Webinar

Introduction to ISA100 Wireless

Jay Werb
WCI Technical Director

Presentation will begin at 11:05am EDT (GMT -6)

29 July 2015
ISA100 Wireless News and Updates

- September 2014 ISA100 Wireless approved as IEC 62734
- ISA100 Wireless is compliant with ETSI EN 300 320 v1.8.1
- April 2015 GasSecure GS-01 gas detector achieves a world first with SIL-2 Certification in Wireless Gas Detection
- Availability of ISA100 Wireless Modules / Stacks (see contact details on www.isa100wci.org)
  1. Nivis
  2. Murata
  3. Yokogawa
  4. Honeywell
## ISA100 Devices Added
### January – June 2015

Total ISA100 Wireless device portfolio = 44  50+ by Q4 2015
Total Certified ISA100 Wireless Devices = 25  33 by Q4 2015

<table>
<thead>
<tr>
<th>Device Type / Manufacturer</th>
<th>Month</th>
<th>Certified</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Yokogawa Stack</td>
<td>Feb</td>
<td>Yes</td>
</tr>
<tr>
<td>2 Yokogawa Adapter</td>
<td>Feb</td>
<td>Yes</td>
</tr>
<tr>
<td>3 Yokogawa Adapter</td>
<td>Feb</td>
<td>Yes</td>
</tr>
<tr>
<td>4 TLV Steam Trap</td>
<td>Feb</td>
<td>Yes</td>
</tr>
<tr>
<td>5 TLV Steam Trap</td>
<td>Feb</td>
<td>Yes</td>
</tr>
<tr>
<td>6 Armstrong Steam Trap</td>
<td>April</td>
<td>Yes</td>
</tr>
<tr>
<td>7 Spirax-Sarco Steam Trap</td>
<td>May</td>
<td>Yes</td>
</tr>
<tr>
<td>8 Cosasco Corrosion Sensor</td>
<td>June</td>
<td>Q3 2015</td>
</tr>
<tr>
<td>9 Scott Safety Gas Detector</td>
<td>June</td>
<td>Q3 2015</td>
</tr>
<tr>
<td>10 Flowserve Valve Positioner</td>
<td>June</td>
<td>Q3 2015</td>
</tr>
<tr>
<td>11 SKF Vibration Sensor</td>
<td>June</td>
<td>Q3 2015</td>
</tr>
<tr>
<td>12 CDS Vibration Sensor</td>
<td>June</td>
<td>Q4 2015</td>
</tr>
<tr>
<td>13 Murata Comm. Module</td>
<td>June</td>
<td>Q4 2015</td>
</tr>
<tr>
<td>14 Bitherm Steam Trap Monitor</td>
<td>June</td>
<td>Q3 2015</td>
</tr>
<tr>
<td>15 Nexcom ISA100 to WIFI bridge</td>
<td>June</td>
<td>Q4 2015</td>
</tr>
</tbody>
</table>
Visit the ISA100 Wireless Website

• ISA100 Wireless Whitepaper available for download from website authored by Jay Werb, Technical Director

• News and details about the ISA100 Wireless Demo at the June 2015 Achema exposition in Frankfurt
  – 3 live networks with 36 devices from 17 vendors

• Full list of certified/registered ISA100 Wireless devices

• Use cases and customer stories

• ISA100 WCI website receiving over 20,000 visitors per month
  
  www.isa100wci.org
Introduction to ISA100 Wireless Webinar Overview

- Applications
- Network Architecture
- Overview of IEC 62734 standard
Applications
General Benefits of Wireless Instrumentation

| Cost Savings                                      | • Up to 90% of installed cost of conventional measurement technology can be for cable conduit and related construction.  
<table>
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<th>• Typically: 1/5 the time, 1/2 the cost.</th>
<th>• New and scaled applications are now economically feasible.</th>
</tr>
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</table>
| Improved Reliability                             | • Wired sensors may be prone to failure in difficult environments.  
  | • Wireless can add redundancy to a wired solution. |                                                  |
| Improved Control                                 | • Add wireless to existing processes for more optimal control.  |
Top Use Classes for Wireless Instrumentation

- Automated Safety Instrumented Functions
- Control
  - Open Loop
  - Closed Loop
- Alerts & Alarms
  - Process
  - Safety
- Monitoring & Compliance
  - Condition
  - Process

Timeliness:
- Hours
- Minutes
- Seconds

Courtesy AIW LLC
ISA100 Wireless
Major Application Types

- Process Monitoring & Control
- Asset Health Monitoring & Analytics
- Safety
Process Monitoring & Control

Applications
• Temperature
• Pressure
• Flow
• pH
• Dissolved O₂
• Valve Position
• Etc…

Wireless Requirements
• Highly Scalable Network
• Low and Deterministic Latency
• Flexible Configuration
• Predictable Battery Life
• Multi-Vendor Interoperability
Asset Health Monitoring & Analytics

Applications
- Vibration
- Corrosion
- Steam Trap
- Etc…

Wireless Requirements
- Scalability with wide range of data rates
- Prioritize data flows
- Support for large waveforms
- Flexible network configuration
Safety Alarms

Applications
• Gas Detection
• Fire Prevention
• Level Detection
• Etc…

Wireless Requirements
• Controlled Quality of Service
• Low and Deterministic Latency
• Layered Open Architecture
  – e.g. ProfiSAFE
Network Architecture
ISA100 Wireless Network Architecture

- Redundant Gateway, System Manager, Security Manager
- Redundant Access Point (Backbone Router)
- Wide variety of Field Devices

Enterprise Scalability
IPv6 to the Devices

Enterprise Networks
Big Data Aggregation from Multiple Sites

Plant-wide Network
High Reliability and Availability
Duicast for redundancy
Scales to 1000s of devices

Stand Alone Network/Point Solution
Simple and Easy
Able to Grow
ISA100 Wireless Network Overview

Asset Management

ISA100 Wireless Gateway

IP Backbone

Process Control

4-20 mA

Legacy HART Devices

BBR

ISA100 Wireless Device Mesh Network
Device Mesh Networks
Performance Considerations

- Neighborhood
  - ±1 second
  - D

- City Streets
  - ±10 seconds
  - C

- On Ramp
  - ±1 second
  - B

- Highway
  - ±0.1 second
  - A

29 July 2015
ISA100 Wireless Installation Example

500m
ISA100 Wireless Network Architecture Example

Max 20 Subnets
Max 500 Field Devices*1

Subnet

Wireless LAN

Optical Ethernet

Existing 2-wire Cable*2

Subnet

Subnet

Subnet

Subnet

Ethernet
IEC 62734 Standard
## Main Features of IEC 62734

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEEE 802.15.4 Radio</td>
<td>Available from multiple high quality sources.</td>
</tr>
<tr>
<td>ETSI Compliant</td>
<td>Compliant to new ETSI 300.328 v1.8.1</td>
</tr>
<tr>
<td></td>
<td>Various modes of compliance, described in the standard</td>
</tr>
<tr>
<td>Robust</td>
<td>Advanced coexistence and resiliency mechanisms at all levels</td>
</tr>
<tr>
<td>Secure</td>
<td>Two layer AES 128 cryptography</td>
</tr>
<tr>
<td>IP based</td>
<td>Future Proof</td>
</tr>
<tr>
<td>Object based</td>
<td>Compact and Extensible</td>
</tr>
<tr>
<td></td>
<td>Supports Tunneling</td>
</tr>
</tbody>
</table>
End-user requirements for Industrial wireless sensing

End-user architectural requirements

1. Security
2. Reliable communication
3. Good power management
4. Open
5. Multi-speed monitoring
6. Multi-functional
7. Scalable
8. Global usability
9. Quality of service
10. Multi-protocol
11. Control ready

Derived from USA Department of Energy and ARC User survey

ISA100 solutions must meet all requirements simultaneously
Technical requirements for Industrial wireless sensing

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rate and Latency</td>
<td>• Publication rates 1-2 seconds</td>
</tr>
<tr>
<td></td>
<td>• Capable of 100 ms latency</td>
</tr>
<tr>
<td></td>
<td>• Controlled latency, ~50% publication rate</td>
</tr>
<tr>
<td></td>
<td>• 4 Hz publication in constrained configurations</td>
</tr>
<tr>
<td>2. Mesh Networking</td>
<td>• IP Backbone: Engineered and scalable</td>
</tr>
<tr>
<td></td>
<td>• Mesh and non-mesh topology; access points and field devices</td>
</tr>
<tr>
<td></td>
<td>• Peer-to-peer communication</td>
</tr>
<tr>
<td></td>
<td>• Objects = Function blocks at device level</td>
</tr>
<tr>
<td></td>
<td>• Long and deterministic battery life</td>
</tr>
<tr>
<td>3. Reliability</td>
<td>• Wireless transmission is deterministic</td>
</tr>
<tr>
<td></td>
<td>• Wireless transmission is received</td>
</tr>
<tr>
<td></td>
<td>• Wireless transmission is accurate</td>
</tr>
<tr>
<td></td>
<td>• Redundant communication paths to process control network</td>
</tr>
<tr>
<td>4. Security</td>
<td>• Wireless transmission has not been hacked</td>
</tr>
</tbody>
</table>
Two Levels of Security

**TL Security**
Secure sessions between IP ports
Protects the data
"Layer 5"

**DL Security**
Hop-by-hop
Protects the mesh
"Layer 2"

*Data Flow*
Robust Communications

<table>
<thead>
<tr>
<th>Spectrum Analysis</th>
<th>System Management</th>
<th>Policy Enforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying Interferers</td>
<td>Device Configuration</td>
<td>Channel Allocation</td>
</tr>
<tr>
<td>Monitoring Saturation</td>
<td>Element Provisioning</td>
<td>Rules Creation</td>
</tr>
<tr>
<td></td>
<td>Performance Monitoring</td>
<td>Blacklisting</td>
</tr>
</tbody>
</table>

**2.4 GHz Band Congestion**

- 2.4GHz ISM shared band
- Microwave Ovens
- 802.11b/g
- Bluetooth

**ISA100.11a 2.4 GHz Solution**

- Channels 11-26
- Frequency Hopping
- 2.4835 GHz

ISA100 – Ensured Coexistence with Many Wireless Networks
ISA100 Application Layer Publication

- Analog Input Object (Temperature)
- Analog Input Object (Pressure)
- Binary Input Object (Contact)

Concentrator Object

Periodic Publication

ISA100 Wireless Network

Gateway

Host
ISA100 Application Layer

Alarms

ISA100 Application Layer

Alert Reporting Management Object

ISA100 Wireless Network

Gateway → Host

- Analog Input Object (Temperature)
- Analog Input Object (Pressure)
- Binary Input Object (Contact)

Alarm Report By Exception
## Conclusion

| 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                                                       | • Troublesome wired sensors replaced by wireless counterparts.  
|                                                                            | • Wireless may serve as a backup for wired technology |
| Improved Control                                                           | • Add wireless to existing processes for more optimal control. |
| Improved Safety                                                            | • Safety related alarms |