National Center for Supply Chain Automation

MASTER SYLLABUS

Programmable Logic Controllers & Variable Frequency Drives

Semester Credit Hours: 4.00

Prerequisites: OSHA Safety Standards, AC/DC Theory & Service

## COURSE DESCRIPTION

This course provides a study of the fundamentals of Programmable Logic Controllers (PLCs) and Variable Frequency Drives (VFDs). Emphasis is on introductory programming and setup of both. PLC topics include components/cards, memory organization, timers, counters, math functions, and operator interfaces, documentation, discrete and analog I/O. VFD topics include device navigation, PLC communication, remote and manual operation. Upon completion, students should be able to select and program a PLC system and configure a VFD to perform a wide variety of industrial control functions, with basic knowledge of safe techniques in operational troubleshooting with the aid of a multimeter.

## STUDENT LEARNING OUTCOMES

Upon successful completion of the course, students should be able to perform the following: PLCs

* Describe the functions of the major parts of a PLC system;
* Knowledge of the principles of operation of a programmable controller with discrete I/O;
* Skill in interpreting basic ladder logic programmable controller programs with basic instructions: output coils, internal coils, timers, counters, and contacts;
* Create ladder logic programs using popular programming software and test for correct operation;
* Skill in configuring a PLC with discrete I/O;
* Skill in replacing PLC components and wiring;
* Skill in transferring programs between PC and PLC;
* Skill in using a Human Machine Interface (HMI) to operate a PLC-controlled machine;
* Skill in testing the operation of a PLC-controlled machine;
* Skill in interpreting a PLC I/O diagram;
* Skill in troubleshooting a PLC with basic program commands;
* Skill in using a Human Machine Interface (HMI) to troubleshoot a PLC-controlled machine;
* Skill in documenting PLC programs;
* Skill in modifying PLC programs;
* Knowledge of PLC Ethernet addressing schemes;
* Skill in configuring a PLC to use Ethernet network to send and receive data;
* Knowledge of types of serial communications (RS-232, RS-422, and RS-485);
* Skill in connecting serial communications devices to a PLC or serial network;
* Skill in configuring a PLC and PLC program to communicate with serial devices;
* Skill in configuring an HMI to communicate to PLCs and other devices via an Ethernet network;

VFDs

* Knowledge of principles of operation of key VFD components such as IGBTs and FET transistors;
* Knowledge of operation of variable frequency AC drives (VFDs);
* Knowledge of VFD parameters and their use;
* Skill in configuring basic parameters of a VFD using onboard HMI and PC software;
* Skill in operating a VFD;
* Knowledge of types of basic VFD diagnostics and alarms;
* Skill in troubleshooting and replacing a VFD;

PLCs & VFDs

* Install and configure parameters of an AC VFD;
* Wire devices to a VFD;
* Interface a VFD to a PLC via a network;
* Interpret PLC programs that communicate data to and from a VFD;
* Monitor and maintain PLC that controls a VFD;
* Use a multimeter and diagnostics to troubleshoot PLCs and VFDs.

**COURSE OUTLINE**

* Elements of PLCs, hardware components, history
* Ladder diagrams, contacts, coils, series and parallel contacts
* Start/Stop Control Programs
* Timers and Counters, and Applications
* Memory Organization, retentive and internal contacts
* Math instructions, program documentation, data monitor
* Analog I/O
* PLC diagnostics and testing
* AC VFD setup and operation
* Configuring VFDs for manual and PLC control
* Diagnostics and testing of VFDs
* Introduction to Networking (Network Models)
* Data Link Layer (Ethernet basics)
* Network Layer (TCP/IP Basics and Routing)
* Session Layer
* DNS Securing TCP/IP
* Networking Devices
* Remote Connectivity
* Network Security