Training Program:

Measurement & Control Appreciation

INTRODUCTION

This course consists of pressure, level, flow, temperature measurement, signal transmission techniques, process control concepts of Proportional, Integral, Derivative (P.I.D) and complex control.
To provide an appreciation of the operation and application of process plant instrumentation used for the measurement and display of the main process variables of pressure, level, flow and temperature.
Also provides an appreciation of the principles of industrial automatic process control and the practical application of these on process plant control systems.

WHO SHOULD ATTEND

This Intensive Ten-day instructional program covering the educational needs of Instrumentation and Control Engineers & Technicians, Plant Operators, Operation Engineers, Process and Utility Supervisors, Project Engineers & Technicians, and Suited to those personnel who require to be acquainted with the actual work carried out by instrument personnel and who are involved with instrumentation personnel on a daily basis. No specific prerequisite training or experience required for registration.

METHODOLOGY

This interactive Training will be highly interactive, with opportunities to advance your opinions and ideas and will include;

- Lectures
- Workshop & Work Presentation
- Case Studies and Practical Exercise
- Videos and General Discussions

CERTIFICATE

BTS attendance certificate will be issued to all attendees completing minimum of 80% of the total course duration.

COURSE OBJECTIVES

Participant will be able to:

- Describe the instruments basic elements of various measurement
- Understand the principles behind the methods of generating measurement signals related to process variable changes.
- Demonstrate a knowledge of pneumatic and electronic instruments used to transmit process variable measurement signals to displays.
- Calibrate a variety of instrumentation systems used to measure and display process variable changes.
- Apply the concepts and principles of process measurement to other process systems.
- Know how the elements of a process control loop are connected to make a control system.
- Understand the operation and application of control valves and valve positioners in a process control loop.
- Understand the generation of proportional, integral and derivative actions, modes of control and their practical applications.
- Understand and apply open and closed loop process control loop tuning techniques to demonstrate process plant systems.
- Describe the effects of changing controller settings to control the process response of a plant.

COURSE OUTLINE

Week One:

1) **Pressure Measurement**

- Pressure Measurement Principles, Units and Types.
- Liquid Head Devices (Manometers).
- Elastic Deformation Elements (Diagrams, Capsules, Bellows).
- Pressure Switches.
- Bourdon Tube Gauges ("C" type, Spiral, Helical, Compound and Duplex).
- Installation of Bourdon Tube Gauges.
- Pressure Calibration Standards (DWT, Venier Manometer and Standard Gauge).
- Calibration Procedures, Errors and Correction.

2) **Pneumatic Transmission Systems**

- Pneumatic Transmitter (Force Balance).
- Flapper and Nozzle Mechanism.
- Feedback Bellows and Pneumatic Relay Amplifier.

3) **3) Electronic Transmission Systems**

- Electronic Transmitter (Force Balance).
- Transmission Signal Converters (I to P and P to I).
- Electronic Display Devices.

4) Level Measurement

- Dipstick and Dip Tapes.
- Sight Glass.
- Hydrostatic Methods (Wet Leg and Dry Leg).
- Purged Dip Pipe Level Measurement Principle.

- Buoyancy Method (Floats and Displacer).
- Capacitor Methods.
- Ultrasonic Methods.
- Load Cells.

5) Flow Measurement

- Rate and Quantity of Flow.
- Laminar, Transient and Turbulent Flow.
- Quantity Displacement Meters.
- Constant Area, Variable Pressure Devices Constant Head, Variable Area Devices. Square Root Extraction.
- Inferential (Velocity) Flowmeters.
- Installation Practices.

6) Temperature Measurement

- Temperature Units and Scales.
- Liquid, Gas and Vapour Filled Systems.
- Bimetal Thermometers.

7) Electrical Methods of temperature Measurement

- Resistance Thermometers.
- The Wheatstone Bridge.
- Thermocouples.
- Reference Junction Compensation.
- Compensating and Extension Cable.
- The Potentiometric Measuring Circuit.

Week Two:
8) Control Valves and Actuators

- Spring and Diaphragm Actuators.
- Single and Double Port Valves.
- Control Valves Trims and Characteristics.

9) Control Valves Positioners

- Motion Balance Postitioner.
- Forced Balance Positioner.
- Setting Up Valve Positioners.

10) Closed Loop Control

- The Elements of a Control Loop.
- Process Control Terms.
- Principles or the Feedback Loop Controller Actions.
- Control Loop Stability.

11) Modes of Control

- On/Off (2-Step) Control.
- Proportional Action.
- Proportional Control.
- Integral Action.
- P+I Control.
- Derivative Action.
- P+I+D Control.

12) Tuning Control Systems

- Ultimate Sensitivity Method.
- Damped Oscillation Method.
- Reaction Rate Method.

13) Complex Control

- Cascade Control.
- Ratio Control.