

Work-Ready Electronics

Synchronizing Curriculum to the Rapidly Changing Workplace

Module: Troubleshooting Electronic Circuits and Systems



Electronic Troubleshooting

The one job activity required of all electronic technicians is troubleshooting. In fact, the number one job of any technician, regardless of the type, industry, or specific technology is to identify faults that occur with electronic equipment and fix them.

Many textbooks and courses attempt to teach troubleshooting either too soon in the curriculum before the student knows enough electronics to understand it or not at all. The purpose of this module is to introduce the procedure of troubleshooting to students who have completed a sufficient number of courses to thoroughly understand component and circuit operation and test equipment usage so that they can grasp the idea and apply it to any other piece of electronic equipment.

Prerequisites

To complete this module successfully, you should have the following knowledge and background:

Electronic fundamentals including DC/AC circuits and semiconductor devices and basic circuits

Digital logic fundamentals

Operation and application of basic test instruments such as the digital multimeter, oscilloscope, and function generator

What Technicians Need to Know

What components fail most often in electronic equipment

Basic tests to determine if a circuit is working

Logical step-by-step process for isolating defects

Troubleshooting by signal injection

Troubleshooting by signal tracing

Troubleshooting by substitution

Electronic Equipment Failures: What Goes Wrong and Why?

What is Troubleshooting?

Troubleshooting is the process of identifying the reasons why some piece of electronic equipment does not work properly. Almost all electronic products fail sooner or later.

Most electronic products are very reliable and have a long life thanks to semiconductor technology. But for various reasons, these products will sometimes fail.

The role of the technician and even most engineers is to find the failed component and correct it. Troubleshooting is a logical process that requires thought and analysis. It is not difficult and can be learned by anyone. The best way to learn it is by actually diagnosing and repairing real equipment.

The Reasons for Failure

Electronic equipment failure can be linked to several different causes. One common problem is component failure. This can be caused by overloading a component or circuit.

Another cause is due to environmental conditions like extreme heat. Excessive mechanical stress like vibration, flexing, repeated excessive use, and subject to heavy G forces (dropping) will also cause equipment failures.

Sometimes the failure is caused by incorrect use of the product.

Another problem is called the cockpit problem. A cockpit problem is one that is perceived but not actual because of user ignorance, lack of training, or experience.

Typical Component Failures

Some types of electronic components fail more often than others. Some components have an inherent weakness such as a light bulb that has a useful life but will eventually fail due to excessive use.

Other parts fail less often. For example, semiconductor components like transistors and integrated circuits are amazingly reliable if not subjected to voltages, currents, or power levels in excess of their rated values.

Mechanical components are far more likely to fail. Wire, cable, and connectors are the best examples. The next frame lists components and the order in which they will most likely fail. This list is just a guideline but it will give you some idea of what to check first.

Common Electronic Component Failures

Fuses and incandescent indicator lights

Batteries

Switches and relays

Wires, cables, and connectors

Mechanical motors, disk drives, etc.

Diodes and transistors

Integrated circuits

Capacitors

Resistors

Inductors and transformers

Printed circuit boards

The Most Common Circuit Failures

These circuits are not given in any order of probable failure. However, these circuits are the more likely ones to fail.

Power supply circuits carry the voltage and currents for all other circuits so are subject to the most stress, heat, and overload. Bad or discharged batteries are one of the most common problems in portable or mobile equipment.

Power amplifier circuits supply high power to speakers, antennas, motors, or other heavy loads. Like power supplies, they undergo major stress from high voltages, currents, and heat.

High density memory IC chips are so tiny that even the smallest internal problem will cause loss of data. Memory supply voltage variations or electrostatic discharge can “zap” one of these chips or modules.

Any high voltage circuits like those that drive cathode ray tubes (CRT) in computer monitors, TV sets, or oscilloscopes and anything with a vacuum tube in it including CRT's are also likely to fail.

Test your knowledge

Troubleshooting Electronic Circuits and Systems Knowledge Probe 1

Electronic Equipment Failures: What Goes Wrong and Why?

Click on [Course Materials](#) at the top of the page.
Then choose **Knowledge Probe 1**.