

EPEC Automation Module 1: Introduction to Automation

Objectives

Upon completion of this module, you will be able to:

- Understand how electricity is generated.
- Explain the differences between alternating current and direct current.
- Describe the relationship between amperes, volts, and ohms.
- Explain how electricity flows.
- Use Ohm's law and the power wattage formula.
- Understand choosing automation over manual control.
- Explain how Inputs send information to logic devices.
- Identify logic devices and how they collect data.
- Describe how output devices become the action to the decision made from the logic device.
- Interpret ladder diagrams.
- Identify symbols used on ladder diagrams for input switches, logic devices, output devices and connections.

Chapter Outline

Chapter 1: Electricity Introduction

- A. Types of Current
- B. Amps and Volts
- C. Conductors and Insulation
- D. Circuits and Circuit Protection
- E. Ohm's Law

Chapter 2: Automation Introduction

- A. Input Devices
- B. Logic Devices
- C. Timing Relays
- D. PLCs
- E. Output Devices

Chapter 3: Language of Automation

- A. Momentary and Maintained Contacts
- B. Ladder Diagrams
- C. Normally Open and Normally Closed
- D. Control Panels
- E. Types of Switches
- F. Logic and Output Devices

Chapter Four: EPEC Assignment

- A. EPEC Electrical System: Ladder Diagram of Packaging Conveyor
- B. EPEC Assignment

EPEC Automation Module 2: Basic Automation

Objectives

Upon completion of this module, you will be able to:

- Explain the differences between a wiring diagram and a ladder diagram.
- Describe the function of a coil.
- Identify the solenoid principle.
- Explain the principal function of an overload relay.
- Explain the principal function of fuses and circuit breakers.
- Identify the four basic types of overload relays.
- Describe how magnetic control starts.
- Explain the purpose of a shading coil.
- Identify a holding contact on a diagram and know its function.
- Explain what circuit protective devices are designed to do and where they can be found.
- Describe the functions of a transformer.
- Explain the sequence of three phase power.
- Give an example of a two-wire and three-wire controls.
- Explain what the digital input signal does.
- Describe discrete inputs.
- Identify the function and design of an analog input signal.
- Understand how logic works in PLCs.
- Explain why notes are written on the side of a diagram.
- Understand how different kinds of signals can be used as outputs.
- Identify analog output signals.
- Identify the standards for enclosures.
- Identify devices that are self-contained within enclosures.

Chapter Outline

Chapter 1: System Functions

- A. System Functions
- B. Wiring Diagrams and Ladder Diagrams
- C. Coils and the Solenoid Principle

Chapter 2: System Operations

- A. System Operations
- B. Fuses and Circuit Breakers
- C. Overload Relays

Chapter 3: Automatic Control

- A. Magnetic Control
- B. Shading Coils
- C. Holding Contacts

Chapter 4: More Complex Systems

- A. Circuit Protective Devices
- B. Transformers
- C. Complex Systems using Three-phase Power

Chapter 5: Control Method Choices

- A. Two-wire Controls
- B. Three-wire Controls

Chapter 6: Input Signals

- A. Digital Input Signals
- B. Discrete Inputs
- C. Analog Input Signals

Chapter 7: Decision Makers

- A. Programmable Logic Controller (PLC) Logic
- B. Notes on the Ladder Diagram

Chapter 8: Discrete Outputs

- A. Types of Outputs
- B. Electromechanical Relay Logic

Chapter 9: Enclosures

- A. Standards for Enclosure
- B. Self-contained Devices

Chapter 10: EPEC Assignment

- A. EPEC Electrical System: Ladder Diagram of Packaging Conveyor
- B. EPEC Assignment

EPEC Automation Module 3: Intermediate Automation

Objectives

Upon completion of this module, you will be able to:

- Describe how automation reduces repetitive motion injuries.
- Describe the difference between constant torque and constant horsepower.
- Understand the need for several different stop devices in an industrial setting.
- State what a transducer is designed to do.
- Explain the roles of an input and a relay.
- Explain what a closed loop system function is.
- Define the role of the no touch sensor.
- Explain the meaning behind the term Supervisory Control and Data Acquisition (SCADA).
- Understand the process of the system designer regarding the logic for a system.
- Explain what semiconductors do.
- Identify the differences between the electromechanical relay and solid state.
- Identify the different terms used for timers.
- Explain what PLCs are designed to do.
- Describe the need for a soft starter.
- List the different types of soft starters.
- Explain the reason for the need of a cooled cabinet.
- Describe how a terminal block fits within the system.
- Describe what the communication system does in a business.
- Decipher why it is important to gather data from the plant floor networks.
- Explain what the *NEC* defines when it comes to working on equipment.
- List the steps to create safe work environments.

Chapter Outline

Chapter 1: Reducing Risk of Harm

- A. Design Considerations
- B. Reducing Risk with Automation

Chapter 2: Motors, Controls, Risks, and Safety

- A. Motors and Constant Torque
- B. Emergency Stop Devices
- C. Transducers
- D. Types of Inputs
- E. Closed Loop Systems
- F. No Touch Sensors
- G. Operator Interface Panels and Human Machine Interfaces (HMI)
- H. Supervisory Control and Data Acquisition (SCADA)

Chapter 3: Logic Options

- A. Solid State Controls
- B. Semiconductors
- C. TDOE and TDOD Timers
- D. PLCs

Chapter 4: Work/Load Automation Options

- A. Soft Starter Design Considerations
- B. Types of Soft Starters

Chapter 5: Distribution and Protection

- A. Cooled Cabinets
- B. Terminal Blocks
- C. Communication Systems
- D. NEC Safety Requirements and Procedures

Chapter 6: EPEC Assignment

- A. EPEC Electrical System: Ladder Diagram of a Bottling Conveyor
- B. EPEC Assignment

EPEC Automation Module 4: Advanced Automation

Objectives

Upon completion of this module, you will be able to:

- Recognize the different types of advanced inputs.
- Explain what a bar code reader's functions are.
- Define the three most common optical sensors and how they operate.
- Describe the function of a laser distance sensor.
- Explain the need for different types of specialty sensors.
- Describe the differences between PNP and NPN solid state transistors.
- Understand what each component does in a PLC.
- Describe the principle of magnetism and how it applies to the design of AC motors.
- Explain the ladder diagram and how power flows to the motor.
- Explain how a PID controller interacts with a machine.
- Explain how an analog sensor can provide advanced outputs.
- Describe a bus network, ring network, star network, tree topology, and mesh network.
- Explain the difference between unmanaged and managed switches.
- Describe the IIOT (Internet of Things).

Chapter Outline

Chapter 1: Advanced Inputs

- A. Types of Advanced Inputs
- B. Bar Code Readers
- C. Optical Sensors
- D. Specialty Sensors

Chapter 2: Advanced Logic

- A. PNP and NPN Transistors
- B. Components of the PLC System
- C. AC Motor Design and Operation
- D. PID Controllers

Chapter 3: Advanced Outputs

- A. Advanced Outputs
- B. PID Controller Corrections

Chapter 4: Convergence of IT and OT Networking

- A. Types of Networks
- B. Unmanaged and Managed Switches
- C. The IIOT (Internet of Things)

Chapter 5: EPEC Assignment

- A. EPEC Electrical System: Ladder Diagram of a Batching System
- B. EPEC Assignment

EPEC Automation: Final Exam

This exam presents 100 random questions based on the content presented in Automation Modules 1 through 4. There is no time limit for this exam, and you need to score 75% or higher to pass.

EPEC Automation: Capstone Project

Objectives

Upon completion of this module, you will be able to:

- Review plans and specifications.
- Create a bill of materials for the products selected.
- Determine the best product for each application.
- Develop a cut package of all selected products including related items from the EPEC Triangle.
- Consider product selection variables and trade-offs.

Chapter Outline

- A. EPEC Electrical System: Ladder Diagram of a Sorter Conveyor System
- B. EPEC Capstone Project