COURSE OVERVIEW IE0150

Distributed Control System (DCS) Principles, Applications, Selection & Troubleshooting

Course Title

Distributed Control System (DCS) Principles, Applications, Selection & Troubleshooting



Course Date/Venue

Session 1: June 27-July 01, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar
Session 2: September 26-30, 2027/Meeting Plus 9, City Centre Rotana, Doha, Qatar



Course Reference

IE0150

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.

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/Outcomes & Benefits for the Participants

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.

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

Haward's certificates are accredited by the following international accreditation organizations:

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). 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.

- 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.

Course Instructor(s)

This course will be con\ducted 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. Peter Hendrik is a **Senior Electrical & Instrumentation Engineer** with over **30 years** of extensive experience within the **Oil & Gas**, **Petrochemical**, **Refinery** and **Mining** industries. His wide expertise lies extensively in the areas of **Industrial Electrical Instrumentation** Systems, **Energy** Management System, **Renewable Energy** Generation, **Energy Storage** Systems, **Renewable & Non-Renewable Energy** Sources, **Cable Testing & Fault** Location, **Fault Analysis** in Electrical Networks & Distribution Cables, **Cable Splicing**, **Jointing & Termination**, **Cable Laying**, **Power Cable** Testing, **Electrical Safety**, **Protection Relay** Application, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Hazards** Assessment, Lock-Out & Tag-Out (**LOTO**), Electrical Transient Analysis Program (**ETAP**), **Distribution** Systems, Electrical **Substations**, **UPS & Battery** System, **Earthing & Grounding**, **Load Forecasting**, **Power Generation** and **Generators**, **Transformers & Motors**. Further, he is also well-versed in **Electrical Instrumentation & Control** Systems, **Industrial Instrumentation**, **Information Technology** Engineering, **Electronic Design & Computer** Engineering, **Industrial Automation**, Programmable Logic Controller (**PLC**), AC Drives, Human-Machine Interface (**HMI**), Supervisory Control and Data Acquisition (**SCADA**), **Automation & Process Control** and Distributed Control System (**DCS**).

During his career life, Mr. Hendrik held significant positions and dedication as the **Human Resources & Training Manager**, **Project Engineer**, **Electrical & Instrumentation Engineer**, **Senior Technician**, **Instrumentation Technician** and **Senior Instructor/Trainer** from various companies such as the Automação Limitada, Rockwell Automation, Rustenburg Platinum Mines, Grootvlei Mine and South African Defence Force.

Mr. Hendrik has a **National Higher Diploma** in **Electrical Engineering** and a **Diploma** in **Teaching & Learning** as well as **Office Management & Administration**. Further, he is a **Senior Instructor/Trainer** and has delivered numerous trainings, courses, workshops, seminars and conferences internationally.

Course Fee

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.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Training Methodology

Our courses employ an interactive, learner-centred methodology that integrates theoretical knowledge with practical application. The training is delivered through a suitable combination of some or all of the following methods, selected according to the course content and learning objectives:

- Instructor-led presentations and facilitated discussions
- Practical workshops and participant presentations
- Hands-on exercises and real-world case studies
- Equipment demonstrations and technical drawings
- Hardware- and software-based simulations
- Gamification & Role Play in soft-skills courses only
- Virtual Reality (VR) and Augmented Reality (AR)
- Instructional videos and other relevant training resources

This blended approach encourages active participation, strengthens practical skills and supports the effective application of acquired knowledge in the workplace.

Learning Design & Customization

This course can be customized to the exact requirements of clients. Haward Technology is so proud of our huge capabilities in tailoring our courses to the training needs of our valued clients.

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 – 1200	***Introduction to Control Systems*** *History ● Direct Digital Control ● Centralised Computer Control ● Distributed Control Systems ● Programmable Logic Controllers*
1200 – 1230	***Video Presentation*** *Distributed Control Systems*
1230 – 1245	*Break*
1245 – 1400	***Modes of Control*** *Stability ● Ultimate Gain ● Tuning Methods ● Quarter Decay Ratio ● Ratio Control ● Application Examples*
1400 – 1420	***Video Presentation*** *Advanced Process Control*
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 One*

Day 2

0730 – 0830	***DCS Hardware & Software*** *Traditional Process Controllers ● Architecture of Controllers ● Software ● Programming ● Execution Time ● Programming versus Configuration ● Function Blocks ● Connections to the Controller*
0830 – 0930	***Video Presentation*** *Kent Freelance 800F*
0930 – 0945	*Break*
0945 – 1030	***SCADA Systems*** *Basic Architecture ● Levels of Hierarchy ● Communication Systems ● SCADA Configuration*
1030 – 1100	***Video Presentation*** *SCADA Case Study*
1100 – 1230	***DCS versus PLC versus SCADA*** *General ● Distributed Control Systems ● Programmable Logic Controllers ● SCADA Systems ● Major Differences ● Hybrid Systems ● Summary*
1230 – 1245	*Break*
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”, “RSLogix 5000”, “Logix5555”, “Schneider Electric Magelis HMISTU”, “Automation Simulator”, “Siemens S7-1500” 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



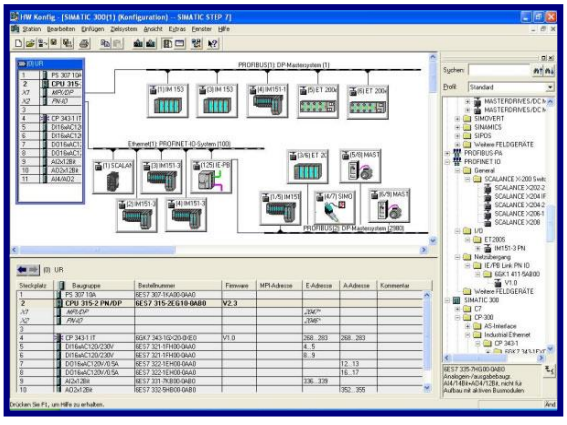
Siemens SIMATIC S7-300



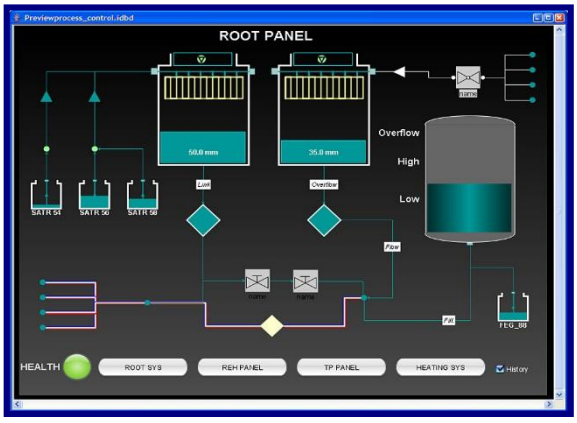
Siemens S7-200 Simulator



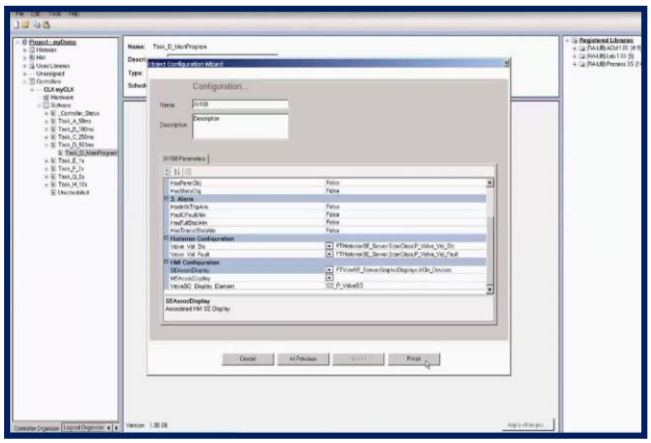
GE Fanuc Series 90-30 PLC Simulator



Siemens SIMATIC Step 7 Professional Software



HMI SCADA



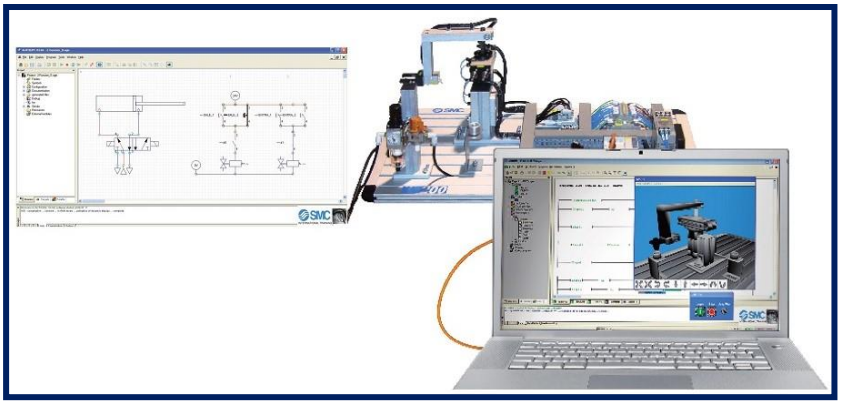
RSLogix 5000



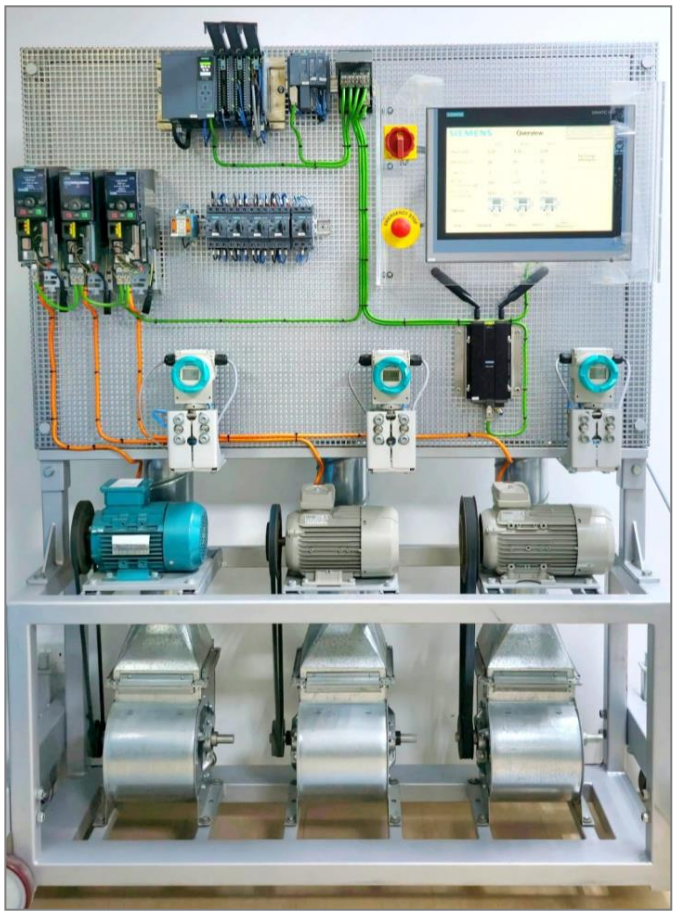
Logix5555

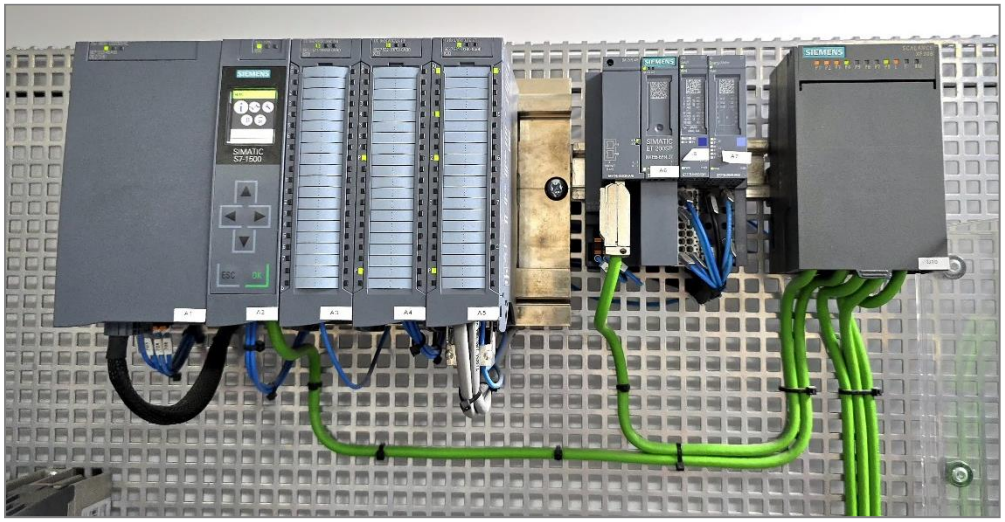


Schneider Electric Magelis HMISTU

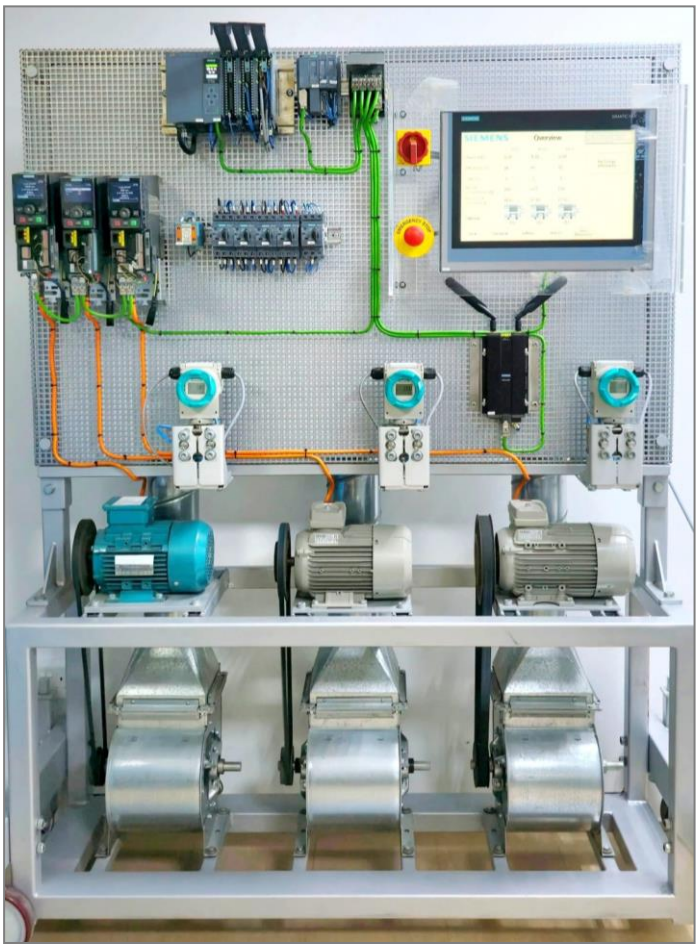


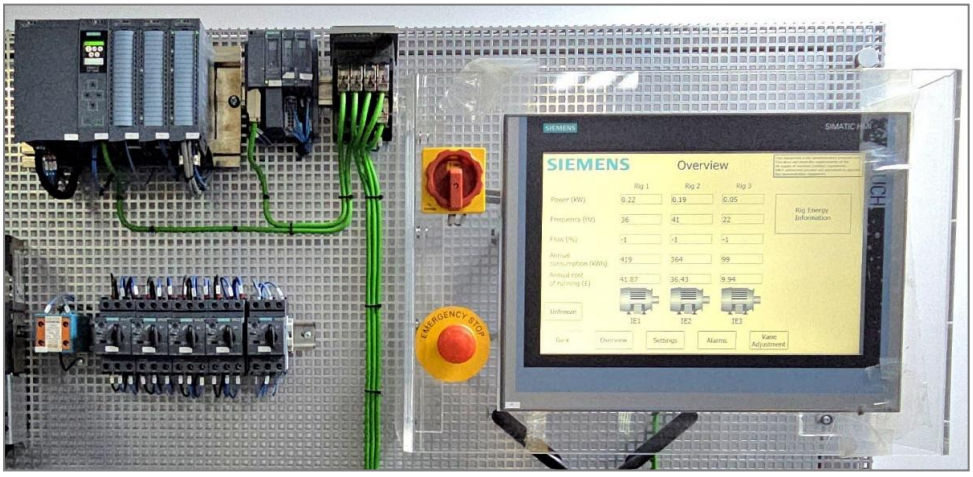
AutoSIM – 200 Automation Simulator





Instrumentation, Automation & Control Simulator
Siemens S7-1500





Instrumentation, Automation & Control Simulator
HMI SCADA

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