

MENDING ELECTRICAL CIRCUITS

This document teaches you the basics of electrics, how to use a multi-meter and how to use these skills to fault-find and mend electrical circuits.

Introduction to electricity:

Electricity is described in terms of voltage and current which determine power.

Voltage (Volts)

Voltage is like the 'push' and if you consider electricity as water in a pipe then voltage is equivalent to the height of water in the pipe (i.e. pressure). Voltage is measured in Volts. Mains is 240 Volts.

Current (Amps)

If you consider electricity as water in a pipe then current (symbol I) is the flow in the pipe and is measured in Amps. Standard mains cables carry 6 Amps.

Power

Power describes how much work something does and is measured in Watts:

Power (Watts) = voltage (Volts) x current (Amps).

This means: Current (Amps) = Power (Watts) / Voltage (Volts)

A 200W amplifier powered by mains (240V) uses less than 1 amp.

AC / DC

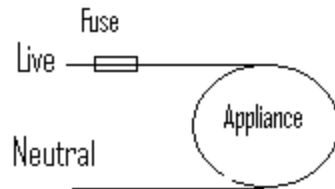
There are two distinct types of electricity known as ac (alternating current) and dc (direct current).

AC refers to electricity which travels as a sine wave and is used for high voltages (such as mains in the house which is 240V AC). AC electricity travels down the live & neutral connections with earth being used purely for safety.

DC refers to electricity which flows from positive to negative. We find DC in low voltage electronics such as lap-tops and batteries (car batteries are 12V DC).

Circuits

For electricity to flow there must be a continuous circuit. Any break in the circuits such as a broken wire will stop electricity flowing. A good connection requires lots of metal in contact. A poor connection will get hot as current flows through it. A good connection has a low resistance.



Fuses

If live and neutral are connected together a huge current will flow and hopefully a fuse will blow. A fuse is a thin piece of wire which burns out if too much current flows. They are used as they will blow (and break the circuit) before the wire or appliance catches fire.

The correct size fuse should be used. Find the power of the appliance in Watts and calculate its current (see above). Use a fuse slightly higher than the required current for the appliance (eg 1A for 200W as Amps = Watts / Volts). Only fuses of 1, 3, 5 and 13A rating are available. If in doubt use a small fuse as it will blow quickest.

Earth

If the appliance has a metal surround / body it should be connected to the earth wire. This means that if the box becomes live the electricity will go to earth via the earth wire rather than anyone that happens to be touching it.

Plugs

Each wire should be connected to the correct pin and an appropriate fuse installed (see above). There may be two or three wires depending whether earth is installed. Wires are as follows:

- earth - yellow / green)
- live - brown (or red)
- neutral - blue (or black)

Using a multi-meter:

When mending electrics we use a multi-meter to find voltage or resistance. We have to set the dial to the right setting and put the probe in the right socket.

Voltage (V):

To measure voltage set the dial to V for voltage and the correct setting: ~ for AC and = for DC and set the dial to a number just larger than you expect to see e.g. for mains: set the dial to ~ 400V for a car battery set it to = 20V.

Resistance (Ω):

To check if there is a good circuit we measure resistance:
To measure resistance set the dial to one of the Ω settings.
0 means there is a good connection, a high number (or 1 which means infinity) means there is a no circuit. A fuse will have low resistance if not blown and high (or show 1 for infinity) if blown.

TIP: When testing complicated circuits draw it out to see what you are testing.

Safety

If you test something live, make sure you do not touch any metal parts including the probe tips) and ensure the socket is correct. Do not try to measure current.

Mending Electrics

To mend a piece of electronics we must systematically test each part of the circuit to identify what is wrong. Often it is the fuse or power lead (near to the plug). Try the following steps to identify what is wrong.
Plug in to see if it works after each stage, then unplug from the mains before the next step:

- 1) Visual inspection, look for broken wires, bad connections etc
- 2) Power cable: swap power cable for another one that you know works
- 3) Plug / fuse: open plug and check fuse and connections. See below:
- 4) Open box: unplug from mains and open box. Keep screws safe and look for signs of burning or fuses to test.
- 5) Test live: if you are brave you can plug in the box with the top open and test live. Test where the wires come in to see if it is live. Be careful you don't touch anything metal (including the multi-meter tip probes).

Blown fuse:

If the fuse is blown this may mean there is a fault so check carefully before you replace fuse and plug in again! Change the fuse, plug-in and test. If it still doesn't work see if it has blown another fuse.

TIP: Before taking anything apart draw how it so you can remember how it was!