

➤ Brief Description

This workshop and accompanying manual is intended for engineers and technicians who need to have a practical knowledge for selecting and implementing industrial instrumentation and control systems. It can be argued that a clear understanding and application of the instrumentation and control systems is the most important factor in an efficient and successful control system.

The objectives of the workshop and manual are for you to be able to:

- ✚ Specify and design instrumentation and control systems.
- ✚ Correctly select and size control systems for industrial use.
- ✚ Understand the problems with installing measurement equipment.
- ✚ Troubleshoot instrumentation systems and control systems.
- ✚ Isolate and rectify instrumentation faults.
- ✚ Understand most of the major technologies used for instrumentation and control systems.
- ✚ Understand and design of P&ID systems.
- ✚ Understand and configuration of Variable frequency drives according to the application requirement
- ✚ Understand Electrical components symbols and P&ID symbols.
- ✚ Design and interpretation of Electrical Drafting standards like JIC, IEC, GB, IEEE etc.
- ✚ Practical of measurements systems i.e. Pressure, temperature, Level, flowmeters and control valves.

Course Documentation

- ✚ Training material documents (Hard form at the time of registration)
- ✚ Course Exercises

- ✚ Post Course open Book test

➤ Software installation and Setup

- ✚ ACAD Electrical
- ✚ VFD drives configuration tools
- ✚ PLCs and SCADA software's for measurement systems

➤ Course Equipment

- ✚ PLC and VFD based three phase motor training Kit.
- ✚ Pressure transducer, Flowmeter, PT 100 and Temperature controller Kit.
- ✚ Control valves Kit.

Course Contents

➤ Introduction to I&C

This chapter gives an overview of basic measurement terms and concepts. A review is given of process and instrumentation diagram symbols and places instrumentation and valves in the context of a complete control system.

- ✚ Basic Measurement and Control Concepts
- ✚ Basic Measurement Performance Terms and Specifications:
 - Accuracy
 - Range of Operation
 - Budget/Cost
 - Hysteresis
 - Linearity
 - Repeatability
 - Response
 - Calibrate
 - Closed loop
 - Coefficient, temperature
 - Controller

➤ P&ID (Piping and Instrumentation Diagram)


- ✚ P&ID (Piping and Instrumentation Diagram) Symbols

- ✚ Instrumentation Line Symbols
- ✚ Letter codes and balloon symbols
- ✚ Instrument representation on flow diagrams
- ✚ Typical Applications and exercises
 - HVAC (Heating, ventilation and air conditioning) Applications
 - Power Industry
- **Three Phase motor control**
 - ✚ Soft starting, Star/Delta starting
 - ✚ Changing direction of Three phase motors
 - ✚ Magnetic contactors and relays
- **Pressure Measurement**
 - ✚ Principles of Pressure Measurement
 - ✚ Absolute, Gauge and Differential Pressure
 - ✚ Pressure transducers and elements – Mechanical
 - ✚ Pressure Transducers and Elements – Electrical
 - Pressure transducer outputs and supply inputs
 - Measurement tools and controllers
 - Measurement systems resolutions
 - Calibration of the pressure transducer
- **Level Measurement**
 - ✚ Principles of Level Measurement
 - ✚ Simple Sight Glasses and Gauging Rod
 - ✚ Float and Tape Systems
 - ✚ Hydrostatic Pressure and differential pressure method of level measurement
 - ✚ Level measurement – Electrical
 - Level meter outputs and supply inputs
- Measurement tools and controllers
 - Measurement systems resolutions
 - Calibration of the Level sensors
- **Temperature Measurement**
 - ✚ Principles of Temperature Measurement
 - ✚ Thermocouples
 - ✚ Orientation Table for Temperature Sensors
 - ✚ Resistance Temperature Detectors (RTD's)
 - PT100
 - PT1000
 - ✚ Thermistors
 - ✚ Temperature measurement
 - TC and PT100 sensor outputs and supply inputs
 - Measurement tools and controllers
 - Measurement systems resolutions
 - Calibration of the TC and PT100 sensors
 - ✚ Temperature measurement using PLCs and Temperature controllers
- **Variable Frequency Drive (VFD)**
 - ✚ Variable Frequency Drives (VFD) Basics
 - ✚ Motor and drive basics
 - ✚ How speed of three phase motor is adjusted
 - ✚ Pump and fan affinity laws and how they apply to energy savings
 - ✚ Installation and startup of a drive and the basic programming of the parameters required to get a drive functioning.
- **Control Valves**
 - ✚ Principles of Control Valves
 - ✚ Control Valve Selection and Sizing
 - ✚ Actuators and Positioners Operation


 Solenoid

➤ **Future Technologies**

 Smart Valves

 The New Smart Instrument and FieldBus

- Intelligent Digital microprocessor based sensor
- Digital data communications capability

 Highway Addressable Remote Transducer Protocol (HART)

 FieldBus