



PROCESS CONTROL and Instrumentation

Course Introduction:

The control of processes in today's oil, gas and chemicals industries requires accurate knowledge of process conditions and this in turn means accurate measurement of those conditions. Without measurement there can be no control and no information as to the state of the process.

A greater understanding of the measuring equipment and the instruments can improve the performance of the operator and this in turn will improve plant performance. Better knowledge of how equipment is selected and how it is constructed and how it works also helps an operator to identify the cause of problems and prevent there

Recurrence, Hence, the economic benefits of properly trained and informed operators can be readily quantified.

Course Objectives:

Participants attending this program will be able to:

- Specify and design instrumentation systems for pressure, level, temperature and flow.
- Identify a large number of industrial analytical measuring instruments.
- Describe the construction and operation of the most important analytical instruments.
- Be able to conduct the following types of measurement; pH, conductivity, turbidity, hygrometry, dissolved oxygen, total free chlorine and on-line chromatography.
- Implement procedures for testing and calibration of analytical instruments.
- Correctly select and size control valves for any particular application.
- Troubleshoot and identify problems with instrumentation systems.
- Isolate control loops and identify a faulty instrument.

Who should attend?

All those working on process plants who are familiar with the general purpose of process measuring instruments and control equipment. This will include process operators and trainee instrument technicians and engineers on all types of oil, gas and chemical plants.

This short intensive course is aimed at operators, technicians and engineers who are currently employed in these industries and require further information on the equipment that they will use.

The course will also be of benefit to plant and laboratory personnel who are required to work closely with plant personnel and therefore should have an understanding of the types of process instruments used and any associated limitations.

Course Outline:

Pre-Test

INTRODUCTION TO PROCESS MEASUREMENT

- Basic measurement concepts
- Measuring instruments.
- Introduction to control valves.
- Pressure, level, temperature and flow principles.

PRESSURE MEASUREMENT

- Principles of pressure measurement
- Units of pressure.
- Pressure measuring transducer
- Installation considerations
- A pressure control loop (block diagram)
- Practical work (simulation software)

LEVEL MEASUREMENT

- Principles of level measurement
- Sight glasses and tape measuring systems.
- Hydrostatic pressure for level measurement
- Ultra-sonic level measuring techniques.
- Measurement of density
- Installation considerations.
- Level control loop (block diagram)
- Practical work (simulation software)

TEMPERATURE MEASUREMENT

- Principles of temperature measurement
- Thermocouples and thermocouple tables.

- Resistance temperature detectors (RTDs)
- Thermometers, liquid in glass, filled and bi-metallic strip.
- Pyrometers.
- Installation considerations.
- Temperature control loop (block diagram)

FLOW MEASUREMENT

- Principles of flow measurement.
- Mass flow measuring instruments
- Positive displacement measuring instruments.
- Oscillatory flow measurement
- Flow measurement for custody transfer or fiscal purposes.
- Future developments.

CONTROL VALVES

- Principles of control valves
- Types of control valves Globe, butterfly, ball and cage vales.
- Control valve flow characteristics.
- Noise and cavitation in control valves.
- Actuators and positioners.
- Valve testing (stroke testing).
- Mounting a positioner and calibrating (procedure)
- Future developments
- Practical work (simulation software)

PROCESS CONSIDERATIONS

- Transmitters for each of the process variables
- Smart transmitters
- Testing a control loop for each of the process variables.
- Practical work (workshop)

TRANSMISSION OF MEASUREMENT SIGNALS

- Concept of a loop and feedback system.
- The 3 – 15 psi control loop
- The 4 – 20 mA control loop
- Digital transmission
- The control room

BASIC CONTROL CONCEPTS

- Manual control
- Feedback control and feed forward control
- Simple on-off control

- On-off control with a differential gap
- Proportional control
- Integral control
- Proportional plus integral control
- Derivative control
- Proportional plus integral plus derivative control
- Tuning a control loop
- The quarter wave decay reaction method
- Ziegler Nichols method (ultimate proportional band and ultimate gain)
- Stability of a control system

COMPLEX CONTROL SYSTEMS

- Cascade control
- Ratio control
- Split range control
- Adaptive control
- Tuning a cascade control loop
- Tuning a ratio control loop

COMPUTER CONTROL SYSTEMS

- Analogue signals
- Digital signals
- Direct digital control
- Analogue/digital conversion
- Digital/analogue conversion
- The distributed control system (DCS)
- The "control cell".
- The Programmable logic controller

NETWORKS

- Network topologies
- Ring, star and multi-drop networks
- Collision detection and avoidance
- Token passing network
- RS-232 C
- Fieldbus protocol
- Modbus protocol

Post Test

Course Certificate:

International Center for Training & Development (ICTD) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Methodology:

A variety of methodologies will be used during the course that includes:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionnaires
- Group Work
- Discussion
- Presentation

Course Timings:

Daily Course Timings:

08:00 - 08:20	Morning Coffee/Tea
08:20 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:30	Recess (Prayer Break & Lunch)
13:30 - 15:00	Last Session