

Appendix 1

Measuring Electricity

Electricity cannot be seen, it can only be felt, which is not very pleasant and can be lethal! Instruments are needed to measure it like voltmeters and ammeters.

When testing appliances and wiring motors the electrical current (Amp) needs to be measured. It will instantaneously show if excessive current is flowing so the power can be turned off before smoke starts to appear and the equipment is damaged.

To measure the motor current, you need a clamp meter (from Jaycar electronics, and electrical stores) or a power meter from a hardware store (They measure volts, Amps, watts and kWh (electrical energy as sold by the house meter) for less than \$50.

In-line Ammeter & Circuit Breaker

Used to help you find faults in electrical appliances. Use it every time you plug a machine in for testing.

- Knowing the current drawn by an appliance can help find faults faster.
- Motors can be tested to see if they draw excessive current.
- When used with a safety switch it protects you from electrical shock and further damage to the appliance.
- Fitted with a circuit breaker to prevent the customer fuse from blowing

Features

- Analogue 0 - 10 Ampmeter (AC).
- Double pole off - on switch for your safety.
- Circuit breaker trips before customer fuse.

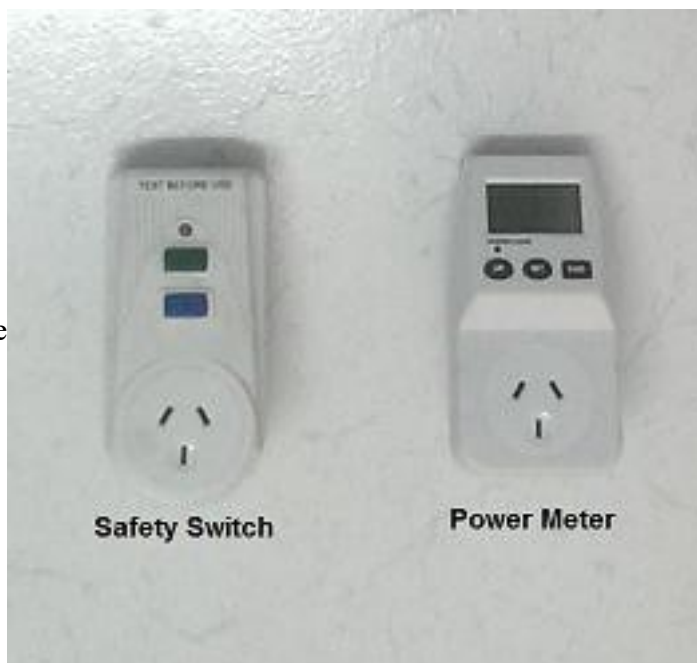


Illustration 1: Safety Switch & Power Meter

A1 Instructions on using the appliance tester.

A1.1 Safety Switch

It is recommended that you use a safety switch between the power point and the appliance tester. These can be purchased from hardware shops, Dick Smiths Electronics, etc. Read and follow the supplied instructions.

The use of the safety switch will increase your safety, but do not get careless. It will find faults with insulation that may be fixed before the component burns out. Many new homes now have safety switches installed in their fuse boxes. Experience has shown if the safety switch trips the local and the one in the fuse box will both trip.

A1.2 Power Point Safety Tester

The vacant plug is for a power point tester (plug with three neon lights). This can be purchased from hardware shops, Dick Smiths Electronics, etc. Read and follow the supplied instructions. This will indicate if the house wiring is OK. This will indicate if the power point is earth, the active and neutral are wired correctly.

It also indicates if power (240V) getting to the appliance. The lights will go out if the safety switches, the circuit breaker, or the off - on switch is turned off.

If the active and neutral are reversed, "make up and label a small extension lead to reverse them back to the correct plugs". This will allow the circuit breaker to work correctly. See circuit diagram.

A1.3 Circuit breaker

I recommend using a circuit breaker less then the 15A in the fuse box. If a short develops the local circuit breaker will trip instead of both. A 8A (for light circuit) will hold in when testing a dryer at using 9A most of the time.

A2 Operation

A2.1 Basic Information

Use the in line ammeter with both a safety switch and the power point tester. See above. Plug in the appliance and try to operate it observing the ammeter and the appliance. The current drawn can be calculated from:

$$P = VI$$

Where P = power in watts from the label

$$V = \text{Voltage (240 V)}$$

$$I = \text{Electrical current (Ampere)}$$

Transposing the formula for current (I):

$$I = \frac{P}{V}$$

Example: A 500 Watt vacuum cleaner operating from 240V.

$$\begin{aligned} I &= \frac{500}{240} \\ &= 2.1 \text{ A} \end{aligned}$$

Some typical examples:

- Induction motor in washing machine: about 3.5 to 4 A
- Capacitor run motors in washing machines: Starts at 4A and drops to about 2A when it has reached it operation speed.

If the motor uses double these values the windings are shorted and will run hot with little power.

Replace the motor.

A2.2 Possible Faults:

Safety switch turns off.

- Moisture or poor insulation dry or replace component.
- Bare wires or terminals touching metal frame, repair fault.

Circuit breaker turns off.

- Shorts in components, repair or replace

The circuit breaker is 6 or 8 A. This will still operate clothes dryers using 8 - 10 A. This circuit breaker should operate before the customer fuse or circuit breaker in their house.

A2.3 Safety

A double pole switch is recommended for your safety, but still keep the habit of pulling out the pulling out the plug before repairing the appliance!

A3 Construction

A3.1 Ammeter

Analogue meter if the best to use if you can obtain them. I had obtained them from eBay They have the advantages that they show variation in current, use no batteries. They have the disadvantages that they are delicate and will stop working if dropped or are subject to vibration when traveling in a motor vehicle. They tend not to be accurate when measuring currents less than 0.5A.

Multimeter with 0 – 10A range. These are not suitable for appliance repairs as the surge current from an induction motor will blow the internal fuse of the multimeter.

Clamp meter are more robust and are 0 - 200A. The disadvantage is that the sample rate is not fast enough to show the variation on a capacitor run washing machine in the wash cycle. When used frequently the batteries do not last very long.

A3.2 Double pole switch.

These are 3- 4 more expensive than a single pole switch. These can be purchased from electrician suppliers or some hardware stores. Jaycar electronics have a number of double pole switches with sufficient rating to be used at a reasonable price. See A2.3!

A3.3 Circuit breaker

See A1.3

A3.3 Metal or Plastic box.

Use to house all the components

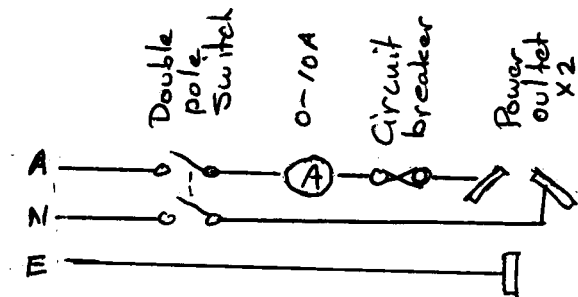


Illustration 2: Circuit Diagram for Meter Box