

## COURSE :

# Troubleshooting Electric Motor Control Circuits

3 Day Seminar



## DESCRIPTION :

This course is devoted exclusively to teaching “hands-on troubleshooting. The student will wire, operate and troubleshoot from simple circuits to the most complex circuit.

These are practical, useful circuits and the techniques the student learns can be put to immediate use in the plant. In one lesson the student will be learning about two-wire control for HAND-OFF-AUTO operation. This common circuit is widely used to control pumps, air compressors, hydraulic systems, heating and air conditioning systems.

The circuits you will wire on the training boards are identical in every respect (except one) to the circuits found in your plant. The one exception is operation at a safe, low level of 24 Volts to virtually eliminate Shock and Arc Blast Hazards when testing circuits. Since the circuits are identical, they operate in the same manner and exhibit the same faults

### Each student receives:

- ① Student Hand Book
- ② Electrical Data Book
- ③ Demonstrations of every component
- ④ Application and lab exercises using animation that reinforces learning

For registration or more information call **303.838.7396**  
or email [armin@deltaparadigm.com](mailto:armin@deltaparadigm.com)

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# COURSE OUTLINE:

## Troubleshooting Electric Motor Control Circuits

3 Day Seminar

### BASIC THEORY

- ☒ Ohm's Law
- ☒ Series, Parallel and Combination Circuits
- ☒ AC vs DC
- ☒ Power Sources
- ☒ Flow of Electricity

### SAFETY

- ☒ Personal Protective Equipment
- ☒ Lockout/Tag Out
- ☒ NEC

### MULTIMETERS

- ☒ Types, Function and Accessories
- ☒ Megohmmeter
- ☒ Clamp-on Ammeter
- ☒ Meter Displays
- ☒ Meter Range Settings
- ☒ Voltage Testing
- ☒ Current Testing
- ☒ Frequency Testing
- ☒ Resistance Testing
- ☒ Continuity Testing
- ☒ Capacitor Testing
- ☒ Diode Testing

### ELECTRICAL DRAWINGS & SYMBOLS

- ☒ Drawing symbols
- ☒ Blue Prints
- ☒ NEMA & IEC Symbols
- ☒ Schematics
- ☒ Ladder Diagrams

### MOTOR STARTERS

- ☒ Overload Relays
- ☒ Auxiliary Contacts
- ☒ NEMA & IEC Ratings

### MOTORS

- ☒ Single Phase, Three Phase & DC
- ☒ Connection Diagrams
- ☒ Full Load Amp (FL) & Service Factor (SF)
- ☒ Theory of Operation

### ELECTRICAL SCHEMATICS

- ☒ Power Circuits
- ☒ Control Circuits
- ☒ Wiring Diagram

### LADDER DIAGRAMS

- ☒ Power Rails and Wire color coding
- ☒ Control Element Arrangement
- ☒ Circuit Protection Arrangement
- ☒ Line Numbers, Wire Numbers
- ☒ Tag Names
- ☒ Common Symbol abbreviations

### LOGIC CIRCUITS

- ☒ "And", "Or", "Not"

### RELAY SWITCHES

- ☒ Normally Open Contacts
- ☒ Normally Closed Contacts
- ☒ Timers
- ☒ Counters

### MANUAL SWITCHES

- ☒ Push Buttons
- ☒ Selector Switches

### AUTOMATIC SWITCHES

- ☒ Limit Switches

- ☒ Proximity Switches
- ☒ Photo Switches
- ☒ Temperature, Pressure,
- ☒ Flow & Float Switches

### TROUBLESHOOTING

- ☒ Open Faults vs Shorts
- ☒ Ground Faults
- ☒ Logical and Sequential Troubleshooting Methods

### CIRCUIT PROTECTION

- ☒ Ground Fault Protection Devices
- ☒ Motor Starter Sizing
- ☒ Conductor Sizing
- ☒ Overload Protection Sizing

### MOTOR OVERLOAD PROTECTION

- ☒ Thermal Overload
- ☒ Magnetic Overload
- ☒ Solid state Overload

### HANDS ON LABS

- ☒ Two Wire Control Circuit
- ☒ Jog Circuit
- ☒ Jog/Stop Circuit
- ☒ Multiple Start/Stop Push Buttons In Series Circuit
- ☒ Multiple Start/Stop Push Buttons In Parallel Circuit
- ☒ Hand/Off/Auto Circuit
- ☒ Three Wire Control Circuit
- ☒ Start/Stop Circuit
- ☒ Stop/Start Circuit With Holding Contacts
- ☒ Multiple Start/Stop Circuit

- ☒ Multiple Mode Circuit
- ☒ Jog/Off/Run Circuit
- ☒ Off-Delay Timing Circuit
- ☒ On-Delay Timing Circuit
- ☒ On-Delay Timing Power Off
- ☒ Motor Time Delayed Off
- ☒ Inching Circuit
- ☒ Variable Delay Inching Circuit
- ☒ Fixed Delay Inching Circuit
- ☒ Manual Sequence Circuit
- ☒ Manual Sequencing With common Control
- ☒ Time Based Sequencing
- ☒ Event based Sequencing With High Temp
- ☒ Forward/Reverse Circuit
- ☒ Forward/Reverse Circuit With Electrical Interlocks
- ☒ Forward/Reverse Circuit With Holding Contacts
- ☒ Anti Plug Circuit
- ☒ Simple Two Speed control Circuit
- ☒ Slow Speed Compelling Circuit
- ☒ Slow Speed Compelling Circuit with Automatic Acceleration
- ☒ Pump Out Primary / Secondary Pump with Stand-by Pump

### APPLICATION OR LOCATION SPECIFIC CIRCUITS

- ☒ Included by Client Request

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