

## PAT Testing IT equipment (AN 28)(2018)



### IT equipment

Information technology (IT) equipment covers all components of a computer system whether the system is a large networked system with multiple computers or a humble single machine system. Generally either of these systems will have the basic tower / desktop computer with a monitor and optional scanner / printer.


The large systems will also include items like hubs, switches, routers and USB / NAS external hard drives. Uninterrupted Power Supplies (UPS) and servers will also be present.

All of the above require a power supply either in the form of a direct 230 V mains lead or a low voltage supply via a dedicated power supply (PSU) module.

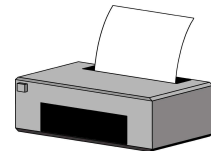
### Class 1 (earthed) or Class 2 (unearthed) equipment?

Majority of monitors and computers, whether a desktop, tower or server, are Class 1 earthed appliances and will be supplied by an earthed IEC 3 core 230 V power lead.

There are a few exceptions such as a few budget TFT (flat screen) monitors which are powered from low voltage PSUs which can be Class 1 or Class 2 double insulated products.

It should be noted at this point that all Class 2 products should have the Class 2 double insulated symbol  marked on the product.

Generally laser printers will be Class 1 earthed products with an IEC mains supply lead whereas inkjet printers are either Class 2, with a 2 core (figure of eight) 230 V lead or low voltage supplied by a Class 2 PSU.



Unfortunately, most hubs, switches and routers are powered by a myriad of different low voltage DC PSUs which may be either Class 1 or Class 2 products so caution has to be exercised when identifying these products. Whether Class 1 or 2, virtually all these PSUs are designated as SELV (Separated Extra Low Voltage). This means the mains supply voltage is reduced to extra low voltage <50 volts which is totally electrically isolated from the mains supply.

### Functional earthed equipment (FELV)

Generally laptops, plus a few IT products, have a PSU that appears to be an earthed Class 1 device with an IEC C6 (Clover leaf) 3 pin socket, but when PAT tested as such, the device fails the bond / continuity test when the PAT tester's bond lead is attached to the only exposed metalwork visible; the sleeve of the low voltage DC plug that plugs into the IT equipment.

Generally the test indicates the earth measurement is in excess of several ohms which is considered a failure.

These products are earthed, but not for electrical safety; the purpose of this 'earth' is not to provide a circuit protective path to earth but to send to earth high voltage static charges that may build up within the connected low voltage equipment.



Technically designated as FELV (Functional Extra Low Voltage) (ITE = Information Technology Equipment) PSUs these devices internally have a double-insulated PSU that provides a low output DC voltage. The mains supply earth is connected to the low voltage negative of the DC output via typically by a 10 to 100 ohm resistor. As these PSUs have an 'earth' manufacturers are unable to place a double-insulated symbol on the product.

Unfortunately the letters ITE are printed within a vast amount of technical information so are not easy to spot.

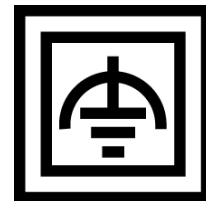
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Regarding PAT testing these particular PSUs visual, insulation and leakage tests can be made through the detachable 3 core mains supply lead, which incidentally, should be tested separately as a standard earthed IEC lead using C5/C6 to IEC adapter.

The IEEE, in 2011, introduced a new symbol especially for this type of PSU. The symbol is a combination of the Class 1 and Class 2 symbols.

The new symbol is now on the IEC/ISO database of approved graphical symbols for use on electrical equipment. IEC 62368-1, the latest international safety standard for audiovisual products and information technology equipment, now includes the symbol. It is expected that this standard will eventually replace IEC 60950-1 (Safety of ITE).



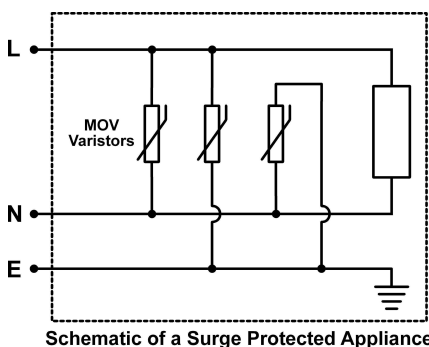
### PAT Testing (Continuity)

The PAT testing of IT equipment is conducted much the same as standard appliances but care must be taken not to use excessive continuity test current. IT equipment generally uses the thin internal printed circuit boards to provide interconnecting earth points so a bond current of 10 amps or more may well burn out these tracks. Generally a continuity test current of 100 or 200 mA is considered the maximum safe current. Since the continuity test is such a low current, a good connection of the PAT tester's earth continuity lead should be sought. For example, TFT monitors generally have an earthed panel on the rear where the VGA / DVI socket are fitted, typically a good position for the continuity lead.

Some computer cases can also prove troublesome, giving high continuity readings when tested. As such nearly all desktop and tower cases are now made in the Far East and due to size are exported by ship. As aluminium reacts with the salt air, a spray-on dressing is applied to the case during manufacture to protect the finish; additionally IT professionals tend not to fully tighten screws so with these facts in mind it is essential to ensure a good contact with the continuity lead.

It should be mentioned that when testing low voltage PSUs the bond / continuity lead should never be connected to the low voltage output connection.

Regarding the testing of the older design CRT (Cathode Ray Tube) monitors, under no circumstances should PAT testing personnel insert a continuity probe through the cooling vents on these pieces of equipment to achieve an 'earth connection'. These monitors have high operating voltages ranging from 400 to 25,000 V internally that can remain charged for several minutes after shut down.



### PAT Testing (Insulation)

A large number of IT devices have internal mains supply suppression components that remove surges and harmonics. The common component is a varistor (voltage dependent resistor or MOV); these resistors generally have a threshold of about 262 V and breakdown when an excess voltage appears on the mains supply 'shunting' out voltage spikes or surges. Obviously a 500 V insulation test would cause a false breakdown with the PAT testing equipment indicating an incorrect failure of the appliance. An insulation test of 100 or 250 V is the maximum recommended test voltage on IT equipment.

### PAT Testing (Load / Leakage test)

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A number of PAT testers have an operation / load and leakage test function that runs the appliance for several seconds to check the current consumption and leakage. If these functions are used to test IT equipment installed with hard drives almost certainly a disc 'read / write' error or crash will occur. These devices have a certain spin up speed and the short term application of the load test (typically 5-20 seconds) is not recommended.

On a final note once a group of IT devices have been tested it is important that the original PSU is mated up to its respective appliance due to the differing voltages and currents. An appliance connected to the wrong PSU can prove costly to replace and may prove to be a fire hazard.