

**Training Title**

**Process Control & Instrumentation Training**

**Training Duration**

5 days

**Training Certificate**

Define Management Consultants Certificate of course completion will be issued to all attendees.

**Training Fees**

- 3300\$ per participant for Public Training

**WHO SHOULD ATTEND**

- Process Control Engineers and Supervisors
- Instrumentation and control system engineers
- Automation Engineers, Instrumentation Engineers and Technologists
- Process Engineers
- Electrical engineers and Supervisors
- Those involved in the design, implementation and upgrading of industrial control systems
- Shift Supervisors, Senior Operators & Operators

**OVERVIEW**

**COURSE DESCRIPTION**

More efficient control can only be achieved through better understanding of the problem and better measurement. However, the field of process control and Instrumentation is changing at a dramatic rate. Measurements and accuracies that would have been thought of as impossible to achieve are now commonplace. But unless applied correctly, huge resources can be wasted to no avail.

Process Control & Instrumentation is designed to provide engineers, technicians and supervisors with the basic theoretical and practical knowledge involved in the selection, application, installation and commissioning of industrial instrumentation, Troubleshooting, problem identifying and a practical understanding of the automatic

process loop and how this can be applied to optimize process control in terms of quality, safety, flexibility and costs.

### COURSE OBJECTIVES

This workshop to provide engineers and technicians with the basic theoretical and practical understanding of

- The impact of modern instrumentation
- The major technologies used in the measurement of temperature, pressure, level flow etc. Choose & Specify Instrumentation systems for pressure. Level, temperature and flow measurement.
- Evaluation and selection of the appropriate instrumentation systems
- Installation of process equipment correctly
- Identify different types of industrial analytical measuring instruments
- Procedures for testing and calibration of analytical instruments
- Troubleshoot and identify problems with instrumentation systems
- The fundamentals of process control engineering
- The effects of proportional, integral and derivative control and apply both open loop and closed loop tuning.
- The effect of different control algorithm on loop tuning
- The process loops and how this can be applied to optimize process control.

### TRAINING METHODOLOGY

This workshop provides an insight into modern closed loop control practices through an in-depth investigation into the four basic elements of any control system:

- The process;
- The process instrumentation
- The final control element
- The controller.

Making use of ISA approved simulation, participants will learn through active participation using exercises, questionnaires, and practical simulation sessions covering:

- Process calibration, span and zero
- Analyze such problems as valve hysteresis, stiction and non linearities and its impact on controllability

- **Troubleshooting**
- **Process reaction**
- **Tuning methods**

## Day 1

### Overview

#### Basic measurement concepts

- **Measurement terminology**
- **Measurements and Errors**
- **Performance related terms**

### Introduction to feedback control system

## Day 2

### Flow measurement

#### Flow measuring sensors types

Differential pressure flowmeters

Mechanical flowmeters

Electronic flowmeters

Mass flow-meters

Flow sensor selection

Accuracy versus Repeatability

### Temperature measurement

- **Basic principles**
- **Thermocouples**
- **Resistance thermometry**
- **Thermistors**
- **Radiation thermometry**

## Day 3

### Pressure measurement

- Basic principles
- Bourdon tubes
- Diaphragm elements
- Electrical displacement sensors

### Level measurement

- Basic principles
- Float systems
- Displacement systems
- Conductive level detection
- Ultrasonic level measurement
- Radar gauging

### Basic valve theory

- Bernoulli's equation
- Defining the valve flow coefficient,  $C_v$
- Choked flow
- Flashing and cavitation

### Valve types

- Control valve characterization
- Inherent characteristics
- Installed characteristic
- Characteristic profiling

### Valve testing and diagnostics

#### Basic process considerations

- Definition of terms
- Process lag, capacitance and resistance
- Process reaction curve
- 1st and 2nd order reactions

### Day 4

## **Fundamentals of Process Control**

- **ON/OFF control**
- **Proportional control**
- **Proportional offset**
- **Integral action**
- **Integral windup**
- **Stability**
- **Derivative action**
- **PID control**
- **Control algorithms**
- **Load disturbances and offset**

## **Fundamentals of Tuning**

- **Basic principles**
- **Open loop reaction curve method (Ziegler-Nichols)**
- **Default and typical settings**
- **Closed loop continuous cycling method (Ziegler-Nichols)**

## **Day 5**

### **Advanced Conventional Control:**

- **Feedforward control and its applications**
- **Cascade control system**
- **Override control**
- **Safety control**

### **Case Studies**

**NOTE: Last Day Assessment & Examinations will be carried out.**

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