



COURSE OVERVIEW IE0038

Process Control, Instrumentation, Troubleshooting & Problem Solving

Course Title

Process Control, Instrumentation,
Troubleshooting & Problem Solving

Course Date/Venue

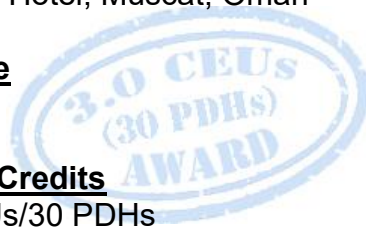
September 06-10, 2026/Musandam Meeting
Room, Royal Tulip Hotel, Muscat, Oman

Course Reference

IE0038

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs



Course Description



This practical and highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using one of our state-of-the-art simulators.



Production processes consist of many complex apparatuses involving both moving and static parts as well as interconnecting pipes, control mechanisms and electronics, mechanical and thermal stages, heat exchangers, waste and side product processing units, power ducts and many others. Bringing such a complicated unit online and ensuring its continued productivity requires substantial skill at anticipating, detecting and solving acute problems. Failure to identify and resolve these problems quickly can lead to lost production, off-spec product, equipment loss, and even catastrophic accidents. Therefore, the ability to troubleshoot process operations is one of the most valuable skills operations personnel can possess.



Troubleshooting is the process used to diagnose the fault safely and efficiently, decide on corrective action and prevent the fault from reoccurring. Process engineering, especially troubleshooting, is different from most other branches of technology in another respect: It is not advancing very quickly.



The principles of distillation, hydraulics, phase separation, and heat transfer, as they apply to process applications, have been well known for quite some time. The challenge in troubleshooting consists of untangling the influence that human error, mechanical failure, and corrosion have on these well-known principles. The aspect of the job that makes it so difficult is that most process problems are initiated by human error – a never-ending source of surprise.

Process control is becoming an increasingly important engineering topic, since the subject plays a crucial role in the design, operation and maintenance in areas such as power plants and chemical and industrial process plants. Control systems have advanced dramatically during the last decade. They become more modular and more sophisticated offering a vast variety of control functions for all the systems that operate within a modern "intelligent" facility. Enhanced functionality of the automation systems also means more complexity, interactive strategies, new technologies and systems management with resulting better control and improved reliability.

This course is designed to provide instruction in process control, instrumentation and the different types of troubleshooting techniques, procedures, and methods used to solve process problems. Participants will use existing knowledge of equipment, systems and the instrumentation to understand the troubleshooting process operations of an entire unit in a facility. Participants study concepts related to troubleshooting commissioning, normal startup, normal operations, normal shutdown, turnarounds, and abnormal situations, as well as the Process team role in performing tasks associated with these concepts within an operating unit.

A major part of the course is devoted to a detailed exposition of currently used control valves, the associated terminology, valve performance, valve and actuator types, control valve accessories as well as to the correct selection and sizing of control valves for a wide range of applications. The course addresses the important issues related to valve installation and maintenance. In addition, this training course also utilizes an extensive collection of state-of-the-art, externally generated process management and video material concerned with all aspects of plant management, including smart wireless solutions to the collection of plant data. In addition, the subjects of digital control systems will be discussed with sections on Distributed Control Systems (DCS), Programmable Logic Controllers (PLC) and SCADA systems.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on process control, troubleshooting and problem solving
- Discuss process control covering process control benefits, basic measurement definitions, control loops and typical applications
- List down the different technologies currently in use in pressure, temperature, level and flow measurement
- Identify the various types of control valve and use a system approach in actuator selection
- Determine flow characteristics, valve accessories, control valve sizing and leakage rates



- Review and employ the different types of control loop strategies, PID control mode and learn the features and application of Distributed Control System (DCS)
- Discuss the system components and operation of the Programmable Logic Controllers (PLC) and describe the configuration of the SCADA systems
- Employ process troubleshooting, process control maintenance, effective methods for troubleshooting and best practices for maintaining process control equipment
- Discuss the most famous problem with process control equipment and apply preventive maintenance procedures

Exclusive Smart Training Kit - H-STK®



*Participants of this course will receive the exclusive “Haward Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides a complete and up-to-date overview of the process control, instrumentation and various troubleshooting techniques and procedures used to solve process problems. Process control engineers, instrumentation engineers, control system engineers, automation engineers and process engineers will definitely benefit from the engineering problem solving approach of the course. Supervisors, technologists and other technical and operational staff will gain an excellent knowledge from the practical aspects of this course.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures
- 20% Practical Workshops & Work Presentations
- 30% Hands-on Practical Exercises & Case Studies
- 20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours.

Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations:

-  British Accreditation Council (BAC)

Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

-  The International Accreditors for Continuing Education and Training (IACET - USA)

Haward Technology is an Authorized Training Provider by the International Accreditors 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 2018-1 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 2018-1 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 Accreditors 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.



Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. Ken Steel is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience. His expertise widely covers **Process Control Instrumentation**, Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), Instrumented Protective Function (**IPF**), **Process Instrumentation & Control**, **Process Control, Instrumentation**, **Instrumentation** for Process Optimization and Control, Process Automation and **Instrumentation** Systems Integration, Troubleshooting in **Process Control Systems**, **Process Control & Safeguarding**, Troubleshooting & **Problem Solving**, **Process Instrumentation** and Control Techniques, Troubleshooting **Instrumentation** and Control Systems, GC Processes Troubleshooting and Control Systems, Programmable Logic Controllers (**PLC**), **SCADA System**, **PLC & SCADA** - Automation & Process Control, **PLC & SCADA** Systems Application, Technical **DCS/SCADA**, Distributed Control System (**DCS**) Principles, Applications, Selection & Troubleshooting, **Electrical Motors Testing**, **Heat Tracing & Insulation** Installation & Testing, **HV Terminations**, **High & Low Voltages** on Overhead Cranes, **HV/MV Cable Splicing**, **Cable & Over Head Power Line**, **HV/MV Switchgear**, **HV Cable** Design, **Medium & High Voltage** Equipment, **High Voltage Circuit Breaker** Inspection & Repair, **High Voltage Power** System, **HV Equipment** Inspection & Maintenance, **HV Switchgear** Operation & Maintenance, Resin / **Heat Shrink & Cold Shrink** Joints, **HV/LV Equipment**, **LV & HV** Electrical System, **Cable** Splicing & Termination, **High Voltage** Electrical Safety, **LV, MV & HV Cable** Installations & Properties, **LV Substation**, **MV & LV Cable**, **UPS Systems**, **MV & LV** Direct on Line Motor Drives, **MV & LV** VSD Motor Drives, **MV & LV** Soft Starter Motor Drives, **LV Two Speed Motor Drives**, Underground **Transformer Oil Containment Tank**, **Electrical & Instrumentation Construction** Installation, 1500KW, 1000KW, 1752KW **Diesel Power Plant** Installation, **110KV Overhead Line**, **110KV Outdoor Switchgear**, **110KV/10KV 6500KVA Transformer**, **Transformer Substation**, 1600KVA 10KV/0.4KV & 2 Off 1000KVA **Diesel Generators**, 1600KVA 10KV/0.4KV & 1650KVA **Diesel Generator**, **110KV/35KV/10KV Substation**, **110KV/10KV Transformers**, **110KV & 2 Off 6KV Overhead Lines**, 34.5KV, 13.8KV, 4.16KV & 480V **Switchgear**, 4.16KV & 480V **MCC**, **Transformers & Motor Drives** Substations, **Diesel Driven Generators**, **Overhead Cranes**, **Overhead Cranes & HVAC Units**, **AC & DC Drives**, **Data Logger**, **Electrical, Instrumentation & Mechanical** Installation Maintenance, Slab Mills, Pre Heat Ovens, Hydraulic Shears, Stamping Machine, Gearboxes, Rollers, Pumps, Valves, Electro Magnets & Pump House Operation, Boilers Construction And Commissioning, Valve Calibration & Testing, Level Gauges, Pressure & Flow Transmitters Installation & Calibration, Pressure & Leak Testing of Boilers, Leak Testing, SMP, Elect, I&C, F&G, HVAC & Utility Services, Nitrogen Leak Test Operations, Steam Blowing Activities, SMP, Elect, I&C, F&G, HVAC & Utility Services, PTW Issue (PA/AC), Installation & Mechanical Piping and Hydro Testing & Leak Testing of Lines Installation.

During Mr. Steel's career life, he has gained his practical experience through several significant positions and dedication as the **3GP PBF & Boilers SC Commission Support**, **SC Site Execution Superintendent**, **E&I Construction Superintendent**, **High Voltage Construction Supervisor**, **Control & Power Construction Supervisor**, **Electrical & Instrumentation Supervisor**, **Electrical Technician**, **Construction Support Electrical Engineer**, **E&I Engineer**, **Electrical/Instrumentation Site Supervisor**, **Q.A/Q.C Inspector**, **Electrical/ Instrumentation Technician**, **Maintenance Fitter Instrumentation Technician**, **Millwright**, **Apprentice Millwright** and **Senior Instructor/Lecturer** for Tengiz Chevron Oil Kazakhstan, Al Jubail Saudi Arabia, Escravos Delta state Nigeria, Lurgi S.A, SuD Chemie Sasol Catalysts, J C Groenewalds Construction (LTA), Tycon (Goodyear S.A.), Dragline Construction and Iscor Vanderbijlpark.

Mr. Steel has a **Diploma in Electronics Mechanic**. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings, courses, workshops, seminars and conferences internationally.



Course Fee

US\$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the course for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: Sunday, 06th of September 2026

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0815 – 0830	Introduction Course Content • Objectives of Course
0830 – 0930	Introduction to Process Control Process Control Definition • Process Control Benefits • Basic Measurement Definitions • Process Control History • Control Loops • Typical Applications
0930 – 0945	Break
0945 – 1100	Pressure Measurement Basic Principles • Definition of Terminology • Pressure Elements • Pressure Transducers • Installation Considerations • Summary
1100 – 1215	Temperature Measurement Principles • Thermocouples • RTD's • Thermistors Thermometer • Infra-Red Thermometry • Installation Considerations
1215 – 1230	Break
1230 – 1330	Level Measurement Main Types • Sight Glass Method • Buoyancy Tape Systems • Hydrostatic Pressure • Ultrasonic Measurement • Radar Measurement • Electrical Measurement • Installation Considerations
1330 – 1420	Video Presentation Radar Level Measurement
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day One

Day 2: Monday, 07th of September 2026

0730 – 0830	Flow Measurement Differential Pressure Flowmeters • Oscillatory Flow Measurement • Non-Intrusive Flowmeters • Mass Flow Meters • Positive Displacement Meters • Installation Considerations • Selection Guidelines
0830 – 0930	Video Presentation Coriolis Effect Mass Flowmeter
0930 – 0945	Break



0945 – 1100	Control Valve Types Rotary • Linear • Control Valve Selection
1100 – 1215	Actuator Selection Introduction • Types of Actuators • Linear Actuators • Rotary Actuators • Actuator Forces • Positioners • Fail Safe Actuators
1215 – 1230	Break
1230 – 1330	Control Valves Basic Terminology • Flow Characteristics • Valve Accessories • Control Valve Sizing • Leakage Rates
1330 – 1420	Practical Session Control Valve Sizing
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3: Tuesday, 08th of September 2026

0730 – 0830	Control Loop Strategies Introduction • Variables • Basic Elements • Manual Control • Feedback Control • System Responses • ON-OFF Control • PID Control Mode
0830 – 0930	Video Presentation PID Control
0930 – 0945	Break
0945 – 1100	Distributed Control Systems Introduction • Traditional Process Controllers • DCS Definition • Architecture of Controllers • Software • DCS Network • DCS Application • DCS Operator WorkStation • Function Blocks
1100 – 1215	Video Presentation Distributed Control Systems
1215 – 1230	Break
1230 – 1330	Programmable Logic Controllers Introduction • Today's Position • Principles of Operation • System Components • I/O Interfaces • Configuration and Programming Languages
1330 – 1420	SCADA Systems Basic Definitions • Level of Hierarchy • Communication Systems • SCADA Benefits
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

Day 4: Wednesday, 09th of September 2026

0730 – 0930	Process Troubleshooting Troubleshoot Process Control Issues • Effective Methods of Troubleshooting
0930 – 0945	Break
0945 – 1130	The Process Control Maintenance Maintenance Definition • Types of Maintenance • Preventive Maintenance
1130 – 1215	Effective Methods for Troubleshooting Identify the Problem • Check the Software • Check the Process • Check the Human Factors • Apply the Solutions



1215 – 1230	Break
1230 – 1420	Best Practices for Maintaining Process Control Equipment Plan and Schedule Maintenance Activities • Train and Equip Maintenance Staff • Monitor and Inspect Process Control Equipment
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Four

Day 5: Thursday, 10th of September 2026

0730 – 0930	Most Famous Problems with Process Control Equipment Control Valves Problems and Methods of Solution • Pressure Transmitter Problems with its Solution • Capillary DPT • Calibration
0930 – 0945	Break
0945 – 1145	Preventive Maintenance Procedures PM Procedure for Pressure Transmitter • PM Procedure for Temperature Transmitter
1145 – 1215	Case Studies - Working in Groups
1215 – 1230	Break
1230 – 1345	Case Studies - Working in Groups
1345 – 1400	Course Conclusion Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course



Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using one of our state-of-the-art simulators “Gas Ultrasonic Meter Sizing Tool”, “Liquid Turbine Meter and Control Valve Sizing Tool”, “Liquid Ultrasonic Meter Sizing Tool” and “Orifice Flow Calculator” simulators.

Daniel Gas USM Sizing Tool

Process Specifications: Unit System: US Customary, Flow Velocity (ft/s): Minimum 3, Maximum 80

Gas Composition: Gas Composition: Amantio

Base Conditions: Pressure: 0 psi, Temperature: 60 DegF

Process Flow Conditions: Flowrate: Minimum 75,000,000, Operating 150,000,000, Maximum 150,000,000, Units: SCF per day

Max/Min Flow Conditions: Maximum Flow occurs at: Min Pressure, Max Temperature

	Flowrate SCFD	Pressure (psi)	Temperature (DegF)
Max Flow Condition	150,000,000	500	120
Operating Flow Condition	150,000,000	1100	120
Min Flow Condition	75,000,000	1100	50

Gas Ultrasonic Meter (USM) Sizing Tool Simulator

Daniel Liquid Turbine And Valve Sizing Tool

Turbine Meter Selection: Process Conditions: Fluid: Gasoline, Specific Gravity / Density: 0.72, Viscosity: 1.1 Centistoke

Valve Selection: Flow Rate: Minimum 200, Operating 400, Maximum 600, Units: Gallons Per Minute

Temperature: 20, 60, 100, Units: °F, °C

Pressure: 60, 100, Units: PSI

Meter Selection: Turbine: Series 1200, Meter: Series 1500

Liquid Turbine Meter and Control Valve Sizing Tool Simulator

Daniel Liquid Ultrasonic Sizing Tool (4-Path)

Process Conditions: Fluid: Gasoline, Specific Gravity / Density: 300, Viscosity: 1.1 Centistoke

Flow Rate: Minimum 200, Operating 400, Maximum 600, Units: Cubic Meters Per Hour

Temperature: 20, 60, 100, Units: °F, °C

Pressure: 60, 100, Units: kPa

Meter Selection: Material: Carbon Steel Body and Flanges (48°C to 150°C), ANSI Class: Rating, Transducer: LT-01 transducer (50°C to 100°C) with NBR o-rings

Nominal Line Size: 6 inch (DN 150), Schedule: Schedule 40, Bore ID: 6.065, Meter Linearity: ±0.15%, Flow Direction: Uni-Directional

Liquid Ultrasonic Meter Sizing Tool Simulator

Daniel Orifice Flow Calculator

Measurement Orifice: Specific Gravity: Flowing Specific Gravity, User Entered, Base Specific Gravity

Density: Operating Density, Saturated, Superheated, User Entered, From ASME Table, Units: lb/cubic foot

Pipe: Nominal Size: 2, Inches, Pipe ID: 2.067" Sch 40, STD, Sch 40S

Options: Calculate Flow Rate, Calculate Differential Pressure, Calculate Beta Ratio

Flow Rate: Gallons Per Minute

Differential Pressure: Inches Water

Beta Ratio: Orifice Bore Diameter, Units: Inches

Flow Type: Liquid, Steam, Air - Gas

Incomplete fluid data (Flowing Specific Gravity, Base Specific Gravity).

Orifice Flow Calculator Simulator

Course Coordinator

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