FPI Mag™ Meter

Full Profile Insertion
High Performance Electromagnetic Flow Meter

Municipal Market
Product Presentation

Manufactured exclusively by
McCrometer, Inc.
Hemet, CA USA
• Founded in 1955 by brothers Floyd and Lloyd McCall, and brother-in-law Art Crom
• Designed a superior flow meter for irrigation
• Floyd McCall, designed the V-Cone® Flow Meter in 1985

Located in Hemet, California USA
Three NIST traceable calibration facilities

- **Hemet, CA (Corporate HQ)**
  - 3 gravimetric & 2 volumetric systems
  - Flow Meters $\frac{1}{2}$” – 20”
  - Flow rates 0 to 4,000 GPM

- **Porterville, CA**
  - One of the world’s largest volumetric facilities owned by a meter manufacturer
  - Flow Meters 3” to 72”
  - Flow rates 0 to 60,000 GPM

- **Aurora, NE**
  - 1 volumetric system
  - Flow Meters 2” to 16”
Principle of Operation

- **Faraday’s Law of Electromagnetic Induction**
  - When a conductor moves through a magnetic field, it induces a voltage
  - The magnitude of the voltage is directly proportional to the velocity of the conductor

- **Application to Electromagnetic Flow Meters**
  - Water is a conductor that flows at a velocity
  - All electromagnetic flow meters generate a magnetic field within the pipe and then collect the voltage induced by the water flowing through it
  - The magnitude of the collected voltage is proportional to the velocity of the water

Michael Faraday
Discovered Electromagnetic Induction in 1831
High Performance
Electromagnetic Flow Meters

The FPI Mag™:
A full profile insertion type electromagnetic flow meter

The Ultra Mag®:
A full profile spool type electromagnetic flow meter

High accuracy enabled by measuring the full flow profile
A uniform flow profile exists only in long straight pipe runs.

Flow profiles are often interrupted by bends, valves, etc... which change the velocity profile across the pipe diameter.

Flow measurement accuracy is dependent on collecting information from as much of the flow profile as possible.

Partial insertion meters can only collect flow data from a small portion of the profile.

Full profile meters collect flow data from the entire diameter.

*FPI Mag is a full profile flow meter*
A series of electromagnetic coils, installed inside the entire length of the sensor, produce magnetic fields.

Stainless steel electrode pairs, installed on the outside of the entire sensor length, collect the induced voltage caused by the flowing water.

The total voltage signal is transmitted to the Converter electronics where it is ‘converted’ to an average flow velocity.

The Converter then multiplies this average flow velocity by the pipe’s cross sectional area to create a volumetric flow rate.

*FPI Mag is a full profile flow meter*
Installation Concept

- A pipe threaded tap is mounted to the exterior of the target pipe
  - Welded tap
  - Bolt on tap via saddle
  - Corporation stop
- A pipe nipple connects the 2” full port ball valve to the tap
- The full port ball valve is opened and a clearance hole is drilled through it, penetrating the pipe wall
- The drill is extracted and the ball valve is closed
- A compression gland seal assembly, on the FPI sensor, threads into the top of the ball valve
- By turning captive nuts on threaded rods, the FPI sensor is inserted through the gland seal assembly, the opened ball valve and the drilled pipe wall until it contacts the opposite pipe wall
- The installation is mechanically secured via the threaded rods and the compression gland seal is tightened around the sensor shaft
- Electrical hook-up is made, via a quick connect electrical connector, to the M- or L-Series Converters

See FPI Mag IO&M manual for actual, detailed installation instructions and important Warnings
Sensor Specifications

- **Performance**
  - **Accuracy**
    - Up to +/- 0.5% of reading from 1 ft/s to 32 ft/s
    - +/- 1.0% from 0.3 ft/s to 1 ft/s
  - **Linearity**
    - 0.3% of range
  - **Repeatability**
    - 0.20% of range
  - **Minimum Fluid Conductivity**
    - 5 μS/cm

- **Installed Environment**
  - **Flow Temperature Range**
    - 14° to 170°F (-10° to 77°C)
  - **Pressure Range**
    - Up to 250 psi
  - **Sensor is submersible (IP68, NEMA 6P)**

- **Materials**
  - **Insertion Hardware:** Stainless Steel
  - **Full Port Ball Valve:** Bronze
  - **Sensor:** Stainless steel with fusion bonded, NSF 61 approved epoxy coating
  - **Sensor Electrodes:** 316 Stainless Steel (Std), Hastelloy® (Opt)
  - **Compression Gland Seal:** Silicone Rubber
Two Basic Options

- 395L – *Forward Flow* (most common)
  - Sensor reports flow in one direction
- 394L – *Bi-Directional*
  - Sensor reports flow in either direction

Sensor Lengths

- 4” to 24” Pipes
  - Standard sensor diameter 1” *
- 25” to 138” Pipes
  - Standard sensor diameter 2”

Options

- Hastelloy® electrodes
- Additional “Stack Height”

* Still uses a 2” tap and full port ball valve
Enclosure
- Die cast aluminum (IP67)
- 5.75” H x 5.75” W x 6.69” D
  (14.6cm H x 14.6cm W x 17cm D)

Electrical Connections
- Compression gland seals (0.125” or 0.375” dia cable)

Dual Outputs
- 4-20 mA analog galvanically isolated and fully programmable for zero & full scale (0-21mA)

Four separate digital programmable outputs:
- Open collector transistor usable for Pulse, Frequency, or Alarm settings including
  - Volumetric Pulse
  - Flow Rate (Frequency)
  - Hardware Alarm
  - High / Low Flow Alarms
  - Empty Pipe
  - Directional Indication
  - Range Indication

Temperature Range
- Operating & Storage -4° to 140°F (-20 to 60°C)

Power Supply
- Standard AC: 90 to 265V 45 to 66 Hz (20W/25VA)
- Optional DC: 10 to 35V at (21W)
Municipal Applications

- Drinking Water
  - Distribution
  - Filter Balancing & Backwash
  - Pump Stations
  - UV Dosing
  - Well Water
  - Booster Stations
  - Effluent

- Waste Water
  - Effluent
  - Recycle/Reclaim
Proven electromagnetic technology based on Faraday’s Law

Debris shedding, self-cleaning sensor eliminates costly maintenance

Cost is independent of line size

Easy Hot Tap Installation - no interruption of flow process

SPI Mag™
Single Profile Insertion Flow Meter

The SPI Mag is suitable for municipal water and wastewater applications including:

- **Wastewater**: Effluent, Waste Activated Sludge (WAS), Return Activated Sludge (RAS), Reclaim / Recycle
- **Clean Water**: Raw Water Intake, Clear Wells

Ideal for Clean or Dirty Water Flow Measurement
- Storage Tanks
- Custody Transfer
- Multiple Water Sources
- Unknown Flow
- Ring Main Distribution Systems
- Complex Plumbing Environments
Challenging Applications
A full profile measuring flow meter
  - Electrodes span the entire pipe diameter

Accuracy
  - Up to +/-0.5% of reading from 1 ft/s to 32 ft/s
  - +/- 1.0% from 0.3 ft/s to 1 ft/s

Linearity
  - 0.3% of range

Repeatability
  - 0.2% of range

Delivered pre-calibrated from McCrometer’s NIST traceable calibration laboratories

Accuracy at this level achieved only by full profile measuring meters
Electromagnetic flow meters have a well proven reliability track record
  - No moving parts

Durable FPI Mag materials
  - 316 stainless steel sensor
    - Fusion bonded, NSF 61 approved epoxy coating
    - Welded end caps
    - Hermetically sealed
  - 316 stainless steel electrodes
    - Hastelloy® option

IP68 & NEMA 6P rated for submersible installation
Installation Ease

- Less heavy rigging equipment to line up
  - FPI weight advantage increases with pipe size

- Less installation time
  - Less site prep work
  - Less pipe cutting
    - Only single point drilling for FPI Mag
  - Little or no welding
    - Spool meters require mating flange welding

- Less installation risk
  - Overall fewer things to go wrong with install work and meter handling

- Installation while continuing to operate the line in many cases
  - Avoids operational impacts
  - Enhances project scheduling flexibility

\textit{Far less complexity, time, risk and operational impact}
Ease of Maintenance

- **No scheduled maintenance** prescribed by McCrometer over the product lifetime

- **For maintenance potentially scheduled by the customer (or for unplanned maintenance)**
  - Removal by simple extraction
    - No major extraction event with heavy handling equipment and large crew
    - No replacement spool required to restore line to flowing status
  - Removable without line shutdown in many cases
  - **Timing flexibility**
    - Simple removal event allows maintenance to be conducted when it is most convenient for plant

*Simple, quick, convenient maintenance while you operate*
- Required install space for **FPI Mag** is a few inches
  - Same short span *no matter what pipe diameter*

- Required install space for full profile **spool type meters** is multiples of the diameter
  - Spool length *grows to multiple feet in larger diameters*

- For New system designs and Retrofits
  - Simplified system design
    - **Meter location flexibility**
  - Shorter pipe runs lead to
    - **Less line loss**
    - **Smaller plant footprint**
    - **Lower capital costs**

*Smaller space requirement enhances location flexibility & reduces cost*
Cost of Ownership

- **Lowest Installation Cost**
  - Often *more than 45% reduction in installation costs* over spool type meters
  - Less equipment
  - Less time
  - Less material
  - Potentially no plant operating loss due to line shutdown

- **Lowest Maintenance Cost**
  - No scheduled maintenance required by McCrometer
  - For customer driven, or unplanned maintenance
    - Remove with little time or cost
    - Simple removals lead to maximum timing flexibility
    - Potentially no plant operating loss due to line shutdown

Far less expensive to install and to maintain over the lifetime
Standard Package and Options

Standard package includes:

- IP67 rated electronics enclosure
- Three-button numerical keypad
- Backlit LCD display
- Four programmable open-collector outputs
- Dual 4-20mA output
- AC Power
- Patented FPI-Mag™ Sensor (IP68 & NEMA 6P)
- Bronze Full Port Ball Valve
- Stainless Steel Nipple
- 20-foot sensor cable
- Quick-Connect cable fitting (IP68)
- Installation and Operation Manual
- 2-Year System Warranty

Options:

Product

- Extended sensor cable (up to max +180ft, 200ft overall)
- Extension to hardware clearance
- Sunshield (Part # 0624B339001)
- DC power
- Hastelloy® electrodes
- Modbus protocol over an RS485 Serial Interface
- Stainless Steel ID Tag
- Stainless Steel Valve
- Sensor insertion tool (Part# 75031)
- Additional IOM Manuals

Services

- Extended warranties
- Factory Verification/Calibration of Customer Installation
NOTE: Custom sensors cannot be manufactured without this information

Current Date: 
End User: 
Customer Contact: 
Rep Name: 
Site Name (Ex. Well #1): 
Application (Ex. Well output): 
Metered Fluid (Ex. Raw Water): 
Model: 
Converter Power: 
Sensor Cable Length in Feet: 

Date received by McCrometer: 
Maximum Flow (Ex: 2500 GPM): 
Minimum Flow (Ex: 100 GPM): 
Average Flow (Ex: 1500 GPM): 
Full Scale (Ex: 2500 GPM): 
Maximum Line Pressure (250 PSI): 
Maximum Temperature (170°F): 

**Authorized Customer Signature:**
The above signature authorizes McCrometer to rely upon the provided specifications.

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### Critical Spacing (Standard 2.5")

- **A** 2.5:
  - Compression Seal Height ("ID > 25" = 3.5" | ID < 25" = 1.5")
- **B**: 
  - Valve Height (McCrometer Supplied Bronze or SS = 5.0")
- **C**: 5.0:
  - Nipple And Coupling/Saddle Height (McCrometer Supplied Close Nipple is 1.0"; Industry Standard Coupling or Saddle Default = 1.5", OR Customer Supplied Dimension)
- **D** 2.5*:
  - Pipe Wall Thickness - Default 1.0", OR Customer Supplied Dimension
- **E** 1.0:
  - Inside Pipe Diameter (Not Nominal Pipe Size)

### Calculated Distance When Close to an Obstruction

**H** = **T** + **C** + **D** + 18"  

**IMPORTANT:** Distance **H** must be at least one sensor length **T** + **C** + **D** + 18"  

**IMPORTANT:** The MINIMUM inside diameter for the installation valve and pipe cut-out to avoid damage to the sensor is 1-7/8" (48mm).
Thank you!