



Instrumentation and Controls Series - 2.3 CEUs*

The Instrumentation and Controls series explains the various components and systems needed to operate an efficient facility. The subject areas in this series include Intro to I&C, Process Measurement, Programmable Logic Controllers, Process Analyzers, and DCS.

Introduction to Instrumentation & Control - 0.2 CEUs

Industrial Instrumentation and Control Overview

- The Basic Instrument Channel
- Closed-Loop Instrument Channels
- Instrument Loops

Principle of Measurement

- Static Characteristics
- Measurement Uncertainty
- Dynamic Characteristics and Response

Industrial Signal Standards

- Analog Signal Standards
- HART Communications Protocol
- Fieldbus Standards

Process Measurement - 0.4 CEUs

Pressure Measurement

- Units of Pressure
- Pressure Measurement Devices
- Electronic Pressure Transducers

Level Measurement

- Direct Measurements
- Indirect Measurements

Intro to Flow Measurement

- Flow Measurement
- Fluid Properties
- Flow Meter Classifications
- Flow Measurement Systems

Head Flow Meters

- Introduction to Head Flow Meters
- Venturi Tubes and Similar Devices
- Pitot Tubes
- Other Pressure-Related Flow Meters

Linear and Mass Flow

- Positive-Displacement Meters
- Velocity Flow Meters
- Mass Flow Meters

Temperature Measurement I

- Temperature Scales and Conversion
- Fundamentals of Temperature Measurement
- Factors Affecting Temperature Measurement

Temperature Measurement II

- Thermocouples
- Resistance Temperature Detectors
- Other Types of Temperature Measurement Devices

Process Control and Monitoring - 0.6 CEUs

Process Control Fundamentals

- Control Loops and Types of Processes
- Terminology
- Feedback

Two Position and Proportional Control

- Two-Position Control
- Proportional Control

Loop Tuning

- Loop Tuning Criteria
- Closed Loop Tuning Methods

Intro to Actuators

- Purpose of a Valve Actuator
- Types of Actuators
- Closed Loop Systems

Actuator Principles of Operation

- Pneumatic Actuator Principles of Operation
- Electric Actuator Principles of Operation
- Hydraulic Actuator Principles of Operation

Control Valves I

- Purpose of Valves
- Valve Components
- Valve Mounting Methods

Control Valves II

- Gate Valves
- Globe Valves
- Needle Valves
- Butterfly Valves

Control Valves III

- Ball Valves
- Plug Valves
- Check Valves
- Regulating Valves

Control System Architecture

- PLCs
- DCS
- SCADA

Integral, Derivate, and PID Control

- Proportional and Integral Control
- Proportional and Derivative Control
- Proportional, Integral, and Derivative Control

Advance Controls Methods

- Feedforward Control
- Cascade Control
- Ratio Control
- Three Element Control

Limitorque Valve Actuator Fundamentals

- Motor-Operated Valve Basics
- Limitorque Valve Actuators
- Adjusting SMB-000 Limit and Torque Switches

Programmable Logic Controllers - 0.2 CEUs

PLC Overview

- PLC Components
- Basic Operation
- Scan Cycle
- Ladder Logic

PLC Software

- Software
- HMI
- Instructions

PLC Hardware

- Power Supplies
- Processors
- Input/Output Modules

PLC Addressing

- Number Systems
- Terminology
- Rack Addressing

PLC Communications

- Communications Terminology
- Networks and Protocols
- Common PLC Communications Configuration

Process Analyzers - 0.7 CEUs

Gas Chromatography I

- History of Chromatography
- Basic Theory of Gas Chromatography
- Natural Gas Applications

Gas Chromatography II

- Gas Chromatography Principle Elements
- Main Factors Affecting Analysis
- Operation Cycle

Hydrogen Sulfide and Oxygen Analyzers

- Hydrogen Sulfide Analyzers
- Oxygen Analyzers

Introduction to Process Analyzers

- Process Analyzers
- Analyzer Systems

Moisture Analyzers

- Moisture Content Measuring Instruments
- Optical Chilled Mirror Hygrometers

Process Analyzer Detectors

- Continuous Gas Analyzers
- Thermal Conductivity Detector
- Flame Ionization Detector
- Photoionization Detector
- Flame Photometer Detector

Introduction to Spectrometry

- Theory of Spectrometry
- Optical Spectrometer Components
- Ultraviolet/Visible, Infrared, X-Ray, and Mass Spectrometry

Mass Spectrometry

- Mass Spectrometry Working Principles
- Measurement Principles
- Sample Conditioning and Safety

Residual Chlorine Analyzers

- Residual Chlorine
- DPD Measurement Method for Total Residual Chlorine
- Amperometric Measurement Method for Free Residual Chlorine
- Amperometric Measurement Method for Total Residual Chlorine

Turbidity Analyzers

- Principles of Turbidity Measurement
- Absorption Method
- 90-Degree Scattered Light Method
- Surface-Scattering Method

Dew Point Analyzers

- Gas Analyzer Dew Point/Moisture Theory
- Aluminum Oxide Capacity Analyzer
- Quartz-Crystal Microbalance Analyzer
- Chilled Mirror Measurement
Analyzer Hydrogen Sulfide Gas Analyzers
- Online H₂S Monitoring
- Photometric Continuous Online

Hydrogen Sulfide Gas Analyzers

- Preserve Public Safety
- Reduce Corrosion in Pipelines and Related Equipment
- Ensure Proper Custody Transfer Agreements
- Control the Odor of Gas

Density Analyzers

- Density Measurement Applications and Theory
- Liquid Density Analyzer
- Gas Density Analyzer UV-VIS Spectrometry
- Operating Principles
- Ultraviolet-Visible (UV-VIS) Photodiode Array (PDA) Spectrometry
- Ultraviolet (UV) Differential Method Spectrometer
- Sample Conditioning and Safety

UV-VIS Spectrometry

- Describe the working principles of Ultraviolet-Visible, or UV-VIS, spectrometry.
- Describe the UV-VIS photodiode array, or PDA, spectrometer.
- Describe the UV differential method spectrometer.
- Explain sample conditioning and safety of UV-VIS spectrometry.

Infrared Spectrometry

- Working Principles
- Spectrometer Hardware
- Types of IR Spectrometers
- Sample Conditioning and Safety

Introduction to Chromatography

- History of Chromatography
- Basic Theory of Gas Chromatography
- Natural Gas Applications

Titration Basics

- Explain the principles of turbidity measurement.
- Describe the absorption method for turbidity measurements.
- Explain the 90-degree scattered light method for turbidity measurements.
- Describe the surface-scattering method for turbidity measurements.

X-Ray Spectrometry

- Working Principles
- Spectrometer Hardware
- Types of IR Spectrometers
- Sample Conditioning and Safety

pH Analyzers

- Introduction to pH
- pH Measuring Instruments
- The Importance of pH in Industry

Total Organic Carbon Analyzers

- Measurement Principles
- UV Persulphate Method
- Catalytic Oxidation Method
- Thermal Oxidation Method

DCS - 0.2 CEUs

Data Acquisition and Control System Architecture

- Control System Architecture
- Distributed Control Architecture
- Programmable Logic Controls
- Recommended Configurations

Data Acquisition Communications Strategies

- General Communications
- Physical Media
- Communication Protocols
- Network Topologies
- Network Redundancy

Data Acquisition System Reliability

- Reliability Criteria
- Redundancy Terminology
- Reliability
- Power Supply Sources

Operator Interface Strategies

- Levels of HMIs
- Human Factors