

Process Control

Persons completing these courses receive a good grounding in process control principles and strategies, controller tuning, and loop dynamics as they relate to Fisher control valves. Engineers and technicians with little or no experience begin to build the fundamental knowledge they need to move forward in this field.

Introduction to Process Control

Course 9000 CEUs: 3.2

This Fisher Division course is for managers, engineers, technicians and others that have little or no process experience. Those in support areas will benefit from this course. A good course for those interested in advancing in the fluid processing industry, and those preparing for ISA or other certification examinations.

Overview

This 4-1/2 day course provides those new to the field with the basic, overall fluid process controls knowledge they need to better understand the interrelationships associated with automated control loops. All major aspects of process control (meas. devices, controllers, final control elements, and fundamental control methods) are covered by classroom presentations and laboratory exercises that are intended to familiarize students with the function and application of the wide variety of equipment commonly found in process plants. The end goal of the course is to raise the levels of skill and confidence of persons with limited experience in process plants.

Prerequisites Some experience with process measurement and control may be helpful, but is not required. This is an introductory course.

Topics

- Process Control Terminology and Symbols
- Process Loop Introduction
- Measurement Instrumentation for:
 - Flow;- Level;- Temp;
 - Pressure; - Chemical Analyses
- Instrument Calibration Concepts
- Final Control Elements
 - Control Valves; - Actuators;
 - Control Valve Instrumentation
- Introduction to Loop Dynamics, Tuning and Control
 - Proportional Control; - Integral Control
 - Derivative Control; - Ziegler-Nichols Tuning; - Lambda Tuning

Price \$2,000

Location Marshalltown, IA **Start Dates 2009** 2/23, 7/20

Loop Tuning & Problem Solving

Course 9001 CEUs: 3.2

This Fisher Division course is for engineers, technicians and other persons responsible for the design, maintenance and operation of pressure, temperature, level and flow control loops. A good course for those new to loop tuning, and for those looking to improve their loop tuning skills.

Overview

This 4-1/2 day course explains the basics of process control and loop dynamics. Those attending participate in hands-on workshops performing controller tuning on level pressure, flow, and temperature loops using digital and pneumatic controllers. Computer process simulators to reinforce and practice classroom concepts. Students will:

- implement common control strategies
- troubleshoot unstable loops
- tune pneumatic, analog, & digital controllers

Prerequisites For recommended prerequisite, please refer to the control valve training path.

Topics

- Cascade Control
- Dead Band
- Feedback Control/Feedforward Control
- Instrument Diagrams
- Open Loop Response Tests
- PID Controller Tuning
- Positioner Guidelines
- Process Gain
- Load Disturbances/Signal Filtering
- Process Response Time/Process Dead Time
- Transmitter Response Time
- Valve Characteristics
- Level, Flow, and Pressure Control

PC-ControlLAB™ 3 and Builder is used in course 9000 and 9001. It is a process control loop simulation and training program. Visit our website at: www.emersonprocess.com/education

Price \$2,100

Location Marshalltown, IA **Start Dates 2009** 5/11, 11/2

Loop Tuning Short Course

Course 9006 CEUs: 1.4

Overview

This 2-day Fisher Division course is designed for those engineers and technicians who have the job responsibility to tune controllers. The procedures that the students will learn and practice will enable them to tune controllers to meet the needs of each loop.

The **first** day will cover tuning methods that do not require calculations. The baseline method requires knowledge of the type of process, and the trial and error method requires making small setpoint bumps and changing controller gain and reset to meet the desired loop performance.

The **second** day will consist of open loop response testing and Lambda tuning to obtain greater loop accuracy, stability, and predictability.

Besides having lecture time, the students will practice tuning on software process simulation as well as practice on actual live pressure, flow, level, and temperature loops.

Topics

- Load Upsets
- Process Noise
- Self Regulating Process
- Integrating Process (Level)
- Valve Deadband and Stick/Slip
- Limit Cycling
- Baseline Controller Tuning
- Trial and Error Tuning
- Lambda Tuning
- Process Time Constant, Deadtime, and Gain
- Positioner Application Guidelines

Price \$1,100

Location Marshalltown, IA **Start Dates 2009** Call to Schedule

Process Control

All these courses deal with optimizing process performance and reliability by reducing process variability through better control. Loop tuning-by-feel is replaced by a systematic, scientifically sound approach, which is the subject of several courses for process control engineers and technicians. These courses provide an excellent platform for further economic optimization via advanced process control.

Process Control Intermediate-ON-SITE

Course 9002 CEUs: 2.1

Overview

This 3-day customer site course is focused on the principles and practices of open loop testing and closed loop controller tuning, using pre-selected fluid processes at the plant or course site. Students will test controllers and their associated loops using techniques that minimize plant upsets during testing. They will then tune the controllers for optimum loop performance based on the needs of each process. Students who complete the course will be able to tune process loops using the correct techniques applicable to the situation.

This course is available on request for customers having a minimum number of participants (normally at least 4).

To arrange training please call 1-800-338-8158 (within the U.S.) or 641-754-3771

Process Control, Measurement & Automation Systems - Video Package Training is Also Available.

Visit Our Website:

www.emersonprocess.com/education



Process Systems and Solutions LEARNINGPATH

**To enroll in Process Control courses or for more information, please call:
800-338-8158 or 641-754-3771**

**Applied Modern Loop
Tuning
9032**

**Applied Advanced
Regulatory Controls
9034**

**Process Dynamics and
Tuning Fundamentals
(PCE I)
9030**

**Process Analysis and
Minimizing Variability
(PCE II)
9031**

**Boiler Powerhouse
Applications
& Problem Solving
8106**

**Paper Machine
Applications & Problem
Solving 8107**

**EnTech Toolkit
Training
1430**

Applied Modern Loop Tuning

Course 9032 CEUs: 2.1

This course is for engineers and technicians responsible for maintaining process control performance using instrumentation and control loop tuning

Overview

MLT is a 3-day course that introduces participants to effective methods for determining optimal tuning parameters for regulation of processes. The non-oscillatory EnTech tuning techniques, based on Lambda concepts, are taught with a focus on minimizing process variability. Effectiveness is gained by the implementation of a tuning strategy that matches control element dynamics to process operating requirements. It contains formal lectures that are amply populated with process examples and supported with hands-on lab exercises using PC-based process simulators. Participants learn how to recognize acceptable/unacceptable control loop performance and to identify the most common source of problems. Fundamental tuning concepts, including the PID controller, process dynamics, valve motion characteristics (backlash and stiction), setpoint tracking and regulation, minimum variance, integrating processes, and level control are studied. High fidelity process simulators are used as the basis for the labs and simulation analysis.

Prerequisites Some experience with process instrumentation and control is helpful.

Topics

- Process Dynamics –perform bump tests to identify process model (gain, deadtime, time constant and valve dynamics) to determine PID tuning.
- Self Regulating loops – apply Lambda tuning to first-order and second-order process loops (flow, pressure, temperature, pH, etc)
- Integrating loops – tune levels and header pressures for load recovery and setpoint response
- Process Interactions – Lambda tune loops to minimize interactions and increase production

Price \$1,700

Location

Austin, TX
Toronto, ON

Start Dates 2009

2/9
3/30, 5/11, 10/5

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For additional contact information refer to the appropriate contact on page 119. Updated dates & locations are available on our website at www.emersonprocess.com/education.

Applied Advanced Regulatory Controls

Course 9034 NEW CEUs: 2.1

This course is for engineers and technicians responsible for process control design, implementation, and control performance.

Overview

This is a 3-day course that teaches the practical principals of advanced regulatory controls and tuning techniques to achieve improvements that can exceed that of basic PID controls.

The course will examine many advanced regulatory control technologies commonly available today and help participants understand which technologies are best suited and how to appropriately apply them given specific process dynamics and conditions.

Formal lectures are amply populated with process examples and supported with hands-on lab exercises. Approximately 40% of the course is hands-on lab based workshops where students develop practical skills required to apply and tune advanced regulatory controls. A dynamic process simulator is used to simulate a variety of process unit dynamics and evaluate the benefits of different advanced regulatory control strategies.

Prerequisites

Participants should possess basic process control knowledge and experience with DCS control strategy configuration.

Topics

- Process and Disturbance Dynamics
- PID Algorithms – PID, PI, PI-D, I-PD, PD, P-D, ID, I-D, 2 degrees of freedom control
- Cascade Control, Dynamic Feedforward
- Ratio Control, Override(selector) Control
- Split Range and Midrange Control
- Interactive Control Loops – Decoupling Control (2X2) and Lambda Tuning
- Deadtime Compensation (Smith Predictor)
- Adaptive Control (Gain Scheduling, Auto Tuning)
- Introduction to Model Predictive Control (Multiple Inputs Single Output)

Price \$1,700

Location	Start Dates 2009
Austin, TX	9/14
Toronto, ON	4/6

Process Dynamics and Tuning Fundamentals (PCE I)

Course 9030 CEUs: 2.8

This course is for engineers, or persons with equivalent math and theoretical background, who have responsibility for process control design and implementation, process optimization, or process design and troubleshooting.

Overview

Process Dynamics, Control and Tuning Fundamentals (Process Control for Engineers I) is a 4-day course that provides the fundamental theory governing process dynamic behavior, control system operation and controller tuning. Course material is based on experience gained in process variability optimization work and is based on modern control engineering concepts coupled with practical process application knowledge. This course presents a systematic approach to optimizing the control of a process unit operation in order to manufacture uniform product more efficiently. The course uses formal lectures with hands-on lab exercises. High fidelity process simulators are used as the basis for the labs and simulation analysis.

Prerequisites

An engineering degree or equivalent knowledge and functionality in the mathematics required to understand the concepts listed in "topics".

Topics

- Process Dynamics - Self Regulating and Integrating
- First Order Process Model
- Second Order Process Model
- Integrating Process Model
- Process & Control Nonlinearity
- Feedback Control & PID Controllers
- QAD Tuning & Lambda Tuning
- Setpoint & Load Response
- Frequency Response - Bode Plots
- Tuning Interactive Control Loops
- Coordinated Lambda Tuning for Unit Optimization

Price \$2,000

Location	Start Dates 2009
Austin, TX	2/23
Toronto, ON	4/20, 11/9

Process Analysis and Minimizing Variability (PCE II)

Course 9031 CEUs: 2.8

This course is for engineers, or persons with equivalent math and theoretical background, who have responsibility for process control design and implementation, process optimization, instrumentation engineering, or process design and troubleshooting.

Overview PCE II is a 4-day course that provides a knowledge of the techniques used to troubleshoot process and control problems, improve performance and reduce variability in processes. Time series analysis, including power spectrum and autocorrelation function, are presented as tools for process and control auditing. The course uses formal lectures that are highlighted with an ample repertoire of process examples and hands-on lab exercises. High fidelity process simulators are used as the basis for the labs and situation analyses.

Prerequisites Participants should have taken Process Dynamics, Control and Tuning Fundamentals (Process Control for Engineers I) or have similar knowledge. The simulators used in the course are similar to those used in Process Control for Engineers I.

Topics

- Review - Topics Presented in PCE I
- Use of Software for Identification of Process Dynamics, Lambda Tuning, Time Series Analysis
- Controller Tuning Troubleshooting - Dynamic Loop Interaction Problems
- Digital Control - Digital Controllers and Digital Sensors
- Signal Quantization, Signal Aliasing and Signal Filtering
- Time Series Analysis
- Power Spectrum
- Auto/Cross Correlation Function
- Interpreting Plant Process Data
- Process and Control Auditing Techniques
- Control Loop Evaluation- Power Spectrum
- Integrated Process and Control Design
- Advanced Process Control
- Mini-Audit Exercise

Price \$2,000

Location	Start Dates 2009
Toronto, ON	3/2
Austin, TX	4/27

Boiler & Powerhouse Applications & Problem Solving

Course 8106 CEUs: 2.1

This course is for technicians, engineers or others who have responsibility for troubleshooting and optimization of the powerhouse area including boilers, steam headers and turbines with the goal of achieving reliable load response, efficient operations and low emissions.

Overview This is a 3-day course that draws on the depth of experience that EnTech has accumulated during years of investigating and improving the performance of power boilers, waste fuel boilers, steam headers, PRV's and turbines. The course focuses on a broad scope of process variability and operational stability issues that affect process reliability, energy usage and steam header stability. Issues examined include the impact of process design and control design on process stability. Topics include the affect of the water/steam system on boiler drum level dynamics from a thermodynamics perspective, improving the speed-of-response of a boiler to setpoint and load changes, stabilizing the steam header pressure and temperature controls, etc. A high fidelity dynamic simulator provides the basis for lab work.

Prerequisites Participants should have taken Applied Modern Loop Tuning Process (9032) or Control for Engineers I (9030) or possess similar process control and instrumentation knowledge related to power house applications.

Topics

- Boiler Thermodynamics
- Steam Drum Process Dynamics
- Drum Level 3-Element Control
- Feedforward Drum Level Control
- Plant Master / Boiler Master Control
- Air / Fuel Combustion Control
- O2 & Furnace Draft Control
- Steam Header, PRV & Turbine Control
- Valves, Dampers & Variable Speed Drives

Price \$1,700

Location Toronto, ON
Start Dates 2009 6/8

Paper Machine Applications & Problem Solving

Course 8107 CEUs: 2.8

This course is for technicians, engineers or other persons who have responsibility for troubleshooting paper machine processes, minimizing process variability and improving product uniformity.

Overview This is a 4-day course that captures the experience that EnTech has developed over years of auditing paper machine and stock supply systems. The course looks into a broad scope of process variability and operational stability issues that affect process reliability and performance. Issues that are examined are related to process design problems, instrumentation capability, control strategy design, loop tuning deficiencies, and advanced control. A series of simulators have been designed to allow participants to discover the problems and their solutions while providing positive feedback on the results obtained.

Prerequisites Participants should have taken Applied Modern Loop Tuning Process (9032) or Control for Engineers I (9030) or possess similar process control and instrumentation knowledge related to paper machine applications.

Topics

- Variability in Paper
- Headboxes and Lean Stock Systems
- Thick Stock Delivery and Stock Blending
- Consistency Control
- White Water Chests, White Water Headers and Saveall Control
- High Density Storage Chest Control
- Refiner Control
- Drive Control
- Dryer Control
- MD Basis Weight and Moisture Control
- CD Basis Weight, Moisture and Caliper Control
- Paper Variability Results and Benchmark Indices

Price \$2,000

Location Toronto, ON
Start Dates 2009 10/19

EnTech Toolkit Training

Course 1430 CEUs: 2.1

This course is for engineers, technicians or other persons who have responsibility for using the EnTech Toolkit as part of their role in process troubleshooting, minimizing variability, and improving or maintaining performance of operations.

Overview This is a 3-day course that fully explores the various functions, options and capabilities that are built into the EnTech Toolkit software. The course starts with the data acquisition features of the Collect module as it is connected to field instrumentation or directly to digital systems. The power of the Analyse time series analysis software for process troubleshooting, auditing and reporting on performance is examined using process simulators. The Tuner module includes bump test analysis, calculation of controller tuning parameters, and simulation of controller response characteristics. Participants are asked to perform process audits and report on their findings and the improvements they make.

Prerequisites Participants should have taken Modern Loop Tuning (9032) or Process Control for Engineers I (9030), or possess similar process control knowledge, or they should have already been exposed to the EnTech Toolkit software.

Topics

- Signal Conditioning Module
- Collect Software, Collect DDE/OPC Software
- Collect Tag Database
- Tuner Identification Software
- Process Dynamic Types
- Tuner Tuning Software
- Tuner Simulation and Analysis Software
- Analyse Software
- Time Series Analysis
- Analyse Plot Interpretation/Manipulation
- Process Audit Methodology
- Mini-Audit of a Simulated Process
- Data Manager Software

Price \$1,700

Location Toronto, ON
Start Dates 2009 7/6

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