COURSE OVERVIEW IE0098
Advancement in RTU Communication & Automation Systems

H-STK© INCLUDED

Course Title
Advancement in RTU Communication & Automation Systems

Course Date/Venue
Session 1: April 07-11, 2025/Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE
Session 2: October 19-23, 2025/Ajman Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
IE0098

3.0 CEUs (30 PDHs) AWARD

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.

This course is designed to provide delegates with a detailed and up-to-date overview of Advancement in RTU Communication & Automation Systems. It covers the purpose of RTUs, the key differences of RTU and PLC and the common industries using RTUs; the RTU hardware architecture, RTU communication protocol and advances in communication media; the common vulnerabilities in RTU system; the importance of data encryption, authentication and access control and cybersecurity standards; the modbus RTU & TCP/IP, DNP3 protocol and IEC protocols in RTUs; and the basics of MQTT protocol, publishing/subscribing model in RTU system and integrating MQTT with industrial IoT platforms.

Further, the course will also discuss the role of protocol converters and gateway configurations; the SCADA system integration and PLC and RTU interfacing; the remote monitoring and control covering real-time data acquisition, web-based RTU monitoring, cloud integration with RTUs and fault detection and diagnostics; the edge computing concepts and the benefits of edge analytics; the redundancy and reliability in RTU systems; the role of RTUs in data collection and basic principles of predictive maintenance; and integrating RTU data with analytics platforms and dashboard and reporting tools.

During the interactive course, participants will learn the artificial intelligence in automation systems, RTUs in smart grids and wireless sensor networks (WSN); reducing the RTU energy consumption, optimizing communication processes and design eco-friendly RTUs; the project management in RTU system deployment covering RTU system implementation, budgeting and resource allocation, risk management in RTU project and evaluating project success; the future trends in RTU communication comprising of advancements in IIoT for RTUs, integration of blockchain in RTU system, role of quantum communication in automation and predictions for RTU evolution; the preventive maintenance best practices, diagnosing communication failures, updating RTU firmware and software and remote troubleshooting techniques; and the system requirements, selecting hardware and protocols, design scalability and redundancy and building a cybersecurity strategy.

Course Objectives

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

- Apply and gain a comprehensive knowledge on the advancement in RTU communication and automation systems
- Discuss the purpose of RTUs, the key differences of RTU and PLC and the common industries using RTUs
- Explain the RTU hardware architecture, RTU communication protocol and advances in communication media
- Identify the common vulnerabilities in RTU systems, importance of data encryption, authentication and access control and cybersecurity standards
- Recognize modbus RTU & TCP/IP, DNP3 protocol and IEC protocols in RTUs
- Discuss the basics of MQTT protocol, publish/subscribe model in RTU systems and integrate MQTT with industrial IoT platforms
- Define the role of protocol converters and apply gateway configurations, SCADA system integration and PLC and RTU interfacing
- Employ remote monitoring and control covering real-time data acquisition, web-based RTU monitoring, cloud integration with RTUs and fault detection and diagnostics
- Describe edge computing concepts and the benefits of edge analytics as well as redundancy and reliability in RTU systems
- Discuss the role of RTUs in data collection, basic principles of predictive maintenance, integrating RTU data with analytics platforms and dashboard and reporting tools
- Recognize artificial intelligence in automation systems, RTUs in smart grids and wireless sensor networks (WSN)
- Reduce RTU energy consumption, optimize communication processes and design eco-friendly RTUs
- Apply project management in RTU system deployment covering RTU system implementation, budgeting and resource allocation, risk management in RTU project and evaluating project success

- Discuss the future trends in RTU communication comprising of advancements in IIoT for RTUs, integration of blockchain in RTU system, role of quantum communication in automation and predictions for RTU evolution
- Employ preventive maintenance best practices, diagnosing communication failures, updating RTU firmware and software and remote troubleshooting techniques
- Identify system requirements, select hardware and protocols, design scalability and redundancy and build a cybersecurity strategy

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 advancement in RTU communication and automation systems for automation engineers, control systems engineers, electrical engineers, instrumentation engineers, SCADA system operators/engineers, telecommunication engineers, project managers, technical support and maintenance staff, 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.

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.

Accommodation

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

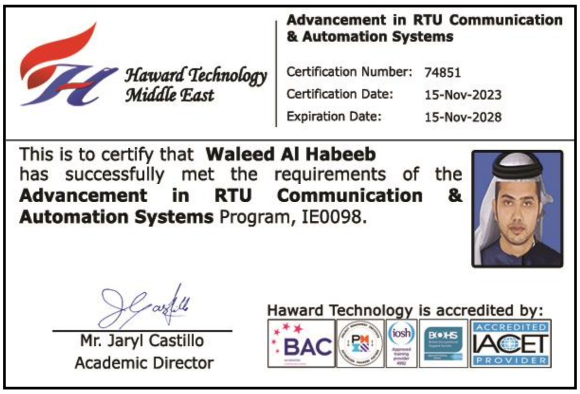
Course Certificate(s)

(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
IE0098	Advancement in RTU Communication & Automation Systems	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

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 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 Electromechanical Engineer** with over **30 years** of extensive experience in the **Power**, **Petroleum**, **Petrochemical** and **Utilities**. He specializes in **SIMATIC S7-300 & S7-1500**: Basic PLC Programming & Operation, Advanced Programming with **SIMATIC S7-1500** in TIA Portal, **SIMATIC S7-300** to **S7-1500 Migration,** Process Automation with **SIMATIC S7-1500 & PID Control,** Implementing Safety **Functions in S7-300/S7-1500 PLCs,** Structured Programming in **S7-300** using STL & SCL, **SIMATIC S7-300** Safety Systems, **HV/LV Equipment**, **High Voltage Electrical Safety**, **LV & HV Electrical System**, **HV Equipments Inspection & Maintenance**, **HV Switchgear Operation & Maintenance**, **LV Distribution Switchgear & Equipment**, **HV Switchgear Maintenance**, **HV/LV Electrical** Authorisation, **Hazardous Area Classification, Power Quality**, **Disturbance Analysis**, **Blackout**, **Power Network**, **Power Distribution**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, **ETAP**, Electrical **Substations**, Tariff Design & Structure Analysis, **Engineering Drawings, Codes & Standards**, **P&ID Reading, Interpretation & Developing**, **PLC**, **SCADA**, **DCS**, **Process Control**, **Instrumentation**, **Automation**, Power **Generation**, **Process Control Instrumentation**, **SIS**, **SIL**, **ESD**, **Alarm Management Systems**, **Fieldbus Systems** and **Fiber Optics** as well as the service pricing of these. Further, he is also well versed in **Pumps**, **Valves**, **Boilers**, **Pressure Vessels**, **Heat Recovery Steam Generators** (**HRSG**), **Bearings**, **Compressors**, **Motors**, **Turbines**, **Actuators**, **Carbon Footprint**, **Energy Efficiency**, **Power Plant Performance & Efficiency**, **P&ID**, **Engineering Drawing**, **Codes & Standards** and **Hydraulic Systems** 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 and also in 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 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 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's** & **Bachelor's** degree in **Electrical** and **Instrumentation Engineering** from the **University of Wisconsin Madison**, **USA**. Further, he has numerous 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	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0900	***Introduction to RTU Systems*** *Definition & Purpose of RTUs • Historical Evolution of RTU Systems • RTU versus PLC: Key Differences • Common Industries Using RTUs*
0900 – 0930	***RTU Hardware Architecture*** *RTU Processor Units • I/O Modules & Configurations • Power Supply Systems • Environmental Considerations (Temperature, Humidity, etc.)*
0930 – 0945	*Break*
0945 – 1100	***RTU Communication Protocols Overview*** *Serial Communication (RS-232, RS-485) • Modbus Protocol Basics • DNP3 Protocol Fundamentals • Introduction to IEC 60870-5*
1100 – 1230	***Advances in Communication Media*** *Fiber-Optic Communication • Wireless Communication in RTUs • Satellite Communication for Remote RTUs • Cellular Technologies (4G/5G)*
1230 – 1245	*Break*
1245 – 1330	***Cybersecurity in RTU Communication*** *Common Vulnerabilities in RTU Systems • Importance of Data Encryption • Authentication & Access Control • Cybersecurity Standards (e.g., NERC CIP, IEC 62351)*
1300 – 1420	***Hands-on Activity: Basic RTU Configuration*** *Setting up an RTU System • Connecting Basic I/O Devices • Monitoring Real-Time Data using Modbus*
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	***Modbus*** *Modbus RTU versus Modbus TCP/IP • Addressing & Function Codes • Modbus Mapping • Troubleshooting Common Modbus Issues*
0830 – 0930	***Understanding DNP3 Protocol*** *Role of DNP3 in SCADA System • Event-Driven versus Polling Mechanisms • DNP3 Object Groups & Variations • Secure Authentication in DNP3*
0930 – 0945	*Break*
0945– 1100	***IEC Protocols in RTUs*** *Introduction to IEC 61850 • Key Features & GOOSE Messaging • Comparison with IEC 60870-5 • Practical Applications in Substations*
1100 – 1230	***MQTT & IIoT Integration*** *Basics of MQTT protocol • Publish/Subscribe Model in RTU Systems • Integration with Industrial IoT Platforms • Security Considerations in MQTT*
1230 – 1245	*Break*

1245 – 1300	***Protocol Conversion & Gateways*** *Role of Protocol Converters • Gateway Configurations • Challenges in Protocol Conversion • Case studies: Multi-Protocol RTU Systems*
1300 – 1420	***Hands-on Activity: Protocol Analysis*** *Simulating Modbus & DNP3 communication • Capturing Data Packets using Wireshark • Analyzing Protocol Performance*
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	***SCADA System Integration*** *RTU as a Data Source for SCADA • RTU-SCADA Communication Workflows • Alarm & Event Management • Data Visualization Best Practices*
0900 – 0930	***PLC & RTU Interfacing*** *RTU-PLC Communication Methods • Protocol Compatibility • Case Study: Hybrid Automation Systems • Challenges in RTU-PLC Integration*
0930 – 0945	*Break*
0945 – 1100	***Remote Monitoring & Control*** *Real-Time Data Acquisition • Web-based RTU Monitoring • Cloud Integration with RTUs • Fault Detection & Diagnostics*
1100 – 1230	***Edge Computing in RTUs*** *Overview of Edge Computing Concepts • Benefits of Edge Analytics • Real-Time Decision-Making at the RTU Level • Use Cases for Edge RTUs*
1230 – 1245	*Break*
1245 – 1330	***Redundancy & Reliability in RTU Systems*** *Dual Communication Paths • Hot Standby Configurations • Fault-Tolerant Designs • Testing & Maintenance Strategies*
1330 – 1420	***Hands-on Activity: SCADA-RTU Integration*** *Configuring RTUs for SCADA Systems • Implementing Alarms & Notifications • Simulating System Failures & Recovery*
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	***Data Analytics & RTU Systems*** *Role of RTUs in Data Collection • Basic Principles of Predictive Maintenance • Integrating RTU Data with Analytics Platforms • Dashboards & Reporting Tools*
0830 - 0930	***Artificial Intelligence in Automation Systems*** *AI Applications in RTU-Based Automation • Machine Learning for Fault Prediction • Neural Networks for Process Optimization • Case Studies: AI-Driven RTU Systems*
0930 – 0945	*Break*
0945 – 1030	***RTUs in Smart Grids*** *Role of RTUs in Smart Grid Automation • Load Balancing & Demand Response • Integration with Renewable Energy Sources • Standards & Regulations for Smart Grids*
1030 – 1130	***Wireless Sensor Networks (WSN) & RTUs*** *Basics of WSN for Industrial Automation • RTU-WSN Integration Workflows • Power Management in Wireless Sensors • Emerging Technologies in WSN*

1130 – 1230	***Energy Efficiency in RTU Systems*** *Reducing RTU Energy Consumption • Optimizing Communication Processes • Energy Harvesting Technologies • Designing Eco-Friendly RTUs*
1230 – 1245	*Break*
1245 – 1420	***Hands-on Activity: Advanced Configuration*** *Configuring AI Tools with RTU Data • Implementing a Smart Grid Use Case • Deploying WSN with RTUs*
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	***Project Management in RTU System Deployment*** *Steps in RTU System Implementation • Budgeting & Resource Allocation • Risk Management in RTU Projects • Evaluating Project Success*
0830 - 0930	***Future Trends in RTU Communication*** *Advancements in IIoT for RTUs • Integration of Blockchain in RTU Systems • Role of Quantum Communication in Automation • Predictions for RTU Evolution*
0930 – 0945	*Break*
0945 – 1030	***RTU Maintenance & Troubleshooting*** *Preventive Maintenance Best Practices • Diagnosing Communication Failures • Updating RTU Firmware & Software • Remote Troubleshooting Techniques*
1030 - 1230	***Case Studies & Real-world Applications*** *RTUs in Oil & Gas • RTUs in Water & Wastewater Management • RTUs in Transportation Systems • Lessons Learned from Industry Failures*
1230 – 1245	*Break*
1245 - 1300	***Designing a Robust RTU System*** *Identifying System Requirements • Selecting Hardware & Protocols • Designing for Scalability & Redundancy • Building a Cybersecurity Strategy*
1300 - 1315	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1315 – 1415	***COMPETENCY EXAM***
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”, “Gas Ultrasonic Meter Sizing Tool”, “Liquid Turbine Meter and Control Valve Sizing Tool”, “Liquid Ultrasonic Meter Sizing Tool” , “Orifice Flow Calculator”, “Automation Simulator” and “PLCLogix 5000 Software”.

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

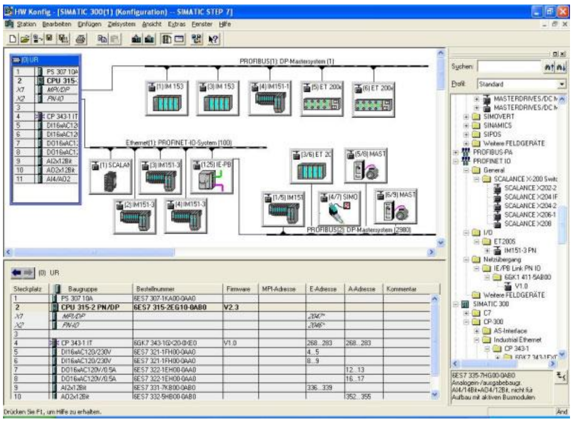
Siemens S7-1200 Simulator

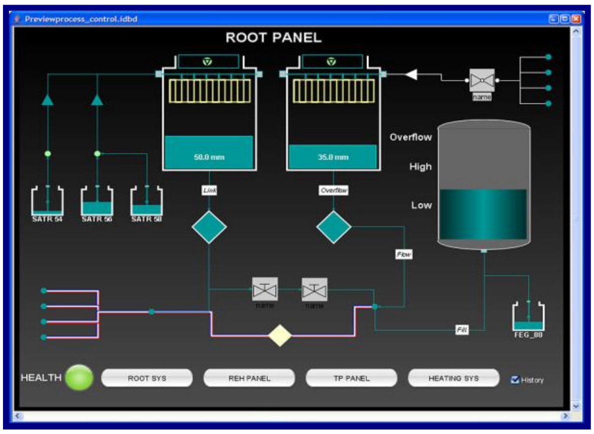
Siemens S7-400 Simulator

Siemens SIMATIC S7-300

Siemens S7-200 Simulator

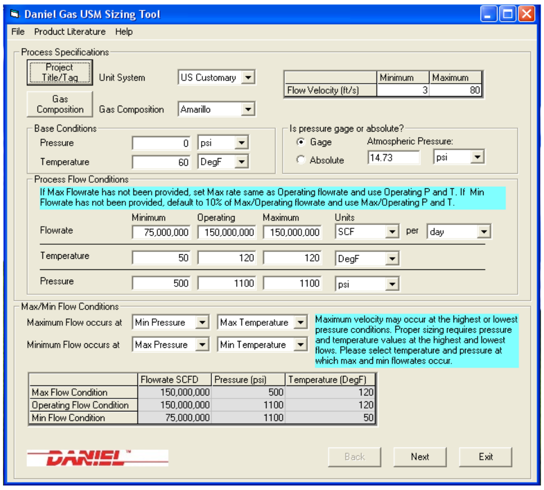
GE Fanuc Series 90-30 PLC Simulator



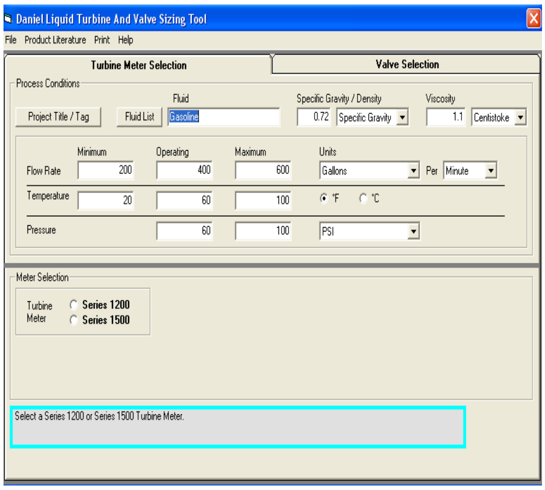


Siemens SIMATIC Step 7 Professional Software

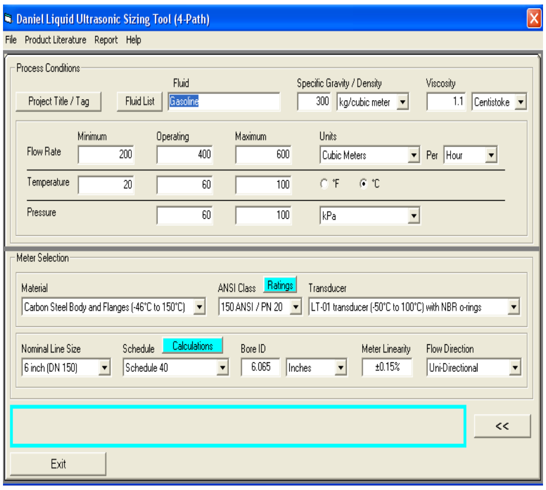
HMI SCADA



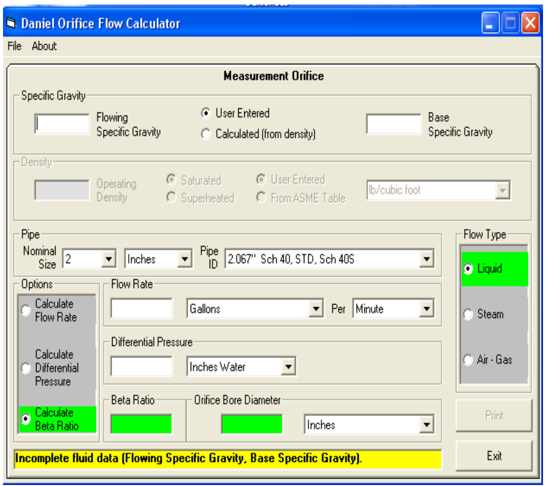
Gas Ultrasonic Meter (USM) Sizing Tool Simulator



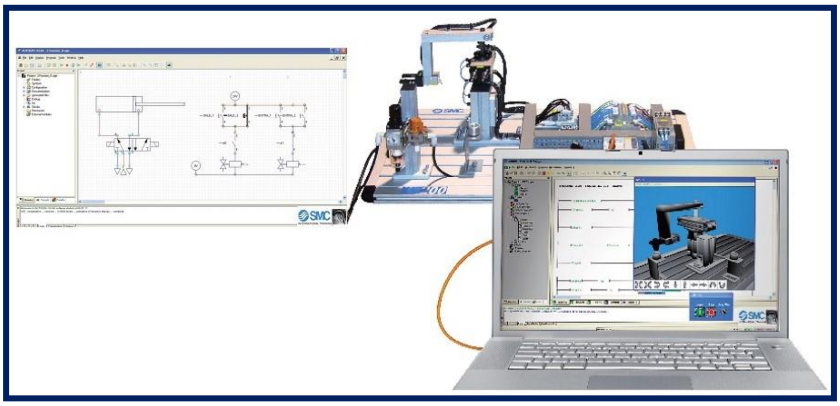
Liquid Turbine Meter and Control Valve Sizing Tool Simulator



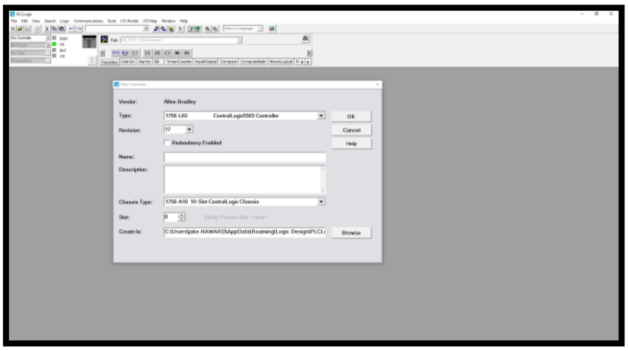
Liquid Ultrasonic Meter Sizing Tool Simulator

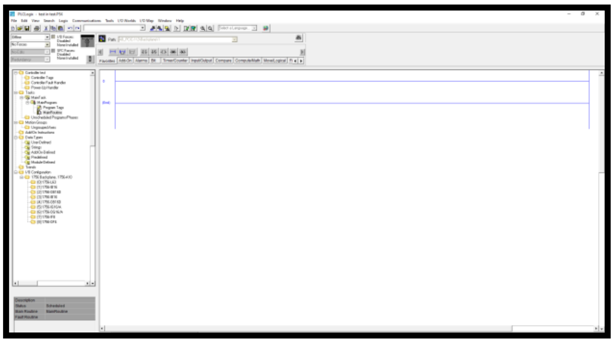


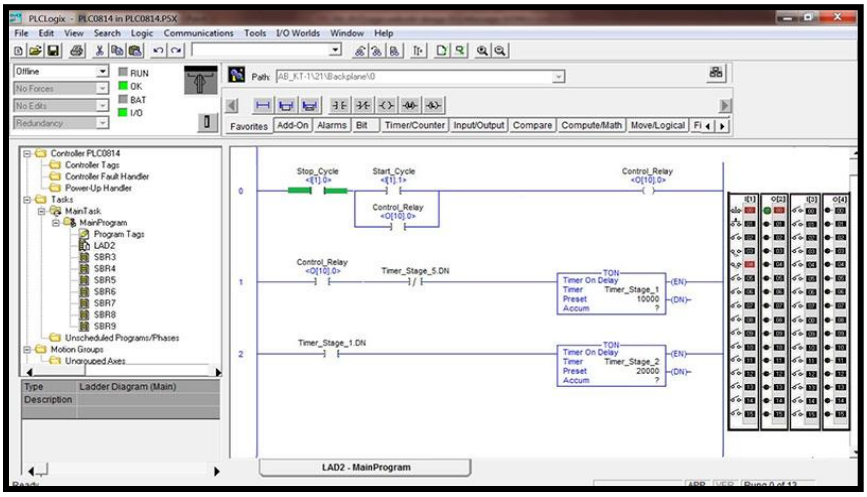
Orifice Flow Calculator Simulator



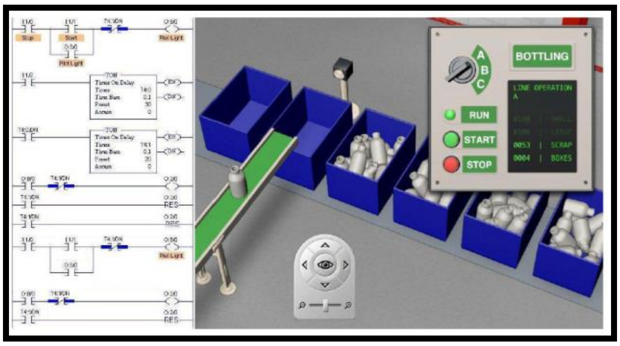
AutoSIM – 200 Automation Simulator

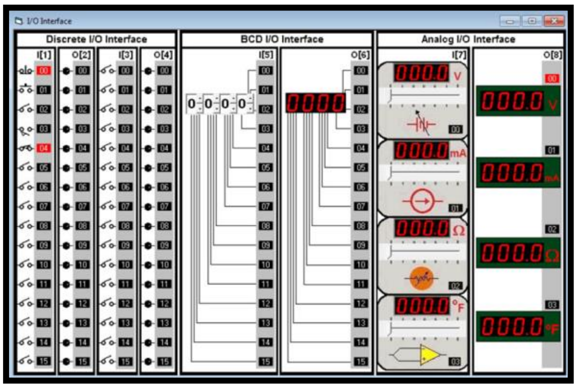






PLCLogix 5000 Software





Course Coordinator

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