

Technical Publication



Ten Fluid Measurement Plant Imperatives That Increase Process Efficiency and Reduce Costs

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Accurately measuring the flow and level of the various liquids and gases that travel through a process industry plant is a critical function for effective and efficient plant operations.

Plant upgrade or maintenance projects that focus continuous improvement in and automation of flow and level measurement will improve plant productivity and lower overall production and maintenance cost by:

- Optimizing process efficiency and control
- Increasing product through-put and yield
- Decreasing the use of consumables
- Reducing energy costs
- Simplifying maintenance and avoiding unplanned maintenance
- Ensuring employee and community safety
- Complying with environmental regulations

Ten important industrial process plant functions that can benefit from accurate, repeatable and reliable electronic flow or level measurement are:

- Pump protection
- Tank liquid level/interface
- Plant gases distribution
- Fluid additive/injection monitoring
- Compressed air consumption
- Boiler fuel gas and air optimization
- Tank blanketing
- Analyzer flow assurance
- Stack gas monitoring (CEMS, QAL1, MCERTS)
- Flare gas measurement

#1 Pump Protection

Pumping systems are extremely important to the continuous operation and production costs of process industry plants. It's important for plant pumping systems to be 100 percent operational with minimal downtime. As a result, flow monitoring for reliable and trouble-free pump protection is a necessary requirement to detect dry-running conditions. Failing to detect pump dry-running conditions results in extra maintenance and can shorten the life of a pump, which is typically expensive to replace.

The use of a flow switch, such as FCI's Model FLT93S, rapidly detects declining flow rates, which can provide early warning to operations to the potential for pump run-dry events (*Figure 1*). Preventative flow monitoring extends the pump lifecycle and increases the intervals between scheduled maintenance. The flow switch is optimally installed in the feed line or discharge line of the pump, and it features two adjustable alarms/relays that are typically set one as a low flow warning signal and the second as a no flow (indicating an empty pipe), shut-down to avoid costly pump damage.



Figure 1: FCI Model FLT93S flow/level switch protects pumps from dry-run and other operational downtime conditions

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#2 Tank Liquid Level/Interface

The reactor is often the central process in chemical and many other types of industrial process plants. Level switches, such as FCI's Model FLT93S, are installed to support various reactor, vessel or tank applications, protecting and ensuring the accuracy of reactor processes. For low level monitoring, the switch is mounted near the bottom of the reactor or a flow switch is installed in reactor discharge line to detect a near empty or empty reactor thereby eliminating contamination between batches.

A level switch is also used for high level detection/alarm to prevent an overfill or spill condition. A thermal dispersion technology level switch is also highly adept as a fast-responding interface sensor, detecting between foam, emulsion or any non-miscible fluids inside a vessel.

#3 Plant Gases Distribution

Many chemical and other process type plants utilize large amounts of nitrogen, argon, oxygen, hydrogen and other gases in their processes, plant power and safety systems. Thermal mass gas flow meters, such as FCI's Models ST50, ST75 and ST100, directly measure mass flow for accurate and repeatable process control and/or inventory purposes.

Where sub-metering is desirable to track individual location or station gas usage and its costs, thermal mass air/gas meters are effective solutions. They measure wide turn-down and are very effective at measuring very low gas flows to detect even slightest usage or even a leakage condition. Furthermore, they have virtually no pressure drop and no moving parts to maintain to achieve lowest installed cost.

#4 Fluid Additive/Injection Monitoring

Liquid and gas additives are frequently injected into processes, including for example oil well heads, mercaptan into natural gas, chlorine into water treatment and more. To assure chemical injection flow is occurring, the ultrasensitive Model FLT93L is an inline flow switch for smaller pipe diameters which can detect gas flows down to 0.6 cc/sec and liquid flows down to 0.02 cc/sec – ideal for virtually all injection processes.

This switch's no-moving-parts flow element design provides outstanding durability and reliability under the harshest process conditions. And, the inherent thermal time delay, available in all FCI flow switch/monitors, prevents false

alarms caused by flow pulsation and eliminates the need for auxiliary time delay relays.

#5 Compressed Air Consumption

Compressed air is useful for many industrial processes and plant applications. In compressed air systems, accurate, repeatable flow measurement helps to reduce the consumption of pneumatic air, improves manufacturing, assembly and process plant efficiency, and identifies leakages to eliminate wasted energy. Compressed air flow meters, such as FCI's ST50 with its specially designed FPC type compressed air sensor design, can measure compressed air accurately and rapidly detect system inefficiencies or expensive leaks.

The installation of air flow meters in large facilities with multiple air compressors allows operators to compare compressor usage and adjust them for optimum efficiencies. The use of mass flow meters at the point of compressed air output also helps to ensure peak performance at a given flow rate.

#6 Boiler Fuel Gas and Air Optimization

Carefully monitoring the natural gas flow fueling plant boilers minimizes fuel consumption, lowers plant energy costs and reduces pollutant emissions. Optimizing the fuel-to-air ratio for boiler control helps to both reduce plant fuel costs and protect the environment. The natural gas flow measurement solution provided by thermal mass flow meters, such as FCI's Model ST98, allows facility engineers to monitor and control the precise amount of fuel needed to run HVAC boilers most efficiently.

The direct mass flow sensing technology of these thermal meters eliminates the need to add temperature sensor, pressure sensor and mass flow computer as is needed with other meter technologies. Eliminating these components, as well as the plant real estate that they occupy and the technician time needed to install and maintain them, reduces plant instrument and operating costs.

#7 Tank Blanketing

Nitrogen tank blanketing is a practice commonly used in the chemical, petroleum refining and other process industry plants to reduce the hazards associated with flammable liquids, improving the plant's safety in the plant and helping to increase productivity. Blanketing or padding is a process of applying

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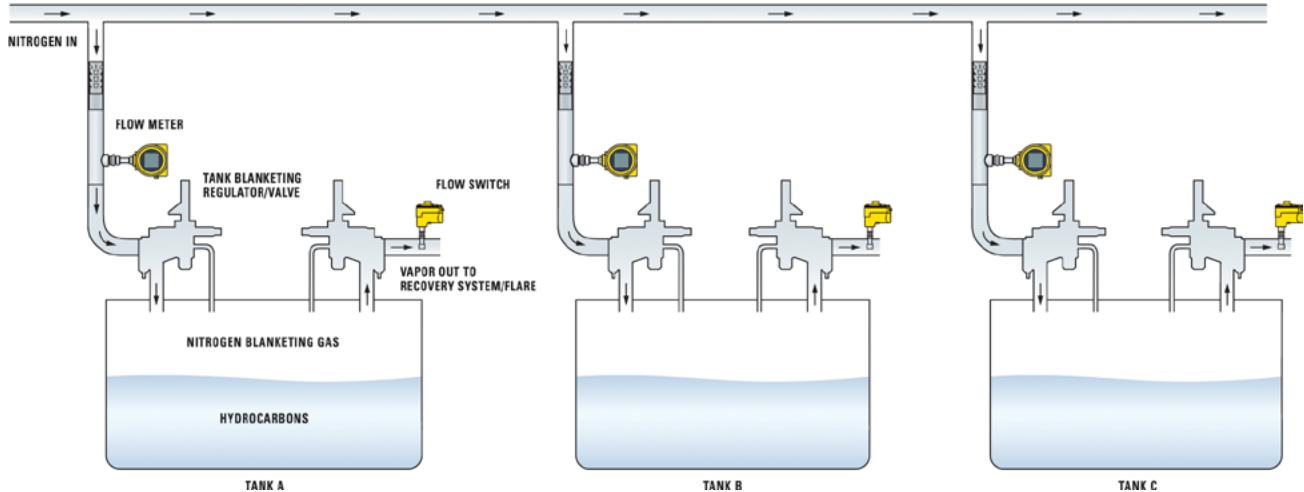


Figure 2: Nitrogen tank blanketing process on refinery tanks

nitrogen gas to the vapor space of a tank or vessel, minimizing the possibility of an explosion or fire. Blanketing also helps decrease product evaporation and protects the tank from structural corrosion damage caused by air and moisture.

Air/gas flow meters, such as the Model ST100 from FCI, help to measure the flow rate of nitrogen more accurately in tank blanketing applications (Figure 2). They provide a repeatable and reliable output necessary for the tank blanketing valve to operate as designed and provide safety and cost savings.

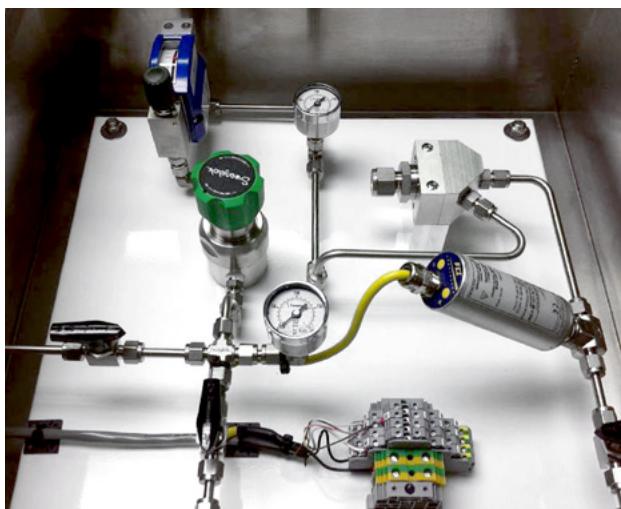


Figure 3: FCI Model FS10A in a typical sampling system

#8 Analyzer Flow Assurance

Gas chromatographs (GCs), mass spectrometers, optical spectrometers and photometers are a few examples of analyzer technologies applied in process and plant systems that need sample flow assurance. It is an accepted industry best practice that sampling systems have some type of flow monitor to assure valid samples and analysis.

Analyzer flow switch/monitors, such as the FCI Model FS10A, are designed specifically for gas and liquid process analyzers and sampling systems (Figure 3). It features a fast responding, highly repeatable sensor that installs easily into a standard tube tee fitting or new SP76 (NeSSI) modular manifold. The instrument's microprocessor-based electronics, on-board keypad and serial I/O computer port provide easy and extensive field adjustability.

#9 Stack Gas Monitoring (CEMS, QAL1, MCERTS)

Flue gases are the general name given to the mixed composition gases that are the by-product of a combustion process. A flue is typically a large pipe, duct, stack, chimney or other venting attached to a process system such as a boiler, furnace, steam generator, oven, etc., through which waste flue gases are exhausted from the combustion process.

Flue gases need to be monitored accurately for process control data and reporting, which is often mandated by environmental and regional air quality regulations. Single- or multi-point air/gas mass

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flow meters, such as FCI's Model MT91, ST102A, ST98 and ST100, offer accurate and cost effective solutions to flue gas measurement. Thermal dispersion insertion flow meters provide a cost effective and accurate solution to flue gas flow measurement.

#10 Flare Gas Measurement

Flaring systems are used to burn-off and dispose of waste, excess or off-gases and as a safety system to protect processes and equipment. They are found throughout the world in oil, gas, petrochemical refining and other industrial processing plants. Flare flow meters are a critical component used in these systems that measure, monitor and report these gas flows (*Figure 4*).

Flare flow meters, such as the FCI ST100 Series, provide plant operations with a tool to signal abnormal process changes, early leak detection and report on flared gases to comply with environmental agency reporting regulations for greenhouse

gases (GHG's). Flare flow meters are installed in both land-based and offshore platform flare systems throughout the world.

Furthermore, many flare systems include an assist gas line, such as natural gas, to ensure effective and efficient combustion. Inline-type (spool-piece) thermal flow meters, such as FCI Models ST75 and ST100L, support flare gas flow control, measure flare gas consumption and flow rate, as well as providing totalized flow data.

Conclusions

Fluid flow and level measurement accuracy and reliability are critical in many industrial process and manufacturing plants. They support efficient and high quality production operations, protect workers and equipment, ensure compliance with environmental regulations and reduce total operational costs. Plant upgrades, maintenance projects and process control initiatives that focus on improving the measurement and control of flow and level, better ensure that plants continuously operate as efficiently as possible.

The various manufacturers of flow and level instruments offer applications expertise and experience across multiple industries. Their factory and field application engineers can provide optimum, cost effective solutions for most common plant installations and also have the ability to engineer custom measurement solutions to meet unique or challenging special plant requirements.

If you're experiencing a measurement or control problem, chances are instrument manufacturers already have solved it before in similar plants and conditions. Frequently, the installation of the current generation of intelligent flow/level instruments, with smart sensors, diagnostics and bus communications capability will pay for themselves after installation in a sometimes surprising short period of time. ■

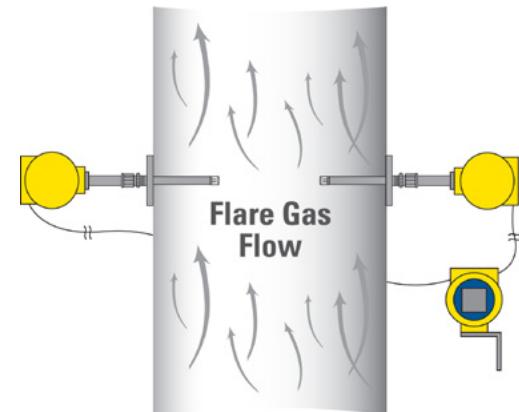


Figure 4: FCI Model ST100 flare flow meter