Certified Control Systems Technician (CCST) Training

Description

Course Description

This five days course focuses on a fast paced review of the knowledge required to properly install and maintain standard measurement and control instrumentation. It is designed specifically for practicing technicians preparing for the Level Certified Control Systems Technician (CCST) examination.

Course Objectives

Participant will be able to:

- Cite principles and theory that explain measurement and control instrument functions
- Describe procedures required to properly maintain the function of measurement and control instrumentation
- Understand 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
- Understand 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 exam
- Identify any need for further study or training in specific knowledge areas

Course Outlines

Concepts of Process Control

- Definition of a Process
- Types of Process
- Typical Industries
- Continuous vs. Batch Processing
- Typical Continuous Processes

- Continuous Process Example
- Typical Batch Processes
- Batch Process Example
- Process Control
- The Process Control System (Loop)
- Industrial Process Example
- Control Loop on P & I Drawings
- Process Dynamics (Response to Change)
- First Order Lag plus Dead Time

Basic Measurement Units

- Pressure and Level Measurement Units
- Relationship between Pressure Terms
- Density
- Specific Gravity
- Viscosity
- Pressure of Fluids
- Liquid Head Measurement
- Effect of S.G. on Liquid Head Measurement
- Unit Systems – Flow Measurement
- Flow Measurement of Fluids
- Flow Terms

Test & Calibration Equipment

- Temperature Scales
- Hydraulic Dead Weight Tester
- U-Tube Manometers
- Well Manometer
- Schematic of Low Pressure Pneumatic Calibrator
- Typical Digital Multimeter
- Voltage Measurement
- Current Measurement
- Resistance Measurement
- Electro-Pneumatic Calibrator

Instrument Performance

- Range and Span
- Suppressed and Elevated Zero Range
- Range and Span Terminology
- Span and Range Calculation Practice
- Accuracy
- Repeatability
- Importance of Accuracy
- Linearity
- Hysteresis and Dead Band

Calibration Principles & Procedures

- Calibration
- Verification: Without Adjustment
- Calibration Block Diagram
- Shop Calibration – DP Transmitter
- RTD Calibration Arrangement
- Thermocouple Calibration Arrangement
- Hierarchy of Standards
- Five-Point Calibration Check
- Calibration Chart
- In-Shop or Field Calibration

Advancing Technology

- Standard Practice
- Industry’s changing Needs
- Smart Devices
- Smart Transmitters
- Digitizing a Measurement
- The Microprocessor
- Smart Instrument Characterization
- Smart Transmitter Functions
- Smart Transmitter Operation
- Configuration vs. Calibration
- Reranging
- Characterization and Digital Trim

Controller Actions and Modes

- Control Hierarchy
- Controllers and Control Strategies
- Direct Acting Controller
- Reverse Acting Controller
- Direct or Reverse Acting?
- Direct or Reverse Acting?
- On-Off Control of Heating

- Proportional Control
- Proportional Action
- Proportional Control of a Continuous Process
- Proportional Action
- Offset with Proportional Control
- Level Control Offset Example
- Integral Action
- Proportional + Integral Control
- Integral Control
- Derivative Action
- Derivative (Rate) Control Action
- Proportional + Integral + Derivative Control
- Characteristics of Controller Modes

Tuning Methods

- Objectives of Tuning
- Trial & Error Tuning
- Tuning Map – Gain and Reset
- The Effect of Adding Derivative
- Tuning by Open Loop Testing
- Ziegler-Nichols (Z-N)
- Open Loop Method Open Loop Considerations
- Tuning by Closed Loop Testing
- Z-N Closed Loop Method
- Closed Loop Considerations

Advanced Control Strategies

- Ratio Control – Wild Stream
- Ratio Control – Both Streams Controlled
- Automatic Ratio Set: Example
- Cascade Control: Diagram
- Application: Without Cascade
- Application: With Cascade
- Inner and Outer Loops
- Cascade Control Considerations
- Feedforward Control
- Feedforward Control Concepts
- Feedforward Control Loop
- Feedforward Control of Heat Exchanger

Loop Checking Concepts

- Loop Check Considerations
- Loop Check Process
- Loop Check Procedure

Instrument Installation

- Instrument Installation
- Installation Detail
- Installation Details
- Instrument Location Plan
- Installation Practices
- Manufacturer’s Requirements
- Instrument Air Quality Considerations
- Instrument Air Supply System

Troubleshooting Considerations

- Purpose of Troubleshooting
- Why Troubleshoot?
- Bottom Line
- What Are You Expected to Troubleshoot?
- Troubleshooting Skills
- Troubleshooting Productivity
- Approaches to Troubleshooting
- Equipment History Approach
- Input/Output (Serial) Approach
- Input/Output Approach
- Halving Approach
- Shotgun Approach
- Logical Analysis Troubleshooting
- Verify something is wrong
- Identify and Locate the Cause of the Problem
- Fix the Problem
- Verify the Problem is corrected
- Follow up to Minimize Future Problems

Final Control Elements

- Control Valves
- A Typical Control Valve with Actuator
- Globe Valves
- Other Linear Motion Valves
- Rotary Motion Valves
- Valve Characteristics (Trim)
- Inherent Flow Characteristics
- Cavitation
- Cv – Valve Coefficient of Flow
- Actuators
- Direct (Air-to-Extend)
- Reverse (Air-to-Retract)
- Positioners

- Typical Motion-Balance Positioner
- I/P Transducer
- Other Final Control Elements

Common Problems

- Pressure
- Level
- Flow
- Temperature
- Valves
- Actuators
- Positioners
- Dampers
- Variable Speed Drives

Troubleshooting with DCS

- Distributed Control System
- Elements of a Distributed Control System
- DCS Graphic Display
- DCS Trend Display
- DCS Alarm Summary

Instrument Maintenance

- What is Instrument Maintenance?
- Importance
- Types

Programmable Electronic Systems

- Basic PLC System
- Numbering Systems
- Decimal Number
- Binary Number
- Octal Number
- Hexadecimal Number
- Conversion Practice
- Ladder Logic Programming
- Typical Ladder Logic Format
- Relay Type Instructions
- Start/Stop Ladder Logic
- Input Wiring Diagram
- Output Wiring Diagram

Fieldbus

- Fieldbus Definition
- What is a Fieldbus?
- Bus Hierarchy
- Why Use a Fieldbus?
- Foundation Fieldbus H1 Bus Segment
- Device Descriptions
- Fieldbus Summary Slide

Start-Up Concerns

- Start-Up Safety Concerns
- Start-Up Documentation