COURSE OVERVIEW IE1038
Programmable Logic Controllers (PLC): Basic to Advanced Application

Course Title
Programmable Logic Controllers(PLC): Basic to Advanced Application

Course Date/Venue
May 05-09, 2024/Oryx Meeting Room, Doubletree By Hilton Doha-Al Sadd, Doha, Qatar

Course Reference
IE1038

3.0 CEUs (30 PDHs) AWARD

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

Course Description

This practical highly-interactive course includes various practical sessions and exercises. Theory learnt will be applied using one of our state-of-the-art simulators.

This course is designed to benefit you with practical up-to-date information on the application of PLCs to the automation and process control of plants and factories. It is suitable for people who have little or no exposure to PLCs, but expect to become involved in some or all aspects of PLC installation. It aims to give practical advice from experts in the field, to assist you to correctly plan, program and install a PLC with a shorter learning curve and more confidence.

While the course is ideal for electricians, technicians and engineers who are new to PLCs, much of the course and additional material in the extensive manual will be of value to those who already have some basic skills, but need a wider perspective for larger and more challenging tasks ahead. The accompanying manual includes contributions from a number of experts and will become a valuable reference document in your work.

The information contained in this course advances from the basics to challenge even the most experienced engineer in the industry today. You will undertake a series of practical hands-on sessions, ranging from elementary to advanced, based on the PLCs supplied. Full working solutions will be distributed to you after you have attempted the practicals.

During this interactive course participants will learn the PLC process, I/O system and programming terminals and peripherals; the installation and maintenance of PLCs; the tag-based PLCs, ladder logic programming and timers; the counters, branch and loop control; the sequencers and data handling; the math instructions, process control, PLC communications and distributed control systems (DCS); and the SCADA systems and advanced PLC programming languages and robotics.

Course Objectives

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

- Apply and gain a good working knowledge on programmable logic controllers (PLC): basic to advanced application
- Gain knowledge on the five PLC programming languages covering ladder logic/diagram (LD), sequential function charts (SFC), function block diagram (FBD), structured text (ST) and instruction list (IL)
- Ability to program PLCs from well-known manufactures (i.e., SIEMENS & ROCKWELL) effectively to control a given process.
- Discuss existing and latest PLC models, sizes, and features available in market for well-known manufactures (i.e., SIEMENS & ROCKWELL) along with their applications.
- Recognize the structure of PLC (chassis, IOs, communication modules, power supply, etc.) including Electrical parameters (e.g. voltage level and chassis backbone, etc.)
- Connect laptop with PLC, types of communication cables for each PLC model for SIEMENS and ROCKWELL.
- Discuss which programming/communication software is used with which PLC model (for SIEMENS and ROCKWELL) and troubleshoot PLC problems
- Apply basic maintenance practices for the mentioned brands (SIEMENS & ROCKWELL) (e.g. battery replacement)
- Identify the main communication protocols dealt with for SIEMENS and ROCKWELL PLCs
- Discuss all related PLC concepts that will be observed in industrial environment such as remote IOs, redundancy configurations, etc.
- Review the history of SIEMENS and ROCKWELL PLC models overtime and recent active PLC modules along with their differences.
- Navigate the code and search for certain functionality and witness the code running live for troubleshooting purpose
- Discuss PLC processors, I/O system, programming terminals and peripharals
- Carryout proper installation and maintenance of PLCs as well as recognize tag-based PLCs, ladder logic programming and timers
- Determine counters, branch and loop control, sequencers and data handling
- Discuss math instructions, process control, PLC communications and distributed control systems (DCS)
- Describe SCADA systems, advanced PLC programming languages and robotics

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 for all significant aspects and considerations of PLC basics to advanced application for associate maintenance engineers from electrical, instrument and automation functions.

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$ 6,500 per Delegate. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Accommodation

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

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: -

- 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.

- 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.

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. Barry Pretorius is a **Senior Instrumentation Engineer** with almost **45** years of extensive experience within the **Oil**, **Gas**, **Petrochemical**, **Refinery** & **Power** industries. His expertise widely covers in the areas of Process Control, Instrumentation, Safeguarding & Security, Programmable Logic Controller (**PLC**), **Siemens PLC** Simatic S7-400/S7-300/S7-200, **PLC & SCADA** for Automation & Process Control, **Artificial Intelligence**, **Allen Bradley PLC** Programing and Hardware Trouble Shooting, Schneider **SCADA System**, **Wonder Ware**, **Emerson**, **Honeywell**, **Honeywell** Safety Manager PLC, **Yokogawa**, Advanced **DCS Yokogawa**, **Endress & Hauser**, Field Commissioning and Start up Testing Pre Operations, System Factory Acceptance Test (**FAT**), System Site Acceptance Test (**SAT**), **SCADA HMI & PLC** Control Logic, **Cyber Security** Practitioner, **Cyber Security** of Industrial Control System, **IT Cyber Security** Best Practices, **Cybersecurity** Fundamentals, **Ethical Hacking & Penetration Testing**, **Cybersecurity** Risk Management, **Cybersecurity** Threat Intelligence, **OT Whitelisting** for Better Industrial Control System Defense, **NESA** Standard and Compliance Workshop, **OT**, **Cyber Attacks** Awareness - Malware/Ransom Ware / Virus /Trojan/ Philsing, **Information Security Manager**, **Security System** Installation and Maintenance, Security of Distributed Control System (**DCS**), Implementation, Systems Testing, Commissioning and Startup, **Foxboro DCS & Triconics, SIS** Systems, **Drives**, Motion Control, **Hydraulics**, **Pneumatics and Control Systems** Engineering, **Electrical & Automation Control Systems**, **HV/MV Switchgear, LV & MV** Switchgears & Circuit Breakers, **High Voltage Electrical Safety**, **LV & HV Electrical System**, **HV Equipment** Inspection & Maintenance, **LV Distribution Switchgear & Equipment**, **Electrical Safety**, **Electrical** Maintenance, **Transformers**, **Medium & High Voltage Equipment**, **Circuit Breakers**, **Cable & Overhead Line** Troubleshooting & Maintenance, **Electrical Drawing & Schematics**, **Voltage Distribution**, **Power Distribution**, **Filters**, **Automation System**, **Electrical Variable Speed Drives**, **Power** Systems, **Power Generation**, **Diesel Generators**, **Power Stations**, Uninterruptible Power Systems (**UPS**), **Battery Chargers**, **AC & DC Transmission**, **CCTV** Installation, **Data & Fire Alarm** System, **Evacuation** Systems and **Electrical Motors & Variable Speed Drives**, & Control of Electrical and Electronic devices.

During Mr. Pretorius's career life, he has gained his practical experience through several significant positions and dedication as the **Senior Technical Analyst, Team Leader, Pre-operations Startup Engineer, Automation System's Software Manager, Automation System's Senior Project Engineer, PLC Specialist, Site Manager, Senior Project & Commissioning Engineer, Technical Director, Project Engineer, Radio Technician**, **A T E Technician** and **Senior Instructor/Trainer** from various companies like the ADNOC Sour Gas, Ras Al Khair Aluminum Smelter, Johnson Matthey Pty. Ltd, Craigcor Engineering, Unitronics South Africa Pty (Ltd), Bridgestone/Firestone South Africa Pty (Ltd) and South African Defense Force.

Mr. Pretorius's has a Higher Diploma in **Electrical Engineering Heavy Current**. Further, he is a **Certified Instructor/Trainer** and delivered numerous trainings, courses, workshops, seminars and conferences internationally.

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: ***Sunday, 05th of May 2024***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to PLCs*** *The Characteristics of Advanced PLCS and their Role in Industry • The Operation of Deterministic Systems and Relational Databases • The Advantages of Using PLC Languages Based on the IEC-61131-3 Standard • The Differences Between PLCs, PACs, and PCs • Studio 5000 PLCs Tag-Based • The Benefits of Simulation of Advanced PLCs*
0930 – 0945	*Break*
0945 – 1100	***PLC Processors*** *ControlLogix Processor • Memory Devices, Memory Storage, and Data Processing • Introduction to Tag-Based Memory • Multiprocessing and PLC Scan Functions*
1100 – 1230	***I/O System*** *Input/output System for PLCs • Discrete, Analog, and Data I/O • I/O Addressing • Allen-Bradley I/O Parameters • The Principles of Remote I/O • Scaling and Resolution of Analog Devices and Signals*
1230 – 1245	*Break*
1245 – 1420	***Programming Terminals & Peripherals*** *PC-Based Programming Terminals and their Application in Advanced PLC Systems • Software Used in Programming Terminals • The Basic Operating Principles of Host Computer Systems • HMI Programming Terminals • Peripheral Devices • Memory Storage & Data Transfer Systems*
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, 06th of May 2024***

0730 – 0930	***Installation & Maintenance of PLCs*** *Various Safety Precautions, Preventative Maintenance, and Troubleshooting Techniques Associated with a Typical PLC System • Proper Grounding Techniques • Sources of Electrical Interference • I/O Installation Techniques • Field Checkout and Troubleshooting*
0930 – 0945	*Break*
0945 – 1100	***Tag-Based PLCs*** *The Fundamentals of Tags and Tag-Based PLC Programming • Common Methods for Creating Tags • The Purpose of User Defined Data Types (UDTs) • The Various Types of Data Used in Tag-Based I/O Systems • The Principles of Projects, Arrays, Throughput, and Scope*
1100 – 1230	***Ladder Logic Programming*** *Ladder Logic Programming Techniques Using Plclogix 5000 Simulation Software • Write Ladder Logic Programs and Test Their Operation Through PLC Simulation • I/O Instructions • Safety Circuitry • Programming Restrictions • I/O Addressing• FORCE Instructions and Bit Status Flags*

1230 – 1245	*Break*
1245 – 1420	***Timers*** *PLC Timers and Their Application in Industrial Control Circuits • Studio 5000/Rslogix 5000 Timing Instructions • TON, TOF, and RTO • Practical Programming Techniques for Timers • Cascading and Reciprocating Timing Circuits*
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, 07th of May 2024***

0730 – 0930	***Counters*** *PLC Counters and their Application in Control Systems • Studio 5000/Rslogix 5000 Counting Instructions • CTU and CTD • Cascading Counters • Combining Counting and Timing Circuits*
0930 – 0945	*Break*
0945 – 1100	***Branch & Loop Control*** *Various Branch and Loop Instructions • MCR, JSR and JMP • Troubleshooting • The Principles of Fault Routines • Subroutines and their Application and Benefit in Complex Control Problems • Plclogix 5000 Simulation Software*
1100 – 1230	***Sequencers*** *The Purpose and Application of PLC Sequencers • Techniques and the Various Types of Sequencers Available Including SQO • SQL and SQ1 Instructions • Sequencers Charts • Maintenance and Recording of Sequencer Chart Information*
1230 – 1245	*Break*
1245 – 1420	***Data Handling*** *The Principles of Studio 5000/RS Logix 5000 Data Handling • Bits, Words, and Arrays • Various Aspects of Data Transfer • MOV, FIFO and LIFO • Introduction to Shift Registers*
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, 08th of May 2024***

0730 – 0930	***Math Instructions*** *Basic and Advanced Mathematical Functions Found in the Logix 5000 PLC • Data Comparison Instructions • SQR, EQU, LES, and GRT • Analog Input and Output Control • Combining Math Functions, Averaging, Scaling and Ramping*
0930 – 0945	*Break*
0945 – 1100	***Process Control*** *Industrial Control Systems • Open- and Closed-Loop Control • Proportional, Integral, and Derivative Control • PID Instructions • Algorithms and Flow Charts*

1100 – 1230	***PLC Communications*** *Data Communication Using PLC Systems and Peripherals • The Fundamentals of LANS and Data Communications • Introduction to Ethernet and Network Switching • Topology and the Operation of Token Passing in a Data Highway • Transmission Media, Response Time and the Basic Principles of Proprietary Networks • Seven OSI Layers*
1230 – 1245	*Break*
1245 – 1420	***Distributed Control Systems (DCS)*** *Remote Terminal Units (RTUs), HMIs and an Introduction to LANs • The Differences Between Star, Bus and Ring Topology and their Applications in Automation Systems • Architecture and Algorithms • Design, Problem Solving and Analysis of Industrial Automation Systems*
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, 09th of May 2024***

0730 – 0930	***SCADA Systems*** *SCADA Using Automation Systems and Peripherals • The Principles of Alarm Management • Alarm Management Lifecycle • SCADA Security and Authentication Methodologies • SCADA Simulation Techniques*
0930 – 0945	*Break*
0945 – 1100	***Advanced PLC Programming Languages*** *Advanced PLC Programming Languages Which are Widely Used in Industrial Automation • Introduction to C and C++ High Level Programming Languages • Studio 5000/RSLogix 5000 Programming Language and Controller Organizer • Tag Names, Alias Tags, and Various Editors (Structured Text (ST), Function Block Diagram (FBD), Sequential Function Chart (SFC), Etc.)*
1100 – 1230	***Robotics*** *The Industrial Robot and The Role it Plays in Industrial Manufacturing Processes • The Origins of the Industrial Robot and its Evolution • The Types, Components, Accuracy, Programming and Applications of Robots*
1230 - 1245	*Break*
1245 – 1345	***Robotics (cont'd)*** *Robot Sensors, Including Vision and Tactile Detection • Safety Considerations Including Fail-Safe Operation and Work-Envelope Design • Artificial Intelligence and How It Relates to Industrial Machines is Presented in Detail*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Simulator (Hands-on Practical Sessions)

Practical sessions will be organized during the course for delegates to practice the theory learnt. Delegates will be provided with an opportunity to carryout various exercises using one of our state-of-the-art simulators "Allen Bradley SLC 500", "AB Micrologix 1000 (Digital or Analog)", "AB SLC5/03", "AB WS5610 PLC", "Siemens S7-1200", "Siemens S7-400", "Siemens SIMATIC S7-300", "Siemens S7-200", "GE Fanuc Series 90-30 PLC", "Siemens SIMATIC Step 7 Professional Software", "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

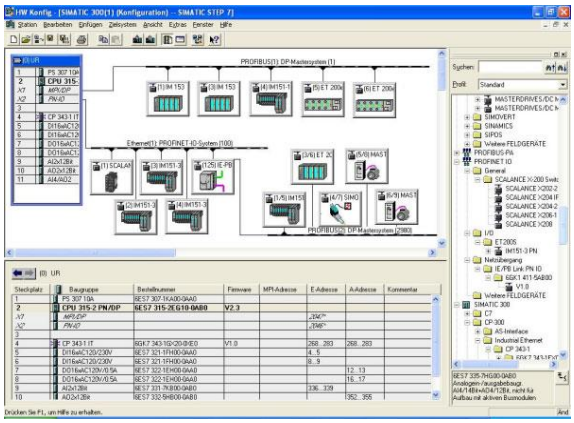
Siemens S7-1200 Simulator

Siemens S7-400 Simulator

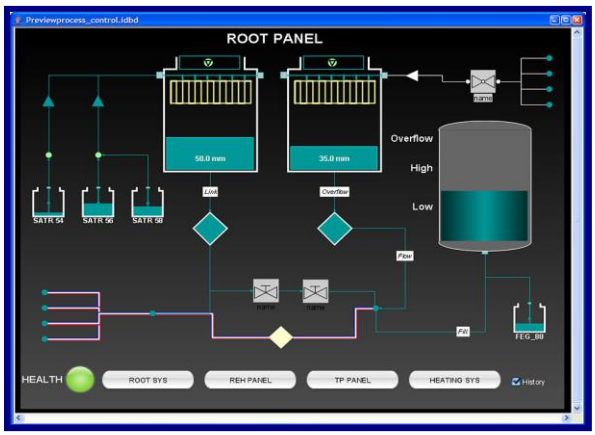
Siemens SIMATIC S7-300

Siemens S7-200 Simulator

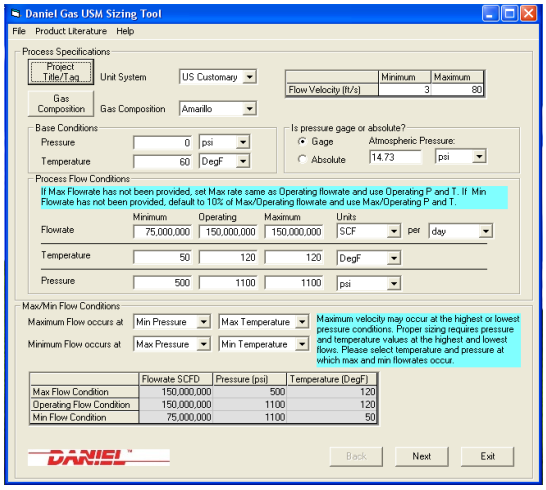
GE Fanuc Series 90-30 PLC Simulator



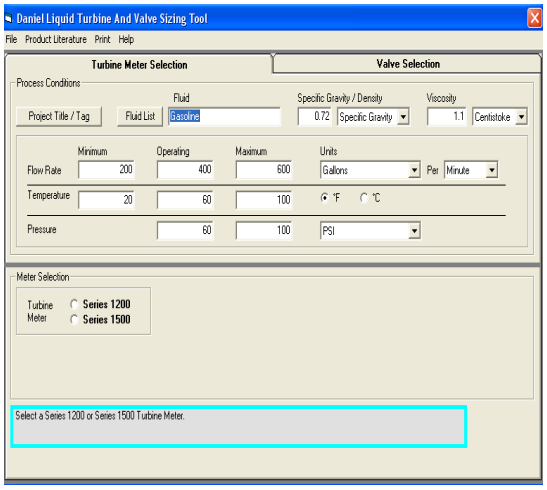
Siemens SIMATIC Step 7 Professional Software



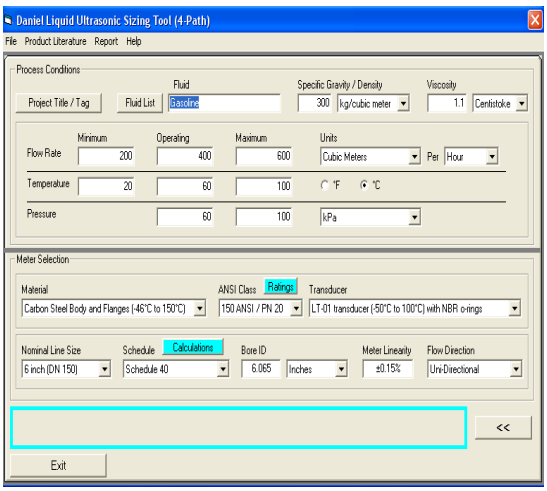
HMI SCADA



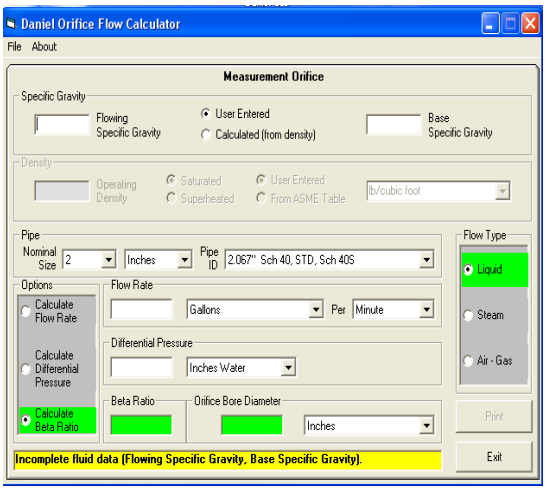
Gas Ultrasonic Meter (USM) Sizing Tool Simulator



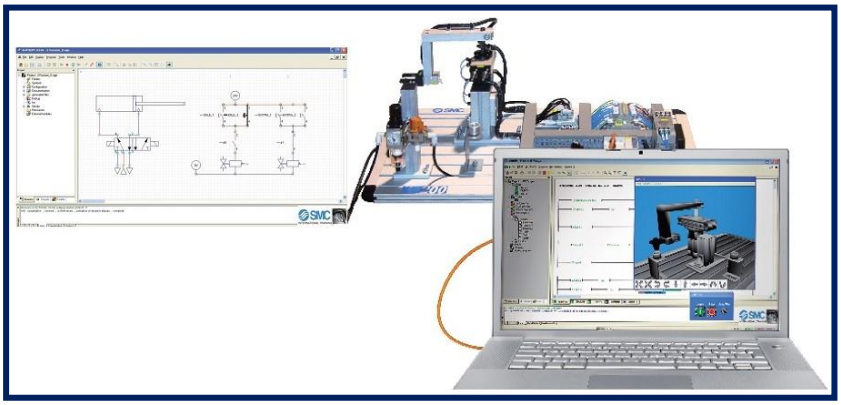
Liquid Turbine Meter and Control Valve Sizing Tool Simulator



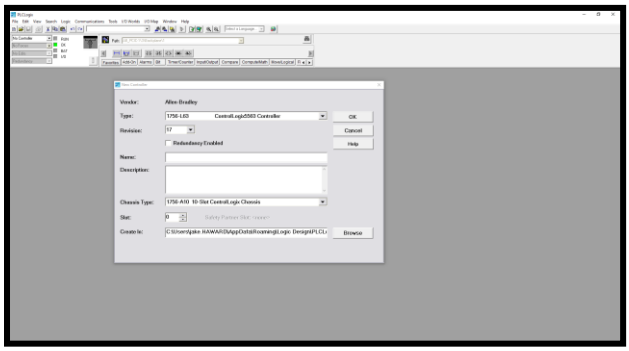
Liquid Ultrasonic Meter Sizing Tool Simulator

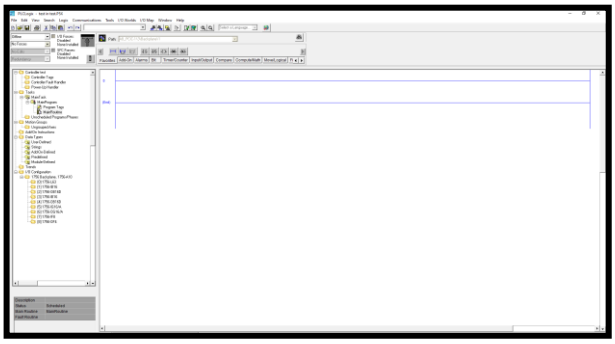


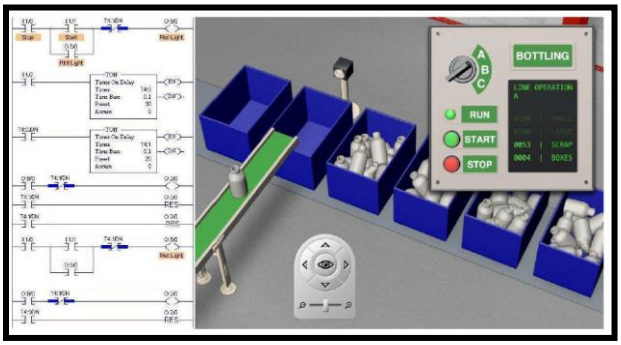
Orifice Flow Calculator Simulator

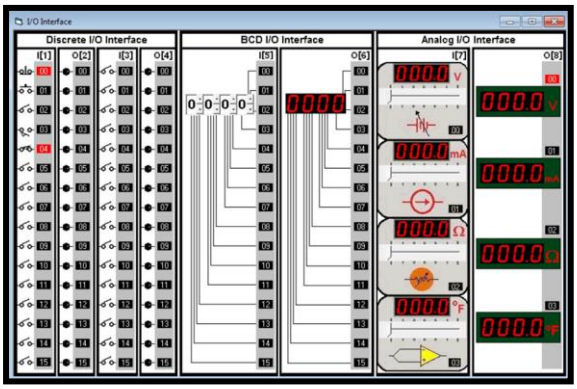


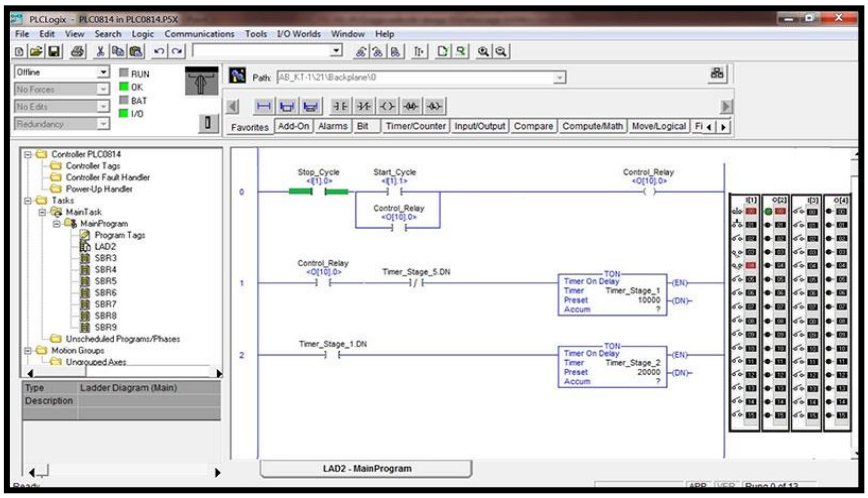
AutoSIM – 200 Automation Simulator











PLCLogix 5000 Software

Course Coordinator

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