**PLC475: PLC Hardware, Programming and Design**

**Contact Us Today:** info@PiControlSolutions.com, **Tel:** (832) 495 6436
**Duration:** 4 Days Classroom or 32 hours Online.
**Audience:** Process Control Engineers, PLC Engineers and Technicians, Instrument Engineers.
**Prerequisites:** Some control room exposure is desirable, but not required.
**Course Material:** Training slides, PLC Simulation Software and Industrial Examples.

## Course Description

This course provides a comprehensive practical foundation in Programmable Logic Controllers (PLCs), with a primary focus on Ladder Logic programming and control scheme design. It is designed to take students from basic hardware knowledge to proficiency in creating, debugging, and optimizing PLC programs for any vendor platform.

While understanding the system architecture is necessary—including how PLCs integrate with DCS and HMIs—the core of this training is logic design. Students will learn how to translate engineering requirements and P&IDs into functioning code using standard PLC instructions. The curriculum covers everything from digital/analog signal processing to complex sequence design, timers, counters, and math functions. Through hands-on simulation, participants will develop the skills to write robust ladder logic, troubleshoot existing programs, and implement safe, reliable control strategies in an industrial environment.

## Learning Outcomes

At the end of this course, students will be able to:

- **Program with Confidence:** Design, write, and troubleshoot Ladder Logic using relays, timers, counters, and boolean algorithms.
- **Translate P&IDs to Logic:** Interpret P&IDs and SAMA diagrams and convert them into actual control schemes inside the PLC.
- **Master Control Strategies:** Distinguish between and implement both sequence control (step-based) and continuous control loops.
- **Handle Industrial Signals:** Configure I/O cards and implement algorithms for analog signal scaling and noise filtering.
- **Implement Advanced Functions:** Use math blocks, comparison instructions, and data handling to solve complex process problems.
- **Integrate Systems:** Understand how the PLC communicates with DCS networks and configure basic HMI elements for operator interaction.

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**Course Topics Outline**

**1. PLC Fundamentals & Hardware**

- Programmable Logic Controller (PLC) Overview
- PLC Hardware and Components
- PLC Input and Output Cards
- Analog and Digital Signals
- Number Systems – Binary, Decimal and Hexadecimal
- Setting up PLC Software on Personal Computers

**2. Engineering Drawings & Control Logic Basics**

- Process Control Nomenclature and Basic Definitions
- How to Read P&IDs and Design Control Schemes
- SAMA Standard Diagrams and Symbols
- Relays
- Relay Logic Diagrams
- Logic Gate Functions
- Boolean Logic Algorithms

**3. Core PLC Programming (Ladder Logic)**

- PLC Program Structure & Scan Cycle
- Timers
- Counters
- Compare and Jump Instructions
- Bit Shift Instructions
- Data Handling Instructions
- Math Instructions & Compute Blocks

**4. Advanced Control Design & Algorithms**

- Analog Signal Scaling & Processing
- SMOOTH Filtering for Noisy Signals
- Discrete vs. Continuous Control Strategies
- Sequence Design and Implementation

- Safety Procedures

**5. System Integration (DCS, HMI & Networks)**

- Distributed Control Systems (DCS) Introduction
- DCS Architecture and Control Network
- PLC Communication
- PLC Networks in Industry
- DCS Tagnames and Graphics
- Other Types of DCS Tags
- HMI System Configuration & Tag Database
- Designing HMI Faceplates & Operator Inputs
- Design process screens

**6. Operations & Maintenance**

- Procedures for Testing, Commissioning & Troubleshooting