
Electric Distribution/Electronic Control (18.00)

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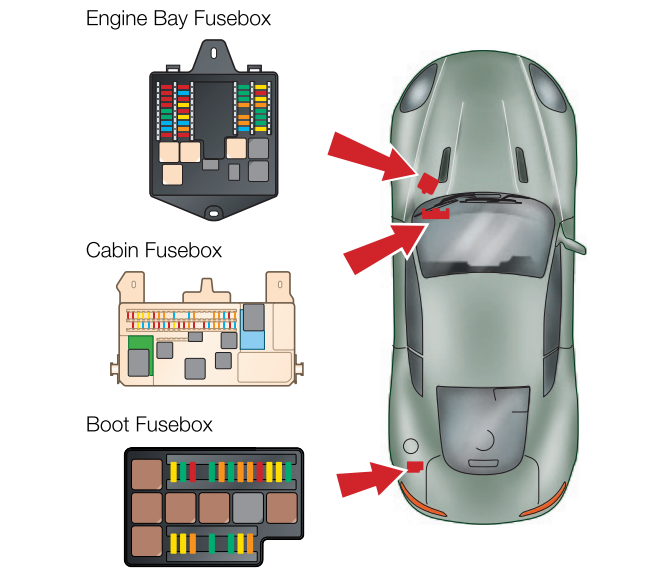
Electric Distribution/Electronic Control (18.00)

Wiring and Circuit Protection (18.01)

Fuse Boxes

From the clean 12V output terminal of the battery disconnect switch, electrical power is distributed to three fuse boxes:

- RH drive shown.** On LH drive vehicles the engine bay fuse box is located on the RH side.
- The central electronic module (CEM) fuse box is always located on the passenger side.

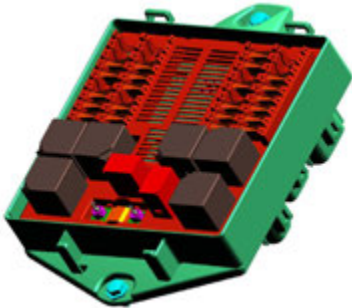


Always ensure that the fusebox covers are located correctly to prevent ingress of water / foreign materials

The fuse boxes also contain the switching relays.

Fuse Listings

Engine Bay Fuse / Relay Box

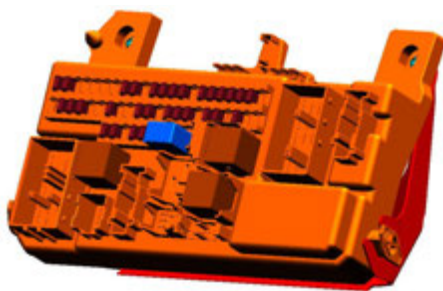


Fuse	Rating	Function
F1	10A	Keep alive power PCM (Bank B)
F2	10A	Tracker (option) / Clock
F3	10A	Cooling fan module
F4	20A	Engine management (Bank A) / Module - ABS, Key Reader and Steering angle sensors
F5	20A	Engine management (Bank B)
F6	15A	Exhaust Gas Oxygen (HEGO) sensors / Catalyst monitor sensor (CMS) (Bank B)
F7	15A	Coils 7-12 / Suppressor solenoid (Bank B)
F8	10A	Engine coolant level sensor (Bank B)
F9	20A	Injectors 7-12 / Mass air flow sensor (MAF) (Bank B)
F10	10A	A/C clutch
F11	15A	Horn
F12	10A	Keep alive power PCM (Bank A)
F13	20A	Injectors 1-6 / Mass air flow sensor (MAF) (Bank A)
F14	10A	Vapour Management valve (VMV) (Bank A)
F15	25A	Starter motor
F16	15A	Coils 1-6 / Suppressor solenoids (Bank A)
F17	5A	Glove box release solenoid
F18	15A	Exhaust Gas Oxygen (HEGO) sensors / Catalyst monitor sensor (CMS) (Bank A)
F19	30A	ABS module / Battery feed
F20	30A	ABS module / Battery feed
F21	30A	Heated front screen
F22	5A	Spare
F23		Blank
F24	5A	Alternator warning lamp
F25	5A	Spare
F26	20A	Headlamp wash pump
F27	25A	Spare

Fuse	Rating	Function
F28	10A	Module - ABS, Key Reader and Steering angle sensors
F29	25A	Spare
F30	5A	Alternator battery sensing
F31	30A	Heated front screen
F32	30A	Wiper (slow)
F33	30A	Wiper (fast)
F34	20A	Heater Blower motor
F35	60A	Cooling fan module

Relay	Rating	Function
R1	PCM A	Coolant fan pack
R2	PCM B	
R3	Injectors (1-6 (Bank A)) MAF Sensor (1-6 (Bank A)) Ignition coils (1-6 (Bank A)) Front and rear HEGO's and CMS (1-6 (Bank A)) VMV	
R4	Wiper motor	
R5	Injectors (7-12 (Bank B)) Ignition coils (7-12 (Bank B)) MAF Sensor (7-12 (Bank B)) Engine coolant level and VMV	
R6	Heater blower moter	
R7	Glovebox	
R8	Wiper motor	

Central Electronics Module Fusebox



Fuse	Rating	Function
F43	10A	Multi media module display / Phone (option) / GPS tuner (option (not Middle East)) / Media player
F44	10A	Airbag module
F45	15A	Accessory socket and illumination
F46	5A	ROPS / Convertible roof switch / Driver Information / Master light switch / Glove box relay / Master lock switch / Battery Off switch
F47	5A	Interior lamps (front / footwell / rear) / Boot lamps relay

Fuse	Rating	Function
F48	15A	Front windscreen relay and wash pump
F49	10A	Airbag module
F50	5A	Spare
F51	10A	Diagnostic connectors / Centre stack switches
F52	5A	Start button
F53	10A	Headlamp levelling module / Power steering module
F54	10A	Engine fuse box, Boot fuse box
F55	20A	Spare
F56	10A	Centre console module / Sounder module / Hazard switch
F57	15A	Diagnostic connectors / Brake pedal switch
F58	10A	High beam (RH)
F59	10A	High beam (LH)
F60	15A	Drivers seat heating
F61	15A	Passenger seat heating
F62	20A	A/C module
F63	20A	Spare
F64	5A	AM / FM receiver module / Traffic Monitoring Control module (TMC)
F65	5A	Media player / Multi media module and display / Antenna amplifiers / Audio amplifier
F66	10A	Centre console module / Infotainment control module
F67	15A	Spare
F68	5A	Spare
F69	5A	Convertible roof module (Volante)
F70	15A	Spare
F71		Spare
F72		Spare
F73	5A	Spare
F74	15A	Fuel pump
F75		Spare
F76		Spare
F77	15A	Boot power socket
F78		Blank
F79	5A	Reversing lamps / Module - Parking aid (option)
F80	5A	Battery 'Off' switch
F81	20A	Ignition switch
F82	25A	Passenger door module
F83	25A	Driver door module
F84	25A	Passenger seat power and switch pack
F85	30A	Driver seat power and switch pack
F86	5A	Start button, Driver and passenger seats



Stand Alone Fuses		
Fuse	Rating	Function
F1	40A	Cabin Fuse box supply
F2	30A	Cabin Fuse box supply
F3		Blank
F4	40A	Cabin Fuse box supply
F5	20A	Cabin Fuse box supply

Boot Fusebox



Fuse	Rating	Function
F1	5A	Convertible deck lid lock motors
F2	20A	Spare
F3	30A	Heated rear window
F4	20A	Rear quarter glass motor (LH) (Volante) Spare (Coupe)
F5	30A	Spare
F6	20A	Rear quarter glass motor (RH) (Volante) Spare (Coupe)
F7	5A	Battery disconnect switch (BDS) power
F8	30A	Fuel pump module (Bank B) / Tracker
F9	20A	Fuel pump module (Bank A)
F10	30A	Convertible roof module
F11	20A	Spare
F12	20A	Transmission control module (Automatic)
F13	10A	Tyre pressure monitoring
F14	5A	Rear parking assistance module (optional)
F15	5A	Transmission control module (Automatic)
F16	30A	Convertible roof hydraulic pump
F17	5A	Boot lamps / Rear power socket illumination
F18	30A	Audio amplifier
F19	5A	Spare
F20	10A	Canister vent
F21	30A	Convertible roof lid lock motors relay
F22	20A	Exhaust by-pass and vacuum pump

Relay	Rating	Function
R1		Fuel pump driver module (7-12 (Bank B)) Tracker (If installed)
R2		Fuel pump driver module (1-6 (Bank A))
R3		Canister vent valve Exhaust bypass valve and vacuum pump
R4		TCM (auto only) Spare Tyre pressure monitor Parking aid (if installed)
R5		Rear quarter glass motor (Volante) Spare (Coupe) BDS Rear quarter glass motor (Volante) Spare (Coupe)
R6		Boot lamps
R7		Heated rear window

How to Read the Circuits

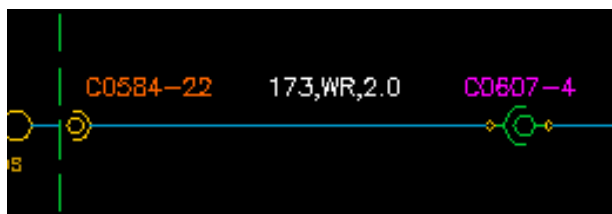
Below is a simple guide to what symbols mean on the circuit diagrams. For some of the symbols there are descriptions as to how they function.

Wires

Wire numbers have been deleted from the original engineering circuits. This allows the type size to be increased for improved legibility of the service circuits.

Wires vary in size to allow different current to be carried. For example a wire with a diameter of 0.50mm (This is the diameter of all the internal copper strands together) will carry 11A (dependant on ambient temperature) whilst a wire with a diameter of 2.00mm will carry 25A.

Wire No.	173	WR	2.0
Colour			
Size			



Twisted Wires

The 'figure of 8' shown on circuits as below denotes a twisted wire and shows the wires that are twisted together. A wire generates a certain amount of 'electrical noise' when a current is passed through it. By twisting the 2 wires together the 'electrical noise' is cancelled out on each wire by the opposing wire. This is used more on sensors and audio speakers.

Wire No.	908	GU	MAPM	05
Colour				
MAP (Defines twisted pair)				
Size				

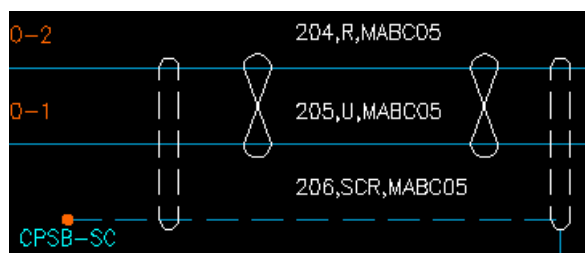


Screened and Twisted Screen Wires

The signals through a wire can be affected by externally generated electrical noise. To reduce the external interference the wires are placed inside a conductive sleeve. One end of the conductive sleeve is always open whilst the other end can be terminated to a ground, to a component, or left open.

The symbol for the screen is an oval with the wires that are to be screened inside it. The letters 'SCR' define the screen.

Wire No.	205	U	MABC	05
Colour				
MAB (Defines Screened)				
Size				



Controller Area Network (CAN)

Controller Area Network (CAN) is the wiring between intelligent modules of the vehicle. This wiring carries the electronic data around the vehicle allowing the various modules and components to interrogate the network and read their specific data signals.

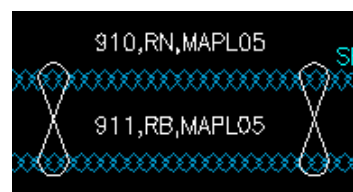
There are 2 different speeds of network.

Low speed - Transmits at 125,000 bits per second. Mainly for body controller systems such as seats and doors

High speed - Transmits at 500,000 bits per second. Mainly for engine management and powertrain associated systems such as ABS.

All wiring in the CAN is twisted. The twisted wires always consist of one wire with a black trace in it for the negative side and one with a brown trace in it for the positive.

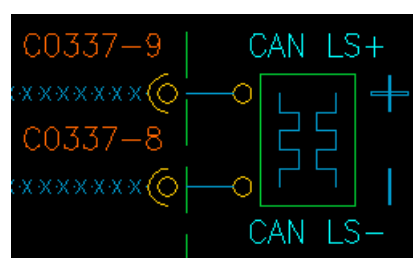
High Speed CAN wire



Low Speed CAN wire



The symbol below shows a module or a component connector with the pin numbers that have CAN wires coming from them.



'CAN LS+' - Low speed CAN positive side

'CAN LS-' - Low speed CAN Negative Side

This naming convention also applies to the High Speed CAN network.

To aid identification of the different speed CAN's in the vehicle different colours of wire have been used, e.g. the Low Speed Volcano is GB twisted with GN, the High Speed Volcano is RB twisted with RN.

There is attached on a separate page a list for wire colour abbreviations and what colour they refer to.

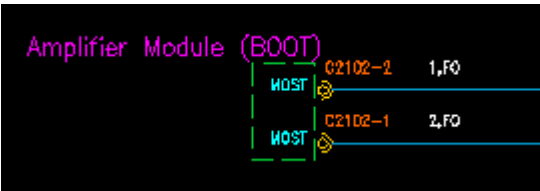
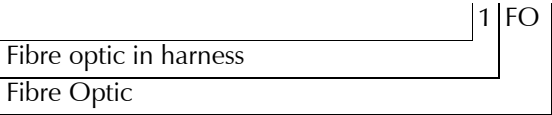


Media Oriented System Transport (MOST)

A fibre optic carries out a similar function to that of a wire in that it transmits data signals. The differences being that where a wire is made up of copper strands in an insulated sleeve a fibre optic is a plastic tube with a highly polished reflective inside surface.

The fibre optic carries the data in the form of a pulse of light, which is sent via an infrared transmitter and picked up at the next component in the loop via an infrared receiver. The light pulse is then converted to an electrical signal that is used by that module or component.

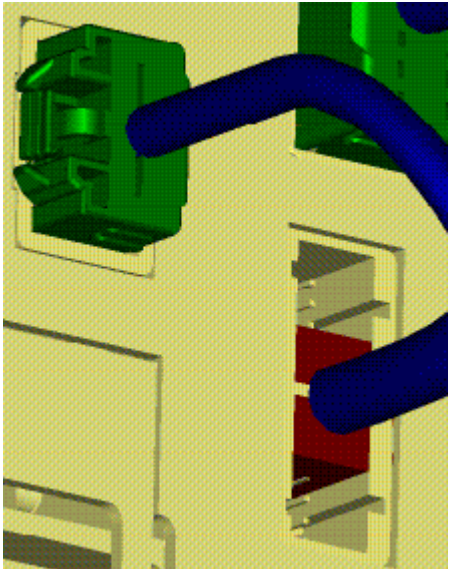
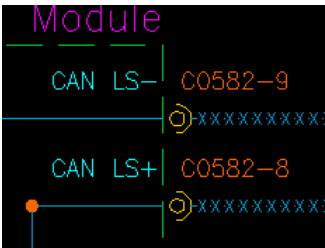
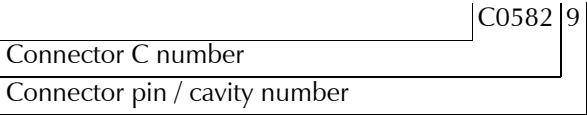
The CAN sends signals around the vehicle where the modules or components remove their specific signals. The fibre optic is in a loop with the module components in that loop, one fibre goes in and one fibre goes out. This is shown below.



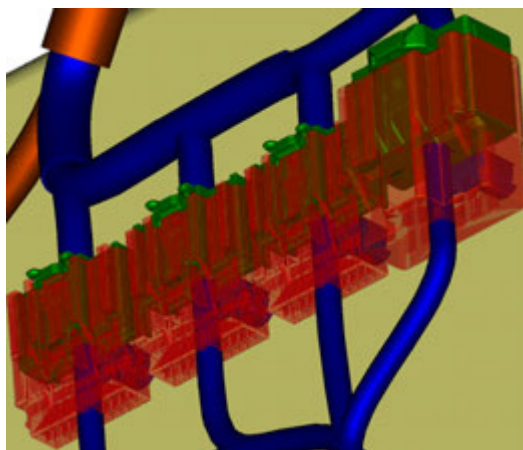
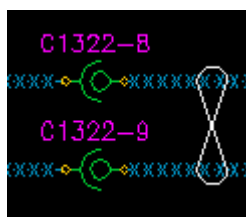
Connectors

There are 2 types of interconnect shown on the circuits. Each connector is given a dedicated 'C' number. The number after the dash is the pin number, also known as the cavity number. The example below is C0582 that when checked on the attached list refers to the CEM Connector Cockpit 2 (C3).

The 1st type is shown for a **connector** that is on a module or component with a mating harness connector attached to it.



The 2nd type is shown for a connector on a harness with the mating connector on another harness. This is known as an **Inline**. Again the above naming convention applies.



The terminals in a connector housing can have a special coating on them. This coating if required is selected using the following criteria.

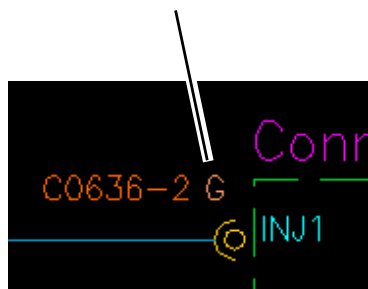
- A specific coating requested by component / system owner.

Or

- The current passing through the terminal.
- The environment the connector is to be situated with respect to temperature.
- The open circuit voltage passing through the terminal at a given.

Depending on the above criteria the coating, if required, can either be gold, silver, phosphor bronze. Generally tin is the common plating on the terminals but there are some that are gold. These are identified in the circuits with the letter 'G' which stands for gold after the connector number. An example of this is shown below.

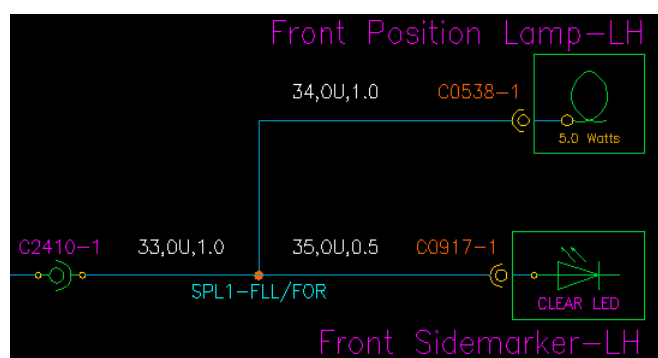
	G
Gold plated pin	



Splices

A splice is used where more than 2 wires that have the same requirement i.e. they need the same signal and meet in the same harness. In the example below the Front Position Lamp-LH and Front Side marker-LH require the same output signal from the CEM. Therefore the 2 wires for the lamps are spliced into the output wire from the CEM on the Forward Harness.

	SPL1	FLL	FOR
Splice No.			
Associated name			
Harness that the splice is on			

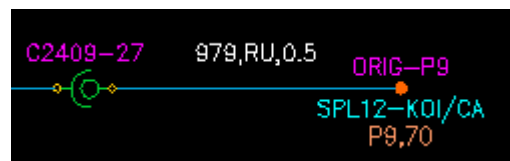


Tracing Spliced Wires

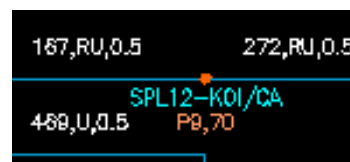
Some splices appear on pages as a wire that goes to one spot and seems to terminate in space. An example of this is shown below.

Splice Origin Page

(e.g.P9)



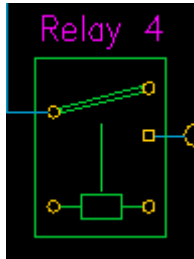
Other Page(s) on which the splice occurs.



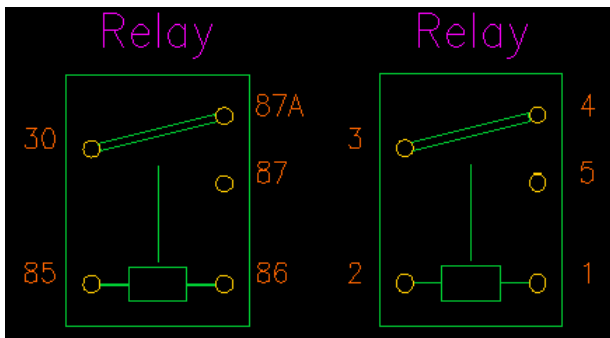
A separate page is attached containing a list of splice abbreviations and the harness to which they refer.

Relays

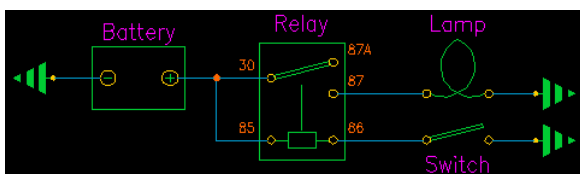
Another significant component in the circuits is a relay, this is in simple terms a switch that operates on the principal of electromagnetism. Below is the circuit symbol for a typical relay. The relay shown below is a normally open relay in its inoperative state i.e The arm is in the open position.



Relays can have either 4 or 5 terminals on the base. The circuit of the relay is shown on the base or the side of the housing. There are 2 types of numbering convention for the relay terminals, both of which are shown below.



Below is a circuit diagram to show the function and operation of a relay in a simple circuit.

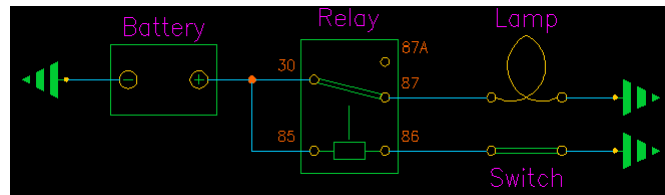


The current from a battery for example flows through the wires to the high power normally open switch (The arm between pins 30 & 87A) and the low power coil (The box between pins 85 & 86). As you can see in the example above the lamp is in not illuminated, because the switch is open.

For the relay to operate there needs to be current flow through the low power coil i.e Current in to the coil then through to an earth. The current passes through the relay coil and creates a magnetic field, this magnetic field is strong enough to 'grab' the high power normally open switch.

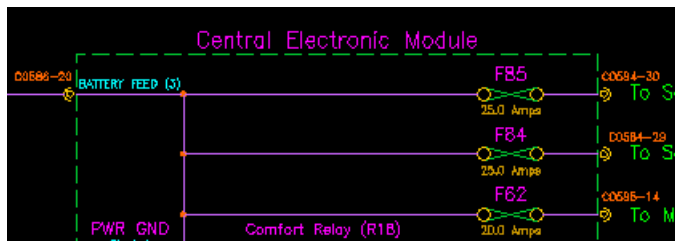
The magnetic field pulls the switch from it's normally open contact to a normally closed contact. The normally closed contact has a path to an earth, in this case it goes through a lamp.

The high power current then flows through the high power normally open switch through the lamp and then to an earth. This can be seen more clearly in the diagram below. Lamp Illuminates

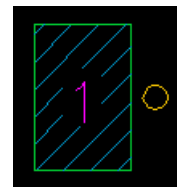


Busbars

A busbar is where a electrical supply is fed into a conductive bar, wire or pcb track and various modules or components 'tap' into this busbar to draw their required power. The Central Electronic Module has 4 of these busbars internally, each of which is supplied from an external power supply, that supply can be a battery feed, ignition feed or a switched supply.



The symbol shown below is the symbol used on the circuits for a busbar, the number inside the box refers to the busbar number in the Central Electronic Module.

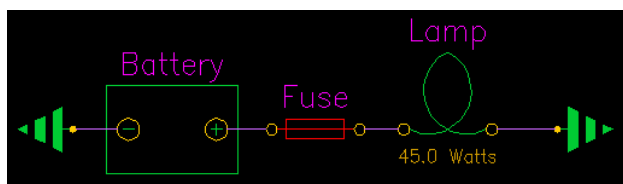


Fuses

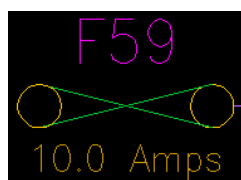
A fuse is a device used to protect a module or component from excessive electrical current which can cause damage or destroy that module or component. In practice the fuse is placed in between the power source and the module or component that is being protected.

The size or 'Rating' of the fuse in amps is calculated according to the power requirements of the module or component it is protecting with other factors being taken into consideration. If the rating has been calculated correctly then the fuse will 'blow' when excessive current passes through it before any harm or permanent damage occurs to the module or component it is protecting.

In a correctly protected circuit, the fuse is placed 'Inline' between the power source in this case the battery and the lamp. If the lamp goes 'short circuit', a massive current will begin to flow and the fuse will fail causing an open circuit. The battery and wiring are protected from over current damage.



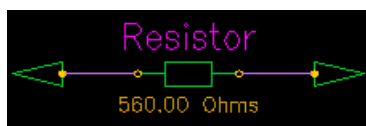
Below is the fuse symbol as shown on the circuit diagrams. The number above the fuse symbol is the fuse number; allocated to this fuse. The number below the fuse symbol is the rating.



Resistors

A resistor is an electronic component that by way of its construction reduces the current flowing through it. A resistors unit of measure is the Ohm.

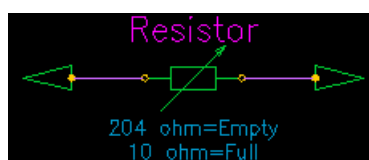
The diagrams below show a resistor and a variable resistor.



Variable Resistors

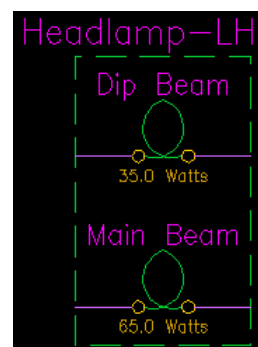
A variable resistor works in the same manner as a normal resistor but the resistance values can fluctuate. The construction of a variable resistor depends upon its use and environment.

One example is for the fuel tank level sensor. The tank full level is 10 ohms and the tank empty level is 204 ohms, the resistance will vary between 10 and 204 ohms depending on how much fuel is in the tank.



Lamps

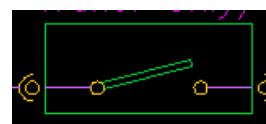
Below is the symbol for a light bulb, shown below the symbol is the power of the bulb in watts.



Switches

There are numerous of types of switch, several of examples are shown below.

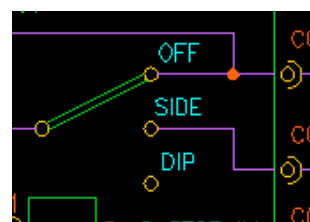
Normally Open Switch



2 Position Switch



3 Position Switch



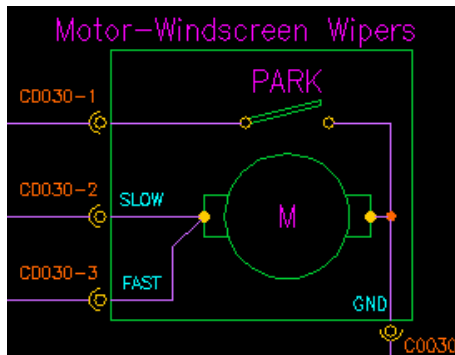
Motors and Pumps

The same symbol is used for a pump or a motor, the description differentiates between them.

Pump



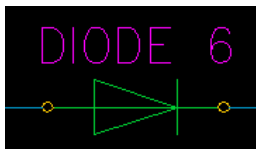
Motor



Diodes

The simplest way of describing a diode is 'a non return valve'. The current will flow through the diode from the anode to the cathode, due to the construction of it though current cannot come back. Diodes are used to reduce the possibilities of 'back feed'. This is where current comes through the circuit the wrong way for one reason or another. Below is the circuit symbol for a diode.

Anode



Cathode

Light Emitting Diode (LED)

The light emitting diode (LED) works on the same principal as the diode. The main difference is that in the manufacturing process one of the materials is replaced by another. This replacement material has certain properties that when a certain voltage passes through it glows.

**Arrow Symbol
indicating light
emission**

Anode

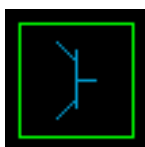
LED Colour



Cathode

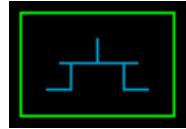
Transistor

A transistor in simplistic terms is a switch with no moving parts. The 'switching' is controlled by electronics and currents etc. rather than a physical switch being operated. Below is the circuit symbol for it. The example shown below is one of the most common basic type used called a 'Bipolar'.



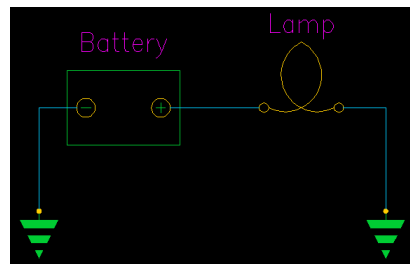
Field Effect Transistor (FET)

A field effect transistor (FET) is, in simplistic terms, a switch with no moving parts. The 'switching' is controlled by electronics and currents etc. rather than a physical switch being operated. The main difference between this and the type of transistor shown above is this one operates using a magnetic field.



Earth / Ground

For an electrical current to 'flow' around a circuit it has to start from a power source and go to an earth / ground. If there are any breaks in this circuit then current will not flow, this is called an 'Open circuit'



There are 2 types of earth, Signal Earth and Chassis Earth, these are referred to sometimes as a Quiet Earth and Noisy Earth respectively.

Some sensors for example specify a Signal / Quiet Earth. While components such as pumps and motors can have a Chassis / Noisy Earth. The reason behind this is that pumps, motors and the like can generate 'electrical noise' by the way of their operation. Some of this 'electrical noise' can be transferred through wires, it is this 'electrical noise' that can have an adverse effect on sensor signals and affect the control readings.

Keeping Signal / Quiet and Chassis / Noisy earths separate reduces the effect of 'electrical noise' being transferred from component to component.



This symbol is a standard symbol for earths.

On the circuit diagrams some earths are shown as eyelets with the description of Earth-**** next to it, the earths also comply with the 4 digit C number. An example of this is shown below.

