

Industrial Automation: PLC Programming to Robotics

Master automation systems with PLC programming, sensor integration, and robotic control for industrial engineers and technicians.

Mechatronics Instructor: Michael Carter • 5 sections • 52 lessons • 17.50h total

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About this course

Industrial automation is evolving fast, but connecting sensors, programmable logic controllers, and robots into reliable systems can be a real challenge. This course cuts through the complexity, starting from the basics and building up to advanced integration. You'll learn step-by-step how to program PLCs, connect various sensors, and control robotic arms using video lessons and case studies from manufacturing and logistics.

Course curriculum

Foundations of Automation and PLCs

- **Understanding Industrial Automation Systems (15m)**
Explore what automation involves and why PLCs are central to modern industry.
- **PLC Hardware Components and Architecture (22m)**
Identify key parts of a PLC system, from processors to communication modules.
- **Introduction to Ladder Logic Programming (30m)**
Start writing basic ladder logic diagrams with practical examples.
- **Setting Up Your First PLC Project (25m)**
Step-by-step guide to configuring a PLC for a simple control task.
- **Digital and Analog Input/Output Basics (18m)**
Learn how to wire and use different I/O types for sensor and actuator connections.
- **Power Distribution and Wiring Safety (12m)**
Cover essential electrical practices to keep systems safe and functional.
- **Overview of Industrial Communication Protocols (20m)**
Understand common protocols like Modbus and Ethernet/IP used in automation.
- **Reading and Interpreting Electrical Schematics (16m)**
Practice drawing and reading schematics to plan and troubleshoot systems.

Sensor Technology and Integration

- **Types of Industrial Sensors: Proximity, Photoelectric, and More (20m)**
Compare sensor types and their typical uses in automation setups.
- **Selecting Sensors for Specific Applications (18m)**
Match sensor specifications to real-world requirements like distance or material.
- **Wiring Sensors to PLC Input Modules (22m)**
Hands-on guide to connecting sensors with proper grounding and shielding.
- **Calibrating and Testing Sensors (15m)**
Ensure accurate readings with calibration techniques and testing procedures.
- **Integrating Encoders and Flow Meters (25m)**
Work with rotary and linear encoders for motion control applications.
- **Using Temperature and Pressure Sensors (19m)**
Apply sensors in process control scenarios with PLC programming examples.
- **Troubleshooting Common Sensor Issues (14m)**
Identify and fix problems like noise, drift, or wiring faults.
- **Sensor Data Processing in PLC Programs (21m)**
Program PLCs to read, filter, and use sensor data effectively.
- **Case Study: Sensor Integration in Packaging Line (28m)**
Walk through a real project from sensor selection to system commissioning.
- **Advanced Sensor Networking with IO-Link (16m)**
Explore digital communication for smart sensors in modern plants.

Advanced PLC Programming Techniques

- **Structured Text and Function Block Diagrams (27m)**
Move beyond ladder logic with textual and graphical programming methods.
- **Programming Timers, Counters, and Sequencers (22m)**
Use built-in functions for timed operations and sequence control.
- **Analog Signal Processing and Scaling (18m)**
Convert raw sensor values to usable engineering units in code.
- **Creating and Using Subroutines (15m)**
Organize code with reusable blocks for cleaner program structure.
- **Error Handling and Fault Detection Routines (20m)**
Build robust programs that detect and respond to system failures.
- **Data Logging and Historian Integration (24m)**
Record process data for analysis using PLC memory or external systems.
- **Simulation and Testing Strategies (19m)**
Use software tools to test programs before deploying to hardware.
- **Optimizing PLC Scan Time and Performance (16m)**
Write efficient code to reduce cycle times in high-speed applications.
- **Real Case: Programming a Multi-Station Assembly System (32m)**
Develop a complete program for a complex automation sequence.

Robotic Systems and Control

- **Introduction to Industrial Robots: Types and Applications (18m)**
Learn about articulated, SCARA, and delta robots in automation.
- **Robot Kinematics and Coordinate Systems (21m)**
Understand how robots move and position themselves in space.
- **Programming Robot Tasks with Teach Pendants (25m)**
Step-by-step guide to teaching robots positions and paths.
- **Integrating Robots with PLCs via I/O Signals (22m)**
Wire and program handshaking signals for coordinated control.
- **Vision Systems for Robot Guidance (19m)**
Use cameras and image processing to direct robot actions.
- **Robot Safety Standards and Compliance (14m)**
Implement safety circuits and protocols for human-robot interaction.
- **End-Effectors and Tooling Selection (16m)**
Choose and integrate grippers, welders, or other tools.
- **Advanced Motion Control with Servo Drives (28m)**
Program precise movements using servo motors and feedback systems.
- **Troubleshooting Robot and PLC Communication (17m)**
Diagnose and resolve issues in connected automation cells.
- **Case Study: Robotic Welding Cell Integration (30m)**
Follow a project from robot setup to production run.

- **Collaborative Robots in Flexible Automation (20m)**
Explore cobots and their programming for shared workspaces.
- **Optimizing Robot Cycle Times (15m)**
Techniques to speed up robot tasks without sacrificing accuracy.

System Integration and Future Trends

- **Designing Complete Automation Architectures (24m)**
Plan systems that combine PLCs, sensors, and robots effectively.
- **Industrial Networking and IIoT Basics (21m)**
Connect devices using Ethernet, MQTT, and cloud platforms.
- **Human-Machine Interface (HMI) Design (22m)**
Create operator screens for monitoring and control.
- **SCADA Systems and Remote Monitoring (18m)**
Implement supervisory control for large-scale operations.
- **Predictive Maintenance with Sensor Data (19m)**
Use analytics to schedule maintenance and reduce downtime.
- **Security Practices for Industrial Control Systems (16m)**
Protect networks and devices from cyber threats.
- **Commissioning and Startup Procedures (25m)**
Step-by-step guide to testing and deploying integrated systems.
- **Documentation and Change Management (14m)**
Maintain accurate records for troubleshooting and upgrades.
- **Energy Efficiency in Automation Design (17m)**
Reduce power consumption through smart programming and hardware.
- **Case Study: Upgrading a Legacy Manufacturing Line (32m)**
Modernize an existing system with new PLCs, sensors, and robots.
- **Emerging Technologies: AI and Digital Twins (20m)**
Explore how machine learning and virtual models are used in automation.
- **Career Paths in Industrial Automation (15m)**
Discuss roles from technician to engineer and skill development.
- **Building Your Automation Portfolio (18m)**
Tips for showcasing projects and continuing professional growth.

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