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Probe Choice Can Make the Difference in Effective Testing

Our thanks to Pomona Electronics for allowing us to reprint the following article.

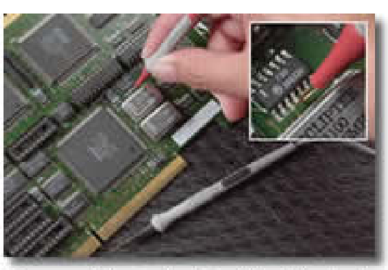
Testing and diagnosis of components and systems in computer systems presents quite a few special challenges. Sometimes it can be very difficult to make contact with the exact point that you need. High density, multi-layer circuit boards and closely spaced components with fine pitch leads makes probing with a voltmeter difficult and sometimes even dangerous. One slip while the system is running can mean a catastrophic short. The goal is to find and fix the problem, without causing any more damage.

There are many possible solutions to this dilemma. Let's take a look at some of the options that are available for probing on board mounted devices and components.

Single point probes

The single point probe is the most common and obvious probing option. Most digital multi-meters (DMMs) are supplied with a set of test leads that are quite useful for a wide variety of testing situations. This type of probe will do quite well for checking the voltage of a power supply or checking a back-up battery. However, most of these probes are going to be too large to be used with confidence on a high-density board. They can easily slip and damage other components or cause a short. The tips on most of these DMM probes are usually about .080" diameter and have a fairly blunt point. Combine that with the rounding off of the tip that results from normal wear and tear, and you have a nearly impossible situation. These tips can be sharpened, but without the outer plating, the underlying base metal tends to tarnish quickly.

Sharp Probe Tips

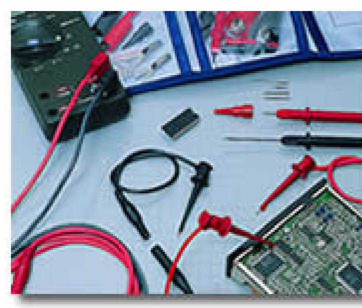


Pomona Electronics' Precision Electronic Probe features a pogo pin style tip of only 0.018" diameter for probing extremely fine pitch IC leads found in TSSOP and SSOP packages and densely populated circuit boards.

The best way to get at small contact points on high-density boards is by using a very sharp probe tip. While sharp tips do have a tendency to be damaged easily, the tip can usually be re-sharpened since there is no plating. Several manufactures make probes with sharp pointed tips that can be easily replaced. Sharp pointed stainless steel points start out at .080" diameter and taper to a very sharp tip. Another type of probe tip starts out with .040" diameter stainless steel wire and is gradually tapered to a long and very sharp tip. This type of tip is also very handy for getting into small places, and with the sharp point, it will be less likely to slip off.

A probe with a tip that can be extended and retracted is another handy multi-purpose tool. These probes have a fine diameter (.040") stainless steel wire and usually have an insulator covering over all but the very end of the probe to prevent accidental contact. With a tip like this, you can extend the reach of your probe up to 3 inches. In addition to being able to get at those hard-to-reach test points, the long slender tip improves visibility of the point that you are trying to reach.

Stainless steel is a fine material for making sharp points, but is a poor choice for an electrical conductor. In addition, after repeated sharpening, the tip may be worn away to such an extent that it may become too short to probe into small places. Of course it can be replaced with a new tip, but that still doesn't address the problem of the inherent resistance of stainless steel. There is a solution for this problem. The Precision Electronic Probe (See fig. 1) uses standard Automated Test Equipment (ATE) probes commonly referred to as "pogo pins," for its probe tip. This probe is available from Pomona Electronics and Hewlett Packard. These pogo pins come in a wide variety of configurations and are readily available. In fact, many users might find that their own production test areas use these pins. Not only does this probe feature the replaceable tip, it is also small enough to get into much tighter places than a full-size probe.



Typical accessories for convenient probing include replaceable tip probes, Minigrabber® and Minipincer® test clips and probe tip adapters.

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Hooks and Pincers

In some cases, the requirement is for a connection that can be left in place. If the test point is accessible, your best option might be to use a hook or pincer clip. These clips are available from a variety of sources in several different sizes. Some of the earlier clips were designed to fit onto bus wires or hook-up wire. These hooks now seem quite large compared to the tiny components found in today's computer systems.

Several companies now offer IC test clips with miniature hooks and pincer wires that are fine enough to fit onto some of the tiniest component leads. These hook test clips can attach to leads on a QFP package with .3mm lead pitch. They can even be stacked side-by-side with as many as five or six clips on adjacent leads of a .5mm chip leads. As long as you do not need to attach to more than a few leads at a time, these clips may be the perfect answer to your probing needs.

IC Test Clips

IC test clips are the ideal solution for probing dozens of leads on an IC chip. They also work very well for finding that one chip lead among many. When there are so many you can easily lose count part way down the side of the chip. With an IC test clip, you can reliably connect your probes to as many chip leads that you need to access without damaging the chip. IC clips are available for most chip formats from Dual In Line package (DIP) through Quad FlatPack (QFP).

IC Test Clips are the ideal solution for probing dozens of leads on an IC chip and allow reliable connection without damaging the chip.

The IC clip solves a number of other problems as well. What if you need to connect to all of the leads coming out of a QFP chip? Of course, you could solder a short pigtail to each chip lead and then connect to these with the small hook clips discussed above. That might work, but soldering those tiny wires to the chip would take most of your day. Furthermore, how do you explain the new growth of hair on microprocessor? So, how do you connect to the chip? The answer is an IC test clip. There is an IC clip for most popular IC chip formats. These test clips fit over the top of the chip and there is a contact point for each chip lead. The clip also has a set of numbered contact pins that allow mass connection to a logic analyzer or an oscilloscope.

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The Truth About Test Leads

Most of us pay little attention to the leads that we use until it's too late. So what do we need to know about test leads and probes? The most important elements are safety issues, materials, and the level of accuracy required. For example, safety is often overlooked. If your work is limited to electronic circuits below 30 Volts, then the design of the leads is really not a safety issue. But if you need to use the leads at higher voltages or close to distribution circuits, you should use leads that have the proper markings and ratings for situation.

The materials used in the construction of the leads can affect your readings. If you are trying to measure a very low voltage, say in the microVolt range, or very low resistance, dissimilar metals that are used in the manufacture of the leads can introduce errors that will be very difficult to trace. The contact between dissimilar metals can act just like a thermocouple and generate their own voltage. There are specially designed test leads for low voltage measurements that will minimize the errors induced by minor temperature differences along the measurement path. These leads are a little more expensive, but they will give you accurate voltage and resistance measurements into six decimal places.

In most common circumstances, the physical condition of the leads that you are using is probably the most important issue that will affect your measurements. Loose connections and corroded plugs or probe tips can cause intermittent or faulty readings. The easiest cure is to replace the leads as soon as it looks like there may be a problem. You can never tell when you will need to make a critical measurement. The price of a set of leads is small compared to the cost of inaccurate data.

Doing the best job we can in the shortest amount of time possible is the optimum goal for almost anyone. Choosing the best probe to perform the test job at hand can make a big difference in the quality of the test and the time it takes to complete the test.

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