

# Minjng Magazine

## Improved slurry management

Bill Flowers and Ron Pozarski of Emerson Process Management explain how improved slurry control and the use of task-specific equipment can yield operational stability, fewer process stoppages and more profit

**T**HE use of low-cost flow-control devices in slurries often means that the products need to be replaced frequently due to the highly erosive or abrasive conditions. However, flow meters and control valves that are not designed for severe service invariably end up costing their users more in both fixed and operating costs.

Lower-cost butterfly valves are frequently employed in slurries even though they introduce a host of issues, including high maintenance, and have a tendency to seize up, causing unscheduled outages. They may last only a few days or weeks before replacement is necessary. When costs are calculated, these 'inexpensive' valves can cost up to US\$125,000 each per annum, without taking into account the hidden costs in reduced slurry handling efficiency and throughput, as well as potential lost production time.

By contrast, control valves designed for specific service conditions and equipped with smart digital valve controllers have embedded microprocessors that provide useful feedback about valve perform-

ance and health. In most cases, they can be expected to provide a much longer service life while saving the customer up to US\$275,000 per valve per annum.

The operation of most mineral slurries can be improved through tighter process control, beginning with flow meters that last longer, are self-diagnostic and deliver more accurate measurements. This can be done by overcoming the signal 'noise' created by particulate-laden slurries, which reduces measurement accuracy.

The diagram below shows a high level of noise on a flow measurement chart. This kind of noise on top of the signal makes it impossible for the control system to recognise the exact measurement. The result is over-controlled due to the noise, which increases undesirable variability.

One approach to noise pollution is to dampen the controls by averaging the measurements over time. This allows improvement as the output signals from the control system are only approximations and are rarely stable. Damping also increases loop response time in reacting to changes in process conditions.

When a control valve receives variable inputs, it fluctuates, over- and- undershooting the desired flow set point. The resulting curve above and below the set point is known as process variability.

Not only does variability reduce quality and throughput targets, it also causes excessive wear on valves and instruments, resulting in a reduced lifespan, higher maintenance costs and greater risk for interruption of the process. The increased and fluctuating demand on slurry pumps is another negative aspect of process variability, causing higher energy consumption than normal.

While the use of low-cost butterfly valves may represent a low initial investment, these valves can be difficult to maintain, resulting in high lifecycle costs over relatively short lives. Valve failures increase the risk of slurry spills, adding other costly and potentially harmful issue to be resolved.

### THE SMART MINE

Contemporary automation, including wireless technologies, provides 'eyes and ears' to the slurry process, allowing much tighter control strategies while also making 'predictive maintenance' a reality.

Excellent results are achievable by implementing what is called a Smart Mine approach, which delivers:

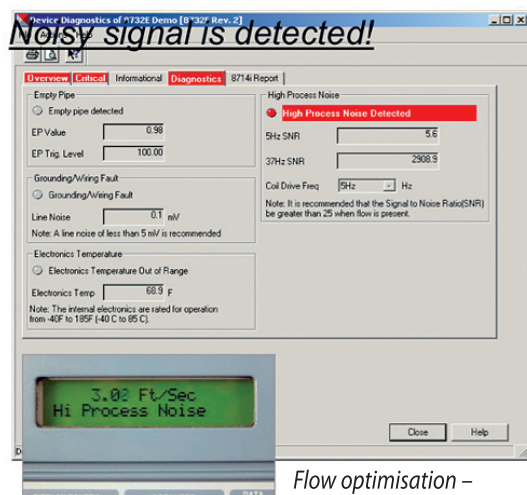
- Accurate, stable flow measurements,
- Greater control accuracy and reliability,
- Extended valve and flow meter life, and
- Advanced diagnostics for more effective maintenance.

The Smart Mine relies on intelligent, micro-processor-based instruments that not only deliver precise measurements of pressure, temperature, flow and level, but also generate a vast amount of diagnostic information about their health and that of nearby process equipment. Smart digital valve controllers (DVCs) provide much the same service when mounted on or near control valves, enabling the user to determine very easily whether a valve's performance and health are up to expectations. The diagnostics generated by smart instruments are of great value in optimising a process and improving maintenance.

When control signals based on accurate measurements reach valves designed for 'throttling' action, the valve opening is easily adjusted to alter the flow according to system design. The set point is reached with minimal variation, resulting in precise flow control which is vital for optimum loop performance. Throughput is increased, and material delivery to the next step in the process is more consistent, resulting in greater productivity, higher product quality and lower operating costs.

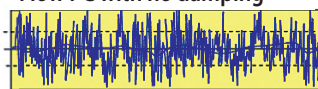
### SLURRY OPTIMISATION

Through the application of advanced diagnostics, operators are alerted when variability levels are too high for effective control. One way to defeat high



Flow optimisation – a noisy application

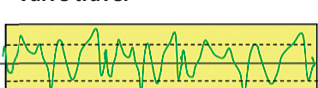
### Flow PC with no damping



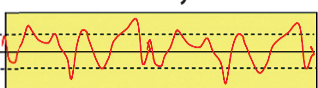
### E-series Detects Process Noise



### Valve travel



### Process variability



## MANAGEMENT IN ACTION – SLURRY CONTROL

→ level noise is to move the meter to a higher frequency, which increases the signal-to-noise ratio (SNR) and provides a solid flow signal without adding damping to the loop.

A higher frequency mode mitigates slurry process noise. Dual-frequency capability is standard on Rosemount magnetic flow meters, making it unnecessary to change flow measurement instruments in response to difficult process conditions.

With measurements more representative of the actual flow, the control unit can react appropriately, sending the correct signal to the final control element. If that valve has been properly selected for the particular slurry service, it will be able to respond very quickly with minimum variability.

In very high-density slurries, the noise can overpower normal signal strength even at higher frequencies. In these cases, high signal technology increases the SNR by a factor of ten, providing ten times the signal strength to power through the noise. This enables unequalled performance in high-density slurries, producing stable, representative flow measurements without damping.

CVG Bauxilum, a major alumina production company in Venezuela, receives raw bauxite in a caustic soda solution containing 50-60% sand and quartz. This slurry is both aggressive and noisy, causing spikes in the flow signal. Automated control of the slurry was impossible, and manual control was inefficient. Flow meter liners and electrodes had to be changed every four to eight months. Electronics board failures were also common.

In response to this, CVG replaced one existing magnetic flow meter with a Rosemount High Signal DC meter to see if the device would read better and last longer. Following its installation in March, 2006, mineral quality has improved while maintenance costs have diminished. Since then, the other magnetic flow meters at the plant have been replaced with High Signal units.

### EXTENDING METER LIFE

A broad variety of materials and configurations is available to extend flow meter life. Options include different liner materials, matched internal diameters, lining protectors and electrodes designed to withstand the characteristics of the slurry.

Among the factors to be considered are the

Fisher V150S Vee-Ball valve

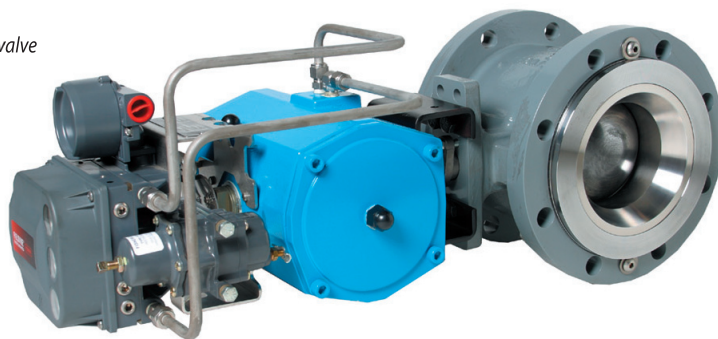
competency of the ore, particle size and flow velocity. As the competence and size of the particles increases and the flow becomes more rapid, the selected liner and electrode materials must be more resistant to cuts and abrasion.

Liner materials can be selected to provide the best performance and extended life, taking into consideration the abrasion, impact and chemical compatibility requirements of the application. Linatex rubber liners are a good choice for large-particle mine slurries prior to chemical additions, while polyurethane provides excellent abrasion resistance for small and medium-sized particulate slurries. Neoprene delivers very good abrasion resistance for small to medium-sized particles and provides better chemical resistance. A variety of fluoropolymers, including PFA, PTFE and ETFE, give less abrasion resistance but provide excellent chemical resistance for slurries with higher concentrations of chemicals.

Electrode materials including tungsten carbide, 316L stainless steel, nickel alloy 276, titanium and platinum iridium alloy provide a range of abrasion and chemical resistances that can be matched to the needs of a specific slurry. Today's standard for slurry lines has the electrode mounted flush with the internal diameter of the meter to minimise wear, with an outside seal to simplify electrode replacement.

### EXTENDING VALVE LIFE

The final control element is critical to the operation of any control loop. The entire control valve assembly should be carefully engineered for the intended service. All the components must complement each other and work together, as lost motion or friction in any component can cripple performance. The goal is to create a control valve that will overcome the shortcomings exhibited by non-engineered solutions.



While the quality of a valve will determine its lifespan, the size and type of valve are also very important, as is the expertise of the company supplying the product. Most often, the effects of a good valve installation are immediate and significant:

- Maintenance intervals dramatically extended,
- Average valve lifespan in a slurry can be increased two to three times,
- Tighter process control.

Some of the most challenging slurry applications in the world are found in oil sands upgrade operations, where inclined plate settler underflow applications are common. The high quartz content in these slurries makes them particularly abrasive and difficult to control.

One major oil sands operator installed a Fisher V150S Vee-Ball valve in an attempt to reduce maintenance, increase controllability and gain visibility into valve health through the smart DVC mounted on the valve. After more than five months in service, there were no performance or wear issues, and controllability was improved. The end-user is now converting all similar applications at the operation to V150S valves.

### THE POWER TO MAKE A DIFFERENCE

Advances in technology and the improved results they provide are beginning to make slurry management problems a thing of the past. Slurries can become a strong part of an operation as long as the process is managed efficiently and effectively.

The right automation strategy can become a company's biggest strategic asset: it's an engineering solution that harnesses field-generated data and intelligence at its source – the customer. When given the right tools, a work force will have the power to make better operating decisions for better results.

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