An Overview of Applicable ISA Standards to the Water and Wastewater Sectors

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About Your Speaker

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- Director-elect of the ISA Water/Wastewater Industries Division
- General Chair for the 2012 & 2013 ISA Waster/Wastewater Symposiums
- Member of the ISA18, ISA101 and CSC/IEC/TC 65 standards committees

- In 2011 received Control Engineering magazine’s “Leaders Under 40” award
- Recipient of ISA Keith Otto Award for best InTech magazine article of the year for his “SCADA Standardization” article in the May/June 2011 issue.
- Background in various industry sectors including municipal water/wastewater

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Presentation Outline

- What is a Standard?
- How Standards Are Developed
- Standards & Standards Body Accreditation
- Benefits of Standards
- ISA Standards
- ISA Standards Committees
- List of some major ISA Standards for Water and Wastewater Sectors
  - ISA5 – P&IDs, Tagging, Drawings, Documentation
  - ISA18.2 – Alarm Management
  - ISA20 – Instrumentation & Valve Specification Forms
  - ISA95 – Enterprise Integration
  - ISA99 – Cyber Security
  - ISA100 – Wireless Systems
- Summary
- More Information
What is a Standard?

- A set of characteristics, quantities, or procedures that describes features of a product, process, service, interface, or material

- Standards provide numerous benefits in automation and production

- A “standards series” can often include Standards, Recommended Practices, and/or Technical Reports

- Format can be printed documents, PDFs, downloadable files, or templates
A Practical Standards Example

- The IEC 60320 standard defines the “C13” power plug/socket
- Standardized power inlet cord for computer equipment

Accommodates all these “weird” country-specific plugs
How Standards are Developed

- Standards are generally developed by standards committees.
- Need to look at the terms of reference for the committee and what organization it is associated with.
- Some “standards committees” are better than others.

- Characteristics of a “good” standards committee / organization:
  - Openness
  - Lack of Dominance
  - Balance
  - Consensus
  - Right of Appeal
Standards Accreditation

• Accreditation of a standards producing organization by a recognized national or international standards body is a good sign

• In the USA:
  – American National Standards Institute (ANSI)

• In Canada:
  – Standards Council of Canada (SCC)

• Two major international standards bodies:
  – IEC = International Electrotechnical Commission
  – ISO = International Organization for Standardization

The ISA is accredited through ANSI and is associated with the IEC internationally
Key Benefits of Standards

• Direct return on investment
  – Lower installation and startup costs
  – Reduce need to maintain large inventories
  – Enable interchangeability of components
  – Improve design with less "custom" effort
  – Increase safety
  – Increase security
Key Benefits of Standards (cont.)

• Use of standards in the Water and Wastewater Sectors
  – Improves communication
  – Provides practical application of expert knowledge
  – Harnesses years of experience and avoids the need to start each project from the ground up
Key Benefits of Standards (cont.)

- Standards help achieve operational excellence by
  - Improving performance
  - Lowering maintenance costs
  - Reducing downtime
  - Enhancing operability
ISA Standards

Accredited by the American National Standards Institute (ANSI) to develop industry standards following approved procedures to ensure openness and fairness in considering the views and needs of end-users, suppliers, regulators, and others involved in each topic area.

- 162 published standards, recommended practices and technical reports
- 133 committees and subgroups
- More than 3500 participating individuals
  ….from over 40 countries,
  ….and representing more than 2000 companies and organizations.
- In person committee meetings 1-2 times per year as needed
- Extensive use of teleconferences and web meetings
ISA Standards Committees

- ISA Standards are developed by volunteer standards committees

- For individuals involved in standards development:
  
  - Expand your knowledge base
  - Identify resources for your work
  - Network with other professionals

  - Enhance your leadership skills
  - Ensure that your ideas and viewpoints are considered in the development of standards that could impact your work and/or your company’s operations
  
  - Have fun
ISA Has Published Standards in Key Areas for the W & WW sector Including:

- Symbols and Diagrams (ISA5)
  - P&IDs, Tagging, Loop Diagrams, Functional Specifications, etc.

- Electrical Equipment for Hazardous Locations (ISA12)

- Alarm Systems (ISA18)
- Instrumentation Specification Forms (ISA20)
- Electrical Signal Compatibility (ISA50)

- Control Valves (ISA75)
- Functional Safety (ISA84)
- Batch Control (ISA88, formerly “S88”)
ISA Has Published Standards in Key Areas Including:

- Enterprise Control System Integration (ISA95)
- Valve Actuators (ISA96)
- Personnel Certification, CCST & CAP certifications (ISA98)

- Industrial Automation & Control System Security (ISA99)
- Wireless Systems for Automation (ISA100)

- Procedural Automation (ISA106)

To be published soon:
- Human Machine Interfaces (ISA101)
- Commissioning, Loop Checks, FAT and SAT Testing (ISA105)
Examples

Examples of Applicable ISA Standards to the Water & Wastewater Sectors

ISA5.1, ISA5.4, ISA5.6 Drawings & Documentation
ISA18.2 Alarm Management
ISA20 Instrument Specification Forms
ISA95 Enterprise Integration
ISA99 Cybersecurity
ISA100 Wireless
ISA5: Symbols and Diagrams

• ISA 5.1 defines P&ID symbols,
  – P&ID = Piping & Instrumentation Diagram

• ISA 5.1 defines basis of ISA-style tagging
  – LIT101 = level indicating transmitter #101
  – PAHH103 = pressure alarm high high on pressure loop #103
  – ZSC205 = “fully closed” position switch for valve #205
  – etc.
ISA5: Symbols and Diagrams (cont’d)

ANSI/ISA-5.1-2009, Instrumentation Symbols and Identification

- ISA’s most widely used American National Standard
- Establishes a uniform means of depicting and identifying instruments or devices and their inherent functions
- Intended for P&IDs, PFDs, UFDs, EFDs, MFDs, technical papers, specifications, and many other types of engineering documents

![Image of pump symbols](image1.png)

Figure 5 - Pumps are shown using simple line drawings

![Image of pressure control loop](image2.png)

Figure 11 - Pressure control loop with high and low alarms
ISA5: Symbols and Diagrams (cont’d)

- ISA 5.4 defines loop diagrams for instrumentation
- ISA 5.6 provides templates for functional specifications
  - a type of very concisely written process control narrative

Example: ISA Loop Drawing
ISA 18.2: Alarm Management

ANSI/ISA-18.2-2009,
Management of Alarm Systems for the Process Industries

**Alarm:** An audible and/or visible means of indicating to the operator an equipment malfunction, process deviation or abnormal condition requiring a response.

Methodology for identifying, rationalizing and designing alarms to be a powerful tool for operations, and eliminating non-useful alarms.
ISA 18.2: Alarm Management (cont’d)


- Addresses the development, design, installation, and management of alarm systems in the process industries

- Defines the terminology and models to develop an alarm system – and the work processes to effectively maintain it throughout its lifecycle

- Six technical reports are now in development by ISA18 to explain specific applications in greater detail

- Currently in international development to become IEC 62682
ISA20: Instrument Specification Forms

- ISA-TR20 templates collection
- Templates for standardized specification forms to make specifying instrumentation easier
  - Standardized layout & content
  - MS Word Templates
  - MS Excel Templates
  - Database driven templates
- Standardized forms ensure consistency and help reduce mistakes
ISA95: Enterprise Integration

- ANSI/ISA-95.xx.xx family of standards and technical reports
- Defines a framework for doing enterprise integration of automation, SCADA and control systems
  - Models and Terminology
  - Object Model Attributes
  - Models of Manufacturing Operations Management
  - Business-to-Manufacturing Transactions
- Adopted as IEC 62264-X family of standards
ISA99: Cyber Security

ANSI/ISA-99-xx-xx family of standards and technical reports
Security for Industrial Automation and Control Systems


- Bringing together control system / industrial cyber security experts from across the globe.

- ISA99 standards are being incorporated into government programs on critical infrastructure protection and smart grid development.

- ISA99 has been internationally adopted as IEC 62443 family of standards
ISA100: Wireless Systems for Automation

- The ISA100 family of standards is under active development
- ANSI/ISA-100.11a.2011 for wireless instrumentation now has IEC approval
Other Key ISA Standards

ISA101 – Human Machine Interfaces
• Collection of standards and technical reports on HMI design best practices
• The ISA101 standards committee is currently working on its third draft
• To be published soon

ISA105 – Commissioning, Loop checks, SAT and FAT tests
• Standards published and under development in areas including:
  – Commissioning
  – Instrumentation & Electrical Loop Checks
  – Factory Acceptance Tests
  – Integration Testing
  – Site Acceptance Tests
  – Calibration Guidelines
ISA Standards: Global Impact

In fact, several original ISA Standards are the basis of major IEC (International Electrotechnical Commission) standards:


- IEC 61511 series: Process Safety (ISA84)
- IEC 61512 series: Batch Control (ISA88)
- IEC 62264 series: Enterprise Control System Integration (ISA95)
- IEC 62443 series: Control Systems Security (ISA99)
Summary

• Using Standards has many benefits, including:
  – Lower installation, commissioning and start-up costs
  – Improved design with less “custom” effort
  – Lower training costs, improved communication, and more consistent operation
  – Leverages the years of experience that are captured in standards
  – Improved performance, less downtime, and enhanced operability

• ISA has an extensive library of Standards available
  – 162 standards, recommended practices, and technical reports
  – ISA Standards are consensus based and non-commercial in nature
  – Broad applicability to SCADA, automation and instrumentation

• ISA Standards are available at www.isa.org
  – For purchase as printed & PDF copies
  – ISA members can view most ISA Standards for free online
For more information:

• How to get ISA Standards
  – For purchase (print & PDF) at www.isa.org, click on Standards
  – ISA Members can view most ISA standards for free at www.isa.org

• More information of ISA Standards
  – www.isa.org/standards

• Other industry standards:
  - www.nssn.org (key word search)

• ISA Water/Wastewater Industries Division
  – www.isa.org/wwid/