

Analog Multimeter

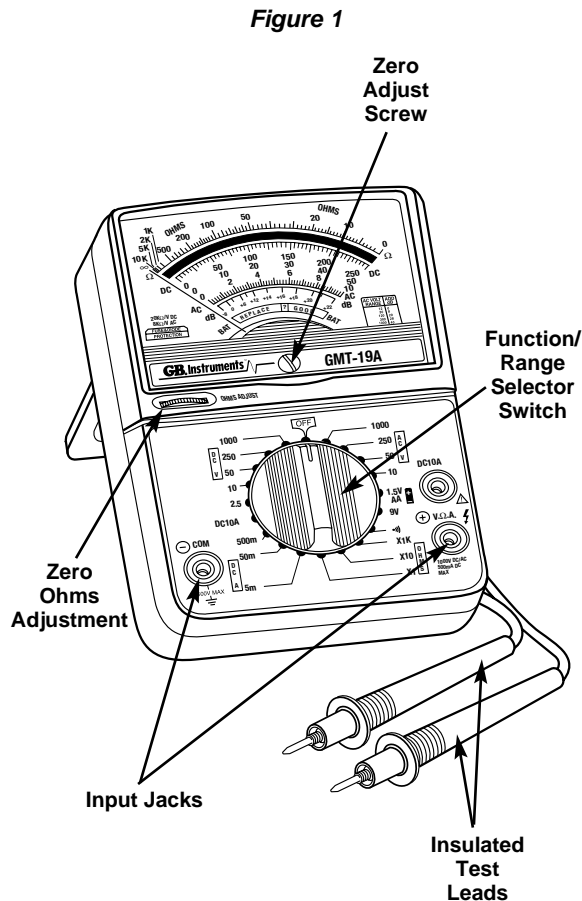
Owners Manual Model

- Read this owners manual thoroughly before use and save.

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1.0 Meter Functions



2.0 Specifications

Ranges:	19 measuring ranges
DC Voltage:	2.5-10-50-250-1000 Volts
AC Voltage:	10-50-250-1000 Volts
DC Current	5-50-500 milliAmps (fused) 10 amps on a separate jack (unfused)
Resistance (ohms)	Rx1 (resistance indicated multiplied by 1) Rx10 (resistance indicated multiplied by 10) Rx1K (resistance indicated multiplied by 1000) 10 Megohm Max
Continuity Buzzer:	For audible continuity checks. Buzzer sounds at less than 100 ohms.
Decibels:	-8dB to +22dB on AC voltage ranges
Accuracy:	DC voltage, Amps = 4% full scale of range AC voltage = 5% full scale of range Resistance = 4% full scale of range
Battery Test:	1.5 volt and 9 volt batteries
Sensitivity:	20,000 ohms per volt DC and 8000 ohms per volt AC
Operating Temperature:	64°F – 77°F (18°C – 25°C)
Function/Range Switch:	6 Functions 20 Positions 19 Measuring ranges
Zero Ohms Adjustment Dial:	Located on the front left side of the housing. Adjustment dial is used to zero the needle indicator on the ohms scale while shorting the test leads together.
Mechanical Zero Adjustment Screw:	Located directly below the center of the scale, used to align needle on the zero settings for accurate readings.
Mirrored Scale Plate:	The mirror on the scale plate is used to line up the needle with its reflection to improve the reading accuracy by preventing parallax error.
Recessed Input Jacks:	Negative (-) input jack for black test lead, positive (+) input jack for red test lead. Separate jack for 10 Amp range.





Important:

Read this operators manual thoroughly before using this multimeter. This manual is intended to provide basic information regarding this multimeter and to describe common test procedures which can be made with this unit. Many types of appliance, machinery and other electrical circuit measurements are not addressed in this manual and should be handled by experienced service technicians.



WARNING! Use extreme caution when using this multimeter. Improper use of this tester can result in severe damage to property, severe personal injury or death. Follow all instructions and suggestions in this operators manual as well as observing normal electrical safety precautions. Do not use this multimeter if you are unfamiliar with electrical circuits and proper test procedures.

2.1 For Your Safety

-  **WARNING!** Use extreme caution when checking electrical circuits.
-  **WARNING!** Do not stand in wet or damp work areas when working with electricity. Wear rubber soled boots or shoes.
-  **WARNING!** Do not apply more voltage or current than the set range of the multimeter will allow.
- Do not touch the metal probes of the test leads when making a measurement.
- Replace worn test leads. Do not use test leads with broken or tattered insulation.
- Discharge a capacitor before measuring it.
- Remove the test leads from the circuit being measured as soon as the test is completed.
-  **WARNING!** Do not measure voltage when the function/range switch is set on the resistance (ohms) or the current (mA) settings. Never measure current when the tester is set on the resistance range. Never measure AC voltage when the tester is set on DC voltage or DCmA/A. Setting the tester on the incorrect function may burn out some of the internal circuitry and may pose a safety hazard.

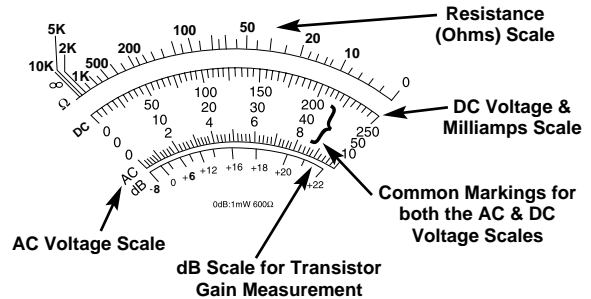
3.0 Operating Suggestions

- 1) Set the function/range switch to the proper position before making a measurement. When the voltage or current is not known, it **MUST** be determined that the capacity of the selected range will handle the amount of voltage or current in the circuit (see #3 under "For Your Safety"). Always start with the highest range in the function. If the voltage applied falls within the range of a lower setting, reset the function/range switch to the appropriate setting for greatest accuracy of reading.
- 2) Avoid placing the tester in areas where vibration, dust or dirt are present. Do not store the tester in excessively hot, humid or damp places. This tester is a sensitive measuring device and should be treated with the same regard as other electrical and electronic devices.
- 3) Using the tester in areas with high magnetic fields can result in inaccurate readings. For greatest accuracy of reading, lay the tester on a flat, non-metallic surface.
- 4) When the tester is not in use, keep the function/range switch in the OFF position. This keeps the needle indicator from deflecting or "bouncing" excessively.
- 5) When disconnecting the test leads from the unit, always grasp the leads where the input jacks meet the tester housing. Never pull the leads out of the jacks by the insulated wire or transport the tester using the test leads as a carrying strap.
- 6) Never immerse the tester in water or solvents. To clean the housing use a damp cloth with a minimal amount of mild soap.
- 7) If the resistance (ohms) function of the tester is not going to be used for a week or more, remove the internal battery to avoid potential leaks that may damage the unit.

3.1 Preliminary Adjustments

Fully seat the test leads in the correct input jacks. If necessary, using a small flat tip screwdriver, slowly turn the mechanical zero adjustment screw clockwise or counter-clockwise until the needle indicator is directly over the three black zeros at the left end of the scale.

Reading the Scale

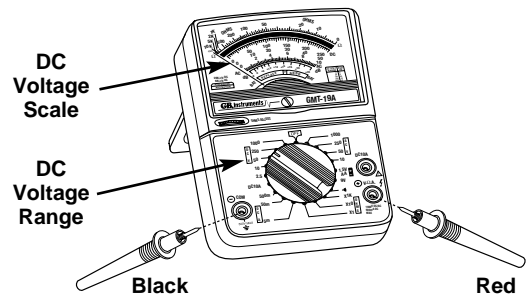


3.2 Check Condition of Internal Battery

Before making resistance or continuity tests, check the condition of the internal battery. First turn the function/range switch to the ohms Rx1 position. Short the test leads together and the needle indicator should deflect to the right side of the scale. Keep the test leads shorted together while simultaneously turning the zero ohms adjustment dial until the needle indicates zero at the right side of the ohms scale. If the needle will not zero, replace the batteries with two new 1.5 volt AA size batteries (see *Battery Replacement*).

4.0 DC Voltage Measurement

- 1) Fully seat the test leads in the correct input jacks, (-) black lead, (+) red lead.



- 2) Set the function/range switch to the appropriate DC voltage range. If the voltage is unknown, use the highest range. If the voltage applied falls within the range of a lower setting, reset the function/range switch to the appropriate setting for greatest accuracy of reading.
- 3) If the polarity of the circuit to be tested is known, touch the black test lead to the neutral side. If the polarity is unknown, touch the test leads to opposite sides of the circuit. If the needle indicator deflects to the left of the scale, reverse the test leads.

Use the chart below as a guide to reading DC voltage measurements:

DCV Range Setting	Read Following Scale	and Multiply Reading By:
2.5	0-250	Divide Reading by 100
50	0-50	1
250	0-250	1
1000	0-10	100

Common DC Measurements

4.1 Automotive Batteries

Set the function/range switch to 50 DCV. First check the quality of the battery terminal connector by touching the red (+) test lead to the connector while touching the black (-) test lead to any bare metal framework of the vehicle. The tester should read 12 volts or higher on the 0-50 scale with all of the vehicle accessories turned off. If the needle indicator moves sporadically, this indicates a bad terminal connection. Remove the terminal connectors and clean both terminals and connectors thoroughly. For improved conductivity and corrosion resistance, coat the terminals and connectors with

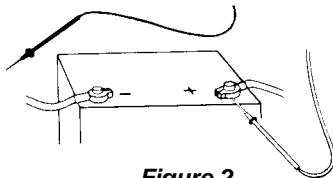


Figure 2

GB #OX-100 anti-oxidant compound (available at your local hardware store). Replace and tighten the terminal connectors. Secondly, if the terminals and connectors are making good contact, touch the test leads to the battery and vehicle framework as described above (see fig. 2). Note the reading of the tester. Get an assistant to turn on the headlights while the test leads are making contact. The needle indicator should drop a few volts. Should the needle indicator drop 5 volts or more, the battery should be charged or possibly replaced if the voltage drop is significant. The circuit may need to be checked further for problems within the electrical system that may be draining the battery.

4.2 Alternators and Generators

Set the function/range switch to the 50 DCV range. While the engine is idling at normal operating speed, touch the black (-) test lead to the metal framework of the vehicle, then touch the red (+) test lead to the output terminal connector. The alternator output cable is always the heaviest gauge cable attached to the alternator (see fig. 3). The needle indicator should read 12 volts or more. If the needle indicator moves sporadically, the cable may need to be tightened. If the engine is idling lower than is specified in the vehicle owners manual, the voltage reading will be lower. If the output voltage is significantly low, the alternator may require service or replacement.

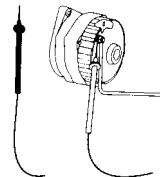


Figure 3



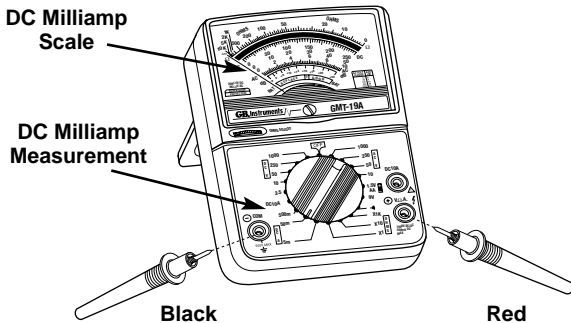
WARNING! When making automotive measurements, observe safety precautions. Stay away from the fan blades, belts and other moving parts of the engine. Keep the multimeter and its leads away from moving parts.

4.3 Household Batteries

Household batteries can be tested in either one of two ways. For a good/bad check, set the function/range switch to the 1.5V or 9V BAT setting depending on which type of battery is to be tested. Plug the red test lead into the jack marked “@V.Ω.A.”. Touch the red (+) lead to the (+) terminal of the battery and the black (-) lead to the (-) terminal of the battery. Read the BAT scale at the very bottom of the scale plate. The scale will indicate if the battery is good, questionable or should be replaced. To more accurately measure the voltage value of household batteries, set the function/range switch to 10 VDC and touch the leads to the battery as before. Read the 0-10 scale to determine the condition of the battery.

5.0 DC Milliamp Measurement

- 1) Fully seat the test leads in the correct input jacks.
- 2) Set the function/range switch to the appropriate DCmA setting.
- 3) Touch the test leads to the circuit in series (in line with the circuit) so that the circuit current passes through the multimeter in order to make the measurement. If the needle indicator deflects to the left, reverse the test leads. With a set range of 5mA, read the 0-50 scale and “drop” the zeros. With a set range of 500mA read the 0-250 scale and multiply the readings by 2.



Common DC Milliampage Measurements

It is important to point out that milliamps can also be expressed as thousandths of an Ampere. Therefore 500 milliamps is 500 thousandths of one Amp or $\frac{1}{2}$ of one Amp. The milliampage function of your multimeter is commonly used by electronics repair technicians and hobbyists to troubleshoot various low voltage circuits. Although not normally used for electrical troubleshooting around the home, this function can be used to measure the milliampage draw of household items such as flashlights and other battery operated devices that do not draw more than 500mA. In fig. 4, the red (+) test lead is hooked up to the (+) terminal of the lantern battery while the black (-) test lead is hooked up to the bulb. The tester will indicate the milliampage draw when the flashlight switch is thrown in the ON position.

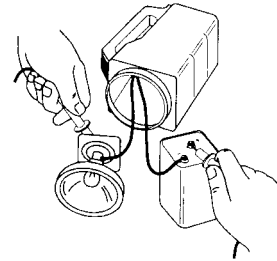


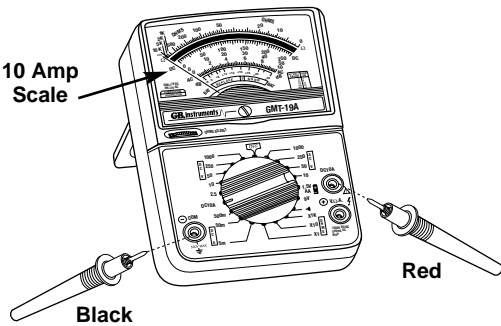
Figure 4



WARNING! Do not apply voltage to the test leads while the tester is set in the milliamp range. See #8 under *For Your Safety*.

DC 10Amp Measurement

A separate input jack is provided for measurement of DC current up to 10 Amps. This range is not fused so it is imperative that the circuit under test does not exceed 10 Amps. Additionally, this function is designed for intermittent use only. Maximum contact of the test leads with the circuit is 15 seconds, with a minimum intermission time of 30 seconds between tests. Set the function/range switch to the 10A range. Touch the test leads to the circuit in the same manner as instructed in DC MILLIAMPERAGE MEASUREMENT. Read the 0-10 scale.



6.0 AC Voltage Measurement

- 1) Fully seat the test leads in the correct input jacks.
- 2) Set the function/range switch to the appropriate AC voltage range. If the voltage is unknown, use the highest range. If the voltage applied falls within the range of a lower setting, reset the function/range switch to the appropriate setting for greatest accuracy of reading.
- 3) Touch the test leads to the circuit under test. With AC voltage, the polarity of the test leads is not a factor.

Use the following chart below as a guide to reading AC voltage measurements:

<u>ACV Range Setting</u>	<u>Read Following Scale</u>	<u>and Multiply Reading By:</u>
10	0-10	1
50	0-50	1
250	0-250	1
1000	0-10	100

Common AC Voltage Measurements

6.1 Wall Receptacles

If the receptacle is controlled by a switch, make sure the switch is ON. Set the function/range switch to 250 ACV. Touch the test leads to the "hot" and "neutral" slots of the receptacle (see fig. 5.) The needle indicator should read 120 VAC on the 0-250 scale. To test for proper grounding of the receptacle, touch one test lead to the "hot" (narrow) side of the receptacle, and the other test lead to the ground slot. The tester should read 120 VAC as before. To test for proper grounding of non-polarized receptacles (fig.6), alternately touch the test leads between the receptacle slots and the wall plate screw. The tester should indicate 120 VAC when one test lead contacts the "hot" side of the receptacle. If ground contact cannot be made on the wall plate screw, remove the wall plate and touch the electrical box with the test lead in the same manner as before. The tester should read 120 VAC with one test lead touching the electrical box and the other touching the live side of the receptacle. If not, the receptacle is not properly grounded.

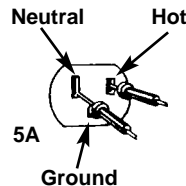
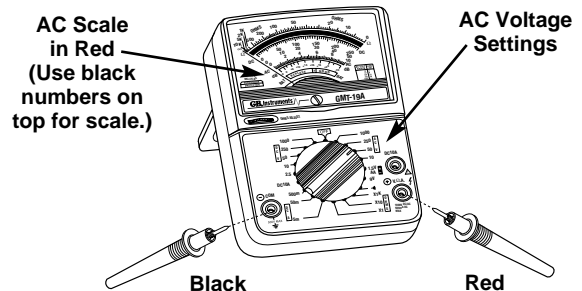


Figure 5

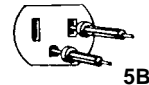
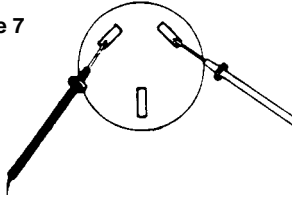


Figure 6

6.2 Appliance Receptacles

Set the function/range switch to 250 VAC. Touch the test leads to the receptacle slots. The tester should read 240 VAC between the two "hot" sides of the receptacle, and 120 VAC between the neutral slot and either of the two "hot" sides (see fig. 7).

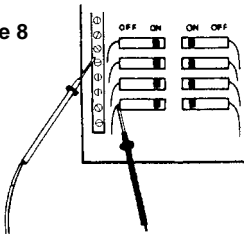
Figure 7



6.3 Circuit Breaker Panel

To test for defective circuit breakers, set the function/range switch to the 250 VAC or 600 VAC settings. Touch one test lead to the neutral (buss) terminal strip of the breaker panel and the other test lead to the terminal on the circuit breaker (see fig. 8). The tester should read 120 VAC on the 0-250 scale.

Figure 8



7.0 Resistance/Continuity Measurement

For resistance and circuit continuity testing with power OFF

- 1) Fully seat the test leads in the input jacks.
- 2) Set the function/range switch to the Rx1K position and short the test leads together. Using the zero ohms adjustment dial, slowly turn the dial until the needle indicator reads -0- ohms at the right end of the ohms

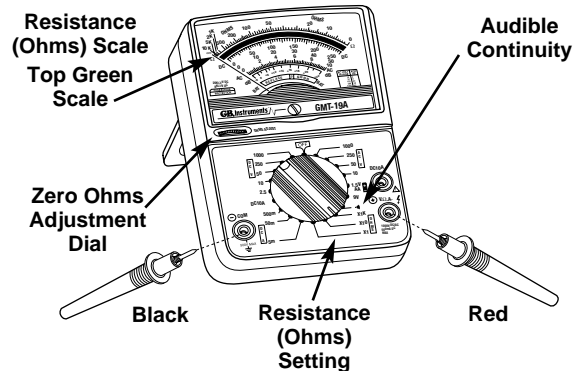
scale. If the needle will not zero, replace the internal batteries with two new 1.5 volt AA size batteries (see *Battery Replacement*).

- 3) Touch the test leads to the resistance or non-energized circuit to be measured. Measure the value of the reading on the ohms scale and multiply the reading by 1000. If you're making basic continuity tests, the needle indicator should move all the way to the right side of the ohms scale if continuity exists.

Note: When switching the unit back and forth from ohms to other functions, always zero the needle indicator before taking another reading. Failure to zero the needle before taking resistance/continuity measurements will result in inaccurate readings.

Continuity Buzzer Setting

For quick, audible continuity checks, turn the function/range switch to the ⏏ setting. If the circuit under test has a resistance of 100 ohms or less, the internal buzzer will sound when the test leads are touched to the circuit. This makes continuity checks quick and easy. Note: The needle indicator will not indicate resistance values when the tester is in the ⏏ mode. Do not operate the continuity buzzer continuously as this will discharge the internal batteries.



Common Resistance and Continuity Measurements

Continuity tests are probably the most frequently performed electrical troubleshooting procedures around the home.

ALWAYS REMEMBER THAT CONTINUITY CHECKS ARE TO BE MADE WITH THE POWER TO THE CIRCUIT TURNED OFF. Polarity of the test leads is not a factor in making continuity checks.

7.1 Extension Cords

Unplug the cord. Set the function/range switch to the Rx1K position. Touch one of the test leads to one of the metal prong ends of the cord, and insert the other test lead in either one of the receptacle slots on the other end of the cord, making sure the test lead is making good contact with the receptacle (see fig. 9). If the needle indicator does not move to -0- ohms, or if the continuity buzzer is being used and does not sound, insert the test lead into the other receptacle slot, again making sure of good contact. If the needle indicator does not move to -0- ohms, or if the continuity buzzer is being used and does not sound, the cord should be replaced.

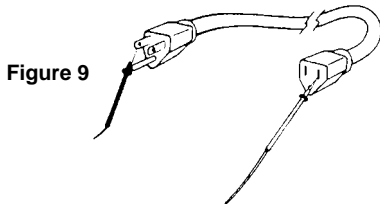


Figure 9

7.2 Appliance Cords

Unplug the appliance from its power source. Turn its power switch to the ON position. Touch the test leads to the metal prong ends of the cord. The tester should indicate a low resistance value. If not, flex the cord while the leads are still in contact with the metal prongs. If the needle indicator moves sporadically, or if the continuity buzzer does not sound, while the cord flexes, there may be a broken conductor in the cord. If the needle indicator does not move at all, or the buzzer does not sound, there may be an open circuit in the appliance.

Should it be determined that the cord is not the source of the problem, the appliance may need to be disassembled in order to pinpoint the problem. Refer to the owners manual of the appliance. The manufacturer of the appliance may require that the appliance be serviced only by a qualified repair technician.

7.3 Fuses

Note: With the power OFF, always remove a fuse from its socket before testing it. With cartridge fuses, touch the test leads to each end of the fuse (see fig. 10). If the fuse is good, the needle indicator will move to -0- ohms, or if the continuity buzzer is being used it should sound. If not, replace the fuse. On plug-type fuses, touch the the test leads on the bottom contact and the other on the threaded metal contact (see fig. 11). On time-delay/tamper-proof fuses, the other metal contact is at the top of the ceramic threads.

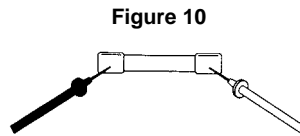


Figure 10

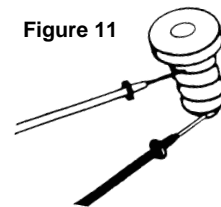
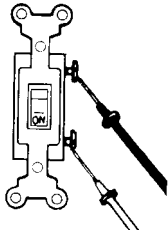


Figure 11

7.4 Switches

Cut off the power source to the switch. If necessary, remove the switch from whatever it's mounted to. Turn the switch to the ON position and touch the test leads to the switches terminals (see fig. 12). If the switch is good, the needle indicator will move to -0- ohms, or if the continuity buzzer is being used it should sound. If not, replace the switch. On other than two-way SPST (single pole, single throw) switches such as three-way light switches or double pole double throw (ON-OFF-ON) switches, in each ON position you will need to alternate the test leads between the switches terminals to determine which two terminals control that ON position.

Figure 12



7.5 Heating Elements

Household appliances such as coffee makers and water heaters contain heating elements which may require troubleshooting. When making continuity checks on heating elements, disconnect the element(s) from the circuit(s) that supply it/them. Touch the test leads, one on each end of the element and observe the needle indicator. The reading should indicate low ohms. If the needle indicator doesn't move, or if the continuity buzzer is being used and does not sound, the heating element is broken. If the element(s) show that continuity exists, test for continuity of the circuit(s) that feed the element(s) .

7.6 Thermostats

Make sure the thermostat control is in the OFF position. Remove the thermostat cover. Touch the test leads to the contact points on the thermostat. The needle indicator should move to read -0- ohms, or if the continuity buzzer is being used, it should sound. If not, either one of the contacts may be loose or broken.

8.0 Decibel Measurement

The decibel feature of this multimeter is for transistor gain measurement in electronic circuits and should not be confused with audio decibels. This function is used primarily by electronics technicians to measure the power gain in transistors, and is rarely encountered in home project applications.

- 1) Fully seat the test leads in the correct input jacks.
- 2) Set the function/range switch to any one of the AC voltage ranges and read the decibel measurement on the bottom (red) scale of the faceplate. Based on the AC voltage

range you selected, you will need to compute the actual measurement by using the decibel conversion chart located at the bottom right of the faceplate.

Important: For absolute decibel measurements, circuit impedance must be at least 600 ohms. -0- decibels = 1 milliwatt in a 600 ohm impedance (equivalent to 0.775 volts across 600 ohms).

9.0 Battery and Fuse Replacement

- 1) Remove the screws in the battery/fuse cover and carefully separate from the front.
- 2) Note the polarity of the batteries when removing them from their compartments and replace.
- 3) Use GB catalog number GF-0306 .5 Amp/250 Volt replacement fuses.
- 4) Carefully replace the battery/fuse cover and tighten the screws. Do not overtighten the screws as this may strip the threads in the tester housing.

Order Form

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