

# Training Brochure



## Module 1: Field Instrumentation for the Process Industry

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### Pre requisite

None

### Training Objectives

- Understanding of measurement principles
- Understanding of development of instrument specification
- Understanding criteria for selecting the right instrument

### Training Agenda:

- |   |   |
|---|---|
| <p>I. Introduction to Control Loop Stability</p> <ul style="list-style-type: none"><li>• Mission of a Process Plant</li><li>• Contribution of Field instrumentation</li><li>• P&amp;ID ANSI ISA S5.1</li><li>• Main process variables : Pressure, Level, Temperature and Flow</li></ul> <p>II. Specification and Selection of Field Instrument</p> <ul style="list-style-type: none"><li>• General Criteria<ul style="list-style-type: none"><li>• Process conditions: service and design conditions</li></ul></li><li>• Industrial environment: IP, ATEX, EMC, PED</li></ul> | <ul style="list-style-type: none"><li>• Metrological Performance<ul style="list-style-type: none"><li>• Vocabulary and Definitions</li><li>• Errors and type of Errors</li><li>• Calibration curve characteristics</li><li>• Response time</li></ul></li><li>• Others: MTBF, MTTR, TOC</li><li>• Conclusion</li></ul> <p>III. Introduction to Sensor Types</p> <ul style="list-style-type: none"><li>• Capacitive</li><li>• Resistive</li><li>• Piezo</li><li>• Magnetic</li><li>• Others</li></ul> |
|---|---|



**Length of course:**  
2 days



**Course location:**  
Worldwide



## Module 1: Field Instrumentation for the Process Industry

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### Training Agenda:

#### IV. Pressure Instrumentation

- Manometer (Torricelli, Bourdon)
- Membrane
- Differential Pressure
- Absolute Pressure
- Hook up principles
- Separators and Capillaries
- Calibration procedure

#### V. Level Instrumentation

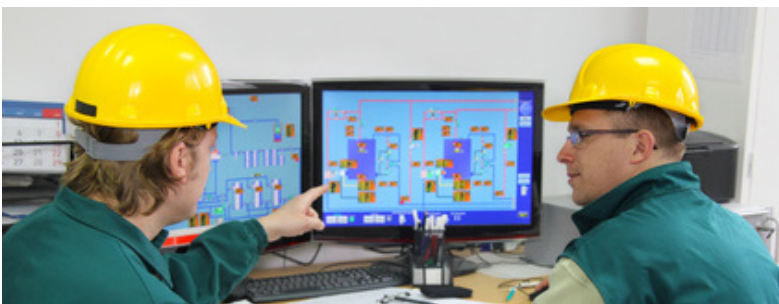
- Local instrument: level glass
- DP
- Float
- Displacement tube
- Capacitive
- Ultrasonic
- Radar
- Gamma Ray
- Load Cells
- Level switch
- Calibration procedure

#### VI. Temperature Instrumentation

- Thermometers
- PT100
- Thermocouple
- Thermowells
- Sources of errors
- Transmitters
- Calibration procedure

#### VII. Flow Instrumentation

- DP Cell
- Magnetic
- Vortex
- Turbine
- Ultrasonic
- Variable area
- Mass Flow
- Selection Guide
- Calibration Procedure



**Length of course:**  
2 days



**Course location:**  
Worldwide

## Module 2: Control Valves

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### Pre requisite

Field instrumentation module or good understanding of P&ID

### Training Objectives

- Understanding of the role of the control valve
- Understanding the limitation of control valves
- Understanding specification and selection procedure

### Training Agenda:

- I. Defining the problem: Why do we need a control valve?
- II. Type of valves
- III. Actuators
- IV. Defining and understanding CV
- V. Valve Characteristics
- VI. Noise, Cavitation and Choke Flow
- VII. Selection Procedure



**Length of course:**  
1 day



**Course location:**  
Worldwide

## Module 3: Fundamentals of Process Control

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### Pre requisite

Good understanding of P&ID

### Training Objectives

- Understanding of process dynamics
- Understanding regulatory control techniques
- Introduction to multivariable control

### Training Agenda:

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|--|---|
| I. Introduction to Control Loop Stability <ul style="list-style-type: none"><li>• Single capacitance process</li><li>• Gain and time constant</li><li>• Dead time process</li><li>• Multi capacitance process</li><li>• Transfer Function</li><li>• Basic components of a control loop</li></ul> | VI. Basic Control Techniques <ul style="list-style-type: none"><li>• ratio control</li><li>• split range control</li><li>• multiple split range control</li><li>• cascade control</li><li>• feed forward control</li><li>• selective and override control</li></ul> |
| II. Introduction to Feedback P&ID Controller   | VII. Examples of Basic Control  |
| III. Block Diagrams Approach   | VIII. Introduction to Advanced (Multivariable) Control <ul style="list-style-type: none"><li>• relative gain matrix</li><li>• decoupling of interacting loops</li></ul>   |
| IV. Experimental Determination of Process Dynamics   | IX. Application of Advanced Control to Distillation Columns   |
| V. Control Loop Stability and Control Performance  |   |



**Length of course:**  
2 days



**Course location:**  
Worldwide



## Module 4: PID Tuning

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### Pre requisite

Fundamentals of Process Control Module or good understanding P&ID and process dynamics

### Training Objectives

- Understanding of feedback control and role of P, I and D
- Understanding of process behaviour
- Understanding tuning principles and techniques

### Training Agenda:

- I. Introduction to feedback PID control
- II. Role of P, I and D
- III. Process Behaviour: Steady State or Integrative
- IV. Identification of the Process Response
- V. Tuning Techniques, Tuning Parameters and Control
- VI. Loop Performance
- VII. Application to Flow, Pressure and Level control
- VIII. Application to Temperature control
- IX. Improvements of Controllability
- X. re-ranging field instrumentation
- XI. linearization of process
- XII. cascade control and tuning of cascade loops anti-reset windup



**Length of course:**  
1 day



**Course location:**  
Worldwide

## Module 5: Advanced Regulatory Control Techniques

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### Pre requisite

Modules 3 and 4

### Training Objectives

- Development of Advanced Control Structures on the Client Process

### Training Agenda:

- To be developed jointly by CPC and Client on basis of case study



**Length of course:**  
2 or 3 days



**Course location:**  
Worldwide

## Module 6: Antisurge Control

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### Pre requisite

None

### Training Objectives

- Understanding centrifugal compressors performance curves
- Understanding the surge phenomena and how it is controlled
- Understanding how the Antisurge Controller Operates
- Understanding the Antisurge Control Valve
- Understanding centrifugal compressor integration for process control.

### Training Agenda:

- I. Introduction to Compressors
- II. Centrifugal compressors performance curves
- III. The Surge Phenomena
- IV. The Antisurge Control Map
- V. How to Control de Surge : The Anti-surge Controller
- VI. The Surge Detector
- VII. The Antisurge Control Valve
- VIII. Compressor integration in Process control
- IX. Safety interlocks and start-up/stop sequence
- X. Practical Case
- XI. Tips to Avoid Production Losses due to Issues Around ASC



**Length of course:**  
2 or 3 days



**Course location:**  
Worldwide



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