

UNUSUAL FEATURES OF THE 8060A DMM AND THEIR APPLICATIONS

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The 8060A (and in some cases, the 8062A) has a number of less apparent features either incorporated in the software, or designed into the front end circuitry. Some of these features can prove highly useful in particular applications and in many cases are things that can't be done with any other handheld DMM. Many of the features and applications presented are touched on in the 8060A and 8062A manual, but will be expanded on here.

Extended Frequency Range

The 8060A's frequency counter will read above 200 kHz if this range is enabled during powerup. This range is not normally available because the sensitivity decreases quite rapidly above 200 kHz. It is usually necessary to use the 200 mV AC range in overload in order to have enough signal to count. The sensitivity that can be expected is graphed in the specification section of the manual. The absolute maximum frequency that the 8060A will count without error is 787.0 kHz.

To enable the extended frequency range:

1. Turn the 8060A off.
2. While holding down the Hz button, turn the unit back on.
3. When the meter displays ".8.8.8.8" release the Hz button.

Now whenever the "Hz" function is selected, the meter will autorange past 200 kHz. Resolution is 100 Hz in the highest range. To disable the extended range, turn the meter off, then on again.

Many new switching power supplies are being designed with higher frequencies. Some 200 kHz supplies are already on the market. The extended frequency range will cover the switching frequencies of these new supplies and those likely to appear in the future.

High Impedance Mode

The loading error of a 10 megohm input impedance can be significant in many types of circuitry. Circuits with source impedances of 10 kohms or greater are common. The voltage measurement error with a DMM having a 10 megohm input impedance in a circuit having a 10 kohm source impedance would be approximately .1%. With the 8060A, which has a .04% basic DC accuracy, the loading error clearly dominates. By using the 8060A/62A high impedance mode, with a typical input impedance of 80,000 megohms, the loading error is effectively eliminated.

The high impedance mode is selected by popping all three of the function switches out. Only two ranges are available, 200 mV and 2 V. Accuracy is degraded .01% for a total accuracy of .05%. The accuracy loss is due to a

out in the normal 10 megohm volts mode. Therefore the high impedance mode readings are skewed high by a factor of .01%.

Consider the circuit of figure 1. The JFET amplifier has a gate bias established by R1 and R2. If a 10 megohm input impedance DMM is used to measure the gate voltage, the error caused by the parallel resistance of the DMM and R2 will exceed 10% (10 megohm // 1 megohm). By switching to the high impedance mode, the error due to loading will be virtually eliminated (80,000 megohms // 1 megohm).

The high impedance mode can be used with an external resistor acting as a shunt to measure extremely low DC currents. Referring to figure 2, by placing a 100 megohm resistor across the volts input, an 8060A/62A will read up to 2 nanoamps with 100 femtoamp resolution. Any value of resistor can be used depending on the desired current resolution. As the resistor value gets higher, careful attention will have to be paid to shielding to avoid hum and noise pickup. 100 megohms should be considered as a maximum value to avoid extraordinary shielding. In order to keep the burden voltage low, it is recommended that the 200 mV range is used in this application.

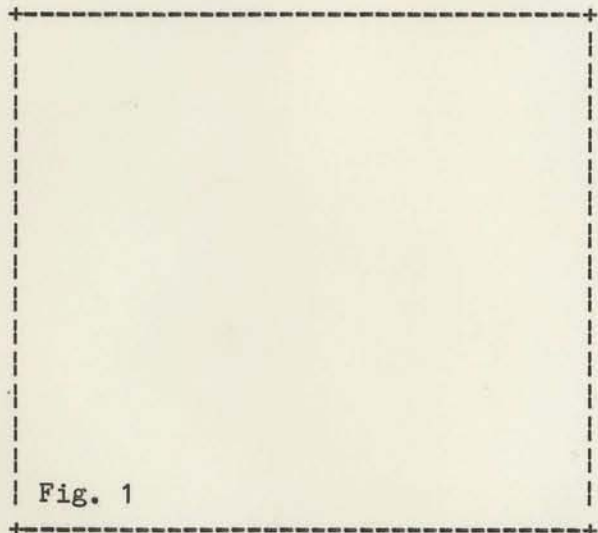


Fig. 1

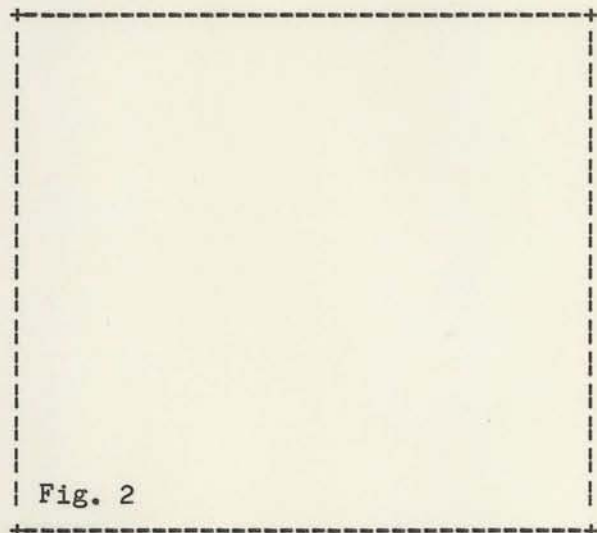


Fig. 2

Measurement errors of a low current DC ammeter constructed this way are:

1. The tolerance of the resistor.
2. The accuracy of the meter in the high impedance mode...8060A (.05% + 2 counts) or 8062A (.06% + 2 counts).
3. The input bias current/leakage of the 8060A/62A.
4. Hum and noise

Error source number three can be eliminated with the use of the REL button. Place the shunt resistor (if it is greater than 1 megohm, it will need to be shielded) across the input terminals. Allow the 8060A/62A display to settle. Push the REL button to eliminate the DMM bias current as an error source.

Autoranging Kohms

The autoranging kohms function can be very handy in troubleshooting. It

provides the technician the capability to read from .1 ohms to 300 kohms without having to switch the range. This range of resistance covers 90% of the typical values found in modern electronics equipment.

The auto kohms range is accessed by pushing the 200 ohm range and megohms range simultaneously (ohms function selected).

Autoranging is much faster than typical autoranging ohmmeters. A resistance step from 0 ohms to 290 kohms takes less than 1 second to settle. Resolution decreases at the range points of 2 kohms and 20 kohms and again at 100 kohms (see section on resolution restoration above), however, in the servicing environment, high resolution readings are rarely required.

Resistance measurements are made "hi power" and therefore some care must be taken when measuring resistance in-circuit. Diodes and transistors can start conducting and cause a measurement error. One way to avoid this problem is to reverse the leads so that the semiconductor junction is reverse biased. For those who are used to using a high power 2 kohms range such as found on Fluke's 8020, 8010, and 8050 series meters, the 8060 provides a versatile substitute while in the auto kohms range. Note: For lo power, higher accuracy, higher resolution (above 2 kohms), resistance readings, the 8060A/62A normal resistance ranges are preferred.

Resolution Restoration --- dB, Megohms, and Autoranging kohms

The 8060A loses resolution in the dB function as the linear counts (the actual number on the display in volts mode) decrease. Below 1024 counts, the dB resolution drops from .01 dB to .1 dB, and below 128 counts, the resolution drops from .1 dB to 1 dB. This is done to prevent the dB reading from skipping any counts. The apparent resolution can be restored to .01 dB with the following procedure:

1. Turn the instrument off.
2. While holding down the dB button, turn the instrument on.
3. As soon as the display is reading .8.8.8.8, release the dB button.

Now when the dB function is activated, the display will always show two digits right of the decimal point (.01 dB). As the linear count decreases, more and more counts will skip. Near the usual drop off point of 1024 counts, resolution will stay fully .01 dB with no skips until about 900 counts are reached. dB resolution is enhanced over the usual display as long as it is realized that there will be skips in the displayed number that will get larger as the linear counts go down.

The same procedure can be followed to restore .1 megohm resolution to the megohms range above 100 megohms, and .1 kohm resolution to the autoranging kohms range above 100 kohms. The skipping of counts increases as the reading goes up.

To return to the normal resolution mode, turn the power off then on again.

2000 Microsiemens Range

The 8060A can provide a 2000 microsiemens range which can be useful for

lower value inverse resistance devices such as photoresistors. This range is an inverse resistance range with full scale equaling 500 ohms and 1 count equal to 10 megohms.

To access the 2000 uS range, select the 2000 nS range while at the same time pushing in the 200 ohm range button (three range buttons down simultaneously).

This range can be used with the transistor beta tester described in the 8020 series manuals, but will give a different result due to a lower V_{CE} level (appx 1 volt). Readings will be valid for matching purposes and in conjunction with the REL feature, transistors can be matched very efficiently.