Integrated Training Program: SCADA, Communication, and Control Systems: Part B - Communication and Control Systems

Course Description

This course is designed to provide a comprehensive understanding of communication and control systems used in industrial automation. Participants will gain foundational knowledge of control strategies, programmable logic controllers (PLCs), and communication protocols. Hands-on exercises will equip participants with the skills to program a basic PLC and configure communication for data collection in a simulated water treatment plant environment.

Audience

This comprehensive training program delves into the intricacies of communication and control systems, specifically focusing on Programmable Logic Controllers (PLCs) and their integration into industrial environments. Participants will gain hands-on experience in designing, programming, and troubleshooting PLC-based systems, along with an understanding of communication protocols crucial for seamless operation. Through a combination of theoretical knowledge and practical exercises, learners will be equipped to tackle real-world challenges in SCADA, communication, and control systems.

Pre-requisite Knowledge/Skills

Participants are expected to have a basic understanding of electrical systems, automation concepts, and programming fundamentals. Familiarity with PLCs or similar control systems will be beneficial but not mandatory.

Course Objectives

Understand the fundamentals of control strategies, including continuous, sequential, and relay-based systems.

- Gain proficiency in PLC systems, programming formats, and logical continuity.
- Familiarize with PLC architecture, memory types, and scanning algorithms.
- Master PLC programming basics, addressing schemes, and data types.
- Develop skills in creating and implementing PLC programs, including timers, counters, and analog signal handling.
- Learn about communication protocols such as Profibus, Profinet, and Ethernet, and configure communication settings.
- Explore data collection techniques in water plants, including field measurement types, totalizers, and system performance analytics.
- Acquire the ability to simulate, analyze, and predict system behavior for improved performance and resilience.

Course Outline

Module 1: Introduction to Control Strategies

- 1.1 Continuous Control Systems
- 1.2 Sequential Control Systems
- 1.3 Relay-Based Systems
- 1.4 Relay-Based Programming Examples

Module 2: Introduction to PLC Systems

- 2.1 PLC vs. Relay Systems
- 2.2 Programming Formats
- 2.3 Logical Continuity
- 2.4 Software Familiarization
- 2.5 Introduction to Industry Standard PLC Programming Software
- 2.6 Construction of Test Programme

Module 3: PLC Architecture

- 3.1 System Architecture
- 3.2 Memory and I/O Types
- 3.3 Scanning Algorithms
- 3.4 Program Scan Cycle

Module 4: PLC Programming Basics

- 4.1 Overview of Programming Languages
- 4.2 Addressing and Data Types in Siemens PLCs
- 4.3 Basic Programming Instructions

Module 5: Creating a Simple PLC Program

- 5.1 Setting up a New Project
- 5.2 Creating Tags and Variables

- 5.3 Writing and Downloading a Basic Program

Module 6: Working with Timers and Counters

- 6.1 Introduction to Timers and Counters
- 6.2 Programming Timers and Counters in Siemens PLCs

Module 7: Analog Input and Output Handling

- 7.1 Understanding Analog Inputs and Outputs
- 7.2 Configuring Analog Modules
- 7.3 Programming Analog Signals

Module 8: Communication Protocols

- 8.1 Introduction to Communication Protocols in Siemens PLCs
- 8.2 Profibus, Profinet, and Ethernet Communication
- 8.3 Configuring Communication Settings

Module 9: Data Collection in Water Plant

- 9.1 Field Measurement Types
- 9.2 Continuous (Analog) vs. Discrete (Digital) Measurements
- 9.3 Totalizers
- 9.4 Physical vs. Logical Points
- 9.5 Interaction and User Data
- 9.6 Process Event Frequency
- 9.7 System Performance Analytics
- 9.8 Simulation and Predictive Analysis
- 9.9 Data Path Robustness and Resiliency