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Plant Maintenance Training

Reducing downtime and improving plant performance

Setting the Standard for Automation™

Expert-led training with real-world application from a global leader in automation and control training

Proper maintenance of plant systems and equipment supports optimal plant operation, capacity, and productivity; improves output quality and worker safety; reduces the likelihood and severity of plant and machinery downtime; and pares overall operating costs.

ISA specializes in teaching the latest, proven plant maintenance techniques and technologies so automation and control professionals can:

- Prevent catastrophic failures before they occur
- Predict ongoing need for maintenance
- Improve reliability and availability of plants' automation systems, including machinery and processes
- Implement state-of-the-art maintenance management programs designed to reduce inspection time, improve plant and equipment operating performance, cut costs, and boost safety

And, ISA's world-renowned plant maintenance experts provide the comprehensive, practical instruction needed to immediately apply knowledge in the workplace, offered through a wide variety of learning formats.

All ISA training courses provide relevant examples and case histories, further reinforcing the practical and real-world scenarios found in the work environment. To ensure flexibility and to meet varying customer needs, ISA offers plant maintenance training at a variety of locations: at ISA headquarters in North Carolina, at ISA's many regional training centers, and onsite directly at customer facilities.



Who is ISA?

Founded in 1945, ISA is a global organization that serves automation and control professionals through standards development, certification, education and training, technical publications, and technical conferences and events.

To learn more about ISA, visit www.isa.org.

ISA Training: World-class subject-matter expertise

ISA's courses are known and respected worldwide for their unbiased, practical approach to technology application.

For more than 65 years, ISA has built on its proven track record of identifying and providing the real-world resources needed by organizations and automation and control professionals by working with leading content experts to deliver rapid, customized solutions.

Taking an ISA training course will:

- Enhance on-the-job training
- Fill in missing knowledge gaps
- Teach you the Hows and Whys
- Provide continuing education credits
- Expand your professional network
- Give you access to industry experts



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Save on training when you join ISA!

ISA members save 20% and ISA Automation Affiliate members save 10% on the Community Member/List price for all ISA training courses and products.

Save with ISA's Multi-Registration Rate!

When you register for more than one course offering in a single registration—whether you are registering yourself for two or more different courses, or registering you and at least one colleague for either the same or a different course—the ISA Multi-Registration rate can be applied to the additional registrations. Learn more at www.isa.org.Training/MultiReg

Installing, Calibrating, and Maintaining Electronic Instruments

Most Popular!

This popular course offers a combination of practical information and hands-on experience, covering proper installation, calibration, and maintenance of electronic instruments. You will examine characteristics of electronic control systems; techniques for installing electronic instruments; and procedures for configuring and calibrating transmitters, transducers, and controllers. **Approximately 40% of your time in this course is spent working with equipment.**

YOU WILL BE ABLE TO:

- Employ proper safety practices during installation, calibration, and maintenance procedures
- Select and operate test equipment to measure electrical properties and calibrate instruments
- Calibrate electronic transmitters and controllers
- Install electronic instruments using manufacturer's guidelines and ISA's recommended practices and procedures
- Use piping and instrumentation diagrams (P&IDs) and wiring, schematic, and installation detail drawings to install, calibrate, and verify proper operation of instruments
- And more....

YOU WILL COVER:

- Loop Characteristics
- Laboratory and Test Equipment
- Calibration and Configuration
- Instrument Maintenance
- Installation
- Electronic Controllers
- Safety in Hazardous Locations
- Trends

CLASSROOM/LABORATORY EXERCISES:

- Calibrate differential pressure, RTD, thermocouple, and I/P transmitters and transducers
- Configure smart differential pressure and temperature transmitters
- Construct a simple feedback flow loop, perform a loop check, and tune the loop using trial and error tuning
- Configure and calibrate a single loop digital controller
- And more...

COURSE DETAILS:

Course No.: TI25

Length: 4.5 days

CEUs: 3.2

Price: \$3,080 ISA Member
\$3,465 Affiliate Member
\$3,855 Community Member/List
\$3,080 Multi-Registration Rate

RECOMMENDED RESOURCE:

ISA Text: *Maintenance of Instruments and Systems, Second Edition* by L.D. Goettsche

"This is an excellent course that enables the participant to study and understand concepts related to individual instruments, instrument loop wiring, and common electronic instruments found in most operating plants."

—Jerry Booher, ISA Instructor

2017 SCHEDULE

Research Triangle Park, NC..... 30 January – 2 February;
19–23 June; 4–8 December
Houston, TX.....6–10 February; 17–21 April
Santa Ana, CA.....7–11 August
(TBD), PA..... 16–20 October

Instrument Calibration and Documentation for FDA-Regulated Industries

Do you really want an untrained technician working on equipment that directly affects the quality and integrity of the product being manufactured at your facility? The implications of inaccuracy could easily amount to millions of dollars in product recall or lawsuits, as a result of a defective product. Current statistics show that finding an out of tolerance calibration is a \$40,000 investigation!

This course offers a combination of practical information and hands-on experience, covering fundamental principles of electronic process control instrumentation used in FDA-regulated industries such as pharmaceutical and food processes. Proper calibration will be covered in hands-on lab exercises using common electronic instrumentation including analyzers. You will examine characteristics of electronic control systems and procedures for configuring transmitters, transducers, and controllers. A good portion of time is spent working hands-on with typical industry equipment.

COURSE PREREQUISITES:

- Basic understanding of FDA industry regulations

WHO SHOULD ATTEND?:

- Technicians, engineers, supervisors, and managers who want to gain a better understanding of the field of process control and calibration standards necessary in FDA-regulated industries

YOU WILL BE ABLE TO:

- Select and operate test equipment to measure electrical properties and calibrate instruments
- Calibrate electronic transmitters
- Use piping and instrumentation diagram (P&ID), wiring, schematic, and installation detail drawings to install, calibrate, and verify proper operation of instruments
- Explain the relevance of ISO 9000 standards to maintenance practices and procedures
- Recognize typical calibration needs for systems used in the FDA-regulated industries
- And more...

YOU WILL COVER:

- Fundamentals of Temperature, Pressure, Flow, Level, and Analytics
- Calibration and Configuration
- Instrument Maintenance
- Standards-Based Calibration Programming
- Measurement Uncertainty, Tolerances, and Validated Systems
- And more...

CLASSROOM/LABORATORY EXERCISES:

- Calculate, record, and graph instrument performance data to compare with specifications and identify errors
- Measure and record voltage, current, and resistance
- Calibrate differential pressure, RTD, and thermocouples
- Configure smart differential pressure and temperature transmitters
- Calibrate pH and conductivity analyzers
- And more...

COURSE DETAILS:

Course No.: TI24	Price: \$3,080 ISA Member
Length: 4.5 days	\$3,465 Affiliate Member
CEUs: 3.2	\$3,855 Community Member/List
	\$3,080 Multi-Registration Rate

2017 SCHEDULE

Houston, TX.....	23–27 January
Royersford, PA.....	5–9 June
Santa Ana, CA	27 November – 1 December

Sizing, Selecting, and Applying Process Control Valves

This course provides a practical explanation of control valves, actuators, and positioner designs and their applications. This course also covers methods that can be used to identify specific valve problems and acceptable solutions within engineering tolerance.

YOU WILL BE ABLE TO:

- Differentiate between various types of valves and the benefits of each
- Analyze a control system to determine control valve needs
- Size valves for any flow condition likely to be found in a process plant
- Specify appropriate auxiliaries including positioners and I/P transducers
- Design control valve installations that are safe and trouble-free
- And more...

YOU WILL COVER:

- Basic Valve Types
- Valve Performance
- Installation
- Specification and Selection
- Smart Valves
- And more...

CLASSROOM/LABORATORY EXERCISES:

- Test valves to evaluate performance factors
- Size valves manually and with software
- Evaluate operation of valves with pneumatic actuators and positioners
- Demonstrate smart valve/positioner operation
- And more...

COURSE DETAILS:

Course No.: EI30

Length: 3 days

CEUs: 2.1

Price: \$1,680 ISA Member

\$1,890 Affiliate Member

\$2,105 Community Member/List

\$1,680 Multi-Registration Rate

RECOMMENDED RESOURCE:

ISA Text: *Control Valve Primer: A User's Guide* by Hans D. Baumann

“The extensive course materials provided contained useful information about valves/sizing and selection, both theoretical and practical.”

—Mike Jones, Electrical Supervisor

2017 SCHEDULE

Research Triangle Park, NC.....18–19 January

Newark, DE..... 19–21 June;

7–9 August

Advanced Operation of Digital (Smart) Transmitters

This lab-intensive course focuses on configuration fundamentals, the calibration process, the measurements of multiple variables, and the utilization of computer-based configuration tools for digital transmitters utilizing HART, Fieldbus and Wireless protocols. You will cover uses in conventional systems and improved communications when combined with digital control networks. You will also be exposed to various hand-held communicators and computer-based configuration and diagnostic software.

YOU WILL BE ABLE TO:

- Differentiate between analog and digital instruments
- Formulate how digital signal sampling works in digital instruments
- Identify the strengths and weaknesses of digital instruments
- Identify the effects of using digital instruments in closed loop control
- Configure, re-range, and calibrate digital field devices
- Test the capabilities of HART™ communication
- Test the operation of a digital multivariable transmitter
- Test the operation of multi-drop transmitter applications
- Communicate with digital devices utilizing computer-based software
- Configure and test Fieldbus and wireless devices

YOU WILL COVER:

- Analog vs. Digital Instruments: Limitations | Calibration of Instruments | Flexibility of Digital Instruments | Digital Signal Transmission
- Digital Signal Sampling: Signal Characteristics | Output of A/D Converter | Speed | Measurement Accuracies
- Strengths and Weaknesses of Digital Instruments: Effect on Performance | Multiple Measurements | Error Messaging | Future Development
- Calibration of Digital Devices: Pressure Zero Trims | Sensor Calibration
- Digital Communications Protocols: Modem | FSK | Protocol | Fieldbus | Wireless
- HART Communication: Features | Master/Slave Communications | Point-to-Point | Capabilities
- Smart Multivariable Transmitters: How They Work | How They Transmit Multiple Variables

CLASSROOM/LABORATORY EXERCISES:

- Configure and test HART protocol digital transmitters
- Perform sensor trims and calibrations
- Use various communication tools to configure smart field devices
- Measure and transmit multiple variables
- Utilize diagnostic messages to determine proper configuration
- Configure and test Fieldbus and wireless protocol devices

RECOMMENDED PRE-REQUISITES:

- Prior attendance in ISA courses FG07 and TI25, or experience in digital transmitter fundamentals, application, and maintenance

COURSE DETAILS:

Course No.: TS17 **Price:** \$3,080 ISA Member
Length: 4.5 days \$3,465 Affiliate Member
CEUs: 2.8 \$3,855 Community Member/List
\$3,080 Multi-Registration Rate

2017 SCHEDULE

Columbia, IL.....20–24 February
Royersford, PA.....1–5 May
Research Triangle Park, NC.....17–21 July
(TBD), PA.....7–11 August

Control Valve Mechanics and Operations from Analog to Digital

This course offers the student a comprehensive study of the control valve's mechanical composition, actuation and positioning accessories including a detail study of digital valve controllers (DVCs). The class is hands-on, lab intensive leading the student to a real-world working knowledge of valve mechanical configurations, valve operations and positioner calibrations.

In addition the student will gain a working knowledge of DVC operations including configuration, calibration, tuning and diagnostics utilizing the latest communication tools (HART communicators, AMS software, etc).

YOU WILL BE ABLE TO:

- Identify various control valve loops on P&ID documentation
- Describe control valve operations including manual operation, on/off control, valve positioning and DVC operations
- Mount various accessories on valves including solenoid, limit switches, positioners and transmitters
- Configure, setup and/or calibrate solenoids, limit switches, positioners, transmitters, I/P transducers and DVCs
- Demonstrate the proper use of communication devices including Fluke calibrators, HART communicator and AMS software

YOU WILL COVER:

- Terminology
 - Valve
 - Actuator
 - Positioner
 - Accessories
- Documentation
 - P&ID
- Body Design
 - Linear motion
 - Rotary Motion
- Actuators
 - Spring opposed diaphragm
 - Piston
 - Rack and Pinion
- Positioners
 - Pneumatic and Electro-pneumatic
- Accessories
 - Solenoids
 - Limit switches
 - Position transmitters
- DVCs
 - Configuration
 - Calibration
 - Diagnostics
- Regulator
 - Direct and Pilot-operated

CLASSROOM/LABORATORY EXERCISES:

- Valve assembly and mounting of actuator, solenoid, limit switch, pneumatic positioner and position transmitter
- Calibrate I/P transducer, pneumatic positioner & position transmitter
- Configure and calibrate a DVC
- Utilization of 475 HART communicator & AMS software

RECOMMENDED PRE-REQUISITES:

- Prior attendance in ISA course FG07 or basic knowledge of process control

RECOMMENDED RESOURCES:

- *Control Valves* (ISA) by Guy Borden, Jr. & Paul G. Friedmann

COURSE DETAILS:

Course No.: TS18

Length: 4.5 days

CEUs: 3.2

Price: \$3,080 ISA Member
\$3,465 Affiliate Member
\$3,855 Community Member/List
\$3,080 Multi-Registration Rate

2017 SCHEDULE

Columbia, IL 12–16 June

Research Triangle Park, NC... 11–14 December

Applying Motor Controls and Drives



This course gives you a broad perspective of DC motors, AC motors (single and three-phase), and Variable Speed Drives (for AC Induction Motors and DC Motors). Industrial applications of Variable Speed Drives for constant torque, constant horsepower, and variable torque/variable horsepower are included. Also covered are Motor Starter Circuits and Reduced Voltage Starting techniques. Stepper Motors and Servo Motors are discussed along with their advantages and applications.

YOU WILL BE ABLE TO:

- Calculate volts per hertz ratio as related to Variable Frequency Drives
- Specify, select, and implement motors for variable torque and horsepower
- Interpret motor performance curves
- Discuss stepper and servo motor systems for industrial applications
- Explain the differences in various motion control feedback devices
- And more...

YOU WILL COVER:

- DC Motors Theory and Construction
- Single-Phase and Three-Phase AC
- Motor Theory and Construction
- Motor Specifications
- Motor Control Circuits
- Motor Applications
- And more...

CLASSROOM/LABORATORY EXERCISES:

- Motor-to-Load calculation
- Torque-to-Load calculation
- Variable Speed Drive operation/measurement

COURSE DETAILS:

Course No.: SP15

Length: 3 days

CEUs: 2.1

Price: \$1,560 ISA Member
\$1,755 Affiliate Member
\$1,955 Community Member/List
\$1,560 Multi-Registration Rate

RECOMMENDED RESOURCE:

ISA Text: *Motors and Drives: A Practical Technology Guide* by David Polka

“[This course provided] a good practical approach to understanding how the drives and motors interact.”
—Paul Nozal,
Senior Instrument Consultant



Save on training when you join ISA!

ISA members save 20% and ISA Automation Affiliate members save 10% on the Community Member/List price for all ISA training courses and products.

2017 SCHEDULE
Pensacola, FL..... 27 February–1 March
Research Triangle Park, NC..... 26–28 June;
6–8 December
Santa Ana, CA 23–25 October

Industrial Pressure, Level, and Density Measurement Engineering

This course presents the principles and applications of modern pressure, level, and density measurement systems. Emphasis is placed on instrument design technologies; system performance and design; and specification, selection, installation, and maintenance requirements.

YOU WILL BE ABLE TO:

- Apply general maintenance, calibration, and safety requirements for specification and selection of various types of pressure and level measuring instruments
- Engineer fundamental level and pressure measurement installations
- Calculate calibration data for different for-process and installation conditions
- Select and apply devices and systems for industrial pressure and level measurement
- Specify and use smart transmitters in level and pressure measurement processes
- And more...

YOU WILL COVER:

- Review of Measurement Principles
- Pressure Transducers
- Smart Transmitters
- Level Measurement Methods, Technologies, and Applications
- Density Measurement Devices and Applications
- And more...

COURSE DETAILS:

Course No.: EI05

Length: 2 days

CEUs: 1.4

Price: \$1,440 ISA Member
\$1,620 Affiliate Member
\$1,800 Community Member/List
\$1,440 Multi-Registration Rate

Introduction to Industrial Pressure, Level, and Density Measurement Technologies

ONLINE!

This online, instructor-assisted course presents an overview of the principles and applications of modern pressure, level, and density measurement systems, emphasizing underlying instrument technologies; device performance and design; and specification, selection, installation, and maintenance requirements for instruments and transmitters.

YOU WILL COVER:

- **Week 1/Module 1:** Measurement Principles
- **Week 2/Module 2:** Primary and Secondary Pressure Transducers
- **Week 3/Module 3:** Technologies for Communication and Introduction to Level Measurement
- **Week 4/Module 4:** Level Measurement Technologies
- **Week 5/Module 5:** High-Tech Level Measurement and Hydrostatic Tank Gauging
- **Week 6/Module 6:** Transmitters and Density Measurement
- **Week 7:** Final Course Examination

COURSE DETAILS:

Course No.: EI05E

Length: 7 weeks

CEUs: 1.8

Price: \$1,440 ISA Member
\$1,620 Affiliate Member
\$1,800 Community Member/List
\$1,440 Multi-Registration Rate

Includes ISA Standard and Technical

Report: ISA-20-1981 and ISA-TR20.00.01-2007

—A \$280 Value!

Includes ISA Text: *Industrial Pressure, Level & Density Measurement*, by Donald R. Gillum

—A \$119 Value!

2017 SCHEDULE

Research Triangle Park, NC.....23–24 January;
13–14 March
Newark, DE.....12–13 June

2017 SCHEDULE

Online 17 April – 2 June;
18 September – 3 November

Industrial Flow Measurement Engineering

This course presents the principles and applications of modern flow measurement systems. Emphasis is on flowmeter accuracy, performance, system design, sizing, specification, installation, and maintenance requirements.

YOU WILL BE ABLE TO:

- Design a system to make practical and precise industrial flow measurements
- Specify and select the appropriate flowmeters for different applications
- Create installation detail drawings to obtain flowmeter accuracy and performance
- Solve typical flow measurement problems
- Plan maintenance activities required by different flowmeter technologies
- And more...

YOU WILL COVER:

- Introduction
- Flowmeters:
 - Differential Pressure
 - Magnetic
 - Mass
 - Oscillatory
 - Correlation
 - Positive Displacement
 - Thermal
 - Turbine
 - Ultrasonic
 - Insertion
- Open Channel Flow Measurement
- Flowmeter Selection

CLASSROOM/LABORATORY EXERCISES:

- Determine upstream and downstream piping considerations
- Perform sizing calculations for different types of flowmeters and different process applications
- Specify installation and calibration requirements for different types of flowmeters and applications
- Complete specification sheets for a variety of flowmeters and flow elements
- And more...

COURSE DETAILS:

Course No.: EI10

Length: 3 days

CEUs: 2.1

Price: \$1,680 ISA Member
\$1,890 Affiliate Member
\$2,105 Community Member/List
\$1,680 Multi-Registration Rate

Includes ISA Standards and Technical Reports: ISA-20-1981 and ISA-TR20.00.01-2007

—A \$280 Value!

Includes ISA Text: *Industrial Flow Measurement, Third Edition* by David W. Spitzer

—A \$109 Value!

2017 SCHEDULE

Research Triangle Park, NC.....25–27 January;
15–17 March
Newark, DE.....14–16 June

Overview of Industrial Flow Measurement Engineering

ONLINE!

This online, instructor-assisted course presents an overview of the principles and applications of modern flow measurement systems. Course emphasis is on flowmeter accuracy, performance, system design, sizing, specification, installation, and maintenance requirements.

YOU WILL BE ABLE TO:

- Describe principles of operation for different flowmeter technologies
- Design a system to make practical and precise industrial flow measurements
- Calculate the effects of fluid properties on flowmeter performance
- Evaluate flowmeter performance statements and compare them with application requirements
- Specify and select the appropriate flowmeters for different applications
- Create installation detail drawings to obtain flowmeter accuracy and performance
- Identify requirements for flowmeter calibration
- Solve typical flow measurement problems

YOU WILL COVER:

- **Week 1/Module 1:** Fluid Properties
- **Week 2/Module 2:** Instrument Performance Measures, Linearization, Compensation, and Totalization
- **Week 3/Module 3:** Flowmeter Introduction and Calibration
- **Week 4/Module 4:** Differential Pressure Flowmeters
- **Week 5/Module 5:** Magnetic Flowmeters • Mass and Open Channel Flowmeters
- **Week 6/Module 6:** Oscillatory Flowmeters
- **Week 7/Module 7:** Positive Displacement, Target, Thermal, and Turbine Flowmeters
- **Week 8/Module 8:** Ultrasonic, Variable, and Correlation Flowmeters • Insertion and Bypass Flowmeters
- **Week 9/Module 9:** Flowmeter Selection
- **Week 10:** Final Course Examination

COURSE DETAILS:

Course No.: E110E

Length: 10 Weeks

CEUs: 2.4

Price: \$1,680 ISA Member

\$1,890 Affiliate Member

\$2,105 Community Member/List

\$1,680 Multi-Registration Rate

Includes ISA Standard and Technical Report: ISA-20-1981 and ISA-TR20.00.01-2007

—A \$280 Value!

Includes ISA Text: *Industrial Flow Measurement, Third Edition* by David W. Spitzer

—A \$109 Value!

2017 SCHEDULE

Online 5 June – 11 August;

13 November – 19 January 2018

Electrical Controls for the Control Systems Technician

This course will focus on electrical controls that are frequently overlooked in a formal training program. The content will begin with Ohm's Law and cover content all the way through technical troubleshooting aspects. The course is geared toward any level technician who wants a thorough review of electrical process concepts to reinforce their knowledge of basic electricity and develop skills required to install and maintain electrical control devices.

YOU WILL BE ABLE TO:

- Use proper terminology and electrical symbols
- Describe the basics of power distribution
- Check various control devices for proper operation
- Make proper electrical connections
- Describe the purpose of control relays for various applications
- Explain the function of timing and counting relays.
- Apply schematics, wiring diagrams and electrical ladder logic to commission, troubleshoot and maintain electrical controls such as switches, pushbuttons, selector switches, solenoids, timing relays, counters, basic motion and speed control devices.
- Use electrical control devices to control the operation and failure modes for valve control applications.

YOU WILL COVER:

- Electrical Standards and Best Practices/NFPA
- Power Sources
- Wiring and Electrical Connections
- Fuses and Circuit Breakers
- Electrical Switching and Communication
- Plug-In Relays
- Timing Relays
- Counters
- Solenoids
- Electrical Ladder Logic
- Documentation
- Valve Control
- Troubleshooting

CLASSROOM/LABORATORY EXERCISES:

- Making wiring connections
- Wiring and Proper use of plug-in relays
- Use of pushbuttons, switches, relays and pilot lights to build and test the AND, NAND, OR, NOT, NOR, XOR, XNOR relay logic.
- Timers
- Counters
- Solenoid Valves and Valve Control

COURSE DETAILS:

Course No.: TI23

Length: 4.5 days

CEUs: 3.2

Price: \$3,080 ISA Member
\$3,465 Affiliate Member
\$3,855 Community Member/List
\$3,080 Multi-Registration Rate

PRE-REQUISITE:

- Completion of ISA TI15 or equivalent work experience

2017 SCHEDULE

Research Triangle Park, NC..... 27 February – 3 March
Newark, DE..... 22–26 May
Houston, TX..... 10–14 July
Santa Ana, CA..... 16–20 October

Bring ISA plant maintenance training directly to you!

All of ISA's plant maintenance classroom training courses can be taught at your company location through ISA's Onsite Training. Contact ISA at **+1 919-549-8411** or at **info@isa.org** for more information.

ISA is accredited by the International Association for Continuing Education and Training (IACET). ISA complies with the ANSI/IACET Standard, which is recognized internationally as a standard of excellence in instructional practices. As a result of this accreditation, ISA is authorized to issue the IACET CEU.



The International Society of Automation (www.isa.org) is a nonprofit professional association that sets the standard for those who apply engineering and technology to improve the management, safety, and cybersecurity of modern automation and control systems used across industry and critical infrastructure. Founded in 1945, ISA develops widely used global standards; certifies industry professionals; provides education and training; publishes books and technical articles; hosts conferences and exhibits; and provides networking and career development programs for its 36,000 members and 350,000 customers around the world.

ISA owns Automation.com, a leading online publisher of automation-related content, and is the founding sponsor of The Automation Federation (www.automationfederation.org), an association of non-profit organizations serving as "The Voice of Automation." Through a wholly owned subsidiary, ISA bridges the gap between standards and their implementation with the ISA Security Compliance Institute (www.isasecure.org) and the ISA Wireless Compliance Institute (www.isa100wci.org).

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Don't miss these limited 2017 course offerings!

Register or learn more at

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