

Mastering ABB PLC Programming

Course Description

This advanced course enables professionals to master ABB PLC programming for robust industrial automation applications. Covering ABB's IEC 61131-3 programming environments (Ladder, Structured Text, Function Block Diagram, SFC), Automation Builder software, industrial networking, troubleshooting, and integration with HMI/SCADA, the course prepares learners to design, debug, and optimize complex PLC systems. Students engage in hands-on labs, advanced programming techniques, communications, safety, security, and maintenance using state-of-the-art ABB technologies.

Audience Profile

- Experienced automation engineers seeking ABB expertise
- Controls and instrumentation engineers working with ABB PLCs
- Project managers overseeing PLC-based automation projects
- Maintenance engineers and technical staff upgrading PLC applications

Prerequisite Knowledge

- Prior experience with PLC concepts and applications
- Familiarity with industrial automation systems
- Basic programming in logic-based or IEC 61131-3 languages

Course Objectives

- Master ABB PLC programming in Ladder Logic, Structured Text, FBD, and SFC
- Effectively use Automation Builder for program development and troubleshooting
- Implement advanced programming structures, state machines, and modular design
- Configure and secure industrial networks, HMI, and SCADA integrations
- Maintain, update, and optimize ABB PLC systems for reliability and performance

Table of Contents

Module 1: Introduction to ABB PLC Programming

- Overview of ABB PLC Programming

- Basic Concepts of ABB PLC Program Structure
- ABB Programming Languages Overview (IEC 61131-3)
- Working with ABB Automation Builder Software
- Programming Structures in ABB PLC Programming
- Debugging ABB PLC Programs
- Interfacing with Other Systems
- Networking with ABB PLCs
- Security and Safety Considerations

After completing this module, students will be able to:

Understand ABB PLC programming concepts, create and debug basic programs, and navigate Automation Builder.

Module 2: Basic Programming Concepts

- Introduction to Programming in ABB PLCs
- Variables and Data Types
- Control Flow Statements
- Functions and Subroutines
- Debugging and Troubleshooting Basics
- Arrays and Strings in Structured Text
- File I/O and Data Handling
- Database & OPC Connectivity in ABB PLCs

After completing this module, students will be able to:

Apply programming fundamentals, develop algorithms and control logic, use debugging tools.

Module 3: Ladder Logic Programming

- Introduction to Ladder Logic
- Basic Ladder Instructions (contacts, coils)
- Timers, Counters, Comparators
- Practical Ladder Logic Examples

- Troubleshooting Ladder Logic Programs
 - Advanced Techniques (interlocks, cascading logic)
 - Best Practices for ABB Ladder Programming
- After completing this module, students will be able to:*
Design/debug ladder programs, implement timers/counters, optimize control applications.

Module 4: Sequential Function Chart (SFC) Programming

- Basics of SFC Programming in ABB
 - States, Transitions, and Actions
 - Creating and Debugging SFC Programs
 - Integrating SFC with Ladder and FBD
 - Case Study: Sequential Motor/Conveyor Control
- After completing this module, students will be able to:*
Create and troubleshoot SFC programs and apply SFC for automation sequences.

Module 5: Structured Text (ST) Programming

- Syntax and Data Types in ST
 - Conditional Statements and Loops
 - Arrays and String Handling
 - Subroutines and Functions in ST
 - Advanced ST Techniques (Math, PID blocks)
 - Debugging and Optimization
- After completing this module, students will be able to:*
Write/debug structured text code and develop modular, reusable logic.

Module 6: Function Block Diagram (FBD) Programming

- Basics of FBD in ABB PLCs
- Standard Function Blocks (Timers, Counters, Math)
- Creating Custom Function Blocks
- Debugging FBD Programs

- Optimizing FBD for performance

After completing this module, students will be able to:

Develop/debug FBD programs and integrate FBD with ladder and ST.

Module 7: Advanced Programming Techniques

- Modular Programming with POU's (Programs, FBs, Functions)
- Task Scheduling and Priority Handling
- State Machine Design in ABB PLCs
- Error Handling and Exception Routines
- Code Optimization & Best Practices

After completing this module, students will be able to:

Implement structured, maintainable ABB PLC applications and manage advanced execution.

Module 8: Troubleshooting and Debugging

- Common ABB PLC Errors and Resolutions
- Using Automation Builder Debugging Tools
- Online Monitoring and Variable Forcing
- Analyzing Error Logs and System Faults
- Optimizing Performance

After completing this module, students will be able to:

Diagnose/fix PLC issues, use watch windows, trace functions, and variable forcing.

Module 9: Networking and Communications

- Overview of ABB PLC Networking (PROFINET, Modbus, EtherCAT)
- Network Topologies and Configurations
- PLC-to-PLC Communication
- Security Considerations in Networking
- Practical Lab: Setting up Modbus TCP in ABB PLC

After completing this module, students will be able to:

Configure communication interfaces and troubleshoot networks.

Module 10: Data Acquisition and Control

- Analog Input/Output Configuration
- Scaling and Engineering Unit Conversion
- Working with Sensors and Transducers
- Data Logging and Storage
- Control Loops (ON/OFF, PID basics)
After completing this module, students will be able to:
Acquire/process analog signals and implement closed-loop control.

Module 11: HMI and SCADA Integration

- ABB CP600 HMI Overview
- Linking ABB PLC with SCADA (Zenon, generic OPC/Modbus systems)
- Designing Basic HMI Screens
- Data Exchange and Tag Mapping
- Troubleshooting HMI/SCADA Integration
- Optional Note: 800xA integration concepts via OPC gateways
After completing this module, students will be able to:
Integrate ABB PLCs with HMI/SCADA and create basic operator interfaces.

Module 12: Safety and Security

- Safety Standards (SIL, IEC 61508) in ABB PLCs
- ABB AC500-S Safety PLC overview
- Implementing Safety Instructions in ABB PLCs
- Cybersecurity in Industrial Automation
- Best Practices for Secure PLC Deployment
After completing this module, students will be able to:
Design safety-compliant PLC applications and apply cybersecurity best practices.

Module 13: Maintenance and Upgrades

- Preventive Maintenance for ABB PLCs
- Backup and Restore Procedures
- Firmware Upgrades in AC500 PLCs

- Troubleshooting Maintenance Issues
- Performance Optimization

After completing this module, students will be able to:

Maintain/upgrade ABB PLC systems and troubleshoot lifecycle issues.