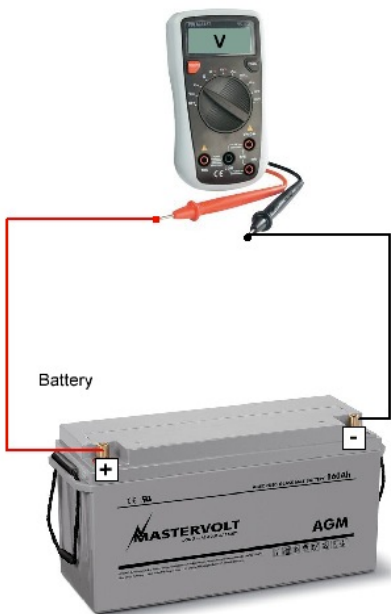
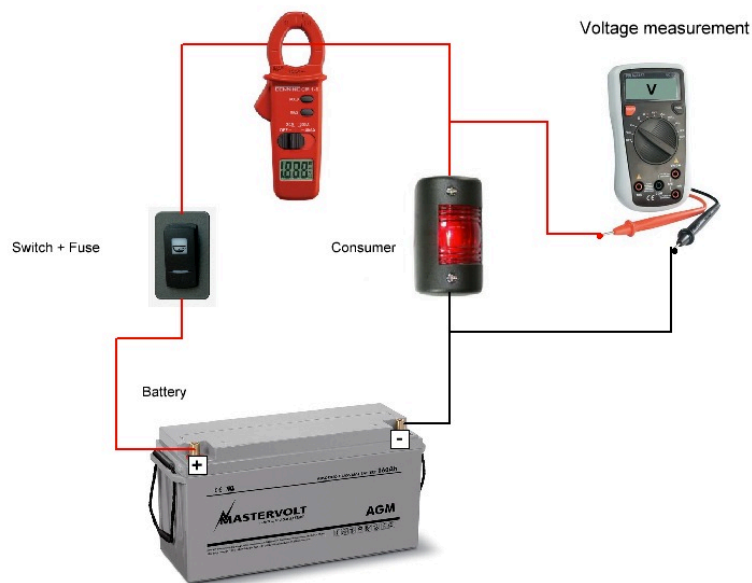


# Electrical measurements - basics

Voltage measurement



Current measurement



## Basics electrical measurement

To perform electrical measurements, you need a basic knowledge of measurement on electrical systems. You should also take a bit of time to perform a few measurements, so you feel confident with the instrument and the use of it.

You'll see it's pretty simple.

All you need is a measuring device a multimeter, is available in retail or electronics store for approximately 50 - 100 Euros).

I recommend to buy an device with current clamp, they are a bit more expensive, but can also measure currents in "closed" wires.

Make sure it has an automatic range selection and can measure AC and DC currents.

My tip, use a headlamp if you measure in the boat. Measurements always require two hands, and must often be carried out in dark, poorly accessible places.



"If you measure, you measure crap" says an old proverb. This is of course highly relevant, since we have little chance to detect a wrong measurement. With a bit practice, you are quickly able to perform the corresponding measurements correctly.

## Electrical measurement

In the measurements you need to perform for "me" / to find faults, we restrict ourselves to measurements on low voltage systems on board in the range of 12/24 volts. We do measurements on 230 volt system only in exceptional cases, as they are dangerous because of the high voltage.

Even when dealing with 12/24 V systems a few points should be considered, because it can flow very high current, which can cause sparks and heat. Short circuits should be avoided in any case.

Read the safety instructions of the measurement instrument carefully and stick to them.

As you learned in the "electrical basics", there are 3 values mainly measured in the electrical fundamentals: The voltage, current and resistance.

An exact current measurement can only be done by inserting a measuring device (shunt / small resistor) into the circuit, we will not measuring like this.

An easier way to measure current is with a clamp-measuring device, here we measure the magnetic field in the wire. This is not that exact as with a shunt, but enough to see if there is a current flowing and about what value. The clamp-measuring devices are a bit more expensive but from me all time its worth, as very easy can be measured if a charge or consume is happening.

It is recommended that on every boat an energy management system is installed. This measures the current, the voltage and time. It calculates the state of charge of the battery. So you always know what is left in the battery, what goes out and what gets loaded. Alarms can be defined and often historical information's are available. This current measurement is enough for basic measurements.

Of course, it is excellent if you buy a clamp measurement device, it helps to find faults faster. But it's higher in price. It can, however perform the same measurements as a classical multimeter.

## Voltage measurement

The voltage measurement is the classic "power measurement". Here, the "pressure" that is present is measured.

Now you run your first voltage measurement:

Take a battery that you have on hand, for example, from a flashlight or a remote control.

Turn on the multimeter and select the range for DC Voltage Measurement (V).

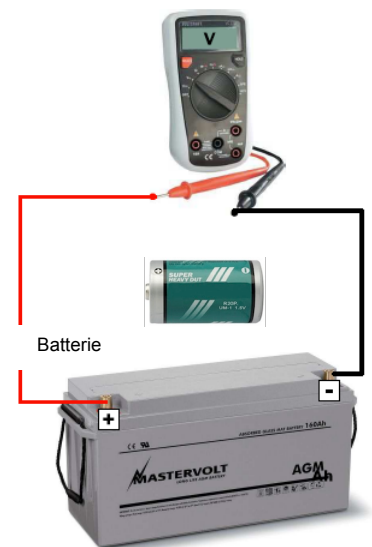
Hold the red (+ / positive) test lead to the positive battery terminal and the black (- / minus) probe tip to the negative pole. Don't worry, even if you swap the two poles, nothing can happen.

Make sure that you keep the tip only on the isolated plastic.

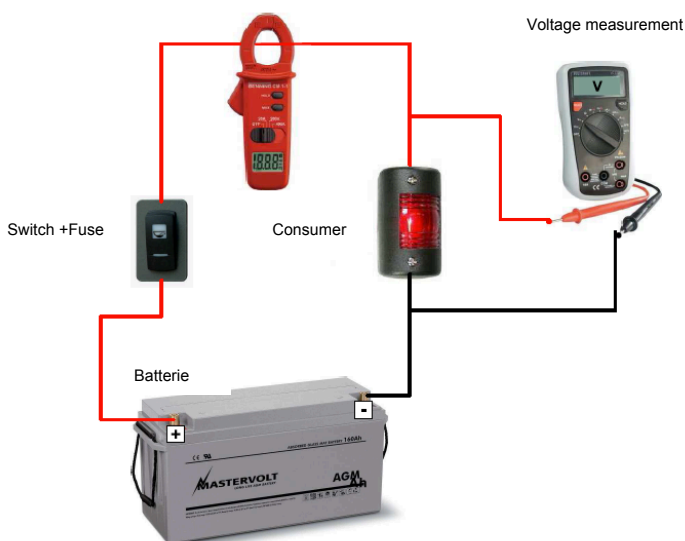
Now read from the existing voltage of the battery. It is used in a 1.5V battery somewhere below 1.6V, depending on how much energy is still in the battery.

Reverse the test probes once, you will see that now the sign change to "-". This shows us that the red (+ / Plus) do not tip the "plus", but the "minus".

Voltage measurement



Current measurement



This measurement scheme shows a measurement on a real power cycle, as is to be found on your boat or your car.

Likewise, you can see how the current is measured with a clamp meter.

You may like to perform this measurement on your boat or your car.

Measure directly to the battery, once without turning the light ON and once with the lights turned ON.

You will see that the voltage slightly drop when the light is on, if not switch ON the van.

By voltage measurements, we always measure a potential difference of - / minus 0V to + / Plus 1.5V / 12V.

The only thing to look out is that you don't make a connection between the two potentials / probes during the measurement (short circuit). Otherwise a large short-circuit current flows, since no resistance is as consumers in between.

My advice: Are the measure points very close together, stick the probe tips with a bit of electrical tape, just leave the tips free.

## Resistant measurement

To measure the resistance of a load (light bulb, motor, or a wire), turn the meter to resistance measurement, which is usually marked with a symbol  $\Omega$  (ohm).

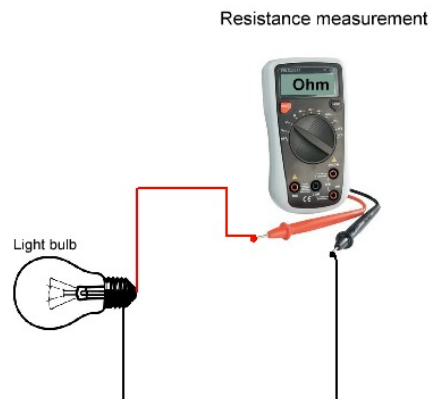
The simplest resistance measurement is to measure the resistance of the cable. Keep up the positive and the negative test probe and read the meter.

This measurement is used for the "passage" measure / check, so to find out whether a wire is continuous from end to end.

This measure function is usually a separate function and stands just next to the ohms function and shows the "continuity test function  $\bullet\))$ " if there is "passage" it is indicated by an acoustic signal.

If you have an old light bulb on hand (rarely these days), you can measure the resistance: One tip to the screw thread and the other under the thread to the point.

Never measure a resistance, when a voltage is applied.



With these basics you will be able to perform the most important measurements. The measurement scheme helps you to find the corresponding data points.

For their analysis, I'm here for you.

Silvio Franceschini, y-tronics