

COURSE OVERVIEW IE0150

Distributed Control System (DCS) Applications, Selection & Troubleshooting

Course Title

Distributed Control System (DCS) Applications, Selection & Troubleshooting

Course Reference

IE0150

Course Duration/Credits

Five days/3.0 CEUs/30 PDHs



Course Date/Venue

Session(s)	Date	Venue
1	June 09-13, 2024	Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar
2	October 13-17, 2024	Kizkulesi, Crown Plaza Istanbul Asia Hotels & Convention Center, Istanbul, Turkey
3	December 08-12, 2024	The KooH Al Noor Meeting Room, The H Dubai Hotel, Sheikh Zayed Rd - Trade Centre, Dubai, UAE

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.



Since its inception, 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 are 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 principles, 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
- 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 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.

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.
Dubai	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. Ahmed El-Sayed, PhD, MSc, BSc, is a **Senior Engineer** with **35 years** of extensive experience within the **Oil, Gas, Power, Petroleum, Petrochemical** and **Utilities** industries. His experience widely covers in the areas of **Advanced Transformer Oil Analysis, Vapor Analyzers, Natural Gas & LNG, Analytical Laboratory Management, Gas Chromatography (GC), Laboratory Quality Management, Lab Management Systems, Good Laboratory Practice (GLP), Laboratory, Statistical Process Control, Laboratory Instruments & Calibrations,**

Separation Technology, Laboratory Quality Management, Gas Analysis, Analytical Laboratory Audit, Transformer Oil Gas Analysis, Natural & Refinery Gas Analysis, Modern Chemical Laboratory, Analytical Instrumentation. Further he is also well-versed in **Bently Vibration Rack 3500 Training, Maintenance & Troubleshooting of 11KV Breaker ABB type VD4, Rotork make MOVs Operation & Maintenance, Air Compressor "Atlas Copco", Advanced Distributed Control System (DCS), DCS Operation & Configuration, DCS Troubleshooting, DCS Yokogawa ProSafe-RS Safety Instrumented System, DCS Yokogawa Centum VP, DCS Emerson DeltaV, DCS GE Mark VI, Programmable Logic Controller (PLC), Supervisory Control & Data Acquisition (SCADA) Systems, Siemens PLC Simatic S7-400/S7-300/S7-200, Siemens SIMATIC S7 Maintenance & Configuration, Siemens WINCC, SCADA System: Siemens SIMATIC & WinCC, Process Control, Control Systems & Data Communications, Instrumentation, Automation, Valve Tuning, Safety Instrumented Systems (SIS), Safety Integrity Level (SIL), Emergency Shutdown (ESD), Telemetry Systems, Boiler Control & Instrumentation, Advanced Process Control (APC) Technology, Practical Fiber-Optics Technology, Compressor Control & Protection, GE Gas Turbines, Alarm Management Systems, Engine Management System, Fieldbus Systems, NEC (National Electrical Code), NESC (National Electrical Safety Code), Electrical Safety, Electrical Hazards Assessment, Overhead Power Line Maintenance & Patrolling, High Voltage Switching Operations, Industrial UPS Systems & Battery Power Supplies, Electric Motors & Variable Speed Drives, Generator Maintenance & Troubleshooting, Generator Excitation Systems & AVR, Transformer Maintenance & Testing, Lock-Out & Tag-Out (LOTO), Confined Workspaces and Earthing & Grounding, 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, Egyptian Electricity Holding, Egyptian Refining Company (ERC), GASCO, Tahrir Petrochemicals Project, and ACETO** industries as the **Instrumentation & Electrical Service Project Manager, Energy Management Engineer, Department Head, Assistant Professor, 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 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.

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	<i>Registration & Coffee</i>
0800 – 0815	<i>Welcome & Introduction</i>
0815 – 0830	PRE-TEST
0830 – 0845	Review of Course <i>Objectives of Course • Timetables</i>
0845 – 0900	Basic Control Concepts <i>Definitions • Variables • Basic Elements • Manual Control • Feedback Control • System Responses • ON – OFF Control • Three Term Control</i>
0900 – 0930	Video Presentation <i>Three Term Control</i>
0930 – 0945	<i>Break</i>
0945 – 1200	Introduction to Control Systems <i>History • Direct Digital Control • Centralised Computer Control • Distributed Control Systems • Programmable Logic Controllers</i>
1200 – 1230	Video Presentation <i>Distributed Control Systems</i>
1230 – 1245	<i>Break</i>
1245 – 1400	Modes of Control <i>Stability • Ultimate Gain • Tuning Methods • Quarter Decay Ratio • Ratio Control • Application Examples</i>
1400 – 1420	Video Presentation <i>Advanced Process Control</i>
1420 – 1430	Recap <i>Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow</i>
1430	<i>Lunch & End of Day One</i>

Day 2

0730 – 0830	DCS Hardware & Software <i>Traditional Process Controllers • Architecture of Controllers • Software • Programming • Execution Time • Programming vs Configuration • Function Blocks • Connections to the Controller</i>
0830 – 0930	Video Presentation <i>Kent Freelance 800F</i>
0930 – 0945	<i>Break</i>
0945 – 1030	SCADA Systems <i>Basic Architecture • Levels of Hierarchy • Communication Systems • SCADA Configuration</i>
1030 – 1100	Video Presentation <i>SCADA Case Study</i>
1100 – 1230	DCS vs PLC vs SCADA <i>General • Distributed Control Systems • Programmable Logic Controllers • SCADA Systems • Major Differences • Hybrid Systems • Summary</i>
1230 – 1245	<i>Break</i>



1245 – 1300	DCS in Petroleum Refining Distillation/Fractionation • Cracking • Treatment • Reforming • Oil & Gas Applications • Case Study
1300 – 1420	DCS Types Main Concepts – General • Honeywell Experion PKS • Emerson Delta V • Yokogawa CENTUM • FoxboroI/A
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Two

Day 3

0730 – 0900	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
0900 – 0930	Video Presentation Explosion at BP Refinery, Texas City
0930 – 0945	Break
0945 – 1100	Humans in Control The Process of Control • Touring the Plant with all the Senses • Control Panel Considerations • Work Stations • Look & Feel • Displays
1100 – 1230	Safety Considerations Intrinsic Safety • Explosion-proof Standard • Approval Standards • Oxygen
1230 – 1245	Break
1245 – 1400	Redundancy General • How Does It Work? • Device Redundancy • Network Redundancy • Port Redundancy • System Redundancy • Power Supply Redundancy • Cable Reliability
1400 – 1420	Video Presentation PLC Redundancy
1420 – 1430	Recap Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today & Advise Them of the Topics to be Discussed Tomorrow
1430	Lunch & End of Day Three

Day 4

0730 – 0930	Analogue Field Communications Introduction • Transmitter Classifications • Intrinsic Safety • HART & 4 – 2-mA • Driving the Circuit
0930 – 0945	Break
0945 – 1030	Smart Measurement Introduction • Features • Brief Specification • Overview • Application • Multi-variable Transmitter
1030 – 1130	Digital Field Communications Data Highway • Fieldbus Communications • Advantages of Fieldbus • Fieldbus Technologies • HART • Foundation Fieldbus • Profibus
1130 – 1230	Video Presentation HART Protocol
1230 – 1245	Break

1245 – 1420	Safety Instrumented Systems Preview • Concept • Safety Instrumented Function (SIF) • Safety Instrumented Systems (SIS) • Safety Integrity Level (SIL) • Hazard & 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 & 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

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”, “HMI SCADA”, “RSLogix 5000”, “Logix5555”, “Schneider Electric Magelis HMISTU” and “Automation Simulator”.



Allen Bradley SLC 500 Simulator



Allen Bradley Micrologix 1000 Simulator (Digital)



Allen Bradley Micrologix 1000 Simulator (Analog)



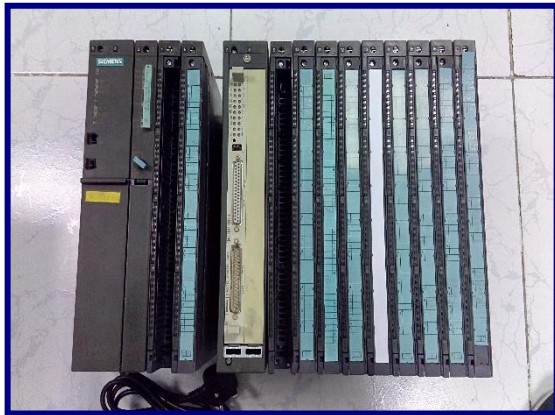
Allen Bradley SLC 5/03



Allen Bradley WS5610 PLC Simulator PLC5



Siemens S7-1200 Simulator



Siemens S7-400 Simulator



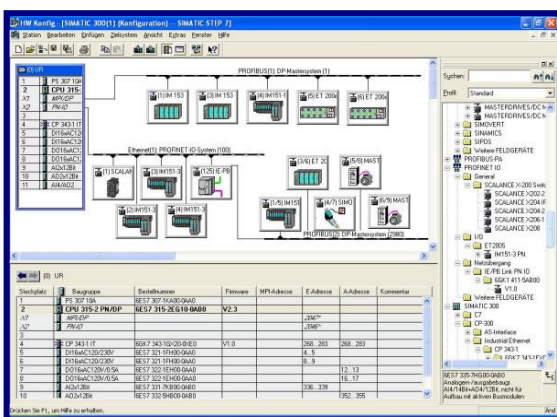
Siemens SIMATIC S7-300



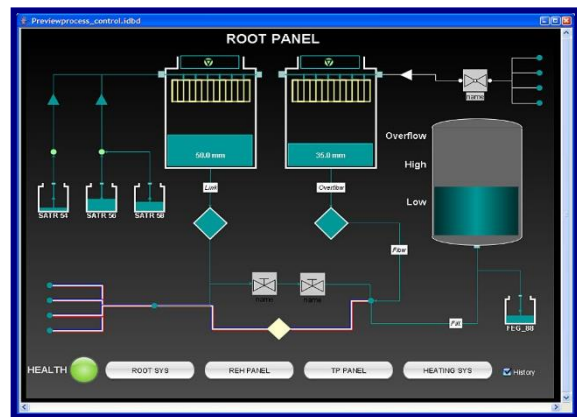
Siemens S7-200 Simulator



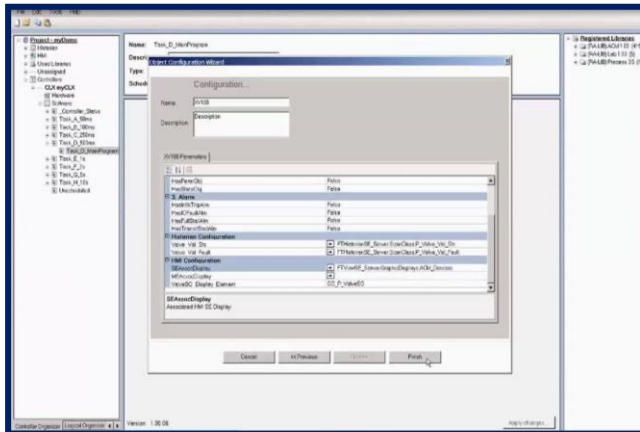
GE Fanuc Series 90-30 PLC Simulator



Siemens SIMATIC Step 7 Professional Software



HMI SCADA



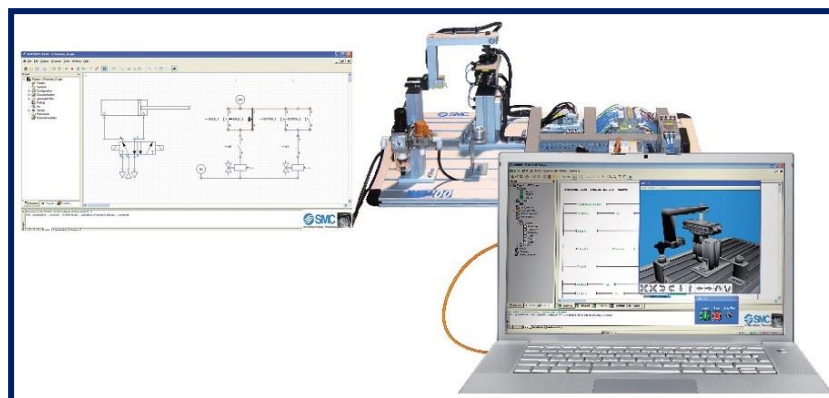
RSLogix 5000



Logix5555



Schneider Electric Magelis HMISTU



AutoSIM – 200 Automation Simulator

Course Coordinator

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