Grüezi YouTubers. Here is the guy with the Swiss accent. With a new episode around sensors and microcontrollers.

All our gadgets run with electrical power. And they usually demand constant voltage. We use batteries or some sort of regulated power supplies to deliver this energy. Today, we will look at procedures to test these power sources.

We will cover:

* The basic principle of testing of power sources like poser supplies or batteries
* The problems associated with it and its resolution
* I will show you my new IT8512A+ electronic load and how it works
* At the end, we will test a very nice small power supply with the procedures we learned

So, let’s start.

We can test our power sources by attaching it to one of our gadgets, say a smartphone, and do our measurements. We often do this with our small USB volt and ampere meters. Just connect them between your power bank and to your Smartphone charging cable and you can read, if the voltage is 5 volts and how big the current is. It even sums up the Amperes over time which is the Energy which was used by our smartphone. But, if we remember the goal of this episode, it is not to understand the behavior of our Smartphone, it was to test the behavior of the power bank or the power supply in general. To do that, we probably want to test the power supply at different voltage levels, or different current consumptions. Or we want to find out the maximum power our Solar panel is capable to source. For such tests, we need something different than just our smartphone. We need a variable load.

The simplest load is a resistor. It converts 100% of the electrical energy into heat. We use such resistors in our primitive USB loads. They are somehow variable and can be adjusted to consume either 1 or 2 amperes, depending on the switch position. But is this true? Let’s check. We supply the normal 5 volts and really, about 1 ampere is used by this load. However, if I reduce or increase the voltage, the current changes. This is because of Ohm’s law which says R=U/I. And R is constant in this scenario. Using a resistor is a simple concept which is useful, but not very accurate.

What could be a better solution? Ohm’s law answers this question: If we would have a variable resistor, we could easily adjust the current to a desired value. And exactly this is done by an electronic load: It has a variable resistor, and it adjusts its resistance to create a constant current. Here is such a simple electronic load for the same purpose as before. If I change the voltage here, the current stays the same. BTW, this is done by a beefy transistor, which, of course, has to be cooled, because this transistor is used as a resistor and, like every resistor, converts 100% of the energy into heat.

These electronic loads have another advantage: You can adjust the current which flows through these loads to any value. Here, we can turn this tiny knob and adjust the current to let’s say 500 mA.

If you are interested in a comparison between the two electronic loads shown before, you can watch my video #75

This primitive electronic load has no meters, and we have to adjust the current using an external ampere meter. Fortunately, we can buy integrated loads which show us the volt- and the amperes, and also the values we choose to keep constant. I used one of these loads in my videos #72 and #76. And I have to confess, that I abandoned this project, because it was too complicated for me to create a stable remote control for this load. But still, I learned a lot. Later, you will see, how I solved the problem. It is not an elegant solution, but it works!

But still, this load itself without any modifications, works.

If we summarize what we learned so far, we see the electronic load consisting of a variable resistor, an ampere and a volt meter, a comparator and an input device to select the desired current. The current is measured with a so called “shunt” resistor which is in series to the load. And the comparator compares the real current with the desired current and adjusts the resistor. That is all. No rocket science.

Unfortunately, there is another problem to be solved if we want to have good results, or if we want to measure larger currents.

Now it is the time to show you how I solved the problem with the project failure: I poured a lot of money onto the problem and bought a decent electronic load. A lot of money, in this case, is relative: As always, I closely watched price performance of my purchase. And this IT8512 is very cheap compared with its more professional “parent”, the BK8500. As we will later see, it does the job for me. And I bought it, because it has a very nice display with big numbers. Very attractive for an old man like me…

For the next step, I connect my bench power supply, which delivers around 5 volts, to the electronic load. Because the power supply is analog, it is not easy to get exactly 5 volts, but whatever is selected stays really constant…

I select 100 mA and switch the load on. We see the roughly 5 volts and the 100 mA. Everything ok. And here you already see a big advantage of this load: We see volt, ampere, power, and the selected current together. For me, this is very valuable, because it speeds my work up.

Now I select 2 amperes. The voltage immediately drops, to about 4.9 volts and, because the load adjusts automatically, it still draws the 2 amperes. Why is that? My Bench Power supply still shows 5 volts. And I trust it.

Let’s go back to the drawing board. Here is our power supply and here is the electronic load. In between, we only have two quite thick cables. I think, I used AWG14 for this experiment, which is a reasonable size for 2 amperes.

Here, we read 5 volts and here 4.9. So, the only possibility is, that the cable has a resistance, which is not neglectable. If we introduce this resistance, everything is ok. At least, theoretically. Do you remember our goal? We wanted to test the performance of our power supply. Now, our measurements at the electronic load suggests, that our power supply is crappy, which is absolutely not true! So, this method is not very valuable.

What to do? There is a simple solution. I use my Bench Multimeter and measure the voltage directly at my power supply. And really, it is stable, even if I switch the load on and off. So, this built-in volt meter in the load is useless! Fortunately, not! The good electronic loads have a possibility to replace the Multimeter by its built-in volt meter. For that, we have these two wires. Unfortunately, they have to be connected to the rear of the load, but still, they exist. If I connect them instead of the Bench Multimeter to my power supply, I just have to select “remote sense: ON”. This is done by entering the config mode, select the right parameter, and press “enter”. Now, we read the same value as the bench multi meter! I will show you later a much easier solution for the mode-change. But for the moment: Problem solved!

For the records: This method often is called the “4 wire” method. And you see also, that the wires for the voltage measurement are very thin, because no current flows through them. They are completely independent from the wires to the load. One big advantage of this method is, that we do not have to care about the quality of the cables here. If you use a crappy cable, the load automatically takes it into account and controls its resistor that the current is still as you selected. And because we measure the voltage without the cable, our results are ok. This is particularly important if we do measurements across normal USB cables, which, quite often, use really thin cables.

Now we have accurate results. Let’s take the opportunity and compare the readings of the load with my best multimeter: The readings of the load seem to be ok. And I even got a sheet of paper with all the values measured during quality control! For my purpose, this accuracy is more than enough. The comfort of having all readings presented together and speed of operation are more important for my purpose. So, I think, the 400$ are a good investment.

Next, we want to test a real power supply I got from AliExpress. I selected a very nice little device which can serve for many purposes. And which has a very good price performance. It delivers up to 50 volts at a maximum of 5 amperes, and also shows all values like volts, ampere, and power in one display. And you can select the values comfortably with a dial. You even can save some presets like 5 volts or 3.3 volts. And you can limit its current, which is very handy if you connect your newly built device the first time to power or if you want to power LEDs…

First, I want to test, if it is capable to really source the 5 amperes. I select 5 volts, and I use 12 volts as input and switch the power on. I could now start the load at 0.5 Ampere and then use the dial to increase the current up to 5 amperes. But I use a much simpler way: I connect my load to my PC. This is done through a isolated USB to serial connection. You can buy one from the manufacturer, but you can also create your own. I will leave the details in my blog.

You also find the installation process for the software on my blog. I had to contact the manufacturer to get this information. But now it works. It still is not optimal, and I did not get a manual on how to use it, but I can use it for my normal testing.

So, first, I switch the “remote sensing” on. Much simpler than before. And now, I can instruct the load to perform a test and record its measurements. At the end, I can download the values and import it to Excel. This is a very nice feature.

So, let’s look at the results: The tiny power supply really is able to provide 5 Amperes. At exactly 5 Amperes, however, it switches off, because its current regulator steps in and drops its voltage. Which would protect our devices, because they would not draw more current than specified. Our electronic load however, still draws the 5 amperes, just at a very small voltage, because it immediately adjusted its internal resistor.

We could also check the behavior of our power supply to fast changes of current. The load is able to switch the current quite fast. But this parameter is not very important for our normal devices.

There are a few other modes of operation available on the IT8512A: Constant voltage, constant power, and constant resistance. The only additional mode to constant current I used so far was constant power. This was very handy for the testing of the Solar cells. You will see more of that in an upcoming video.

Do I recommend the load? Yes and no. The load itself is ok and the build quality as well as the electrical quality are good. And the display is very readable The software, however, is not state of the art and the support provided on the web site is also less than optimal.

Fortunately, there is also an alternative: The Maynuo M9712, which has very similar specs. There is even a rumor, that one of the engineers left Itech to founded Maynuo…

I also downloaded their software and it was much easier to install. It also looks nicer. But of course, I cannot tell you, how good this electronic load works. But there are some other videos you can consult.

Coming back to our neat DPS5005 power supply: I also can recommend this tiny device. It met its specifications. And all products from this supplier come with nice manuals, also in English. Maybe not the best English, but understandable.

You even can buy a housing especially produced for it. But before you buy it, maybe you wait a few weeks. The supplier promised to send me his newest device which has an interesting additional feature. So, stay tuned!

Summarized:

* We looked at the basics of power testing and used resistors and electronic loads for that
* We solved the problem of varying voltages by using adjustable resistors
* And we solved the problem of “crappy” wires by remote sensing, also called 4-wire method. And the best is, that you can use this method also with simple loads and your multimeter. Just measure the voltage at the power supply, not at the load
* You saw my new IT8512A+ electronic load at work, its advantages and the problem with its PC software
* I even showed you an alternative for this load. BTW. You find a link of the supplier I purchased from. I had no issues and the device was delivered in only a few days. He sells both, the Itech and the Maynuo brand.
* We used the tiny DPS5005 power supply for our tests. It is a decent device and met its specification. And even at 5 amperes at 5 volts, it did not heat up. A cool device!

I hope, this video was useful or at least interesting for you. If true, then like. Bye