Using ISA100 Wireless to Enhance Plant Safety

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- Fellow of International Society of Automation (ISA)
- Chairman of ISA100 Wireless Compliance Institute (WCI) for 2015-2017
- Director of ISA Communication Division for 2015-2017
- US Expert of IEC SC65C
- Member of Standards Committees
  - ISA100, ISA99, Co-Chair of ISA100.15 Wireless Backhaul Networks Working Group
  - IEEE-SA, IEEE P2413 IoT Architecture Framework
  - IEC TC 65C WG16
- Ph.D. in Electrical Engineering from Northwestern University
### Why Wireless? What are the Tangible Benefits?

| Cost Savings | • Up to 90% of installed cost of conventional measurement technology can be for cable conduit and related construction.  
| | • Typically: 1/5 the time, 1/2 the cost.  
| | • New and scaled applications are now economically feasible. |
| Improved Reliability | • Wired sensors may be prone to failure in difficult environments.  
| | • Wireless can add redundancy to a wired solution. |
| Improved Visibility | • Condition monitoring (equipment)  
| | • Process monitoring |
| Improved Control | • Add wireless to existing processes for more optimal control. |
| Improved Safety | • Safety related alarms |

Source: ISA100 WCI
What is the ISA100 Wireless?

“Communication specifications including security and management; for wireless devices serving applications Classes 1 through 5 for fixed, portable and moving devices.”

“Periodic monitoring and process control where latencies on the order of 100 ms can be tolerated, with optional behavior for shorter latency.”

<table>
<thead>
<tr>
<th>Safety</th>
<th>0</th>
<th>Emergency action</th>
<th>Always critical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1</td>
<td>Closed loop Regulatory control</td>
<td>Often critical</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Closed loop Supervisory control</td>
<td>Usually non-critical</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Open loop control</td>
<td>Human in the loop</td>
</tr>
<tr>
<td>Monitoring</td>
<td>4</td>
<td>Alerting</td>
<td>Short-term consequences</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Logging Downloading/uploading</td>
<td>No immediate consequences</td>
</tr>
</tbody>
</table>
Why ISA100 Wireless?

Plant-Wide Solution:
- **Industry**
  - Oil & Gas, Petrochemicals, Powers, Metals, etc.

  **Applications**
  - Process Monitoring
  - Process Control
  - Asset Management
  - Safety Alarm Management
  - Energy Monitoring
  - Environmental
  - etc.

Industry IoT Technologies:
- Strong Security (Two Layered Security, Policy Based, Time Stamped, etc.)
- Flexible Network Topology (Mesh / Star, Duocast, Multiple Subnets, etc.)
- Single Network Infrastructure support Variety Applications (Variety Industrial Protocols, Tunneling, Publish/Subscribe, etc.)
- QoS, Co-existence, OTA

**Provide Solutions**

Assure Multivendor Interoperability
- ISA100 Compliance Test
- Developing Implementation Specifications

**Implementation**

**Standardization**

Co-innovating tomorrow®
Single Network for Multiple Industrial Applications

- Architected to concurrently accommodate multiple protocols at the device and host level (HART, FF, Modbus, PROFIBUS, etc.)
- Applications run in an interoperable manner over a single common network infrastructure
Applications In Industry Plant

- Fertilizer plants
- Petrochemical plants
- Gas processing plants
- Pharmaceutical facilities
- Industrial gas facilities
- Power plants
- LNG plants
- Refineries
- Environmental systems
- Offshore applications
Today -- Variety Wireless Applications

- **Preventive measures**
  - Process condition / status monitoring: Temperatures / Pressures / Flows / Levels / etc.
  - Asset condition monitoring: Vibration / Corrosion / Temperature / etc.

- **Accident avoidance / Limit the extent of damages**
  - Alarm / Warning: Gas leak detection / Safety shower detection / Tsunami detection
  - Emergency shutdown: Fire detection and extinguishers / etc.

- **Human safety**
  - People tracking / Communication or navigation during evacuation / etc.

Gas explosion  →  Plant wide monitoring
Tsunami disaster  →  Predictive monitoring
Fire prevention  →  Emergency shutdown
Yokogawa to Release ProSafe®-RS SIL2 Wireless Gas Detection System
- Offering of a total system solution, including consulting and engineering -

Yokogawa Electric Corporation (TYO: 6841)

Tokyo, Japan - July 25, 2017

Yokogawa Electric Corporation (TYO: 6841), a leader in Industry 4.0 connected enterprise systems, announces the release of its ProSafe®-RS SIL2 Wireless Gas Detection System.

The system is a total solution for the detection of hazardous gases, offering a wireless network for improved safety and efficiency. The system includes a ProSafe®-RS Safety Instrumented System, a Safety Engineering Station, a Wireless Gas Detector (GasSecure GS01, GS01-EA), a Field Wireless Management Station (YFGW410), and a Field Wireless Access Point (YFGW510).

System Configuration:
- ProSafe®-RS Safety Instrumented System
- Safety Engineering Station
- Wireless Gas Detector (GasSecure GS01, GS01-EA)
- Field Wireless Management Station (YFGW410)
- Field Wireless Access Point (YFGW510)

This system is designed to provide reliable and accurate gas detection while reducing the complexity and cost of traditional hardwired systems. It is ideal for a wide range of industries, including chemical, petrochemical, and oil and gas, where safety and efficiency are of utmost importance.

LEFT: ProSafe-RS, RIGHT: YFGW510

GS01
How does the Wireless Gas Detection System works?

- **Wireless protocol:** ISA100 Wireless
- **Safety protocol:** PROFIsecure over PROFINET
**RSSI & PER**

The ISA100 wireless system reliability, interoperability, and stability were put on test for six (6) months by monitoring the Received Signal Strength Indicator (RSSI) and the Packet Error Rate (PER).

Robust and Reliable Wireless Network of 5km with Received Signal Strength Indicator (RSSI) of approximate 60dbm and Packet Error Rate (PER) of 0%

http://www.isa100wci.org/en-US/Learning-Center/White-Papers
Tsunami Warning System

Application
- Lessons learned from the great east Japan earthquake disaster -- Tsunami is usually preceded by a sudden tidal wave, detecting a sudden lowering of tide level from shore may indicate a tsunami to come

Challenges
- Long distance (over 600m without repeaters)
- Reliable communication systems
- Rapid response time

Solutions
- Level meters with wireless adaptor installed on a storm surge barrier near the plant to monitor the tide level
- Fully redundant communication paths with Duocast

Benefits
- Quick project execution with low cost
Fire Prevention in the Coke Pretreatment Process

Application

- Ensure plant safety by monitoring a sign of fire and activated fire extinguishers of the coke pretreatment process in a steel plant

Challenges

- High speed and high reliable monitoring
- Difficult environment with lots of obstacles

Solutions

- Single wireless system with 50 wireless temperature transmitters
- 5s update rate with very low PER
- Sky mesh with full redundant wireless communication path to ensure reliability

Benefits

- Enhance plant safety, reduce project time and cost
**System overview**
- 1,2 km long LNG terminal pipeline
- 125 pcs dual wireless transmitters
- Wireless skin temperature sensors
- 6 years battery life
- In case of leakage temperature drop
Yokogawa Demonstrated -- Wireless for Control Application

Water level control demonstration
Feature of the demonstration
1) Field wireless devices controlled by the PID control of the DCS
2) Fast data update : 1 second
3) State-of-the-art redundant technologies: Duocast and redundant Field Wireless Management Station
4) The prototype product of wireless valve positioner by Flowserve Corporation
Remote Valve Control for Emergency Action

System overview
• Rapid response for controlling valve
• Read back status can be monitored
• 10 years battery life
• Compliant to Japanese regulations regarding to the earthquake and tsunami for hazardous materials facilities

Close drain valve to avoid fire accident when big earthquake occurred

Note: This wireless Tx are certified to use actually in Japan only!
Few More Examples

High Speed Temperature Monitoring for Heat Exchanger in LNG Plant
Co-innovating tomorrow ®

Thank you!