



The course is designed to provide participants with a comprehensive understanding of the various types of Variable Frequency Drives. Participants will be able to specify, select, commission and maintain these equipment for their applications. The excellent knowledge and skills that participants gained in this course will help their companies in achieving reduced capital, operating and maintenance costs along with increase in efficiency.

Course Objectives

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

- Apply and gain a good working knowledge on variable frequency drives (VFDs)
- Explain the basic principles of electrical machines, electrical devices, symbols and circuits
- Discuss electric motor types, operations and performance as well as the 3-phase AC induction motors including its basic construction, principles of operation, electrical and mechanical performance, etc
- Describe motor speed control, power electronic converters, protection of AC converters and motors
- Illustrate the control systems for AC variable frequency drives (VFD)
- Select AC converters and install and commission AC variable frequency speed drives (VFD)

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 variable frequency drives (VFD) for those in charge of variable frequency drives and electrical motors including engineers, managers, technologists and other technical personnel.

Course Fee

Al Khobar	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.
Abu Dhabi	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
Doha	US\$ 5,500 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.
Dubai	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 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 **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.

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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.

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, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:



Mr. Sydney Thoresson, PE, BSc, is a **Senior Electrical & Instrumentation Engineer** with over **40 years** of extensive experience within the **Power & Water Utilities** and Other **Energy Sectors**. His specialization highly evolves in **Electrical Safety, Power System Equipment, Electrical Drawing, Electrical Forecasting, Transmission Networks, Substation, Distribution**

Networks, Substation Automation Systems & Application, Electrical System, HV/LV Electrical Authorisation, Variable Frequency Drives (VFD), HV/LV Equipment, Circuit Breaker, Motor Controllers, Hazardous Area Classification, Intrinsic Safety, Electrical Power Systems Quality & Troubleshooting, Protection & Relay, Electric & Control System Commissioning, Liquid & Gas Flowmetering, Fault Analysis in Electrical Networks & Distribution Cables, Custody Measurement, Ultrasonic Flowmetering, Loss Control, Gas Measurement, Process Control Instrumentation, Compressor Control & Protection, Control Systems, Programmable Logic Controllers (PLC), SCADA, Distributed Control Systems (DCS) especially in Honeywell DCS, H&B DCS, Modicon, Siemens, Telemecanique, Wonderware and Adrioit. Moreover, he has vast experience in the field of **Safety Instrumented Systems (SIS), Safety Integrity Level (SIL), Emergency Shutdown (ESD), Flowmetering & Custody Measurement, Multiphase Flowmetering, Measurement and Control, Mass Measuring System Batching (Philips), Arc Furnace Automation-Ferro Alloys, Walking Beam Furnace, Blast Furnace, Billet Casting Station, Cement Kiln Automation, Factory Automation and Quality Assurance Accreditation (ISO 9000 and Standard BS 5750).**

During Mr. Thoresson's career life, he has gained his thorough and practical experience through various challenging positions such as a **Project Manager, Contracts Manager, Managing Director, Technical Director, Divisional Manager, Plant Automation Engineer, Senior Consulting Engineer, Senior Systems Engineer, Consulting Engineer, Service Engineer and Section Leader** from several international companies such as **Philips, FEDMIS, AEG, DAVY International, BOSCH Instrumentation and Control, Billiton, Endress/Hauser, Petronet, Iscor, Spornet, Eskom and Afrox.**

Mr. Thoresson is a **Registered Professional Engineering Technologist** and has a **National Higher Diploma (NHD) & a National Diploma in Radio Engineering** from the **Witwatersrand Technikon**. Further, he is a **Certified Instructor/Trainer, a Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management (ILM)**, an active member of the **International Society of Automation (ISA)** and the **Society for Automation, Instrumentation, Measurement and Control (SAIMC).**

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 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 – 0745	<i>Registration & Coffee</i>
0745 – 0800	<i>Welcome & Introduction</i>
0800 – 0815	PRE-TEST
0815 – 0930	Basic Principles of Electrical Machines <i>Introduction to Electrical Machines • AC Power Systems • Meters Used in Troubleshooting</i>
0930 – 0945	<i>Break</i>
0945 – 1100	Electrical Devices, Symbols & Circuits <i>Devices and Symbols • Electrical Circuits • Reading and Understanding Electrical Drawings • Reading and Understanding Ladder Logic • Wires and Terminal Numbering</i>
1100 – 1230	Electric Motors Types, Operations & Performance <i>Fundamentals of Motor Technology • Basic Principles of Rotating Electrical Machines • Fundamental Principles of Speed Control • Efficiency, Torque, Inertia, Horsepower/Power Factor</i>
1230 – 1245	<i>Break</i>
1245 – 1420	Electric Motors Types, Operations & Performance (cont'd) <i>Torque-Speed Curves • Induction/Wound Rotor/Synchronous Motor Types • Basic Construction of a Motor • Principles of Operation and Performance</i>
1420 – 1430	Recap <i>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</i>
1430	<i>Lunch & End of Day One</i>

Day 2

0730 – 0930	3-Phase AC Induction Motors <i>Basic Construction • Principles of Operation • The Equivalent Circuit • Electrical and Mechanical Performance</i>
0930 – 0945	<i>Break</i>



0945 – 1100	3-Phase AC Induction Motors (cont'd) Motor Acceleration • AC Induction Generator Performance • Efficiency of Electric Motors
1100 – 1230	3-Phase AC Induction Motors (cont'd) Rating of AC Induction Motors • Electric Motor Duty Cycles • Cooling and Ventilation of Electric Motors (IC) • Degree of Protection of Motor Enclosures (IP)
1230 – 1245	Break
1245 – 1420	3-Phase AC Induction Motors (cont'd) Construction and Mounting of AC induction Motors • Anti-Condensation Heaters • Methods of Starting AC Induction Motors
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 – 0930	Motor Speed Control The Need for Variable Speed Drives • Fundamental Principles • Torque-Speed Curves for Variable Speed Drives • Types of Variable Speed Drives
0930 – 0945	Break
0945 – 1100	Motor Speed Control (cont'd) Mechanical Variable Speed Drive Methods • Hydraulic Variable Speed Drive Methods • Electromagnetic or 'Eddy Current' Coupling • Electrical Variable Speed Drive Methods
1100 – 1230	Power Electronic Converters Power Diodes • Power Thyristors • Commutation • Power Electronic Rectifiers (AC/DC Converters) • Gate Commutated Inverters (DC/AC Converters) • Gate Controlled Power Electronic Devices • Other Power Converter Circuit Components
1230 – 1245	Break
1245 – 1420	Protection of AC Converters & Motors AC Frequency Converter Protection Circuits • Operator Information and Fault Diagnostics • Electric Motor Protection • Thermal Overload Protection - Current Sensors • Thermal Overload Protection - Direct Temperature Sensing
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	Control Systems for AC Variable Frequency Drives (VFD) The Overall Control System • Power Supply to the Control System • The DC Bus Charging Control System • The PWM Rectifier for AC Converters • Variable Speed Drive Control Loops • Vector Control for AC Drives • Current Feedback in AC Variable Speed Drives • Speed Feedback from the Motor
0930 – 0945	Break

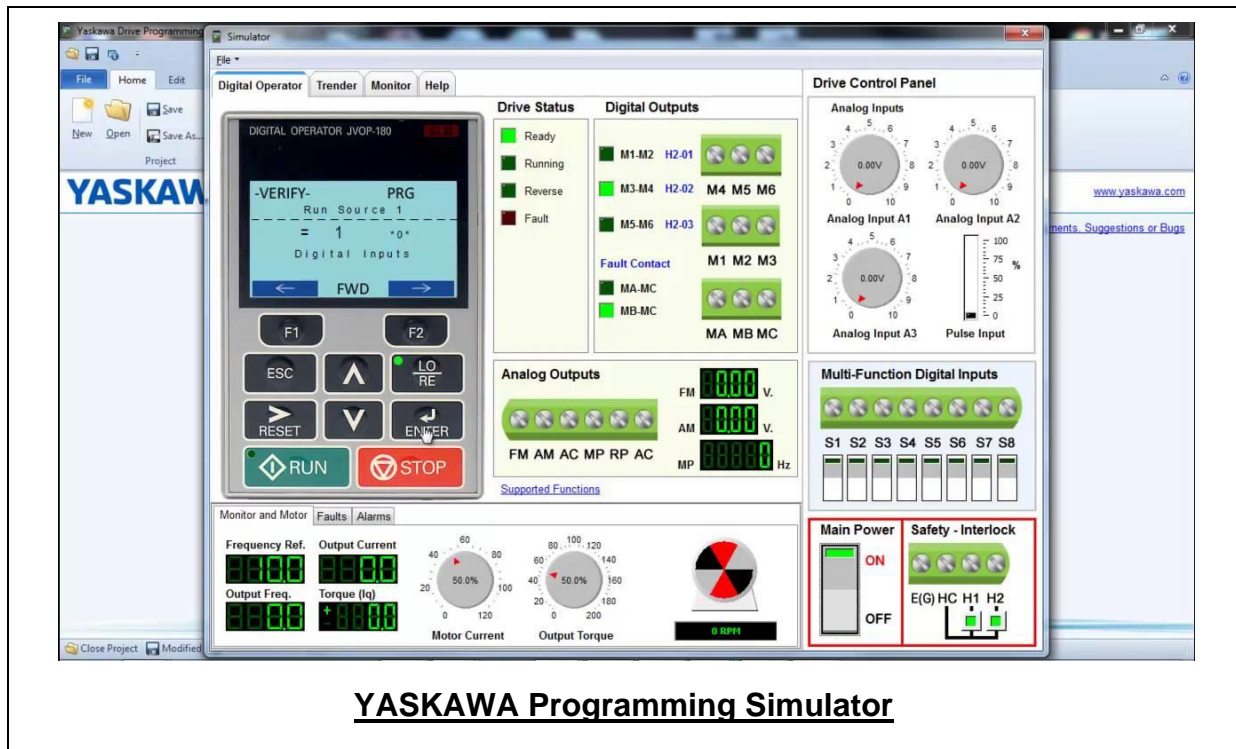




0945 – 1100	Selection of AC Converters The Basic Selection Procedure • The Load ability of Converter Fed Squirrel Cage Motors • Operation in the Constant Power Region • The Nature of the Machine Load • The Requirements for Starting • The Requirements for Stopping • Control of Speed, Torque and Accuracy • Selecting the Correct Size of Motor and Converter
1100 – 1230	Installation & Commissioning of AC Variable Frequency Drives (VFD) General Installation and Environmental Requirements • Power Supply Connections and Earthing Requirements • Start/Stop Control of AC Drives
1230 – 1245	Break
1245 – 1345	Installation & Commissioning of AC Variable Frequency Drives (VFD) (cont'd) Installing AC Converters into Metal Enclosures • Control Wiring for Variable Speed Drives • Commissioning Variable Speed Drives Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course
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 our state-of-the-art “Yaskawa Programming Simulator”.



YASKAWA Programming Simulator

Course Coordinator

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