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REF: Electrical System

Buying a Cheap Multimeter

First, if you have a meter of any kind with AC/DC/Ohms scales, it will probably suffice for working on your motocycle because there are typically only two functions we need - 1) measure DC voltage from 0-15v and 2) measure 0-20,000ohms. If your meter can do that, it will handle 90% of what needs to be done by DIY bike mechanics.

For those who do not have a meter - all cheap meters are, well, CHEAP in every way - But most of them do function, and for light duty usage, they function well enough to be worth the cost, which normally is between $10 & $20. If you're a professional or intend to do alot of meter work, invest in a quality brand (which will be more expensive - $50-$150+). Don't expect the cheap units to take alot of abuse and don't expect them to work perfectly (anything cheap and mechanical will fail eventually) or last long enough to pass on to your children.

I've included a picture of a cheap meter here to give you an idea of what's available (at this time) and Amazon always has a huge list of these from which to choose (Shown is product no. B005EK3NRS from Amazon.com - 7.90 w/Free Shipping). This unit comes with a rubberized cover that helps to minimize bumps and fall damage - but remember, cheap is cheap, so be careful not to drop it. And at these low prices, quality control is at a minimum (if at all) so you may get a dud and have to return it for a replacement - it happens...

Most of the electrical and electronic measurements you will need are based around 12 volts and the ability to measure less than 1000 ohms. Most of these cheap meters can do this. They use a standard 9-volt battery to power themselves (most are designed around a single computer chip) and to provide the power necessary for doing continuity checking (which is used to test whether a wire is broken or a switch is bad) for which this meter also has a buzzer sound.

Types of Meters & Functions:

There are two basic types of meters - analog and digital. Each has it's own advantages and disadvantages along with hundreds of variations in models in each category. The shown meter is known as a DMM - meaning Digital MultiMeter - and it is cheap and sufficient because it has the scales of measurement we typically need. Remember - it is an advantage to have a 20v DC scale and an ohms scale of less than 5000ohms for our purposes.

Analog meters use a needle scale which can be helpful in some situations but are more complicated to setup and use properly - plus, they are typically more sensitive to damage. But, if you have one with the appropriate scales and know how to use it, it will suffice for our purposes.

The displayed model is not “autoranging” meaning that you must be careful to manually select the proper range scale to make your measurements. An autoranging DMM will have only a couple options for selecting modes and then it will automatically pick an internal scale to use when showing you a measurement. While autoranging may sound better, there is an advantage to not having it - the advantage is speed of measurement because the internal computer chip does not have to decide which range to use because we have already selected what range we want. This is an advantage because sometimes we are looking for intermittant signals and the faster speed of non-autoranging is helpful in seeing the variation in signal. BUT, if you have an autoranging meter already, it's probably not necessary to buy another just for the advantage. (If you are intending to use this meter for a variety of applications besides the bike, you may also want to get one with autoranging to simplify using it for other applications.)

Most meters come with leads, the wires to connect it for measurements. The leads have meter plugs on one end and the other end has probes (the handle part with a needle-like metal tip).

Using the Meter - The Basics

Connect the meter end of the BLACK lead into the meter socket marked COM. For our shown meter, connect the meter end of the RED lead into the socket on the meter marked VΩmA (we will seldom use the high current socket, but if used, it would be the RED lead plugged into it). Some meters will have separate sockets for voltage measuring and resistance measuring.

For voltage testing, you will typically use the RED probe to identify the voltage level at whatever test location you place the probe. It will most often be a positive voltage point, although most digital meters have autopolarity meaning they will show negative voltage if the test point is negative relative to the other probe. The BLACK probe is typically connected to a good ground point (or the negative post of your battery). Since the mid-60s, almost all vehicles use negative ground systems, meaning you should be able to clamp the BLACK probe to any good frame location on the bike then use the RED probe for making measurements. There are specialized Alligator Clips available for meter probes, but any good plastic spring clamp should allow you to solidly connect the BLACK probe to an engine fin or axle nut or the frame itself. Just be sure it is bare metal and not isolated from the battery/frame by any plastic, paint or other non-conducting material.

Sometimes voltage testing requires you to make a connection while the circuit is operating (like testing at the battery for 14v+ to see if the alternator is working while the bike is running) and other times you

will simply be testing connectors to see if the 12v is getting to a particular pin (with the key switch on and engine off).

For continuity & resistance testing, since both functions send a small voltage out of meter, it is important that the main switch be OFF during these tests - and in some cases, it is important to disconnect the circuit being tested from all other devices in order to get a proper reading.

For continuity checking, you will typically place the BLACK probe at one test location and the RED probe at another test location. With the meter set for continuity (this meter shows a buzzer symbol), the internal battery sends a voltage out of the meter to see if that voltage reaches the other probe - which would indicate continuity between the two probes. In continuity checking, the BLACK probe may not be connecting to ground or the negative battery post. Continuity checking is really a form of ohms resistance testing for nearly 0ohms (meaning little resistance) and very good conduction between the two test points.

For measuring ohms resistance, it is important to check the meter for 0ohms when the two probes are simply touching each other - If the reading is above 0ohms, you'll need to subtract this amount from whateve resistance readings you take. For instance, if you meter reads .02ohms when the meter leads are touched together, then you need to subtract .02ohms from any reading of resistance that you take.

When taking a typical reading, you will place the probes at two testing points (which may not include grounding). This measures the resistance to the voltage being sent out from the meter on one probe as it makes it's way to the other probe. For instance, you may be testing the resistance in the starter motor windings in order to see if there is a short circuit (shown as too low resistance) or testing the starter relay windings for shorts. Most of these type tests are expecting a small level of resistance even when functioning correctly, so it's important to have a low scale on your meter in order to properly see small differences.

XLForum Threads:
http://xlforum.net/forums/showthread.php?t=1662427
http://xlforum.net/forums/showthread.php?t=753160

Inline Ignition Spark Tester

The tester plugs inline between the spark plug wire and the spark plug. When the engine runs, the light in the simple tester will flash with each spark - brighter with more voltage.

The adjustable tester takes the place of the spark plug. The spark gap can be set by the position of the thumbscrew contact. By enlarging the gap, the power being utilized to create the spark can be gauged.

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