

COURSE OVERVIEW IE0031
Maintain Process Control Systems

Course Title

Maintain Process Control Systems

Course Date/Venue

March 03-07, 2024/The Mouna Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE

Course Reference

IE0031

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 our state-of-the-art simulators.



This course is designed to provide participants with a detailed and up-to-date overview of process control system and controller turning. It covers the process control terminology, need and benefits; the control theory basics; the process control variables and applications including on/off control applications of temperature and level; the control loop components and symbols used for the equipment and technology; and the feedback control and feedforward.



Further, the course will also discuss the components and applications of field instrumentation control loops; the control valves covering actuators and positioners, classification, principles, application-function and on-off valves; the smart transmitters configuration and calibration; the types of control loop diagrams, P&ID reading and interpretation; the field process control system design and installation; and the PID controller, proportional control (P), integral (reset) action and derivative or rate action.

During this interactive course, participants will learn to employ the controller algorithms and tuning including the algorithms types and the necessity for controller tuning; discuss the methods of tuning PID control, set tuning parameters PID and applications and troubleshoot PID control loops; recognize the process control systems for ratio control, cascade control and feedforward control; differentiate the oil production separator control system and turbine and compressor lube/seal oil control system; and identify the main components of PLC and DCS systems.

Course Objectives

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

- Apply and gain a basic knowledge on process control system and controller tuning
- Define process control system including its terminology, need and benefits as well as consider safety and abnormal situations
- Discuss the control theory basics consisting of control loop types, the task necessary for process control to take action and the terms commonly used
- Identify process control variables and applications including on/off control applications of temperature and level
- Recognize the control loop components and symbols used for the equipment and technology
- Employ feedback control and feedforward as well as describe the components and applications of field instrumentation control loops
- Discuss the control valves covering actuators and positioners, classification, principles, application-function and on-off valves
- Configure and calibrate smart transmitters by using HART communicator and process switches
- Identify the types of control loop diagrams, P&ID reading and interpretation
- Design and install field process control system and multivariable loops
- Apply PID controller, proportional control (P), integral (reset) action and derivative or rate action
- Employ controller algorithms and tuning including the algorithms types and the necessity for controller tuning
- Explain the methods of tuning PID control, set tuning parameters PID and applications and troubleshoot PID control loops
- Recognize the process control systems for ratio control, cascade control and feedforward control
- Differentiate the oil production separator control system and turbine and compressor lube/seal oil control system
- Describe the main components of PLC and DCS systems

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, 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 an overview of all significant aspects and considerations of process control system and controller tuning for engineers and other technical staff who are willing to learn more about single loop controllers, PID and tuning. The course explains the essence of feedback control without going in-depth into math.

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 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 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 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:



Dr. Alaa Abdel Kerim, PhD, MSc, BSc, is a Senior Electrical & Instrumentation Engineer with over 35 years of extensive experience in ABB 11kV Distribution Switchgear, Operation & Maintenance of Rotork, Electrical Safety, HV Cable Design, Cable Splicing & Termination, Cable Jointing Techniques, High Voltage Electrical Safety, Electrical Drawing & Schematics, Electrical Power, Electrical Wiring, Machines, Transformers, Motors, Power Stations, Substation Site Inspection, HV/MV Cable Splicing, High Voltage Circuit Breaker Inspection & Repair, Cable & Over Head Power Line, High Voltage Power System Safe Operation, High Voltage Safety, High Voltage Transformers, Safe Operation of High Voltage & Low Voltage Power Systems, Fundamentals of Electricity, Electrical Standards, Practical High Voltage Safety Operating Procedures, Modern Power System Protective Relaying, Electrical & Control System Testing, Design, Commissioning, Operation and Maintenance of Switchgears, Transformers, Substations, Medium & High Voltage Equipment and Circuit Breakers, Electrical Motors & Variable Speed Drives, Power System Equipment, Distribution Network System, Electric Distribution System Equipment, Practical Troubleshooting of Electrical Equipment & Control Circuits, Electrical & Control System Testing & Commissioning, LV/MV/HV Circuit Breakers Inspection & Maintenance, Electrical Power Substation Maintenance, Power Stations, Uninterruptible Power Systems (UPS), Battery Chargers and AC & DC Transmission, DCS, PLC, SCADA, Siemens SIMATIC S7 Maintenance & Configuration, Siemens Simatic S7 PLC, Siemens WINCC, Siemens SIMATIC & WinCC, Siemens, PLC Simatic S7-400/S7-300/S7-200, HMI, Automation System, Process Control & Instrumentation, Hydrocarbon, Level & Flow Measurements, Analytical Instrumentation, Find Control Elements, Control Loop Operation, Data Acquisition & Transmission, Electronics Technology, Power Systems Control, Power Systems Security, Power Transmissions, Power Generation, Electrical Substations and MV/LV Electrical System.

During his career life, Dr. Alaa has been practically and academically involved in different **Power System and Instrumentation international companies and Universities** as a **Senior Professor & Consultant, Instrumentation Engineer and Electrical Engineer**. His recent practical applications experience includes the design, supply, installation, operation of full **DCS, SCADA, PLC, HMI Automation System** for **Sumid Line Petroleum, Siemens USA, AREVA USA** to name a few. His experience also includes electrical coordination, protection level adjustments and electrical testing.

Dr. Alaa has a **PhD degree in Electrical Engineering** from the **Technical University of Gdansk, Poland** and has **Master's and Bachelor's degrees in Electrical Machine & Power Engineering** from **Cairo University and Helwan University**, respectively. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings and workshops worldwide.

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, 03rd of March 2024

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Definitions & Theory of Process Control System Definition of Terminology Associated with Process Control System • Need and Benefits of Process Control • Consideration of Safety and Abnormal Situations in Process Control System.
0930 – 0945	Break
0945 – 1100	Control Theory Basics Types of Control Loops & The Task Necessary for Process Control to Take Actions • Definitions of the Terms Commonly Used in Process/Process Control • Various of Process Variable Which Commonly Controlled with the Real Plant Operation • Advanced Control Loop
1100 - 1145	Process Control Variables & Applications Process Variable (PV), Manipulated Variable (MV) and Setpoint SP or Set Value (SV) • Process Control Loops (Level, Pressure, Temperature, Flow)
1145 - 1230	ON/OFF Control Applications (Temperature & Level) Open Loop and Closed Loop Diagrams • Manual and Automatic Control Comparison and Applications
1230 – 1245	Break
1245 – 1330	Hands - on Practical Training Using Digital Temperature Indicating Controller Video Presentation
1330 - 1420	Components of Control Loops & the Symbols Used The Equipment and the Technology • The Symbols Referring to Common P&ID and SATORP P&ID
1420 – 1430	Recap
1430	Lunch & End of Day One

Day 2: Monday, 04th of March 2024

0730 – 0830	Feedback Control & Feedforward Applications Feedforward Plus Feedback
0830 - 0930	Components & Application of Field Instrumentation Control Loops Sensors, Transducers, Transmitters, Controllers and Control Valves
0930 – 0945	Break
0945 – 1100	Control Valves Actuators and Positioners, Classification, Principles, Application Function – Isolation, ON-OFF Valves • Configuration and Calibration of Valve Positioners (Smart and Pneumatic)
1100 – 1230	Configuration & Calibration of Smart Transmitters Using HART Communicator • Process Switches (Installation and Calibration) • Pressure , Level, Temperature and Flow
1230 – 1245	Break



1245 – 1420	Types of Control Loop Diagrams, P&ID Reading & Interpretation Design and Installation of Field Process Control System • Multivariable Loops
1420 – 1430	Recap
1430	Lunch & End of Day Two

Day 3: Tuesday, 05th of March 2024

0730 – 0830	PID Controller Theory Control Algorithm (Three-Term PID) PID Controller Modes • Proportional, Integral or Reset and Derivative or Rate Action
0830 - 0930	Proportional Control (P) Proportional Control Algorithm • Offset • Manual Reset
0930 – 0945	Break
0945 – 1100	Proportional Control (P) (cont'd) Proportional Gain, Proportional Band, Limits of Proportional Action Determining the Controller Output • Direction of Control Action (Direct and Reverse Action) • Bumpless Transfer Between Manual and Automatic Control System • Setting Values of Gain and Proportional Band • Tuning of Proportional Control System
1100 – 1230	Integral (Reset) Action Integral Action Eliminates Offset • Setting Value of Integral or Reset Time • Video Presentation • Proportional-Integral Control Applications • Tuning PI Process Control Loops
1230 – 1245	Break
1245 – 1420	Derivative or Rate Action Setting value of Derivative or Rate Action • Precaution When Using Derivative Action
1420 – 1430	Recap
1430	Lunch & End of Day Three

Day 4: Wednesday, 06th of March 2024

0730 – 0830	Controller Algorithms & Tuning Types of Algorithms – the Difference & the Working Principles • The Necessity for the Controllers Tuning • Proportional, Integral, Derivatives – The Definition and Application • Sharing the Example from the Real Running Unit in SATORP
0830 - 0930	Tuning PID Controller Methods of Tuning PID Controller • Setting Tuning Parameters PID and Applications • VIDEO Presentation • Troubleshooting of PID Control Loops
0930 – 0945	Break
0945 – 1100	Hands on PID Practical Training on Digital Indicating Controller
1100 – 1230	Process Control Systems Ratio Control • Cascade Control • Feedforward Control
1230 – 1245	Break
1245 – 1420	Cascade Control Cascade Heat Exchanger Control System • Cascade, Feedforward and Boiler Level Control • Cascade Control Tuning Guidelines
1420 – 1430	Recap
1430	Lunch & End of Day Three

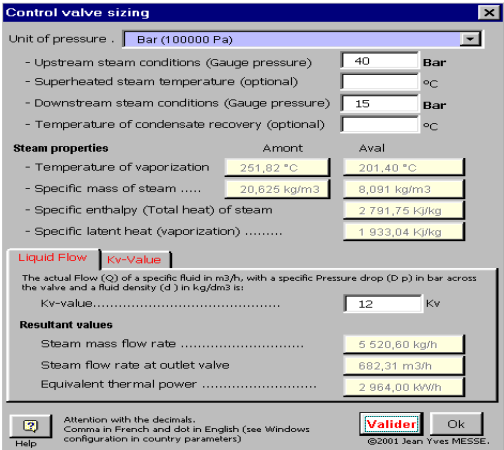


Day 5: Thursday, 07th of March 2024

0730 – 0830	Ratio Control <i>System and Application of Ratio Control System</i>
0830 – 0930	Oil Production Separator Control System <i>Two and Three Phase Oil Separator Control System</i>
0930 – 0945	Break
0945 – 1100	Turbine & Compressor Lube/Seal Oil Control System <i>Compressor Surge Control</i>
1100 – 1230	Introduction to PLC & DCS <i>Main Components of PLC & DCS Systems</i>
1230 – 1245	Break
1245 – 1345	VIDEO Presentation <i>Control Tuning</i>
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 our state-of-the-art simulators “Valve Sizing Software”, “Valve Software 3.0”, “Valvestar 7.2 Software” and “PRV2SIZE Software”.



Control valve sizing

Unit of pressure : Bar (100000 Pa)

- Upstream steam conditions (Gauge pressure) : 40 Bar

- Superheated steam temperature (optional) : °C

- Downstream steam conditions (Gauge pressure) : 15 Bar

- Temperature of condensate recovery (optional) : °C

Steam properties

Temperature of vaporization	251,82 °C	201,40 °C
Specific mass of steam	20,625 kg/m ³	8,091 kg/m ³
Specific enthalpy (Total heat) of steam	2 791,75 kJ/kg	
Specific latent heat (vaporization)	1 933,04 kJ/kg	

Liquid Flow | Kv-Value

The actual Flow (Q) of a specific fluid in m³/h, with a specific Pressure drop (D p) in bar across the valve and a fluid density (d) in kg/dm³ is:

Kv-value : 12 Kv

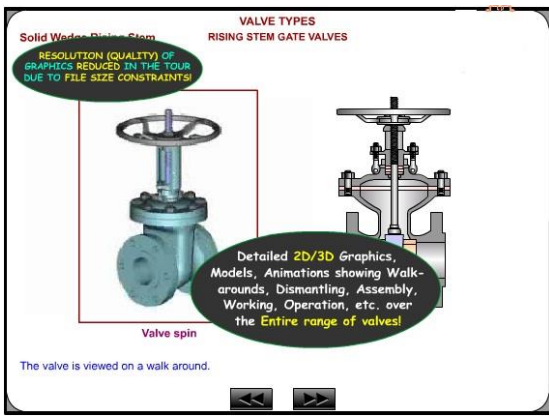
Resultant values

Steam mass flow rate	5 520,60 kg/h
Steam flow rate at outlet valve	682,31 m ³ /h
Equivalent thermal power	2 964,00 kW/h

Attention with the decimals. Comma in French and dot in English (see Windows configuration in country parameters)

Validat OK

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VALVE TYPES

RISING STEM GATE VALVES

Solid Wedge Rising Stem

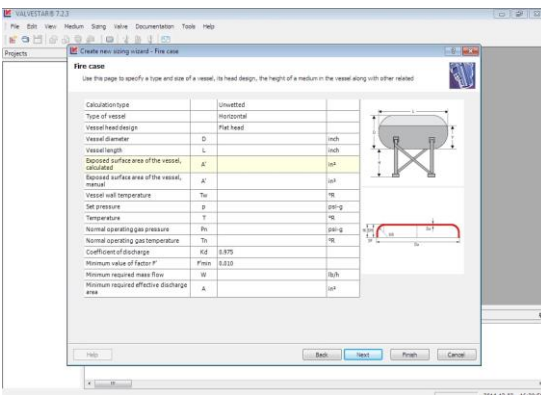
RESOLUTION (QUALITY OF GRAPHICS REDUCED IN THE TOUR DUE TO FILE SIZE CONSTRAINTS)

Valve spin

Detailed 2D/3D Graphics, Models, Animations showing Walk-arounds, Dismantling, Assembly, Working, Operation, etc. over the Entire range of valves!

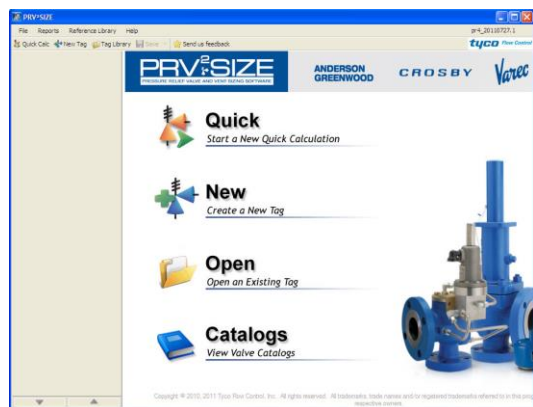
The valve is viewed on a walk around.

Valve Sizing Software



Valvestar 7.2 Software

Valve Software 3.0



PRV²SIZE Software

Course Coordinator

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