Lesson 1: Introduction to Programmable Logic Controllers

Topics
The Electromagnetic Relay; Characteristics of Programmable Controllers; Applications of Programmable Controllers; Limitations of Programmable Controllers; Parts of a Programmable Logic Controller System; The Input Side; The Processor; The Output Side; Programming Devices; Power Supplies

Objectives
• Describe an electromagnetic relay and define the terms control circuit, power circuit, NO and NC.
• Define programmable logic controller.
• Describe the general type of application in which a programmable logic controller would best be used, and give examples.
• Define scan time.
• Name each of the blocks in a block diagram of a programmable logic controller system and explain how each functions within the system as a whole.
• Define memory and explain the different types.

Lesson 2: Number Systems and Logic

Topics
Number Systems; Binary-Coded Decimal (BCD); ASCII; Gray Code; Boolean Logic; Ladder Logic

Objectives
• Compare the decimal, binary, octal, and hexadecimal number systems.
• Explain the purpose for using each of the following: BCD, Gray code, and ASCII.
• Explain what AND, OR, and NOT mean in Boolean logic, and identify the symbols for each.
• Identify AND and OR logic circuits in a relay ladder diagram, and construct a truth table for each.
• Explain the basic concepts of ladder logic.

Lesson 3: Programming the System

Topics
PLC Programming; Ladder Logic Programming; Boolean Programming; The AND Instruction; The OR Instruction; The Stack Register

Objectives
• Explain the relationship between a programmable logic controller processor and program.
• Define the term scan and explain the basic steps involved in a scan.
• Explain the basic concepts of ladder logic programming.
• Explain the purpose of a parallel branch in a ladder logic program.
• Explain the basic concepts of Boolean programming.
• Define stack register and state the stack rule.

Lesson 4: Input/Output Devices and Modules

Topics
Definition of I/O Devices; Discrete Input Devices; Analog Input Devices; Digital Input Devices; Discrete Output Devices; Analog Output Devices; Sourcing and Sinking; Definition of I/O Modules; Input Modules; Output Modules

Objectives
• Explain the operation of common input and output devices and identify their symbols.
• Describe the relationship of an input/output device to a terminal on an input/output module.
• Contrast the basic concepts of a sourcing device and a sinking device.
• Explain the operation of various input and output modules.

Lesson 5: Developing a Programmable Logic Controller System

Topics
Before You Begin; Equipment Operation Specifications; Sizing the System; Program Development; Assembling the Documentation Package; Functional Model; Startup and Debugging

Objectives
• Explain the importance of working with accurate information from a specification.
• Demonstrate how to size a system.
• List the elements in a good documentation package.
• Name the steps involved in specifying the hardware and developing the program for a simple control system.
• Describe system startup and debugging procedures.

Lesson 6: Maintenance and Troubleshooting

Topics
The Importance of Documentation in Maintenance Troubleshooting; Using the Hardware Documentation; The Maintenance Log; Using the Program Documentation; Operational Documentation; Routine Maintenance; Batteries; Troubleshooting; Problems in Troubleshooting; Troubleshooting in Practice

Objectives
• Explain the importance of good documentation.
• Tell what type of information can be found in user's manuals and operations manuals.
• Tell what types of logs are kept and why they are necessary.
• Explain the major concepts of troubleshooting, including problems sometimes encountered.
• Describe routine maintenance procedures required by a programmable controller system.
Lesson 7: System Expansion and Data Networks

Topics
- I/O Expansion; Configuring the System; Math and Data Handling Instructions; Timers and Counters; The Shift Register; Spray Booth Retrofit; Indexing Table Retrofit; Local Area Networks; Uses for LANs; Transmission Media; Transmission Schemes; Vendor Offerings

Objectives
- Compare the procedures involved in local and remote I/O expansion.
- Explain what is meant by configuring a system.
- Describe the operation of the shift register instruction.
- Explain how math and data-handling instructions work and why they are added to PLC systems.
- List important items to consider in I/O expansion and retrofitting.
- Define the terms local area network, baud rate, and throughput.
- List and explain the contents of a data packet used in LAN data transmission.
- Name and define the three main applications of LANs.
- List advantages and disadvantages of the three common transmission media used with LANs.