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will be a range of activities that will help a flow measurement professional. There will be training courses, where they can learn the latest technologies and how to apply them. There will be user-presented workshops, where successes and lessons from practical experience can be shared.

In all of these, the end users can frankly discuss the issues they have seen in the real world, understand best practice from each other, and have the manufacturer acknowledge product shortcomings and commit to addressing them. As such, users and industry leaders can gain a common understanding.

Q: What are some of the high-level best practices you typically propose?

A: Understand the purpose of the measurement and its value. Make sure you know the properties of the fluid you're measuring, as well as the physical installation requirements and how fast, repeatable and accurate you need the measurement to be. Take environmental and safety considerations into account and make sure that the balance between capital and lifecycle costs is sensible. Now choose the right technology, the right materials of construction, and install it correctly, away from equipment that will affect the measurement.

Q: What are some of the future scenarios in terms of flowmeter technology?

A: The trend to more intelligence in the device will continue. This will allow signal processing to be further enhanced. In addition, we're seeing devices made of increasingly exotic materials, like Coriolis meters with super-duplex stainless steel measuring tubes, and in a wider range of sizes.

Then you have wireless measurement technology, which has the ability to drastically reduce the installation and maintenance cost of installing a flowmeter and with four or two-wire meter technology, Wireless can bring the intelligence from a meter connected to a legacy control system to the maintenance shop.

Chikezie Nwaoha is a Petroleum Engineer and contributing editor to Control Engineering Asia.

Technology Takes Magmeters from Four to Two

Enabling the operational benefits of two-wire magnetic flowmeters while maintaining the performance levels associated with traditional four-wire devices. *Rivai Tirtasudira* explains how.

Magnetic flowmeters are used to measure the flow rate of conductive fluids. The magmeter (as it is often called) gets its name from the magnetic field generated within the flow tube that produces a signal proportional to the flow. This principal employs Faraday's law of electromagnetic induction: as a conductive liquid flows through the flow tube, an electromotive force is generated, which is proportional to the flow velocity.

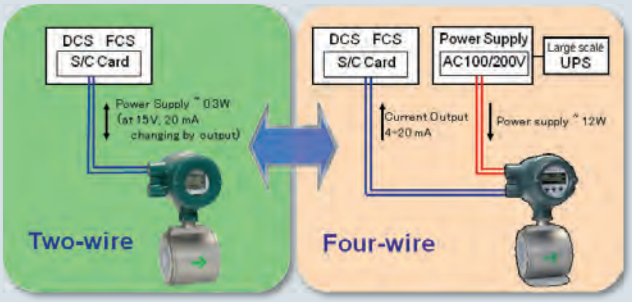
A magmeter can be used for many flow applications in various industries. Some of the advantages of the magmeter are: Minimal pressure loss and easy maintenance because of no obstruction or moving part in the flow tube; Suitable for corrosive fluid due to a wide range of wetted parts materials.

The traditional four-wire magmeter can achieve high accuracy and fast response by means of a dedicated power supply cable that is separate from the signal cable used for current output. It requires power, sometimes as much as 30 W, to generate the magnetic field.

The two-wire magmeter was introduced more than a decade ago with the objective of reducing the total cost of ownership. It uses just a pair of wires for current output and power supply. With direct connection to the DCS module, it significantly reduces wiring and lower installation cost by an amount in the region of US$1,000-1,600 per 100 m of cable length per unit.

As well as the power consumption of the two-wire device being only one to four percent of the four-wire magmeter, which significantly reduces operational cost, wiring footprints are reduced and opportunities are opened up to connect to more digital devices for collection of data from smart sensors. In other words, more devices can be connected in the plant to provide valuable process information.

Although the benefits of using a two-wire magmeter surpass those of a four-wire, the two-wire devices have had issues with meeting the process automation sector's minimum performance requirements in areas such as measurement accuracy and stability, and as such, have not been well accepted in the marketplace.



Compared to the traditional four-wire magnetic flowmeter, the two-wire instrument offers greatly reduced power consumption and significant savings in operational cost.

The need for significant power to excite the coil regardless of the flow rate also makes the reading of the traditional two-wire magmeter unstable, especially in slurry or low conductivity liquid. In the past, effort has been made to store the power to improve it but users experienced slow responses in batch application when using lower frequency excitation to conserve power.

Key technologies

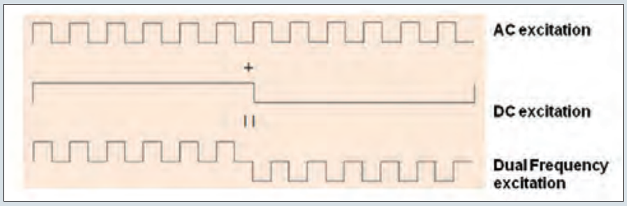
As many companies now need to reduce their instrumentation costs, flowmeter suppliers such as Yokogawa are being called upon to develop higher performance two-wire devices. The company's ADMAG AXR magnetic flowmeter uses technologies that are capable of minimizing electric noise to a level comparable to that of four-wire type, thereby achieving the necessary high measurement accuracy and stability.

Noise reduction

The main contributors to noise are: Slurry noise – the solids contained in the slurry fluid hit on the surface of the electrodes contained in the slurry fluid hit on the surface of the electrodes and generate the noise; Flow noise – the friction between the low fluid and electrode surface generate the noise; Noise generated by the conductivity change.

Theoretically, noise level decrease with higher frequency, so called 1/f characteristics. This means the flow noise level can be decreased and S/N ratio can be improved, by applying a high excitation frequency.

With dual frequency excitation method, a magnetic field is generated (excitation) by supplying a current with high and low frequency components through the flowmeter coil. Having the advantages of low frequency excitation (stability) and high frequency excitation (noise resistance), this method offers greater accuracy and stability than the single frequency excitation method



Although superior (noise immunity, accuracy, stability) to the AC and pulsed DC excitation methods, dual frequency excitation requires power reduction and software optimization to overcome the higher power consumption it entails.

and addresses disadvantages of AC (high power consumption) and pulsed DC (slow response time) excitation methods.

The drawback of dual frequency excitation method is it conducts high-speed CPU processing to execute complex algorithms, thus increasing the power consumption. Though this may not pose much difficulty in the four-wire magmeter, it is a challenge for the two-wire device.

But through drastic power reduction and software optimization, the use of dual excitation frequency has enabled the next generation of two-wire magmeters to deliver high flow noise immunity, accuracy and stability under flow condition changes, and to be applied to control loop applications.

Further noise reduction can be achieved by smooth finishing of the flowmeter internal circumference lining. Ordinarily, the rough surface lining generates additional flow turbulences causing the flow noise to become bigger. A mirror finished lining improve the smoothness and therefore reduces the flow noise. Additionally, a noise cancellation electrode system with a larger and special treated surface area will minimize the flow noise.

Valuable noise reduction can be achieved via a mirror finished lining (that reduces the flow turbulence) plus a noise cancellation electrode system.