ADVANCED INSTRUMENTATION
FLOW, TEMP, PRESSURE & LEVEL

IPC016

COURSE DESCRIPTION

The control of processes in oil, gas and chemicals industries requires accurate knowledge of process conditions and this 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 them.

COURSE GOAL

To enhance the participants' knowledge, skills, and abilities necessary for a better understanding of the advanced control instrument and the problems related to their use.

COURSE OBJECTIVES

By the end of this course the participant will be able to:

- Know the main types of instruments and their working principle.
- Understand the working principle of the different types of control loops.
- Know the typical DCS architecture and the typical Safety System layout.
- Specify and design instrumentation systems for pressure, level, temperature and flow.
- 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 CAN BENEFIT

- Process operators and trainee instrument technicians and engineers on all types of oil, gas and chemical plants.
- Operators, technicians and engineers who are currently employed in these industries and require further information on the equipment that they will use.

COURSE DURATION

5 working Days

COURSE OUTLINE

1. The Control Loop
    - Function and constitution of control loops and on/off control systems.
    - Pneumatic, electrical and digital control loops.
    - Power supply, signal transmission (tubes, cables, bus, optical fibers, ...) and conversion.
    - Tags and symbols.
2. Sensors: Accuracy and tuning of measuring devices
    - Temperature measurement.
        - Temperature scales.
        - Non-electrical thermometers.
        - Electrical measuring devices.
    - Pressure measurement:
        - Measurement units.
        - Devices for local reading or for transmission.
        - Pressure gauge installation.
    - Flow measurement:
        - Measurement units.
        - Head meters.
        - Other principles and devices.
            - Electromagnetic and ultrasonic meters.
            - Vortex effect.
            - Coriolis effect.
    - Level measurement.
        - Level glass.
        - Float-actuated.
        - Displacer devices.
    - Other principles and devices.
        - Radioactive.
        - Capacitance.
        - Ultrasonic.
        - Radar devices.
        - Differential pressure cells.
    - Safety Devices.
        - Two-position sensors.

- Position sensors.
- Temperature.
- Pressure.

3. Transmitters

- Pneumatic transmitters.
  - Transformation of force into a pneumatic signal and amplification.
  - Technology and transmitter tuning.
  - Operation of the sensor-transmitter combination.
- Electric and electronic transmitters.
  - Operating principle of strength equilibrium and displacement transmitters.
- Digital and programmable transmitters.

4. Control Valves

- Linear displacement valves.
  - Technology.
  - Different plug types.
  - Characteristic curves (linear, exponential and quick opening).
  - Safety position (AO, AC, FC, FO...).
- Positioners.
  - Operating principle.
  - Types (pneumatic, electro pneumatic, ...).
- Other types of control valves:
  - Simple and double seat valves.
  - Cage valves.
  - "Camflex" type valves.
  - Tree-way valves.
- On/off sensors.
  - Position sensors.
  - Electro-valves.
- Safety valves.
  - Types.
  - Simple and double actuators.

5. Control Loop Implementation

- Simple, override, and split-range loops.
- Fractionation, calculated variable, feedforward control systems.

6. Distributed Control System (DCS)

7. Safety System Layout

- Network architecture and constitution – Examples.
- Emergency Shut-Down (ESD) systems.
  - Role.
  - Examples of typical architectures.
- Fire and gas system.
  - Role.
  - Typical arrangements.
- High Integrity Pressure Protection Systems (HIPPS).
  - Role.
  - Specificities.
  - Typical arrangements.