

Programmable Logic Controllers – Course Outline

Hello and welcome to this course on **Programmable Logic Controllers, or PLCs**.

Programmable Logic Controllers are at the heart of modern industrial automation. They are used to control machinery, production lines, processes and automated systems across a wide range of industries.

Throughout this course, you will develop the knowledge and practical skills required to understand, programme and troubleshoot PLC systems, working either independently or in a supervisory capacity.

The course is structured into **six Lessons**, taking you from the fundamentals of PLCs through to programming, commissioning, troubleshooting and safe operation.

Lesson 1 – Introduction to Programmable Logic Controllers

We begin by looking at **what a PLC is and the role it plays in industrial automation**.

You will learn about the advantages of PLCs compared with traditional relay-based control systems, as well as the different types of PLC and their typical applications.

We will examine the main components of a PLC system, including the **Central Processing Unit, input and output modules, and power supply**.

You will also be introduced to the different types of field input and output devices used with PLCs, including sensors, actuators, relays and contactors.

Finally, we will look at **PLC panel diagrams and connections**, helping you understand how the PLC connects to the equipment it controls.

Lesson 2 – Introduction to Programming

Having established the fundamentals, we move on to **PLC programming**.

You will be introduced to the basic concepts of PLC programming and the different programming methods that can be used, including **ladder logic, Function Block Diagram and Structured Text**.

You will learn how PLC projects are created, edited and saved, as well as how programs can be **downloaded to and uploaded from a PLC**.

We will also examine the difference between **online and offline programming**, the configuration of digital and analogue inputs and outputs, and the importance of I/O addressing and data tables.

Safety considerations will also be introduced as an essential part of working with PLC systems.

Lesson 3 – PLC Programming

Module 3 takes your programming skills further.

You will learn how the fundamental PLC instructions work, including **normally open and normally closed logic, outputs, AND, OR and NOT functions**.

We will then introduce conditional programming concepts and look at **word- and file-level instructions**, including mathematical and data manipulation functions.

You will learn how to use **timers and counters**, before progressing to more advanced programming concepts such as **sequencers and shift registers**.

The emphasis throughout this module is on developing your ability to construct and understand practical PLC programs.

Lesson 4 – Installation and Commissioning

We then move from programming into the **installation and commissioning of PLC and SCADA systems**.

You will be introduced to **factory simulation software**, which allows PLC programs and automated processes to be developed and tested in a simulated environment.

You will work through practical examples such as **programming a conveyor sequence and programming a sorting system**.

We will also introduce **PID control loops**, control hierarchy, industrial networking and SCADA packages.

You will learn about communication protocols such as **Modbus and Ethernet/IP**, together with data logging and storage.

The module will also look at integrating PLCs with peripheral equipment, including **Human Machine Interfaces, or HMIs**, and how these interfaces are designed and operated.

Lesson 5 – Troubleshooting and Debugging

An important part of working with PLC systems is being able to identify and resolve problems.

In Module 5, we focus on **troubleshooting and debugging**.

You will learn techniques for diagnosing and resolving PLC program errors and will use **debugging tools and online monitoring** to help identify problems within a PLC system.

We will also examine common PLC issues and the approaches that can be used to diagnose and resolve them.

By the end of this module, you should have a structured approach to locating faults rather than simply trying to identify problems by trial and error.

Lesson 6 – Safety and Best Practices

The final module brings together the importance of **safety and good working practices** when working with PLC systems.

You will examine safety considerations associated with PLC programming and operation and learn about best practices for **documenting and organising PLC programs**.

We will also look at **firmware updates and program backups**, which are important for maintaining PLC systems and protecting the programs used to control industrial equipment.

Bringing It All Together

Across the six modules, the course will take you on a journey from understanding the **basic components and principles of PLCs**, through to **programming, commissioning, networking, SCADA, troubleshooting and safe operation**.

You will encounter both the theory behind PLC systems and practical examples designed to help you apply what you have learned.

By completing the course, you will have developed a solid foundation in PLC technology and programming, together with the knowledge required to **interpret PLC systems, develop ladder logic programs, diagnose faults and work safely with PLC-controlled equipment**.

So, let's get started with **Lesson 1 – Introduction to Programmable Logic Controllers**, and begin exploring the technology that forms the foundation of modern industrial automation.