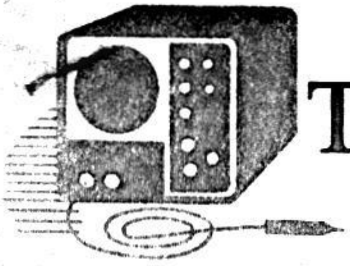


Test Equipment Scene

By Leslie Solomon

USING YOUR VTVM OR VOM

THIS may sound a bit trite, but there are some electronic devices that we use so often and so easily that we are inclined to take them for granted—not always realizing their intricacies and overall characteristics. We are thinking specifically here of the VTVM or VOM—that ubiquitous instrument that every technician has on his workbench and which he uses constantly without giving much thought to its actual operation. Let's remedy the situation, then, by taking a closer look at how and why we use this valuable meter.

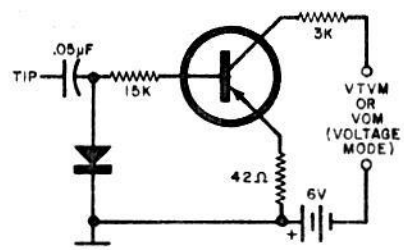
First, consider its accuracy. Have you ever noticed that your meter is not as accurate on ac as it is on dc? For example, a meter with 3% accuracy (full scale) on dc may be only 5% accurate on ac. The discrepancy results from the fact that the meter is basically a dc device and in measuring ac, some form of rectification must be used. As the rectifier ages, inaccuracy creeps in.

Other inaccuracies can come from overloading situations where precision attenuator resistors get enough of a "jolt" to affect their values. Division ratios are thus thrown off so that incorrect readings are obtained. In the case of an ac overload, the meter rectifier can be affected, reducing its accuracy. Severe overloads can also bend the needle so that the entire scale is thrown off.

If you do any degaussing of color TV receivers, keep in mind that the degaussing that wipes out stray magnetic fields on the TV can also affect the magnet in a meter movement, permanently.

Some meter "windows" are made of plastic that may maintain a static charge which causes the slender needle to assume all kinds of wrong positions. This charge is easily built up when the window is cleaned with a dry cloth. If you find that this situation exists, try one of the anti-static sprays that are now available.

Some Different Uses. There are many uses for the VTVM that are not always employed to advantage. For example, when using an r-f signal generator to align a tuned circuit, don't forget that the generator may not have a flat output over the entire range of interest. Thus, the generated curve may be drastically wrong. Before suspecting the circuit under test, check the generator using the circuit shown at (A). This simple probe and

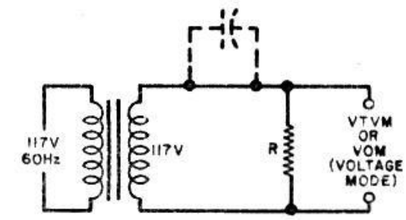


(A)

Probe and VTVM circuit is used to check r-f generators.

VTVM arrangement (measuring current) is connected to the r-f generator, which is then tuned across the desired spectrum. This will show whether the generator is really "flat." (This circuit can also be permanently wired to the r-f generator using a low-cost milliameter instead of the VTVM.)

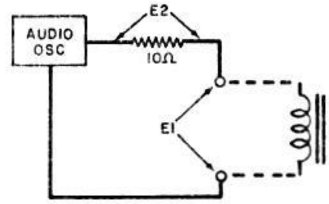
Here's another unusual use for your VTVM. Did you know it can double as a capacitance checker for odd-ball or unmarked capacitors? The circuit to use is shown at (B). The isolation transformer is a safety device. For capacitor values between 0.001 and 0.01 microfarads, the resistor is not necessary. Use the 10-volt ac range on the meter. Calibrate the meter scale by checking a number of known capacitances. For capacitances between 0.01 and 0.1 microfarads, use a 2960-ohm resistor and calibrate the meter for various known values. This odd resistance value can be obtained either by connecting a number of resistors in series and parallel or by "filing up" a 2700-ohm carbon resistor. For capacitor values between 0.1 and 1 microfarad, use a 231-ohm resistor. Here again, you can connect resistors together or use a file on a 220-ohm carbon unit. If you get the resistance values close enough, you will find a linear relationship between the capacitor value and the meter scale.



(B)

Using a VTVM or VOM to check values of unknown capacitors.

A VTVM can also be used to determine the impedance of an inductor. Using the circuit shown at (C), all you need is an audio oscillator that covers the frequencies of interest and a 1%, 10-ohm resistor. Connect the unknown inductor as shown and set the oscillator to the desired frequency. Carefully measure and record voltages E1 and E2. The impedance is then equal to E1/0.1E2. You can now determine the impedance of almost any inductor, anywhere in the range of your oscillator.



(C)

An audio oscillator is used to check inductor impedance

The same setup can be used to determine the turns ratio of a transformer. Connect the audio oscillator to the primary of the transformer using a frequency of about 1 kHz for an audio transformer, 60 Hz for a power transformer, and about 5 kHz for a TV flyback. Measure the ac voltage across the primary. Then measure the voltage across the secondary. The turns ratio is the same as the voltage ratio of the two windings.

Power Monitor. If you don't have a power consumption monitor, you can make one easily by using a 1-ohm high-power resistor (which can be made of the resistance wire from an old toaster) and your VTVM. Connect the resistor in series with the power line supplying the unit being tested and measure the ac voltage across the resistor. Since the resistor is 1 ohm, 1 ampere of current will produce a 1-volt reading on the meter. Multiply the current by the line voltage to determine the power. The value should be the same as that shown on the manufacturer's nameplate.

Many technicians, though they invariably use a VTVM to measure dc voltage levels, never think to use the ac voltmeter function to measure the amount of ripple on a dc line. After all, ripple is ac, so why not measure it? This is a good way to check a rectifier filter system.

To check the audio-frequency range of your ac meter, use the circuit shown at (A) with the VTVM connected directly across the oscillator output. Keeping the oscillator output at some fixed level, gradually sweep from the lowest audio frequency to the highest available at the generator. If you record the VTVM voltage versus frequency, you will be able to plot the frequency response of the ac mode of your VTVM. This comes in hand in performing voltage measurements on audio systems.

Semiconductor Checks. Some people like to use a VTVM to check the front-to-back ratio of a semiconductor diode to see if it is good. It usually comes as a surprise to them to find that the diode shows different resistance values on different ranges of the resistance portion of the meter. This is easily understood if you remember that a semiconductor diode is a nonlinear device and the actual dc resistance depends on the amount of dc voltage applied. Since different voltages are used in the various resistance ranges (in most meters), different resistances give different readings on the scales. To obtain the front-to-back ratio, divide the larger resistance by the smaller. The most useful check is to compare the resistances with a known good diode of similar type (silicon or germanium).

Adding It Up. We hope these examples have shown that even the most common type of bench test equipment can be put to unusual and valuable service—often in areas where you would not ordinarily expect to use it. Keep in mind that there are many low-cost paper-back books on sale at local electronics distributers covering just about every piece of test equipment you may have. These basic books contain a wealth of odd bits of information that may enable you, in effect, to double the value of your test equipment. You will also find you can make tests that would otherwise be impossible without a new piece of equipment or tests that you had never even though of.

Get yourself a couple of precision resistors (1% is fine), and a new battery (not to be used in any projects), and use these as "standard" any time you suspect your meter has undergone any excessive abuse. It only takes a moment to check. ◈