COURSE OVERVIEW IE0068
Industrial Automation with MCC and VFD System

Course Title
Industrial Automation with MCC and VFD System

Course Date/Venue
Session 1: April 21-25, 2025/Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: October 13-17, 2025/Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
IE0068

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies and exercises Theory learnt will be applied using our state-of-the-art simulators.

This course is designed to provide participants with a detailed and up-to-date overview of Industrial Automation with MCC and VFD Systems. It covers the basics of electrical power systems, power factor, energy efficiency, electrical safety fundamentals and earthing and grounding principles; the control system basics, industrial motors and detailed MCC design and layout; the MCC installation guidelines and procedures, testing, commissioning, routine and preventive maintenance practices and common troubleshooting techniques; and the types of starters in MCCs, protection devices in MCCs and communication and smart MCCs.

Further, the course will also discuss the VFD principles of operation, VFD components and design, VFD configuration and programming, VFD protection mechanisms and applications of VFD system; the writing and communication setup, protocols for MCC-VFD communication and synchronization of multiple drives; the role of PLCs in MCC and VFD integration; configuring HMIs for MCC and VFD control; and the real-time monitoring, data logging and alarm and fault management.

During this interactive course, participants will learn the energy-saving strategies with MCC and VFD, power quality issues and mitigation techniques; the electrical and mechanical safety measures, lockout/tagout procedures, risk assessment and emergency shutdown procedures; the advanced features of VFDs and process automation with MCC and VFD; the diagnostic tools for MCC and VFD, step-by-step troubleshooting methodology, and analyzing fault logs and system reports; modernizing existing MCC system and upgrading VFDs for higher performance; the energy efficiency retrofitting techniques and cost-benefit analysis of upgrades; and the industrial automation standards, environmental regulations, electrical codes and certifications and documentation and reporting requirements.

Course Objectives

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

- Apply and gain an in-depth knowledge on industrial automation with motor control center (MCC) and variable frequency drive (VFD) systems
- Discuss industrial automation, motor control center and variable frequency drive system
- Explain the basics of electrical power systems, power factor, energy efficiency, electrical safety fundamentals, and earthing and grounding principles
- Recognize control system basics, industrial motors and detailed MCC design and layout
- Employ MCC installation guidelines and procedures, testing, commissioning, routine and preventive maintenance practices, and common troubleshooting techniques
- Identify the types of starters in MCCs, protection devices in MCCs, and communication and smart MCCs
- Determine VFD principles of operation, VFD components and design, VFD configuration and programming, VFD protection mechanisms and applications of VFD system
- Apply writing and communication setup, protocols for MCC-VFD communication and synchronization of multiple drives
- Define the role of PLCs in MCC and VFD integration, configure HMIs for MCC and VFD control and apply real-time monitoring, data logging, and alarm and fault management
- Employ energy-saving strategies with MCC and VFD, identify power quality issues and mitigation techniques and apply electrical and mechanical safety measures, lockout/tagout procedures, risk assessment and emergency shutdown procedures
- Discuss the advanced features of VFDs covering multi-motor control, regenerative braking, dynamic braking resistors and custom programming options
- Carryout process automation with MCC and VFD, integration with SCADA/DCS systems and predictive maintenance systems
- Use diagnostic tools for MCC and VFD, apply step-by-step troubleshooting methodology and analyze fault logs and system reports

- Modernize existing MCC system, upgrade VFDs for higher performance and apply energy efficiency retrofitting techniques and cost-benefit analysis of upgrades
- Review industrial automation standards, environmental regulations, electrical codes and certifications, and documentation and reporting requirements

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 industrial automation with MCC and VFD systems for engineers, electrical engineers, automation engineers, mechanical engineers, technicians and operators, maintenance technicians, plant operators, project managers, supervisors and team leads, consultants and system integrators and other technical staff.

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 Fee

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.

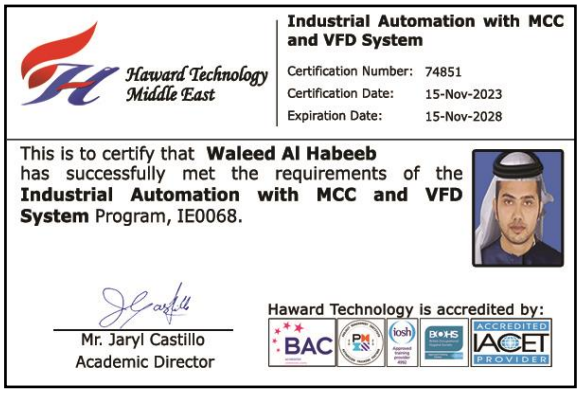
Course Certificate(s)

(1) Internationally recognized Competency Certificates and Plastic Wallet Cards will be issued to participants who completed a minimum of 80% of the total tuition hours and successfully passed the exam at the end of the course. Certificates are valid for 5 years.

Recertification is FOC for a Lifetime.

Sample of Certificates

The following are samples of the certificates that will be awarded to course participants:-



(2) Official Transcript of Records will be provided to the successful delegates with the equivalent number of ANSI/IACET accredited Continuing Education Units (CEUs) earned during the course.

Haward Technology Middle East

Continuing Professional Development (HTME-CPD)

CEU Official Transcript of Records

TOR Issuance Date: 15-Nov-23

HTME No. 74851

Participant Name: Waleed Al Habeeb

Program Ref.	Program Title	Program Date	No. of Contact Hours	CEU's
IE0068	Industrial Automation with MCC and VFD System	November 11-15, 2023	30	3.0

Total No. of CEU's Earned as of TOR Issuance Date **3.0**

TRUE COPY

Jaryl Castillo
Academic Director

Haward Technology has been approved as an Accredited Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this approval, Haward Technology has demonstrated that it complies with the ANSI/IACET 1-2018 Standard which is widely recognized as the standard of good practice internationally. As a result of their Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for programs that qualify under the ANSI/IACET 1-2018 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 Association 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 is accredited by

P.O. Box 26070, Abu Dhabi, United Arab Emirates | Tel.: +971 2 3091 714 | E-mail: info@haward.org | Website: www.haward.org

Certificate Accreditations

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**. 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 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 **Petrochemical**, **Utilities**, **Oil**, **Gas** and **Power** industries. His specialization highly evolves in **Process Control Instrumentation**, **Process Instrumentation & Control**, **Process Control**, **Instrumentation**, Troubleshooting & Problem Solving, Instrumentation Engineering, Process Control (**PCI**) & Safeguarding, **Instrument Calibration & Maintenance**, **Instrumented Safety Systems**, High Integrity Protection Systems (**HIPS**), Process Controller, **Control Loop & Valve Tuning**, **Compressor Control & Protection**, **Control Systems**, Programmable Logic Controllers (**PLC**), **SCADA System**, **PLC & SCADA** - Automation & Process Control, **PLC & SCADA** Systems Application, Technical **DCS/SCADA**, **PLC-SIMATIC S7 300/400**: Configuration, Programming and Troubleshooting, **PLC, Telemetry and SCADA** Technologies, Cyber Security of Industrial Control System (**PLC, DCS, SCADA & IED**), Basics of **Instrumentation Control System, DCS**, **Distributed Control System** - Operations & Techniques, Distributed Control System (**DCS**) Principles, Applications, Selection & Troubleshooting, Distributed Control Systems (**DCS**) especially in **Honeywell DCS**, **H&B DCS**, **Modicon, Siemens**, **Telemecanique**, **Wonderware** and **Adrioit,** Safety Instrumented Systems (**SIS**), Safety Integrity Level (**SIL**), Emergency Shutdown (**ESD**), **Emergency Shutdown** System, Variable Frequency Drive (**VFD**), **Process Control & Safeguarding**, **Field Instrumentation**, **Instrumented Protective Devices** Maintenance & Testing, Instrumented Protective Function (**IPF**), **Refining & Rotating Equipment**, **Equipment Operations**, **Short Circuit Calculation**, **Voltage Drop Calculation**, **Lighting Calculation**, **Hazardous Area Classification**, **Intrinsic Safety**, **Liquid & Gas Flowmetering**, **Custody Measurement**, **Ultrasonic Flowmetering**, **Loss Control**, **Gas Measurement**, **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**). Further, he is also well-versed in **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Log-Out & Tag-Out (**LOTO**), **ALARP & LOPA** Methods, Confined Workspaces, 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** and **Generator Protection**. He is currently the **Projects Manager** wherein he manages projects in the field of electrical and automation engineering and in-charge of various process hazard analysis, fault task analysis, FMEA and HAZOP study.

During Mr. Thoresson's career life, he has gained his thorough and practical experience through various challenging positions and dedication as the **Contracts & Projects 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**, **Billiton** and **Endress/Hauser**.

Mr. Thoresson is a **Registered Professional Engineering Technologist** and has a **Bachelor's** degree in **Electrical & Electronics Engineering** and a **National Diploma** in **Radio Engineering**. Further, he is a **Certified Instructor/Trainer**, a **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**) and an active member of the International Society of Automation (**ISA**) and the Society for Automation, Instrumentation, Measurement and Control (**SAIMC**). He has further delivered numerous trainings, courses, seminars, conferences and workshops worldwide.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop 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 – 0930	***Introduction to Industrial Automation*** *Definition & Importance • Components of Automation Systems • Key Industrial Automation Applications • Trends & Future Prospects in Automation*
0930 – 0945	*Break*
0945 – 1030	***Overview of MCC (Motor Control Center)*** *What is an MCC? • Types of MCCs (Conventional & Intelligent) • Basic Components of MCC (Switchgear, Breakers, Relays, etc.) • Standards & Classifications (IEC, NEMA)*
1030 – 1130	***Basics of VFD (Variable Frequency Drive) Systems*** *What is a VFD? • Importance of VFDs in Automation • Basic Working Principles • Benefits of VFD Systems*
1130 – 1215	***Electrical Fundamentals for MCC & VFD Systems*** *Basics of Electrical Power Systems (Single-Phase versus Three-Phase) • Power Factor & Energy Efficiency • Electrical Safety Fundamentals • Earthing & Grounding Principles*
1215 – 1230	*Break*
1230 – 1330	***Control Systems Basics*** *Open-loop versus Closed-Loop Control • Overview of PLCs & HMIs in Automation • Sensors & Actuators in Control Systems • Communication Protocols in Automation (e.g., Modbus, Profibus)*
1330 – 1420	***Understanding Industrial Motors*** *Types of Motors Used in Automation (AC, DC, Stepper, Servo) • Motor Control Principles • Motor Ratings & Specifications • Motor Starting Methods & Protection*
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	***Detailed MCC Design & Layout*** *Components of MCC Design • Busbar Configuration & Types • Power Distribution Inside MCC • MCC Panel Arrangement & Labeling*
0830 – 0930	***MCC Installation & Maintenance*** *Installation Guidelines & Procedures • Testing & Commissioning MCCs • Routine & Preventive Maintenance Practices • Common Troubleshooting Techniques*
0930 – 0945	*Break*

0945 – 1100	***Types of Starters in MCCs*** *Direct-On-Line (DOL) Starter • Star-Delta Starter • Soft Starters • Applications & Differences Among Starters*
1100 – 1215	***Protection Devices in MCC*** *Overload Relays & Circuit Breakers • Short-Circuit Protection Devices • Thermal Protection & Fuses • Coordination of Protection Devices*
1215 – 1230	*Break*
1230 – 1330	***Communication & Smart MCCs*** *Intelligent MCCs (iMCCs) Overview • Integration of MCC with SCADA & DCS Systems • Use of Smart Devices in MCC • Data Monitoring & Diagnostics in iMCCs*
1330 – 1420	***Practical Exercises*** *Identifying MCC Components • Reading MCC Wiring Diagrams • Hands-on Assembly of a Basic MCC Panel • Simulated Troubleshooting Exercises*
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 – 0830	***VFD Principles of Operation*** *Working Principle of VFDs • Pulse Width Modulation (PWM) in VFDs • Frequency & Voltage Control • VFD Efficiency & Energy Savings*
0830 – 0930	***VFD Components & Design*** *Rectifier & Inverter Units • Filters & Capacitors • Cooling Systems in VFDs • User Interfaces & Displays*
0930 – 0945	*Break*
0945 – 1100	***VFD Configuration & Programming*** *Understanding VFD Parameters • Setting up Acceleration & Deceleration Times • Torque & Speed Control Settings • Integration with External Controls (PLCs, HMIs)*
1100 – 1215	***VFD Protection Mechanisms*** *Overcurrent & Overvoltage Protection • Thermal Overload & Ground Fault Protection • Common Fault Codes & Remedies • Maintenance Practices for VFD Systems*
1215 – 1230	*Break*
1230 – 1330	***Applications of VFD Systems*** *Pump & Fan Control • Conveyor Belt Systems • HVAC Applications • Specialized Applications (e.g., Cranes, Lifts)*
1330 – 1420	***Hands-on VFD Exercise*** *Connecting a Motor to a VFD • Parameter Setup for Specific Applications • Troubleshooting Common VFD Issues • Live Demonstration of Energy Savings*
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 – 0830	***Interfacing MCC & VFD Systems*** *Wiring & Communication Setup • Protocols for MCC-VFD Communication • Synchronization of Multiple Drives • Case Studies of MCC-VFD Integration*
0830 – 0930	***Automation Control with MCC & VFD*** *Role of PLCs in MCC & VFD Integration • Configuring HMIs for MCC & VFD Control • Real-time Monitoring & Data Logging • Alarm & Fault Management*
0930 – 0945	*Break*
0945 – 1100	***Energy Efficiency & Power Quality*** *Energy-Saving Strategies with MCC & VFD • Power Quality Issues & Mitigation Techniques • Harmonics in VFD Systems • Role of Filters & Reactors*
1100 – 1215	***Safety in MCC & VFD Operations*** *Electrical & Mechanical Safety Measures • Lockout/Tagout Procedures • Risk Assessment for MCC & VFD Systems • Emergency Shutdown Procedures*
1215 – 1230	*Break*
1230 – 1330	***Advanced Features of VFDs*** *Multi-Motor Control • Regenerative Braking • Dynamic Braking Resistors • Custom Programming Options*
1330 – 1420	***Practical Case Study*** *Simulated Industrial Scenario • Designing an Integrated MCC-VFD System • Configuring Parameters for Specific Applications • Testing the Integrated System*
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*

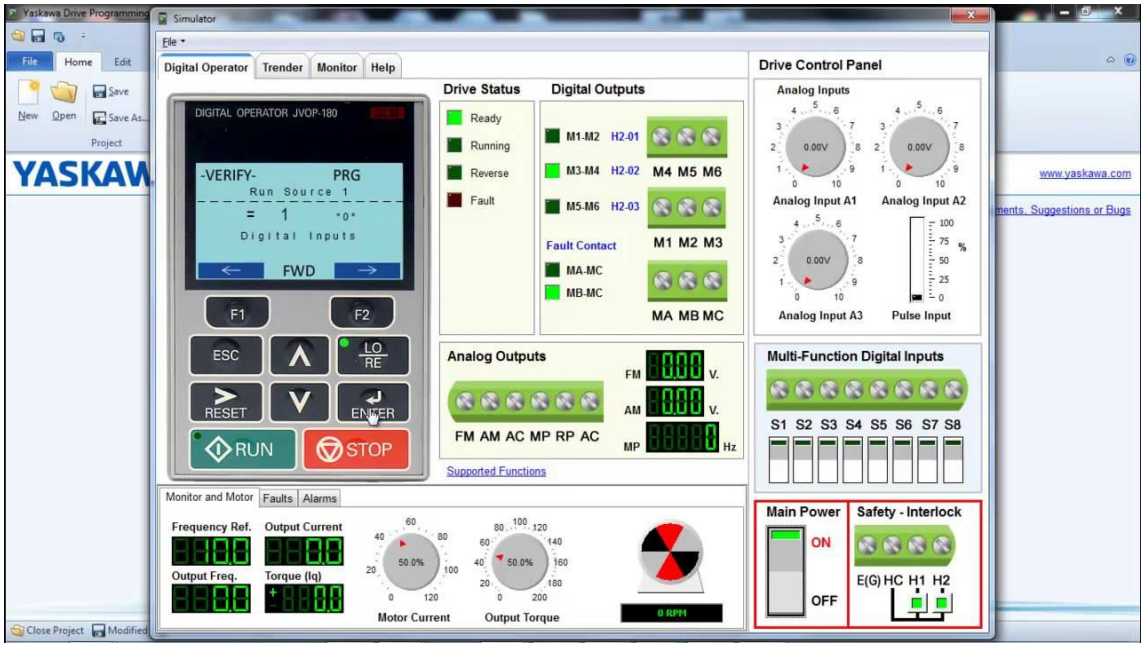
Day 5

0730 – 0830	***Advanced Industrial Applications*** *Process Automation with MCC & VFD • Integration with SCADA/DCS Systems • Predictive Maintenance Systems • IIoT Applications in MCC & VFD Systems*
0830 – 0930	***Diagnostics & Troubleshooting*** *Using Diagnostic Tools for MCC & VFD • Step-by-Step Troubleshooting Methodology • Analyzing Fault Logs & System Reports • Real-World Problem-Solving Scenarios*
0930 – 0945	*Break*
0945 – 1100	***Retrofitting & Upgrading Systems*** *Modernizing Existing MCC Systems • Upgrading VFDs for Higher Performance • Energy Efficiency Retrofitting Techniques • Cost-Benefit Analysis of Upgrades*
1100 – 1200	***Compliance & Standards*** *Industrial Automation Standards (IEC, IEEE, NEMA) • Environmental Regulations (EMI/EMC Compliance) • Electrical Codes & Certifications • Documentation & Reporting Requirements*
1200 – 1215	*Break*

1215 – 1300	***Capstone Project*** *Design & Implement a Real-World Automation System • MCC & VFD Integration for a Specific Application • Presentation & Demonstration of the Project • Feedback & Evaluation*
1300 – 1315	***Course Conclusion***
1315 – 1415	***COMPETENCY EXAM***
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

Allen Bradley SLC 500 Simulator

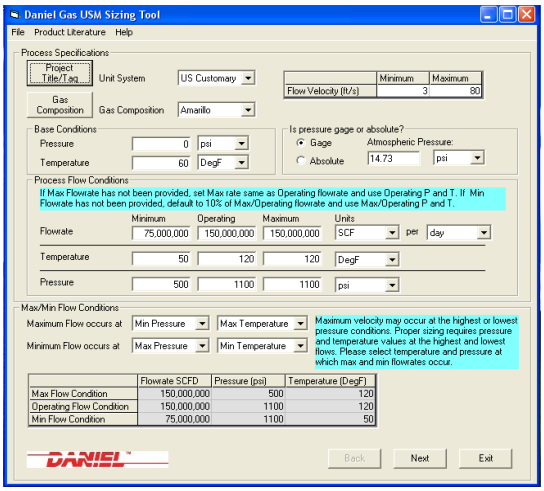
Siemens S7-200 Simulator

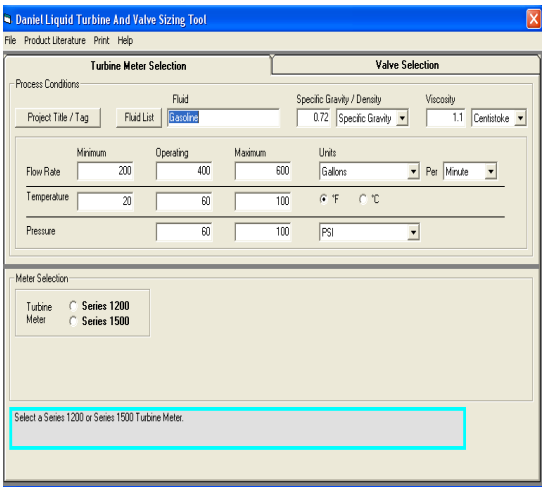
Allen Bradley Micrologix 1000 Simulator (Digital)

Allen Bradley Micrologix 1000 Simulator (Analog)

Allen Bradley SLC 5/03

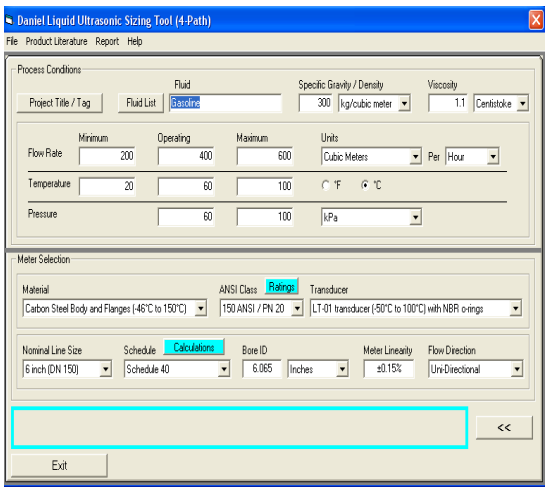
Allen Bradley WS5610 PLC Simulator PLC5

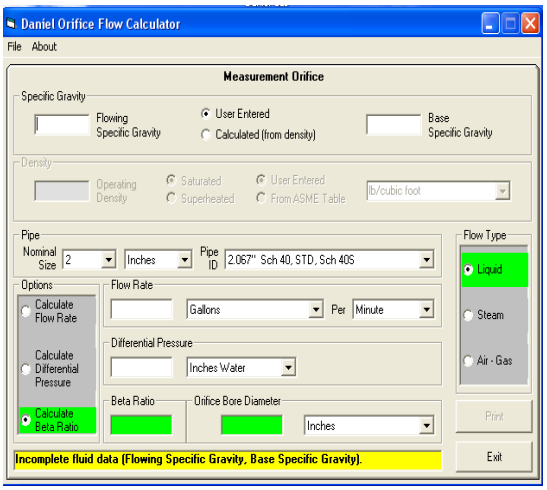




Gas Ultrasonic Meter (USM) Sizing Tool Software

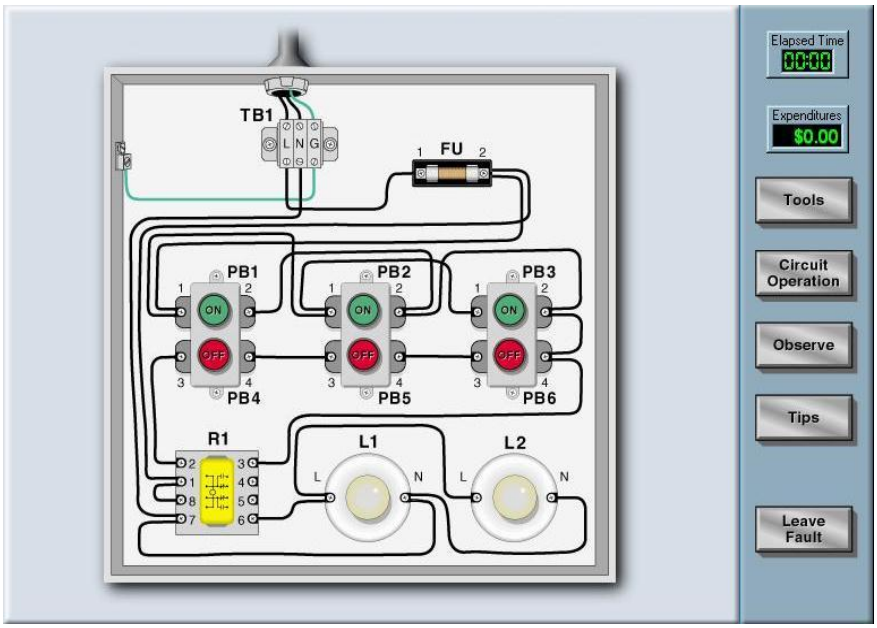
Liquid Turbine Meter and Control Valve Sizing Tool Software





Liquid Ultrasonic Meter Sizing Tool Software

Orifice Flow Calculator Software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PB2
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PB6
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L1
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Expenditures
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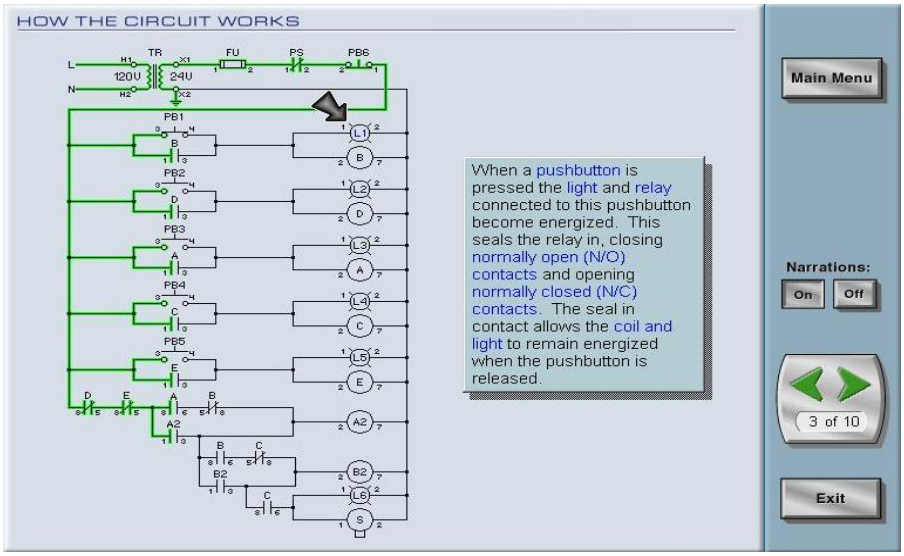
Tools
Circuit Operation
Observe
Tips
Leave Fault


HOW THE CIRCUIT WORKS
TR
FU
PS
PB6
120V
24V
PB1
PB2
PB3
PB4
PB5
When a pushbutton is pressed the light and relay connected to this pushbutton become energized. This seals the relay in, closing normally open (N/O) contacts and opening normally closed (N/C) contacts. The seal in contact allows the coil and light to remain energized when the pushbutton is released.
Main Menu
Narrations:
On
Off
3 of 10
Exit

Simutech Troubleshooting Electrical Circuits V4.1

Lab Volt Testing Device

Course Coordinator

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