

Before the First Rung

Relay Logic, Field Devices, &
Control Wiring for Practitioners



2-Day Program | 7
Hands-On Labs | Text &
Materials | Certificate of
Completion

**MOST CONTROL FAULTS NEVER REACH
THE PROGRAM. THEY LIVE IN THE WIRE.**

WHY THIS COURSE COVERS INDUSTRIAL, WATER, REFRIGERATION, & HVAC

- Relay logic built by hand...the foundation of every PLC
- 7 labs, zero fluff, wire it, break it, fix it, understand it
- Control power, protection, & grounding done right
- Field devices selected with confidence...the right sensor
- PLC I/O wiring without the mystery...shields, NPN, PNP, etc

Its easy...

- You provide coffee, lunch, & location
- Provide 8 to 16 Students
- I come to you

\$1200 per seat

- travel & expenses
included

Carl Lee Tolbert, PhD, CMRP
carl@waywardleaders.com
(678) 523-2050

National & International

Brand Agnostic



Not a programming class...

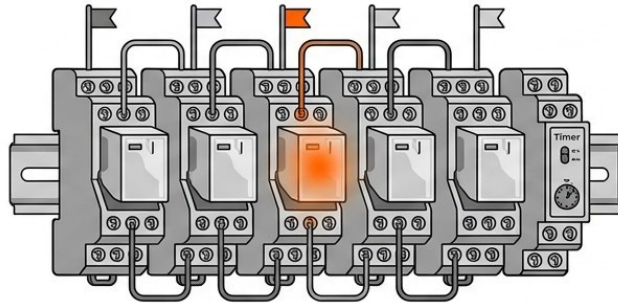
*no laptops, no software, just the reliable
foundation of all controls.*

Before the First Rung

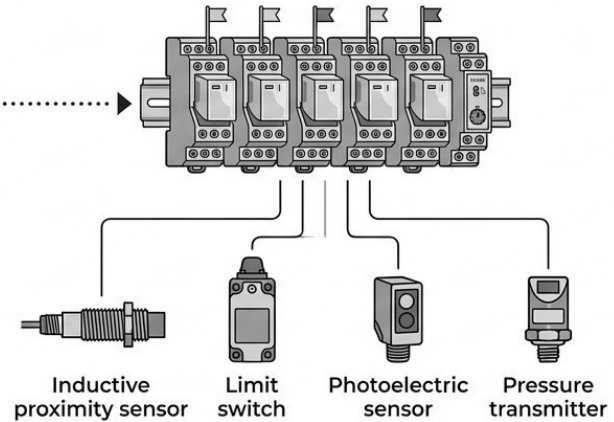
Relay Logic, Field Devices, &
Control Wiring for Practitioners



Day 1



Day 2



Who should attend:

Field technicians & electricians

Plant & maintenance folks

Integrators & panel builders

Industrial distribution specialists

Controls technicians



About Me



Website

Pricing Details

Cost per Student:

- Days 1 & 2: **\$1200**
- Materials: **included**

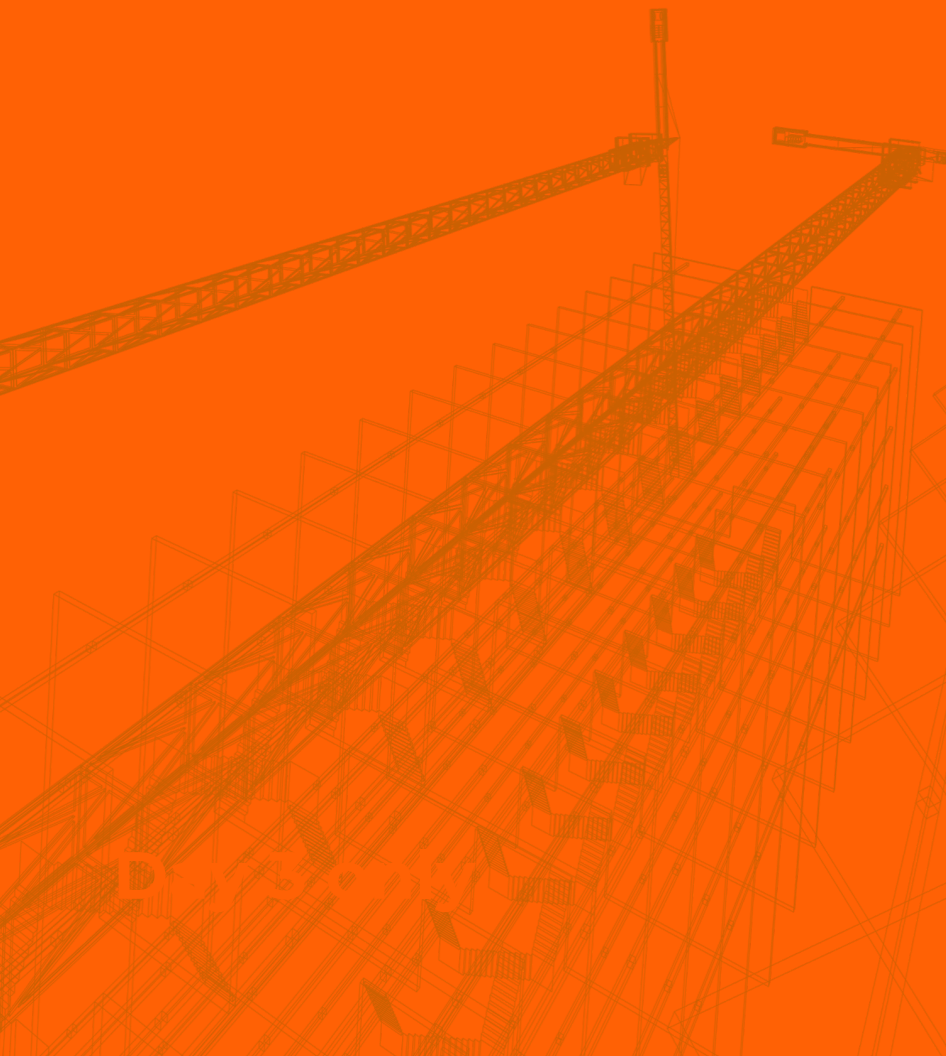
Notes:

- **Anywhere in the US**
- Insured
- Custom options
- CC or Net 15

**Simple pricing for
serious training**

Before the First Rung

Relay Logic, Field Devices, &
Control Wiring for Practitioners



D1 Relay Logic: Understanding Hard-Wired Control by Building It

- Motivation and Scope: Most Control Faults Live in the Wire, Not the Program
- The Control Circuit World: 24VDC vs. 120VAC
- The 24VDC Supply: Sizing, Derating, Hold-Up Time, Bus Protection, and the Case for UPS
- Terminal Discipline and Best Practices: Screw vs. Spring Clamp, Ferrules, Color Conventions
- Lab 1: Terminal Reliability (Terminate, Torque, Loosen, Retighten)
- Relay Anatomy: Coils, Contacts, Ratings, Pilot Duty vs. Power Duty, and Coil Suppression
- Lab 2: Relay Bench Familiarization
- Relay Logic: The Seal-In Circuit, Permissive Logic, Multiple Outputs, and the Forward/Reverse
- Lab 3: Progressive Relay Build (Seal-In, Permissive, Forward/Reverse)
- Timer Modes: On-Delay, Off-Delay, One-Shot, and Timer Cascade
- Lab 4: Timer Wiring (All Three Modes Plus Cascade -- Set, Verify, Fault)
- The Bridge Setup: Tomorrow We Replace Half of It With Field Devices

D2 Field Devices: Selection, Behavior, and Integration

- Day 2 Orientation: The Relay Logic Is Already Built
- Proximity Sensors: Inductive vs. Capacitive, Sensing Distance, Target Material Effects
- Photoelectric Sensors: Through-Beam, Retroreflective, and Diffuse
- Encoders: Incremental vs. Absolute, Resolution, Quadrature Output
- Lab 5: Sensor Identification and Bench Test (Identify the Device, Read the Nameplate, Determine Output Type, Verify Behavior Against a Live Circuit)
- Pushbuttons, Selector Switches, and Pilot Devices: Contact Blocks, Operator Types
- Contactors and Full-Voltage Starters: Ratings, Utilization Categories, Overload Classes
- Coil Suppression in the Output Circuit: What Happens Without It and Why It Is Never Optional
- Lab 6: Starter Wiring (Pushbutton to Contactor to Pilot Light, Add Overload Relay, Trip)
- NPN vs. PNP, Sourcing vs. Sinking: The Logic of Current Flow
- The 4 to 20mA Loop: Loop Power, Signal Flow, and Shield Termination
- Cable Routing and Separation: Power vs. Control vs. Signal
- Lab 7: Full Circuit Integration (Connect a Field Device to the Relay Logic Built on Day 1 -- Close the Loop, Verify Operation, Introduce a Fault, Diagnose It)
- Control Circuit Troubleshooting: Field Device First, Wiring Second, Card Third, Program Last
- The Bridge: Relay Bank to PLC Ladder -- Every Symbol Mapped to What You Built This Week