COURSE OVERVIEW IE1205
DNP3 Application Layer, Supporting the RTUs from SCADA Master Side & Troubleshooting OPC Issues

Course Title
DNP3 Application Layer, Supporting the RTUs from SCADA Master Side & Troubleshooting OPC Issues

Course Date/Venue
December 06-10, 2026/TBA Meeting Room, Al Bandar Rotana - Creek, Dubai, UAE

3.0 CEUs (30 PDHs) AWARD

Course Reference
IE1205

H-STK© INCLUDED

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 participants with a detailed and up-to-date overview of DNP3 Application Layer, Supporting the RTUs from SCADA Master Side & Troubleshooting OPC Issues. It covers the DNP3 protocol, DNP3 protocol stack overview and DNP3 application layer fundamentals; the SCADA master architecture, RTU communication principles and DNP3 object groups and variations; the application layer function codes, time synchronization and event buffer management; supporting RTUs from SCADA master side; and the advanced polling strategies, DNP3 command processing and communication diagnostics.

During the interactive course, participants will learn the network performance analysis and DNP3 troubleshooting techniques; the OPC fundamentals, OPC integration with SCADA, OPC communication troubleshooting and OPC performance optimization; diagnosing OPC data problems and end-to-end SCADA communication troubleshooting; the common DNP3 communication problems and advanced root cause analysis; and the cybersecurity considerations and SCADA system performance optimization.

Course Objectives/Outcomes & Benefits for the Participants

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

- Apply and gain an in-depth knowledge on DNP3 application layer, supporting the RTUs from SCADA master side and troubleshooting OPC issues
- Discuss DNP3 protocol, DNP3 protocol stack overview and DNP3 application layer fundamentals
- Identify SCADA master architecture, RTU communication principles and DNP3 object groups and variations
- Carryout application layer function codes, time synchronization and event buffer management
- Support RTUs from SCADA master side and carryout advanced polling strategies, DNP3 command processing and communication diagnostics
- Employ network performance analysis and DNP3 troubleshooting techniques
- Identify OPC fundamentals and apply OPC integration with SCADA, OPC communication troubleshooting and OPC performance optimization
- Diagnose OPC data problems and apply end-to-end SCADA communication troubleshooting
- Recognize common DNP3 communication problems and carryout advanced root cause analysis, cybersecurity considerations and SCADA system performance optimization

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 DNP3 application layer, supporting the RTUs from SCADA master side and troubleshooting OPC issues for SCADA engineers, SCADA system administrators, automation and control engineers, instrumentation engineers, RTU & PLC engineers, electrical engineers, substation automation engineers, control room operators, SCADA support engineers, network and industrial communication engineers, maintenance engineers responsible for SCADA and RTU systems and system integrators supporting DNP3-based automation systems.

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)

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 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 Electrical & Instrumentation Engineer** with over **30 years** of extensive experience in the **Oil**, **Gas**, **Power**, **Petroleum**, **Petrochemical** and **Water** & **Utilities**. He specializes in **Advanced RTU** Operations & Maintenance, **SCADA RTU** Networking & Cybersecurity, **RTU** Data Acquisition & Control, **Fire Fighting** System Instrumentations, **Fire Protection** System, **Fire & Gas Detection** & Alarm System, **Instrumentation Protection Devices** Maintenance & Testing, **Protection Devices** Troubleshooting, Water **Meter Calibration**, Liquid & Gas Flowmetering & **Meter Calibration**, **Testing & Calibration of Energy Meters**, **DCS & ESD** System Architecture, **Distributed Control System**, **DCS** & **SCADA**, Distributed Control System (**DCS**) Selection & Troubleshooting, Advanced **DCS Yokogawa**, **Yokogawa CENTUM VP DCS**, **Modern Distributed Control System** (**DCS**) **& Process Instrumentation**, **Cyber Security** of Industrial System, **DCS System** (**Honeywell**), **DCS Experion** System, **DCS Siemens Telepherm XP**, **Relay Coordination Using ETAP Software**, **Power System Study on ETAP**, **ETAP-Power System Analysis**, **Flow Measurement** Foundation, **Hydrocarbon** Measurement & Sampling, **Gas Dosiers** Preparation, **Gas/Liquid Fuel** Measurement, **Instrumentation Measurement & Control System**, **Flow** Measurement, **Pressure** Measurement, **Level & Temperature** Measurement, **Measurement Devices & Control System**, **Instrumentation & Control** Systems, **Control System** Orientation, Uninterruptible Power Supply (**UPS**) **Battery Charger**, **Industrial UPS Systems Construction & Operation**, **Test Lead-Acid & Ni-cad Battery Systems**, **Hazards & Safe Work Practices**, **Transformer** Operational Principles, Selection & Troubleshooting; **HV & LV Transformers**, **Control Valves & Actuators**, **Electrical Safety**, **Protection Relay Application**, **Maintenance & Testing**, **NEC** (National Electrical Code), **NESC** (National Electrical Safety Code), **Electrical Safety**, **Electrical Hazards Assessment**, **Electrical Equipment**, **Personal Protective Equipment**, Lock-Out & Tag-Out (**LOTO**), Confined Workspaces, Alerting Techniques, Electrical Transient Analysis Program (**ETAP**), Power **Quality**, Power **Network**, Power **Distribution**, **Distribution Systems**, **Power Systems Control**, **Power Systems Security**, Power **Electronics**, Electrical **Substations**, **UPS** & **Battery System**, **Earthing & Grounding**, **Load Forecasting**, Power **Generation**, **Protective Systems**, **Electrical Generators**, **Power** & **Distribution Transformers**, **Electrical Motors**, **Switchgears**, **Transformers**, **AC** & **DC Drives**, **Variable Speed Drives** & **Generators**, **Generator Protection**, **GE Gas Turbines**, PLC, SCADA, DCS, Process Control, Control Systems & Data Communications, Instrumentation, Automation, Valve Tuning, SIS, SIL, ESD, **Alarm Management** Systems, **Energy** Management System, Engine Management System, Bearing & Rotating Machine, Fieldbus Systems and Fiber Optics Technology. 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** and **ACETO** industries as the **Instrumentation & Electrical Service Project Manager**, **Instrumentation & Control Engineer**, **Fire Protection Engineer**, **Energy Management Engineer**, **Department Head**, **Assistant Professor**, **Instrumentation & Control Instructor**, **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 is well-versed in different electrical and instrumentation fields like **ETAP**, 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 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.

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 workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: ***Sunday, 06th of December 2026***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to DNP3 Protocol*** *Evolution of DNP3 in Industrial Automation • DNP3 Architecture & Communication Model • Advantages Over Legacy SCADA Protocols • Typical Applications in Power, Oil & Gas, Water & Utilities*
0930 – 0945	*Break*
0945 – 1030	***DNP3 Protocol Stack Overview*** *Physical, Data Link, Transport & Application Layers • Layer Interaction During Communications • Message Encapsulation Process • Comparison with IEC 60870-5-104 & Modbus*
1030 – 1130	***DNP3 Application Layer Fundamentals*** *Application Layer Functions • Application Protocol Data Units (APDUs) • Function Codes & Object Groups • Request/Response Mechanisms*
1130 – 1215	***SCADA Master Architecture*** *Master Station Components • Communication Server Functions • Database Architecture • Redundancy & Failover Concepts*
1215 – 1230	*Break*

1230 – 1330	***RTU Communication Principles*** *RTU Addressing • Communication Sessions • Polling Mechanisms • Event-Driven Communications*
1330 – 1420	***Laboratory Session*** *Configuring a DNP3 Master • Connecting Multiple RTUs • Monitoring Communications • Capturing Protocol Traffic*
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 One*

Day 2: Monday, 07th of December 2026

0730 – 0830	***DNP3 Object Groups & Variations*** *Static Objects • Event Objects • Analog & Binary Objects • Counter Objects*
0830 – 0930	***Application Layer Function Codes*** *Read Functions • Write Functions • Select-Before-Operate • Direct Operate Commands*
0930 – 0945	*Break*
0945 – 1100	***Time Synchronization*** *Time Synchronization Methods • Time Delay Measurements • Clock Synchronization • Time Quality Verification*
1100 – 1215	***Event Buffer Management*** *Event Classes • Event Prioritization • Buffer Overflow Handling • Event Retrieval Optimization*
1215 – 1230	*Break*
1230 – 1330	***Supporting RTUs from SCADA Master Side*** *Remote Diagnostics • Configuration Verification • Communication Health Monitoring • Recovery After Communication Failures*
1330 – 1420	***Practical Workshop*** *Configuring Object Maps • Poll List Optimization • Event Monitoring • RTU Troubleshooting Exercises*
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: Tuesday, 08th of December 2026

0730 – 0830	***Advanced Polling Strategies*** *Integrity Polling • Exception Polling • Class Polling • Poll Scheduling Optimization*
0830 – 0930	***DNP3 Command Processing*** *Binary Output Control • Analog Output Control • Control Relay Output Block (CROB) • Secure Command Execution*
0930 – 0945	*Break*
0945 – 1100	***Communication Diagnostics*** *Communication Statistics • Error Counters • Retry Mechanisms • Link Quality Assessment*
1100 – 1215	***Network Performance Analysis*** *Communication Latency • Packet Loss Analysis • Bandwidth Utilization • Communication Bottleneck Identification*
1215 – 1230	*Break*

1230 – 1330	***DNP3 Troubleshooting Techniques*** *APDU Analysis • Frame Decoding • Log Interpretation • Root Cause Analysis*
1330 – 1420	***Practical Laboratory*** *Wireshark DNP3 Packet Analysis • Communication Trace Interpretation • Fault Simulation • Troubleshooting Real Communication Failures*
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: Wednesday, 09th of December 2026

0730 – 0830	***OPC Fundamentals*** *OPC DA Architecture • OPC HDA Overview • OPC A&E Fundamentals • OPC UA Introduction*
0830 – 0930	***OPC Integration with SCADA*** *OPC Server Architecture • OPC Client Configuration • Tag Mapping • Data Exchange Mechanisms*
0930 – 0945	*Break*
0945 – 1100	***OPC Communication Troubleshooting*** *Connection Failures • Server Registration Issues • DCOM Configuration Problems • Firewall & Network Issues*
1100 – 1215	***OPC Performance Optimization*** *Scan Rates • Update Rates • Subscription Management • Memory Optimization*
1215 – 1230	*Break*
1230 – 1330	***Diagnosing OPC Data Problems*** *Bad Quality Tags • Stale Data • Communication Timeouts • Synchronization Issues*
1330 – 1420	***Practical OPC Workshop*** *Configuring OPC Servers • Diagnosing Failed Connections • Repairing Communication Issues • Validating Data Integrity*
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 Four*

Day 5: Thursday, 10th of December 2026

0730 – 0830	***End-to-End SCADA Communication Troubleshooting*** *SCADA Master Diagnostics • Network Diagnostics • RTU Diagnostics • OPC Diagnostics*
0830 – 0930	***Common DNP3 Communication Problems*** *RTU Offline Conditions • Address Conflicts • Polling Failures • Communication Interruptions*
0930 – 0945	*Break*
0945 – 1100	***Advanced Root Cause Analysis*** *Systematic Troubleshooting Methodology • Event Log Correlation • Communication Trend Analysis • Preventive Maintenance Techniques*
1100 – 1230	***Cybersecurity Considerations*** *DNP3 Secure Authentication (DNP3-SA) • User Authentication • Secure Remote Access • Security Monitoring*

1230 – 1245	*Break*
1245 – 1345	***SCADA System Performance Optimization*** *Database Optimization • Communication Optimization • Alarm Optimization • System Health Monitoring*
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*

Practical Exercises Throughout the Course

- Configure DNP3 master communications with multiple RTUs
- Analyze DNP3 application Layer packets using Wireshark
- Configure object groups, polling lists & event classes
- Support RTUs remotely from the SCADA Master station
- Diagnose communication failures using protocol analyzers
- Configure & troubleshoot OPC DA and OPC UA servers
- Resolve DCOM, firewall & network-related OPC issues
- Analyze communication logs & event buffers
- Perform SCADA Master performance tuning
- Complete integrated fault-finding scenarios involving DNP3, RTUs, SCADA master & OPC connectivity

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", "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

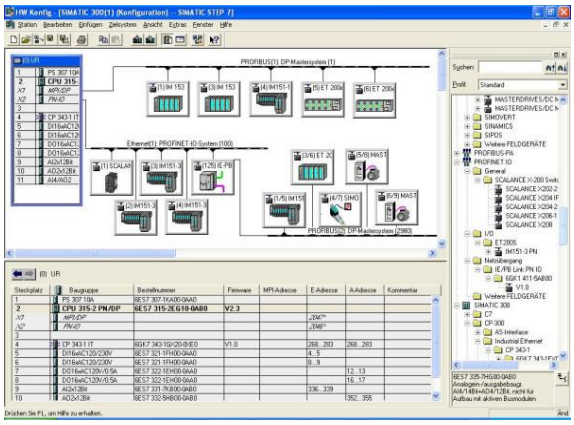
Siemens S7-1200 Simulator

Siemens S7-400 Simulator

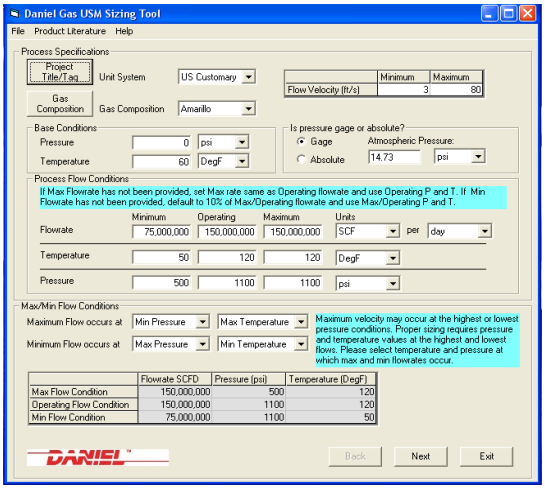
Siemens SIMATIC S7-300

Siemens S7-200 Simulator

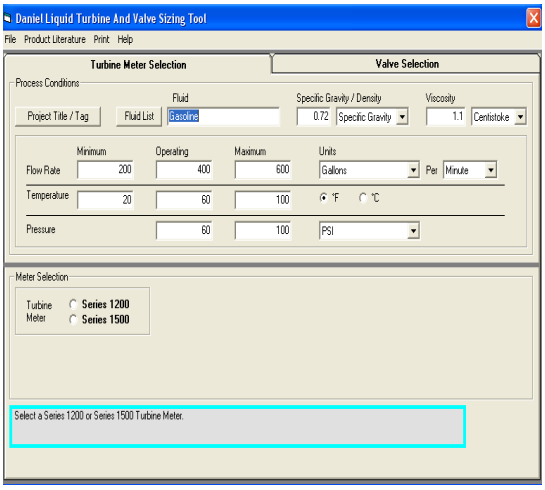
GE Fanuc Series 90-30 PLC Simulator



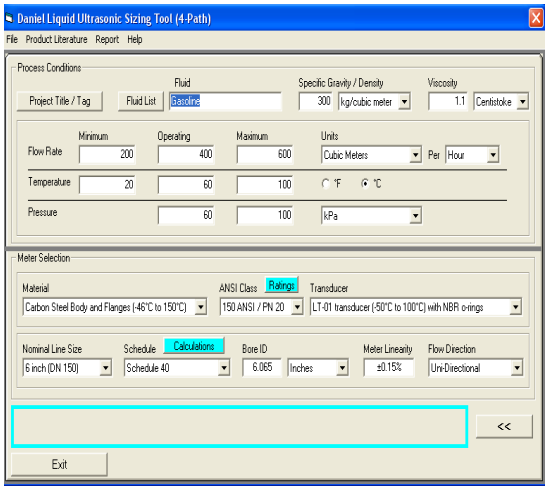
Siemens SIMATIC Step 7 Professional Software



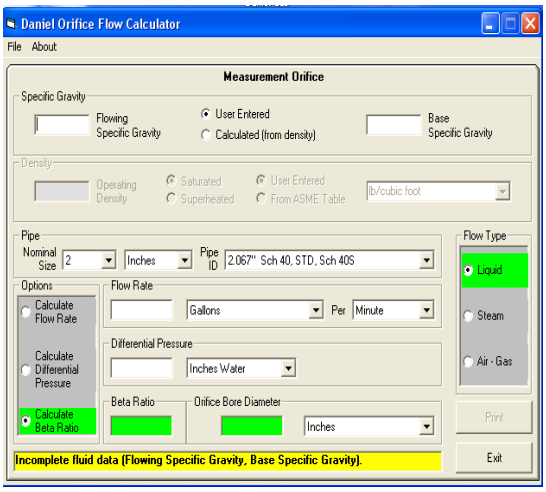
Gas Ultrasonic Meter (USM) Sizing Tool Simulator



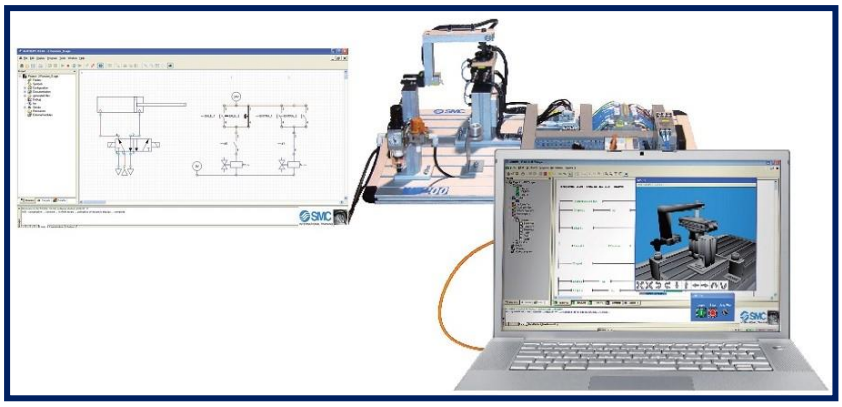
Liquid Turbine Meter and Control Valve Sizing Tool Simulator



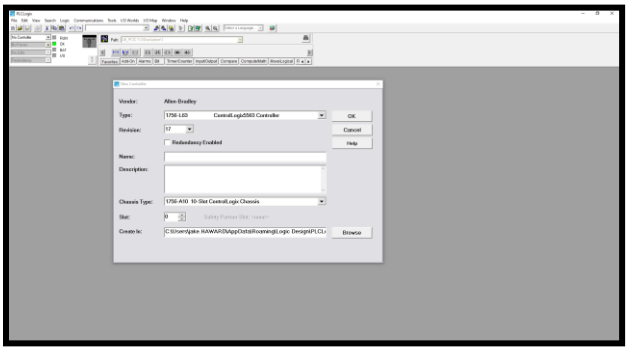
Liquid Ultrasonic Meter Sizing Tool Simulator

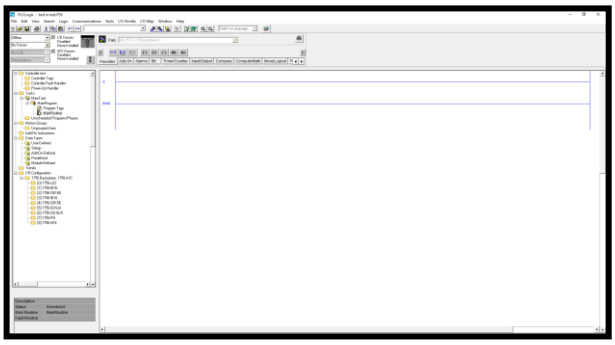


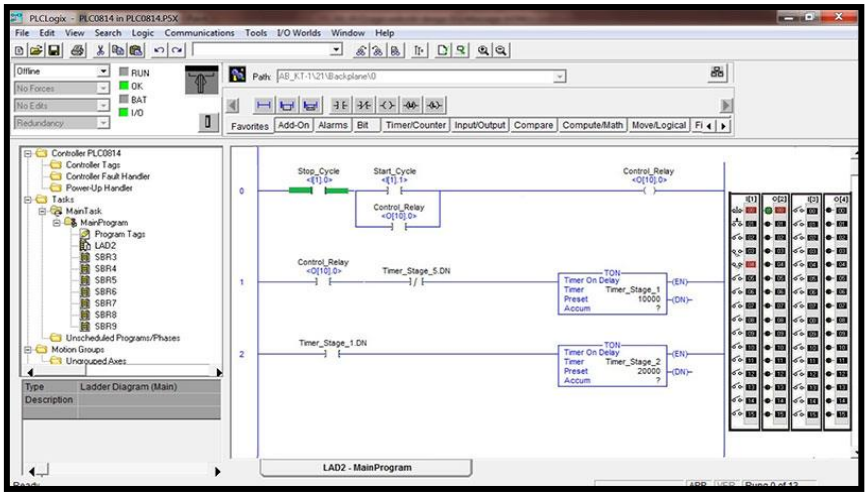
Orifice Flow Calculator Simulator

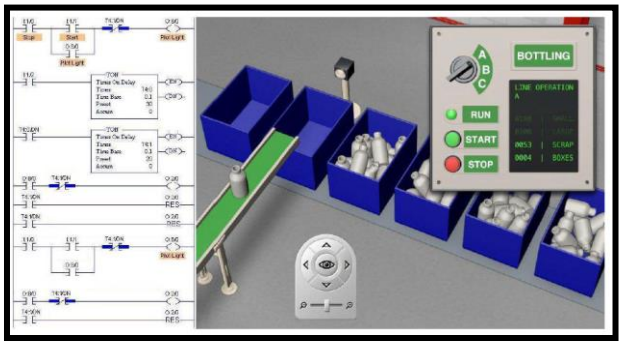


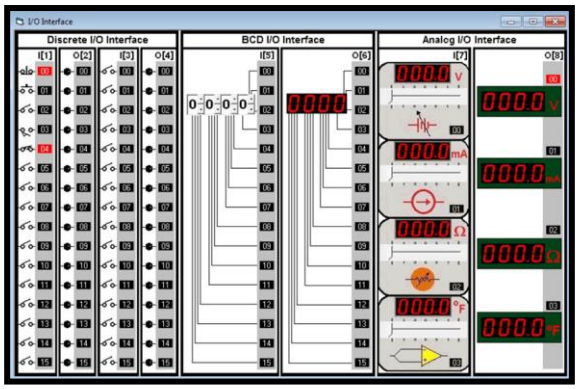
AutoSIM – 200 Automation Simulator











PLCLogix 5000 Software

Course Coordinator

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