

Electrical Mastery

Automotive Electrical & Electronics Troubleshooting

Car • Truck | Petrol • Diesel • CNG

Master fuses, relays, wiring, sensors, actuators, signals and modules — and learn to find electrical faults step by step on every type of vehicle. Practical, workshop-focused training with examples from Indian cars, trucks and 2-wheelers.

Course	Electrical Mastery - Automotive Electrical & Electronics Troubleshooting
Parts	8 parts
Lessons	75 lessons (videos of 15-20 minutes each)
Total Duration	Approx. 22 hours
Vehicles	Cars, trucks, 2-wheelers and 3-wheelers
Engines	Petrol, Diesel and CNG
Not Covered	Electric Vehicles (EV) — a separate EV course is coming soon
Study Material	PDF notes with every lesson
Practice	Quiz at the end of every part
Live Support	Live doubt-clearing sessions every Monday (morning) and Tuesday (evening)
Language	Hindi / Hinglish
Free Access	Part 1 (Electric Blueprint) Lessons 1.1 to 1.4 free + intro lesson of every other part free (11 free lessons)

Who Is This Course For

Automotive technicians already working in workshops who want to move from parts-replacing to real electrical and electronic fault finding. New to electrical work? Start with Part 1. Experienced? Jump straight to the part you need.

What You Will Learn

- ✓ Use a multimeter and oscilloscope correctly and safely
- ✓ Test fuses and relays and find open circuit, short circuit and voltage drop faults step by step
- ✓ Test every major sensor and actuator — and know if the fault is the part, the wiring or the ECU
- ✓ Test ECU and BCM power, ground, inputs and outputs before replacing any module
- ✓ Troubleshoot Petrol, Diesel (Common Rail / BS-VI) and CNG engine systems

Course Roadmap

Part	Name & Focus	Level	Lessons	Access
Part 1	Electric Blueprint Wiring, Fuse, Relay & Circuit Testing	Basic	7	LESSONS 1-4 FREE
Part 2	Sensor DNA Types, Working & Testing of Every Sensor	Intermediate	17	INTRO FREE
Part 3	Actuator DNA Types, Working & Testing of Every Actuator	Intermediate	15	INTRO FREE
Part 4	Signal Decoder Understanding & Reading Electrical Signals	Advanced	7	INTRO FREE
Part 5	Module Brain ECU, BCM & Module Power, Input and Output Testing	Advanced	7	INTRO FREE
Part 6	Petrol Pulse Petrol EMS Troubleshooting (Car & 2-Wheeler)	System Troubleshooting	8	INTRO FREE
Part 7	Diesel Power Diesel Common Rail & BS-VI Truck Troubleshooting	System Troubleshooting	8	INTRO FREE
Part 8	CNG Code CNG System Troubleshooting	System Troubleshooting	6	INTRO FREE

Learning path: Basic (Part 1) → Intermediate (Parts 2-3) → Advanced (Parts 4-5) → System Troubleshooting (Parts 6-8)

How Every Lesson Works

- ✓ Clear explanation with diagrams and animations
- ✓ Live practical demo on a real vehicle in the workshop
- ✓ Common mistakes technicians make — and how to avoid them
- ✓ Safety points wherever needed
- ✓ PDF notes to use in the workshop

Safety First: Every part includes safety training — battery handling, airbag (SRS) circuits, ECU handling and static protection, high fuel pressure in diesel common rail, high voltage in ignition and injector circuits, and high-pressure CNG systems.

Part 1: Electric Blueprint

Wiring, Fuse, Relay & Circuit Testing

Level: Basic | 7 Lessons | Access: LESSONS 1-4 FREE

Part goal: Build a strong base: use a multimeter like a professional, test fuses and relays, find open, short and voltage drop faults, and check battery, charging and ground circuits — on cars and trucks.

Lesson 1.1 - Electrical Basics for Technicians **FREE**

- Voltage, current and resistance explained the practical way
- Ohm's law — only what you need for fault finding
- Power, ground and load — the three parts of every circuit
- 12V (car) vs 24V (truck) electrical systems

Lesson 1.2 - Digital Multimeter Mastery **FREE**

- DC voltage, resistance, continuity, diode test and current measurement
- Auto range vs manual range, MIN/MAX and hold functions
- Measuring current safely — using the 10A socket and meter fuse
- **Common mistake:** Measuring voltage with the lead in the current socket
- **Safety:** Correct meter category and probe handling

Lesson 1.3 - Circuit Types & Switching **FREE**

- Series and parallel circuits in real vehicles
- High-side and low-side switching
- How the ECU and BCM control loads (lamps, relays, solenoids)

Lesson 1.4 - Fuses & Relays - Working & Testing **FREE**

- Fuse box tour on a car and a truck
- Fuse types: blade, mini, maxi, fusible link, MIDI/mega fuse
- Testing a fuse in the circuit (voltage on both sides) and finding why fuses blow
- 4-pin and 5-pin relays; pins 30, 85, 86, 87 and 87a
- Relays with diode or resistor — why polarity matters
- Relay bench test and in-circuit test
- **Case study:** Fuel pump / cooling fan not working due to relay circuit

Lesson 1.5 - Open Circuit, Short to Ground, Short to Battery **PREMIUM**

- How to identify each fault with a multimeter
- Isolating a short step by step (divide the circuit)
- Intermittent faults — wiggle test
- **Common mistake:** Replacing fuses again and again without finding the short

Lesson 1.6 - Voltage Drop Testing **PREMIUM**

- Why a circuit can show correct voltage but still fail under load
- Voltage drop on the power side and the ground side
- Testing starter, charging and lamp circuits under load

Lesson 1.7 - Battery, Charging & Ground Circuits **PREMIUM**

- Battery testing: open circuit voltage and load test
- Charging system basics — alternator output and warning lamp
- Ground straps and body grounds — hidden cause of strange faults
- Parasitic drain test (battery goes down overnight)
- **Safety:** Battery gases, jump-starting and correct disconnection order

✓ **Part 1 quiz • PDF notes for every lesson**

Part 2: Sensor DNA

Types, Working & Testing of Every Sensor

Level: Intermediate | 17 Lessons | Access: INTRO FREE

Part goal: First understand sensors by their property (how they are built) and then by their working (what they measure) — so you can test any sensor on any vehicle, even one you have never seen before.

Section A: Introduction

Lesson 2.1 - Introduction to Sensors & Their Types **FREE**

- What is a sensor and how the ECU uses its signal
- Two ways to classify sensors: Property-wise (how it is built) and Working-wise (what it measures)
- 2-wire, 3-wire and 4-wire sensors; 5V reference, signal and sensor ground
- One universal testing method: reference → ground → signal

Section B: Sensor Types - Property-wise

Lesson 2.2 - Resistance Based Sensors - Temperature Resistance **PREMIUM**

- Thermistors: NTC (resistance goes down as temperature goes up) and PTC
- Resistance vs temperature testing with a multimeter
- Voltage signal to the ECU and how open/short faults show up

Lesson 2.3 - Resistance Based Sensors - Pressure Resistance **PREMIUM**

- Piezo-resistive / strain-gauge pressure elements
- Why most pressure sensors are 3-wire with a 5V reference
- Testing signal voltage against pressure

Lesson 2.4 - Resistance Based Sensors - Variable Resistance **PREMIUM**

- Potentiometer working (sliding contact)
- Throttle, pedal and fuel level examples
- Checking smooth voltage sweep — finding dead spots

Lesson 2.5 - Hall Effect Sensors **PREMIUM**

- Hall effect principle and digital square-wave output
- Power, ground and signal testing
- Examples: CMP, CKP, speed and position sensors
- **Common mistake:** Checking a Hall sensor only by resistance

Lesson 2.6 - Magnetic (Inductive) Sensors **PREMIUM**

- Magnet + coil sensors that generate their own AC signal
- Resistance, AC voltage and frequency testing
- Air gap, reluctor ring and wiring problems
- Examples: CKP and passive ABS wheel speed sensors

Lesson 2.7 - Chip Based (Smart / Digital) Sensors **PREMIUM**

- Sensors with built-in electronics (MEMS and digital sensors)
- Digital outputs: frequency, PWM and serial data
- Why resistance testing does not work on these sensors
- Examples: digital MAF, active wheel speed, steering angle sensors

Lesson 2.8 - Special Sensors **PREMIUM**

- Oxygen sensors: zirconia (narrowband) and wideband / air-fuel ratio
- Knock sensor (piezoelectric)
- NOx sensors in BS-VI vehicles
- How their signals differ from normal sensors

Lesson 2.9 - Infrared (Light Based) Sensors **PREMIUM**

- Infrared LED and photodiode principle
- Rain and light sensors, sun-load sensors in climate control
- Basic testing and common faults

Section C: Sensors - Working-wise

Lesson 2.10 - Temperature Sensors **PREMIUM**

- ECT, IAT, fuel, oil and AC evaporator temperature sensors
- Exhaust gas temperature (EGT) sensors in diesel after-treatment
- **Case study:** Hard starting and high fuel consumption due to a wrong ECT signal

Lesson 2.11 - Pressure Sensors **PREMIUM**

- MAP and boost pressure sensors
- Diesel fuel rail pressure sensor
- Oil, AC, DPF differential and CNG pressure sensors

Lesson 2.12 - Position Sensors **PREMIUM**

- CKP and CMP (engine position and sync)
- TPS and accelerator pedal position (dual track)
- EGR position, steering angle and gear position sensors
- **Case study:** Engine cranks but does not start

Lesson 2.13 - Speed Sensors **PREMIUM**

- Vehicle speed sensor (VSS)
- ABS wheel speed sensors — passive and active
- Turbo speed and transmission speed sensors

Lesson 2.14 - Level Sensors **PREMIUM**

- Fuel level sender
- Coolant, oil, brake fluid and washer level sensors
- DEF/AdBlue level sensor in BS-VI vehicles

Lesson 2.15 - Flow Sensors **PREMIUM**

- MAF sensor: analog voltage and frequency types
- Dirty vs faulty MAF — live data comparison

Lesson 2.16 - Gas & Quality Sensors **PREMIUM**

- O₂ / lambda and NOx sensors
- DEF/AdBlue quality sensor
- Water-in-fuel sensor
- **Common mistake:** Replacing the O₂ sensor when the real fault is a leak or misfire

Lesson 2.17 - Sensor Fault Finding - Case Studies **PREMIUM**

- Sensor fault vs wiring fault vs ECU fault
- One shorted sensor pulling down the 5V reference of other sensors
- Real cases from Maruti, Hyundai, Tata, Mahindra and commercial vehicles

✓ Part 2 quiz • PDF notes for every lesson

Part 3: Actuator DNA

Types, Working & Testing of Every Actuator

Level: Intermediate | 15 Lessons | Access: INTRO FREE

Part goal: Understand actuators property-wise (how they are built) and working-wise (what they control) — and learn how to test the actuator, its power supply and its ECU control circuit.

Section A: Introduction

Lesson 3.1 - Introduction to Actuators & Their Types **FREE**

- What is an actuator and how the ECU controls it
- Two ways to classify actuators: Property-wise and Working-wise
- Ground control, power control and PWM control
- Universal testing method: power → control → resistance → current

Section B: Actuator Types - Property-wise

Lesson 3.2 - Solenoid (Electromagnetic) Actuators **PREMIUM**

- On/off and PWM solenoids
- Resistance, control signal and current testing
- Examples: injectors, purge valve, VVT/OCV, IMV/SCV

Lesson 3.3 - DC Motor Actuators **PREMIUM**

- Brushed DC motors and H-bridge (forward/reverse) control
- Examples: electronic throttle, power window, door lock, mirror
- Current draw and voltage drop testing

Lesson 3.4 - Stepper & Brushless (BLDC) Motors **PREMIUM**

- Stepper motor working (idle air control, gauges)
- BLDC motors in fans and electric pumps
- Testing coils and control signals

Lesson 3.5 - Heating Element Actuators **PREMIUM**

- O2 sensor heater, glow plugs, DEF/AdBlue line heaters
- Resistance and current testing
- Heater faults that set warning codes

Lesson 3.6 - Piezo Actuators **PREMIUM**

- Piezo effect — electricity creates movement
- Piezo common rail injectors
- **Safety:** High voltage on piezo injector circuits

Lesson 3.7 - High-Voltage Actuators - Ignition Coils **PREMIUM**

- Coil working as a transformer: primary and secondary
- Coil-on-plug and coil pack systems
- **Safety:** High voltage in the secondary circuit

Lesson 3.8 - Smart (Module-Controlled) Actuators **PREMIUM**

- Actuators with their own electronics and LIN/CAN control
- Electronic VGT/turbo actuator, smart cooling fans, EPB motors
- Why they need power, ground and communication checks

Section C: Actuators - Working-wise

Lesson 3.9 - Fuel Delivery Actuators **PREMIUM**

- Fuel pump and fuel pump control
- Petrol injectors and CNG injectors
- Checking the injector control pulse

Lesson 3.10 - Diesel Fuel Control Actuators **PREMIUM**

- Common rail injectors (solenoid and piezo)
- Inlet metering valve (IMV/SCV) and pressure control valve (PCV)
- How rail pressure is controlled
- **Safety:** Very high fuel pressure — never loosen lines with the engine running

Lesson 3.11 - Air Control Actuators **PREMIUM**

- Electronic throttle body and idle control
- EGR valve, intake throttle and swirl flaps
- VGT and wastegate control

Lesson 3.12 - Ignition & Starting Actuators **PREMIUM**

- Ignition coils and misfire
- Glow plugs and glow plug control
- Starter motor and starter relay circuit

Lesson 3.13 - Emission Control Actuators **PREMIUM**

- Purge (EVAP) valve
- EGR in petrol and diesel engines
- DEF/AdBlue dosing module and pump in BS-VI vehicles

Lesson 3.14 - Cooling & Body Actuators **PREMIUM**

- Radiator fan and blower motor
- Window, door lock, wiper and horn
- BCM-controlled outputs

Lesson 3.15 - Actuator Fault Finding - Case Studies **PREMIUM**

- Actuator fault vs wiring fault vs ECU driver fault
- Limp mode and derate caused by actuator faults
- Real cases from cars, trucks and 2-wheelers

✓ Part 3 quiz • PDF notes for every lesson

Part 4: Signal Decoder

Understanding & Reading Electrical Signals

Level: Advanced | 7 Lessons | Access: INTRO FREE

Part goal: Read the "language" of sensors, actuators and modules — voltage, frequency, PWM and network signals.

Lesson 4.1 - Types of Vehicle Signals **FREE**

- DC analog, AC, digital on/off
- Frequency, PWM and duty cycle
- Serial and network signals (CAN, LIN)

Lesson 4.2 - Measuring Signals with a Multimeter **PREMIUM**

- Frequency (Hz) and duty cycle (%) measurement
- Where a multimeter is enough — and where it is not

Lesson 4.3 - Oscilloscope for Technicians **PREMIUM**

- Why a scope finds faults a meter cannot
- Basic settings: volts/div, time/div, trigger
- Connecting safely to vehicle circuits

Lesson 4.4 - Sensor Waveforms **PREMIUM**

- CKP and CMP waveforms and sync
- O2 sensor and MAF frequency signals
- Good vs bad waveform comparison

Lesson 4.5 - Actuator Waveforms **PREMIUM**

- Injector and ignition primary waveforms
- PWM solenoid signals
- Introduction to current probe testing

Lesson 4.6 - Network Signals - CAN & LIN **PREMIUM**

- CAN-H and CAN-L on a scope
- LIN bus signal
- Recognising a damaged or shorted network

Lesson 4.7 - Signal Fault Case Studies **PREMIUM**

- Electrical noise and interference
- Intermittent signal drop-out
- Shielding and grounding problems

✓ Part 4 quiz • PDF notes for every lesson

Part 5: Module Brain

ECU, BCM & Module Power, Input and Output Testing

Level: Advanced | 7 Lessons | Access: INTRO FREE

Part goal: Test any module properly before declaring it faulty — power, ground, inputs, outputs and communication.

Lesson 5.1 - What is Inside an ECU **FREE**

- Power supply, input circuits, processor, memory and drivers
- How the ECU reads sensors and drives actuators
- **Safety:** ESD (static) protection and correct handling of ECUs

Lesson 5.2 - ECU Power, Ground & Wake-up **PREMIUM**

- Battery supply, ignition supply and main relay control
- Multiple ground pins — why every ground matters
- Testing at the ECU connector using the pinout

Lesson 5.3 - ECU Input & Output Testing **PREMIUM**

- 5V reference and sensor ground checks at the ECU
- Output driver testing under load
- Using a breakout box / back-probing safely

Lesson 5.4 - ECU Dead or Wiring Fault? **PREMIUM**

- Step-by-step checks before replacing an ECU
- Common causes of ECU damage: water, wrong jump-start, welding, shorts
- **Safety:** Disconnect the battery before removing ECU connectors or welding

Lesson 5.5 - BCM & Body Modules **PREMIUM**

- Lighting, central locking, wiper and horn control
- Body inputs and outputs
- LIN bus in body systems

Lesson 5.6 - Network & Gateway Faults **PREMIUM**

- CAN and LIN network layout
- U-codes (communication codes) and what they mean
- Module not going to sleep — battery drain

Lesson 5.7 - Truck Modules (24V) **PREMIUM**

- Engine ECU, vehicle control unit and instrument cluster in trucks
- 24V power and ground checks
- Common commercial vehicle module faults

✓ Part 5 quiz • PDF notes for every lesson

Part 6: Petrol Pulse

Petrol EMS Troubleshooting (Car & 2-Wheeler)

Level: System Troubleshooting | 8 Lessons | Access: INTRO FREE

Part goal: Complete fault finding on petrol fuel injection systems using everything learned in Parts 1-5.

Lesson 6.1 - Petrol EMS Overview **FREE**

- MPFI system layout — inputs, ECU and outputs
- Open loop and closed loop control
- Examples from Maruti, Hyundai, Tata and Honda

Lesson 6.2 - Fuel Supply System **PREMIUM**

- Fuel pressure testing
- Returnless fuel system and pressure regulator
- Fuel filter and pump related faults
- **Safety:** Relieve fuel pressure before opening fuel lines

Lesson 6.3 - Air Management **PREMIUM**

- Electronic throttle and idle control
- MAP/MAF based systems
- Finding vacuum and intake leaks

Lesson 6.4 - Ignition System & Misfire **PREMIUM**

- Misfire codes and misfire counters
- Coil, plug, injector and mechanical causes
- Step-by-step misfire diagnosis

Lesson 6.5 - Emission Control Systems **PREMIUM**

- O2 sensors and catalytic converter
- EVAP / purge system
- Emission-related warning lamp faults

Lesson 6.6 - Crank No-Start & Hard Start **PREMIUM**

- Step-by-step: fuel, spark, sync, immobilizer, compression
- Using live data to narrow down the fault

Lesson 6.7 - Idle, Pickup & Mileage Problems **PREMIUM**

- Rough idle, hesitation and low pickup
- High fuel consumption diagnosis

Lesson 6.8 - 2-Wheeler Fuel Injection (BS-VI) **PREMIUM**

- FI system in BS-VI bikes and scooters
- Sensor and injector testing on 2-wheelers
- Common 2-wheeler FI faults

✓ Part 6 quiz • PDF notes for every lesson

Part 7: Diesel Power

Diesel Common Rail & BS-VI Truck Troubleshooting

Level: System Troubleshooting | 8 Lessons | Access: INTRO FREE

Part goal: Diagnose common rail diesel engines in cars, pickups and trucks — including BS-VI after-treatment.

Lesson 7.1 - Common Rail System Overview **FREE**

- Low pressure and high pressure sides
- Pump, rail, injectors, sensors and ECU
- Bosch, Delphi and Denso systems in Indian vehicles
- **Safety:** Common rail works at very high pressure — never loosen lines with the engine running

Lesson 7.2 - Low Pressure Fuel System **PREMIUM**

- Fuel filter, feed/lift pump and priming
- Air in fuel and water in fuel sensor
- Low pressure testing

Lesson 7.3 - High Pressure System **PREMIUM**

- Rail pressure sensor, IMV/SCV and PCV
- Desired vs actual rail pressure in live data
- Rail pressure related no-start and power loss

Lesson 7.4 - Diesel Injectors **PREMIUM**

- Back leak (return flow) test
- Injector coding and correction values
- Solenoid vs piezo injector faults

Lesson 7.5 - Air System - Turbo, EGR & Intake **PREMIUM**

- Turbo, VGT and boost pressure control
- Intercooler leaks
- EGR and intake throttle faults

Lesson 7.6 - Diesel No-Start, Low Power & Smoke **PREMIUM**

- Step-by-step crank no-start diagnosis
- Low power and limp mode
- Black, white and blue smoke causes

Lesson 7.7 - BS-VI After-Treatment **PREMIUM**

- DOC, DPF and SCR explained simply
- DEF/AdBlue system and NOx sensors
- DPF regeneration and derate conditions

Lesson 7.8 - Commercial Vehicle Case Studies **PREMIUM**

- 24V truck systems
- Cases from Tata, Ashok Leyland, Mahindra, BharatBenz and Eicher
- Fleet-level common faults

✓ **Part 7 quiz • PDF notes for every lesson**

Part 8: CNG Code

CNG System Troubleshooting

Level: System Troubleshooting | 6 Lessons | Access: INTRO FREE

Part goal: Understand factory-fitted and retrofit CNG systems and fix CNG-related electrical and running faults safely.

Lesson 8.1 - CNG System Overview **FREE**

- Factory-fitted CNG vs retrofit kits
- Cylinder, valves, pressure reducer, CNG ECU, rail and injectors
- Examples: Maruti S-CNG, Hyundai CNG, Tata iCNG

Lesson 8.2 - CNG Safety **PREMIUM**

- **Safety:** CNG is stored at very high pressure (~200 bar)
- Leak testing the correct way
- Cylinder testing validity and rules — what a technician must not touch

Lesson 8.3 - CNG Electrical System **PREMIUM**

- CNG ECU power, ground and communication
- Solenoid valves and changeover switch
- Petrol-CNG changeover logic

Lesson 8.4 - CNG Injectors, Reducer & Sensors **PREMIUM**

- CNG injector testing
- Pressure and temperature sensors
- Reducer related faults

Lesson 8.5 - CNG Running Faults **PREMIUM**

- Not changing over to CNG
- Misfire and power loss on CNG
- Starting problems on CNG vehicles

Lesson 8.6 - CNG in 3-Wheelers & Commercial Vehicles **PREMIUM**

- CNG autos, LCVs and buses
- Common faults and case studies

✓ Part 8 quiz • PDF notes for every lesson

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