

Working with Controllers

Course 281: Working with Controllers

Covers the purposes and kinds of controllers and their relationship to other components in process control systems. Explains the concepts of current-, position-, and time-proportioning control. Compares the operation of several kinds of controllers. Describes the operation of proportional, integral, and derivative modes, and discusses tuning procedures for each. Discusses cascade, feedforward, ratio, and auctioneering control systems as well as other operations. Describes ways to eliminate or reduce controller problems.



TPC Training is accredited by IACET to offer **0.5 CEU** for this program.

Lesson 1: Introduction to Controls

Topics

Development of Controllers; Purpose of Automatic Controllers; Kinds of Controllers; Variables; Process Dynamics; Final Control Elements; Current Proportioning; Position Proportioning; Time Proportioning; Controller Modes and Actions; Controller Terminology; Controller Alarms and Options; Advanced Controllers; Safety in Control Loops; Accuracy in Control Loops

Objectives

- Describe the kinds of controllers most often used in industrial applications.
- Discuss six important problems of process dynamics that controllers must overcome.
- Compare the actions of current proportioning, position proportioning, and time proportioning.
- Name four kinds of controller alarms.
- Discuss the importance of safety in control loops.

Lesson 2: Controller Operations

Topics

Kinds of Controllers; Automatic/Manual Control; Controller Range and Span; Direct- and Reverse-Acting Controllers; On/Off Controllers; Proportional Controllers; Controller Tuning; Kinds of Output; Current-Proportioning Control; Time-Proportioning Control; Position-Proportioning Control; Control Strategies

Objectives

- Explain why automatic/manual control is necessary.
- Explain how on/off controllers work and discuss the difference between on/off and proportional controllers.
- Describe a basic controller tuning process.
- Describe current-, time-, and position-proportioning controllers and name possible uses for each.
- Explain how split control works.

Lesson 3: Controller Modes and Tuning

Topics

Controller Tuning; Proportional Mode; Offset; Integral Mode (Reset); Derivative Mode (Rate); Single-Mode Controller; Two-Mode Controller; Three-Mode Controller; Tuning the Control Loop; Step-Change Response Method

Objectives

- Describe the effect of the proportional, integral, and derivative modes on a controller's response to process changes.
- Discuss proper uses for the proportional, integral, and derivative modes.
- Explain how the proportional, integral, and derivative modes affect the tuning of a controller.
- Describe the procedure for tuning a controller by the step-change response method.

Lesson 4: Special Controller Applications and Options

Topics

Cascade Control; Feedforward Control; Ratio Control; Auctioneering Control; Hardware Options for Controllers; Auto/Manual Station; Remote Setpoint; Auxiliary Outputs; Indicators; Operational Features; Limits and Alarms

Objectives

- Compare cascade, feedforward, ratio, and auctioneering control strategies.
- Describe three optional features used with auto/manual controllers.
- Discuss the use of remote setpoint, auxiliary outputs, and several kinds of indicators as hardware options for controllers.
- Explain how input signal conditioning, anti-reset windup, adaptive gain, error-squared calculation, and setpoint/output ramp and clamp affect controller operation.
- Discuss the use of limit and alarm options available for controllers.

Lesson 5: Maintaining Controller Systems

Topics

Preventing Controller Problems; Electrical Noise; Electrical Noise Suppression; Regulating Primary Power; Electrical Coupling; Effects of Temperature Variations; Test Equipment; Test Connections; Maintenance and Troubleshooting

Objectives

- Describe five ways of suppressing electrical noise.
- Discuss the effects of an inadequate power supply and explain how to regulate it.
- Describe ways to avoid the harmful effects of electrical coupling.
- Explain how temperature variations affect controllers.
- Describe the kinds of equipment and proper connections needed to test controllers.
- Discuss elements of effective controller maintenance and troubleshooting.