Mastering Siemens S7-1200/S7-1500 PLCs Programming with TIA Portal

Course Description:

This course is designed to provide participants with a comprehensive understanding of Programmable Logic Controllers (PLCs) and their use in industrial automation, specifically focusing on Siemens S7-1200 and S7-1500 systems. It covers the fundamentals of automation, types of control systems, PLC architecture, programming languages, and I/O modules within the Siemens TIA Portal environment. Participants will gain practical insights into analog processing, fault diagnostics, and parameter passing. Whether using simulation tools or real hardware, learners will develop skills to confidently program and troubleshoot Siemens PLC systems using TIA Portal.

Audience Profile:

This course is suitable for a wide range of learners interested in industrial automation, including:

- Engineering students aiming to develop skills in PLC programming and automation
- Technicians, electricians, and maintenance personnel seeking to upgrade their capabilities
- Engineers and managers involved in automation projects
- Anyone interested in acquiring a practical understanding of industrial automation systems

Prerequisite Knowledge/Skills:

There are no specific prerequisites for this course. However, a basic understanding of electrical and electronic circuits is beneficial.

Course Objectives:

Upon completion of this course, participants will be able to:

- Understand the basics of automation and different types of control systems
- Describe the different types of PLCs and their applications
- Explain the architecture of a PLC and various I/O modules
- Program a PLC using ladder logic, function block diagrams, and structured text
- Understand analog signal processing and perform fault diagnostics

- Apply parameter passing techniques and utilize shared data blocks effectively

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Module 1: Introduction to Automation and PLC

- What is automation?
- Different types of control systems
- Closed loop control system
- Introduction to PLC controller
- PLC units
- Advantages and disadvantages of PLCs
- Applications of PLCs

Module 2: PLC Architecture

- PLC block diagram
- Input and output modules
- Power supply modules
- Main PLC CPU details
- General PLC architecture
- PLC capabilities
- Expansion Modules in PLC

Module 3: S-7 Controllers and Programming Languages for PLC

- Types of S-7 controllers
- Addressing of digital I/Os
- Siemens communication protocols
- Profibus protocol overview
- Sink and source concept
- CPU scan cycle
- PLC programming languages
- Programming examples

Module 4: TIA Portal and Programming Languages

- Importance of DI modules

- Cyclic program processing sequence

- PLC selection criteria

- Introduction to TIA Portal

- Hardware configuration and project setup

- PLC and PC communication

- Clock memory application

- Memory reset procedure

- Programming language conversion

Module 5: PLC Operations and Memory Types

- Instruction writing

- Logic operations (AND, OR, NOR, etc.)

- Online diagnostics

- Data types (BIT, BYTE, WORD, DWORD)

- RLO and status concepts

- Load, work, and system memory

- Switch operation examples

- SET-RESET instructions

- Ex lab 5.1 - 2 Lamps and 3 NO/NC Contact coil Program

- Ex lab 5.2 - 3 Lamps and 3 NO/NC Contact coil Program using dual Network

- Ex lab 5.3 - 4 Lamps and 4 NO/NC Contact coil Program using Multiple Branching Network

Module 6: PLC Blocks and Timers

- Comparator block applications

- Program design techniques

- Timer types (pulse, delay, etc.)

- Counter operations

- Comparison functions and examples

- S-7 block types

- Organization blocks and error handling

- Ex lab 6.1 - Sequential 2 Motor Control with Delayed Start and Stop Functionality

- Ex lab 6.2 - Motor Control with Delayed Start and Timed Stop Hold

- Ex lab 6.3 - Car Parking Control System Using Sensors and Visual Indicator Logic

- Ex lab 6.4 - Sequenced Conveyor Control with Delayed Start/Stop and Cycle Limitation

- Ex lab 6.5 - Controlling Multiple Conveyor Belt with ON – OFF Bit Reset emergency stop functionality

- Additional Timer biased and Counter combined Logic Problems

Module 7: Block Architecture and Program Structure

- Warm, cold, and hot restarts

- FB vs FC blocks

- Block architecture and editing

- Program structure and routine calling

- Time-Of-Day and cyclic interrupts

- Practical programming examples

Module 8: Processing of Analog Values

- Analog value processing

- Analog sensor block diagram

- Signal flow from sensor to PLC

- 2-wire and 4-wire sensors

- Analog module wiring

- Engineering value conversion

- Norm X and Scale X Function Block

- Ex lab 8.1 - Analog Speed Regulation of Conveyor System through Potentiometer Signal Processing in TIA Portal

Module 9: Faults and Cross-Reference Function

- Functional vs system faults

- Forcing I/O variables

- Cross-reference usage

- Parameter passing

- Shared data blocks

- Practical fault diagnosis examples

Module 10: Practical Examples and Conclusion

- Real-world practical examples

- Course review

- Conclusion