

# Model 60 Meter-Master Flow Sensor

## Operating Instructions

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## Section One

# INTRODUCTION

## 1.1 About The Meter-Master Model 60

The METER-MASTER MODEL 60 Flow Sensor is a loop-powered flow monitor that converts a meter's magnetic drive signal to a 4-20ma current output. The linear output is proportional to the meter's flow rate. The Model 60 is small enough to fit inside any meter box and easy to set up. It is compatible with almost all water meters world-wide. The 20ma flow rate is calibrated at the factory to equal any desired maximum flow rate for any meter.

The Model 60 uses a patented sensor to pick up the magnetic pulses generated by a meter's drive magnets. No electrical or mechanical connection or adapter is required for most meters (gear-driven meters, Hersey MHR meters, and Sensus Compound meters require available adapters).

Meter-Master set-up in the field is simple, requiring only velcro straps to secure the sensor in position. Alternatively, the sensor can be epoxied to the meter. Typically, the sensor is placed on the side of the water meter's register with the sensor cable going straight up or down. A small number of meters have different sensor locations (see Section 2.2). An LED continually flashes with the magnetic pulses generated by the meter, which allows the user both to check the sensor location during installation and to verify that the Model 60 is working properly. Each LED flash equals one North-South pole combination on the meter's drive magnets.

The Model 60 uses two wires to connect to an external device such as a remote telemetry unit or a PLC. One wire is for the external 24 VDC required to power the unit and the other provides the 4-20mA signal output.

Meter-Master products are durably built for long, accurate service in accordance with military quality standards. Each unit is manufactured at our factory and shipped ready for operation.

F. S. Brainard & Co. reserves the right to modify its designs at any time in order to supply the best products possible. All instruments are warranted for two years from either the date of purchase or the date of manufacture (see Section 4.2). Maintenance agreements are available following the initial warranty period.

## 1.2 Logger Cable Connection

<b>Power In:</b> 24 volts DC	<b>Blue wire</b>
<b>Return (Common):</b> Variable 4ma to 20ma, proportional to flow rate. 4ma = 0 flow. 20ma flow equivalent is preset (see Section 1.3).	<b>Brown wire</b>

## 1.3 MM60 Factory Calibration

### CALIBRATING THE MM60

The 4-20ma output signal of the MM60 is based on the number of magnet poles sensed per unit of time. In our database, we have the pulse factors for most all meters used in North America. By offering factory calibration of the 20ma setting, we are able to provide a good milliamp span for most meters, which equates to better data resolution.

The Meter-Master Model 60's 4-20ma output is calibrated based on the target meter make, model, and size and the 20ma (maximum) flow rate setting specified by the customer. This information is shown on each unit shipped.

### CALIBRATING THE MODEL 60 FOR METERS NOT IN OUR DATABASE

In order for us to calibrate the 20ma (maximum) flow rate setting, we need to know your meter's "pulse factor". Pulses are generated by the magnetic poles of the meter's rotating internal drive magnet moving past the sensor. The pulse factor is the number of magnet poles that equals one unit of liquid measure for the target meter. Some meters use 2-pole magnets (one North and one South pole per revolution), while others use 4-pole magnets (two North and two South poles per revolution). If you do not have the pulse factor for your meter, contact the meter manufacturer.

## 1.4 MM60 Specifications

- **Size:** 7.0" x 4.3" x 1.5" (178mm x 108mm x 38mm).
- **Weight:** 1.6 lbs. (.7 kg).
- **Case:** Submersible, ABS/polycarbonate blend.

- **Integral Handle:** May be used to chain unit for security and/or suspend unit above the ground.
- **Integral Cables.**
- **Electrical Output:** 4ma = 0 flow rate; 20ma = max flow rate per user specification. Linear output proportional to flow rate.
- **Loop Powered:** 24 volts DC in; 4-20 ma output signal return. Assume 270 ohm load.
- **Logger/Power Connection:** Flying wire with tinned leads. (Customer specified connectors may be factory installed at a reasonable cost.)
- **Strap-On Magnetic Sensor:** Fastens to outside of meter with velcro straps provided.

## Section Two

# OPERATION

## 2.1 Installation

### 1. Connect MM60 To Data Logger And Power

See Section 1.2, “Logger Cable Connection”, for color code of wire leads. The MM60 requires a 24 volt source. After applying power to the MM60, allow 2 minutes for signal to begin. Before securing the sensor to the meter, you may check the sensor operation by flipping the sensor over and back with your hand and checking the sensor LED signal. Because the sensor senses the earth’s magnetic field, flipping the sensor over and back creates pulses. *Make sure that the electronics have settled before checking the sensor:* wait 1 minute after attaching the sensor; wait 2 minutes after applying power.

### 2. Attach Sensor To Meter

Attach the MM60 sensor to the meter with the velcro strap(s) provided (tape may also be used). Alternatively, you can epoxy the sensor to the register. The sensor is typically placed on a side of the meter register; however, the location varies, especially for some large meters. When placed on the side of the register, the sensor cable should extend either straight downward or upward. For more detailed information on positioning the sensor, see Section 2.2, “Pointers for Positioning the Sensor”, and Appendix A.

### 3. Check Sensor Location

Check the sensor location and operation by referring to the sensor LED on the face of the MM60. Before checking the sensor LED, make sure you have allowed time for the electronics to settle: if you just moved the sensor, wait 10 seconds; if you have just applied power to the MM60, wait 2 minutes. The LED will flash in relationship to the amount of water passing through the meter; each flash indicates one magnetic pulse. Each pulse equals one North-South pole combination. Accordingly, each revolution of a 2-pole magnet will create one pulse, and each revolution of a 4-pole magnet will create two pulses. If the sensor signal does not flash regularly or in proportion to the flow rate, try the sensor in other locations. For more information, see Section 2.2, “Pointers for Positioning the Sensor”.

## 2.2 Pointers For Positioning The Sensor

### BEFORE YOU BEGIN

The METER-MASTER senses the magnetic pulses generated by the magnets which couple the register of a water meter to the meter body. An adapter for gear-driven meters is available as an accessory.

Attaching the MM60 sensor is straightforward for most meters, especially positive displacement meters. Appendix A describes the suggested sensor locations for almost all meters used in North America.

**Testing the sensor by itself** Even without water flowing, you can create magnetic pulses by flipping the sensor over and back again continuously with your hand which causes the MM60 to sense the earth's magnetic field.

**Special adapters** Sensus SRH and SRM compound meters require the Sensus Compound Adapter. This adapter may also be used with ABB/Kent (US models) and Neptune/Schlumberger turbine meters to increase the resolution of the recorded data from these meters by a factor of 12, which is significant when identifying and defining leakage rates.

In Appendix A, Hersey MHR turbine meters have been noted as requiring a modified gear train in order to attain compatibility with the MM60. These gear trains are available as accessories.

### POSITIONING THE SENSOR

Appendix A describes the location of the sensor for almost all meters used in North America and can be used as a guide for other meters with similar construction (meters with “similar construction” have their drive magnets in similar locations). Refer to the pictorial representations of the suggested sensor locations located at the end of Appendix A.

In general, the four most important points in positioning the sensor are:

#### 1. Position Sensor At Meter's Sweet Spot.

- **Positive Displacement Meters:** Place the sensor on a side of the meter register, unless otherwise indicated in Appendix A and the sensor location diagrams in this manual.
- **Turbine Meters:** Refer to Appendix A. If the target meter is not included, check the sensor location diagrams in Appendix A for a meter of similar construction to the target meter and try the indicated location first. If that location proves unsatisfactory, try other locations. Move the sensor to the other side of the meter, place the sensor flat on top of the register, etc. When you move the sensor,

remember to wait ten seconds to allow the electronics to settle before initiating a sensor test.

- **Shielded Registers:** If no signal is detected when the sensor is placed on the side of the register because of shielding on the side of the register, place the sensor flat on top of the register. Note that when the sensor is placed flat on top of the register, a 4-pole magnet will typically generate a 2-pole signal (half as many pulses).
- **Drive Magnets Integral To Turbine Rotor:** If the meter's drive magnet is integral to the turbine rotor (e.g., Sensus Turbo), place the sensor on the side of the meter body with the cable extending in a *horizontal* direction. (See sensor location diagrams.)
- **Compound Meters With Two Registers:** Position the sensors on the sides of both registers such that the sensors are physically located as far away from the other register as possible. In the case of a Neptune/Schlumberger TRU/FLO compound, place the sensor on the PD (small) side flat on top of the register.
- **Insulated Meters:** Because it is not necessary for the MM20 sensor to make direct contact with the meter housing, it may not be necessary to remove insulation when it covers a meter. Test the sensor pick-up from the outside of the insulation before removing any meter insulation.

## 2. Do Not Cock Sensor Or Sensor Cable.

The sensor itself should be positioned flat against the meter casing or register with the velcro on the outside, away from the meter. It is not necessary for the sensor to touch the meter. If the sensor is on the side of the register, position the sensor such that the sensor cable extends straight up or straight down toward the ground. If the sensor is on the side of the meter body (Sensus Turbos, Hersey MHR 2"-3", and Badger Recordall Compounds-turbine side), position the sensor such that the cable extends in a horizontal direction.

## 3. Secure The Sensor As Tightly As Possible.

Velcro straps come with the Meter-Master. The straps will stretch slightly over time, so test each attachment to ensure that the sensor will resist any effort to move it. The velcro is provided in 2 lengths which may be secured together to create one extended length. If desired, tape or epoxy can also be used to secure the sensor.

## 4. Wait For The Electronics To Settle Before Checking The Pulse Rate.

If you have just moved the sensor or turned on the power to the MM20, make sure you have allowed sufficient time for the electronics to settle before checking the sensor location. The circuit takes 10 seconds to stabilize when the sensor is moved and 2 minutes when power is initially applied to the MM60.

## ELECTROMAGNETIC INTERFERENCE (EMI)

Place the sensor farthest from any nearby equipment which may generate electromagnetic interference (EMI). Typical examples are motors, burglar alarms, and generators. Because the MM60 is designed to pick up the magnetic signal generated by a water

meter, you may encounter a circumstance in which the location of the meter is so close to other electromagnetic sources that the light flashes extremely quickly or stays solid when no flow is occurring. Unless you can deactivate or shield the source of EMI, an accurate record may not be possible.

## Section Three

# TROUBLESHOOTING

## 3.1 List Of Topics

### GENERAL

- (1) Insulated Meter
- (2) Sensor Does Not Seem To Be Working

### SENSOR TEST

- (3) No Sensor LED Signal Or Current Output Above 4ma At All
- (4) Sensor LED Signal Is On Solid
- (5) Sensor LED Flashes Erratically
- (6) Sensor LED Flashes Regularly But Not At The Expected Rate

### NOTES ON SPECIFIC METERS

- (7) Dual Register Compound Meters
- (8) Compound & Turbine Meters With Change Gears
- (9) Sensus (Invensys): SR; Turbo (W-3500, W-5500); Compound (SRH, SRM)
- (10) Neptune (Schlumberger): T-8 & T-10 (5/8", 3/4", 1"); Turbine; TRU/FLO
- (11) Badger: Recordall Turbo; RCDL-Turbo (older version)
- (12) Hersey: MHR (4"-10"); MVR; MCT & MFM
- (13) ABB (Kent): Turbine
- (14) Precision: All Models
- (15) Master Meter: All Models

## 3.2 Recommended Action

### GENERAL

- (1) **Insulated Meter**
  - Sensor does not need to be touching meter and can be located on outside of insulation if distance from magnets does not result in too weak a signal.
- (2) **Sensor Does Not Seem To Be Working**
  - Make sure power is on to the MM60.
  - Repeatedly turn sensor over and back again (flip like a pancake) to cause sensing of earth's magnetic field. Flipping sensor over and back will create pulses.
  - Alternatively, attach sensor to a PD meter with active flow and check sensor operation.
  - Make sure that the MM60 is compatible with and correctly wired to your logging equipment (see Section 1.2).

### SENSOR TEST

- (3) **No Sensor LED Signal Or Current Output Above 4ma At All**
  - Make sure that the MM60 is properly wired to the data logger and power is on.
  - Make sure that there is adequate flow to cause flashes and an output above 4ma.
  - Make sure sensor is in correct location for current meter.
  - Make sure sensor is working (see above).
- (4) **Sensor LED Signal Is On Solid**
  - Normal for many PD meters and some turbines at medium and high flow rates.
  - May indicate an electromagnetic noise interference area. To test for magnetic interference, remove the sensor from the meter and check the signal in various locations around the meter (wait 10 seconds before initiating a test). Check for switching equipment, transformers, motors, alarm systems, generators, etc. in close proximity. If you determine that there is magnetic interference, try moving the sensor to the side of the meter away from the noise source; try aiming the sensor in a slightly different direction.
- (5) **Sensor LED Flashes Erratically**
  - When you move the sensor, make sure you wait ten seconds to allow the electronics to settle before initiating a sensor test.
  - The pulses may not be evenly spaced around the dial; however, each dial revolution should provide the correct number of flashes.

- Make sure sensor is properly positioned for meter and not cocked (see Section 2.2 and Appendix A). When the sensor is not cocked, the sensor cable will extend straight down or straight up (or horizontally for some turbine meters).
- Try the sensor in other locations until the signal becomes regular.

**(6) Sensor LED Flashes Regularly But Not At The Expected Rate**

(E.g., two of the same type of meter give a different pulse rate per equal register volumes.)

- Meters with change gears may have discrepancies of as much as 15%.
- On certain meters, the MM60 may sense either a 2-pole or a 4-pole signal, depending on variations in the manufacture of the meters themselves (2-pole vs. 4-pole magnet) or on sensor location. Data is accurate; however, the relationship of the flow rate to the output signal will need to be adjusted (half or double).
- If LED is flashing more than 3 times too quickly, there may be electromagnetic interference. Check for switching equipment, transformers, motors, alarm systems, generators, etc. in close proximity. Try moving sensor to side of meter away from noise source. Test may not be possible at this location.
- The signal may simply be weak where the sensor is located due to peculiar magnet characteristics, location of magnets within the meter, or shielding material in the meter. Try the sensor in other locations.

**NOTES ON SPECIFIC METERS** (SEE ALSO APPENDIX A)

In general, PD meters are easy; some turbine meters require special attention.

**(7) Dual Register Compound Meters**

- Position the sensors on the sides of both registers such that the sensors are physically located as far away from the other register as possible. See special instructions for Neptune/Schlumberger TRU/FLO compound below.

**(8) Compound & Turbine Meters With Change Gears**

- Some large meters (e.g., Neptune Trident turbine and Hersey MCT, MFM, MCTII, MFMII, and MHR) use change gears for calibration. Different change gear combinations will cause variations (typically less than 15%) in the volume per pulse.

**(9) Sensus (Invensys)**

- *SR*: If the sensor pick-up appears weak, place the sensor directly on top of the register.
- *Turbo (W-3500, W-5500)*: Accurate positioning of sensor is more critical than with smaller Sensus turbos due to distance from magnets. Sensor should be centered on the side of the meter body.
- *Compound (SRH, SRM)*: Sensus Compound Adapter required. Call your sales representative.

**(10) Neptune (Schlumberger)**

- *T-8 & T-10 (5/8", 3/4", 1"; including TRU/FLO PD side)*. Place the sensor flat on top of the register. In the case of small Neptune meters, a sensor located close to the same plane as the meter's magnetic coupling area will frequently generate half as many pulses (2-pole signal) as a sensor placed toward the top of the register (4-pole signal); moreover, a 4-pole signal can convert to a 2-pole signal during high flow periods. The sensor position on top of the register provides a consistent 2-pole signal at all flow rates.
- *Turbine (including TRU/FLO & Protectus)*: The Sensus Compound Adapter may be used to increase the pulse frequency and resultant data resolution by a factor of 12. For example, without the Sensus Compound Adapter, each pulse generated by a 6" Trident turbine equals 43.1 US gallons; with the adapter, each pulse equals 3.6 US gallons.
- *TRU/FLO*: Because the registers are close together on a TRU/FLO meter, it is possible for the magnetic field generated by one register to interfere with the signal generated by the other. Should you experience this problem, you can locate a spacer (wood, plastic, etc.) between sensor(s) and register(s) to increase physical separation.

**(11) Badger**

- *Recordall Turbo (current version)*: Some sensor locations on the side of the register may provide a better signal than others.
- *RCDL-Turbo (older version)*: If it is a large turbine, some sensor locations on the side or bottom of the meter may provide a better signal than others.

**(12) Hersey**

- *MHR (4"-10")*: Modified gear train is required. Call your sales representative. (Gear train part numbers: P/N B0600 for 4" and 8"; P/N B0610 for 6"; P/N B0620 for 10".)
- *MVR*: Place sensor flat on top of the register.
- *MCT & MFM (Mag 1)*: A minority of MCT and MFM turbine meters require a modified gear train (P/N B3100) for pickup due to location and size of magnet. MCTII & MFMII (Mag 2) never require a modified gear train. Some Mag 1 meters use 2-pole magnets and some use 4-pole magnets.

**(13) ABB (Kent)**

- *Turbine*: Because these turbines typically do not have gears in the register (direct drive), only two pulses are generated per dial revolution (4-pole magnet). It is highly recommended that the Sensus Compound Adapter be used with Kent turbines (US version) in order to enhance the data resolution by a factor of 12. Otherwise, the pulse resolution is inadequate due to the slow magnet speed.

**(14) Precision**

- *All Models*: There is a magnetic shield on the side of some registers. The sensor may have to be located flat on top of the register.

**(15) Master Meter**

- *All Models:* Because the magnet is relatively weak in all Master Meter models, the Meter-Master must be modified to the high-sensitivity version. In all cases, center the sensor flat on top of the register so that the sensor is as close to the meter's magnets as possible.

## Section Four

# SERVICE AND SUPPORT

## 4.1 Customer Service

Should you experience any problems with your Meter-Master product, fax or call our Customer Service Department between 8 A.M. and 5 P.M. (Eastern US Time). Phone and fax numbers are shown on the front page of these instructions. Explain the problem, and we may be able to solve it on the telephone or via email. If not, we will provide a Return Material Authorization Number (RMA#). Be sure to include: a packing slip with the RMA#, the serial number of the unit, a description of the problem, and a contact person including phone number and address. Pack the equipment in a solid cardboard box secured with adequate packing material. Ship prepaid and insured to the address shown on the cover of this manual.

## 4.2 Two Year Limited Warranty

F. S. Brainard & Co. (FSBCO) warrants to the original consumer purchaser that this Meter-Master product shall be free from defects in materials and workmanship for a period of two years from either the date of purchase, provided a proof-of-purchase is presented, or alternatively, if proof-of-purchase is not presented, the date of manufacture. During the two year warranty period, liability shall be limited to replacing or repairing, at FSBCO's option, any defective product. Product which has been subjected to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation is not covered by this warranty. FSBCO shall have the right of final determination as to the existence and cause of defect. As to product repaired or replaced, the warranty shall continue in effect for the remainder of the warranty period, or for ninety (90) days following date of shipment by FSBCO of the repaired or replaced product, whichever period is longer.

No liability is assumed for expendable items. No warranty is made with respect to custom equipment or products produced to buyer's specification, except as specifically stated in writing by FSBCO and contained in the contract. FSBCO liability arising out of its warranty shall be limited to a refund of the purchase price. In no event shall FSBCO be liable for costs of procurement of substitute products or services, loss of profits, or for any consequential, incidental, indirect, and/or other damages of any kind however caused and on any theory of liability, arising out of this warranty. Other products, not manufactured by FSBCO but distributed by FSBCO, such as computers, software, and accessories, are offered as third party products. As such, these products are not warranted by FSBCO. Requests for warranty or nonwarranty repairs of third party

products should be addressed directly to the manufacturers of such products. Should your FSBCO product require nonwarranty repair, please contact FSBCO for available repair information.

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