€TRAINING

Industrial Instrumentation and Modern Control Systems

21 - 25 October 2024
London (UK)
Landmark Office Space

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REF: O372 DATE: 21 - 25 October 2024 Venue: London (UK) - Landmark Office Space Fee: 6375 Euro

Introduction:

In an industrial situation where it is required to measure and control some aspects of a process, it is often the application of the knowledge and the ingenuity of the Engineer or Technician which is relied upon to solve the measurement and control problem. Therefore a fundamental understanding of the principle of operation of a range of sensors/transducers and instrumentation techniques applicable in an industrial situation combined with a working knowledge of Process control techniques and tuning methods equips the Engineer or Technician with the necessary skills and makes them invaluable in their workplace.

The attendees will investigate the concepts of instrumentation and measurement and will acquire the knowledge relating to the characteristics and properties of the variables being measured. Moreover, the delegate will gain an understanding of the Process control systems and methods used in a modern industrial system.

This is practical and hands-on training and where applicable, theoretical studies will be supplemented with practical activities where the delegate will have the opportunity to design, develop, build, test, and evaluate their instrumentation systems.

Course Objectives:

At the end of this course the participants will be able to:

- Understand the principles and practice of a range of sensors and transducers
- Use a hands-on approach, enable the delegate to investigate the operation of an instrumentation system through designing, building and testing typical sensor combined with appropriate signal conditioning circuits
- Become familiar and confident with a range of measurement techniques
- Understand the concepts of Process Control and acquire the knowledge relating to the characteristics and properties of a process variable being measured
- Disseminate and share experience and knowledge with other delegates through open session discussions hence broadening the knowledge base of all
- Become familiar and knowledgeable with PID control and develop the ability to tune a process control system using PID control
- Have the confidence and knowledge to apply the above techniques and principles to solve an unfamiliar and bespoke measurement situation in the workplace
- Evaluate and select the most appropriate sensor technology for a given instrumentation system
- Design, build and test using a given specification and censor, their instrumentation system
- Identity components and features of a Process control system
- Calibrate and signal condition the above system and take measurements from the system

Targeted Audience:

- Plant Management Personnel
- Engineers from all disciplines
- Processing Control Technicians
- Instrumentation Artisans
- Supervisors
- People involved in Projects

- People dealing with Instrumentation Equipment Selection
- Representatives from the Safety Department
- Representatives from Purchasing Departments
- Anyone with more than just a passing interest in instrumentation

Course Outlines:

Unit 1: Introduction to Sensors, Transducers, and Instrumentation Systems:

- Introduction to Sensors, Transducers and Instrumentation Systems
- Examples
- Terms and definitions associated with Instrumentation systems, including:
    - Maximum error
    - Hysteresis
    - Repeatability
    - Sensitivity
    - Resolution
    - Span
    - Response time
- Process Variables
- Mass flow
- Volumetric flow rate
- Pressure
- Viscosity
- Turbidity

Unit 2: Strain, Pressure, and Flow Measurement:

- Principle of Strain Measurement - tension, compression, stress, strain, Youngs modulus
- Principle of operation, application, and installation considerations
- Gauge types - the principle of operation and configurations
- Principles of Pressure measurement
- The principle of operation, application, and installation considerations of:
    - Diaphragms
    - Bellows
    - Capacitive devices
    - Fibre Optic pressure measurement techniques
- Principles of flow measurement
- Reynolds number
- The principle of operation, application, and installation considerations of Invasive types
- Coriolis Flowmeter
- Differential Pressure type flowmeters
- Orifice plate
- Venturi tube
- Flow nozzle
- Dall flow tube
- Electromagnetic flowmeters

Unit 3: Temperature, Level, and Non-Invasive Ultrasonic Measurement Techniques:

- Temperature scales
- The principle of operation, application, and installation considerations of:

- Resistance temperature detectors RTD□s
- Thermistors
- Thermocouples
- Radiation Pyrometers
- Principle of single point and continuous level measurement techniques
- Direct and indirect level measurement techniques
- The principle of operation, application, and installation considerations of:
- Ultrasonic techniques
- Capacitive techniques
- Pressure techniques
- Principles and applications of Ultrasonic techniques for non-invasive measurement
- Doppler shift and transit techniques
- Ultrasonic flowmeters

Unit 4: Introduction to Process Control Engineering:

- Control Strategies
- Block diagram representation
- Control components
- Servomechanisms and Regulators
- Open and closed-loop systems
- Negative Feedback NFB
- Transfer Functions
- 1st and 2nd order systems
- Transfer functions and Closed Loop systems
- ON/OFF control
- Two-step control action
- Proportional control
- Proportional band vs. proportional gain
- Proportional offset
- Reset
- Integral action
- Integral windup
- Derivative action
- PID control

Unit 5: Tuning PID Controllers:

- Stability
- System response
- Bode plot
- Nyquist plot
- Load disturbances and offset
- Empirical methods of setting Controllers
- Open-loop reaction curve method Ziegler-Nichols
- Default and typical settings
- Closed-loop continuous cycling method Ziegler-Nichols
- Fine-tuning