

Technical Article

FPI Mag Meter: Measuring Flow in a Pump Station

"The FPI Mag is a highly accurate flow meter with comparable specs of a full bore mag meter but with the capability of installation and removal while the pipeline is under pressure. The FPI can be hot tapped and doesn't have the same upstream requirements of a full bore mag. The FPI Mag is more robust, accurate, and repeatable than any single point insertion meter on the market because the FPI uses multiple electrodes that are designed to measure the flow profile across the entire pipe. These features combined with its many communication protocol options make the FPI Mag meter the best choice for almost any application."

– Dan Hardin, Regional Sales Manager, McCrometer

Municipal Drinking Water Treatment and Distribution System

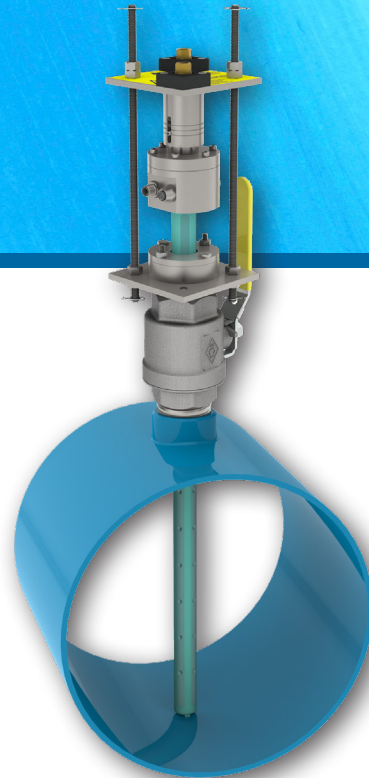
A municipal drinking water distribution system, also known as a water supply system, is used to provide fresh drinking water to residential and commercial customers and facilities around the world. A distribution system for drinking water typically begins with: a) intake of raw surface water from a reservoir or lake or b) ground water intake from wells transferred to a water treatment plant. During the water treatment process, the water intake must flow through a series of processes that clarify, filter, and disinfect the water source transported to the distribution system and made available for storage and human consumption.

To provide clean and fresh drinking water suitable for human consumption, standard procedures in place regulate processes such as dosage of fluoridation, chlorination and regulatory methods for disinfection.

These standard procedures are regulated in part by the Environmental Protection Agency (EPA). Upon completion of the water treatment processes, the potable water suitable for drinking can begin the transportation process. The finished potable water will travel to multiple locations, including delivery to a residential sink faucet or shower head.

Pump Station Distribution Network

To support delivery for residential and commercial customers within the distribution network, the water requires pressure, which provides the necessary energy to force the water through the pipeline to each end destination. Pressure can be generated using multiple methods, including pumps, air, and feed from gravity as water is dispersed in a downhill pipeline. However, for this discussion we will focus on pump stations as the source for pressurizing the water for distribution.



The primary purpose of a pump station for water distribution is to transport water from one place to another within the distribution system, including delivery to consumers and to storage reservoirs when gravity feed is sufficient. However, pump stations are also used during the final processes to lift water from one elevation to another, including delivery into alternative storage locations, such as an above ground water tower or water storage system.



Potable Water

There are two primary types of pump stations typically used within a distribution system that achieve this goal; high lift pump stations and booster pump stations.

- A high lift pump station will direct water into a transmission line, which ultimately will be transported to the end user
- Booster pump stations are in many areas throughout the distribution system and are remote from the main pump station. Booster pump stations are designed for use when typical consumption and demand surges, including summertime surges from uses such as drinking more, filling pools, and watering landscapes throughout the hot summer months

Whether using a high lift pumping station or a booster pump station, each of these stations allow finished potable water to be pressurized for proper delivery within a distribution system.

Flow Measurement in a Pump Station

Water losses within the distribution system can raise costs for both plants and customers. As a result, many municipal plants are being forced to run their plants and operations as efficiently as possible. Water supply issues, budget constraints and environmental concerns have raised the importance of understanding plant production and losses. Acquiring the ability to measure flow effectively at various points within the distribution system will provide data regarding the quantity of water pumped into a treatment facility, and the quantity of water pumped from the treatment facility throughout the distribution system.

Measuring flow in each pump station will provide a reference point to these quantities of water flowing through the pump station. This will assist with maintenance planning, provide data references for potential loss analysis and accurately determine how much water is transported for billing and revenue processes.

Historically, measuring flow at various points in a pumping station included the use of flow meter technologies such as Ultrasonic or Propeller. Although each of these methods has benefits, advancements in flow meter technologies, such as electromagnetic flow meters, provide a greater accuracy rating and improved repeatability standard over the traditional flow measurement equipment. In addition, the upstream and downstream pipe run



Pumping Station

requirements for these technologies in comparison to an electromagnetic type flow meter can result in additional installation costs and manpower.

What is the FPI Mag Meter?

The FPI Mag meter represents the next generation of development of magnetic flow meter technology and employs a unique and ground-breaking configuration whereby the coils and electrodes are assembled in a tube that inserts into a pipe perpendicular to the full profile of the flow stream. The advantages of this configuration are numerous in a wide variety of applications. In fit and form the FPI Mag is unique; in function the FPI Mag meter is just that – a mag meter.

The FPI Mag meter is a Full Profile Insertion electromagnetic flow meter. What does Full Profile Insertion mean, one might ask? Full Profile Insertion means that the flow meter provides all the benefits of a hot tappable insertion flow meter in terms of installation and cost savings. However, it is far more advanced than the technology of a typical single point insertion mag meter. By measuring flow at various points within the pipe diameter, the FPI Mag provides the robustness, rangeability, and accuracy rating of a full-bore mag meter.

Think of it this way - the FPI Mag comes with the benefits of hot tap installation, comparable specs of a full-bore mag, and the ability to install and remove the meter while the pipeline is under pressure. The FPI Mag is essentially just a full-bore mag meter turned inside out, but it is still a mag meter. The FPI

Mag is more robust, accurate, and repeatable than any single point insertion meter on the market. Single point insertion meters only reference flow at one point in the pipe, whereas the FPI Mag uses a multi-electrode sensor design that measures flow across the entire pipe.

McCrometer's high-performance FPI Mag Flow Meter features ISO 9001:2015 and CSA certification, the new M-Series Converter, which provides excellent accuracy to $\pm 0.5\%$ from 1 ft/s to 32 ft/s (0.3 m/s to 10 m/s), and up to $\pm 1\%$ from 0.3 ft/s to 1 ft/s (0.1 m/s to 0.3 m/s) of reading, and covers pipe sizes from 4 to 138 inches, available in both forward and bidirectional configurations.

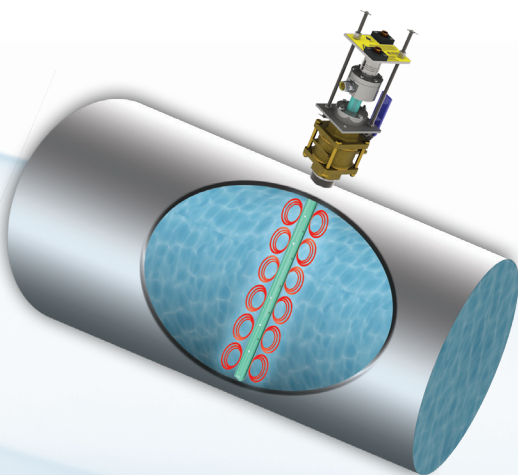
The ProComm Converter, standard with all McCrometer mag meters, offers many other new features, including built-in dual 4-20mA outputs for communication flexibility, additional programmable outputs to support SCADA systems and a simplified menu structure for ease of use.

The FPI Mag Flow Meter is the industry's only hot tap full profile insertion flow meter available on the market. The FPI Mag installs without service interruption, making it ideal for retrofits, upgrades, maintenance projects and sites never metered before. The hot tap installation significantly reduces installation time by eliminating the need to de-water lines, cut pipe or weld flanges, saving customers up to 45% on the total cost of ownership. The flow sensor comes pre-calibrated from McCrometer's NIST traceable Calibration Lab and requires no recalibration in the field.

Why is the FPI Mag a good fit in a pump station application?

The FPI Mag Meter is a good fit in a pump station application because it can be installed in a live pressurized pipe application eliminating revenue losses incurred by dewatering and process shutdown, resulting in service loss to customers.

The FPI Mag flow meter's multi-electrode sensing makes accurate flow measurement possible without the need for long upstream and downstream pipe runs. The multi-electrode sensor design compensates



for variable flow profiles, including swirl, turbulence, and low-flow conditions.

In a pump station, the FPI Mag provides an accurate solution at a reduced cost compared to a full-bore mag meter. The FPI Mag can also assist with maintenance scheduling, by providing timely flow rate data that can be used to determine when seal replacement or other maintenance is necessary. The FPI Mag will also provide data references for potential loss analysis and accurately determine how much water is transported through the metering location for billing and revenue processes.