

COURSE OVERVIEW IE0038
Process Control: Instrumentation, Troubleshooting
and Problem Solving

Course Title

Process Control: Instrumentation, Troubleshooting and Problem Solving

Course Date/Venue

November 18-22, 2024/Fujairah Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

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 hermal 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 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

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

- Apply and gain an in-depth knowledge on process control, instrumentation, troubleshooting and problem solving
- Discuss process control covering control history, basic measurement definitions, P&ID symbols, 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 the various process considerations for the instrumentation for industrial applications

- Review and employ the different types of control loop strategies 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 proper techniques in troubleshooting process operations and carryout successful troubleshooting activities
- Analyze the mental problem-solving process and demonstrate the use of the troubleshooter's worksheet
- Practice the rules-of-thumb techniques for troubleshooting process equipment and enumerate the typical causes of problems with process equipment that covers an extensive range of process equipment
- Develop problem solving, data gathering and interpersonal skills and recognize the importance of these skills in troubleshooting process operations
- Practice the troubleshooting skills by working in small workshops on a wide range of case studies drawn from the process industries

Exclusive Smart Training Kit - H-STK®



*Participants of this course will receive the exclusive “Howard Smart Training Kit” (H-STK®). The H-STK® consists of a comprehensive set of technical content which includes **electronic version** of the course materials, sample video clips of the instructor’s actual lectures & practical sessions during the course 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.

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.

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

Certificates are accredited by the following international accreditation organizations:-

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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.

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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.

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 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. John Vorster, MSc, BSc, is a Senior Instrumentation & Control Engineer with over 20 years of industrial experience within the Oil, Gas, Process, Refinery, Power and Nuclear industries. His wide expertise includes Flow Computer, Turbine Flowmeters, Ultrasonic Flowmeter, Positive Displacement Flowmeter, Coriolis Flowmeter, Flow Rate Corrections, Pressure Flow Transmitters, Pressure Methods, Flow Nozzles, Orifice Plates, Venturi Tubes, Pitot Tubes, Process Control Design & Plant Modelling, Instrumentation, Automation, Process Control Instrumentation, Analyzer Measurement Systems, Pressure Management, Selection & Sizing of all Instrumentation, SIL Criteria, Calibration & Configuration of Installed Instrumentation, PLC & DCS, Bearing Replacement and Control Valves. Further, he is also well-versed in HAZOP, LOPA Studies, Radiation Protection, Hazardous Substances, Hazardous Area Classification, Nuclear Devices Maintenance, Loop Drawings, Loop Calculations, Engineering Drawings, Shutdown Maintenance & Planning, Asset Management, Six Sigma, Energy Management & Measurements, Project Management, Strategic Resource Planning, Budget Preparation, ISO 9001, ISO 14000 and ISO 18000 standards. He is currently the Instrumentation & Analyzer Engineer of Sasolburg wherein he is in-charge of the design and monitoring of the analyzer measurement systems.

During his career life, Mr. Vorster has gained his practical and field experience through his various significant positions and dedication as the **Project Manager, Instrumentation & Analyser Engineer, Engineering Manager, Senior Instrumentation Engineer, Instrumentation Engineer, Green Belt Project Leader, Instrumentation Technologist, Instrumentation Project Coordinator & Supervisor, Senior Instrumentation/Electrical Artisan, Instrumentation Artisan and Apprentice Instrumentation** for numerous international companies including **Sasolburg, DOW Chemical Company, Safripol and Iscor.**

Mr. Vorster has a **Master** degree in **Engineering Development & Management** and a **Bachelor** degree in **Electrical Engineering, Instrumentation & Control** from the **North West University** and **Vaal University of Technology, South Africa** respectively. Further, he is a **Certified Instructor/Trainer**, an **Appointed Radiation Protection Officer**, a **Qualified Instrument Mechanician** and an active member of Project Management Institution (**PMI**).

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, 18th of November 2024

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 Control History • The Process of Control • Basic Measurement Definitions • P&ID symbols • 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
1430	Lunch & End of Day One

Day 2: Monday, 19th of November 2024

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	Process Considerations End Connections • Face to Face Criteria • Materials Selection • Modes of Failure • Leakage Rates
1330 – 1420	Practical Session Control Valve Sizing
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 3: Tuesday, 20th of November 2024

0730 – 0830	Control Loop Strategies Introduction • Variables • Basic Elements • Manual Control • Feedback Control • System Responses • ON-OFF Control • Three Term Control
0830 – 0930	Video Presentation Three Term Control
0930 – 0945	Break
0945 – 1100	Distributed Control Systems Introduction • Traditional Process Controllers • Three Term Control • Architecture of Controllers • Software • Programming • Execution Time • Programming vs. Configuration • Function Blocks





1100 – 1215	Video Presentation <i>Distributed Control Systems</i>
1215 – 1230	<i>Break</i>
1230 – 1330	Programmable Logic Controllers <i>Introduction • Today's Position • Principles of Operation • System Components • I/O Interfaces • Configuration</i>
1330 – 1420	SCADA Systems <i>Basic Definitions • Level of Hierarchy • Communication Systems • SCADA Configuration</i>
1420 – 1430	Recap
1430	<i>Lunch & End of Day Three</i>

Day 4: Wednesday, 21st of November 2024

0730 – 0930	Process Troubleshooting <i>Characteristics of a Trouble-Shooting Problem • Characteristics of the Process Used to Solve Trouble-Shooting Problems</i>
0930 – 0945	<i>Break</i>
0945 – 1130	The Mental Problem-Solving Process <i>Problem Solving • Troubleshooting • Overall Summary of Major Skills and a Worksheet • Example Use of the Trouble-Shooter's Worksheet</i>
1130 – 1215	Rules of Thumb for Troubleshooting <i>Overall • Transportation Problems • Energy Exchange • Homogenous Separation • Heterogenous Separations • Reactor Problems • Mixing Problems • Size-Decrease Problems • Size Enlargement • Vessels, Bins, Hoppers and Storage Tanks • "Systems" Thinking • Health, Fire and Stability</i>
1215 – 1230	<i>Break</i>
1230 – 1420	Problem Solving Skills <i>Developing Awareness of the Problem-Solving Process • Strategies • Exploring the "Context": What is the Real Problem? • Creativity • Self-Assessment</i>
1420 – 1430	Recap
1430	<i>Lunch & End of Day Four</i>

Day 5: Thursday, 22nd of November 2024

0730 – 0930	Data Gathering Skills <i>How to Select Valid Diagnostic Actions • Consistency: Definitions, Cause-Effect and Fundamentals • Classification • Recognizing Patterns • Reasoning</i>
0930 – 0945	<i>Break</i>
0945 – 1145	Interpersonal Skills <i>Interpersonal Skills • Factors that Affect Personal Performance • The Environment</i>
1145 – 1215	Case Studies - Working in Groups
1215 – 1230	<i>Break</i>
1230 – 1345	Case Studies - Working in Groups
1345 – 1400	Course Conclusion
1400 – 1415	POST-TEST
1415 – 1430	<i>Presentation of Course Certificates</i>
1430	<i>Lunch & End of Course</i>





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 “Allen Bradley SLC 500”, “AB Micrologix 1000 (Digital or Analog)”, “AB SLC5/03”, “AB WS5610 PLC”, “Siemens S7-1200”, Siemens S7-400” “Siemens SIMATIC S7-300”, “Siemens S7-200” “GE Fanuc Series 90-30 PLC”, “Siemens SIMATIC Step 7 Professional Software”, and “HMI SCADA”.



Allen Bradley SLC 500 Simulator



Allen Bradley Micrologix 1000 Simulator (Digital)



Allen Bradley Micrologix 1000 Simulator (Analog)



Allen Bradley SLC 5/03



Allen Bradley WS5610 PLC Simulator PLC5



Siemens S7-1200 Simulator



Siemens S7-400 Simulator



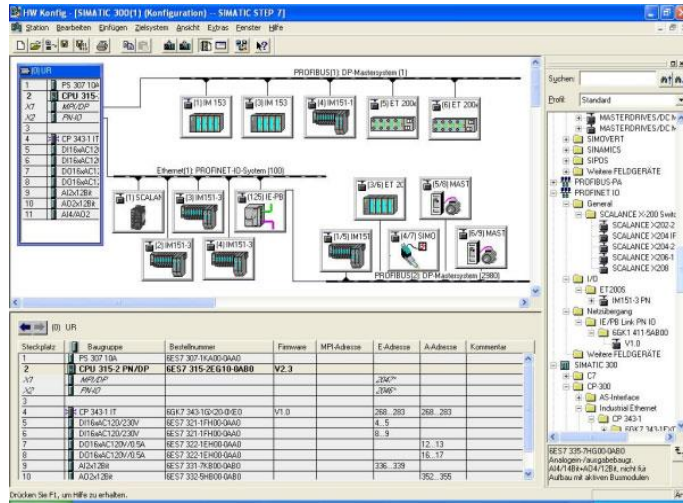
Siemens SIMATIC S7-300



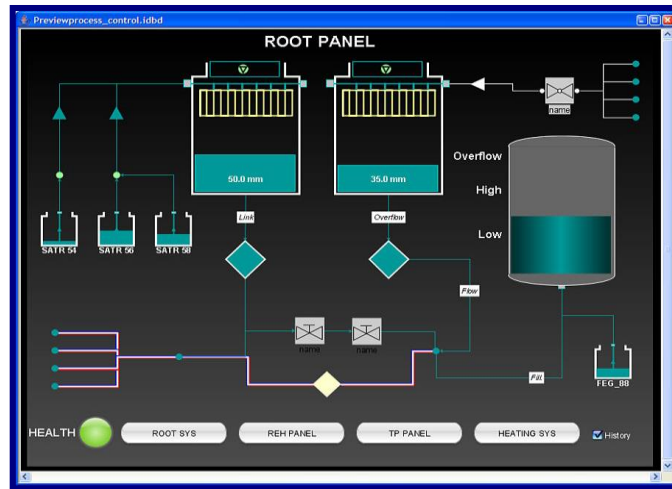
Siemens S7-200 Simulator



GE Fanuc Series 90-30 PLC Simulator



Siemens SIMATIC Step 7 Professional Software



HMI SCADA

Course Coordinator

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