CONCEPT

# Electrical Drawings and Control Circuits: Reading Schematics, Relay Logic and Fault Tracing

26 – 30 September 2027
Riyadh - KAFD district five-star



# Electrical Drawings and Control Circuits: Reading Schematics, Relay Logic and Fault Tracing

**Ref:** 333_15631 **Date:** 26 – 30 September 2027 **Location:** Riyadh - KAFD district five-star **Fees:** 20000 SAR

## Introduction:

Electrical drawings and control circuits are the shared language of every panel, motor starter and distribution board, yet misread symbols, outdated revisions and untraced wire numbers still lengthen breakdowns and cause wiring errors at handover. This Core Concept course teaches electricians, technicians and junior engineers to read single-line, schematic and wiring diagrams, follow relay and contactor logic through motor control circuits, and trace faults on paper before testing live equipment. Participants produce an Annotated Control Panel Drawing Set and Fault-Tracing Worksheet based on a panel from their own site.

## Course Objectives:

- Interpret single-line diagrams, schematics, wiring diagrams, panel layouts, cable schedules and loop diagrams and navigate cross-references between sheets
- Identify IEC 60617, IEEE 315 and JIC symbols and decode IEC 81346 reference designations and IEEE C37.2 device function numbers
- Trace relay and contactor logic through start-stop, direct-on-line, star-delta and reversing motor control circuits
- Check control transformer, DC power supply and control circuit protection arrangements shown on drawings
- Locate control circuit faults from the drawing using structured multimeter voltage and continuity checks
- Keep panel documentation accurate through redline mark-ups, as-built updates and revision control

## Target Audience:

- Electricians who install, wire and maintain control panels, motor starters and distribution boards
- Electrical technicians who test, fault-find and modify relay and contactor control circuits
- Junior electrical engineers who check and review drawings for installation, modification and handover
- Instrument technicians who connect field devices to control panels through loop and terminal drawings
- Maintenance crew leads who keep panel documentation current after plant modifications

## Course Outline:

### Day 1: Drawing Types, Title Blocks and the Electrical Documentation Set

- Single-Line Diagram Reading: Busbars, Breakers, Transformers and Feeder Paths
- Schematic Versus Wiring Diagram: Functional Logic Against Physical Connections
- Panel General Arrangement Drawings: Door, Mounting Plate and DIN Rail Views
- Cable Schedules and Interconnection Diagrams: Cable Tags, Cores, Sizes and Routes
- Title Block, Sheet Numbering and Cross-Reference Grid Navigation

### Day 2: Symbols, Device Designations and Numbering Conventions

- IEC 60617 Graphical Symbols for Contacts, Coils, Protective Devices and Meters
- IEEE 315 and JIC Symbol Equivalents on Older Machine Drawings
- IEC 81346 Reference Designations: Function, Product and Location Aspects
- IEEE C37.2 Device Function Numbers 52, 50/51 and 86 on Protection Schematics
- Terminal Strip Numbering, Wire Numbering and Ferrule Marking Schemes

### Day 3: Relay Logic and Motor Control Circuit Reading

- Ladder Diagram Structure: Rails, Rungs, Normally Open and Normally Closed Contacts
- Start-Stop Station with Seal-In Contact and Overload Relay Trip Contact
- Direct-On-Line Starter Power and Control Circuit Trace
- Star-Delta Starter Timer Sequence and Contactor Changeover Logic
- Forward-Reverse Starter with Electrical and Mechanical Interlocks

### Day 4: Control Power, Field Wiring and Fault Tracing from Drawings

- Control Transformer Fusing and Earthed Control Circuit Arrangements
- DC Control Power Supplies, Circuit Protection and Common Return Paths
- Instrument Loop Diagrams: Field Device, Junction Box and Marshalling Terminals
- Multimeter Fault-Tracing Method: Voltage Drop, Continuity and Half-Split Checks
- Common Control Faults: Open Coils, Welded Contacts, Tripped Overloads and Loose Terminals

### Day 5: Panel Walkthrough, As-Built Control and Deliverable Build

- Panel Inspection Walkthrough: Matching Installed Devices and Wire Tags to the Schematic
- Redline Mark-Up and As-Built Drawing Update Procedure
- Revision Control: Revision Tables, Clouding, Approval and Superseded Sheets
- Seeded-Fault Tracing Exercise on a Reversing Motor Control Circuit
- Annotated Control Panel Drawing Set and Fault-Tracing Worksheet Build and Peer Review

## Skills You Will Gain:

- Schematic Interpretation
- Symbol and Designation Decoding
- Ladder Logic Tracing
- Motor Starter Circuit Analysis
- Control Power Verification
- Multimeter Fault Isolation
- Wire and Terminal Tagging
- Drawing Revision Management

## Why Attend This Course:

- Return with an Annotated Control Panel Drawing Set and Fault-Tracing Worksheet built from a panel on your own site
- Shorten breakdown time by locating the faulty contact, coil or terminal on paper before opening the panel
- Read drawings from different vendors and eras, whether drawn to IEC or American symbol conventions
- Hand over modified panels with marked-up, revised drawings that the next shift can rely on

## Conclusion:

Reliable maintenance and clean handovers depend on drawings that are read correctly and kept current. The course moves from drawing types and title blocks, through symbols, designations and numbering, to relay logic and motor starter circuits, then to control power, loop diagrams and structured fault tracing with a multimeter. The final day applies every step during a panel walkthrough and a seeded-fault exercise. Participants leave with an Annotated Control Panel Drawing Set and Fault-Tracing Worksheet ready for their next panel modification or breakdown.