

Unit 79: Vehicle Electronics

Unit code: T/601/1364

QCF level: 4

Credit value: 15

- **Aim**

This unit will develop learners' understanding of vehicle electrical and electronic systems, circuits and components and will develop the skills needed to carry out tests, find faults and repair systems.

- **Unit abstract**

The increasing use of electronic circuitry in motor vehicle control systems has contributed to advances in safety, comfort and economy. New applications, often incorporating microprocessor hardware, continue to be introduced. It is thus essential for motor vehicle engineers to be familiar with the operation of electronic circuits and methods of fault diagnosis.

Learning outcome 1 will provide learners with knowledge of electronic principles, circuit components and test procedures. In learning outcome 2, learners are introduced to the various types of sensors, actuators and display units used in motor vehicle control and driver information systems. Learning outcome 3 provides knowledge of microprocessor hardware applications and the suppression methods used to prevent interaction between systems. Learning outcome 4 will provide learners with the opportunity to apply their knowledge of vehicle electronics and circuitry to the systematic testing and fault diagnosis of vehicle control and information systems.

- **Learning outcomes**

On successful completion of this unit a learner will:

- 1 Be able to analyse vehicle electrical and electronic circuits
- 2 Understand the operation of vehicle sensors, actuators and display units
- 3 Understand the operation of microprocessor hardware and suppression methods used in vehicle circuits
- 4 Be able to carry out systematic fault diagnosis and repairs on vehicle electronic systems.

Unit content

1 Be able to analyse vehicle electrical and electronic circuits

Electrical calculations: voltage; emf; current; power; resistance; capacitance; inductance; series and parallel circuits

Semiconductor devices: electrical properties and characteristics of semiconductor material; P-N junction diode; Zener diode; N-P-N junction transistor; P-N-P junction transistor and thyristor; analyse the operation of a semiconductor based circuit, eg electronic ignition amplifier

Circuit diagrams: electrical and electronic component and circuit symbols; circuit diagram layouts

Systematic testing: test procedures; correct use of multimeters and oscilloscope for measuring circuit and component values

2 Understand the operation of vehicle sensors, actuators and display units

Sensors: principles of operation and electrical characteristics of sensors used in vehicles eg sensors used in anti-lock braking systems (ABS), electronic fuel injection (EFI), engine management systems, airbags, security, driver information and vehicle condition monitoring systems); relevant test procedures for sensors

Actuators: principles of operation and electrical characteristics of vehicle actuators eg relays, solenoids, electro-hydraulic/pneumatic valves, rotary actuators, stepper motors; relevant tests procedures for actuators

Information display devices: types of devices eg analogue gauges, light emitting diodes, liquid crystal displays, vacuum fluorescent displays, cathode ray tubes; relevant test procedures for displays

3 Understand the operation of microprocessor hardware and suppression methods used in vehicle circuits

Microprocessor hardware: implementation, operation and relevant developments of microprocessor systems in vehicles eg computer area network (CAN) bus links; packaging; microcontrollers; integrated circuits; reliability; electromagnetic compatibility

Suppression methods: resistive suppression of oscillations; screening; use of inductors; capacitors and filter networks in interference suppression

4 **Be able to carry out systematic fault diagnosis and repairs on vehicle electronic systems**

Systematic testing: testing of input/output sensors, cables, supplies, earths, output actuators, display devices and microprocessor systems

Self diagnosis: signal plausibility checks; open and short circuit checks; processor operation and memory test routines; error/trouble codes; standardisation of connectors and codes; continuity checks; sensor output; resistance checks

Fault repairs: correct procedures for removal/refitting eg following manufacturer's recommendations; repair and replacement of system components

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	Assessment criteria for pass The learner can:
LO1 Be able to analyse and test vehicle electrical and electronic circuits	1.1 carry out calculations to solve problems in series and parallel automotive electrical circuits 1.2 explain the properties and characteristics of common semiconductor devices 1.3 read and interpret electrical and electronic circuit diagrams 1.4 perform systematic testing of vehicle electronic systems and record results
LO2 Understand the operation of vehicle sensors, actuators and display units	2.1 explain the principles of operation and electrical characteristics of different sensors when used in vehicles 2.2 explain the principles of operation and electrical characteristics of different actuators when used in vehicles 2.3 examine the operation and relevant test procedure of a driver information display device
LO3 Understand the operation of microprocessor hardware and suppression methods used in vehicle circuits	3.1 analyse microprocessor hardware operation in vehicle systems 3.2 analyse the operation of a suppression method
LO4 Be able to carry out systematic fault diagnosis and repairs on vehicle electronic systems	4.1 carry out systematic test procedures on vehicle microprocessor, sensor and suppression systems and record results 4.2 evaluate the use of a vehicle self diagnosis system 4.3 identify and repair faults on a vehicle microprocessor, sensor/actuator and suppression system.

Guidance

Links

This unit links with *Unit 74: Vehicle Fault Diagnosis* and *Unit 75: Vehicle Technology*.

Essential requirements

Learners will need access to sufficient test equipment to support a range of practical tests on vehicle electrical and electronic systems.

Employer engagement and vocational contexts

The delivery of this unit will benefit from centres establishing strong links with employers willing to contribute to the delivery of teaching, work-based placements and/or detailed case study materials.