

# PLC Programming for Beginners: A Step-by-Step Guide to Industrial Control Systems

## Course Description

This course, titled "PLC Programming Fundamentals," is designed to provide an in-depth understanding of Programmable Logic Controllers (PLCs) and their programming principles. The course covers topics such as basic functionality of PLC programs, IO modules, programming fundamentals, process logic, alarms and notifications, HMI development, and debugging techniques. Participants will learn to program PLCs using RS Logix 500 software and gain hands-on experience in setting up programs, configuring modules, and troubleshooting issues. Upon completion of this course, participants will have the skills and knowledge required to design, develop and maintain PLC-based systems

## Audience

The target audience for this course is individuals who want to learn about Programmable Logic Controllers (PLCs) and their role in automation. This course is designed for beginners with no prior experience in PLC programming and automation, as well as those with some knowledge who want to expand their skills. The course covers the basic concepts of PLC programming, programming fundamentals, program setup, IO programming, process logic, alarms and notifications, HMI programming, analyzing an existing PLC program in detail, and shakedown/debugging. Students will gain a solid understanding of PLC programming and automation, which will be useful for entry-level positions in the field.

## Pre-requisite Knowledge/Skills

The prerequisite for this course is a basic understanding of electrical circuits and logic. Familiarity with programming concepts and software would also be beneficial.

## Course Objectives

The objective of this course is to provide participants with a comprehensive understanding of Programmable Logic Controller (PLC) programming and its applications in industrial automation. Participants will learn the fundamentals of PLC programming and how to develop PLC programs from scratch using RS Logix 500 software. They will also gain hands-on experience in IO programming, process logic, alarms, notifications, and human-machine interface (HMI) programming. Upon completion of the course, participants will have the skills and knowledge required to design, implement, and troubleshoot basic PLC control systems in industrial settings.

## Course Outline

The course comprises 32-hours of theory and labs. It's divided into 10 different modules.

Module	Topic	Subtopic
1	Introduction	Software and Course Notes

<b>2</b>	PLC Programming Overview	PLC Automation, RS Logix 500 Environment, Basic Functionality of a Program (Inputs, Outputs, Conversion)
<b>3</b>	IO (Inputs and Outputs)	IO Overview, Digital IO, Analog IO, IO Modules
<b>4</b>	Programming Fundamentals	Data Management, A Bit More on Addresses, Rungs and Branches, Conditions and Outputs (Left to Right), XIO, XIC, OTE, OTL, OTU, ONS, OSR, OSF, TON, TOF, RTO, CTU, RES, Comparators, Mathematical Operators, CPT, SCP, A Bit More on Analog Scaling, MOV, JMP, LBL, PID (Proportional Integral Derivative) Control Loops
<b>5</b>	Program Setup	Setup Program / Processor, Module Configurations, Scaling / Resolution, Function Files, Program Files
<b>6</b>	IO Programming	Programming Digital IO, A Bit More on Digital Control Logic, Programming Analog IO, Analog Process Control (LL, L, H, HH)
<b>7</b>	Process Logic	Process Programming Overview, Blower HOA (Hand / Off / Auto) Control, A Bit More on HOA Controls, Digital Tank / Pump Control, Analog Tank / Pump Control, PID Heater Control
<b>8</b>	Alarms and Notifications	Alarms Overview, Considerations, Dual-bit Alarm / Notification Programming, Setpoints
<b>9</b>	HMI (Human Machine Interface)	HMI Overview, HMI Alternatives, Basic Flow of an HMI Program, Setting Up a Screen, Alarms / Events / Notifications, Permissions
<b>10</b>	Analyzing an Existing PLC Program in Detail	Overview, Main, D Input, D Output, A Input, A Output, Controls, Alarms, Display, Demo Test Program Report
<b>11</b>	Shakedown / Debugging	Emulation, Dry Run, Forcing IO, Electromechanical Checks, Full-function Test, Troubleshooting Methodology, Consequences