Wireless Valve Position Monitoring, Diagnostics and Predictive Maintenance through ISA100

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Presented by Israel Radomsky
Typical Industrial Application of Valves

Main reason is cost: data suggests $2K to $5K per valve (Wires, Cable Trays, Cabinets, I/Os, Installation...)

*Ratio may vary depending on process and application

*up to 95% of valves are not monitored!
There is a real need for valve monitoring in the process industry.

Valve malfunctioning can result in:

- Danger to human and compromise safety
- Affect yield
- Generate environmental risk

In some industries regulation requires valve monitoring

The current solution – wired Switch Boxes:

- Costly to install in the process industry
- Cost increases due to explosive environment
- Source for failures due to harsh environment
The Cost of Wired Solution

- Various Field Buses have not changed the situation
- The Switch Boxes are still connected via wires to bus concentrators.
- Wires must be laid, protected, brought to concentrators and connection tested to the I/O.
- Deploying wires can cost $100 to $400 per meter, making the cost of a wired monitored valve prohibitive at $3,000 to $12,000 (assuming 30 m home run cable per valve).
Greenfield Sites (new facilities)

- By using typical vendor prices, and cost estimates on work load and hours from former Statoil projects, the total cost saving per wireless instrument is approximately USD 3,300. Note that the cost saving per instrument will increase with an increased number of wireless sensors per gateway, and vice versa.

Brownfield Sites (existing facilities)

- For typical monitoring instruments (pressure, temperature, etc), cost savings are estimated to 2-3 times higher compared to Greenfield projects with remote I/O, i.e. in the area of USD 6,600 to USD 9,900.

Process Industry Valves Operation Challenges

90% of Valves in the process industries are not monitored due to high TCO costs

Process Failure

1. Reduced yield
2. Prone for human errors
3. Health, Safety and Environmental events
4. Inferior or expensive maintenance strategies
5. Compliance with emerging regulations
What End User Expect from Valve Monitoring

- Accurate and repeatable position indication
- Real time response time (less than 1 second)
- Small size sensor
- Ease of installation
- Any valve any where (manual, actuated, small, big, 1/4 turn and linear)
- Dynamics analysis of pneumatic actuators
- Actuated valves diagnostics
- Low cost
- International Standard compatible
ISA100 based valve monitoring can fulfill these requirements:

- Accurate and repeatable
- Near Real Time response
- Small size
- Ease of installation
- Any valve
- Valve diagnostics
- Low cost
VD ISA100 Free Space Test
VD ISA Free Space Results

Open Space VD5 to YE GW Link
PER vs Range

Range [m]

PER [%]
Ifak is an independent lab in Germany focused on evaluating various wireless technologies.

In 2010 ifak performed an evaluation of WirlessHART performance.

The test results were presented at the Automation exhibition in Hannover in April 2010.

The ifak presented performance data is similar to WH vendor data.
WirelessHART – Update Time

Source: Ifak Lab Test Comparison (April 2010)
As network size increases, the delays get longer.
Valves Monitoring & Diagnostics Field Experience
The Eltav Company

- Company stage – sales and implementation
- Development, production, sales and support of wireless valve monitoring and diagnostics solutions
- Products with ISA100 and ZigBee Protocols.
- Member of ISA100 standard committee since 2006.
- ZigBee in production; ISA100 scheduled industrial release end 2016.
- ISA100 product in collaboration with major System Company.
- Located in Ranana Israel
- Founded in 2006.
- Acquired by Rotork in November 2015.
The Wireless Valve Monitoring Device (VD)

- Autonomous, Power Efficient
- Retains configuration
- LEDs for alive indication
- Installed on a Valve or an Actuator
- Measures Angle, Temperature, Dynamics, Battery, (4 Digitals)
- ISA100 or ZigBee, 125KHz Magnetic and IR OOB provisioning
- In future – control of valves.
Wireless monitoring is here!
Eltav offers a breakthrough wireless technology, that provides real time information directly to control systems.

- Full Range Position- 0%-100% (Detecting the un completed movements)
- Predictive Valve Maintenance (Detecting damaged O-Ring, air pressure problems, sticky valve, hydraulic shock etc.)
- Any valve, Any Actuator (quarter turn, multi turn, Gate valves, Diaphragm valves, etc.)
VD ISA100 Diagnostics Features

Partial open

Prolonged movement

Reference Graph

Actual movement

Air pressure problem

Sticky valve
Malefunction of Actuated Valve
FIELD EXAMPLE – LIVE DIAGNOSTICS MOVIE
Irregular operation of the valve/actuator

Process lack of synchronization
Keeping the World Flowing
FULL INTERNAL LOGGING SYSTEM

Logging system in milliseconds resolution
Raising Handle 2.wmv
To reduce the risk for unwanted fluid release and cross contamination a monitoring solution is desired for Vopak globally to determine the position of valves at real time.
Paz Refinery in Israel
Paz Refinery – VD Installation
Field Example - Detect the un completed valve movement
# Valve Status Summary

<table>
<thead>
<tr>
<th>EUI</th>
<th>Valve Tag</th>
<th>Last Seen</th>
<th>Hardware Timestamp</th>
<th>Angle</th>
<th>Open Percentage</th>
<th>Valve State</th>
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<tbody>
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<td>XV-1610171</td>
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</table>

## Valve Dynamics - CLOSE [Deg]

**Dynamics Duration:** 2540 [msec]

- **Set Reference**
- **Remove Reference**

Open Reference taken on 17/07/2012 [2540 msec]

- **Position Status 19.2°**
Detect the Mid Short Stop of Valve Movement

000D6F0000174DC9 - DL20616AV

Time [Min: Sec]

A rotork® Company
Filtration site of National Water Co.

The Challenge:

- Monitoring the process of adding chemicals to drinking water
Sapir – Sea of Galilee Intake
Chemical Production site

**The Challenge**
Monitoring critical manual valves in the process following an incident

**The Solution**
The Eltav wireless solution has been installed on variety of manual ball valves and actuators providing process interlocks and on line monitoring.
Monitor ON/OFF and CIP
Dannon Installation
Lifting Monitoring

ON OFF P1080011.MOV

Lifting P1080012.MOV
ON OFF Lifting DEMO P1080136.MOV

GEA in Field Strauss P1070500.MOV
Dynamics CLOSED > OPEN

[Graph showing dynamics of a process with open and closed states over a range of measurements.]
# George Fisher Torn Diaphragm Detection

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<th>Test #</th>
<th>Torn Diaphragm</th>
<th>New Diaphragm VD Calibrated (REF)</th>
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**Average** 60.0  1.4
Damaged O-RING
Thank You

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