



# IE126: Advanced Process Control & Instrumentation

## Training Description:

Process control is becoming an increasingly important engineering topic, since the subject plays a crucial role in the design, operation and maintenance in areas such as power plants and chemical and industrial process plants. **Control systems have advanced dramatically during the last decade.** They become more modular and more sophisticated offering a vast variety of control functions for all the systems that operate within a modern "intelligent" facility. Enhanced functionality of the automation systems also means more complexity, interactive strategies, new technologies and systems management with resulting better control and improved reliability.

This intensive training course is designed to update participants with the **latest technologies** in instrumentation and process control. The training course will describe the various types of sensors relating to level, pressure, flow and temperature. Also included is an in-depth look at control valves, actuators with associated accessories together with practical valve sizing and selection techniques. The topics of digital field communications and Smart transmitters form an integral part of this course.

A major part of the course is devoted to a detailed exposition of currently used control valves, the associated terminology, valve performance, valve and actuator types, control valve accessories as well as to the correct selection and sizing of control valves for a wide range of applications.

The training course addresses the important issues related to valve installation and maintenance. In addition, this training course also utilizes an extensive collection of state-of-the-art, externally generated process management and video material concerned with all aspects of plant management, including smart wireless solutions to the collection of plant data. In addition, the subjects of digital control systems will be discussed with sections on Distributed Control Systems (DCS), Programmable Logic Controllers (PLC), SCADA systems and Safety Instrumented Systems (SIS).

This practical and highly-interactive training course includes various practical sessions and exercises. Theory learnt will be applied using one of our state-of-the-art simulators.

## Training Objectives:

**By the end of the training, participants will be able to:**

- ✓ Apply an in-depth knowledge and skills in process control and instrumentation
- ✓ List down the different technologies currently in use in pressure, temperature, level flow measurement
- ✓ Identify the types of control valve and use a system approach in actuator selection
- ✓ Determine the various process considerations for the instrumentation for industrial applications
- ✓ Review and apply the different types of control loop strategies and identify the features and application of Distributed Control System (DCS)
- ✓ Discuss the system components and operation of the Programmable Logic Controllers (PLC) and apply the configuration of the SCADA systems
- ✓ Maintain control systems for rotating equipment and acquire knowledge on Process Safeguarding including safety instrumented systems (SIS), safety integrity level (SIL) and loop safety considerations
- ✓ Identify the various trends in flow calibration and apply meter proving

- ✓ Maintain field instruments, become acquainted with field communications and employ proper testing and commissioning of field instruments

### Training Designed for:

This course is intended for process control and instrumentation for process control engineers and supervisors, instrumentation and control system engineers, automation engineers, instrumentation engineers and technologists. Further, process engineers, electrical engineers and supervisors and those involved in the design, implementation and upgrading of industrial control systems will also benefit from the practical aspects of this course.

### Training Requirement:

"Hand's on practical sessions, equipment and software will be applied during the course if required and as per the client's request."

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client's learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

### Training Program:

#### DAY ONE:

- ❖ Introduction
  - Objectives of the course
- ❖ Introduction to Process Control
  - Control History
  - The Process of Control
  - Basic Measurement Definitions
  - P&ID Symbols
  - Control Loops
  - Typical Applications
- ❖ Pressure Measurement
  - Basic Principles
  - Definition of Terminology
  - Pressure Elements
  - Pressure Transducers
  - Installation Considerations
  - Summary
- ❖ Temperature Measurement
  - Principles
  - Thermocouples
  - RTD's
  - Thermistors Thermometer
  - Infra-Red Thermometry
  - Installation Considerations
- ❖ Level Measurement

- Main Types
- Sight Glass Method
- Buoyancy Tape Systems
- Hydrostatic Pressure
- Ultrasonic Measurement
- Radar Measurement
- Electrical Measurement
- Installation Considerations
- ❖ **Video Presentation**
  - Radar Level Measurement
- ❖ Recap

#### **DAY TWO:**

- ❖ **Flow Measurement**
  - Differential Pressure Flowmeters
  - Oscillatory Flow Measurement
  - Non-Intrusive Flowmeters
  - Mass Flow Meters
  - Positive Displacement Meters
  - Installation Considerations
  - Selection Guidelines
- ❖ **Video Presentation**
  - Coriolis Effect Mass Flowmeter
- ❖ **Control Valve Types**
  - Rotary
  - Linear
  - Control Valve Selection
- ❖ **Actuator Selection**
  - Introduction
  - Types of Actuators
  - Linear Actuators
  - Rotary Actuators
  - Actuator Forces
  - Positioners
  - Fail Safe Actuators
- ❖ **Process Considerations**
  - End Connections
  - Face to Face Criteria
  - Materials Selection
  - Modes of Failure
  - Leakage Rates
- ❖ **Practical Session Control**
  - Valve Sizing
- ❖ Recap

### DAY THREE:

- ❖ **Control Loop Strategies**
  - Introduction
  - Variables
  - Basic Elements
  - Manual Control
  - Feedback Control
  - System Responses
  - ON-OFF Control
  - Three Term Control
- ❖ **Video Presentation**
  - Three Term Control
- ❖ **Distributed Control Systems**
  - Introduction
  - Traditional Process Controllers
  - Three Term Control
  - Architecture of Controllers
  - Software
  - Programming
  - Execution Time
  - Programming vs. Configuration
  - Function Blocks
- ❖ **Video Presentation**
  - Distributed Control Systems
- ❖ **Programmable Logic Controllers**
  - Introduction
  - Today's Position
  - Principles of Operation
  - System Components
  - I/O Interfaces
  - Configuration
- ❖ **SCADA Systems**
  - Basic Definitions
  - Level of Hierarchy
  - Communication Systems
  - SCADA Configuration
- ❖ **Maintain Control Systems for Rotating Equipment**
- ❖ **Recap**

### DAY FOUR:

- ❖ **Safety Instrumented Systems (SIS)**
  - Introduction
  - Overview
  - Ensuring Safety
  - Layers of Safety

- Factors Affecting Safety
- Anatomy of a Disaster
- Disaster Prevention
- ❖ **Safety Integrity Level (SIL)**
  - Introduction
  - Definition
  - Selection Procedure
  - Practical Examples
- ❖ **Loop Safety Considerations**
  - Intrinsic Safety
  - Explosion-Proof
  - Approval Standards
  - Oxygen Service
- ❖ **Flow Calibration General**
  - Trends in Calibration
  - Types of Calibration Test Rigs
  - In-Situ Calibration
  - Turbine Meters
- ❖ **Meter Proving**
  - Practical Exercise
- ❖ Recap

#### DAY FIVE:

- ❖ **Field Communications**
  - Analogue Signals
  - Digital Communications
  - Fieldbus Technologies
  - Future Trends
- ❖ **Maintain Field Instruments**
  - Video Presentation
  - HART Protocol
- ❖ **Testing & Commissioning Field Instruments**
- ❖ **Case Studies**
  - Bhopal Gas Tragedy
  - Piper Alpha Disaster
  - Chernobyl Catastrophe
  - Buncefield Oil Depot Explosion
- ❖ **Video Presentation**
  - BP Texas City – Refinery Explosion
- ❖ **Addendums**
  - Valve Sizing Exercise
  - Choke Valves
  - Any Other Subjects
- ❖ Course Conclusion
- ❖ POST-ASSESSMENT and EVALUATION

## Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

## Training Certificate(s):

CMCT Internationally recognized certificate(s) will be issued to each participant who completed the course.

## Training Fees:

**TBA as per the course location** - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01<sup>st</sup> of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

## Training Timings:

### Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

### For training registrations or in-house enquiries, please contact:

Aisha Relativo - Training & Career Development Manager

[aisha@cmc-me.com](mailto:aisha@cmc-me.com) / [training@cmc-me.com](mailto:training@cmc-me.com)

Tel.: +971 2 665 3945 or +971 2 643 6653 | Mob.: +971 52 2954615