Solve your biggest challenges with ISA’s comprehensive, hands-on training courses, taught by industry experts.

Technician Pathway

Engineering Pathway

Cybersecurity Pathway

Safety Pathway

See page 5 for customizable training solutions!
**ISA sets the standard and helps you solve your biggest training challenges.**

### Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISA Training Formats</td>
<td>3</td>
</tr>
<tr>
<td>Training Pathways</td>
<td>4</td>
</tr>
<tr>
<td>Customizable Training</td>
<td>5</td>
</tr>
<tr>
<td>Technician Pathway</td>
<td>6</td>
</tr>
<tr>
<td>Certified Control Systems Technician® (CCST®)</td>
<td>7</td>
</tr>
<tr>
<td>Certified Control Systems Technician® (CCST®)</td>
<td>7</td>
</tr>
<tr>
<td>Certified Control Systems Technician® (CCST®)</td>
<td>8</td>
</tr>
<tr>
<td>Technician Training Boot Camp (TTBC)</td>
<td>9</td>
</tr>
<tr>
<td>Extreme Instrumentality: Electrical to</td>
<td>9</td>
</tr>
<tr>
<td>Instrumentation Cross Training Bootcamp (XTBC)</td>
<td>9</td>
</tr>
<tr>
<td>Tactics for Advanced Troubleshooting</td>
<td>10</td>
</tr>
<tr>
<td>Process Automation Boot Camp for Non-Maintenance Personnel (PABC)</td>
<td>10</td>
</tr>
<tr>
<td>Introduction to Industrial Processes,</td>
<td>10</td>
</tr>
<tr>
<td>Measurement, and Control (FG07)</td>
<td>11</td>
</tr>
<tr>
<td>Fundamentals of Industrial Process,</td>
<td>11</td>
</tr>
<tr>
<td>Measurement, &amp; Control (FG05E–Online Only)</td>
<td>11</td>
</tr>
<tr>
<td>Developing and Applying Standard Instrumentation and Control Documentation (FG15E–Online Only)</td>
<td>12</td>
</tr>
<tr>
<td>Instrument Calibration and Documentation</td>
<td>12</td>
</tr>
<tr>
<td>for FDA-Regulated Industries (TI24)</td>
<td>12</td>
</tr>
<tr>
<td>Installing, Calibrating, &amp; Maintaining</td>
<td>13</td>
</tr>
<tr>
<td>Electronic Instruments (TI25)</td>
<td>13</td>
</tr>
<tr>
<td>Control Valve Mechanics and Operations</td>
<td>13</td>
</tr>
<tr>
<td>from Analog to Digital (TS18)</td>
<td>13</td>
</tr>
<tr>
<td>Tuning Control Loops (TC05)</td>
<td>14</td>
</tr>
<tr>
<td>Troubleshooting Instrumentation and Control Systems (TC10)</td>
<td>14</td>
</tr>
<tr>
<td>IT and OT Survival Basics for I&amp;C Personnel (TS06)</td>
<td>15</td>
</tr>
<tr>
<td>IT and OT Advanced Skills for I&amp;C Personnel (TS12)</td>
<td>15</td>
</tr>
</tbody>
</table>

| Engineer Pathway                            | 16   |
| Certified Automation Professional® CAP®      | 17   |
| Exam Review Course (EC00 and EC00E)          | 17   |
| Automation Engineering Survival Training     | 18   |
| Automation Engineering Survival Training—    | 18   |
| Integrator Version (AESTIV)                  | 18   |
| Industrial Pressure, Level, and Density      | 19   |
| Measurement Engineering (EI05)               | 19   |
| Industrial Flow Measurement Engineering (EI10) | 19   |
| Fire & Gas System Engineering: Performance-Based | 20   |
| Methods for Process Facilities (EC56P)       | 20   |
| Applying Instrumentation in Hazardous       | 21   |
| (Classified) Locations (ES10)                | 21   |
| Boiler Control Systems Engineering (ES15)    | 21   |
| Burner Management Systems Engineering Using  | 21   |
| NFPA Code 85 and ANSI/ISA77 Standards (ES16) | 22   |
| Management of Alarm Systems (IC39)           | 22   |
| Batch Control Using the ANSI/ISA88 Standards (IC40 and IC40E) | 23   |
| Control Systems Engineering (CSE) Exam Review Course (EN00) | 23   |

| Cybersecurity Pathway                       | 24   |
| Using the ISA/IEC 62443 Standards to Secure | 25   |
| Your Control Systems (IC32 and IC32E)       | 25   |
| Assessing the Cybersecurity of New or Existing | 25   |
| IACS Systems (IC33 and IC33E)               | 25   |
| IACS Cybersecurity Design & Implementation (IC34) | 26   |
| IACS Cybersecurity Operations & Maintenance (IC37) | 26   |

| Safety Pathway                              | 27   |
| Safety Instrumented Systems: A Life-Cycle    | 28   |
| Approach (EC50 and EC50E)                   | 28   |
| Advanced Safety Integrity Level (SIL) Selection (EC52) | 28   |
| Advanced Design & SIL Verification (EC54)    | 29   |

| Join ISA                                    | 30   |
| ISA 2020 Events                             | 31   |
Open Enrollment Classroom Training

- Hands-on equipment
- Developed and taught by industry experts
- Real-world examples
- Training locations around the world

ISA's open enrollment classroom courses are hands-on lessons taught by industry leaders, giving attendees an opportunity to work through real-world examples on equipment used in facilities worldwide. ISA's in-person classroom courses are the best opportunity to interact with our expert instructors and to network with industry professionals.

ISA's open enrollment classroom training courses are held several locations throughout the United States, including Texas, North Carolina, Colorado, California, Pennsylvania, and Wisconsin. The training schedule is subject to change, so please be sure to check ISA's website for the most recent schedule and to register by going to isa.org/schedule.

Online Training

Online training from ISA is a convenient alternative to open enrollment classroom options. Online training is offered in two formats that provide varying levels of flexibility and access to an expert instructor.

Online, Instructor-Led Courses
ISA's online, instructor-led courses have a start and end date and are guided by an expert instructor. Each course includes live Q&A sessions with the instructor so that students can ask questions and clarify material.

Online, On-Demand Courses
ISA's online, on-demand courses are a series of modules that can be completed on the student's schedule. These courses are truly self-paced and can be completed at any time within one year of registering for the course.

Customizable In-Plant Training

ISA offers customizable, private training solutions that can be scheduled at your facility or online. These trainings can be customized to fit your needs. Speak with an ISA learning consultant today by contacting us at trainingsales@isa.org or +1 919-549-8411. See page 5 for additional information.

"Companies around the world are concerned about workforce development, and that starts with upgrading the skill levels of your current employees. Employers are realizing that the continued improvement of each member of their staff is a crucial part of their overall success."

Nick Sands, CAP, P.E. on the importance of ISA training
Manufacturing Technology Fellow,
Dupont Protection Technologies
Past ISA VP of Professional development

"All throughout my career the one thing that was constant was change. I started my professional life as a technician in the food processing industry in Sandusky, OH. When I started, the levels of automation were nowhere near where they are today. What used to change or upgrade every 10 years would be cut to five then three then two, and now it seems there is something being improved upon month by month. If the training wasn’t available to me, especially later in my career, I don’t know what I would have done."

Paul Kowalcyzk
Retired Systems Control Operator
Con-Agra Foods

The open enrollment schedule can be viewed online at www.isa.org/training
# TRAINING PATHWAYS

ISA’s training courses each fall into one of the following training pathways:

<table>
<thead>
<tr>
<th>Technician</th>
<th>Engineer</th>
<th>Cybersecurity</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>These courses help technicians and new industry professionals in industrial automation process and control hone their technical skills.</td>
<td>These courses are designed with automation professionals, control system engineers, and engineering managers in mind.</td>
<td>Based on ISA’s internationally recognized cybersecurity standards, these courses help automation professionals secure their control systems against cyberattack.</td>
</tr>
<tr>
<td><strong>Topics Covered</strong></td>
<td>Domains: I. Calibration, Maintenance, Repair, Troubleshooting II. Project Start-up, Commissioning, Loop-check, Project Organization, Planning III. Documentation IV. Administration, Supervision, Management</td>
<td>Domains: I. Feasibility Study II. Definition III. System Design IV. Development V. Deployment VI. Operation and Maintenance</td>
<td>• Using ISA/IEC 62443 Standards • IACS Cybersecurity Assessment, Design, and Maintenance</td>
</tr>
</tbody>
</table>

With ISA’s training program, you have the flexibility to choose the courses that fit your needs. You can choose from multiple pathways or focus on only one. Within each pathway, ISA offers either a certification or a certificate program.

Certification requires documentation of your experience and education and requires a passing score on an exam. The Certified Automation Professional® and Certified Control Systems Technician® programs are examples of the certification programs.

Certificate programs require the completion of a course and the successful completion of an examination demonstrating mastering of content covered in the course. The ISA cybersecurity and safety course series are certificate programs.
What does success look like to you?

Maximize your training ROI with custom training solutions:

**Individualized Learning Plans**
ISA offers access to world-renowned SMEs not only through our public and private training offerings, but also to assist clients with onsite assessment services of their employees. Through a combination of personal interviews and written evaluation tools, ISA can work to develop a skills-gap analysis and personalized learning plans for your employees.

**Custom Course Development**
In addition to an array of open enrollment public training programs covering technician and automation engineering skills all the way through certification preparation and licensure, ISA also offers clients the expertise of custom course development to meet your specific business needs. Maybe one topic doesn’t meet all your needs, but ISA can create a course combining multiple touch points and objectives specialized for your site.

**Onsite Employee Credentialing**
As part of a recommended learning path, ISA can assist you and your employees not only with training, but verification of knowledge/skills through our CCST or CAP certification programs. We can bring the training and exam right to you, saving you time and travel, as part of our onsite client services.

Close knowledge gaps and create a more flexible workforce today. Schedule a consultation with one of ISA’s learning consultants. ISA will help you use your training budget strategically so you can invest in the training you need on a schedule that works for you.

Schedule your ISA needs assessment today.
Consult with our learning experts to find the training solutions you need.

Heidi Cooke  
Sr. Learning Consultant  
hcooke@isa.org  
919-990-9405

Jon Phillips  
Learning Consultant  
jphillips@isa.org  
919-990-9258

Matthew Rothkopf  
Sr. Learning Consultant  
mrothkopf@isa.org  
919-990-9403
The Technician Resources prepare you to become an ISA Certified Control Systems Technician® (CCST®)

CCSTs are an elite group of automation and control technicians that have proven they possess an extensive knowledge of automation and control systems. CCSTs calibrate, document, troubleshoot, and repair/replace instrumentation for systems that measure and control level, temperature, pressure, flow, and other process variables.

ISA’s Certified Control System Technician Certification provides an objective, third-party assessment and confirmation of a technician’s skills by assessing their proficiency in the four knowledge domains that all control systems technicians need:

- Calibration, Maintenance, Repair, and Troubleshooting
- Project Planning, Start-up, and Commissioning
- Documentation
- Supervision, Management, and Administration

While no ISA courses are required prerequisites for taking the CCST exam, the technician pathway courses provide a roadmap for the information needed to pass the exam. ISA also provides review courses listed on the following pages.

There are three levels of CCST certification, requiring different degrees of technical experience, education, and training. You do not need to move through the program sequentially. Simply apply for the level that matches your experience level.

**Technician** – Five years of combined education, training, and/or experience.
**Specialist** – Seven years of combined education, training, and/or experience.
**Master** – 13 years of combined education, training, and/or experience.

Do you qualify?
Experience and documentation requirements can be found at www.isa.org/ccst.

Apply today!
Apply online or download an application from www.isa.org/ccst. You will be notified by ISA of your eligibility to take the exam, provided with a registration code, and given instructions for how to sign up for the exam with our testing service.

Group private testing for facilities is available upon request.

Control Systems Technician (CST) Associate Degree Program

Recognition of your achievements is critical when you seek employment. The ISA CST Associate program will give you a recognition that demonstrates your commitment to a career in automation and control and shows that your educational accomplishments are only the beginning.

An ISA CST Associate will have specialized work experience and/or an educational background in instrumentation and control or a related field and be able to successfully complete an ISA examination. The ISA CST Associate examination is designed to measure a fundamental understanding of knowledge in instrumentation and control.

Note: This recognition program is not a certification. Those who take the CST Associate examination may be interested in pursuing the ISA Certified Control Systems Technician® (CCST®) program, once the education and/or experience level reaches five years. Successfully completing the CST Associate exam equals one year of education good toward the Level I CCST requirements. For more information on the CCST program, go to http://www.isa.org/ccst.
Certified Control Systems Technician® (CCST®) Level I Review Course (TS00 and TS00E)

www.isa.org/training/TS00

Length: 4 days  |  CEUs: 2.8  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This is a fast-paced review of the knowledge and practical skills necessary to install and maintain standard measurement and control instrumentation. It is intended for practicing technicians preparing for the CCST Level I exam and covers process control basics, calibration maintenance and repair, documentation, and installation practices.

You will be able to:

- Cite principles and theories that explain measurement and control instrument functions
- Describe procedures required to properly maintain the function of measurement and control instrumentation
- Identify the procedures and safety requirements for loop checking and its purpose
- Perform calculations and other analysis of information related to the calibration and troubleshooting of measurement and control instruments and systems
- Describe procedures required to safely start-up and shut-down a new or existing process
- Review normal tasks of process control technicians as outlined by the current CCST job task analysis
- Define the education, experience, and examination requirements for becoming a CCST
- Identify important knowledge and skill requirements of a practicing CCST
- Describe the procedures involved in taking the CCST Level I Exam
- Identify any need for further study or training in specific knowledge areas
- Complete a simulated CCST Level I Practice Exam at the end of each day

TS00 Scheduled In-Person Courses (subject to change)

- 27–30 January, Raleigh, NC
- 23–26 March, Houston, TX
- 6–9 April, Newhall, CA
- 11–14 May, Royersford, PA
- 3–6 August, Edgemont, PA
- 9–12 November, Raleigh, NC

TS00E Online, Instructor-Led Courses Start Dates
17 February, 18 May, 10 August

Certified Control Systems Technician® (CCST®) Level II Review Course (TS02 and TS02E)

www.isa.org/training/TS02

Length: 4 days  |  CEUs: 2.8  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This is the ultimate review course for technicians with 7+ years of practical experience who are preparing to sit for the CCST Level II exam. An explanation of the requirements, examination process, and practice certification exams are provided.

You will be able to:

- Explain multi-step troubleshooting methodology
- Evaluate control systems tuning and system response to changes in control parameters
- Describe the isolation of a process component from an operational system to perform proper testing, maintenance, or troubleshooting
- Evaluate installed industrial network data and performance using network diagnostic tools
- Explain the process to identify and correct problems that may arise during the commissioning of control systems
- Verify final control element functionality through manipulated variables using controller mode and output functions
- Define system documentation and symbology to effectively troubleshoot instrumentation, control loops, and electrical and pneumatic installations
- Identify electrical or hazard area classifications and determine appropriate procedures to be followed for safe and effective operation
- Identify any need for further study or training in specific knowledge areas

TS02 Scheduled In-Person Courses (subject to change)

- 17–20 February, Raleigh, NC
- 13–16 July, Raleigh, NC

TS02E Online, Instructor-Led Courses Start Dates
3 February, 4 May, 14 September
Certified Control Systems Technician® (CCST®) Level III Review Course (TS03 and TS03E)

www.isa.org/training/TS03

Length: 4 days  |  CEUs: 2.8  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course reviews the knowledge and skills areas included on the Certified Control Systems Technician® (CCST®) Level III examination to prepare technicians with 13+ years of experience.

You will be able to:

• Define the scope and format of the CCST Level III exam
• Compare process variable measurements and control valve selections
• Discuss how the various types of control technologies are used in industrial automation, including process control from basic to advanced control, discrete, batch, motor, and motion control
• Determine the requirement for tuning and discuss tuning procedures
• Identify the range of digital communications used in automation and how these are used in system integration
• Explain when safety instrumented systems (SISs) are needed and how they are specified
• Apply the critical areas of regulatory procedures and project documentation
• Interpret the best practice methodology for troubleshooting automation projects

TS03 Scheduled In-Person Courses (subject to change)

• 16–19 March, Raleigh, NC
• 28 September – 1 October, Raleigh, NC

TS03E Online, Instructor-Led Courses Start Dates

3 Mar, 15 June, 14 Sept, 7 December

Related Resource from ISA

ISA CCST® Study Library

Classic resources and real-world knowledge for your plant

This 22-book library is a compilation of the popular ISA Technician Guide Series and other technical resources that serve as indispensable informational tool kits and reference guides.

This library contains real-world knowledge for all facets of automation and control. The books are peer-reviewed, written by industry experts, and focus on the topics that matter most to technicians, including:

• Automation and control system design
• Implementation and maintenance
• Safety systems
• Industrial data communications
• Cybersecurity
• Instrumentation systems

Buy the CCST® Study Library today and save!

www.isa.org/techlibrary

A great resource for your instrument shop
Intensive **Boot Camp** Technical Training Courses

ISA's boot camps are intensive, week-long automation and control technical training courses taught by industry experts. They feature condensed learning and hands-on lab exercises.

### Technician Training Boot Camp (TTBC)

**Length:** 4.5 days  |  **CEUs:** 3.6  
**Hours:** 8:00 a.m. – 4:00 p.m. (M–Th), and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

ISA Technician Training Boot Camp combines a unique technical training course with minimum lecture and maximum hands-on experience. Over 75% of your time will be spent on equipment labs!

This week of intensive training will cover a broad range of technical topics needed to get the job done right. Starting with basic instrumentation fundamentals and ending with the advanced and ultimate in smart technology, this comprehensive program will serve as a vital building block to your professional development and skills enhancement efforts.

**Who Should Attend?**

- Technicians with instrument maintenance responsibilities, and a good working knowledge of instrument fundamentals and terminology
- Instrument supervisors needing to understand and evaluate the skill sets required to perform instrument maintenance tasks
- Reliability and maintenance engineers needing to learn and/or evaluate instrument maintenance processes

**It will challenge an individual's skill sets and serve as a self-assessment of additional training needs, and will:**

- Provide a review of industrial measurement and control concepts and terminology
- Review and refresh present skills
- Introduce new skills

**TTBC Scheduled In-Person Courses (subject to change)**

- 13–17 January, Royersford, PA
- 2–6 March, Raleigh, NC
- 1–5 June, Houston, TX
- 3–7 August, Denver, CO
- 5–9 October, Houston, TX
- 9–13 November, Raleigh, NC

### Extreme Instrumentality: Electrical to Instrumentation Cross Training Boot Camp (XTBC)

**Length:** 4.5 days  |  **CEUs:** 3.6  
**Hours:** 8:00 a.m. – 4:00 p.m. (M–Th), and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This class focuses on the knowledge and skill sets required to function as an instrument maintenance technician. The electrical skill set possessed by a trained electrician will serve as basis for expansion to include the skills required to maintain an instrument control system. The knowledge gained from attending this class will lead the student to become an asset to an I&E maintenance team.

**Who should attend?**

- Electricians assigned the additional responsibilities of instrument maintenance
- Technicians with electrical skills cross training into the instrument discipline
- Supervisors needing to audit/evaluate a cross training program for their employees
- Individuals with less than four years of instrument knowledge

**You will be able to:**

- Interpret P&ID documentation
- Explain the PID tuning process
- Utilize various process calibrators
- Properly design and construct a current (4-20 mA) loop
- Analyze and troubleshoot a current loop for proper operation
- Connect, test, and calibrate various electronic analog transmitters
- For more details visit: www.isa.org/XTBC

**XTBC Scheduled In-Person Courses (subject to change)**

- 30 March – 3 April, Raleigh, NC
- 4–8 May, Raleigh, NC
- 28 September – 2 October, Raleigh, NC
### Tactics for Advanced Troubleshooting Boot Camp (TATC)

**www.isa.org/training/TATC**

**Length:** 4.5 days  |  **CEUs:** 3.2  
**Hours:** 8:00 a.m. – 4:00 p.m. (M–Th), and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This intensive boot camp course details the techniques required to troubleshoot today's instrument loops and equipment. From understanding loop fundamentals to employing built-in equipment diagnostics, this class will give the student an advantage in problem identification via the latest in test equipment and communicators used in the process control industry. The various equipment built-in diagnostics will be discussed and employed to aid in equipment troubleshooting.

#### Who should attend?
- Instrument technicians with maintenance responsibilities that require specific knowledge of instrument control loops and equipment malfunction identification
- Maintenance and reliability engineers responsible for loop and equipment integrity
- Process control or automation engineers
- Supervisors needing general knowledge of troubleshooting techniques employed for rapid problem identification

#### You will be able to:
- Demonstrate actions and measurements used to troubleshoot pneumatic loops
- Provide specific troubleshooting techniques and measurements used for the analysis of the 4-20 mA loop
- Review, illustrate, and discuss the operation of HART protocol physical form of transmission
- Discuss various built-in diagnostics employed to determine proper transmitter operation or malfunction
- Discuss the effects of transmitter malfunction and failure on control loops
- Describe the most common communication signals and demonstrate measurements used to ensure proper operation
- Demonstrate control valve DVC configuration and calibration processes used to validate proper operation
- Discuss and demonstrate DVC built-in diagnostics used to identify control valve malfunctions

**TATC Scheduled In-Person Courses (subject to change)**
- 27–31 July, Houston, TX
- 21–25 September, Raleigh, NC

### Process Automation Boot Camp for Non-Maintenance Personnel (PABC)

**www.isa.org/training/PABC**

**Length:** 4.5 days  |  **CEUs:** 3.2  
**Hours:** 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

#### Who Should Attend?
- Technicians with instrument maintenance responsibilities and a good working knowledge of instrument fundamentals and terminology
- Instrument supervisors needing to understand and evaluate the skill sets required to perform instrument maintenance tasks.
- Reliability and maintenance engineers needing to learn and/or evaluate instrument maintenance processes.

#### You will be able to:
- Present an overview of industrial measurements, automation equipment, and equipment installations to familiarize non-maintenance personnel with a basic knowledge of instrumentation including terminology and operation
- Define the latest P&ID standards
- Convey recommended installation practices for the most common process measurement and control equipment
- Describe measurement technologies employed by different types of measurement instruments
- Describe the various communication signals and related pros and cons
- Demonstrate transmitter and control valve configuration and calibration processes
- Explain the process control loop
- Explain basic troubleshooting techniques to verify proper field equipment operation

**PABC Scheduled In-Person Courses (subject to change)**
- 6–10 April, Houston, TX
- 17–21 August, Royersford, PA
Introduction to Industrial Processes, Measurement, and Control (FG07)

**Length:** 4.5 days  |  **CEUs:** 3.2  
**Hours:** 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)  
**A Certificate of Completion** indicating the total number of CEUs earned will be provided upon successful completion of the course.

This popular course combines lecture and hands-on labs to provide an overview of industrial measurement and control. Technicians, engineers, and managers are provided with a foundation for communication with other control system professionals. Serves as a solid fundamental course for introduction to other ISA courses.

“It gave me a basic understanding of standardized signals and the many ways they are utilized. I feel more confident in looking at our automation/system controls.”  
— FG07 Student Richard Miller

You will be able to:
- Communicate with measurement and control professionals  
- Discuss the role of measurement and control in industrial processes  
- Differentiate between continuous, batch, and discrete control  
- Apply specific ISA standards to interpret symbols and drawings associated with process control documentation  
- Discuss and apply the most common methods and devices used in temperature, pressure, level, and flow measurement  
- List control valves in a feedback control loop  
- Discuss the fundamentals of process control  
- Differentiate between various control system architectures  
- Discuss trends in measurement and control technology  
- Apply safe laboratory practices  
- Apply hands-on skills learned in the laboratory exercises  
- Apply basic devices and procedures for connecting and calibrating various measurement devices  
- Operate digital controllers and smart devices

FG07 Scheduled In-Person Courses (subject to change)
- 27–31 July, Houston, TX  
- 21–25 September, Raleigh, NC

Fundamentals of Industrial Process, Measurement, & Control (FG05E Online Only and FG05M On-demand)

**CEUs:** 2.1  |  **Hours:** Refer to Syllabus  
**A Certificate of Completion** indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course provides an overview of industrial measurement and control for technicians, engineers, and managers, providing a basic understanding and foundation for communication with other control systems professionals.

You will be able to:
- Communicate the latest trends in measurement and control  
- Recognize the role of measurement and control in industrial processes  
- Compare continuous, batch, and discrete control and how they are used in the industry  
- Interpret measurement and control terminology  
- Compare the methods and devices used in temperature, pressure, level, and flow measurement  
- Describe the operation and components of a feedback control loop  
- Identify the fundamental concepts of controller tuning  
- Compare different control system architectures, including single loop controllers, Distributed Control Systems (DCS), and Programmable Logic Controllers (PLCs)  
- Apply ISA standards to interpret symbols and documentation

FG05E Online, Instructor-Led Courses Start Dates
- 10 February, 11 May, 10 August, 28 September
Developing and Applying Standard Instrumentation and Control Documentation (FG15E—Online Only)

www.isa.org/training/FG15

CEUs: 1.4 | Hours: Refer to Syllabus

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course will present the methodology for the designing and developing control systems documentation. The development of Piping and Instrument Diagrams (P&IDs) and related ISA drawings are emphasized. This course covers both the development and the reading/interpreting of these documents, making it beneficial to engineers, designers, software programmers, system integrators, and technicians.

You will be able to:

- Design, develop, and interpret the documents used to define instruments and control systems for a typical project, including P&IDs, loop diagrams, specification forms, instrument lists, logic diagrams, installation details, and location plans
- Explain the information included on each document
- Plan document development as it relates to project management
- Apply ISA standards for symbols and terminology to documentation
- Describe the relationship of ISO 9000, OSHA Process Safety Management (PSM), and API 750 to control systems documentation

FG15E Online, Instructor-Led Courses Start Dates
23 March, 1 June, 14 September, 7 December

Instrument Calibration and Documentation for FDA-Regulated Industries (TI24)

www.isa.org/training/TI24

Length: 4.5 days | CEUs: 3.2
Hours: 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

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 including pharmaceutical and food processes. You will examine characteristics of electronic control systems and procedures for configuring transmitters, transducers, and controllers.

You will be able to:

- Select and operate test equipment to measure electrical properties and calibrate instruments
- Calibrate electronic transmitters
- Recognize the importance of maintenance in the proper operation of instruments and control systems
- Use manufacturer’s guidelines to configure instruments for specific process applications
- 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

TI24 Scheduled In-Person Courses (subject to change)
- 4–8 May, Newhall, CA
- 12–16 October, Newhall, CA
Installing, Calibrating, & Maintaining Electronic Instruments (TI25)

www.isa.org/training/TI25

Length: 4.5 days  |  CEUs: 3.2
Hours: 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

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
- Connect wiring in an electronic control loop
- Select and operate test equipment to measure electrical properties and calibrate instruments
- Calibrate electronic transmitters and controllers
- Recognize the importance of maintenance in the proper operation of instruments and control systems
- Use manufacturer’s guidelines to configure instruments for specific process applications
- Explain installation considerations and practices for instruments and control systems
- Install electronic instruments using manufacturer’s guidelines and ISA’s recommended practices and procedures
- Use piping and instrumentation diagram (P&ID), wiring, schematic, and installation detail drawings to install, calibrate, and verify proper operation of instruments
- Explain methods for reducing electrical hazards including intrinsically safe installation
- Describe the trend toward using fieldbus systems and personal computers in process control
- Explain the relevance of ISO 9000 standards to maintenance practices and procedures

TI25 Scheduled In-Person Courses (subject to change)
- 6–10 April, Cleveland, OH
- 22–26 June, Newhall, CA
- 20–24 July, Raleigh, NC
- 14–18 September, Houston, TX

Control Valve Mechanics and Operations from Analog to Digital (TS18)

www.isa.org/training/TS18

Length: 4.5 days  |  CEUs: 3.2
Hours: 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

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

You will be able to:
- Identify various control valve loops on P&ID documentation
- Describe control valve operations
- Mount various accessories on valves
- Configure, setup, and/or calibrate various tools
- Demonstrate the proper use of communication devices

TS18 Scheduled In-Person Courses (subject to change)
24–28 August, Raleigh, NC
Tuning Control Loops (TC05)

www.isa.org/training/TC05

Length: 3 days | CEUs: 2.1 | Hours: 8:00 a.m. – 4:00 p.m.

This course is directed to anyone who would like to gain a better understanding of how to tune control loops—whether they have tuned loops but would like to become more proficient, or they have never tuned a loop before. Registrants are expected to have a basic understanding of instrumentation and controls.

You will be able to:

- Define the concepts of PID control
- Explain the operation of the components in a closed loop control system, including static and dynamic functions
- Identify the requirements for open loop and closed loop stability
- Use three methods to tune a control system for stated quality control
- Apply the functions of cascade control loops and the advantage of cascade control over single element feedback control
- Tune a cascade control loop for optimum control
- Apply the principles and design features of feedforward control
- Tune a feedforward control system for optimum control
- Identify the advantages of feedforward control over feedback control
- Apply the operation and function of ratio control systems
- Tune ratio control systems

TC05 Scheduled In-Person Courses (subject to change)

- 27–29 January, New Hall, CA
- 20–22 April, Houston, TX
- 12–14 October, Raleigh, NC

Troubleshooting Instrumentation and Control Systems (TC10)

www.isa.org/training/TC10

Length: 2 days | CEUs: 1.4 | Hours: 8:00 a.m. – 4:00 p.m.

This course presents a systematic approach to troubleshooting and start-up of single- and multi-loop control loops. You’ll see how pressure, level, flow, and temperature loops operate to maintain good process control systems. Knowledge of instrumentation and control is assumed.

You will be able to:

- Develop a systematic approach to troubleshooting
- Identify why a systematic approach to troubleshooting is most effective
- Follow specified procedures for proper loop check-out
- Verify, locate, and identify performance problems and the causes of the problems
- Take or recommend appropriate follow-up procedures to minimize problem recurrence
- Identify the common causes of sensor, transmitter, controller, and final control element problems
- Troubleshoot control systems
- Apply Distributed Control System (DCS) functions for troubleshooting
- Interpret pneumatic and electronic loops
- Apply safety practices for start-up
- Check and utilize control loop documentation
- Discuss applications and procedures to troubleshoot conventional analog control systems
- State the general operation features of a HART™ control system
- State the general operations features of a FIELDBUS™ control system
- Compare general troubleshooting procedures for conventional, FIELDBUS™, and HART™ control systems

TC10 Scheduled In-Person Courses (subject to change)

- 30–31 January, Newhall, CA
- 23–24 April, Houston, TX
- 13–14 August, Appleton, WI
- 15–16 October, Raleigh, NC
IT and OT Survival Basics for I&C Personnel (TS06M On-demand)

www.isa.org/training/TS06
Length: 5 days | CEUs: 3.5 | Hours: 8:00 a.m. – 4:00 p.m.
A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

Starting from the basics, this course gives you the tools to design and maintain industrial communications systems on your plant floor. You’ll learn the underlying principles behind today’s industrial communications systems, including Modbus, Data Highway Plus, Ethernet, and TCP/IP. Real-life examples and case histories provide insight into the facts behind control networks and how to apply and maintain them effectively in your plant.

You will be able to:
• Apply traditional and current serial standards, such as EIA-232, 422, 423, and 485, in industrial plant floor settings
• Explain the inner working of proprietary PLC networks
• Identify Local Area Network (LAN) topologies and protocols
• Compare media access techniques such as CSMA/CD, token passing, and master/slave
• Describe design methods for Industrial LANs using Ethernet
• Define the different Ethernet varieties and which are best for industry
• List options for Ethernet hardware to avoid instant obsolescence and being locked in the past
• Select and apply fiber optic technology
• Differentiate between different wireless and Industrial Ethernet alternatives

TS06 Scheduled In-Person Courses (subject to change)
• 4–8 May, Raleigh, NC
• 13–17 July, Newark, DE
• 2–6 November, Raleigh, NC

IT and OT Advanced Skills for I&C Personnel (TS12)

www.isa.org/training/TS12
Length: 5 days | CEUs: 3.5 | Hours: 8:00 a.m. – 4:00 p.m.
A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

In this course, you will learn about the latest developments in networking, including practical tips on designing, implementing, and testing TCP/IP-based networks and how to apply them securely and reliably in an Industrial environment. You will discuss the functions and purposes of the elements used to create and protect an industrial network including switches, routers, firewalls, and intrusion detection/prevention systems.

You will be able to:
• Expand your understanding of LAN, WAN intranet, and Internet concepts
• Recognize how the structure of the telephone system impacts industrial networks
• Identify analog dial-up connections and modems standards
• Explain modern digital WANs and the service options for corporate intranets
• Learn the basics of fiber-optic networks, including cable selection for the plant floor
• Apply the TCP/IP protocols, addressing, and troubleshooting
• Learn how web technology works and how web server capability is being used in industry
• Estimate where web technologies can safely be used for process control
• Understand the basics of network security architectures and how layering and segmentation can improve security
• Understand security technologies such as firewalls, proxy servers, virus scanning, and intrusion protection
• Perform basic security scanning on your networks and perform “hardening” of your computers

TS12 Scheduled In-Person Courses (subject to change)
• 11–15 May, Raleigh, NC
• 20–24 July, Newark, DE
• 9–13 November, Raleigh, NC
The Engineering Resources prepare you to become an ISA Certified Automation Professional® (CAP®)

CAPs are an elite group of automation professionals that have proven they possess an extensive knowledge of automation and controls—and have documented evidence that they possess the expertise and qualifications to excel in their fields.

ISA CAP certification provides a non-biased, third-party, objective assessment, and confirmation of an automation professional's skills—specifically, the CAP exam is focused on direction, definition, design, development/application, deployment, documentation, and support of systems, software, and equipment used in control systems, manufacturing information systems, systems integration, and operational consulting. The CAP certification exam reflects the documented knowledge, skills, and abilities needed for competent job performance.

Do you qualify?
Experience and documentation requirements can be found at www.isa.org/cap

Apply today!
Apply online or download an application from www.isa.org/cap

You will be notified by ISA of your eligibility to take the exam, provided with a registration code, and given instructions for how to sign up for the exam with our testing service.

ISA’s CAP program:
• Sets the standard for the automation professional
• Promotes safety and improves productivity
• Establishes your professional credentials
• Prepares you for additional job responsibilities
• Improves ROI by impacting mission critical decisions
• Proves that you are an automation leader
Certified Automation Professional®
CAP® Exam Review Course
(EC00 and EC00E)

www.isa.org/training/EC00

Length: 3 days | CEUs: 2.1 | Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course reviews the knowledge and skill areas included on the CAP examination. The intent is to prepare an automation professional who meets the criteria to take the exam. The content is based on the job analysis domains, tasks, knowledge areas, and skill areas developed as the basis for the CAP certification exam.

You will be able to:

- Define the scope and format of the CAP exam
- Compare process variable measurements and control valve selections
- Discuss how the various types of control technologies are used in industrial automation, including process control from basic to advanced control, discrete, batch, motor, and motion control
- Identify the range of digital communications used in automation and how these are used in system integration
- Explain when safety instrumented systems (SISs) are needed and how they are specified
- Recognize the importance of electrical issues that relate to grounding and noise
- Apply the critical areas of automation opportunity identification and project justification
- Interpret the best practice methodology for automation project execution

EC00 Scheduled In-Person Courses (subject to change)
- 28–30 January, Raleigh, NC
- 7–9 April, Newhall, CA
- 7–9 July, Royersford, PA
- 14–16 September, Newhall, CA

EC00E Online, Instructor-Led Courses Start Dates:
- 3 February, 4 May, 3 August, 5 October

Related Resources from ISA

Advanced Control Foundation: Tools, Techniques, and Applications
By Terrence Blevins, Willy K. Wojsznis, and Mark Nixon
► www.isa.org/advcontrolfoundation

ISA
► www.isa.org/autobok

CAP Study Guide
ISA
► www.isa.org/capguide

By William M. Hawkins and Thomas G. Fisher
► www.isa.org/batchcontrol

By Michael D. Whitt
► www.isa.org/iandcdesignCD

Measurement and Control Basics, Fifth Edition
By Thomas A. Hughes
► www.isa.org/mandcbasics

Basic and Advanced Regulatory Control: System Design and Applications, Third Edition
By Harold L. Wade
► www.isa.org/regcontrol

Safety Instrumented Systems: A Life-Cycle Approach
By Paul Gruhn, PE, CFSE, and Simon Lucchini, CFSE, MIEAust, CPEng
► www.isa.org/SISlifecycle

Electrical Instruments in Hazardous Locations, 4th Edition
By Ernest Magison
► www.isa.org/hazardlocations
Automation Engineering Survival Training (AEST)

www.isa.org/training/AEST

Length: 4.5 days | CEUs: 3.6
Hours: 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

Automation Engineering Survival Training is a unique process automation engineering experience designed to hone your process automation knowledge and skills. This intensive technical training boot camp for automation engineers combines lecture and hands-on labs with bonus features, including a plant tour, to maximize your learning experience.

You will be able to:

• Differentiate between continuous, batch, and discrete control
• Discuss the fundamentals of process control
• Compare various types of final control elements
• Size valves for any flow condition likely to be found in a process plant
• Explain the operation of the components in a closed loop control system including static and dynamic functions
• Use three methods to tune a control system for stated quality control
• Analyze the performance of different logic system technologies
• Specify and select safety instrumented systems (SIS)
• Identify Local Area Network (LAN) topologies and protocols
• Specify the requirements for a batch control system
• Effectively structure and subdivide equipment entities
• Describe the interfaces that are needed between batch control and other systems within an enterprise
• Apply the critical areas of automation opportunity identification and project justification
• Interpret the best practice methodology for automation project execution
• For more details visit www.isa.org/AEST

AEST Scheduled In-Person Courses (subject to change)
• 27–31 January, Royersford, PA
• 9–13 March, Raleigh, NC
• 8–12 June, Houston, TX
• 10–14 August, Denver, CO
• 12–16 October, Houston, TX
• 9–13 November, Raleigh, NC

Automation Engineering Survival Training—Integrator Version (AESTIV)

www.isa.org/training/AESTIV

Length: 4.5 days | CEUs: 3.6
Hours: 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

Do you work for a system integrator? Do you support client projects? Do you need to expand your skills in working in a project design or commissioning environment? ISA’s new Automation Engineering Survival Training: Integrator Version (AESTIV) focuses on concepts important to automation engineers and others involved in a project design and commissioning role.

You will be able to:

• Apply specific ISA Standards to interpret symbols and drawings associated with process control documentation
• Wire, scale, measure, calibrate, and troubleshoot a pressure transmitter in a current loop control scheme
• Use a simple fieldbus (HART™) to evaluate the performance of a pressure transmitter
• Compare various types of final control elements
• Determine the effect of valve selection, sizing, and actuator selection on control loop performance
• Explain the operation of the components in a closed loop control system including static and dynamic functions
• Use several methods to tune a feedback control system for stated quality control
• Describe the process for HAZOP analysis and assigning actions
• Discuss strategies for assigning permissives and interlocks
• Differentiate between process control and safety control
• Specify the requirements for an enterprise-control integration solution
• Explain the economics and business drivers involved in integration
• Explain the four important objectives critical to automation projects vs. the three objectives typical of other projects
• Explain the importance of automation interpersonal skills
• For more details visit www.isa.org/AESTIV

AESTIV Scheduled In-Person Courses (subject to change)
• 4–8 May, Newhall, CA
• 7–9 July, Royersford, PA
• 14–18 September, Newhall, CA
**Industrial Pressure, Level, and Density Measurement Engineering (EI05)**

www.isa.org/training/EI05  
**Length:** 2 days  |  **CEUs:** 1.4  |  **Hours:** 8:00 a.m. – 4:00 p.m.  
**A Certificate of Completion** indicating the total number of CEUs earned will be provided upon successful completion of the course.

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:**  
- Recognize the importance of measurement for monitoring, control, and custody applications  
- Apply the characteristics of fluid properties that relate to pressure and level measurement  
- Identify various types of transducers used in pressure and level measurement  
- Identify the operation of various types of level measurement devices  
- Use specified criteria to select a method for pressure and level measurement  
- 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  
- Compare the signal generation and conditioning involved in pressure, differential pressure, and level transmitters  
- Select and apply devices and systems for industrial pressure and level measurement  
- Specify and use smart transmitters in level and pressure measurement processes

**EI05 Scheduled In-Person Courses (subject to change)**  
- 16–17 March, Raleigh, NC  
- 10–11 August, Raleigh, NC

**Industrial Flow Measurement Engineering (EI10)**

www.isa.org/training/EI10  
**Length:** 3 days  |  **CEUs:** 2.1  |  **Hours:** 8:00 a.m. – 4:00 p.m.  
**A Certificate of Completion** indicating the total number of CEUs earned will be provided upon successful completion of the course.

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:**  
- Describe principles of operation of 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  
- Perform flowmeter compensation and totalization calculations  
- Plan maintenance activities required by different flowmeter technologies  
- Illustrate flow and related phenomena (piping hydraulics, Reynolds Number, cavitation, etc.)  
- Size flow elements for specific applications

**EI10 Scheduled In-Person Courses (subject to change)**  
- 18–20 March, Raleigh, NC  
- 12–14 August, Raleigh, NC
Burner Management Systems: Design & Engineering Using NFPA Codes (EC56P)

www.isa.org/training/EC56P

Length: 3 days | CEUs: 2.1 | Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course was designed for all audiences from high-level decision makers to users of FGS, including a basic understanding of design techniques to a comprehensive case study that involves employing software to develop a complete performance-based design for a sample oil and gas production facility.

You will be able to:

- Understand the scope of fire and gas engineering for process facilities and the myriad standards, regulations, and requirements
- Review the fire and gas system design methods and guidelines that are currently available including their strengths and limitations
- Explain the Safety Lifecycle (per IEC 61511 / ISA84 and ISA-TR84.00.07-2010) and how they can provide a framework for functional safety of Fire and Gas Systems
- Identify and define the fire and gas zones along with the hazards contained in those zones
- Discuss quantitative consequences analysis and how it is employed in performance-based fire and gas system engineering
- Analyze the impact on overall risk of the consequence scenario and the beneficial effect of fire and gas systems using consequence integration and event tree analysis
- Apply statistical analysis, industry databases, and data integration techniques to assess the likelihood of fire and gas system relevant events

EC56P Scheduled In-Person Courses (subject to change)

- 18–20 February, Houston, TX
- 29 Jun – 1 July, Houston, TX
- 14–16 July, Houston, TX
- 18–20 August, Houston, TX

Related Resources from ISA

Practical Thermocouple Thermometry, Second Edition
By Thomas W. Kerlin and Mitchell Johnson
- www.isa.org/thermometry

Industrial Pressure, Level, and Density Measurement, Second Edition
By Donald R. Gillum
- www.isa.org/pressureleveldensity

Performance-based Fire and Gas Systems Engineering Handbook
By Austin Bryan, Elizabeth Smith, and Kevin Mitchell
- www.isa.org/fireandgas

Electrical Instruments in Hazardous Locations, 4th Edition
Author: Ernest Magison
- www.isa.org/hazardlocations

Boiler Control Systems Engineering, Second Edition
By G. F. (Jerry) Gilman
- www.isa.org/boilereng

By Bill R. Hollifield and Eddie Habibi
- www.isa.org/alarmmanagement

Applying S88: Batch Control from a User’s Perspective
Author: Jim Parshall and L. B. Lamb
- www.isa.org/applyS88

By William M. Hawkins and Thomas G. Fisher
- www.isa.org/batchcontrol

Control Loop Foundation: Batch and Continuous Processes
By Terrence Blevins and Mark Nixon
- www.isa.org/controlloop

ISA
- isa.org/CSEReview6
Applying Instrumentation in Hazardous (Classified) Locations (ES10)

www.isa.org/training/ES10

Length: 2 days  |  CEUs: 1.4  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course provides a detailed, systematic approach to specifying and implementing instrumentation in hazardous locations.

You will be able to:

- Identify process and environmental factors that determine classification
- Describe and use procedures for electrical classification
- Use applicable standards to develop classification drawings for gases, dusts, and fibers
- Describe the basic principles of protection
- Select explosion proof apparatus for specific applications
- Determine when and why explosion seals should be used
- Specify the use of intrinsically safe and nonincendive systems
- Select the appropriate protective techniques for different hazards
- Select alternative protective techniques for reduced cost

ES10 Scheduled In-Person Courses (subject to change)
• 2–3 March, Raleigh, NC

ES10E Online, Instructor-Led Courses Start Dates
28 January, 23 March, 20 July, 14 September

Boiler Control Systems Engineering (ES15)

www.isa.org/training/ES15

Length: 3 days  |  CEUs: 2.1  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course covers boiler components and their purposes. Additionally, the course explains the ISA symbols used in boiler control, how to identify the engineering and control of boilers using these symbols, and a method of presenting the engineering.

You will be able to:

- Identify the benefits of improved boiler process control and savings from improved efficiency
- Develop proper control systems documentation
- Apply principles and methods for flow and level measurements to improved boiler operations
- Specify appropriate strategies for flow, level, and pressure control
- Explain how to tune boiler control systems
- Implement analyzer measurements for improving boiler efficiency
- Analyze basic control loops required for boiler operation
- Apply control concepts such as cascade, ratio, and feedforward control for boiler control
- Specify appropriate safety system interlocks
- Evaluate process requirements for writing instrumentation specifications

ES15 Scheduled In-Person Courses (subject to change)
• 23–25 March, Raleigh, NC
• 5–7 October, Raleigh, NC
Burner Management Systems
Engineering Using NFPA Code 85 and ANSI/ISA77 Standards (ES16)

www.isa.org/training/ES16

Length: 2 days  |  CEUs: 1.4  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course covers the safe start-up, monitoring, and shut-down of multiple burner boiler furnaces. It also discusses the causes of furnace explosions and the relationship between burner management systems and boiler control systems.

You will be able to:
• Identify the primary cause of furnace explosions
• Apply NFPA 85 Code
• Use design basis documentation and flow sheets
• Identify equipment needs for gas, oil, and pulverized coal systems
• Explain prefiring purge requirements for both single and multiple burner boilers
• Follow the ignition-permissive establishment procedures for single and multiple burner systems
• Implement flame failure protection for specific systems
• Design alarms, interlocks, and emergency shutdown systems
• Describe the function and use of the burner front, operator interfaces, and logic systems

ES16 Scheduled In-Person Courses (subject to change)
• 26–27 March, Raleigh, NC
• 8–9 October, Raleigh, NC

Management of Alarm Systems (IC39)

www.isa.org/training/IC39

Length: 2 days  |  CEUs: 1.4  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This two-day course focuses on the key activities of the alarm management lifecycle provided in the ANSI/ISA-18.2 standard, Management of Alarm Systems for the Process Industries, and the IEC version, IEC 62682. The activities include the alarm philosophy development, alarm rationalization, basic alarm design, advanced alarm techniques, HMI design for alarms, monitoring assessment, management of change, and audit. Key workshops help demonstrate the concepts of these lifecycle activities.

You will be able to:
• Develop an alarm management philosophy
• Identify alarms
• Rationalize alarms, including classification and prioritization
• Design basic alarms
• Determine when advance alarm techniques should be used
• Document alarms for operations
• Design reports for monitoring and assessment of alarm system performance
• Manage changes to alarm systems
• Audit alarm systems

IC39 Scheduled In-Person Courses (subject to change)
• 2–3 June, Raleigh, NC
Batch Control Using the ANSI/ISA88 Standards (IC40 and IC40E)

www.isa.org/training/IC40

Length: 3 days  |  CEUs: 2.1  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course presents an approach to developing functional requirements/specifications using the models and terminology defined in the ANSI/ISA88 batch control standards. A review of the characteristics of batch manufacturing systems is included. Participants will explore the ANSI/ISA88 concept that separates the recipe from the equipment.

You will be able to:

• Specify the requirements for a batch control system
• Effectively structure and subdivide equipment entities
• Define procedural elements that can be effectively used with the above equipment entities
• Describe modes and states and how they are applied at the equipment level
• Develop phase logic that executes in equipment and can deal with both normal and abnormal operations
• Recognize the various control languages that are available
• Identify the alternative architectures for Programmable Logic Controllers (PLCs), Distributed Control Systems (DCSs), and PC-based control systems
• Describe the interfaces that are needed between batch control and other systems within an enterprise

IC40 Scheduled In-Person Courses (subject to change)

• 1–3 June, Newhall, CA
• 28–30 September, Newhall, CA

IC40E Online, Instructor-Led Courses Start Dates

3 February, 6 April, 1 June, 3 August, 28 September

Control Systems Engineering (CSE) Exam Review Course (EN00) (EN00E)

www.isa.org/training/EN00

Length: 3 days  |  CEUs: 2.1  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course reviews the knowledge and skill areas that are included on the Control Systems Engineer (CSE) Professional Engineer (PE) examination produced by the National Council of Examiners for Engineering and Surveying (NCEES) and administered by US state professional license boards each October. The intent of the class is to prepare an engineer with four or more years of experience to take the exam by providing instruction in the broad range of technical areas that will be tested.

You will be able to:

• Follow the guidelines for taking the CSE exam
• Identify the breadth of the knowledge and skills areas covered
• Apply recognized standards for symbols and documents
• Recognize the basic calculation techniques for measurement devices
• Apply process variable measurements and sensor selection
• Compare the various final control elements/valves
• Explain basic process control loops: their configuration, operation, and performance
• Follow discrete logic in motor and interlock control
• Describe various signal conversion and wiring arrangements
• Compare various installation methods and techniques
• Determine material requirements from physical parameters
• Use safety instrumented basics
• Interpret system scope statements and apply to design needs

EN00 Scheduled In-Person Courses (subject to change)

• TBD, Houston, TX
• 9–11 June, Raleigh, NC
• 7–9 July, Santa Clarita, CA
• 6–9 October, Raleigh, NC

EN00E Online, Instructor-Led Courses Start Dates

13 April, 22 June
The Cybersecurity Pathway prepares you for the ISA/IEC 62443 Cybersecurity Certificate Program

This new ISA/IEC 62443 Cybersecurity Fundamentals Specialist certificate program is designed for professionals involved in IT and control system security roles who need to develop a command of industrial cybersecurity terminology and understanding of the material embedded in the ISA99 standards.

ISA continues efforts to meet the growing need of the industrial control systems professional and expand global leader outreach into the security realm and has developed a knowledge-based certificate recognition program to increase awareness of the ISA/IEC 62443 standard.

ISA/IEC 62443 cybersecurity certificates are awarded to those who successfully complete a designated training program and pass a multiple choice exam offered through Prometric testing centers. When you register for the required course, the certificate exam registration is included as of 1 February 2020.

All certificate program exams are administered electronically through Prometric testing centers. Please visit www.prometric.com/isa to determine the locations that are closest to you. Certificate program applicants must successfully complete the required course prior to taking the certificate exam.

- **Certificate 1:** ISA/IEC 62443 Cybersecurity Fundamentals Specialist
- **Certificate 2:** ISA/IEC 62443 Cybersecurity Risk Assessment Specialist
- **Certificate 3:** ISA/IEC 62443 Cybersecurity Design Specialist
- **Certificate 4:** ISA/IEC 62443 Cybersecurity Maintenance Specialist
- **ISA/IEC 62443 Cybersecurity Expert:** Individuals who achieve Certificates 1, 2, 3, and 4 are designated as ISA/IEC 62443 Cybersecurity Experts.

**Related Resources**

ISA’s Cybersecurity Library features seven titles covering the most important topics in industrial automation and control system security today. Buy the full library to get 15% off the individual book prices at issa.org/cyberlibrary

**Titles Include:**

  By Ronald L. Krutz, PhD, PE

- **Industrial Network Security, Second Edition**
  By David J. Teumim

- **Security PHA Review for Consequence-Based Cybersecurity**
  By Edward M. Marszal and Jim McGlone

  By Dick Caro

- **Industrial Data Communications, Fifth Edition**
  By Lawrence M. Thompson and Tim Shaw

- **Industrial Ethernet, Third Edition**
  By John S. Rinaldi and Perry S. Marshall

- **Mission Critical Operations Primer**
  By Steve Mustard
Using the ISA/IEC 62443 Standards to Secure Your Control Systems (IC32 and IC32E)

www.isa.org/training/IC32

Length: 2 days | CEUs: 1.4 | Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

The move to using open standards such as Ethernet, TCP/IP, and web technologies in supervisory control and data acquisition (SCADA) and process control networks have begun to expose these systems to the same cyberattacks that have wreaked havoc on corporate information systems. This course provides a detailed look at how the ISA/IEC 62443 standards can be used to protect your critical control systems. It also explores the procedural and technical differences between the security for traditional IT environments and those solutions appropriate for SCADA or plant floor environments.

You will be able to:

• Discuss the principles behind creating an effective long-term program security
• Interpret the ISA/IEC 62443 industrial security framework and apply them to your operation
• Define the basics of risk and vulnerability analysis methodologies
• Describe the principles of security policy development
• Explain the concepts of defense in depth and zone/conduit models of security
• Analyze the current trends in industrial security incidents and methods hackers use to attack a system
• Define the principles behind the key risk mitigation techniques, including anti-virus and patch management, firewalls, and virtual private networks

IC32 Scheduled In-Person Courses (subject to change)
• 24–25 February, Newhall, CA
• 4–6 April, Akron, Ohio
• 4–5 May, Houston, TX
• 13–14 July, Raleigh, NC
• 14–15 September, Houston, TX
• 12–13 October, Akron, OH
• 7–8 December, Raleigh, NC

IC32E Online, Instructor-Led Courses Start Date
27 January, 23 March, 18 May, 20 July, 14 September, 16 November

Assessing the Cybersecurity of New or Existing IACS Systems (IC33, IC33E, and IC33M On-demand)

www.isa.org/training/IC33

Length: 3 days | CEUs: 2.1 | Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course will provide students with the information and skills to assess the cybersecurity of a new or existing IACS and to develop a CRS that can be used to document the cybersecurity requirements for a project.

You will be able to:

• Identify and document the scope of the IACS under assessment
• Specify, gather, or generate the cybersecurity information required to perform the assessment
• Identify or discover cybersecurity vulnerabilities inherent in the IACS’ products or system design
• Organize and facilitate a cybersecurity risk assessment for an IACS
• Identify and evaluate realistic threat scenarios
• Identify gaps in existing policies, procedures, and standards
• Establish and document security zones and conduits
• Develop a cybersecurity requirements specification (CRS)

IC33 Scheduled In-Person Courses (subject to change)
• 26–28 February, Newhall, CA
• 8–10 April, Akron, OH
• 6–8 May, Houston, TX
• 15–17 July, Raleigh, NC
• 16–18 September, Houston, TX
• 14–16 October, Akron, OH
• 9–11 December, Raleigh, NC

IC33E Online, Instructor-Led Courses Start Dates
3 February, 6 April, 1 June, 3 August, 28 September
IACS Cybersecurity Design & Implementation (IC34M On-demand)

www.isa.org/training/IC34

Length: 3 days  |  CEUs: 2.1  |  Hours: 8:00 a.m. – 4:00 p.m.  |

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course will provide students with the information and skills needed to select and implement cybersecurity countermeasures for new and existing IACS in order to achieve the target security level assigned to each IACS zone or conduit. Additionally, students will learn how to develop and execute test plans to verify that the cybersecurity of an IACS solution has properly satisfied the objectives in the cybersecurity requirements specification (CRS).

You will be able to:

• Interpret the results of an IACS cybersecurity risk assessment
• Develop a cybersecurity requirements specification (CRS)
• Develop a conceptual design based upon information in a well-crafted CRS
• Explain the security development lifecycle process and deliverables
• Perform a basic firewall configuration and commissioning
• Design a secure remote access solution
• Develop system hardening design specification
• Implement a basic network intrusion detection system
• Develop a Cybersecurity Acceptance Test Plan (CFAT/CSAT)
• Perform a basic CFAT or CSAT

IC34 Scheduled In-Person Courses (subject to change)

• 13–15 January, Raleigh, NC
• 1–13 May, Houston, TX
• 8–10 June, Akron, OH
• 5–7 August, Raleigh, NC
• 22–24 September, Houston, TX
• 14–16 December, Raleigh, NC

IACS Cybersecurity Operations & Maintenance (IC37M On-demand)

www.isa.org/training/IC37

Length: 3 days  |  CEUs: 2.1  |  Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course will provide students with the information and skills needed to detect and troubleshoot potential cybersecurity events, as well as the skills to maintain the security level of an operating system throughout its lifecycle—despite the challenges of an ever-changing threat environment.

You will be able to:

• Perform basic network diagnostics and troubleshooting
• Interpret the results of IACS device diagnostic alarms and event logs
• Develop and follow IACS backup and restoration procedures
• Understand the IACS patch management lifecycle
• Develop and follow an IACS patch management procedure
• Develop and follow an antivirus management procedure
• Define the basics of application control and whitelisting tools
• Define the basics of network and host intrusion detection
• Define the basics of security incident and event monitoring tools
• Develop and follow an incident response plan
• Develop and follow an IACS management of change procedure
• Conduct a basic IACS cybersecurity audit

IC37 Scheduled In-Person Courses (subject to change)

• 21–23 January, Raleigh, NC
• 18–20 May, Houston, TX
• 15–17 June, Akron, OH
• 12–14 August, Raleigh, NC
• 29 September – 1 October, Houston, TX
• 16–18 December, Raleigh, NC
The Safety Pathway prepares you for the ISA/IEC 61511 Standard Certificate Program

Based on the ISA84 Standards, this program measures the understanding of process safety standards.

ISA and the Automation Standards Compliance Institute (ASCI) developed three certificate programs designed to increase knowledge and awareness of the ISA/IEC 61511 standard. The ISA/IEC 61511 standard has improved safety in industrial environments worldwide.

ISA safety certificate programs are awarded to those who successfully complete the requirements of ISA’s related safety courses.

Choose from three different safety certificate program levels:

- **Certificate 1**: ISA/IEC 61511 SIS Fundamentals Specialist
- **Certificate 2**: ISA/IEC 61511 SIL Selection Specialist
- **Certificate 3**: ISA/IEC 61511 SIL Verification Specialist
- **ISA/IEC 61511 SIS Expert**: Individuals who achieve Certificates 1, 2, and 3 are designated as ISA/IEC 61511 SIS Experts.
Safety Instrumented Systems: A Lifecycle Approach (EC50 and EC50E)

www.isa.org/training/EC50

Length: 4.5 days | CEUs: 3.2
Hours: 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course focuses on the engineering requirements for the specification, design, analysis, and justification of safety instrumented systems for the process industries. Students will learn how to determine safety integrity levels and evaluate whether proposed or existing systems meet the performance and documentation requirements defined in the ISA84 (IEC 61511) standard.

You will be able to:

• Differentiate between process control and safety control
• Implement the IEC 61511 (ISA84) standard
• Evaluate process risk levels
• Select Safety Integrity Levels (SILs) for Safety Instrumented Functions (SIFs) using a variety of techniques
• Analyze the performance of different logic system technologies
• Analyze the performance of various sensor, logic, and final element configurations, as well as the impact of diagnostics, test intervals, common cause, system size, imperfect manual testing, and bypassing
• Determine optimum system test intervals
• Specify and select safety instrumented systems
• Apply the documentation requirements for process safety management, regulations, and industry standards

EC50 Scheduled In-Person Courses (subject to change)

• 3–7 February, Houston, TX
• 15–19 June, Houston, TX
• 17–21 August, Denver, CO
• 19–23 October, Houston, TX
• 16–20 November, Raleigh, NC

EC50E Online, Instructor-Led Courses Start Dates
27 January, 23 March, 18 May, 20 July, 14 September, 16 November

Note: standards sold separately.

Advanced Safety Integrity Level (SIL) Selection (EC52)

www.isa.org/training/EC52

Length: 2 days | CEUs: 3.2
Hours: 8:00 a.m. – 4:00 p.m. (M–Th) and 8:00 a.m. – 12:00 p.m. (F)

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course focuses on further hands-on examples of Safety Integrity Level (SIL) selection using a variety of different techniques and providing more insight into the factors that determine risk reduction requirements. Students will be better able to save their companies time and money through the optimization of system performance requirements.

You will be able to:

• Develop and implement different SIL selection techniques within your organization, including the risk matrix, risk graph, and LOPA (Layer of Protection Analysis), in order to determine the appropriate level of performance needed for your safety systems. This will prevent you from over- or under-designing the system requirements and will save your organization time and money.

EC52 Scheduled In-Person Courses (subject to change)

• 10–11 February, Houston, TX
• 22–23 June, Houston, TX
• 24–25 August, Denver, CO
• 26–27 October, Houston, TX
• 1–2 December, Raleigh, NC
Advanced Design & SIL Verification (EC54)

www.isa.org/training/EC54

Length: 2 days | CEUs: 1.4 | Hours: 8:00 a.m. – 4:00 p.m.

A Certificate of Completion indicating the total number of CEUs earned will be provided upon successful completion of the course.

This course focuses on more detailed design issues and further hands-on examples of system analysis/modeling. Students will be better able to perform system design and analysis thus saving their companies time and money in optimizing system designs. This course will enable you to analyze any system technology and configuration to see if it will meet the required SIL (Safety Integrity Level) and determine if existing systems are safe enough, if they need to be upgraded, and whether proposed systems will meet the performance requirements. You will also be able to determine the optimum manual test interval for any system, saving your company time and money.

You will be able to:

• Analyze any system technology and configuration to see if it will meet the required SIL (Safety Integrity Level)
• Determine if existing systems are safe enough (or whether they need to be upgraded) and whether proposed systems will meet the performance requirements
• Determine the optimum manual test interval for any system, saving your company time and money by not over- or under-testing systems

EC54 Scheduled In-Person Courses (subject to change)

• 12–13 February, Houston, TX
• 24–25 June, Houston, TX
• 26–27 August, Denver, CO
• 28–29 October, Houston, TX
• 3–4 December, Raleigh, NC

Related Resources from ISA

These resources provide automation and control professionals with proven safety standards, technologies, and procedures that can be used to identify and mitigate safety hazards in industrial environments.

Performance-Based Fire and Gas Systems Engineering Handbook
Austin Bryan, Elizabeth Smith, and Kevin Mitchell
► www.isa.org/fireandgas

Control Systems Safety Evaluation & Reliability, Third Edition
William M. Goble
► www.isa.org/safetyevaluation

Safety Instrumented Systems: A Lifecycle Approach
Paul Gruhn, PE, CFSE, and Simon Lucchini, CFSE, MIEAust CPEng
► www.isa.org/SISlifecycle

Safety Instrumented System Design: Techniques and Design Verification
Iwan van Beurden, CFSE, and William M. Goble, CFSE
► www.isa.org/sistechnique

Safety Integrity Level Selection: Systematic Methods Including Layer of Protection Analysis
Edward M. Marszal, P.E., Dr. Eric W. Scharpf, MIPENZ
► www.isa.org/safetyintegrity

Safety Profiles for Real-Time Ethernet-Based Industrial Automation Networks (PDF)
Alberto Elia, Luca Ferrarini, and Carlo Veber
► www.isa.org/safetyprofiles
Take your training to the next level—join ISA!

Being a member of ISA connects you to the automation community. Membership comes with exclusive access to a global network of professionals. Did we mention that ISA members also receive a 20% discount on training and certification? The money you save more than pays for the price of your membership!

ISA members also enjoy ISA Connect—our online membership community. ISA Connect makes it easy for members to explore technical discussions and build long-lasting relationships with like-minded peers.

Interested in making an impact? Leadership opportunities are plentiful across our numerous geographic sections and technical divisions. ISA members possess the untapped potential to lead, network, and create actionable differences within our communities.

Join today: [www.isa.org/membership/join-isa](http://www.isa.org/membership/join-isa)

There is no better time to join ISA. This year, we celebrate 75 years of serving the automation community. Members—like you—help us shape the future of our industry.
Attend an ISA event in 2020

Introducing six topic-focused conferences for industrial automation and advanced manufacturing professionals

Each event offers a high-quality, standards-based technical program, peer-reviewed presentations, engaging networking activities, exhibit and sponsorship opportunities, and coordinated training course offerings. Presenters have real-world experience applying technology and uniquely understand the challenges faced by attendees.

ISA IIoT & Smart Manufacturing Conference

15–16 April • Galveston, TX
- Data-Driven Design Engineering
- Real-Time Production Optimization
- Cybersecurity
- Artificial Intelligence
- Remote Maintenance
- System Integration

ISA Analysis Division Symposium

27–29 April • Long Beach, CA
- Chemical Analyzers
- Gas Detectors
- Systems Integration
- Sampling Systems
- Emerging Technologies
- Validation/Calibration
- Spectroscopy
- Chromatography

ISA Cybersecurity Standards Implementation Conference

13–14 May • Galveston, TX
- Industry/Organization/Change Management
- Risk Assessment and Prioritization Determination
- Implementing a Security Development Lifecycle
- System Design and Architecture

ISA Energy & Water Automation Conference

5–6 August • San Antonio, TX
- Control System Strategies
- SCADA Systems Design Execution
- Data Analytics & Work Order Reporting
- Smart Cities Initiative/Intelligent & Expert Systems
- Operational Efficiency

ISA Subsea Automation Conference

16–17 September • Galveston, TX
- Dynamic Digital Twin
- Remote Inspection/Certification of Equipment
- Machine Learning
- Safety and Cybersecurity Through Sea Communications/Resident AUVs

ISA Process Industry Conference

18–19 November • Houston, TX
- Process Control
- Safety & Cybersecurity Systems
- Open Architecture/Infrastructure
- Robotics & Industrial Applications
- Operator Performance
Vendor-Neutral, Hands-On Portable Laboratories

Integrating the classroom and laboratory experience is a critical and unique component of ISA’s world class unbiased training programs. Many ISA courses have laboratory exercises that utilize our portable, hands-on trainers. These portable training labs can be shipped directly to your site or to one of our regional locations for an ISA in-company training program. ISA’s portable training labs are vendor-neutral, using a variety of suppliers’ equipment to demonstrate key concepts.

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.