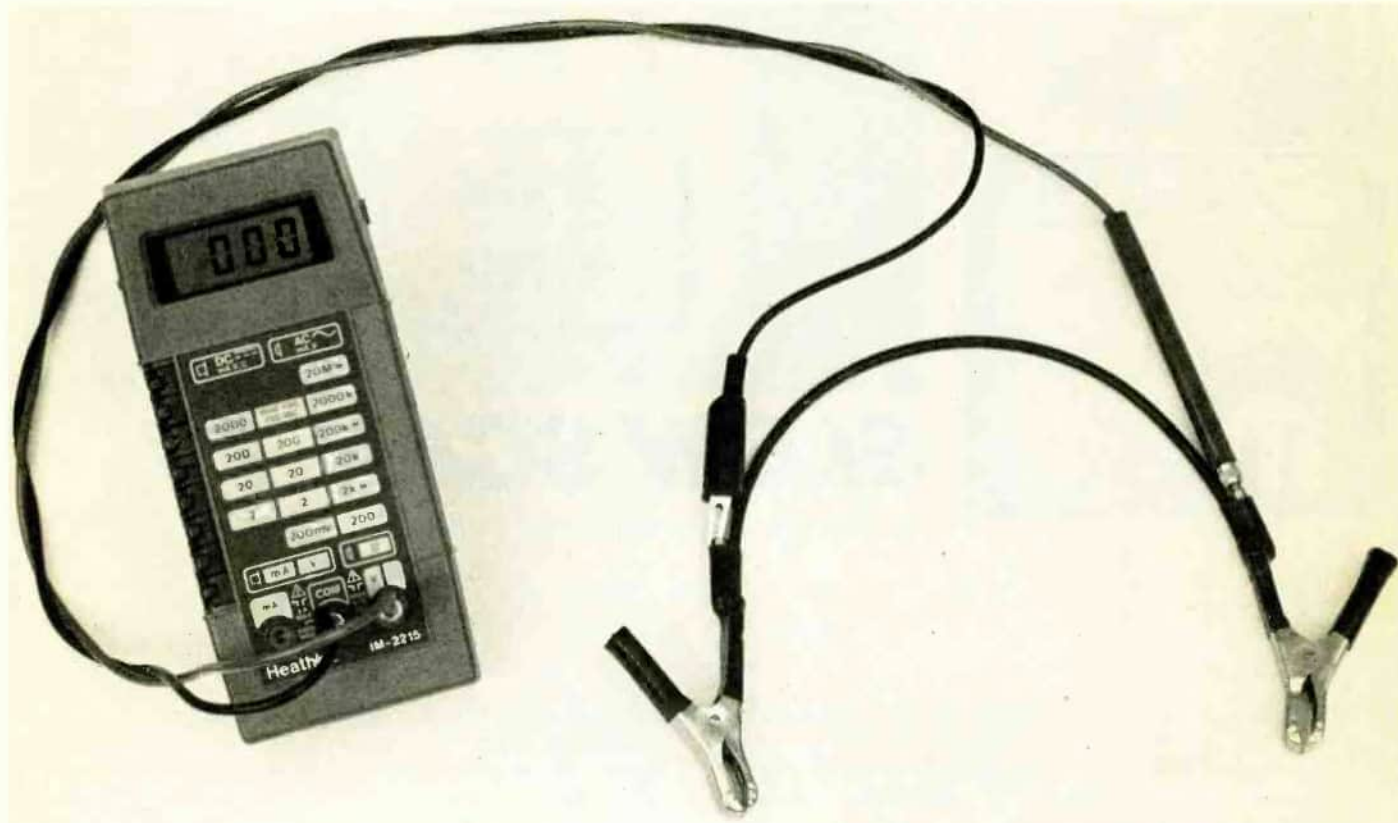


TROUBLESHOOTING WITH A DIGITAL MULTIMETER

Check out your ignition system for fun and profit



IF YOU WANT to measure the large current from your car's alternator or starter, here are a few tricks on how to do it with your digital multimeter.

Digital multimeters (DMM) are sensitive and accurate devices. They have a much greater range than common analog multimeters; with a little help, they can measure very large currents. The help is from a low resistance shunt.

A Small Resistance. A one milliohm shunt is a very small resistance, but it still behaves as a resistor and every ampere through it causes a one millivolt drop. Digital voltmeters can read millivolts and most will read and display tenths of millivolts. This extreme voltage sensitivity allows them to work as ammeters when connected across a one milliohm shunt.

A DMM connected across the ground cable thus becomes a high-current ammeter. Similarly, a charging current of 40 amps into the battery produces a voltage drop of .040 volts across the cable.

The key is to calibrate your battery cable. It's easy. Most car low beams,

including the running lights, use about 12 amperes. With the headlights on, measure the voltage drop across the ground cable. Suppose this turns out to be .020 volts.

Therefore, a starter draw of .192 volts across the cable means that $12 \div .020$ or .6 of 192 amperes are flowing: about 120 amperes. Approximately .6 of the millivolts read on a DMM are the amperes through it.

If the 12 ampere headlight had caused a .005 volt drop across the cable, $12 \div .005$ or 2.2 times the DMM reading of millivolts across the cable represents the amperes through it.

Needs A Strong Battery. This calibration is best done with a strong battery. Check the cable on the positive terminal, running to the solenoid. It might be more convenient to use.

If you do not like the mental arithmetic involved in converting millivolts into amperes, connect taps to the battery cable to produce a 12 millivolt drop when the low beams are on.

Puncture the cable insulation with a sharp pin. Place the tap in the middle

of the region of the cable where the voltmeter reads 12 millivolts.

The taps are combination jacks accepting probe tips, banana plugs, or alligator clips (GC F2-883 or Allied 920-0222). Make the electrical connection with a small sheet metal screw, #4, $\frac{1}{4}$ " long. It will separate the strands of wire in the cable and be held snug to the taps.

Tape it securely. This is a more satisfactory way to measure all currents in the car, even down to tenths of amperes for small lights or electronic systems, provided your DMM reads to tenths of millivolts.

Even a 20% error is acceptable when looking for trouble and will tell the difference between a shorted starter motor and a solenoid that isn't closing.

A third way to read currents in your car with a DMM is to build or buy a one milliohm shunt that can be clamped in between the battery ground cable and the negative terminal.

With this value of shunt the millivolts on the DMM connected to the shunt read accurately as amperes. ■