Safety and alarming applications using ISA100 Wireless

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Today’s topics

1) Review WCI end use survey
2) Motivation of wireless for plant safety
3) Benefits of wireless
4) Key requirements
5) ISA100 Wireless solutions
6) Applications
7) Summary
Review WCI end user survey

Which applications interest you the most?

- Asset & Condition Monitoring
- Wireless for Control
- Safety
- Other

- All
- Users
- Suppliers
- Other
Review WCI end user survey

Circle the top 3 barriers to you adopting Industrial wireless technology

- Reliability
- Communication Performance
- Power Supply
- Security
- Interoperability
- Too many wireless Protocols on the Market

Legend:
- All
- Users
- Suppliers
- Other
Wireless application map

End users are expecting industrial wireless to adapt to more wide coverage of applications including safety.

- **Small scale**
  - Fast update /Reliable
  - Low speed
  - Process monitoring & control
  - Health, Environmental, Safety and Maintenance

- **Large scale**
  - Gas detection
  - Steam trap
  - Corrosion

- **Closed loop**
  - Open loop
  - Temperature
  - pH
  - Level
  - Pressure
  - Vibration
  - Environmental monitoring
  - Emergency action

- **Process monitoring & control**
  - Emergency action
  - Gas detection
  - Steam trap
  - Corrosion
Motivation of adopting wireless for safety

- **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: **Remote valve control** for safety mode

- **Human safety**
  - People tracking on site / Communication to navigate for evacuation / etc.
Unique benefits of wireless

- **Features of wireless**
  - No signal wiring
  - No power supply wiring

- **Measurement in places where it has never been done before**
  - Measurement in places where it is hard to access with wiring
  - No feasible wiring cost
  - Making intelligent existing devices
  - Temporary installation
  - No power environment

- **Expected benefits**
  - Reducing field work
  - Improving safety
  - Improving efficiency
  - Reducing maintenance costs
  - Reducing construction costs

Even more remarkable points are

- **Robust to physical damages**
- **Easy expansion for additional measurement points**
Key requirements for safety

• Robust communication
  – Committed reliability and availability
    • Reliable radio / Fault tolerant system

• Emergency actions
  – Committed deterministic performance
    • Timeliness / Rapid response time

• Plant wide coverage
  – Committed large scale configuration
    • Long range communication / Flexible configuration

Dependable wireless system is required
How to realize dependable wireless system?
## ISA100 Wireless is ready for safety applications

<table>
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<tr>
<th>Field devices</th>
<th>Robust communication</th>
<th>Emergency action</th>
<th>Plant wide coverage</th>
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<td></td>
<td>- Channel hopping</td>
<td>- TDMA: Time slot communication</td>
<td>- Long range communication 600m (line of sight), 5km with 15dBi Ant</td>
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<tr>
<td></td>
<td>- DuoCast com</td>
<td>- Publish/Subscribe</td>
<td>- Remote antenna</td>
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<td>- Mesh network</td>
<td>- QoS management</td>
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<td></td>
<td>- Retry</td>
<td>- Uplink / Downlink</td>
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<td></td>
<td>- CCA compliant to EN 300 328 v.1.8.1.</td>
<td>- Star topology</td>
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<tr>
<td></td>
<td>- AES 128 encryption</td>
<td>- Safety layer on the top of ISA100 stack</td>
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<th>Wireless Infrastructure</th>
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<td>- Backbone highway Ethernet, Opt-Fiber, Sky Mesh NW to minimize latency</td>
<td>- Multiple access points for scalable NW</td>
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<td>Ch Black listing for coexistence with Wi-Fi</td>
<td>- GW high side I/F to support Safety protocol</td>
<td>- Flexible NW design</td>
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<td>Flexible network engineering for deterministic com</td>
<td>- Satisfy IEC60079-29-1 performance requirement</td>
<td>- Flexible NW design</td>
<td>- Sky Mesh NW planning concept</td>
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<th>Operation &amp; Maintenance</th>
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<td>Monitoring PER/RSSI and com routes</td>
<td>- Predictable Battery life</td>
<td>- Easy expansion of sub networks by adding access points</td>
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</table>
ISA100 Wireless (ISA100.11a / IEC 62734) was developed by end users voice

Plant wide solution:
- Industry
- Oil & Gas, Petrochemicals,
- Powers, Metals, etc.
- Applications
- Process monitoring
- Process control
- Asset management
- Safety alarm management
- Energy monitoring
- Environmental
- etc.

Breakthrough Technologies:
- Two layered Security, OTA
- Mesh / Star / Duocast
- Battery Alert
- Interpretability
- Multiple subnets (co-existing)
- Bandwidth management
- Backbone network (Small-Large)
- Country code
- QoS (contracts)
- Multi-protocols by Tunneling
- Publish / Subscribe

Provide Solutions

Standardization

Implementation

Assure multivendor interoperability
- ISA100 compliance test
- Developing Implementation specifications
ISA100 Wireless key implementations

Reliability

Fault Tolerance

Redundant Gateway and Duocast

Production Control System

Redundant Gateway

Duplicate

Standby

Filed Wireless Backbone

Field Wireless Access Point

Radio Path

Duocast

Active

Field Wireless Access Point

Wireless Field Device

ISA100 Wireless Architecture
**Timeliness**

- **TDMA**: Time Division Multiple Access
- **Publish / Subscribe**: Periodic data transmission
- **The “Sky Mesh”**: Network planning concept

1) **Deterministic communication with short latency** (minimizing hops)
2) **Reliable communication with redundant paths**, Predictable battery life
Scalability

Plant wide large scale wireless infrastructure

ISA100 Full Functional

Redundant Gateway
1 sec Switchover

20 Access Points

500 devices@5sec update
200 devices@1sec update
World first SIL2 Gas detection system

- Wireless protocol: ISA100 Wireless
- Safety protocol: PROFIsafe over PROFINET
Key implementations for dependable wireless infrastructure

1. Reliability
   - Robust radio
   - Ch hopping
   - DuoCast
   - Redundant Gateway

2. Timeliness
   - TDMA
   - Sky Mesh design
   - Publish/Subscribe
   - Non-routing function

3. Scalability
   - IP Backbone
   - Mesh/Multi-hop
   - Long distance communication

4. Security
   - Device & Message authentication
   - AES-128 encryption
   - Time stamp

5. Easy Engineering
   - Predictive battery life
   - Manageable network configuration
   - Multi-vendor interoperability

6. SIL2 compliant
   - Safety protocol
   - Event notification
   - Black Channel principle
   - Device diagnostics
Applications

Gas explosion → Plant wide monitoring

GasSecure – A Dräger Company : GS01

World first SIL2 compliant ISA100 Wireless Gas detector

Short latency

Tsunami disaster → Predictive monitoring

Tsunami warning system ISA100 adapter + level meter

Long range

Fire of floating-roof tank → Emergency shutdown

Remote valve control ISA100 DI/DO box

Downlink QoS
Safe plant operation

Gas leak detection

SIL certified
Conclusion

The test has proven the capability of improving asset management and improving safety via wireless implementation.

☐ ISA100 wireless system stays interoperable during the six (6) months test period. The communication remained robust and stable over the 5km distance in heavy steel multi-deck structure and the harsh offshore environment with monsoon, thunder storm and high tidal differences.

☐ ISA100 wireless network installation and commissioning time is only 5% to 10% of that required for a conventional wired system – lower project cost.

☐ ISA100 wireless implementation in offshore platform has proven to be beneficial in terms of safety, operational flexibility and cost saving as demonstrated during the testing period.

☐ ISA100 as Wireless Standard is able to deliver the full wireless functionality as promised.

http://www.isa100wci.org/en-US/Learning-Center/White-Papers
Use cases – 2: Downstream

Fit for purpose solution

Benefits

• Reduction in overall project risk. No cables; hence no excavation and working at height.
• Installation can be done quickly, safely and seamlessly while plant is online.
• Simplifies engineering and drawing updates.
• Significant reduction in overall project cost.

Lessons Learned

• Good stakeholder management
  - Client, principal, local business partner and vendors were involved right from the beginning.
• Good communication plan
  - Good support and collaboration between all parties involved ensured the system was tested successfully to the client’s requirements.
• Need to pay attention on future upgrades of hardware that may affect the network.

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WCI assures multi-vendor interoperability for best in class solution.

Multiple suppliers are providing ISA100 Wireless Gas detector products

GasSecure
- A Dräger Company

Riken Keiki

New Cosmos
Another use cases

- **Process monitoring**
  - Temperature, Pressure, level, pH → Periodic data update, High availability, Low latency

- **Asset condition monitoring**
  - Vibration, Corrosion, Leakage → Plant wide scalability, Number of nodes, Large data size

- **Safety alarm & Emergency action**
  - Gas leak, Emergency shutoff valve, Tsunami warning → High reliability, Low latency

Temperature monitoring for improving productivity
Vibration analysis for predictive maintenance
Gas leakage detection for safe plant operation
Reduce field patrols

Tank level monitoring
Optimized operation

Heat exchanger monitoring
Predictive maintenance

Vibration monitoring
Summary

• Dependable plant wide infrastructure must be required to cover variety of wireless safety applications

• Multi-vendor devices and interoperable wireless network provide the best-in-class solution.

• World first SIL 2 wireless gas detection system has been realized with co-innovation of multiple vendors and multiple breakthrough technologies on the ISA100 Wireless
Thank you for your attention

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