

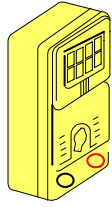
# EXAMPLE

**Electrical Safe  
System of Work**

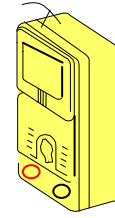
**Canon**

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# Test Meters



The test meter is just one of the tools used in logical fault analysis and the use of the test meter is greatly reduced by:

- a) not knowing how to read circuit diagrams or even more frightening
- b) the service technician not being fully conversant with how a meter can be used safely.

There are three modes that field service personnel will commonly use on their test meter:

DC Volts  
AC Volts  
Resistance



Most test meters unfortunately include the more hazardous function of current measurement. There is no need or requirement for any field service technician to measure current flow.

**Always ensure that the probes are not connected to the Current (A) Terminal**

Using these modes you will be able to measure:

1. Logic High/Low (digital) signals: for example **PEXP / SCFW\***
2. Analogue voltages: **LINT, AE (DCBC)**, control voltages from the DC controller.
3. **AC mains voltages: Be aware! Only to prove 'dead'.**
4. DC supply voltages: 5 Volts, 12 Volts & 24 Volts.
5. Continuity / resistance testing: Connectors, wiring harness etc.

**NOTE:**

With most LCD (liquid crystal display) style test meters check that the battery symbol is not displayed. If it is, replace the battery. Batteries that need replacing in a test meter may induce incorrect readings especially in the resistance range.

Check that the leads are in good condition and that they are connected to the correct terminals on the test meter. For example the black lead connected to the 'COM' terminal with the other lead connected to the V/ohms for voltage or resistance depending on the mode of operation.

Not all meters are auto-ranging, so it is essential that the field service technician knows what voltage they are trying to measure.

## Electrical Safe System of Work

Before changing modes, disconnect the test meter from the circuit as this may cause internal damage to the meter / machine or to the field service technician.

Never attempt to measure resistance when there is power to the system.

Needle point test probes are now becoming more widely required because of the size of modern connectors used (UK-3007-00T).

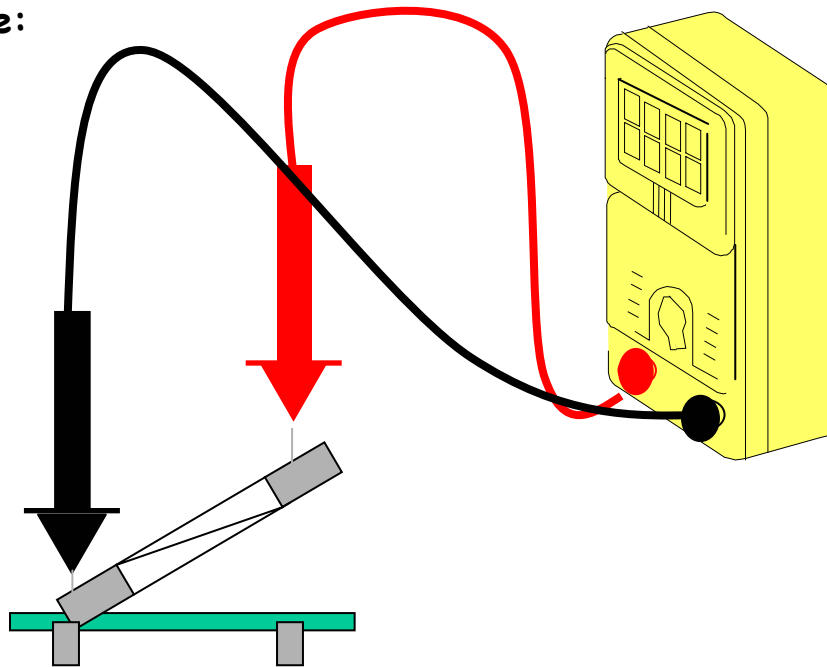
# Checking Continuity

## (not resistance)

Most test meters today include the feature 'continuity checking', often supported by an electronic bleep to confirm continuity (for continuity up to 40 ohms). The principle of using a test meter in the continuity mode is literally as the term describes: Continuation of conductors (without a break). For example checking a wiring loom or connector.

The test meter in all cases when checking for continuity must be to an un-powered machine and in most cases the wiring or components required for testing would need to be 'out of circuit'. This would mean at least the physical disconnection of one side of the component being tested.

**Example:**

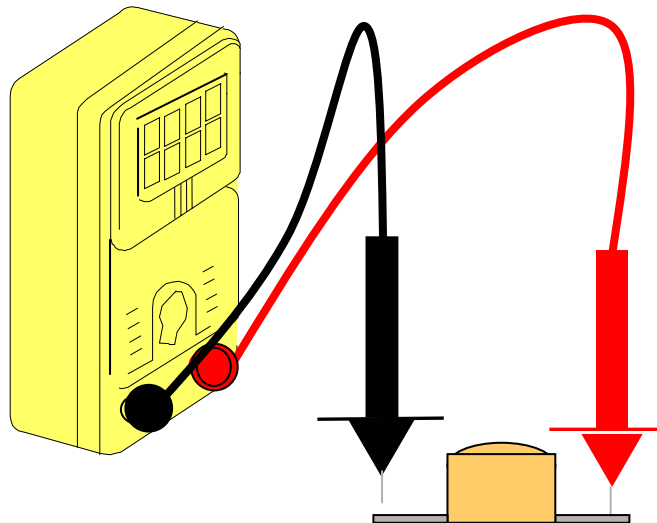


Field service personnel should consider the characteristics of any component before guessing at what the results from the test could be.

Continuity testing is one of the main tests carried out by field service technicians in their job roles. The continuity test will 'bleep' if the component or wire is still intact. No sound will be generated from the test meter if the circuit / component / wire is open-circuit (or above 40 ohms).

### **Thermo Switch / Fuse**

These components are designed as 'fail-safe' devices. These 'switches' are activated by heat, but they can still be tested for continuity.



## Electrical Safe System of Work

Insulated wire and solid conductors should of course provide a suitable path for current flow, in whatever application. The wiring or conductors can be checked for continuity. 'Tracks' on a circuit board can also be tested for continuity. The machine earth integrity is, as every field service technician knows a mandatory routine test (i.e. the metal framework of the product to the earth pin of the mains plug).

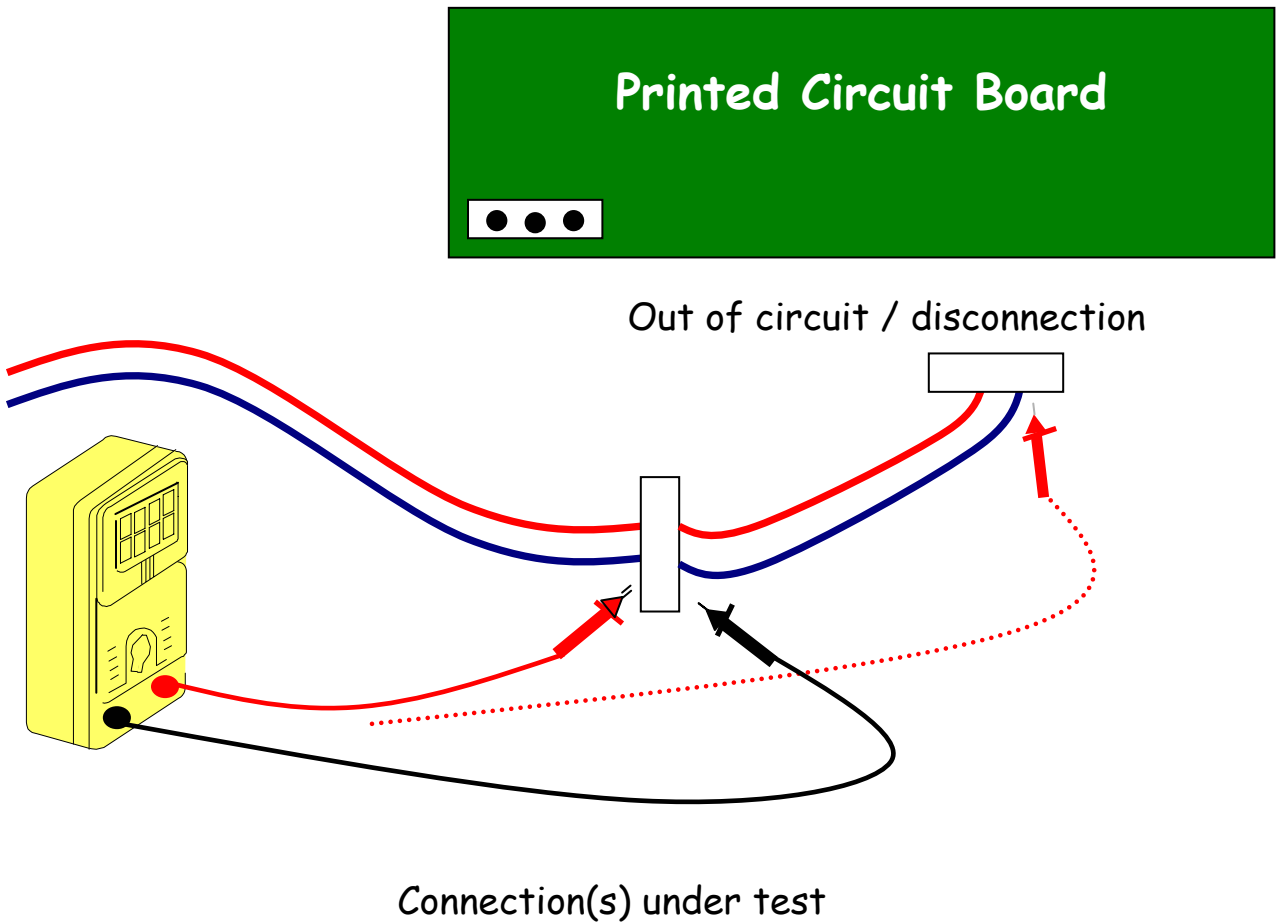


# Checking Resistance

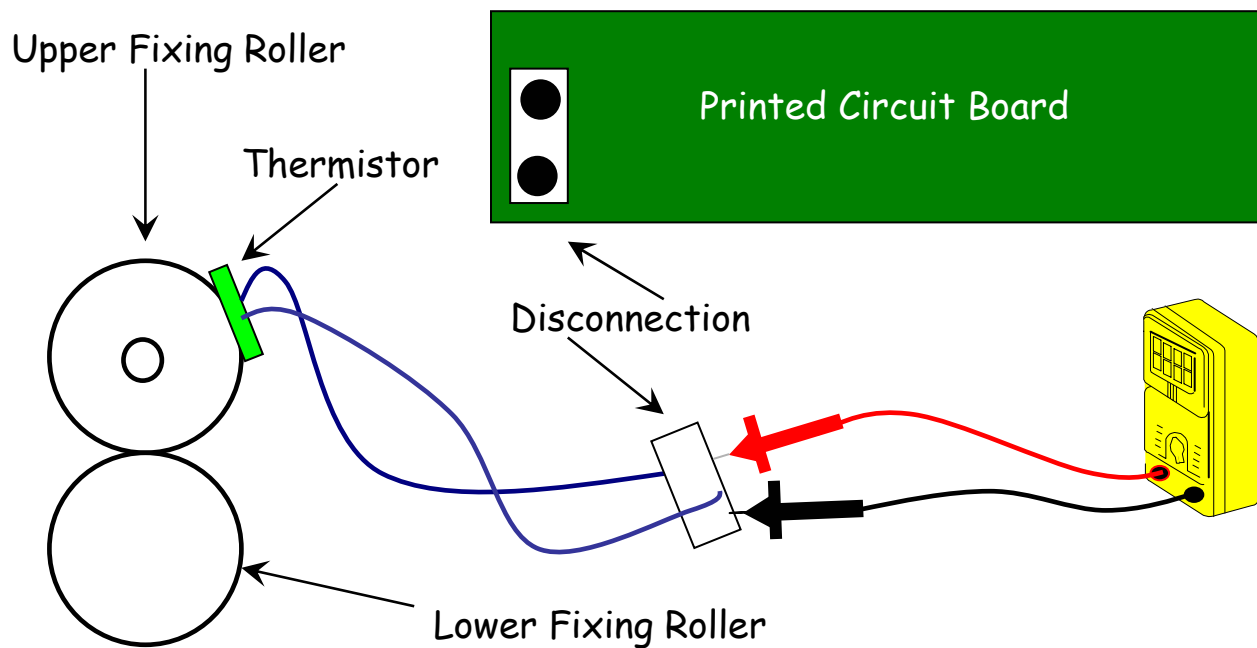
## (Not Continuity)

The principle of using a test meter in the OHMs range is, simply, measuring the resistance in a given circuit or a electrical component to confirm it's integrity or status.

The following example shows that components can be checked for correctness in terms of a resistance measurement.



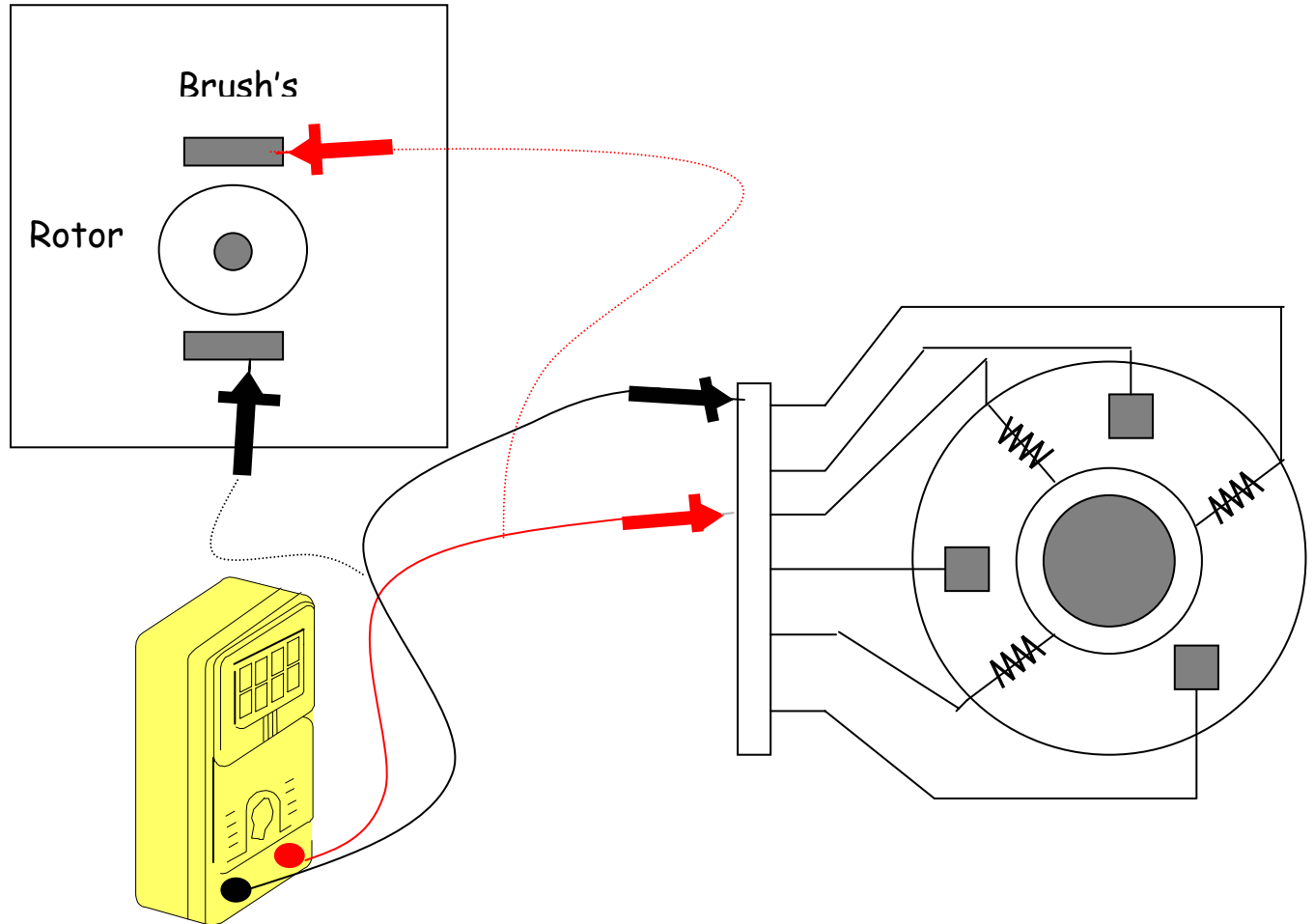
All components have resistance, specifically with regards to a thermistor. The DC controller requires a change in resistance for it to know whether to turn the 'ON / OFF' drive command to the heater (HTRMD).



When checking the thermistor always avoid finger contact with the probe points or terminals being tested as this will allow for 'body resistance' readings and thus generate false readings. The resistance being measured will change as the thermistor cools. It is interesting to note that the resistance value is not an important issue as long as consistent variation in resistance is measured during cooling of the upper fixing roller.

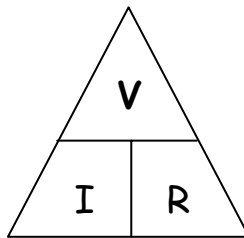
Electrical Safe System of Work

The motors Canon use range from the conventional 'brush' type to the 'Hall IC frequency driven', they employ coils of wire which can be checked using the following method. An unknown resistance value should be expected, but a reasonable resistance level compared with the supply voltage would indicate a good condition.



## Electrical Safe System of Work

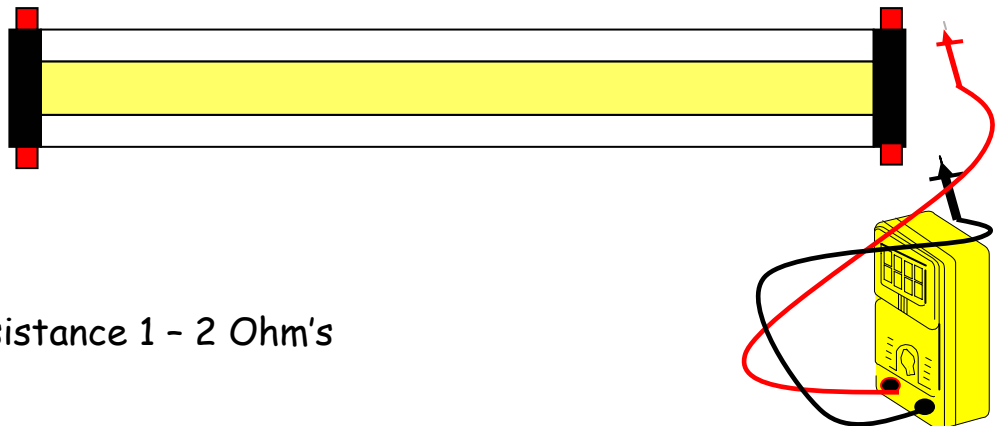
Field service personnel will be aware that a conventional tungsten filament lamp offers a resistance to current flow in order to produce light (a resistance which is measurable). The only interest that service personnel have is chiefly proving whether the lamp is open-circuit (infinite resistance) or not. At a more in-depth level you could go on to calculate the ideal resistance using Ohm's law, given that a lamp will be marked with its voltage and wattage.



When checking any lamp confirm that  
it is unpowered & disconnected

A fluorescent lamp can only be checked on resistance, with the test probes across each end of the fluorescent tube contacts.

### Fluorescent Lamp



Element resistance 1 - 2 Ohm's

Heater elements, much like a lamp is a resistive element which, instead of resisting current flow to produce light, it produces heat. The measurement procedure for heater elements is the same as for all other lamps (don't forget unpowered and disconnected).

### **H/T Leads:**

HT (high tension) leads conduct the high voltage supply to the corona wires etc are usually constructed of a resistance type material - as this implies the resistance check should therefore not result in full continuity, but rather a resistance value which indicates correct conductivity of about 10,000 (10K) ohms for a 6.5Kv lead. Note it will not be 0 ohm's...

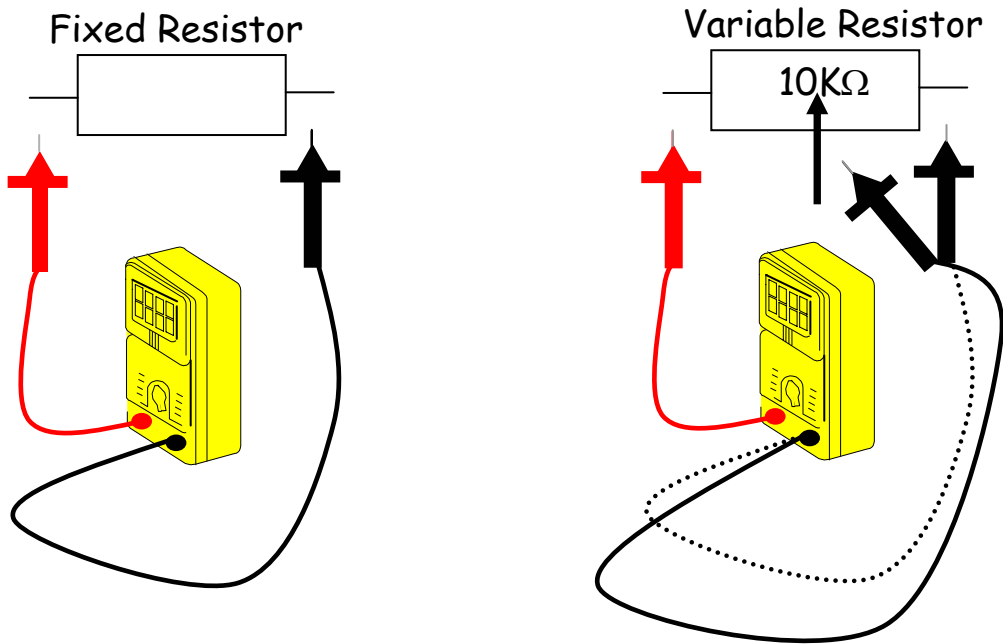
### **Solenoid and electro-magnetic clutches:**

For the purpose of this testing techniques these components can be thought of as the same in principle as the motor - simply a coil. Resistance will be observed (for example 50 ohms is not an unrealistic figure).

### **Resistors:**

A resistor is designed to resist current flow and will be marked with the specified resistance value or indicated by a set of coloured rings around the resistors length (as all field service personnel should already know). Bear in mind the method of test would differ slightly for a fixed value resistor as opposed to a variable resistor.

Electrical Safe System of Work



Variable resistors may be used on manual feed guides, varistors, cassette size detect i.e. paper width.

# Using Test Meters On Electrically Energised Equipment

## **Safety & Introduction:**

Using a test meter on electrically energised equipment can be hazardous, every consideration should be given to the potential risks before starting work; our study here will relate specifically to electricity, but do not forget issues such as - when measuring voltages on a machine it is very likely it will be unguarded therefore be aware of moving parts of machinery and adverse conditions such as ozone inhalation due to covers incorporating filters being removed.

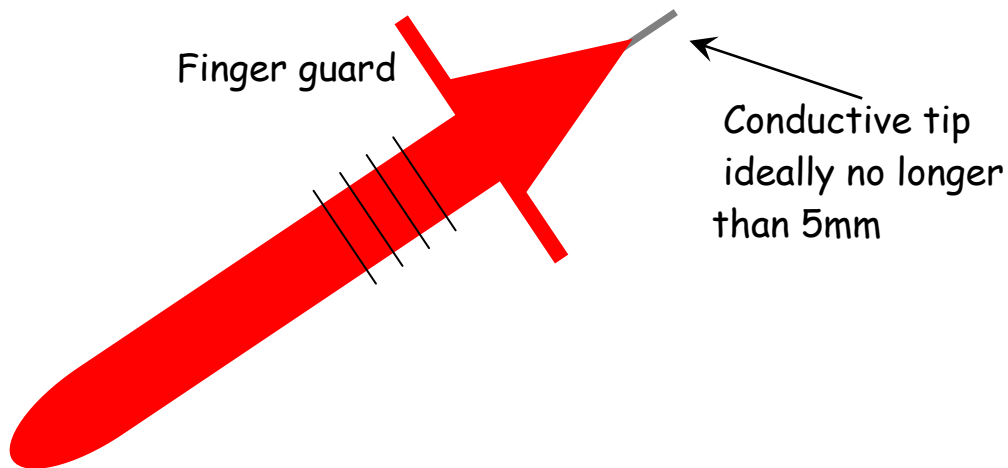
## **Preparation:**

Preparation of the test meter is important if its use is to be safe and successful. Field service personnel should always carry out the following check list before using their test meters.

1. Check the meter is in good sound condition (i.e. no cracks to the casing and clean of any dirt, grease or other possibly conductive materials).

## Electrical Safe System of Work

2. Check the test leads - they should be clean, not chuffed or have any part of the insulation damaged in any respect. The probes must have finger guards to prevent against accidental contact with tips, and a minimal length of conductive tip exposed.



3. Check the selected mode and range and compare them to the checks about to be taken e.g. measuring 24v DC. The DC volts mode is selected and if not auto ranging, a range higher than 24volts DC is to be used.
4. Check and consider carefully the expected reading for the test about to be performed, e.g. a general purpose 24v DC supply is expected to give a measured reading of 24v DC  $\pm 5\%$



Electrical Safe System of Work

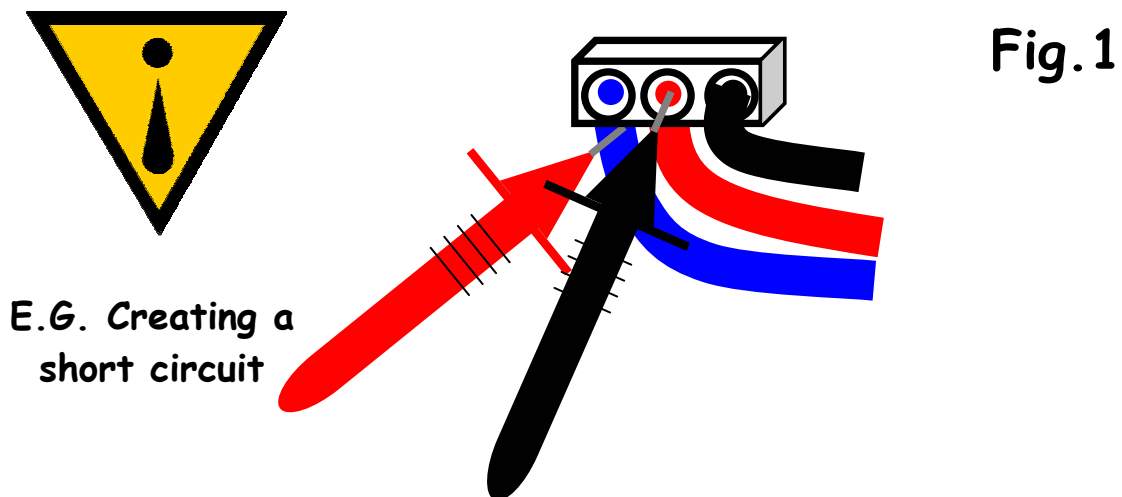
5. Check the test meter for proper functionality before making any actual tests for which the results need to be reliable, e.g. apply the test meter to a known good supply and observe the reading or if continuity testing, connect the probes together and confirm zero ohms indicated.
  
6. Perform your meter tests.

# Best Working Practice With The Test Meter

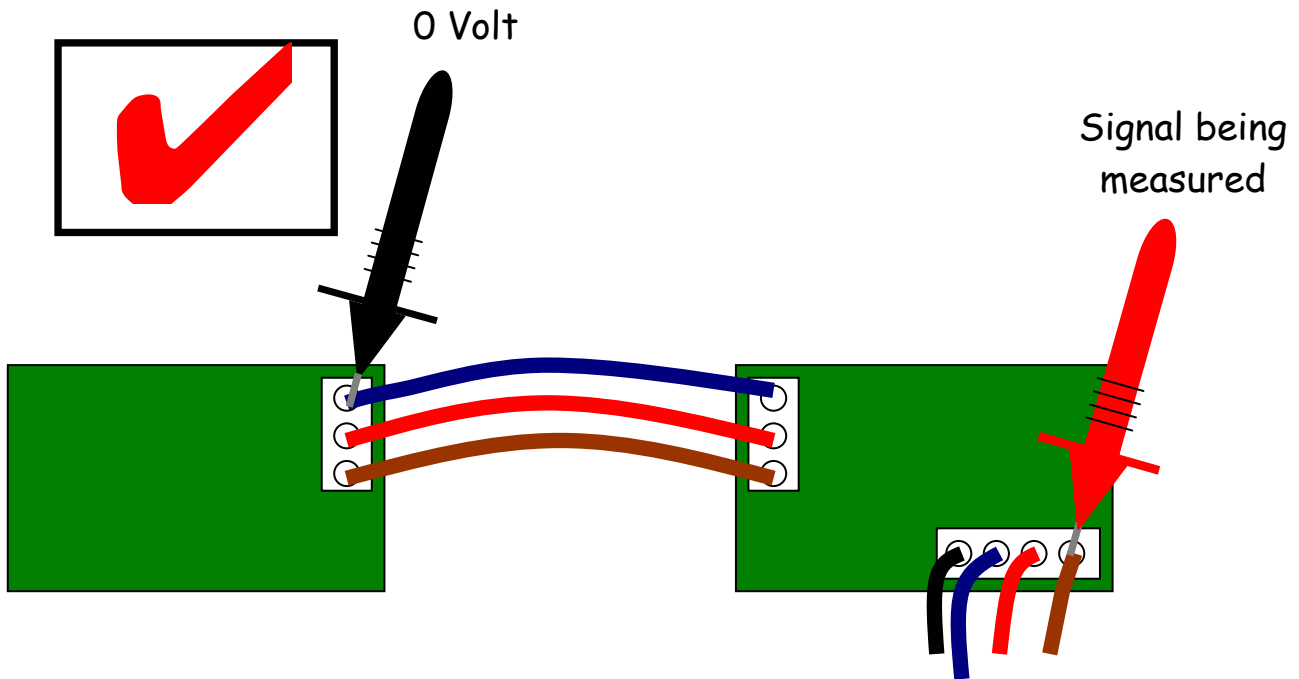
The following best practice techniques can also be regarded as safe working practice in some aspects, not least we will consider elements of safety for the system or appliance being tested to prevent damage being caused.

## Probe Positioning:

When applying the test meter probes to test points, every effort must be made to avoid contact between the probe tips. This is particularly relevant when measuring potential difference as the risk of touching can cause short circuits under a powered situation - potentially dangerous (i.e. mains voltage short) or damage to supply or control circuitry involved.



When faced with the situation as previously mentioned in Fig 1., perhaps a more distant reference should be used for example when measuring a high active signal. It is possible to find another 0 volt reference which guards against the close proximity of meter probe tips as demonstrated on page 18.



It is for this reason that mains voltages are connected with a statutory distance between Phase, Neutral, and Earth - To avoid such risks.

### **Non-Frame Reference:**

It is rarely appropriate to use the appliance frame or earth connections as a output reference; therefore the actual circuit 0 volt rail should be used, this is particularly true if measuring potential difference, whilst it of less importance when simply checking for activation of high / low signals.

In most situations, whilst monitoring DC voltages or signals, one hand should be kept free. This one hand free technique can easily be mastered by fixing the 0 volt reference probe as long as the probe does not damage the reference point contact.

In the interest of safety, technicians will often be crouched around a product when either conducting a service or dealing with a fault. It is advised that the technicians, instead of crouching, place one knee on the ground as this creates more stability and lessens the chances of potentially falling into the product.

### **Apply With Knowledge:**

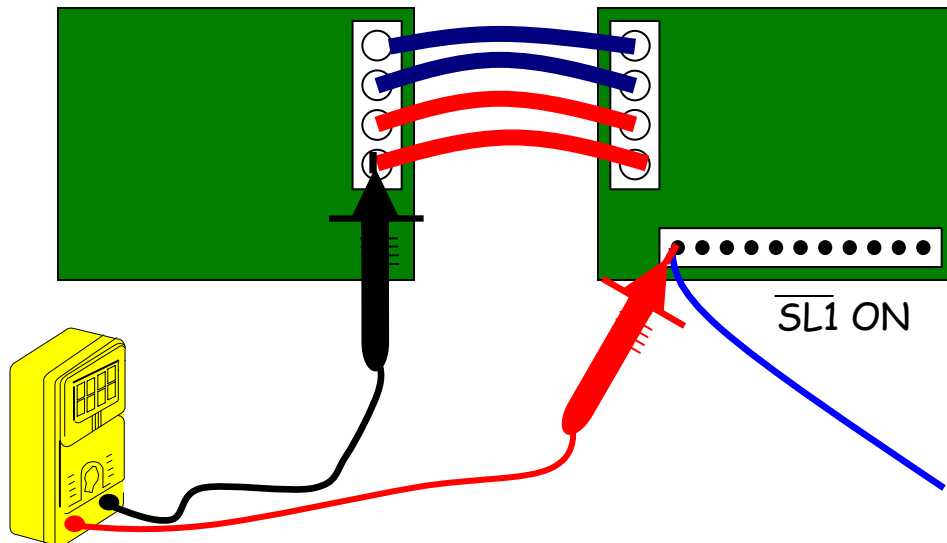
Decisions based on the technicians knowledge of what is being tested must always be carefully considered before applying test meter probes to test points; i.e. a qualitative judgement of expected readings or results is made, otherwise the reading or result will be meaningless.

### Dead Checks:

It is always preferable where possible, to perform test meter checks in a 'machine dead' environment. For the obvious safety reasons, any checks that may have equally valid results whilst the product is isolated from the supply voltage, should be used and considered the preferred option, i.e. continuity and resistance testing.

### High Rail Reference:

There are clear advantages to using a high rail reference point. This is particularly the case when checking active low signals.



This method positively indicates the 'truth' of the active low signal and avoids the risk of false indication caused by the momentary loss of connection between probe and test point when using 0 volt as a reference.

By measuring the difference between the high rail and the high state of a bar signal, the meter will indicate approximately 0 volts. Being as there is no potential difference when the signal goes 'low' the meter will indicate the main rail voltage (in our example 24volts DC) The only event that can cause this is the activation of the low signal.

### **Check & Double Check:**

The whole purpose of using a test meter is to obtain positive results - evidence we can later rely upon in making quality diagnostic decisions. It is therefore extremely important that the apparent results of our test are factual. By checking and double checking, the regularity of error can at least be reduced, preferably eliminated.