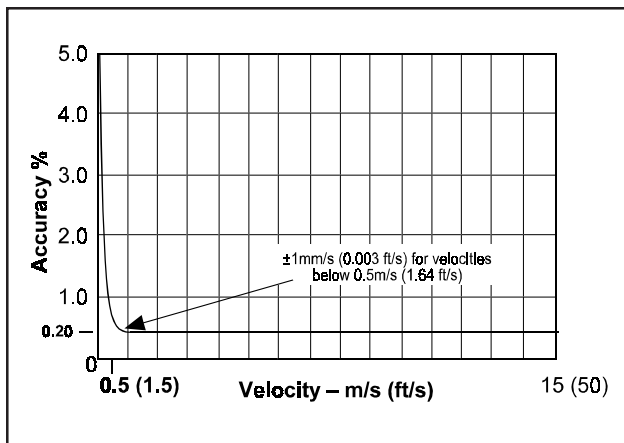
Sensor: $< \pm 0.03\%$ of rate per 10°C .

Repeatability & Reproducibility:

$\pm 0.05\%$ or $\pm 0.0008 \text{ ft/s}$ ($\pm 0.25 \text{ mm/s}$), whichever is greater.

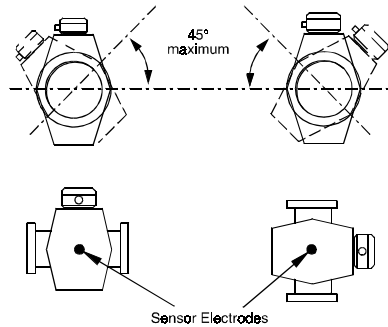
Conductivity:

Liquids and slurries having a conductivity of not less than $5 \mu\text{S}/\text{cm}$ ($5 \mu\text{mho}/\text{cm}$).



Mounting:

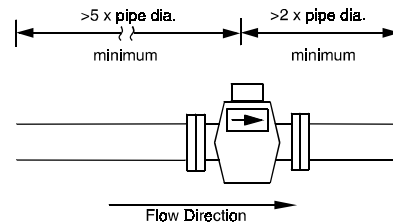
Directly into pipeline at any attitude. Electrodes can not be in vertical plane. Flow must be up if installed in a vertical pipe.



Recommended Mating Pipe Conditions:

Upstream: 5 to 10 diameters straight pipe depending on performance requirements and upstream disturbance.

Downstream: 2 to 3 diameters straight pipe depending on performance requirements and downstream disturbances.



Power consumption:

Less than 20VA with transmitter.

Hazardous Area Certification:

FM approved and CSA certified for Class I, Div. 2, Groups A, B, C, D hazardous locations, 0.5-24 inches (15-600 mm).

NOTE: FM approved sensors for hazardous locations include an intrinsic safety shunt circuit for the electrodes allowing for a Div. 1 rating inside the pipe. The circuit is located in the larger than standard terminal box housing. CSA certified sensors for hazardous locations may or may not include the circuit, depending on the rating inside the pipe.

Calibration:

3 point, 8 point, witnessed, NAMAS (8- to 24-inch only), slurry calibration options.

Sensor cable connection:

0.5 inch NPT--single opening. A single cable is available that provides for the coil drive and electrode signals. See Options.

SPECIFICATION – SENSORS

MAGMASTER sensors are available in flanged and wafer styles and come in a wide choice of lining and electrode materials to satisfy all applications. (Refer to **Table B** for option details.)

Sizes (Nominal Bore):

1/2-inch to 24-inches (15mm to 600mm).

Refer to MAG.PLUS specifications for larger sizes. Refer to Micro-MAG specifications for sizes smaller than 1/2-inch.

Metering Tube:

Lined stainless steel. (304 SST)

Lining:

PFA-Perfluoroalkoxy fluorocarbon – UKWFBS* (chemically resistant to almost all liquids),
Elastomer - chlorobutylrubber and EPDM – UKWFBS*,
Polypropylene – UKWFBS*,
Ebonite (hard rubber), Bonded FEP (Viton seals),
Polyurethane and Neoprene.

Polyurethane meeting FDA approval also available for potable water (consult factory for ordering information)

* *United Kingdom Water Fittings Bylaws Scheme (UKWFBS) listed for potable water.*

Electrodes:

Non-removable, 316 S.S, Hastelloy C, Titanium, Tantalum and Platinum/Iridium. Treated titanium for pulp and paper applications where concentrations of stock are greater than 5% or liquid contains long fibers regardless of the concentration. Tungsten carbide coated electrodes for high abrasion mining, cement or flyash applications.

Grounding Electrode:

Fitted as standard in flanged meters in the same material as measuring electrodes.

Grounding Ring:

For Wafer meters or liner protection.

≤ 12 in (300 mm) = 316 SST, >12 = 304 SST

Note: Pressure Limitations

Flanged meters:

Sizes 0.5-inch to 24-inch (15mm to 600mm):

maximum pressure dictated by flange rating.

Wafer meters: 725 psi (50 bars)

Process Connections:

Flanged meter-Carbon steel flanges to mate with BS4504, DIN, UNI, AFNOR, ANSI, AS2129 and BS10 flanges.

Wafer meters mate with the flange standard BS4504 (6, 10, 16, 25 and 40 bar), BS10 Table D & E, and ANSI 150 for 1, 1.5, 2.0, 3.0, 4.0, 6.0 inch (25, 40, 50, 80, 100, 150 mm) or with ANSI 300 for 1, 1.5, 3.0, 4.0 inch (25, 40, 80, 100 mm).

NOTE: No 2 inch or 6 inch ANSI 300 Wafer meters.

Temperature:

Sensors (with integral transmitters, except Wafer design):

Ambient: -10 to +60°C (14 to 140°F)

Process Fluid:

Polyurethane lining: -10 to +70°C (14 to 158°F)

All other linings: -10 to +80°C (14 to 176°F)

Ambient and process fluid is limited to -10° to 60°C for the integral CSA-certified hazardous area meter

Wafer Meters: Maximum Temperature of 26.6°C (80°F)

Sensors (remote transmitter): see **Table A**.

Environmental Protection:

Sensors with integral transmitters:

NEMA 4X/IP65

Flanged sensors, with remote transmitters*:

NEMA 6P/IP68 with potted terminal box and cable

- up to 33 ft (10 M) depth.

Buriable:

3 ft. (1m) to 16 ft. (5m) depth (to top of sensor).

Wafer sensors: NEMA 4X/IP65

*NOTE: All remote sensors are supplied with potting compound for sealing on-site or can be ordered with cable connected to sensor and terminal box potted.

Sensor Housing:

Wafer meters:

Epoxy coated SG iron (nodular cast iron)

Flanged meters:

1/2 to 6-inch (150mm) Cast aluminum alloy, Epoxy coated.

Non-approved/certified meters:

8- to 12-inch (200 to 300mm) ABS plastic

14- to 24-inch (350 to 600mm) GRP (Glass Reinforced Plastic)

Approved/certified & High temperature meters:

8- to 24-inch (200 to 600mm) Fabricated steel.

Table A Temperature Limits for Sensors (Remote Transmitter) at -30 to 140°F (-35 to 60°C) Ambient

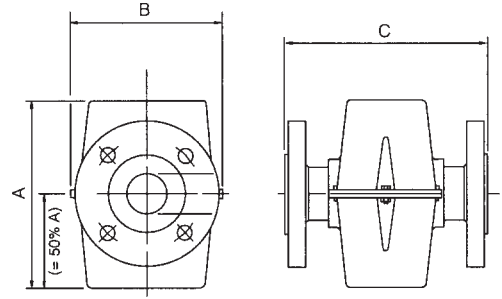
Sensor Construction	Liner Material vs Process Fluid Temperature Maximum (°C/°F)				
	Poly-propylene	FEP/PFA "Teflon" & Elastomer	Ebonite	Poly-urethane	Neoprene
ABB Standard, Non-hazardous, 1/2" to 6", metal cased 8" to 24"	26.6/80	120/248	95/203	70/158	110/230
FM approved, CSA certified, Non-Hazardous, high temp., 1/2" to 24"	26.6/80	120/248	95/203	70/158	110/230
FM approved, CSA certified, Hazardous, high temp., 1/2" to 24"	26.6/80	120/248*	95/203	70/158	110/230*
ABB Standard, Non-hazardous, > 24", plastic case 8" to 24"	N/A	80/176	80/176	70/158	80/176
FM approved, CSA certified, Non-Hazardous, 1/2" to 24"	26.6/80	80/176	80/176	70/158	80/176
FM approved, CSA certified, Hazardous, standard temp., 1/2" to 24"	26.6/80	60/140	60/140	60/140	60/140

* Note: 8- to 24-inch (200 –600mm) sizes limited to 100°C (212°F)

DIMENSIONS

1/2- to 6-inch (15 to 150mm) flanged sensors without transmitter or terminal box

Meter Size		A		B		C		Net Weight	
mm	inch	mm	inch	mm	inch	mm	inch	kg	lbs.
15	0.5	174	6.9	140	5.5	200	7.9	9	20
20	0.75	174	6.9	140	5.5	200	7.9	9	20
25	1.0	210	8.3	176	6.9	200	7.9	10	22
40	1.5	210	8.3	176	6.9	200	7.9	12	27
50	2.0	210	8.3	176	6.9	200	7.9	14	31
65	2.5	280	11.0	219	8.6	200	7.9	19	42
80	3.0	280	11.0	219	8.6	200	7.9	20	44
100	4.0	312	12.3	230.5	9.1	250	9.9	28	62
150	6.0	370	14.6	281	11.1	300	11.8	39	86

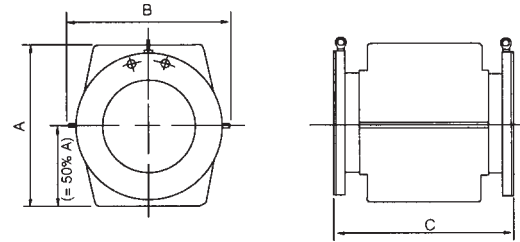


Polyurethane and PFA are part face linings

DIMENSIONS

8- to 24-inch (200 to 600mm) flanged sensors without transmitter or terminal box

Meter Size		A		B		C		Net Weight	
mm	inch	mm	inch	mm	inch	mm	inch	kg	lbs.
200	8	400	15.7	396	15.6	418	16.5	52	115
250	10	446	17.6	442	17.4	488	19.2	80	176
300	12	508	20.0	510	20.1	538	21.2	108	238
350	14	560	22.0	562	22.1	568	22.4	120	264
400	16	614	24.2	596	23.5	618	24.3	186	410
450	18	656	25.8	640	25.2	698	27.5	210	462
500	20	710	28.0	700	27.6	768	30.2	266	586
600	24	810	31.9	810	31.9	918	36.1	378	832



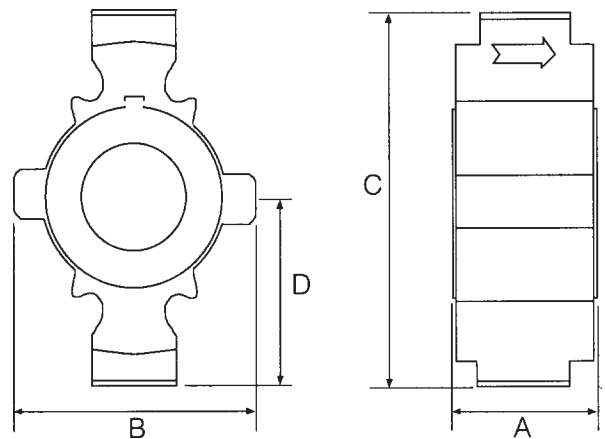
Polyurethane and FEP are part face linings

DIMENSIONS

Wafer meters without transmitter or terminal box

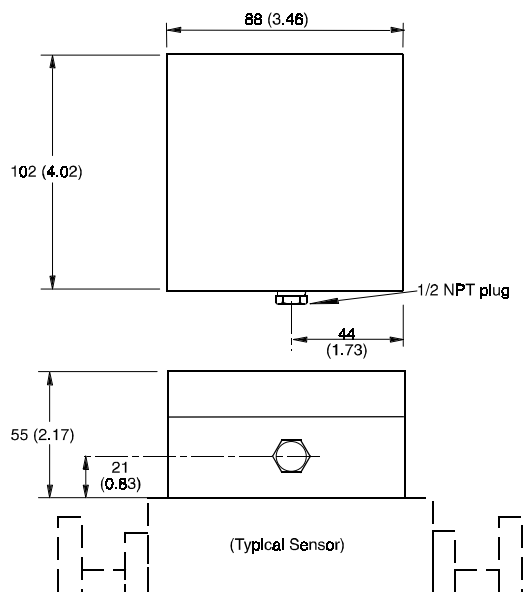
Size		A		B		C		D	
mm	in	mm	in	mm	in	mm	in	mm	in
25	1.0	64	2.5	110	4.3	212	8.3	95	3.7
40	1.5	85	3.3	115	4.5	238	9.4	108	4.25
50	2.0	90	3.5	124	4.9	238	9.4	110	4.3
80	3.0	120	4.7	170	6.7	282	11.1	130	5.1
100	4.0	150	5.9	200	7.9	342	13.5	160	6.3
150	6.0	225	8.9	250	9.8	402	15.8	190	7.5

Size		Weight	
mm	in	kg	lbs
25	1	2.5	7.7
40	1.5	2.5	7.7
50	2	5.3	13.9
80	3	9.3	22.6
100	4	14.1	33.2
150	6	26.5	60.6



DIMENSIONS

Standard terminal box (mounted on sensor)



DIMENSIONS

Hazardous area terminal box (mounted on sensor)

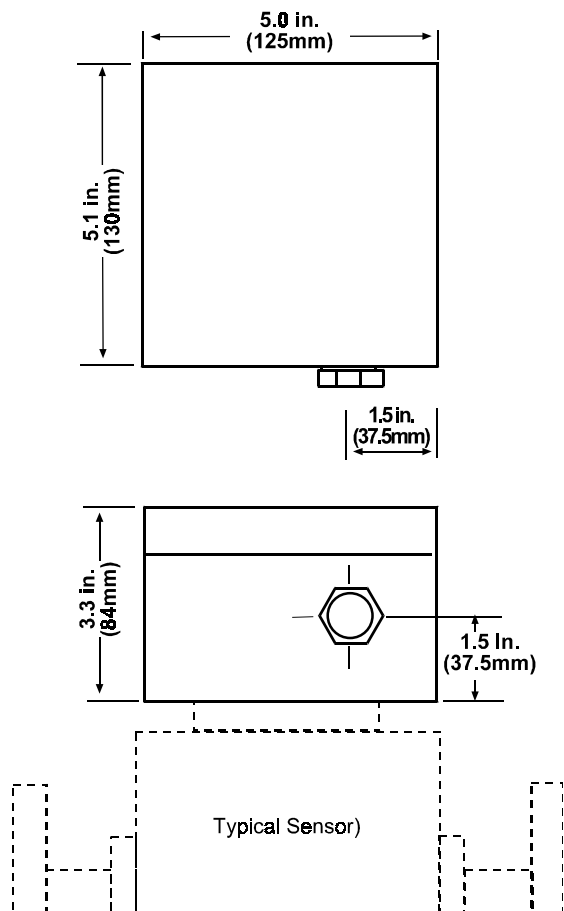


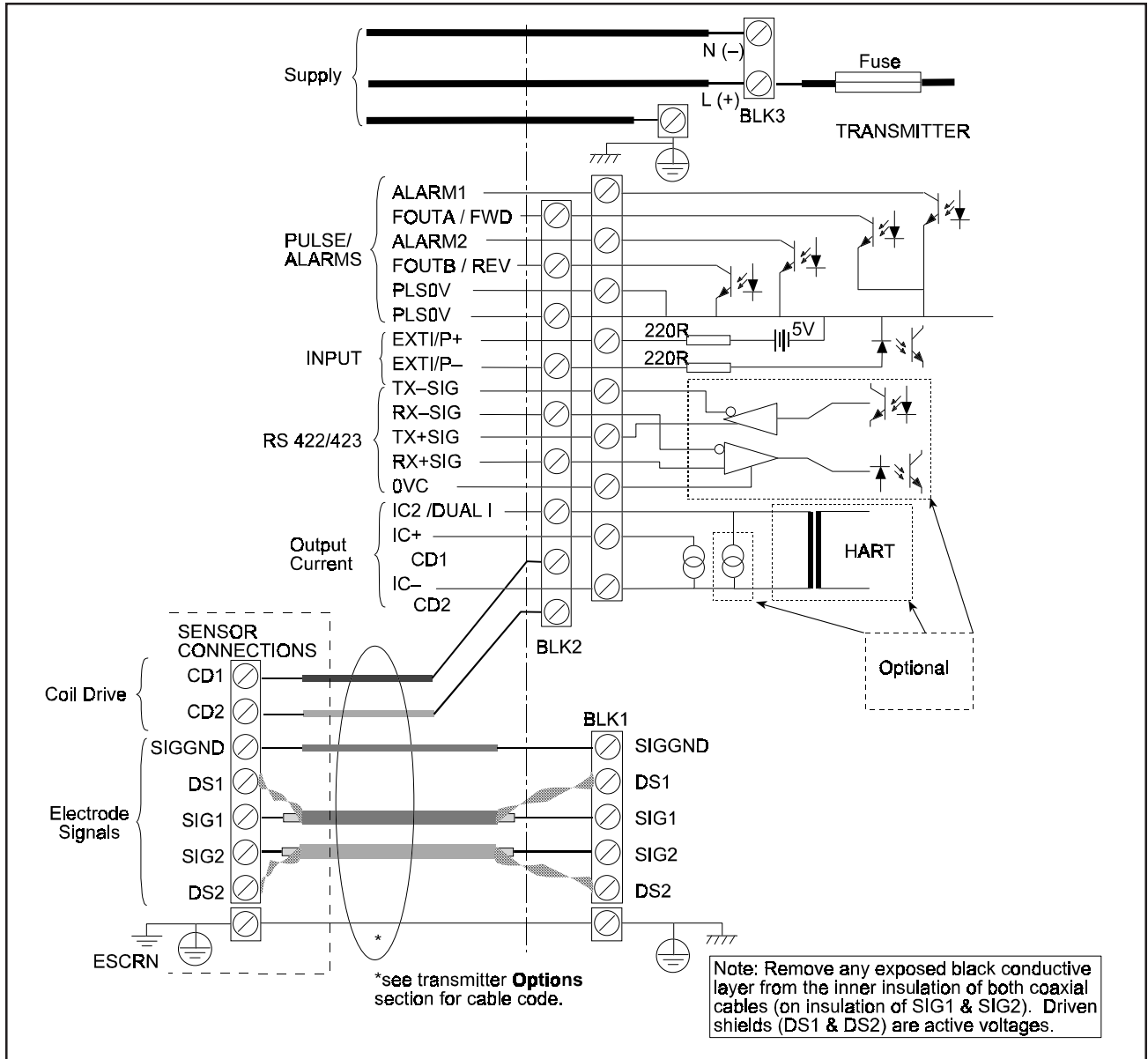
Table B Flowmeter Sizing

Size		USGPMs				
mm	Inches	Operable Minimum Flow	Flow Rate Deviation See Note 1	Minimum Flow at Rated Accuracy	Maximum Flow @ 10 m/s (33 ft./sec)	Std. Calibrated Range See Note 2
15	0.5	0.03	0.003	1.4	28	10
20	0.75	0.05	0.005	2.5	49	15
25	1	0.08	0.008	3.9	77	25
40	1.5	0.20	0.020	10.0	199	60
50	2	0.31	0.031	15.6	311	100
65	2.5	0.53	0.053	26.3	525	150
80	3	0.80	0.080	39.8	796	225
100	4	1.24	0.12	62.2	1244	400
150	6	2.80	0.28	140	2800	900
200	8	4.98	0.50	249	4980	1500
250	10	7.78	0.78	389	7780	2000
300	12	11.2	1.12	560	11,202	3000
350	14	15.2	1.5	762	15,248	4000
400	16	19.9	2.0	996	19,916	5000
450	18	25.2	2.5	1260	25,209	6000
500	20	31.1	3.1	1556	31,122	7500
600	24	44.8	4.5	2240	44,812	10,000

Note 1: Flow rate deviation listed is the plus and minus inaccuracy in terms of USGPM for all flows below the **Minimum Flow at Rated Accuracy** column. These values apply to the pulse/frequency/displayed output of flanged meters.

Note 2: The transmitter is set to this range for the 4-20 mA output unless otherwise specified.

CONNECTION INFORMATION



Select one character or set of characters from each category and specify complete catalog numbers for sensor as per samples below. Specify full scale if different from the calibrated ranges shown on the specification sheet. Complete a flow data sheet for further assistance. See the options section of SS MAG.MFE for selecting a transmitter, cable selection, accessories and instruction manuals.

Code No. Description

Sample catalog # MFE500361801004ER

MF **BASE Number - 1st and 2nd Characters**
 MAGMASTER Electromagnetic Flowmeter

Bore Size - 3rd through 6th Characters

E150	0.5 in (15mm)	
E200	0.75 in (20mm)	
E250	1.0 in (25mm)	
E250	1.0 in (25mm)	Wafer Style only (7th character = 4)
E400	1.5 in (40mm)	
E400	1.5 in (40mm)	Wafer Style only (7th character = 4)
E500	2.0 in (50mm)	
E500	2.0 in (50mm)	Wafer Style only (7th character = 4)
E650	2.5 in (65mm)	
E800	3.0 in (80mm)	
E800	3.0 in (80mm)	Wafer Style only (7th character = 4)
E101	4.0 in (100mm)	
E101	4.0 in (100mm)	Wafer Style only (7th character = 4)
E151	6.0 in (150mm)	
E151	6.0 in (150mm)	Wafer Style only (7th character = 4)
E201	8.0 in (200mm)	
E251	10.0 in (250mm)	
E301	12.0 in (300mm)	
E351	14.0 in (350mm)	
E401	16.0 in (400mm)	
E451	18.0 in (450mm)	
E501	20.0 in (500mm)	
E601	24.0 in (600mm)	

Flange Style End Connections - 7th Character

3	Standard: Flanged ANSI Class 150 compatible, Fully rated
4	Wafer 1 inch through 6 inches (25mm -150mm) (POLYPROPYLENE ONLY) (80°F max. temperature)
K	Flanged ANSI Class 300 compatible, Fully rated, 8 to 24 inch. Consult factory for face to face dimension.

Lining Materials - 8th Character

2	Polypropylene, 1 through 6 inches (25mm -150mm), wafer only
3	Teflon bonded FEP, 8 through 24 inches (200mm -600mm), flanged only
	8 inch
	10 inch
	12 inch
	14 inch
	16 inch
	18 inch
	20 inch
	24 inch
4	Elastomer, 2 through 24 inches (50mm -600), flanged only
5	Ebonite, 8 through 24 inches (200mm -600mm), flanged only
6	Polyurethane, 1 through 24 inches (25mm -600mm), flanged only (Note 4)
7	Teflon (PFA), 0.5 through 6 inches (15mm -150mm), flanged only
8	Neoprene, 8 through 24 inches (200mm -600), flanged only

Code No.	Description
	Electrodes - 9th Character (CHARACTER ALSO INCLUDES SENSOR SLURRY CALIBRATION)
1	316 Stainless Steel (Standard on wafer)
2	Hastelloy C,
3	Titanium, Flanged only
4	Tantalum, Flanged only, .5 through 6 inches (15mm-150mm)
	Tantalum, Flanged only, ≥8 inches (≥200mm)
5	Platinum/Iridium, Flanged only, .5 through 6 inches (15mm-150mm)
	Platinum/Iridium, Flanged only, ≥8 inches (≥200mm)
6	Tungsten Carbide Coated 316SST, Flanged Only (For Mining, Cement, Flyash applications)
8	Treated Titanium Slurry Electrode, Flanged Only (only with slurry calibration & slurry mode transmitter)
A	316 Stainless Steel, Slurry Calibration
B	Hastelloy 'C', Slurry Calibration
C	Zirconium (flanged only)
	Sensor Construction - 10th Character
1	ABB standard. Non-hazardous location. 1 in. through 6 in.
4	ABB standard. Non-hazardous location. Metal case for 8 through 24 inches (200mm-600mm)
6	FM approved, CSA certified non-incendive for Class I, Div 2, Groups A, B, C, D hazardous locations, intrinsically safe electrodes, remote sensor only. <u>Process fluid temperature 140°F (60°C) maximum.</u> .5 through 6 inches (15mm-150mm) 8 through 24 inches (200mm-600mm)
7	FM approved, CSA certified non-incendive for Class I, Div 2, Groups A, B, C, D hazardous locations, intrinsically safe electrodes, remote sensor only. <u>High temperature process fluid temperature above 140°F (60°C)</u> .5 through 6 inches (15mm-150mm) 8 through 24 inches (200mm-600mm)
8	FM approved, CSA certified for non-hazardous locations. <u>Standard temperature range.</u> .5 through 6 inches (15mm-150mm) 8 through 24 inches (200mm-600mm)
D	FM approved, CSA certified for non-hazardous locations. <u>High temperature process temperature above 140°F (60°C). Remote only.</u> .5 through 6 inches (15mm-150mm) 8 through 24 inches (200mm-600mm)
A	CSA certified non-incendive for Class I, Div 2, Groups A, B, C, D hazardous locations. Non- incendive electrodes. <u>Process fluid temperature 140°F (60°C) maximum.</u> .5 through 6 inches (15mm-150mm) 8 through 24 inches (200mm-600mm)
B	CSA certified non-incendive for Class I, Div 2, Groups A, B, C, D hazardous locations. Non- incendive electrodes. <u>High temperature process fluid temperature above 140°F (60°C). Remote only.</u> .5 through 6 inches (15mm-150mm) 8 through 24 inches (200mm-600mm)

ORDERING INFORMATION (Cont'd.)
MagMaster Electromagnetic Sensor

Code No.	Description		
	Accessories - 11th Character		
	0	None	
See Table	1	Grounding ring (one piece)	
See Table	8	Grounding rings (two pieces)	
		Grounding Rings (Note 3) - each	
		Stainless Steel	
		Size	Size
		0.5	8
		0.75	10
		1	12
		1.5	14
		2	16
		2.5	18
		3	20
		4	24
		6	
	Calibration - 12th Character		
	1	Standard 3-point calibration	
	2	8-point calibration	
		.5 through 6 inches (15mm-150mm)	
		≥8 inches (200mm)	
	9	Custom calibration	
	Unused - 13th and 14th Character		
00	Unused		
	Glanding - 15th Character		
4	Conduit entry: 0.5" NPT - order cable and length per OPTIONS		
8	Conduit entry: 0.5" NPT - cable fitted and potted - order cable and length per OPTIONS		
	TRANSMITTER TYPE -- 16th and 17th Characters		
EH	Sensor built for integral mounted MagMaster transmitter (≤ 16" only) See SS MAG.MFE to order transmitter.		
ER	Sensor built for Remote MagMaster transmitter See SS MAG.MFE to order transmitter.		
FH	Sensor built for Integral FH MagMaster Transmitter (10 th character = 1, or 4 only) See SS MAG.FH to order transmitter.		
FR	Sensor built for Remote FR MagMaster Transmitter (10 th character = 1, or 4 only) See SS MAG.FH to order transmitter.		

MFE500361801004ER MagMaster 2 inch sensor, class 150 flange, polyurethane lining, stainless steel electrode, FM approved standard temperature range, 3-point calibration, built for remote transmitter.

Notes:

1. FM approved, CSA certified sensors or transmitter must be part of an approved/certified MAGMASTER system.
2. Use a "9" in the catalog number to signify special feature in the character position (to be used with an Special Product Request SPR number).
3. Consult factory for other materials of construction.
4. Character not intended for potable water. Consult factory to order polyurethane that meets FDA approval for drinking water.

OPTIONS (specify as separate item on order)

Cable, sensor/transmitter (list number of feet)

STT3350	Standard. Can be used with FM/CSA approved instruments.
STT3500	Submersible-Waterproof. <u>Cannot be used</u> with FM/CSA approved instruments.
STT3300	Armored. <u>Cannot be used</u> with FM/CSA approved instruments.



The Company's policy is one of continuous product improvement and the right is reserved to modify specifications contained herein without notice.

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SS MAG.E 98.2

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