

Flow metering in water abstraction applications

Using ABB's WaterMaster electromagnetic flowmeter to measure water abstraction



Improving water resource management through accurate measurement in water abstraction applications

Measurement made easy

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Introduction

The need to manage water supplies more carefully has led to the introduction of water abstraction controls in many parts of the world. These controls can apply to applications where water is being drawn for purposes such as drinking water, industrial usage or irrigation.

Abstraction controls offer two main benefits. Firstly, restricting the amount of water that can be drawn from any one source helps to prevent any associated environmental damage, such as depletion or, where water is drawn from a watercourse, harm to aquatic life. Secondly, quantifying the amount of water that is extracted enables existing stocks to be better managed and conserved.

The application

Water can be abstracted from various sources, including streams, rivers, reservoirs and underground aquifers. Where abstraction controls apply, users will normally be licenced to draw a specific quantity of water from a specified location over a set period of time and for a specific purpose. It is therefore necessary to measure the amount of water abstracted in some way and for the figures to be recorded to ensure that consumption remains within the prescribed limit.

Purposes of abstraction controls:

- improved management of water resources, including effects of abstraction on the environment
- to check that the abstractor is complying with the terms of their abstraction license
- to enable accurate calculation of annual charges
- to gain a clear overview of how much water is available for other uses after the licenced abstraction amount
- to help create an informed assessment of overall demands, which can then be passed to Government or some other supervisory authority for action

...The application

Various types of flowmeters can be used to measure water abstraction, including mechanical, ultrasonic and electromagnetic technologies.

Selecting the appropriate flowmeter for the application depends on a number of factors, including the desired accuracy and repeatability and also the characteristics of the installation. For example, where water is being abstracted from a river or stream, pebbles and sediment may be present which could quickly damage and even destroy a mechanical meter. Where sea water is being abstracted, the salinity of the water can also quickly wear out a stainless steel flowmeter, requiring consideration of the materials of construction.

The challenge

As the metered values may be used to bill the abstractor and to assess the overall quantity of water available, it is important that any flowmeter used can offer the required levels of accuracy and repeatability. Not only that, but it must also be able to withstand the various rigours of the application, especially where high levels of sediment or other non-ideal conditions may be present.

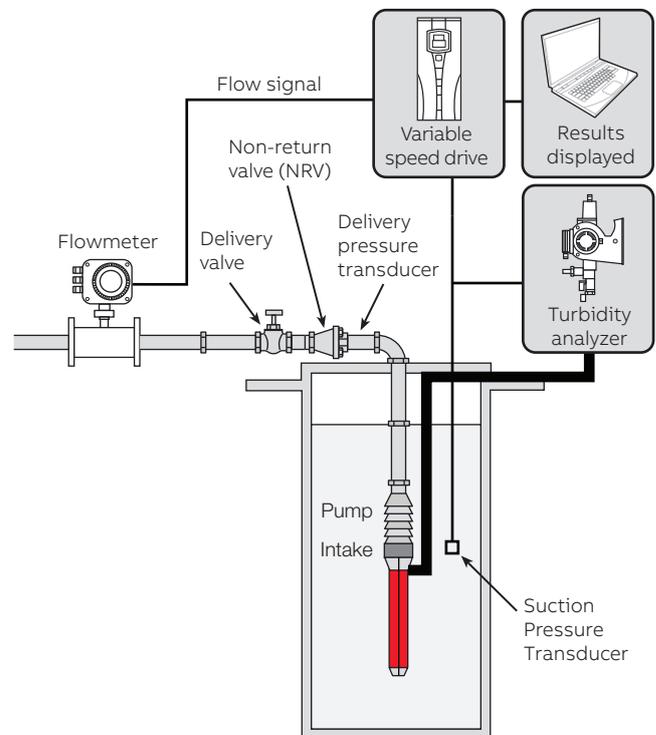
With moving parts subject to wear and tear, mechanical meters can quickly suffer reduced accuracy, leading to either under or over-registration of flows. Furthermore, the need for mechanical meters to be periodically tested, recalibrated and repaired means that they have to be removed, requiring users either to replace the meter with a temporary device or cease abstraction until the meter is refitted back into the line.

Ultrasonic flowmeters also suffer various drawbacks which can make them unsuitable for water abstraction applications. Transit time meters in particular can struggle to handle flows with high levels of particulate matter, requiring a strainer to be fitted. Both transit time and Doppler meters can also be affected by velocity profile distortions, requiring from 10 to 40 upstream diameters, depending on the severity of the disturbance. The turndown of ultrasonic meters is also limited within an ideal range of 20:1 to 40:1. Ultrasonic meters can also be difficult to install and set up, especially where high accuracy is required.

A solution

Electromagnetic flowmeters overcome these problems. Compared to other flowmeter types, electromagnetic flowmeters offer greatly enhanced accuracy and repeatability throughout their operational life, with uncertainty of $\pm 1\%$ reading or better. With no moving parts, they do not suffer from problems with wear and tear, minimizing maintenance and require no upstream strainers to filter sediment. A choice of flow primary linings affords further protection against high sediment flows, with users able to choose from a variety of materials, including ceramic linings for particularly abrasive flows.

The ability of electromagnetic flowmeters to better handle distorted velocity profiles also means that the amount of piping upstream and downstream of the meter is reduced.



Recommended arrangement for an abstraction measurement installation.

What can ABB offer?

ABB's WaterMaster and AquaMaster electromagnetic flowmeters offer the ideal solution for water abstraction applications. Both flowmeter ranges bring a host of advanced features and functionality for water measurement.

A key feature of the WaterMaster is its revolutionary octagonal sensor design. By improving the flow profile, the octagonal design minimizes the upstream and downstream pipe lengths required from the point of installation, substantially lowering the cost of fitting the meters into new or existing pipelines.

The WaterMaster also features onboard verification capability. Called VeriMaster, it assures operators of the performance of the meter through constant self-checking. When coupled with ABB's VeriMaster software tool, it enables operators to produce a printed verification certificate for regulatory compliance.

Available in sizes from 10 to 2400 mm ($\frac{3}{8}$ to 96 in), all WaterMaster sensors have a rugged, robust construction to ensure a long, maintenance-free life even under the most difficult conditions experienced in water and waste water applications. The sensors are inherently submersible (IP68, NEMA 6P) as standard, ensuring suitability for installation in chambers and metering pits which are liable to flooding. All sizes of the WaterMaster are buriable and are straightforward to install.

WaterMaster is proven to be robust and reliable, with unmatched diagnostic capabilities providing the right information to keep the process up and running. Alarms and warnings are classified in accordance with NAMUR NE107.

Available in sizes from 10 to 600 mm ($\frac{3}{8}$ to 24 in) the AquaMaster can be installed anywhere, making it the true anyplace, anytime, flowmeter for abstraction, distribution and network management applications. The meter sensor can be buried, fully submerged or mounted in a chamber. The transmitter can be installed with it or separately at ground level up to 200 metres away, ideal when the sensor is required to be buried under a road or highway.

With the introduction of a renewable energy option, the AquaMaster can be installed in even the remotest locations. Adding to the existing battery and mains-powered versions, it can be hooked up to sources as small as a 5 Watt solar panel or a 60 Watt wind turbine generator.

Requiring zero pipe diameters upstream and downstream, the AquaMaster is well-suited to installations with limited space. The meter's reduced bore sensor conditions the flow profile in the measuring section, flattening any distortions that could affect either upstream or downstream measurement, as proven through OIML R49 and MID testing.

With no moving parts to wear out, the AquaMaster provides a true fit and forget flowmetering solution, with no need for meter maintenance. Its advanced sensor design also means there are no obstructions, minimizing flow pressure loss.

All data collected by the AquaMaster is stored in an integrated data logger, which gathers data on both flow and pressure every 15 minutes. This data can be automatically sent daily via SMS to a receiver of the customer's choice.



ABB's WaterMaster electromagnetic flowmeter offers the ideal solution for water abstraction applications.

Operating both the WaterMaster and AquaMaster flowmeters has been simplified by the use of ABB's universal Human Machine Interface (HMI), which has now been extended across its range of instrumentation products. Based on Windows™ technology, the HMI simplifies operation, maintenance and training, reducing cost of ownership and providing a consistent user experience.

Both flowmeter ranges are also verified to OIML R49 type 'P' requirements to ensure the highest accuracy and long term performance.

All ABB flow meters are designed and manufactured in accordance with international quality procedures (ISO 9001) and are calibrated on nationally-traceable calibration rigs to provide the end-user with complete assurance of both quality and performance.

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