COURSE OVERVIEW IE0751
Field Instrumentation and Control Philosophy (E-Learning Module)

Course Title
Field Instrumentation and Control Philosophy (E-Learning Module)

Course Reference
IE0751

Course Format & Compatibility
SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration
30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description

This E-learning course is designed to provide participants with a detailed and up-to-date overview of field instrumentation and control philosophy. It covers the accuracy, range of operations, hysteresis, linearity and repeatability; the P&ID symbols and application of instruments and control valves in the overall control system; the basic control concepts and control theory covering variables involved, controlled quantities, manipulated quantities, disturbances and elements of a process control system; the process, measurement, evaluation, control, typical manual control and feedback control; the conversion table of the most commonly used units; and the typical bourdon springs and C-bourdon tube including its advantages and disadvantages.

During this course, participants will learn the spring, bellows, diaphragm elements, strain gauges and wheatstone circuit for strain gauges; the advantages and disadvantages of piezoelectric; the capacitance of pressure transducers; the location of process conditions, isolation valves, test and drain valves, sensor construction and pressure flanges; the level measurement, various configuration of tank farms, wire guided systems and typical applications; the various types of control valves including its characteristics and applications; and the digital and analogue field communications and safety considerations.

Course Objectives

Upon the successful completion of this course, participants will be able to:-

- Apply and gain an in-depth knowledge on field instrumentation and control philosophy
- Determine accuracy, range of operations, hysteresis, linearity, repeatability and response
- Recognize P&ID symbols and the application of instruments and control valves in the overall control system
- Discuss the basic control concepts and theory covering variables involved, controlled quantities, manipulated quantities, disturbances and elements of a process control system
- Employ process, measurement, evaluation, control, typical manual control and feedback control
- Review the conversion table of the most commonly used units as well as recognize the typical bourdon springs and C-bourdon tube including its advantages and disadvantages
- Identify the spring, bellows and diaphragm elements including strain gauges and wheatstone circuit for strain gauges
- Determine vibrating wire and explain the advantages and disadvantages of piezoelectric
- Describe the capacitance of pressure transducers and capacitance D.P. meter body
- Identify location of process conditions as well as isolation valves, test and drain valves, sensor construction and pressure flanges
- Employ level measurement and various configuration of tank farms, wire guided systems and typical applications
- Carryout temperature, flow and smart field measurements
- Recognize various types of control valves including its characteristics and applications
- Differentiate digital and analogue field communications as well as implement safety considerations

Who Should Attend

This course provides an overview of all significant aspects and considerations of field instrumentation and control philosophy for process control engineers and supervisors, instrumentation and control system engineers, automation engineers, instrumentation engineers and technologists, process engineers, electrical engineers and supervisors.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 1-2013 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 1-2013 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Association for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Fee

As per proposal

Course Contents

- Theory & Application - Basic Measurement Definitions
- Theory & Application - Basic Measurement Definitions (Accuracy)
- Theory & Application - Basic Measurement Definitions (Accuracy can be Expressed as any of the Following)
- Theory & Application - Basic Measurement Definitions (Range of Operations)
- Theory & Application - Basic Measurement Definitions (Hysteresis)
- Theory & Application - Basic Measurement Definitions (Linearity)
- Theory & Application - Basic Measurement Definitions (Repeatability)
- Theory & Application - Basic Measurement Definitions (Response)
- Theory & Application - P&ID Symbols
- Theory & Application - Applications
- Theory & Application - Applications (Instruments and Control Valves in the Overall Control System)
- Theory & Application – Basic Control Concepts
- Theory & Application – Basic Control Theory
- Theory & Application – Basic Control Theory (Variables Involved)
- Theory & Application – Basic Control Theory (Controlled Quantities)
- Theory & Application – Basic Control Theory (Manipulated Quantities)

- Theory & Application – Basic Control Theory (Disturbances)
- Theory & Application – Basic Control Theory (Elements of a Process Control System)
- Theory & Application – Basic Control Theory (Process)
- Theory & Application – Basic Control Theory (Measurement)
- Theory & Application – Basic Control Theory (Evaluation)
- Theory & Application – Basic Control Theory (Control)
- Theory & Application – Basic Control Theory (Typical Manual Control)
- Theory & Application – Basic Control Theory (Feedback Control)
- Theory & Application – Basic Control Theory (Feedback Control Concept)
- Pressure Measurement
- Pressure Measurement – Basic Principles
- Pressure Measurement – Pressure Sources
- Pressure Measurement – Definition of Terminology
- Pressure Measurement – Definition of Terminology (Conversion Table of the Most Commonly Used Units)
- Pressure Measurement – Pressure Elements (Typical Bourdon Springs)
- Pressure Measurement – Pressure Elements (C-Bourdon Tube)
- Pressure Measurement – Pressure Elements (C-Bourdon Tube Advantages)
- Pressure Measurement – Pressure Elements (C-Bourdon Tube Disadvantages)
- Pressure Measurement – Pressure Elements (Spring & Bellows Elements)
- Pressure Measurement – Pressure Elements (Diaphragm, Bellows and Piston)
- Pressure Measurement – Pressure Elements (Advantages - Spring/Bellows)
- Pressure Measurement – Pressure Elements (Disadvantages - Spring/Bellows)
- Pressure Measurement – Pressure Elements (Application Limitations)
- Pressure Measurement – Pressure Elements (Diaphragm Element, Diaphragm Sensors, Simple Corrugated Diaphragm)
- Pressure Measurement – Pressure Elements (Advantages – Diaphragm)
- Pressure Measurement – Pressure Transducers
- Pressure Measurement – Pressure Transducers (Strain Gauges)
- Pressure Measurement – Pressure Transducers (Wheatstone Circuit for Strain Gauges)
- Pressure Measurement – Pressure Transducers (Strain Gauges Typical Application)
- Pressure Measurement – Pressure Transducers (Vibrating Wire)
- Pressure Measurement – Pressure Transducers (Piezoelectric)

- Pressure Measurement – Pressure Transducers (Piezoelectric - Advantages)
- Pressure Measurement – Pressure Transducers (Piezoelectric - Disadvantages)
- Pressure Measurement – Pressure Transducers (Capacitance)
- Pressure Measurement – Pressure Transducers (Capacitance, Illustration of a Capacitance D.P. Meter Body)
- Pressure Measurement – Pressure Transducers (Capacitance, Diagram of a Capacitance D.P. Meter Body)
- Pressure Measurement – Installation Considerations
- Pressure Measurement – Installation Considerations (Location of Process Conditions)
- Pressure Measurement – Installation Considerations (Isolation Valves)
- Pressure Measurement – Installation Considerations (Impulse Tubing)
- Pressure Measurement – Installation Considerations (Test & Drain Valves)
- Pressure Measurement – Installation Considerations (Sensor Construction)
- Pressure Measurement – Installation Considerations (Temperature Effects)
- Pressure Measurement – Installation Considerations (Process Flanges)
- Future Technologies
- Level Measurement
- Level Measurement – Main Types (Tank Farms Contain Various Configurations)
- Level Measurement – Main Types (Continuous Measurement, Point Detection)
- Level Measurement – Buoyancy Tape Systems
- Level Measurement – Buoyancy Tape Systems (Wire Guided Systems)
- Level Measurement – Buoyancy Tape Systems (Typical Applications)
- Level Measurement – Buoyancy Tape Systems (Advantages, Disadvantages)
- Level Measurement – Hydrostatic Pressure
- Level Measurement – Hydrostatic Pressure (Static Pressure, level Measurement with Differential Pressure)
- Level Measurement – Hydrostatic Pressure (Advantages, Disadvantages)
- Level Measurement – Hydrostatic Pressure (Application Limitations)
- Level Measurement – Hydrostatic Pressure (Changing Product Density, Different Vessel Shapes)
- Level Measurement – Hydrostatic Pressure (Volume Measurement: Entering a Characteristic Curve)
- Level Measurement – Hydrostatic Pressure (Differential Pressure, Level Measurement with Differential Pressure)
- Level Measurement – Hydrostatic Pressure (Differential Pressure: Installation Techniques, DP for Filters)

- Level Measurement – Hydrostatic Pressure (Load-Cell Measurement: Installation Techniques)
- Level Measurement – Ultrasonic Level Measurement
- Radar Level Measurement – Radar Measurement
- Radar Level Measurement – Radar Measurement (Main Types of Antenna)
- Level Measurement – Vibrating Switches
- Level Measurement – Radiation level Measurement (Basic Principles)
- Level Measurement – Radiation level Measurement (Continuous Level Measurement)
- Level Measurement – Radiation level Measurement (Source Sizing, Advantages, Disadvantages, Application Limitations)
- Level Measurement – Electrical Level Measurement
- Level Measurement – Radiation Level Measurement (Conductive)
- Level Measurement – Radiation Level Measurement (Conductive Level Detectors Selection & Sizing)
- Level Measurement – Radiation Level Measurement (Conductive Level Detectors Advantages & Disadvantages)
- Level Measurement – Radiation Level Measurement (Capacitive Level Measurement)
- Level Measurement – Radiation Level Measurement (Capacitive Level Measurement Selection & Sizing)
- Level Measurement – Radiation Level Measurement (Installation Techniques)
- Level Measurement – Radiation Level Measurement (Installation Techniques, Advantages, Disadvantages)
- Installation Considerations – Typical Tank Level Installations
- Level Measurement – Installation Considerations
- Level Measurement – Impact on Overall Loop
- Level Measurement – Installation Considerations (D.P Level Transmitters – Installation Examples)
- Level Measurement – Installation Considerations (Conductive Level Detectors – Installation Examples)
- Level Measurement – Future Technologies
- Temperature Measurement
- Temperature Measurement – Principles
- Temperature Measurement – Thermocouples
- Temperature Measurement – Thermocouples (External Reference Junction)
- Temperature Measurement – Thermocouples (Extension & Compensating Cable)

- Temperature Measurement – Thermocouples (Averaging Temperatures)
- Temperature Measurement – Thermocouples (Two T/C's to Measure Temperature Differential)
- Temperature Measurement – Thermocouples (Construction)
- Temperature Measurement – Thermocouples (Installation Techniques)
- Temperature Measurement – Thermocouples (Application Details)
- Temperature Measurement – Thermocouples (Typical Thermal Well Installation)
- Temperature Measurement – Thermocouples (Typical Application)
- Temperature Measurement – Thermocouples (Advantages)
- Temperature Measurement – Thermocouples (Application Limitations)
- Temperature Measurement – Thermocouples (Detection of Thermocouple Faults)
- Temperature Measurement – Thermocouples (Thermocouple Voltage Curves)
- Temperature Measurement – Thermocouples (Change of Measurement from 0 to 20 Degrees
- Temperature Measurement – Resistance Temperature Detectors (Overview)
- Temperature Measurement – Resistance Temperature Detectors (Typical RTD and Thermowell Construction)
- Temperature Measurement – Resistance Temperature Detectors (Two Main Types)
- Temperature Measurement – Resistance Temperature Detectors (Null Balance Bridge Type Two Wire RTD Installation in a Balanced Situation)
- Temperature Measurement – Resistance Temperature Detectors (Null Balance Bridge Type Two Wire RTD Installation Where DVM Reads V0)
- Temperature Measurement – Resistance Temperature Detectors (Three Wire Null-Balance Bridge)
- Temperature Measurement – Resistance Temperature Detectors (Typical Applications)
- Temperature Measurement – Resistance Temperature Detectors (Advantages, Disadvantages)
- Temperature Measurement – Resistance Temperature Detectors (Comparative Transfer Curves)
- Temperature Measurement - Thermistors
- Temperature Measurement – Thermistors (Hand Held Thermometer)
- Temperature Measurement – Non-Contact Measurement
- Temperature Measurement – Non-Contact Measurement (Infra-Red Measurement)
- Temperature Measurement – Radiation Pyrometry (Non-Contact Pyrometers)

- Temperature Measurement – Installation Considerations
- Temperature Measurement – Installation Considerations (Protect Thermocouple Signal)
- Temperature Measurement – Impact on the Overall Loop
- Temperature Measurement – Future Technologies
- Flow Measurement
- Principles of Flow Measurement
- Flow Measurement - Differential Pressure Flow Measurement
- Flow Measurement – Basic Flow Theory (Bernoulli's Theorem)
- Flow Measurement – Differential Pressure Flowmeters (Basis of Operation)
- Flow Measurement – Basic Principles (Vena Contracta)
- Flow Measurement – Differential Pressure Flowmeters (Orifice Types)
- Flow Measurement – Differential Pressure Flowmeters (Orifice Plate Advantages & Disadvantages)
- Flow Measurement – Differential Pressure Flowmeters (Orifice Plate Application Limitations)
- Flow Measurement – Differential Pressure Flowmeters (Pitot Tube)
- Flow Measurement – Differential Pressure Flowmeters (Pitot Tube Advantages & Disadvantages)
- Flow Measurement – Differential Pressure Flowmeters (Multiport "Annubar" Pitot Averaging System)
- Flow Measurement – Differential Pressure Flowmeters (Multi-port Averaging Pitot)
- Flow Measurement – Differential Pressure Flowmeters (Multi-port Averaging Pitot Advantages & Disadvantages)
- Flow Measurement – Differential Pressure Flowmeters (Secondary Element)
- Flow Measurement – Oscillatory Flow Measurement
- Flow Measurement – Oscillatory Flow Measurement (Selection & Sizing)
- Flow Measurement – Oscillatory Flow Measurement (Advantages & Disadvantages)
- Flow Measurement – Oscillatory Flow Measurement (Vortex Flowmeters)
- Flow Measurement – Oscillatory Flow Measurement (Vortex Flowmeters Advantages & Disadvantages)
- Non-Intrusive Flow Measurement – Non-Intrusive Measurement (Main Types)
- Flow Measurement – Non-Intrusive Measurement (Magnetic Flow Measurement, Diagram of a Magnetic Flowmeter)
- Flow Measurement – Non-Intrusive Measurement (Basis of Operation)

- Flow Measurement – Non-Intrusive Measurement (Principle of a Magnetic Flowmeter)
- Flow Measurement – Non-Intrusive Measurement (General)
- Flow Measurement – Non-Intrusive Measurement (Selection & Sizing)
- Flow Measurement – Non-Intrusive Measurement (Selection & Sizing, Liners)
- Flow Measurement – Non-Intrusive Measurement (Selection & Sizing, Liners Advantages & Disadvantages)
- Flow Measurement – Non-Intrusive Measurement (Ultrasonic Flow, Clamp-on Ultrasonic Flowmeter)
- Flow Measurement – Non-Intrusive Measurement (Ultrasonic Flow Transit Time, Transit Time Measurement)
- Non-Intrusive Measurement – Transit Time (Installation Techniques, Application Limitations)
- Non-Intrusive Measurement – Doppler Effect
- Non-Intrusive Measurement – Application Limitations
- Mass Flow Measurement – Mass Flow (General)
- Flow Measurement – Mass Flow (Coriolis Effect)
- Flow Measurement – Mass Flow (Coriolis Effect – Straight Through Meter)
- Mass Flow – Coriolis Effect (Basic Principle of Straight Through Pipe
- Flow Measurement – Mass Flow (Coriolis Effect Advantages & Disadvantages)
- Positive Displacement Flow Measurement – Positive Displacement (General)
- Flow Measurement – Positive Displacement (Rotary Vane)
- Flow Measurement – Positive Displacement (Rotating Vane Meter)
- Flow Measurement – Positive Displacement (Rotating Vane Meter – Lobe Impeller)
- Flow Measurement – Positive Displacement (Lobed Impeller Advantages & Disadvantages)
- Flow Measurement – Positive Displacement (Oval Gear Meters)
- Flow Measurement – Positive Displacement (Summary, Advantages, Disadvantages)
- Flow Measurement – Installation Considerations (General, Installation Techniques)
- Installation Considerations – Straight Pipe-Run Arrangements, Flow Meter Remains Full
- Selection Guidelines – Flowmeter Selection Process
- Types of Control Valves
- Control Valve Types – Main Types

- Control Valve Types – Rotary Valves
- Control Valve Types – Butterfly Valves
- Control Valve Types – Butterfly Valves (Standard)
- Control Valve Types – Butterfly Valves (Fish Tail Disc)
- Control Valve Types – Eccentric Disk Valves
- Control Valve Types – Eccentric Disk Valves (High Performance Butterfly Valves)
- Control Valve Types – Eccentric Disk Butterfly Valves
- Control Valve Types – Eccentric Rotary Plug Valves
- Control Valve Types – Rotary Plug Valves
- Control Valve Types – Ball Types
- Control Valve Types – Plug Valves
- Control Valve Types – Linear Valves
- Control Valve Types – Globe Valves
- Control Valve Types – Hygiene Applications
- Control Valve Types – Diaphragm Valves
- Control Valve Types – Pinch Valves
- Control Valve Types – Application Comparisons
- Control Valve Types – Leakage Rates
- Control Valve Types – Valve Characteristics
- Control Valve Types – Cage Guided Globe
- Control Valve Types – Valve Characteristics (Selection of Characteristic)
- Control Valve Types – Application Example
- Control Valve Types – Turndown/Rangeability
- Analogue Field Communications
- Analogue Field Communications – Transmitter Classifications
- Analogue Field Communications – Intrinsic Safety
- Analogue Field Communications – HART and 4 –20 mA
- Analogue Field Communications – Driving the Circuit
- Smart Field Measurement
- Smart DP Transmitter - Smart Sensor Basics
- Smart Field Measurement - A Smart Transmitter
- Smart Field Measurement - Rosemount 3051 DP Transmitter with Coplanar Connections
- Smart Field Measurement – Brief Specification

- Smart Field Measurement – Dimensional Drawing of a DP Transmitter
- Smart Field Measurement – Overview – Block Diagram of Operation
- Smart Field Measurement – A Typical DP Transmitter Meter Body
- Smart Field Measurement – Calibration
- Smart Field Measurement – Calibration (An Example of One Set Spans)
- Smart Field Measurement – Calibration (Square Root Extraction)
- Smart Field Measurement – Calibration (Zero and Span Adjustment)
- Smart Field Measurement – Commissioning
- Smart Field Measurement – Commissioning (Bench calibration tasks)
- Smart Field Measurement – Commissioning (Field Hook-up Wiring for a Field Hook-Up with a Hart Communicator)
- Smart Field Measurement – Wiring Detail
- Smart Field Measurement – Wiring Detail (Multi-Drop Applications)
- Digital Field Communications
- Digital Field Communications – Data Highway
- Digital Field Communications – Fieldbus Communications (Definition)
- Digital Field Communications – Wasteful Conversion of Signals
- Digital Field Communications – Which Is Better- Analogue or Digital?
- Digital Field Communications – Fieldbus Is Specifically Designed for Digital Communications
- Digital Field Communications – Traditional Analog Technology
- Digital Field Communications – When Control and Monitoring Were Local and Analog, Not All Control Panels Were in the Control Room.
- Digital Field Communications – There were Advantages and also Disadvantages
- Digital Field Communications – Direct Digital Control (DDC) Brought about the Central Control Room
- Digital Field Communications – Fieldbus Communications (Microprocessor Technology Allowed the Design of Distributed Control Systems (DCS))
- Digital Field Communications – Fieldbus Control & Monitoring Significantly Reduces Field Wiring
- Digital Field Communications – Advantages of Fieldbus
- Digital Field Communications – Fieldbus Allows Remote Diagnostics Through Standard Access to Calibration And Maintenance Attributes
- Digital Field Communications – Fieldbus Technologies
- Digital Field Communications – Fieldbus Technologies (HART)
- Digital Field Communications – Fieldbus Technologies (Foundation Fieldbus)

- Digital Field Communications – Fieldbus Technologies (Profibus)
- Digital Field Communications – Fieldbus Technologies (Architecture of Profibus Profiles)
- Safety Considerations
- Safety Considerations – Intrinsic Safety
- Safety Considerations – Intrinsic Safety (Background)
- Safety Considerations – Intrinsic Safety (General)
- Safety Considerations – Approval Standards
- Safety Considerations – Intrinsic Safety (Class I Area Protection Method Comparison)
- Safety Considerations – Intrinsic Safety (Explosion-Proof Protection)
- Safety Considerations – Oxygen Service (Oxygen Cleaning Equipment)
- Safety Considerations – Oxygen Service (Fire Hazard)
- Safety Considerations – Oxygen Service (Ignition Chain)