IIoT will radically change the valve market

By Bob McIlvaine

The Industrial Internet of Things (IIoT) will radically change the valve routes to market and valve revenues. If general purpose valves are the foot soldiers of IIoT then high performance valves belong in the armored division.

The performance of high performance valves is much more critical to the outcome of the battle to improve plant performance. IIoT will generate continuous performance and condition information about each valve. A large plant could have 10,000 valves.
The world industrial valve revenues will grow from $62 billion in 2017 to $88 billion in 2025.
By 2025 purchases of valves by IIoT providers will rise to $10 billion/yr. Additional revenues of $7 billion will be achieved through the addition of smart technology by the valve suppliers.
The McIlvaine article in *Valve World* two months ago addressed the 2030 market. However, there is an immediate market which will grow substantially over the next eight years. The question is Who Will Capture the Largest Share? Will it be a large valve supplier e.g. Emerson/Pentair or a valve supplier with automation divisions e.g. Metso and Flowserve, a valve supplier which is part of a company also selling processes, systems and or plants, e.g. GE, Wärtsilä.

World Industrial Valve Revenues $ billions		
Segment	**2017**	**2025**
Traditional route to market	55	71
New route to market	4	10
New smart revenues	3	7
Total	62	88
IIoT Impacted Market	7	17

If valves are the foot soldiers of IIoT then actuators are the small arms

At the very minimum the valve supplier must design his valve for smart sensing. He also should supply the sensors.
At Level 1 he can sell to suppliers of processes. But by teaming up with Honeywell, Rockwell, ABB, Schneider Electric, Yokogawa or other Level 2 & 3 providers the valve supplier can play a more important role. The insights he will receive will allow him to improve his valve products for specific applications. The valve supplier can better improve his products with the support of what are called "subject matter experts" of the IIoT community. It can be argued that subject matter expertise needs the same degree of organization through the Industrial Internet of Wisdom (IIoW) as IIoT.
There is a need to connect on-off valves including solenoid air pilot valves.

Most vendors of control systems have integrated diagnostics for electronic sensors and electronically actuated control valves. Simple on-off valves, like solenoid air pilot valves, have often been overlooked because it has been a standard assumption that these valves are not as important as control valves, or field sensors. Pneumatic solenoids have been bypassed or ignored for diagnostic purposes for years. But this will need to change, as all of the sensors and field devices in a plant become connected and smart. In the pharmaceuticals and biotech industries, validation and GMP issues have increased the demand for real-time diagnostic information. At the same time, the increasing use of skid-mounted production processes has made the use of dissimilar control systems a near certainty. This means that end users must insist on diagnostics in every I/O terminal, in every sensor, and in every final control element on their skid. I/O must have easy diagnostic information transfer using fieldbus. Festo says its CPX/ MPA series provides a way to produce that.
If valves are the foot soldiers of IIoT then actuators are the small arms. They not

only provide the control but their health is vital. So IIoT dictates that there are

- more actuators to replace manual operations
- the actuators provide more accurate feedback of their operations
- the remote monitoring platforms supplied by actuator companies must be suitable for the large cloud based operation and maintenance

AUMA is one of actuator companies focused on IIoT. The AUMA Cloud is a digital platform for seamless networking of products, solutions, services, colleagues, and partners. Flexibility and safety - on a global scale. AUMA has new PROFINET and Modbus TCP/IP interfaces which open up the world of Industrial Ethernet to AUMA's electric actuators, combining the familiarity of Ethernet with the reliability of fieldbus protocols.

AUMA Cloud and AUMA Support App are the company's approach to the Internet of Things (IoT), allowing users to collect and share in-depth information on all the actuators in their plants.

Remote monitoring, valve health and improved operations are all intertwined. One example is the drain lines used on combined cycle heat recovery steam generators. Lester Stanley is with HRST. This company helps turbine owners solve problems with engineering support and training. He explains the sequence of events at gas turbine combined cycle power plant startup that often causes avoidable damage. When feed pumps are turned on, he said, there's a high differential pressure across closed attemperator valves which often leak because of cycling.

Water leaking by the valves enters the steam piping when there is no, or low steam flow and minimal vaporization. Absent positive drainage, water runs down the pipe to the superheater tube panels. The rapid cooling caused by spray water entering the harps can warp and crack tubes and damage headers. The same scenario may be repeated in the reheat circuit.

The leakage problem typically is easy to correct. Add a tight-shutoff, fast-opening isolation valve upstream of the attemperator control valve if one is not installed. If a block valve is installed and it is leaking, upgrade to a quarter-turn ball valve with a metal seat at a minimum. Use smart control logic and keep the isolation valve closed when desuperheating is not necessary. Also look into the possible use of condensate pots if they are not installed and consider a double-block-and-bleed arrangement in the spray-water line. Constantly check for leaks during rounds and plan for valve service when required.

So, the first step is to prevent the leakage with tight valves. But continuous monitoring is the second step. Temperature and or flow or level in the drain line will be indicators of the condition of the valve and the leakage. Continuous monitoring of valve health is important to HRSG maintenance and health.

goal for the plant is that 70% of the maintenance budget and maintenance spending should be based on the results of condition monitoring.

Condition monitoring is used for the 41 most critical shutdown isolation valves at Ormen Lange. The population of critical valves includes a mix of single and double acting pneumatic and hydraulic gate, ball and flow control valves. These valves are instrumented with strain gages, pressure transducers and acoustic leakage sensors. The sensor data is continually streamed to a data acquisition system that combines other important data pulled from the plant's distributed control system (DCS) such as command signals, limit switch signals and upstream and downstream

IIoT will transform the valve industry

Valves play a vital role in advancing IIoT in every industry where they are used. An example in oil and gas is unmanned, remote wellsite locations that require field personnel to manually track inventory, ensure proper dosage rates, troubleshoot pumps and facilitate chemical orders and delivery. A North American operator was looking for a solution to better manage their chemical program in their South Texas conventional oilfield.

Nalco Champion collaborated with the customer to assess their current chemical program, and found there was some scope for improvement for injection assurance, dosing accuracy and risk control that could be addressed with enhanced access to operational data. They selected 54 tank locations based on the criticality of chemical programs and remoteness of location attributing to a history of documented operational inefficiencies. The ability to actuate valves remotely led to improved operations.

Ormen Lange is one of the world's most advanced gas processing plants but is operated by a skeleton crew. In fact, Shell's goal for the facility is to operate and maintain the plant with as few people as possible. In order to accomplish this, online condition monitoring systems are employed to monitor virtually everything that moves in the plant including pumps and compressors, control valves, certain structures and critical shutdown isolation valves. A stated

system pressures to create a complete picture of what is occurring at the valve during operation. Acceptance criteria for key parameters such as thrust or torque output at various points in the cycle, stroke time, leakage and other critical measures are automatically evaluated by the valve monitoring system after each cycle and icons in the system display software provide a visual indication of current valve condition. The monitoring approach is essentially the same as having a motor-operated valve (MOV) or air operated control valve (AOV) diagnostic system continually attached to these valves at all times.

Power and oil and gas are just two examples of the critical role valves play in IIoT. The water and wastewater industries have already embraced IIoT. The pharmaceutical and semiconductor industries have big investments in process IIoT. Remote monitoring and control of treatment chemicals in the pulp and paper industry is now commonplace. IIoT will transform the valve industry.

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