FieldIT

Electro-Magnetic Flowmeters
Sensors
MagMaster MFE

- Unrivalled flow performance
  – ±0.2% accuracy.

- Pulsed DC Technology Incorporates
  Benefits of AC Systems

- Operable flow range of 1000:1.

- Two-year warranty.

- Submersible and buriable sensors.

- FM approved and CSA certified for
  hazardous locations.

- Bi-directional flow metering system.

- Designed, manufactured and calibrated
to internationally accepted standards
  – ISO 9001/UKAS(NAMAS)/NIST/NATA
  – insures reliable, maintenance-free
    operation

- CalMaster In-situ verification system
  enabled
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 (15-400mm) or remote from sensor for all sizes.

Separation (remote transmitters):
The maximum cable length is 330 feet. Longer lengths are special order.

Accuracy (under forward flow reference conditions) with MagMaster Transmitter

Flanged sensors:
Display, Serial communications, Frequency output:
±0.2% of reading or ±0.003 ft/sec (0.001m/s) (whichever is greater) up to a maximum velocity of >49 ft/sec (15m/s). See Figure below.

Analog output:
As Frequency output plus ±0.008mA.

Pressure effect:
Less than 0.15% over the operating range of the instrument.

Temperature effect:
Sensor: <±0.03% of rate per 10°C.

Repeatability & Reproducibility:
±0.05% or ±.0008ft/s (±0.25mm/s), whichever is greater.

Conductivity:
Liquids and slurries having a conductivity of not less than 5µS/cm (5µmho/cm).

Mounting:
Directly into pipeline at any orientation. 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.

![Accuracy vs. Velocity Graph](image-url)
Electro-Magnetic Flowmeters
Sensors - MagMaster MFE

Calibration:
3 point, 8 point, witnessed, NIST/NAMAS (8- to 24-inch only), slurry calibration options. Calmaster fingerprinting.

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 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.

Metering Tube:
Lined stainless steel. (304 SST)

Lining:
PFA-Perfluoroalkoxy fluorocarbon (chemically resistant to almost all liquids),
Elastomer - chlorobutyl rubber and EPDM,
Polypropylene,
Polyurethane and Neoprene.
Polyurethane meeting FDA approval also available 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 flash applications.

Grounding Electrode:
Fitted as standard in flanged meters, 1/2 in. to 6 in. (15 to 150 mm), in the same material as measuring electrodes.

Note: Pressure Limitations
Flanged meters:
Sizes 0.5-inch to 24-inch (15mm to 600mm):
maximum pressure dictated by flange rating.

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

Temperature:
Sensors (with integral transmitters):
Ambient: 14 to 140°F (–10 to +60°C)
Process Fluid:
Polyurethane lining: 14 to 158°F (–10 to +70°C)
All other linings: 14 to 176°F (–10 to +80°C)
Ambient and process fluid is limited to 14 to 176°F (-10° to 60°C) for the integral CSA-certified hazardous area meter

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 (10m) depth.
Buriable:
3 ft. (1m) to 16 ft. (5m) depth (to top of sensor).

*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:
Flanged meters:
1/2 to 6-inch (15-150mm) Cast aluminum alloy, Epoxy coated.
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

<table>
<thead>
<tr>
<th>Sensor Construction</th>
<th>Liner Material vs Process Fluid Temperature Maximum (°C/°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Polypropylene</td>
</tr>
<tr>
<td>ABB Standard, Non-hazardous, 1/2” to 6”, metal cased 8” to 24”</td>
<td>26.6/80</td>
</tr>
<tr>
<td>FM approved, CSA certified, Non-Hazardous, high temp., 1/2” to 24”</td>
<td>26.6/80</td>
</tr>
<tr>
<td>FM approved, CSA certified, Hazardous, high temp., 1/2” to 24”</td>
<td>26.6/80</td>
</tr>
<tr>
<td>FM approved, CSA certified, Non-Hazardous, 1/2” to 24”</td>
<td>26.6/80</td>
</tr>
<tr>
<td>FM approved, CSA certified, Hazardous, standard temp., 1/2” to 24”</td>
<td>26.6/80</td>
</tr>
</tbody>
</table>

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

TEFLO® is a registered trademark of the E.I. DuPont de Nemours & Co.
Hastelloy® is a registered trademark of Haynes International, Inc.
DIMENSIONS AND APPROXIMATE SHIPPING WEIGHT
1/2- to 6-inch (15 to 150mm) flanged sensors without transmitter or terminal box

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>A (mm)</th>
<th>A (inch)</th>
<th>B (mm)</th>
<th>B (inch)</th>
<th>C (mm)</th>
<th>C (inch)</th>
<th>Net Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>174</td>
<td>6.9</td>
<td>140</td>
<td>5.5</td>
<td>200</td>
<td>7.9</td>
<td>9</td>
</tr>
<tr>
<td>20</td>
<td>174</td>
<td>6.9</td>
<td>140</td>
<td>5.5</td>
<td>200</td>
<td>7.9</td>
<td>9</td>
</tr>
<tr>
<td>25</td>
<td>210</td>
<td>8.3</td>
<td>176</td>
<td>6.9</td>
<td>200</td>
<td>7.9</td>
<td>10</td>
</tr>
<tr>
<td>40</td>
<td>210</td>
<td>8.3</td>
<td>176</td>
<td>6.9</td>
<td>200</td>
<td>7.9</td>
<td>12</td>
</tr>
<tr>
<td>50</td>
<td>210</td>
<td>8.3</td>
<td>176</td>
<td>6.9</td>
<td>200</td>
<td>7.9</td>
<td>14</td>
</tr>
<tr>
<td>65</td>
<td>280</td>
<td>11.0</td>
<td>219</td>
<td>8.6</td>
<td>200</td>
<td>7.9</td>
<td>19</td>
</tr>
<tr>
<td>80</td>
<td>280</td>
<td>11.0</td>
<td>219</td>
<td>8.6</td>
<td>200</td>
<td>7.9</td>
<td>20</td>
</tr>
<tr>
<td>100</td>
<td>312</td>
<td>12.3</td>
<td>230.5</td>
<td>9.1</td>
<td>250</td>
<td>9.9</td>
<td>28</td>
</tr>
<tr>
<td>150</td>
<td>370</td>
<td>14.6</td>
<td>281</td>
<td>11.1</td>
<td>300</td>
<td>11.8</td>
<td>39</td>
</tr>
</tbody>
</table>

Polyurethane and PFA are part face linings

DIMENSIONS AND APPROXIMATE SHIPPING WEIGHT
8- to 24-inch (200 to 600mm) flanged sensors without transmitter or terminal box

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>A (mm)</th>
<th>A (inch)</th>
<th>B (mm)</th>
<th>B (inch)</th>
<th>C (w/liners) (mm)</th>
<th>C (w/liners) (inch)</th>
<th>Net Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>400</td>
<td>15.7</td>
<td>396</td>
<td>15.6</td>
<td>418</td>
<td>16.5</td>
<td>52</td>
</tr>
<tr>
<td>250</td>
<td>446</td>
<td>17.6</td>
<td>455</td>
<td>17.9</td>
<td>488</td>
<td>19.2</td>
<td>80</td>
</tr>
<tr>
<td>300</td>
<td>508</td>
<td>20.0</td>
<td>510</td>
<td>20.1</td>
<td>538</td>
<td>21.2</td>
<td>108</td>
</tr>
<tr>
<td>350</td>
<td>560</td>
<td>22.0</td>
<td>562</td>
<td>22.1</td>
<td>568</td>
<td>22.4</td>
<td>120</td>
</tr>
<tr>
<td>400</td>
<td>614</td>
<td>24.2</td>
<td>596</td>
<td>23.5</td>
<td>618</td>
<td>24.3</td>
<td>186</td>
</tr>
<tr>
<td>450</td>
<td>656</td>
<td>25.8</td>
<td>640</td>
<td>25.2</td>
<td>698</td>
<td>27.5</td>
<td>210</td>
</tr>
<tr>
<td>500</td>
<td>710</td>
<td>28.0</td>
<td>700</td>
<td>27.6</td>
<td>768</td>
<td>30.2</td>
<td>266</td>
</tr>
<tr>
<td>600</td>
<td>810</td>
<td>31.9</td>
<td>810</td>
<td>31.9</td>
<td>918</td>
<td>36.1</td>
<td>378</td>
</tr>
</tbody>
</table>

Polyurethane and FEP are part face linings
## CAPACITY TABLE

### Table B  Flowmeter Sizing

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

**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.

### Table C  Piping Configuration Chart

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Up Stream</th>
<th>Down Stream</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elbow</td>
<td>0 – 3 *</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Tee</td>
<td>3</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Reducers</td>
<td>None</td>
<td>None</td>
<td>&lt;15°</td>
</tr>
<tr>
<td>Control Valves</td>
<td>10</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Gate Valves</td>
<td>None</td>
<td>None</td>
<td>Fully open</td>
</tr>
<tr>
<td>Check Valves</td>
<td>10</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>Butterfly Valves</td>
<td>10</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Pump</td>
<td>10</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

* Magmeter accuracies of 1% can be achieved with these configurations

* Depending on electrode orientation.
### Model Number Designation

<table>
<thead>
<tr>
<th>Bore Size</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 in (15mm)</td>
<td>E150</td>
</tr>
<tr>
<td>0.75 in (20mm)</td>
<td>E200</td>
</tr>
<tr>
<td>1.0 in (25mm)</td>
<td>E250</td>
</tr>
<tr>
<td>1.5 in (40mm)</td>
<td>E400</td>
</tr>
<tr>
<td>2.0 in (50mm)</td>
<td>E500</td>
</tr>
<tr>
<td>2.5 in (65mm)</td>
<td>E650</td>
</tr>
<tr>
<td>3.0 in (80mm)</td>
<td>E800</td>
</tr>
<tr>
<td>4.0 in (100mm)</td>
<td>E101</td>
</tr>
<tr>
<td>6.0 in (150mm)</td>
<td>E151</td>
</tr>
<tr>
<td>8.0 in (200mm)</td>
<td>E201</td>
</tr>
<tr>
<td>10.0 in (250mm)</td>
<td>E251</td>
</tr>
<tr>
<td>12.0 in (300mm)</td>
<td>E301</td>
</tr>
<tr>
<td>14.0 in (350mm)</td>
<td>E351</td>
</tr>
<tr>
<td>16.0 in (400mm)</td>
<td>E401</td>
</tr>
<tr>
<td>18.0 in (450mm)</td>
<td>E451</td>
</tr>
<tr>
<td>20.0 in (500mm)</td>
<td>E501</td>
</tr>
<tr>
<td>24.0 in (600mm)</td>
<td>E601</td>
</tr>
</tbody>
</table>

### Flange Style End Connections

- Standard: Flanged ANSI Class 150 compatible, Fully rated ........................................... 3
- Flanged ANSI Class 300 compatible, Fully rated, 8 to 24 inch. .......................................... K

### Lining Materials

- Teflon bonded FEP, 8 through 16 inches (200mm-400mm) ................................................. 3
- Elastomer, 2 through 24 inches (50mm-600mm) .................................................................. 4
- Polyurethane, 1 through 24 inches (25mm-600mm) .......................................................... 6
- Teflon (PFA), 0.5 through 6 inches (15mm-150mm) .............................................................. 7
- Neoprene, 8 through 24 inches (200mm-600mm) ................................................................. 8

### Electrodes

- 316 Stainless Steel ............................................................................................................... 1
- Hastelloy C ........................................................................................................................... 2
- Titanium ............................................................................................................................... 3
- Tantalum, 5 through 6 inches (15mm-150mm) ................................................................... 4
- Tantalum, >6 inches (>200mm) ........................................................................................... 4
- Platinum/Iridium, 5 through 6 inches (15mm-150mm) ....................................................... 5
- Platinum/Iridium, >8 inches (>200mm) .............................................................................. 5
- Tungsten Carbide Coated 316SST (For Mining, Cement, Flash applications) ................. 6
- Treated Titanium Slurry Electrode (only with slurry calibration & slurry mode transmitter) ........................................................................................................................................... 8
- 316 Stainless Steel, Slurry Calibration ............................................................................... A
- Hastelloy C’, Slurry Calibration ......................................................................................... B
## Electro-Magnetic Flowmeters
### Sensors - MagMaster MFE

#### Sensor Construction
ABB standard. Non-hazardous location. 1/2” in. through 6 in (15mm-150mm).  
ABB standard. Non-hazardous location. Metal case for 8 through 24 inches (200mm-600mm)  
High temperature process fluid temperature above 140°F (60°C)  
FM approved, CSA certified non-incendive for Class I, Div 2, Groups A, B, C, D hazardous locations, intrinsically safe electrodes, remote sensor only  
Process fluid temperature 140°F (60°C) maximum.  
FM approved, CSA certified non-incendive for Class I, Div 2, Groups A, B, C, D hazardous locations, intrinsically safe electrodes, remote sensor only.  
High temperature process fluid temperature above 140°F (60°C)  
FM approved, CSA certified for non-hazardous locations.  
Standard temperature range  
High temperature process temperature above 140°F (60°C). Remote only.

#### Accessories
- None: 0
- Grounding ring (one piece) (0.5” through 24”): 1
- Grounding ring (two piece) (0.5” through 24”): 8

#### Calibration
- Standard 3-point calibration: 1
- 8-point calibration: 2
- Custom calibration: 9
- CalMaster Fingerprint w/3-point calibration: J

#### Glanding
- Conduit entry: 0.5” NPT - order cable and length per OPTIONS: 4
- Conduit entry: 0.5” NPT - cable fitted and potted - order cable and length per OPTIONS: 8

#### Transmitter Type
- Sensor built for integral mounted MagMaster transmitter (< 16” only): EH
- Sensor built for Remote MagMaster transmitter: ER

#### Instruction Manual
- IM/MAG/MAS

#### OPTIONS (specify as separate item on order)
- Cable, sensor/transmitter (list number of feet):  
  - Standard. Can be used with FM/CSA approved instruments: STT3350  
  - Submersible-Waterproof. Cannot be used with FM/CSA approved instruments: STT3500

### 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 a Special Product SPR number).  
3. Consult factory for other materials of construction.  
4. Cable must be priced separately. See P-FMZ-10D9000 for current price information.