

PLC and SCADA Automation Training

Course Description

This comprehensive training program delves into the intricacies of Programmable Logic Controllers (PLCs) and Supervisory Control and Data Acquisition (SCADA) systems. Covering 12 detailed modules, the course encompasses fundamental to advanced concepts in automation, including PLC architecture, programming, and operations, as well as SCADA system integration. Participants will gain practical experience through hands-on exercises with Siemens S-7 controllers and TIA Portal, ensuring a thorough understanding of both PLC and SCADA systems and their applications in modern industrial environments.

Audience

This course is designed for:

- Engineering students and recent graduates aiming to specialize in automation, PLC, and SCADA systems.
- Electrical, Electronics, and Automation Engineers seeking to enhance their knowledge and skills in PLC programming and SCADA system integration.

Pre-requisite Knowledge/Skills

Basic understanding of electrical circuits and digital electronics.

Familiarity with computer programming concepts.

Prior exposure to automation systems is beneficial but not mandatory.

Course Objectives

- Understand the principles of automation and the role of PLCs and SCADA systems.
- Learn the architecture and functionality of PLCs, focusing on Siemens S-7 controllers.
- Develop proficiency in PLC programming using various languages.
- Gain hands-on experience with TIA Portal for PLC programming and hardware configuration.
- Explore the integration of PLCs with SCADA systems for effective monitoring and control.
- Diagnose and troubleshoot common PLC and SCADA system faults.
- Implement practical automation solutions using PLCs and SCADA.

Course Outline

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 protocols
- Sink and source concept
- Scan cycle of CPU
- Programming languages for PLC
- Examples (series circuit, parallel circuit, series and parallel circuit)

Module 4: TIA Portal and Programming Languages

- Need for DI module
- Sequence of cyclic program processing
- PLC selection criteria
- Starting with 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 instructions
- Different operations (AND, OR, NOR, NAND, XOR, XNOR)
- "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 the use of timers, 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 "Cyclic 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: Modbus RTU and TCP Communication

- Siemens communication protocols
- Communication between PLC and PG/PC
- Introduction to Modbus
- TCP connection with device (PLC)

Module 11: Connection to SCADA

- Creating a SCADA project
- Adding devices to the project
- Establishing communication connections
- Setting Ethernet addresses
- Connecting to non-integrated PLCs
- Runtime settings configuration
- Configuring buttons and outputs
- Basic exercises related to push buttons and displays

Module 12: Practical Examples and Conclusion

- Practical examples
- Review of the course
- Conclusion