

USING ELECTRONIC METERS FOR YOUR TRACK CAR

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I recently read an article about installing an alternator in an M-19, that was very interesting and helpful. My ex Pittsburgh & Lake Erie R.R. M-19 #299 received this addition also last fall, in time for my rail car trip to "Almost Heaven", West Virginia.

After all my mechanical work (hammering, bending and painting) was completed on the #299, I wanted to check the output of my junk yard alternator, to see if it was working properly. If you want to do the same thing, a good meter will be required. This tool can be used for many jobs around the home as well as in the motor car shed. If you have little or no experience using meters, now is the time to start.

The first step is selecting the right type of meter for the job. A low cost meter is better than a test light, even though they have limited range and accuracy. Remember, you get what you pay for. There are two types of meters, analog and digital. The analog has a needle to indicate the reading and the digital has a series of three or four numbers that appear in the window. The analog has been the old reliable workhorse, since Thomas Edison first invented utility bills. Most early models were used for only one type of measurement, and had only one range, such as 0-15 volts DC. To measure current flow (amperage) a different meter would be used. To measure resistance an additional meter would be used. To cut costs and make meters easier to handle, several ranges were combined into one, and became known as the multi-meter.

Advantages of the multi-meter are lower cost, and the ability to check everything in the circuit. Ignition timing can also be checked. Meters today have many ranges, so that voltages, amperes, and ohms can be read by setting the switch to the correct position. An analog meter will usually have three or four DC volt ranges, 0-1.5 volts, 0-15 volts and 0-150 volts. The same number of AC volt ranges, current (amperage) ranges, and resistance (amperage) ranges are also provided.

The reason for so many ranges is that the most accurate reading is available when the needle is between 1/4 and 3/4 of the range being used on analog meters. If you want to check your battery in the track car, select the 0-15 volt DC range. This would be much more accurate than using the 0-150 volt range.

New technology has given us the digital style meter. Some of the advantages of the digital include accuracy, readability, and ruggedness. The model that you choose should be easy to read and have a durable case. The test leads should fit tight in the meter jacks, and the probes should have a rib near the tip to prevent fingers from slipping off the end of the probe handles and onto the metal tip. This safety feature is found on all good probes. A set of insulated alligator clips that fit on the probes is also very handy. If you already have a good set of small jumper wires, they will help too. If not, you will need at least one piece of #14 gauge stranded wire, with an insulated alligator clip on each end. Select a meter that has good leads and a durable case. I still have an old Radio Shack basic meter that works well after 15 years. New digital meters can be purchased that measure current with a clamp that goes around the wire, it isn't necessary to open the circuit to put the meter in series with the wire. More on current and resistance readings later.

Some of you might wonder precisely what makes voltage different than amperage. Voltage is a unit of electrical *pressure*; the more voltage, the greater the pressure to "push" current (amperage). Direct current (DC) voltage is produced by batteries and generators. Alternating current (AC) voltage is generated by most power plants, to be used in homes and industry; it is also produced by automotive style alternators which have built-in diodes to produce DC.

Amperage is a unit or "amount" of electricity that flows in a wire, bulb, coil, or motor. For example,

the small bulbs in a track car marker light use about 1 ampere (usually called *amp*). Resistance (ohms) is what limits the current in a circuit. For example, many old style ignition circuits have a resistor in them to reduce the current (amps) going through the points. This, along with the capacitor (in the past called a condenser) gives the points longer life.

Here's a safety tip, when using the meter...most voltages on track cars are 12 volts or less, except for the spark voltage, which can be quite high. Even the 12 volts though can be dangerous, due to the high amperage of storage batteries. Get in the habit of connecting the meter leads or jumpers by holding the insulated parts only.

Here's an exercise that you can try with your new meter (or one borrowed from the electrician in your neighborhood). To find out if your track car battery is properly charged, (1.) select the proper scale, 0-15 volts DC for most analog meters, or 0-20 volts DC for most digital models. (2.) Find the positive and negative battery cables and connect the meter leads, using the alligator clips (usually supplied with the meter) or jumpers. Since the battery is always "on", use caution, and connect only one lead at a time. (3.) Read the meter; a 6-volt battery should read 6.6 volts when fully charged. A 12-volt battery should read 13.2 volts when fully charged, and the maintenance-free batteries should read slightly higher...about 13.4 volts.

If your readings are lower than this, check your connections to be sure that you are connected to a clean spot on the battery cable. If you find corroded terminals, they should be taken apart, cleaned, then reassembled. A bad connection between the battery and the cables will prevent the battery from getting a full charge. This will cause hard starting, and possible damage to the alternator. After correcting any problems, check the voltage again. If it is still low, (11-12 volt range for a 12-volt battery) it will need additional charging. If your engine has a charging system, start the engine and watch the meter (*be sure the leads are not near any moving parts and the meter is secured!*). When the engine speed is increased, the voltage should increase to 14-16 volts, depending on your charging system. If there is no increase in voltage, the charging system isn't working. In some cases, there will be a slight increase, but it won't be enough to fully charge the battery. This could mean that you have a bad regulator or open diodes in an alternator, or a dirty commutator or bad brushes in a generator. Alternators also have brushes or slip rings that can wear out.

This is just one example of what a meter can do for you , no more guess work..