Troubleshooting Wiring and Cabling

The Problems With Wiring and Cabling

Because of its mechanical nature, wiring and cabling is one of the most problem prone segments of electrical or electronic systems. A very high percentage of equipment failures can be traced to wiring or cabling. Wire and cables break or get cut. For example, a cable that is constantly moved or flexed will soon break.

But a higher percentage of the failures with wires and cables lie with the connectors. The points where the wires are attached to the connector are very vulnerable to breakage. Wires are either soldered or mechanically crimped to the connector pins. Some connections are poor to begin with and others can break. Connector pins can also corrode or get dirty. If connectors are frequently being connected and disconnected, the pins may wear or break.

Another common trouble is crushed cables. Even if the wires are not broken, crushing a cable changes its characteristic impedance and can increase reflections and standing waves.

Isolating a Wire or Cable Problem

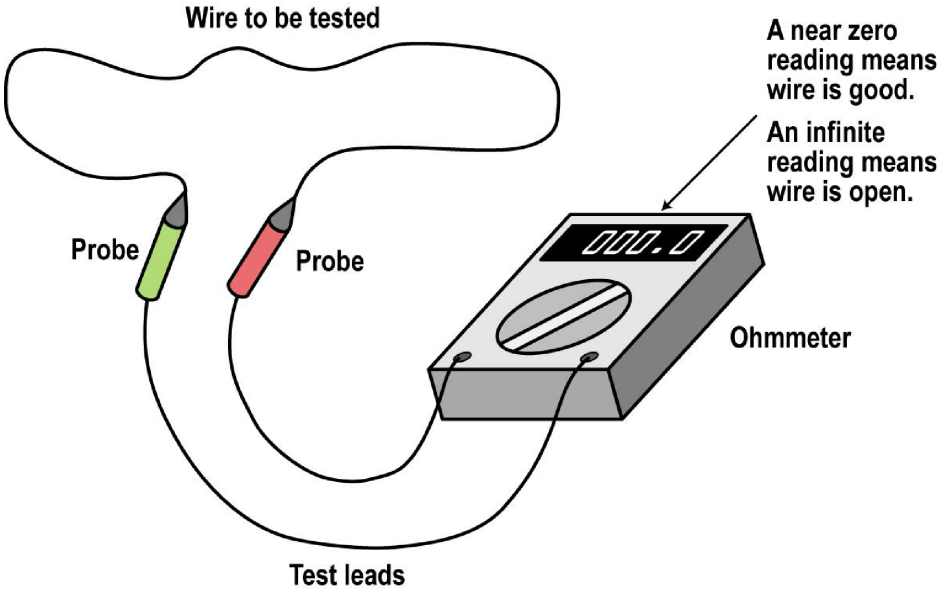
All troubleshooting begins with a problem. In many cases, a bad wire, cable, or connector may be the culprit.

If a cable is suspected, start by examining the obvious. If power is not being received by the equipment, check to see that the unit is plugged into the wall outlet or an AC power wiring strip. It is very common for an AC plug to be pulled or knocked out.

For other cables, check to see if they are plugged in completely. Sometimes a connector does not get seated correctly or it may have been pulled out. Reconnect any cables not fully seated in their connector. Be sure to check both ends of the cable.

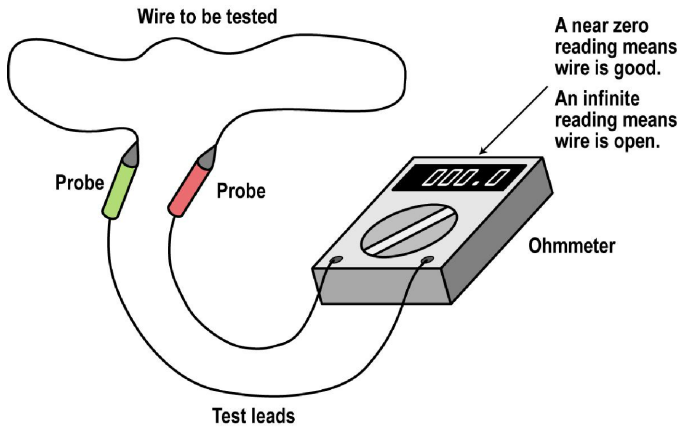
Inspect any cables you suspect. Look for broken wires, damaged connectors, missing or damaged pins on the connector, and crushed cables. Any suspect cable should be tested.

How to Test a Wire or Cable



You can test a wire or cable to see if it is good by using an ohmmeter. You actually use the ohmmeter to measure the resistance of each wire. Since wire has very low resistance, the ohmmeter will read near zero ohms. Such a test is called a continuity test.

Testing



First set the ohmmeter for the lowest resistance range (Rx1) and zero it if necessary.

Then touch the ends of the meter probes to the opposite ends of the wire. Be sure there is good mechanical and electrical contact between the meter probes and the wire.

If the meter reads near zero ohms, the wire is good. An infinite reading indicates the wire is broken or open.

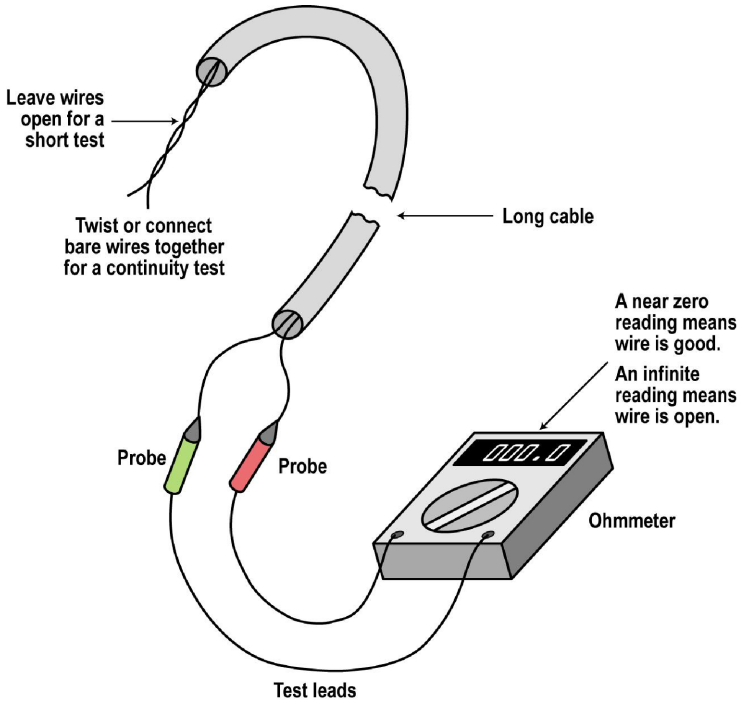
Additional Wire Tests

If the wire or cable has a connector on it, be sure to include it in the continuity test. Touch the ohmmeter probes to the cable connector pins. This will test the pin itself as well as the attachment to the wire and the wire.

An occasional problem in a cable with two or more wires is a short between adjacent wires. Insulation on the wires may have failed due to crushing or melting. Again use your ohmmeter and touch the probes to the wires you suspect are shorted. If you get a zero or low ohms reading, you have a short. A good cable will indicate infinite resistance between adjacent wires.

Additional Wire Tests

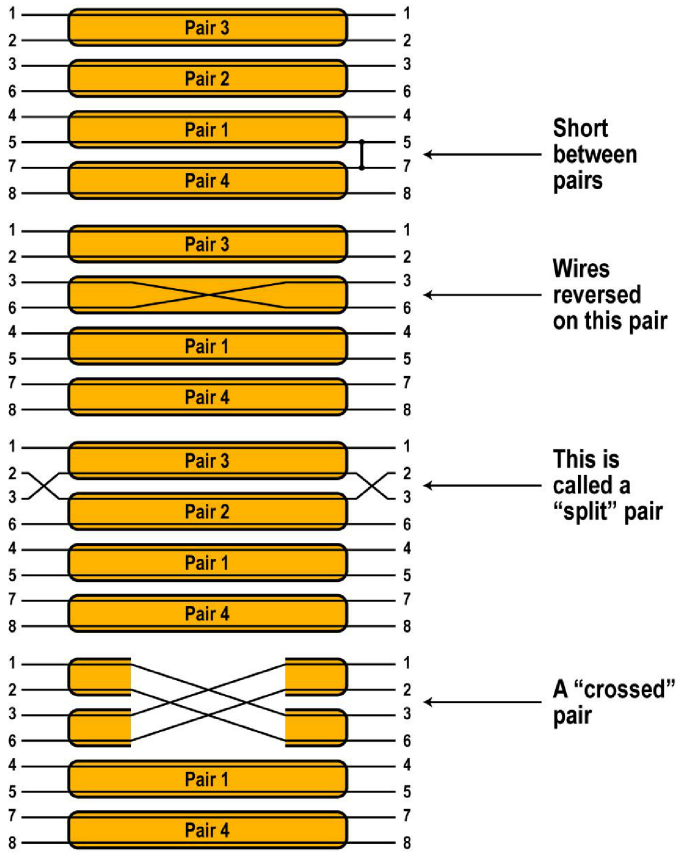
Sometimes a cable is very long and you do not have access to both ends. You can still make a continuity test by using two wires in the cable as shown in here. At the far end of the cable, twist two of the wires together. Then at the other end of the cable make a continuity test between the two wires involved. This tests both wires even though you suspect that only one is bad.



Unique Cable Problems

In multiconductor cables, all sorts of problems can occur when a cable is first made or when a connector is installed or replaced. A wire can be accidentally connected to the wrong pin. This will certainly create a problem when the cable is used. Yet the wire in the cable will test good.

Some of the common problems that can occur in twisted pair computer network cabling are shown here. There are four pairs: 1-2, 3-4, 5-6, and 7-8. The numbers refer to the pins on an RJ-45 connector.

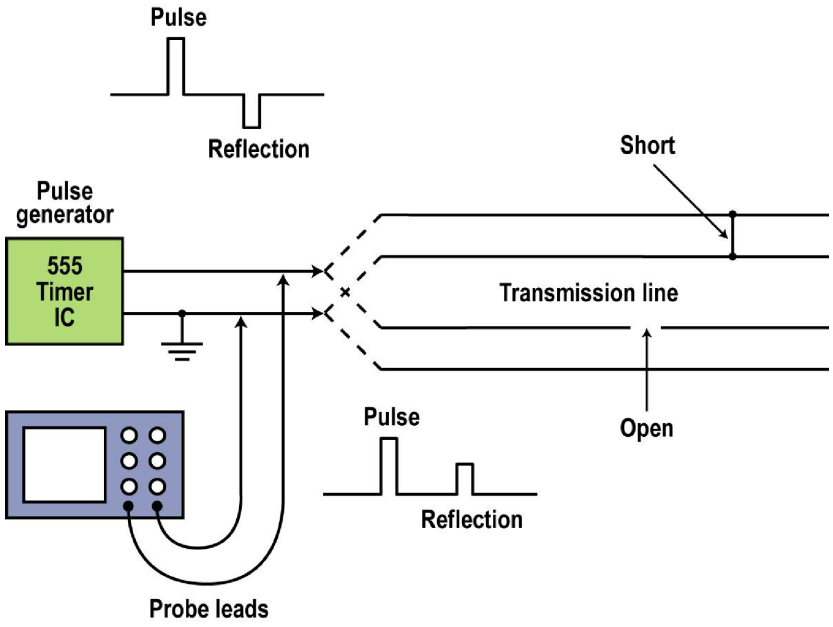


Cable Testers

To save time and cut troubleshooting costs, special cable testers have been developed. Factories that make up cables usually build their own cable testers. The connectors plug into a test panel where internal circuits check for proper connections and operation. A good cable usually is indicated by the presence of an “on” indicator light.

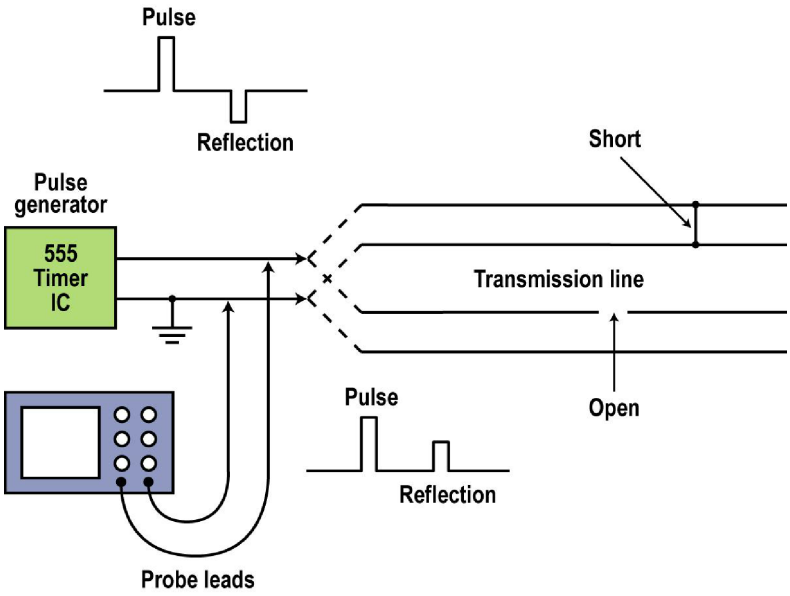
Special cable testing instruments are also available. Since computer network wiring is so widespread, a special CAT5/6 tester allows any such cable with its connectors to be quickly checked. Bad cables and problems such as broken pins or cross connected wires are identified.

Time Domain Reflectometry (TDR)



Some cable testers apply a narrow pulse from a signal generator to the cable and measure for reflections. These are called time domain reflectomerty (TDR) tests. This reveals problems with crushed or broken coax or twisted pair cable used as a transmission line.

Common Problems



The most common problems are open or shorted lines. The waveform shows the original pulse and its reflection from the fault back at the generator. Both shorted and open conditions are shown. Knowing the time interval between the pulse and its reflection can allow you to calculate the propagation delay for that cable and to actually locate precisely where the open or short is along the cable.

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Wiring and Cabling
Knowledge Probe 5

Troubleshooting Wire and Cables

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