

INSTRUMENTATION FOR OPERATORS (REF:OTSIOPO01)

Course Objectives

To gain an understanding of the measuring equipment.

Course Description

The control of processes in today's oil and gas industry requires accurate knowledge of process conditions. Without measurement there can be no control and no information as to the state of the process. This course acts as the interface between operations and maintenance staff.

Better knowledge of how equipment is selected and how it is constructed and how it functions will help an operator to identify the causes of problems and prevent their recurrence. Hence the economic benefits of properly trained and informed production staff can be easily justified.

The course takes a look at measurement systems from the advanced level. We first look at each of the process variables and then introduce the delegate to methods employed to control each of these variables. This includes basic PID control, ratio and cascade control. Furthermore, a brief mention is made of the enhancements in control by the introduction of computerised control systems. Topics such as feed forward and adaptive control methods are discussed.

Who Should Attend

This course is targeted at electrical technicians.

Pre-Requisites

All Attendees should have a sound power generation and electrical background.

Course Outcome

At the end of this course you will be able to understand instrumentation measurement.

Course Outline

Day 1

Introduction to Process Measurement

Basic measurement concepts
Measuring instruments

The Pressure Variable

Principles of pressure measurement
Units of pressure
Pressure measuring transducers
Installation considerations
A pressure control loop

Level Measurements

Principles of level measurement
Primary level measurement instruments
Hydrostatic pressure level measurements
Ultrasonic level detection and measurement
Microwave level measurement
Electromechanical level detection and measurement
Capacitive and conductive level measurements
Vibrating level detection
Safety aspects in level measurements
Level control loop

Temperature Measurement

Principles of temperature measurement
Thermocouple theory and practice
Different thermocouple types
Terminating the thermocouple
External reference junction techniques
Thermocouple response times
Surface temperature measurement
Resistance thermometer theory and practice



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Adoption of the Pt100 thermometer
Resistance thermometer practice
RTD installation and application
Thermowells fittings and terminations
Temperature calibration
Temperature control loop (P+I+D controller)
Transmitters and instrumentation

Day 2

Flow Measurement

Basic properties of fluid
Positive displacement meters
Inferential meters
Oscillatory flow meters
Differential pressure meters
Electromagnetic flow meters
Ultrasonic flow meters
Mass flow meters
The Coriolis effect
A Coriolis mass flow meter

Day 3

Flow Measurement

Transmitters for process variables
The smart transmitter
The added attraction of smart transmitters
Asset management and proactive maintenance schedules
The concept of feedback in a measuring system
The measurement signal (3 – 15 psi, 4 – 20 mA)
Digital signals and the fieldbus system

Basic Control Concepts

Manual control
Feedback control
Simple on-off control
On-off control, introduction of 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 ratio
Process reaction curve method of loop tuning
The ultimate method of loop tuning
The trial and error method of loop tuning

Day 4

Complex Control Systems

Cascade control system
Ratio control
Split range control
Feedback and Feedforward control
Adaptive control
Computer Control Systems
The evolution of digital control
Digital signals
Direct digital control
The distributed control system (DCS)
The field control system (a truly distributed control system)

Course Review and Feedback

