COURSE OVERVIEW IE0043
DCS & ESD System Maintenance

Course Title
DCS & ESD System Maintenance

Course Date/Venue
Session 1: February 11-15, 2024/Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar
Session 2: March 03-07, 2024/Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey

Course Reference
IE0043

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.

Since the first DCS system was installed in the late 1970's, the concept of Distributed Control Systems has swept alternative control technologies from the field. The substantial growth in grass-roots construction of plants in the traditional heavy process industries, such as power generation, refining, oil and gas, water and petrochemicals is driving significant growth in the utilization of Distributed Control Systems (DCS). The broad architecture of a solution involves either a direct connection to physical equipment, such as switches, pumps and valves or connection via a fieldbus communication system.

With the advent of high speed data highways and locally collected plant information, Distributed Control Systems are being used to reduce cabling costs, as well as the implementation of advanced control strategies. The course will cover the practical applications of Distributed Control Systems. The course is based on a selection of subjects that either have had a strong impact on distributed systems today, or explore novel ideas which may be important in the future. Other subjects cover important aspects of distributed systems such as data communications, SCADA and Safety Instrumented Systems plus PLC applications.

The evolution of computer control systems is discussed in this course and the architecture of contemporary DCS offerings is described in general terms. The course covers hardware, configuration, data communications, user interfaces and I/O devices. In addition, the course introduces the general maintenance requirements of the DCS. It covers troubleshooting techniques using DCS self-diagnostics and the various diagnostic displays available to the engineers and technicians as well as safe and proper component replacement procedures for cards, modules and power supplies.

The course also looks at the different methods of tuning three term controllers using the various Zeigler- Nichols approaches.

Course Objectives

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

- Apply an in-depth knowledge and skills in DCS systems and implement systematic applications, selection and troubleshooting techniques and methods
- Identify the DCS hardware & software particularly the traditional process controllers, programming, execution time, configuration, etc
- List the parts and configuration of the SCADA system and determine its basic architecture and levels of hierarchy
- Differentiate DCS from PLC and SCADA and discuss their features and functions
- Determine the types of DCS used in petroleum refining processes and explain their specific function in each process
- Employ the concepts of alarm management system including its types, features, architecture and functions
- Discuss the concepts of humans in control and identify the factors that contribute in the following concept
- Recognize the safety considerations involved in DCS such as intrinsic safety, explosion, approval standards, oxygen, etc
- Identify types of redundancy and recognize how it works
- Appreciate the principles analogue and digital field communications and discuss its transmitter classifications, intrinsic safety, fieldbus communications & technologies, etc
- Discuss the concepts of safety instrumented systems and explain its functions, integration and hazard and risk analysis
- Discuss ESD architecture covering ESD system and signal definition including level of shutdown as well as re-set philosophy
- Interlock ESD systems and interface field devices as well as recognize sequence of events recorder, bypass and override key switches

- Carryout input signal line monitoring and hazard analysis techniques
- Illustrate alarm annunciation of ESD signals in DCS and determine ESD matrix panel facilities as well as ESD areas of special attention
- Identify hardware power failure requirements, DCS configuration requirements, analogue signals with trip amplifiers and employ proper safety measures
- Explain the maintenance considerations of DCS and identify the various types of failures and faults
- Select the proper DCS system for each application and determine the system specification, its functional description and diagrams

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 course conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of distributed control system for managers, engineers and other technical staff who are responsible for the selection, application, implementation and troubleshooting of distributed control systems (DCS). Personnel in technical positions who want to know more about distributed control systems will also benefit from the practical approach 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.

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: -

- 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.

- 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

Doha	**US$ 6,000** per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Istanbul	**US$ 6,000** per Delegate + **VAT**. This rate includes Participants Pack (Folder, Manual, Hand-outs, etc.), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

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. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **35 years** of extensive experience in the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Utilities**. He specializes in **P&ID** Reading & Interpretation, **Engineering Drawings**, **Electrical Drawing & Schematics, Electrical Drawing & Wiring,** Developing & Revising **Engineering Drawing**, **Piping & Instrument Drawing** Reading, **Electrical & Instrument Drawings**, **Relay** Design & Maintenance, **Relay** Programming, **Relay** Construction & Functions, **Protective Relaying**, **Relay** Coordination, **Siemens Protection Relays**, **Power System Protection Relays & Hardware**, **Electrical Power System Protection Relays**, **Electrical Faults & Relay** Protection, **ABB Relay** REG 216, **Fault Calculation Relay**, Modern **Power System Protective Relaying**, **Power System Study on ETAP**, **ETAP-Power System Analysis**, **Flow Measurement** Foundation, **Hydrocarbon** Measurement & Sampling, **Gas Dosiers** Preparation, **Gas/Liquid Fuel** Measurement, **Instrumentation Measurement & Control System**, **Flow** Measurement, **Pressure** Measurement, **Level & Temperature** Measurement, **Measurement Devices & Control System**, **Instrumentation & Control** Systems, **Control System** Orientation, Uninterruptible Power Supply (**UPS**) **Battery Charger**, **Industrial UPS Systems Construction & Operation**, **Test Lead-Acid & Ni-cad Battery Systems**, **Hazards & Safe Work Practice**s, **Transformer** Operational Principles, Selection & Troubleshooting; **HV & LV Transformers**, **Control Valves & Actuators**, **Electrical Safety**, **Protection Relay Application**, **Maintenance & Testing**, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Lock-Out & Tag-Out (**LOTO**), Confined Workspaces, Alerting Techniques, Electrical Transient Analysis Program (**ETAP**), Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, Electrical **Substations**, **UPS** & **Battery System**, **Earthing & Grounding**, Power **Generation**, **Protective Systems**, **Electrical Generators**, **Power** & **Distribution Transformers**, **Electrical Motors**, **Switchgears**, **Transformers**, **AC** & **DC Drives**, **Variable Speed Drives** & **Generators**, **Generator Protection**, **GE Gas Turbines**, PLC, SCADA, DCS, Process Control, Control Systems & Data Communications, Instrumentation, Automation, Valve Tuning, SIS, SIL, ESD, Alarm Management Systems, Engine Management System, Bearing & Rotating Machine, Fieldbus Systems and Fiber Optics Technology. He is currently the **Systems Control Manager** of **Siemens** where he is in-charge of Security & Control of Power **Transmission Distribution** & **High Voltage** Systems and he further takes part in the Load Records Evaluation & Transmission Services Pricing.

During his career life, Dr. Ahmed has been actively involved in different Power System Activities including Roles in Power System Planning, Analysis, Engineering, **HV Substation** Design, Electrical Service Pricing, Evaluations & Tariffs, Project Management, Teaching and Consulting. His vast industrial experience was honed greatly when he joined many International and National Companies such as **Siemens**, **Electricity Authority** and **ACETO** industries as the **Instrumentation & Electrical Service Project Manager**, **Instrumentation & Control Engineer**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **Instrumentation & Control Instructor**, **Project Coordinator**, **Project Assistant and Managing Board Member** where he focused more on dealing with Technology Transfer, System Integration Process and Improving Localization. He was further greatly involved in manufacturing some of **Power System** and **Control & Instrumentation Components** such as Series of Digital Protection **Relays**, MV **VFD**, **PLC** and **SCADA** System with intelligent features.

Dr. Ahmed is well-versed in different electrical and instrumentation fields like **ETAP**, Load Management Concepts, **PLC** Programming, Installation, Operation and Troubleshooting, **AC Drives** Theory, Application and Troubleshooting, Industrial Power Systems Analysis, AC & DC **Motors**, Electric Motor **Protection**, **DCS SCADA**, **Control** and Maintenance Techniques, Industrial Intelligent Control System, **Power Quality** Standards, Power Generators and Voltage Regulators, Circuit Breaker and Switchgear Application and Testing Techniques, **Transformer** and **Switchgear** Application, Grounding for Industrial and Commercial Assets, Power Quality and **Harmonics**, **Protective Relays** (O/C Protection, Line Differential, Bus Bar Protection and **Breaker Failure Relay**) and Project Management Basics (PMB).

Dr. Ahmed has **PhD**, **Master** & **Bachelor** degrees in **Electrical Engineering** from the **University of Wisconsin Madison**, **USA** and **Ain Shams University**, respectively. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/ Assessor/Trainer** by the **Institute of Leadership and Management** (**ILM**), an active member of IEEE and ISA as well as numerous technical and scientific papers published internationally in the areas of Power Quality, Superconductive Magnetic Energy Storage, SMES role in Power Systems, Power System **Blackout** Analysis, and Intelligent Load Shedding Techniques for preventing Power System Blackouts, HV **Substation Automation** and Power System Stability. He has further delivered numerous trainings, seminars, courses, workshops and conferences internationally.

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

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0845	***Review of Course*** *Objectives of Course ● Timetables*
0845 – 0900	***Basic Control Concepts*** *Definitions ● Variables ● Basic Elements ● Manual Control ● Feedback Control ● System Responses ● ON – OFF Control ● Three Term Control*
0900 – 0930	***Video Presentation*** *Three Term Control*
0930 – 0945	*Break*
0945 – 1030	***Introduction to Control Systems*** *History ● Direct Digital Control ● Centralised Computer Control ● Distributed Control Systems ● Programmable Logic Controllers*
1030 – 1100	***Video Presentation*** *Distributed Control Systems*
1100 - 1200	***Modes of Control*** *Stability ● Ultimate Gain ● Tuning Methods ● Quarter Decay Ratio ● Ratio Control ● Application Examples*
1200 - 1230	***Video Presentation*** *Advanced Process Control*
1230 – 1245	*Break*
1245 – 1300	***DCS Hardware & Software*** *Traditional Process Controllers ● Architecture of Controllers ● Software ● Programming ● Execution Time ● Programming vs Configuration ● Function Blocks ● Connections to the Controller*
1300 – 1420	***Video Presentation*** *Kent Freelance 800F*
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

0730 – 0830	***SCADA Systems*** *Basic Architecture ● Levels of Hierarchy ● Communication Systems ● SCADA Configuration*
0830 – 0930	***Video Presentation*** *SCADA Case Study*
0930 – 0945	*Break*
0945 – 1030	***DCS vs PLC vs SCADA*** *General ● Distributed Control Systems ● Programmable Logic Controllers ● SCADA Systems ● Major Differences ● Hybrid Systems ● Summary*
1030 – 1100	***DCS in Petroleum Refining*** *Distillation/Fractionation ● Cracking ● Treatment ● Reforming ● Oil & Gas Applications ● Case Study*

1100 – 1145	***DCS Types*** *Main Concepts – General ● Honeywell Experion PKS ● Emerson Delta V ● Yokogawa CENTUM ● FoxboroI/A*
1145 - 1230	***Alarm Management*** *Introduction ● Architecture ● Update Times ● Speed of Response ● Operator Considerations ● Alarm Types ● Alarm Displays ● Alarm Priorities ● Alarm Functions ● Hierarchies ● Summaries ● Seven Steps to Alarm Management*
1230 – 1245	*Break*
1245 – 1300	***Video Presentation*** *Explosion at BP Refinery, Texas City*
1300 – 1420	***Humans in Control*** *The Process of Control ● Touring the Plant with all the Senses ● Control Panel Considerations ● Work Stations ● Look and Feel ● Displays*
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

0730 – 0900	***Safety Considerations*** *Intrinsic Safety ● Explosion–proof Standard ● Approval Standards ● Oxygen*
0900 – 0930	***Redundancy*** *General ● How Does It Work? ● Device Redundancy ● Network Redundancy ● Port Redundancy ● System Redundancy ● Power Supply Redundancy ● Cable Reliability*
0930 – 0945	*Break*
0945 – 1100	***Video Presentation*** *PLC Redundancy*
1100 – 1145	***Analogue Field Communications*** *Introduction ● Transmitter Classifications ● Intrinsic Safety ● HART and 4 – 2-mA ● Driving the Circuit*
1145 - 1230	***Smart Measurement*** *Introduction ● Features ● Brief Specification ● Overview ● Application ● Multi-variable Transmitter*
1230 – 1245	*Break*
1245 – 1315	***Digital Field Communications*** *Data Highway ● Fieldbus Communications ● Advantages of Fieldbus ● Fieldbus Technologies ● HART ● Foundation Fieldbus ● Profibus*
1315 – 1330	***Video Presentation*** *HART Protocol*
1330 - 1420	***Safety Instrumented Systems*** *Preview ● Concept ● Safety Instrumented Function (SIF) ● Safety Instrumented Systems (SIS) ● Safety Integrity Level (SIL) ● Hazard and Risk Analysis ● Safety PLC ● General Notes*
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

0730 – 0930	***ESD System Architecture*** *ESD System & Signal Definition ● Level of Shutdown & Re-Set Philosophy Interlocking with ESD Systems ● Interfacing with Field Devices*
0930 – 0945	*Break*
0945 – 1100	***ESD System Architecture (cont'd)*** *Sequence of Events Recorder ● Bypass & Override Key Switches ● Input Signal Line Monitoring ● Hazard Analysis Techniques*
1100 – 1230	***ESD System Architecture (cont'd)*** *Alarm Annunciation of ESD Signals on DCS ● ESD Matrix Panel Facilities ● ● Hardware Power Failure Requirements*
1230 – 1245	*Break*
1245 – 1420	***ESD System Architecture (cont'd)*** *DCS Configuration Requirements ● Analogue Signals with Trip Amplifiers ● Safety Measures*
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

0730 – 0930	***Maintenance Considerations*** *Mean Time Between Failures ● Spare Parts ● Types of Failures ● Types of Faults ● Diagnostics*
0930 – 0945	*Break*
0945 – 1030	***System Specification*** *Functional Description ● Process Diagrams ● P & ID's ● Loop Diagrams ● HAZOP ● Instrument Index*
1030 – 1230	***New Trends Wireless Technology*** *Introduction ● Application ● Installation ● Network Architecture ● System Integrity ● Wireless in Oil & Gas ● Wireless Transmitters*
1230 – 1245	*Break*
1245 – 1300	***Review***
1300 – 1345	***Wrap-up Session***
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*

Simulators (Hands-on Practical Sessions)

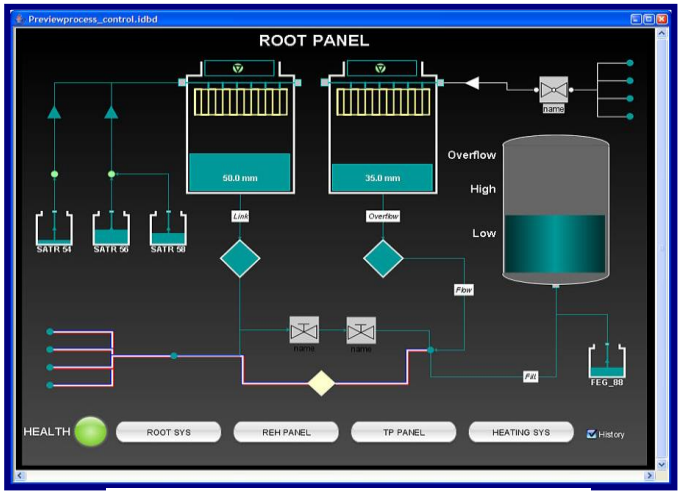
Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using one of our state-of-the-art simulators "Allen Bradley SLC 500", "Siemens S7-300", "Siemens S7-200", "Allen Bradley Micrologix 1000 (Digital)" and "HMI SCADA".

Allen Bradley SLC 500 Simulator

Siemens S7-300 Simulator

Siemens S7-200 Simulator

Allen Bradley Micrologix 1000 Simulator (Digital)



HMI SCADA

Course Coordinator

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