Mastering Siemens PLCs: From Fundamentals to Advanced Programming

Course Description

The course is designed to provide participants with a comprehensive understanding of Programmable Logic Controllers (PLCs) and their use in industrial automation. The course covers the fundamentals of automation, different types of control systems, PLC architecture, programming languages, and the different types of I/O modules. The course also covers the basics of analog processing, fault diagnostics, and parameter passing.

Audience

The course is suitable for anyone interested in learning about Programmable Logic Controllers (PLCs). This course is suitable for:

- Engineering students who want to develop their skills in industrial automation
- Technicians, electricians, and maintenance personnel who want to upgrade their skills
- Engineers and managers involved in automation projects
- Anyone who wants to learn about industrial automation

Pre-requisite Knowledge/Skills

There are no specific prerequisites for this course. However, basic knowledge of electrical and electronic circuits would be beneficial.

Training Requirements

- Software for Online Simulation Based Training
  - SIMATIC S7-PLCSIM

OR

- ✓ Hardware Requirements for HandsOn Offiline Training (Client)
  - Siemens S7-1200 PLC's
  - Profinet Cable
- ✓ Software Requirement (Client)
  - Siemens Licenses
    - TIA Basic
    - Wincc Professional (SCADA)
- ✓ System Requirements for Software Installation (Client)
  - Processor -- Intel® Core(TM) i7-6700 CPU @3.40GHz

- Installed memory(RAM)—32.0 GB
- System type—64-Bit Operating System
- Optical Drive—DL Multistandard DVD RW
- Monitor—15.6” wide Screen Display(SCADA)(1920*1080)
- Software—Microsoft. Net framework 3.5SP1
- Ethernet—10Mbpsor Faster

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 the different types of I/O modules
- Program a PLC using ladder logic, function block diagram, and structured text
- Understand the basics of analog processing and fault diagnostics
- Understand the concept of parameter passing and shared data blocks

Course Outline

The course comprises 40-hours of theory and labs. It's divided into 10 different modules.

Module 1: Introduction to Automation and PLC

- What is automation?
- Different types of control systems
- Details of the closed loop control system
- Basic introduction to PLC controller
- Units of PLC
- Advantages and disadvantages of PLC
- Different applications of PLC

Module 2: PLC Architecture

- Block diagram of PLC
- Different input modules
- Different output modules
- Power supply modules

- Main PLC CPU details
- PLC general architecture
- PLC capability

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

- Different types of S-7 controllers
- Addressing of digital I/Os
- Siemens communication protocols
- Profibus different protocol
- Sink and source concept
- Scan cycle of CPU
- Programming languages for PLC
- Examples (series circuit, parallel CKT, series and parallel CKT)

Module 4: TIA Portal and Programming Languages

- Need of DI module
- Sequence of cyclic program processing
- PLC selection criteria
- Starting of TIA portal
- Steps: hardware configuration, create project view, add new device, click on OB 1, start programming, properties of all hardware
- Communication between PLC and PG/PC
- Clock memory application
- Procedure for “memory reset”
- Different programming languages
- How to convert LDA/FBD/STL

Module 5: PLC Operations and Memory Types

- Writing of instruction
- Different operation (and, or, NOR, NAND, ex-or, ex-NOR)
- “Online and diagnostics” for the project
- Data types and details of elementary data types (BIT, byte, word, double word)

- Understanding of RLO and status
- Different types of memory: load memory, work memory, and system memory
- Example of 2NO, 1NO+1NC, and 2NC switch
- Use of “SET-RESET” instructions

Module 6: PLC Blocks and Timers

- Application of comparator blocks
- Easy to design your program
- Different types of timers (pulse timer, extended pulse timer, on-off delay timer)
- Counters operation
- Comparison functions
- Examples on use of timers and comparators and counters
- Different types of S-7 blocks
- Different types of organization blocks
- Asynchronous error organization block
- Different reset OBS

Module 7: Block Architecture and Program Structure

- Warm restart, cold restart, and hot restart
- Difference between FB and FC
- Block architecture and block editor
- Program structure (take examples)
- Calling of main routine and sub-routine
- Use of “Time-Of-Day interrupt” and “Cylic interrupt”
- Practical examples

Module 8: Processing of Analog Values

- Processing of analog values
- Generalized block diagram of analog sensors
- Signal flow from analog device to PLC
- 4-wire and 2-wire sensors

- Different types of S-7 blocks
- Schematic wiring diagram of analog modules
- Converting raw values into engineering values

Module 9: Faults and Cross-Reference Function

- Different types of faults: functional and systems faults
- Forcing of I/O variables
- Use of “cross-reference” function
- Concept of “parameter passing”
- Shared data blocks
- Examples

Module 10: Practical Examples and Conclusion

- Practical examples
- Review of the course
- Conclusion