CNC Technical Solutions Inc.

CNC Technical Solutions - Phase 3 Advanced Industrial Controls

Phase 3 – Advanced Control Systems

Classroom and Lab Hours - Combined 136 total hours.
Typical method of delivery - 1 day of class per week, 8 hours a day. Instructor led, combined classroom and lab delivery.

Phase 3 – Advanced Control Systems is an instructor led class that will build upon the concept of the pre-requisite Phase 2 - Industrial Controls class. Advanced Control Systems is designed to integrate advanced concepts of design, programming and troubleshooting of PLC systems. This class will use the Allen Bradley platform as the basis of learning, as this is the predominant PLC system found in Advanced Manufacturing facilities in North America. This class will cover every facet of integration of systems and components in the overall PLC system in a highly interactive classroom and lab reproduction of the manufacturing process. The primary learning objective of Advanced Control Systems is the theory, implementation, and practical understanding of Programmable Logic Controls (PLCs) and their associated electrical devices and how they function and interact with mechanical hardware.

Course Highlights

- Allen Bradley Micro-logic 850 PLC Controls
- Relay Logic
- Motor Controls
- Laptop/cabling - PC to PLC communications using RS Logic and CCW for PLC code debug and development
- Electrical drawing set for the Factory Automation Simulator
- Sequence of operations theory, two dimensional arrays, sequencer control
- All associated test eq. including DVMs, Scope etc.
- Allen Bradley Micro logic 850 and Panel View System
- Numbering Systems
- Logic Concepts IEC 61131
- The processor, power supply & programming software
- The memory system & I/O Interaction
- The Discrete I/O System
- The Analog I/O System
- Tag Based Programming
- Structured Text & Function Block Programming
- Relay Logic
- Motor Controls with Encoder Feedback

- Laptop/cabling - PC to PLC communications using RS Logic and CCW for PLC code debug and development
- Electrical drawing set for the Factory Automation Simulator
- Sequence of operations theory
- Machine Control Programming design will focus on a two-dimensional array, 14 &17 step sequencer, the use of high-speed counters using encoder feedback from axis motor encoders and Ethernet data communication from control to control, i.e. MSGCIP Instructions.

Advanced Industrial Controls & Practical Applications

This will be an instructor-led class building upon the concepts of the Phase 2 - Industrial Controls class (Pre-requisite). This is a unique classroom and lab experience which will simulate the entire manufacturing process with the use of a tabletop simulator. Each work area or component of the simulator is linked, as the overall PLC system would be in an actual manufacturing facility. The class is broken down into modules that will combine theory and hands on participation and debugging/troubleshooting.

Advanced PLC applications and controls theory is demonstrated on a fully functional but scaled Factory Automation Simulator. The system is broken down into four main areas of the factory and they are as follows:

- Automated Warehousing stacking and storage system.
- Heat treat and processing system complete with turn table & post process milling station.
- Laser color sorting and batching system.
- Three-Axis Robotic load and unload station with a vacuum end effecter for part handling.

The main control system features four separate Micro Logic 850 Allen Bradley Tag Based PLC controls and panel views which are all communicating over an Ethernet ring to the multiple PLC controls, panel views and laptops. The applications of each are discussed and demonstrated in hands on activities on the simulator.

Additional key areas that are focused on and in use with the factory simulator are ball screws, gearing and gear reductions, conveyor belts, turn tables, worms and wheels, as well as pneumatics including air compressors, vacuum pumps, pneumatic cylinders and vacuum part lifts. There is also a fully integrated analog laser color recognition system.

PLC Practical Application and Troubleshooting

As outlined above, this is a highly interactive instructor-led class that has been designed to maximize the student's PLC & machinery troubleshooting skills. The centerpiece for this training is the proprietary CNCTS-Factory Automation System Simulator (US Patent). This simulator uses the latest Allen Bradley ethernet based controls and features AB panel views for the HMI. The system is a scale model of a working factory. This technology has been painstakingly designed and miniaturized by CNCTS to replicate this widely used factory technology all in a 4' by 4' area. The instructor can inject 48 different "bugs" into the system that students must diagnose and troubleshoot on the simulator. Student will debug using all associated test equipment including, but not limited to, DVMs, oscilloscopes, amp meters, megger and high potential testing.

CNCTS has received a US patent # 11,056.016 for the design of its automated miniature scale training simulators.

Anticipated Learning Outcomes

Upon completion of Phase 3 - Advanced Industrial Electronics the student will achieve the following Learning Outcomes.

- Comprehend the operation of the Allen Bradley Micro-logic 850 PLC control system
- Comprehend advanced electrical drawings for the automation simulator and its components
- Comprehend sequence of operation theory and the role of PLC logic, motor controls and field devices.
- Be proficient in the use of test equipment in advanced troubleshooting of PLC systems
- Comprehend PLC logic, laptop/cabling (PC to PLC communications using AB Connect Components Workbench for PLC programming)
- Be proficient in the debug and analysis of multiple PLC's all connected and communicating via ethernet MIGCIP instructions (Advanced level)