



COURSE OVERVIEW IE0131-4D Understanding and Tuning Controllers and Control Loops

Course Title

Understanding and Tuning Controllers and Control Loops

Course Date/Venue

July 01-04, 2024/Al Khobar Meeting Room, Hilton Garden Inn, Al Khobar, KSA

Course Reference

IE0131-4D

Course Duration/Credits

Four days/2.4 CEUs/24 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 an introduction to process control to engineers and other technical staff. It teaches the base fundamentals, as well as open and closed loop tuning methods. The course is developed with field tuning in mind, not control design.



The course will discuss the control fundamentals and terminology including the principles, control loop as well as the various types and right selection of control valve and describes the process control methods and characteristics of control valve.



It illustrates the different tuning rules available and explains the fundamentals of control systems, proper tuning of PID controllers, the concepts and application of feed forward control, auto tuning and new developments and troubleshooting tuning.

The various types of control valves, actuators and valve selection will also be discussed during the course.



Course Objectives

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

- Apply and gain a good working knowledge on tuning controllers and control loops
- Carryout tuning concepts for controllers based on business need
- Discuss the control fundamentals and terminology including the principles, control loop as well as the various types and right selection of control valve
- Describe the process control methods and characteristics of control valve
- Illustrate the different tuning rules available and explain the fundamentals of control systems
- Demonstrate the proper tuning of PID controllers and the concepts and application of feed forward control
- Identify auto tuning and new developments and employ good practices and troubleshooting tuning
- Discuss the various types of control valves, actuators and valve selection

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 conveniently saved in a **Tablet PC**.

Who Should Attend

This course provides an overview of all significant aspects and considerations of tuning controllers and control loops for senior engineers, engineers, senior foremen, foremen 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 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 accreditation by the following international accreditation organizations:

- 
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 **2.4 CEUs** (Continuing Education Units) or **24 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.

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, Haward Technology has the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. Ahmed Abozeid is a Senior Electrical & Instrumentation Engineer with over 30 years of Onshore & Offshore experience within the Oil & Gas and Power industries. His wide expertise covers Bearing Failure Analysis Process Control & Instrumentation, Process Control Measurements, Control System Commissioning & Start-Up, Control System & Monitoring, Process Control & Loop Tuning, Understanding and Tuning Controllers & Control Loops, Control Valve, Power

Station Control System, Instrumentation Devices, Process Control & Automation, PID Controller, Distributed Control Systems (DCS), Programmable Logic Controllers (PLC), Flowmetering & Custody Transfer, Meters Calibration, Installation & Inspection, Crude Metering & Measurement Systems, Flow Meter Maintenance Troubleshooting, HV Cable Design, Cable Splicing & Termination, Cable Jointing Techniques, High Voltage Electrical Safety, HV/MV Cable Splicing, High Voltage Circuit Breaker Inspection & Repair, High Voltage Power System Safe Operation, High Voltage Safety, High Voltage Transformers, Safe Operation of High Voltage & Low Voltage Power Systems, Electric Distribution System Equipment, ABB 11KV Distribution Switchgear, Rotork Operation & Maintenance, Power System Protection and Relaying, Electrical Motors & Variable Speed Drives, Motor Speed Control, Power Electronic Converters, AC Converters Section, Electromagnetic Compatibility (EMC), Motor Failure Analysis & Testing, Machinery Fault Diagnosis, ABB PLC & DCS System, Gas Analyzers, Simulation Testing, Load Flow, Short Circuit, Smart Grid, Vibration Sensors, Cable Installation & Commissioning, Calibration Commissioning and Site Filter Controller. Further, he is also well-versed in Fundamentals of Electricity, Electrical Standards, Electrical Power, PLC, Electrical Wiring, Machines, Transformers, Motors, Power Stations, Electro-Mechanical Systems, Automation & Control Systems, Voltage Distribution, Power Distribution, Filters, Automation System, Electrical Variable Speed Drives, Power Systems, Power Generation, Power Transformers, Diesel Generators, Power Stations, Uninterruptible Power Systems (UPS), Battery Chargers and AC & DC Transmission. He is currently the Project Manager wherein he manages, plans and implements projects across different lines of business.

Mr. Ahmed worked as the **Electrical Manager, Electrical Power & Machine Expert, Electrical Process Leader, Team Leader, Electrical Team Leader, Technical Instructor, and Instructor/Trainer** from various companies such as the Lafarge Nigeria, Egyptian Cement Company, ECC Training Center, Alrajhi Construction & Building Company and Ameria Cement Company, just to name a few.

Mr. Ahmed has a **Bachelor's degree in Electrical Engineering**. Further, he is a **Certified Instructor/Trainer, Certified TQUK Level 3 Vocational Achievement (RQF) Assessor** and has delivered numerous trainings, seminars, courses, workshops and conferences internationally.

Course Fee

US\$ 4,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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: Monday, 01st of July 2024

0730 – 0800	Registration & Coffee
0800 – 0815	Welcome & Introduction
0815 – 0830	PRE-TEST
0830 – 0930	Control Fundamentals Terminology • Principles of Control • Basic Control Loop • Advanced Control Loop
0930 - 0945	Break
0945 – 1100	Control Fundamentals (cont'd) Introduction to Different Types of Control Loops (Open, Close) • Introduction to Different Types of Complex Control Loops • Control Algorithm • Control System
1100 – 1215	Control Valve Types Butterfly • Eccentric • Rotary Plug • Ball • Plug
1215 – 1230	Break
1230 - 1420	Control Valve Types (cont'd) Linear Valves • Globe • Cage • Double Port • How to Select the Right Valve?
1420 - 1430	Recap
1430	Lunch & End of Day One

Day 2: Tuesday, 02nd of July 2024

0730 – 0930	Process Control Methods Open Loop • Process Behaviour • Time Lags • Selection of Type of Controller • Proportional
0930 - 0945	Break
0945 – 1100	Process Control Methods(cont'd) Integral • Derivative • Feedback • Cascade • Ratio • Feed Forward
1100 – 1215	Control Valve Characteristics Selection of Flow Characteristics • Sizing Steps • Classification
1215 – 1230	Break
1230 - 1420	Control Valve Cavitation • Flashing • Noise
1420 - 1430	Recap
1430	Lunch & End of Day Two



Day 3: Wednesday, 03rd of July 2024

0730 – 0930	Different Tuning Rules Available Basic Tuning (Proportional, Integral etc.) • Overshoot • Lambda Tuning • Trial Tuning • Cohen Coon Tuning • Process Controlability • Suggestions & Rules of Thumb
0930 - 0945	Break
0945 – 1100	Fundamentals of Control Systems On-Off Control • Cascade • Ratio • FF • FB • Prop. Band • Integral • Derivative • Direct/Reverse
1100 – 1215	Tuning of PID Controllers Open Loop • Ziegler Nichols • Continuing Cycling Method • Response Lags • Closed Loop Control
1215 – 1230	Break
1230 - 1420	VIDEO Presentation Control Tuning
1420 - 1430	Recap
1430	Lunch & End of Day Three

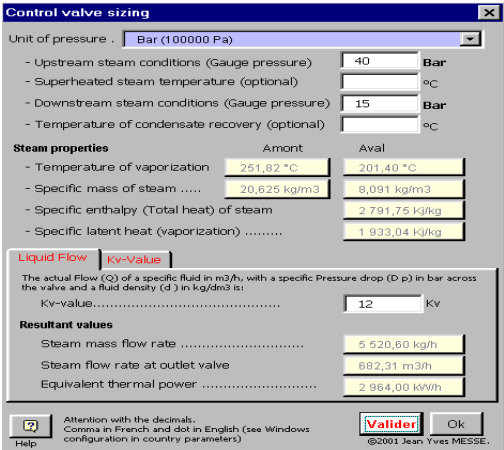
Day 4: Thursday, 04th of July 2024

0730 – 0930	Concepts & Application of Feed Forward Control
0930 - 0945	Break
0945 – 1100	Auto Tuning & New Developments
1100 – 1215	Good Practices & Troubleshooting Tuning
1215 – 1230	Break
1230 - 1345	Types of Control Valves, Actuators & Valve Selection
1345 - 1400	Course Conclusion
1400 – 1415	POST-TEST
1415 – 1430	Presentation of Course Certificates
1430	Lunch & End of Course



Simulator (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	Armont: 251,82 °C	Aval: 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

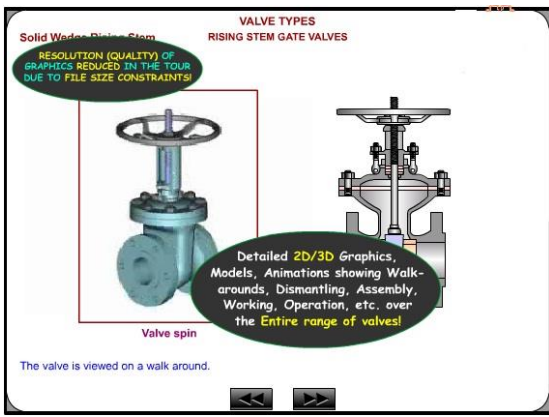
Resultant values

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

©2001 Jean Yves MESSE.



VALVE TYPES

RISING STEM GATE VALVES

Solid Wedge Rising Stem

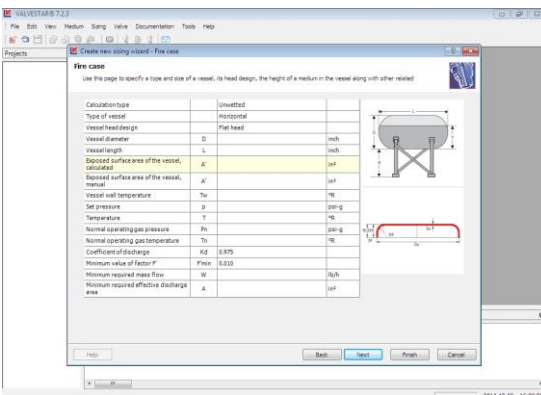
RESOLUTION (QUALITY OF GRAPHICS REDUCED IN THE TOUR DUE TO FILE SIZE CONSTRAINTS)

Valve spin

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

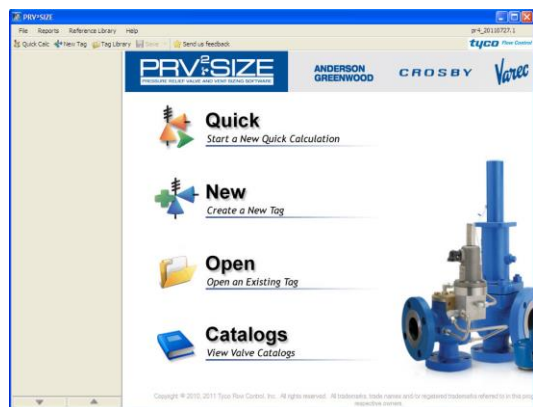
The valve is viewed on a walk around.

Valve Sizing Software



Valvestar 7.2 Software

Valve Software 3.0



PRV²SIZE Software

Course Coordinator

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org