

BASICS OF INDUSTRIAL ELECTRICITY AND TROUBLESHOOTING ELECTRICAL CONTROL CIRCUITS

Learn how to effectively diagnose electrical control circuit problems. You will experience live circuit faults in a real world scenario. Become a confident and safe troubleshooter from techniques presented.

Understand the basics of electricity generation and delivery. Learn to safely use the proper measurement instruments and tools to understand the characteristics and properties of electrical signals. The terms voltage, current and impedance (resistance) will become standard in your electrical conversations.

Work hands-on with the same control circuits and devices commonly used on HVAC systems, pump systems, hydraulics, conveyors and automated machines.

This program is ideal for apprentice electricians just starting out, journeymen wishing to upgrade their skills, or any engineering, maintenance, operations, or management personnel who come into contact with electrical control systems in the course of their daily activity. They will benefit by being able to find, understand and fix electrical problems more easily, thereby reducing downtime.

CLASS FORMAT:

Lab + classroom

The participant is able to “learn-by-doing” in the course; this knowledge can be transferred to the workplace.

STANDARD CLASS SIZE:

NTT recommends a course size of 12 participants for the best results.

NTT PROVIDES:

- 5-Days (40 contact hours) of on-site instruction
- Textbooks, “Troubleshooting Electrical Control Circuits,” and “Basics of Industrial Electricity,” “Safety Awareness” and lab manuals
- Classroom consumables
- Completion certificates
- Shipping and instructor travel logistics

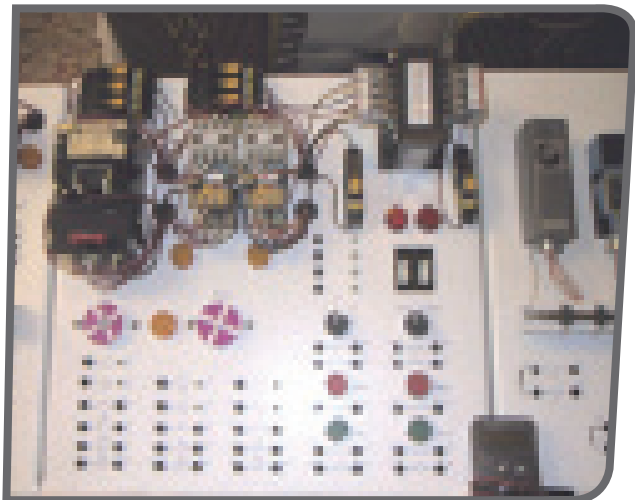
CLIENT PROVIDES:

- The classroom, with easy access, of 750 square feet or greater
- Projection screen, white board and/or flip chart(s)
- A dock facility or forklift
- A pallet jack to move the crates around after they have been unloaded may also be needed
- The equipment needs to be relocated to the training room for the NTT instructor to test and set up prior to the course start

SHIPPING:

Six Cases at 2050 lbs

- 1 @ 58" x 47" x 62"
- 5 @ 47" x 22" x 17"



BASICS OF INDUSTRIAL ELECTRICITY AND TROUBLESHOOTING ELECTRICAL CONTROL CIRCUITS

COURSE AGENDA

BASIC ELECTRICITY

- Current, voltage, and resistance
- Ohm's Law and calculations
- Series-parallel circuits
- Kirchhoff's Laws and corollaries

BASICS OF MULTIMETERS

- Analog and digital multimeters
- Solenoid meters
- Accessories

ELECTRICAL SAFETY

- Basic safety guidelines
- Lockout/tagout
- Test safety equipment
- Electrical shock
- Arc flash
- Arc blast

ELECTRICIANS' TOOLS AND TEST EQUIPMENT

- Tools for conduit
- Phase-rotation meter
- The megohmmeter
- Voltage and continuity testers

GENERATORS AND TRANSFORMERS

- DC power sources and voltmeter
- Measuring DC volts*
- AC generators
- Generators sinewave voltage
- 3-phase AC
- Current lag/lead waveform
- Transformers including Control Transformers
- Transformer voltages*
- Wyes and deltas
- Measuring a wye

SOLID-STATE DEVICES

- Resistor color codes
- Resistor board*
- Diodes and continuity*
- Rectifiers
- Capacitor sine waves
- Capacitor check*
- Solid-State switches
- Checking a solid-state switch*

PROTECTIVE DEVICES

- Fuses and disconnect switches
- Circuit breakers, panels, and switchgear
- Overload devices
- Checking protective devices
- Ground-fault protection
- Grounding and isolating
- Phase reversal
- Surge protection
- Coordination and selectivity

LIGHTING SYSTEMS

- Incandescent and fluorescent
- HID lamps
- Lighting circuits
- Series, parallel, and series-parallel lamps

COMMON WIRING DEVICES

- Receptacles
- Specification grade, isolation, and hospital grade
- NEMA locking
- Wiring a receptacle, troubleshooting receptacles & GFCI
- Lighting outlets—switches and dimmers
- Switch operation and installation
- 3- and 4-way switches
- Testing and installing 3- and 4-way switches

**Lab Exercises*

BASICS OF INDUSTRIAL ELECTRICITY AND TROUBLESHOOTING ELECTRICAL CONTROL CIRCUITS

COURSE AGENDA

CONDUCTORS AND RACEWAYS

- Insulation and ampacity
- Solid and stranded cable
- Conduit-metal and nonmetallic
- Splices: wirenuts, crimps, terminal blocks, split bolts and solder
- Conductor and box fill
- Parallel conductors
- 2-, 3-, and 4-wire circuits

ELECTRICAL DRAWING AND SYMBOLS

- Drawing symbols
- Blueprints
- One-line drawings
- NEMA symbols
- Schematics
- Ladder diagrams
- Physical layout

RELAYS

- Motor Starters
 - Basic Parts to a motor starter and their function
 - MCP – motor circuit protection
 - » Replacing overloads
 - » Adjustable trip breaker settings

MOTORS

- Single-phase, three-phase and DC
- Connection diagrams
- Motor construction
- Theory of operation
- Basic Parts of a motor
 - Motor types
 - De-terminating the motor via motor terminal box
 - Motor replacement - Dismounting and mounting
 - Reconnecting the motor
 - Checking and correcting
- Phase/Rotation

BASICS OF INDUSTRIAL ELECTRICITY HANDS-ON LAB EXERCISES

- Basic trainer set up
- Series circuit
- Parallel circuit
- Series-parallel circuits
- DC voltage
- Transformers
- Resistors
- Capacitor
- Rectifiers
- Problem receptacles
- Single-pole switch multiple-way switches

ELECTRICAL SCHEMATICS

- Power circuits
- Control circuits

MAPPING CONTROL CIRCUITS—LADDER DIAGRAMS

- Power rails and wire colors
- Control element arrangement
- Load arrangement
- Circuit protection arrangement
- Line numbers
- Wire numbers
- Tag names and common electrical symbol abbreviations

CONTROL ELEMENTS, SWITCHES AND SYMBOLOGY

- Relay contacts—normally open, normally closed
- Solid-state relays
- Timing relays
- Overload relays

SUPPLEMENTARY CONTACT SYMBOLS AND TERMS

- Breaks, poles, throws
- Single break, double break
- Single pole, double pole
- Single throw, double throw

BASICS OF INDUSTRIAL ELECTRICITY AND TROUBLESHOOTING ELECTRICAL CONTROL CIRCUITS

COURSE AGENDA

MANUAL SWITCHES—FUNCTIONALITY AND SYMBOLOGY

- Selector switches
- Push buttons
- Drum and foot switches

AUTOMATIC SWITCHES

- Limit switches
- Temperature, pressure, flow, and float switches
- Motion switches
- Proximity and photo switches

TROUBLESHOOTING SUGGESTIONS

- Measuring ohms, voltage, and current
- Open faults vs. shorts
- Using the proper tools and meters
- Logical and sequential troubleshooting methods
- Meter categories and types
- Safety and precautions

GROUND-FAULT & OVERLOAD PROTECTION

- Conductor sizing
- Ground-fault protection devices and sizing
- Motor starter sizing
- Motor overload protection sizing
- Disconnect sizing

MOTOR OVERLOAD PROTECTION

- Thermal overloads
- Bimetallic overloads
- Magnetic overloads
- Solid-state overloads

HANDS-ON LAB EXERCISE CIRCUITS

- Two-wire control and hands-off/auto
- Three-wire control—start/stop
- Jog/inch circuits
- Sequencing start and stop circuits
- Timing circuits
- Automatic sequencing circuits
- Forward/reversing circuits
- Plug stop and anti-plugging circuits
- Two-speed motor control
- Reduced voltage starting circuits

