ABB Programmable Logic Controllers (PLCs) Essentials

Course Description

This course provides a complete understanding of ABB Programmable Logic Controllers (PLCs) and their role in industrial automation. It introduces PLC fundamentals, ABB PLC hardware architecture, programming environments, communication protocols, and advanced functions. Participants will gain hands-on experience using ABB's Automation Builder, including programming in Ladder Diagram, Function Block Diagram, and Structured Text. The course also covers analog signal processing, diagnostics, and industrial case studies using ABB PLCs.

Audience Profile

- Engineering students interested in ABB PLC programming
- Technicians and maintenance engineers upgrading to ABB platforms
- Automation engineers and project managers working with ABB PLC systems
- Professionals aiming to gain hands-on knowledge of ABB PLCs and Automation Builder

Prerequisite Knowledge

- Basic understanding of electrical and electronic circuits
- Familiarity with digital logic concepts

Course Objectives

- Understand the fundamentals of automation and control systems
- Learn ABB PLC hardware structure (e.g., AC500 series) and I/O modules
- Configure and program PLCs in Automation Builder
- Work with Ladder, FBD, and ST programming languages
- Implement timers, counters, and block architecture in ABB PLCs
- Perform analog signal acquisition and engineering value conversion
- Troubleshoot and perform fault diagnostics using ABB tools

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Module 1: Introduction to Automation and ABB PLCs

- Overview of industrial automation
- Control system types (open-loop, closed-loop)
- Introduction to ABB PLC families (AC500, AC800M)
- Applications of ABB PLCs in industries

Module 2: ABB PLC Hardware & Architecture

- AC500 PLC system overview
- CPU modules, power supply, communication interfaces
- Digital and analog I/O modules
- Expansion modules and accessories
- Identifying ABB PLC hardware components (Lab: Hardware walkthrough)

Module 3: Communication & Networking in ABB PLCs

- ABB communication protocols (EtherCAT, Modbus TCP, PROFIBUS, PROFINET)
- Addressing I/O in ABB PLCs
- CPU scan cycle and execution sequence
- Sink/source wiring concept in ABB systems
- Case Study: ABB PLC in material handling

Module 4: ABB Automation Builder Environment

- Introduction to Automation Builder software
- Project setup and hardware configuration
- PLC-PC communication
- Task configuration (cyclic, periodic, event-driven)
- Language editors: LD, FBD, ST
- Lab: Writing your first ABB PLC program

Module 5: Basic Operations & Memory Handling

- Data types (BOOL, BYTE, WORD, DWORD, REAL)

- Work memory, retain memory, system memory concepts
- Boolean operations (AND, OR, XOR, NOT)
- SET/RESET operations
- Lab Exercises: Basic lamp/relay control using ABB PLC

Module 6: Timers, Counters & Program Control

- Timer types in ABB PLC (TON, TOF, TP)
- Counters (CTU, CTD, CTUD)
- Sequential control examples
- Lab: Traffic light control using timers & counters
- Lab: Conveyor motor control with delay

Module 7: Function Blocks & Program Structuring

- Function Blocks (FB) vs Functions (FC)
- Program organization units (POUs) in ABB
- Task and program scheduling
- Interrupt handling and cyclic tasks
- Lab: Implementing motor start/stop with interlocks

Module 8: Analog Value Processing in ABB PLC

- Analog signal acquisition and scaling
- Norm_X and Scale_X equivalents in ABB
- 2-wire & 4-wire sensor integration
- Engineering unit conversion
- Lab: Analog speed control of a motor using potentiometer input

Module 9: Diagnostics & Fault Handling

- ABB PLC diagnostic tools
- Forcing and monitoring variables
- Cross-reference functions

- Handling hardware and software faults
- Lab: Fault detection & troubleshooting in Automation Builder

Module 10: Industrial Case Studies & Conclusion

- Practical automation applications with ABB PLCs (Oil & Gas, Power, Manufacturing)
- Integration with ABB SCADA (e.g., Zenon, 800xA)
- Review and wrap-up