

Fundamentals of Variable-Frequency Drives (VFD)



Level 1

This certification is designed to teach students the theory, application, installation, and troubleshooting of VFDs used to control AC motor speed and torque. Certification delivery blends classroom presentations with paired-student lab activities using trainer hardware, lab sheets, and measurement tools. Emphasis is placed on safe work practices, understanding VFD control circuits and functions, selecting appropriate VFDs for load types, installation and maintenance best practices, and integrating VFDs with PLCs and HMIs. Students are expected to follow the instructor through guided labs, demonstrate correct wiring and commissioning procedures, perform diagnostic troubleshooting, and complete practical exercises that reflect real-world motor control scenarios.

Industry Recognized Certification Topics

- VFD Fundamentals — Purpose and benefits of VFDs; basic VFD topology and functional blocks
- Motor Control Basics — Relationship between frequency, voltage, and motor speed; slip, torque, and motor characteristics
- VFD Control Circuits and Functions — Control inputs, control modes, PID and closed-loop control concepts, and protective functions
- VFD Load Types and Control Methods — Characteristics of different loads and appropriate control strategies
- VFD Installation — Mechanical and electrical installation practices and cooling/ventilation considerations
- VFD Commissioning & Configuration — Setup, data entry, auto-tuning, speed/torque limits, ramp profiles, and testing procedures
- Measurement & Instrumentation — Use of appropriate test equipment for confirming proper motor/VFD operation
- VFD Maintenance & Troubleshooting — Fault code interpretation, diagnosing common faults, preventive maintenance, and replacement practices
- VFD Safety Practices — Lockout/tagout, PPE and safe testing procedures
- VFD Operation with PLCs and HMIs — Integrating VFD control and feedback with PLCs/HMIs (optional if additional lab equipment is available)

Industry Recognized Certification Competencies

- Apply safe work practices for electrical motor control, including lockout/tagout and PPE requirements
- Explain the purpose and basic functional blocks of a VFD and how they enable variable-speed drive of AC motors
- Describe the relationship between applied frequency/voltage and AC motor speed and torque, and how VFDs control these parameters
- Identify common VFD control inputs/outputs and configure basic control circuits
- Differentiate load types and select appropriate VFD control methods for each application
- Perform proper mechanical and electrical installation steps for a VFD
- Configure essential VFD parameters and execute initial commissioning tests
- Use measurement instruments to confirm motor/VFD performance under load
- Interpret VFD fault codes and systematically troubleshoot common
- Execute preventive maintenance checks and document findings
- Integrate VFDs with PLCs/HMIs for control and monitoring (when covered)
- Demonstrate wiring, commissioning, fault diagnosis, and performance verification on VFD trainer hardware

Units - 8 / Labs - 8

