HANDHELD SCIENFITIC, INC.

Battery Capacity Analyzer

User Guide

V1.5

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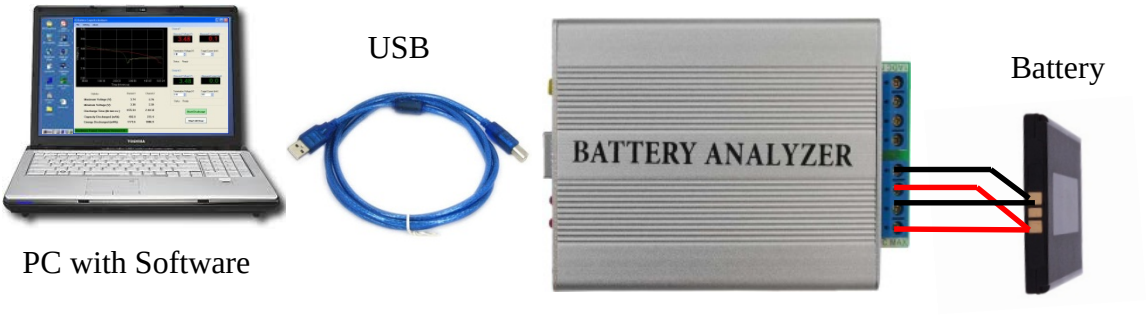
Battery Capacity Analyzer User Guide

A battery is in almost every modern electronic gadget. There are different types of batteries from a wide variety of sources. Some of them are good and many of them are of very low quality. A battery analyzer is used to study the true characteristic of batteries. It emulates the real use scenarios by controlling the discharge and recording the parameters. The BAT-10 from Handheld Scientific is a low-cost analyzer with proven reliability and precision.



Battery Analyzer Setup

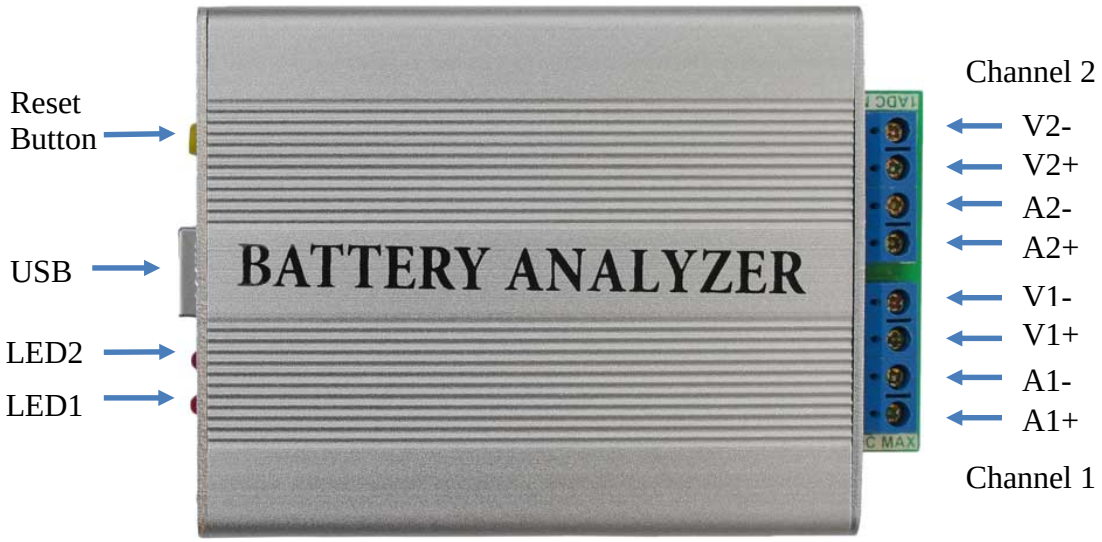
Hardware specifications:

- USB 1.1 device. Compatible with USB 2.0
- Sampling rate: 1Hz (one sample per second)
- Two independent channels
- 4-wire design for better accuracy
- Reversed voltage polarity protection
- Voltage range: 1-12VDC
- Voltage accuracy: ±1%. Resolution: 10mV
- Current range: 0-1000mA
- Current accuracy: 1mA or 1% of target current. Resolution: 10mA
- Power dissipation: 2W for one channel. 3W for two channels combined
- Over-power beeper alarm
- LED status indicator
- USB current consumption: < 20mA
- Strong aluminum case for long life

Software features:

- USB HID class device. Uses Windows built-in driver so no additional driver installation is needed.
- Works with Windows XP/7/8, 32-bit or 64-bit. Microsoft .NET framework 3.5 required.
- Adjustable discharge current and termination voltage
- Records time, voltage, current, maximum/minimum voltage, discharged capacity (mAh) and discharged energy (mWh).
- Plots voltage-time graph
- Saves data in tab-delimited file
- Built-in battery simulator for testing the software without hardware
- Green software. Just download and run. No installation is needed so your computer will not be changed in any way and no garbage is left.

Hardware Layout



Reset Button: reset the device. Same as power cycling it.
USB: USB Type B Receptacle. Connect this to a PC using the included cable.
LED1, LED2: LED indicator for channel 1 and 2, respectively.
A1+, A1-: Channel 1 current input positive and negative. Polarity reversal protected.
V1+, V1-: Channel 1 voltage input positive and negative. Polarity reversal protected.
A2+, A2-: Channel 2 current input positive and negative. Polarity reversal protected.
V2+, V2-: Channel 2 voltage input positive and negative. Polarity reversal protected

The voltage on a channel must be at least 0.6V for the analyzer to consider the channel active.

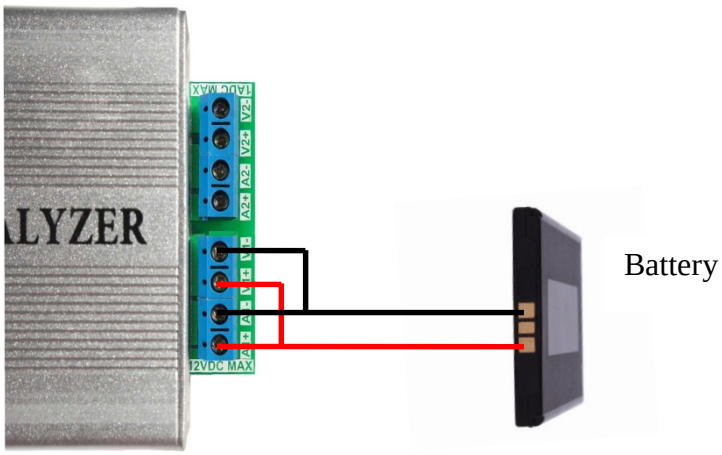
LED Status Indicator

Each channel has a LED indicator with the following meaning:

Flash slowly (once every 3 seconds): USB is connected. No battery voltage is detected.
Flash fast (3 times per second): Battery voltage detected. Not discharging.
Flash normal (once per second): Discharging and recording.

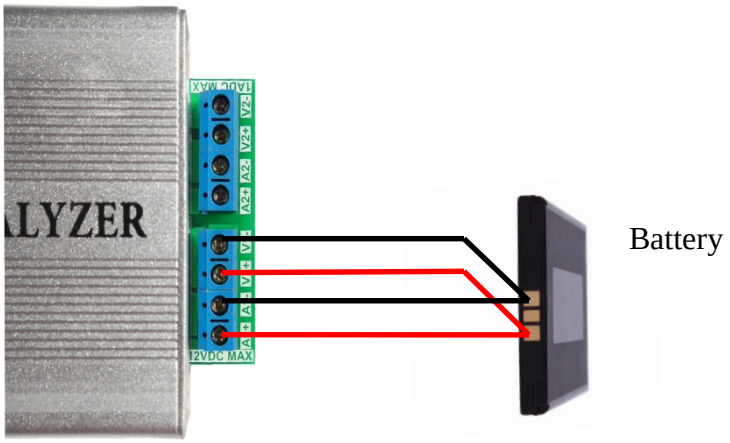
How to connect a battery

There are two ways to connect a battery to the analyzer: using only two wires or all 4 wires



Two-wires connection to battery: low current, thick and short wires

In two-wires connection, V- and A- are connected at the analyzer's end, so are V+ and A+. When the current is small or the wires are thick and short, the voltage drop along the wires is small so the voltage at the analyzer end is almost the same as at the battery's end. Therefore this two-wires connection scheme will not generate too much error.

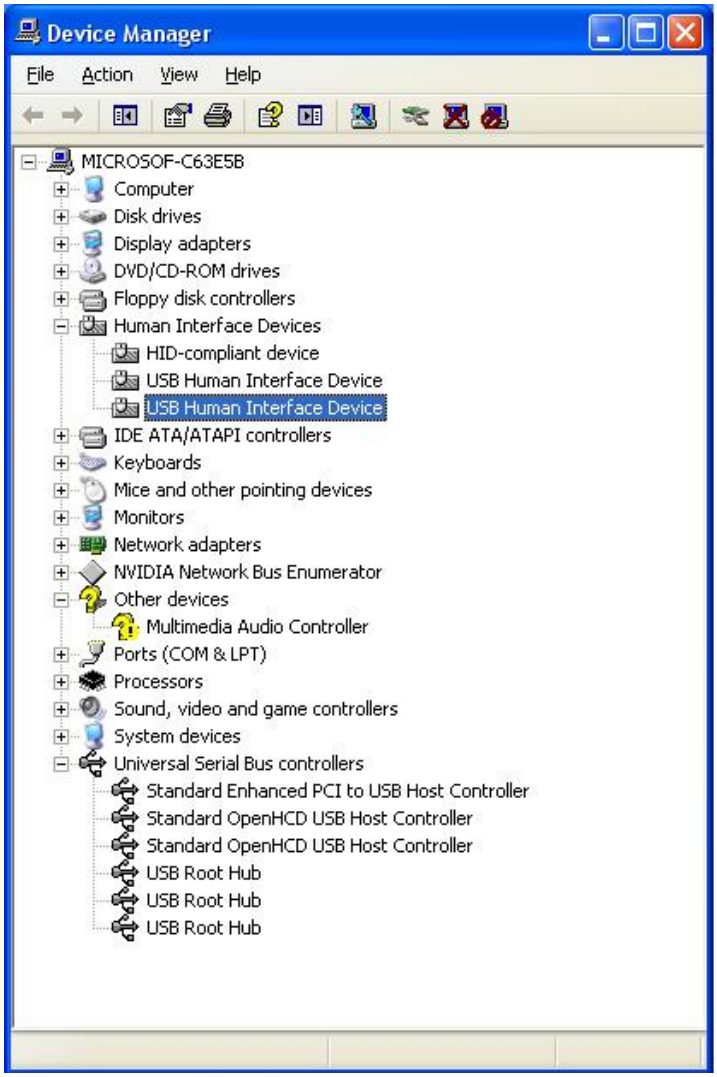


Four-wire connection to battery: more accurate for large current or long wire

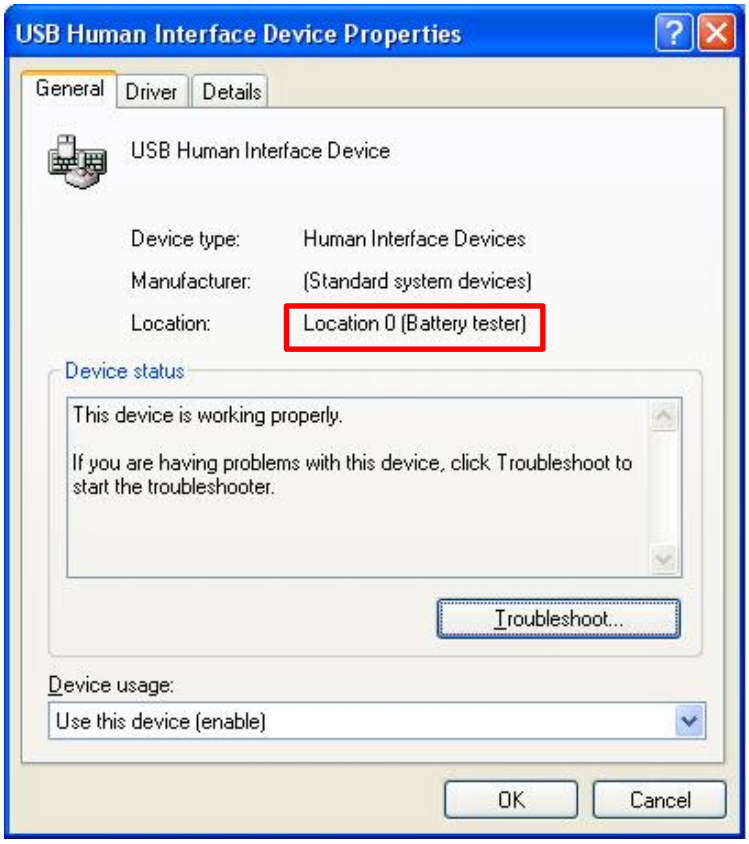
When the current is large or the wires are long, the voltage drop along the wires will become a factor that can't be ignored. In 4-wires connection as shown above, the analyzer actually measures the voltage at the battery's end, therefore eliminates the error created by wire resistance.

Device Driver

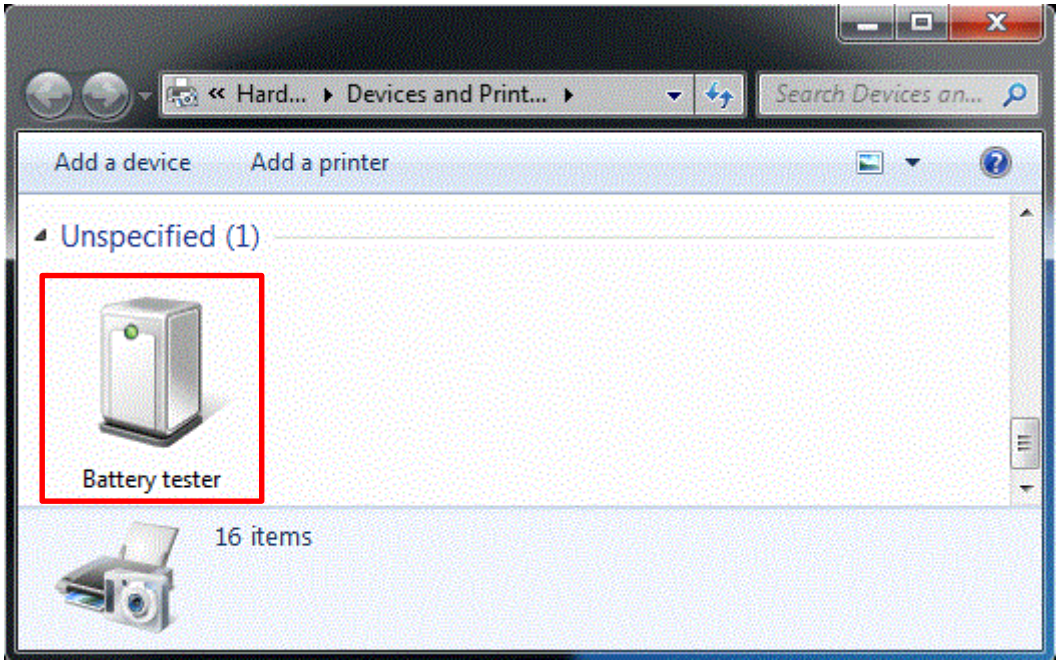
The analyzer is a HID (Human Interface Device) class. Most operating systems have built-in support for this type of devices so no external device driver installation is necessary. When plugged into a PC USB port, the operating system will automatically install necessary driver. This may take a little time. After it is done, you will see the following device in the hardware manager:



Windows XP Device Manager – Human Interface Devices



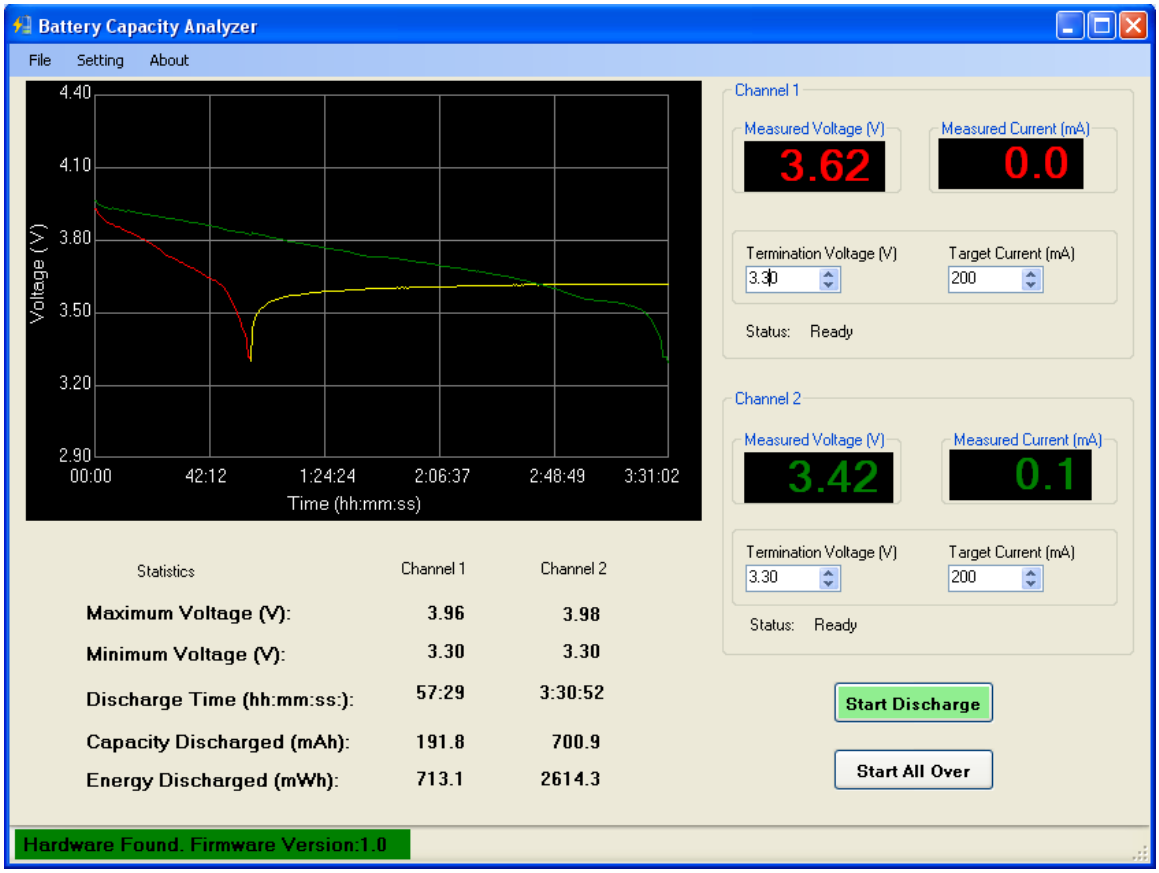
Windows XP Device Manager – Device Property



Windows 7/8 “Devices and Printers” view

Software

The following depicts the graphical user interface (GUI) of the PC software with a typical test for two batteries.



When the PC software starts up, if an analyzer is connected, its status (lower left corner) will show “Hardware Found” with firmware version, as shown above. Once detected, the PC software will measure and display the voltage on the inputs at 1Hz sampling rate continuously.

When a battery is connected to either channel, the GUI will display the detected voltage. If not, check the connection and the polarity of the battery. If you connect the battery reversed, it will not damage the device but the voltage will show zero. The voltage will need to reach the 0.6V threshold. Otherwise the analyzer will ignore the channel.

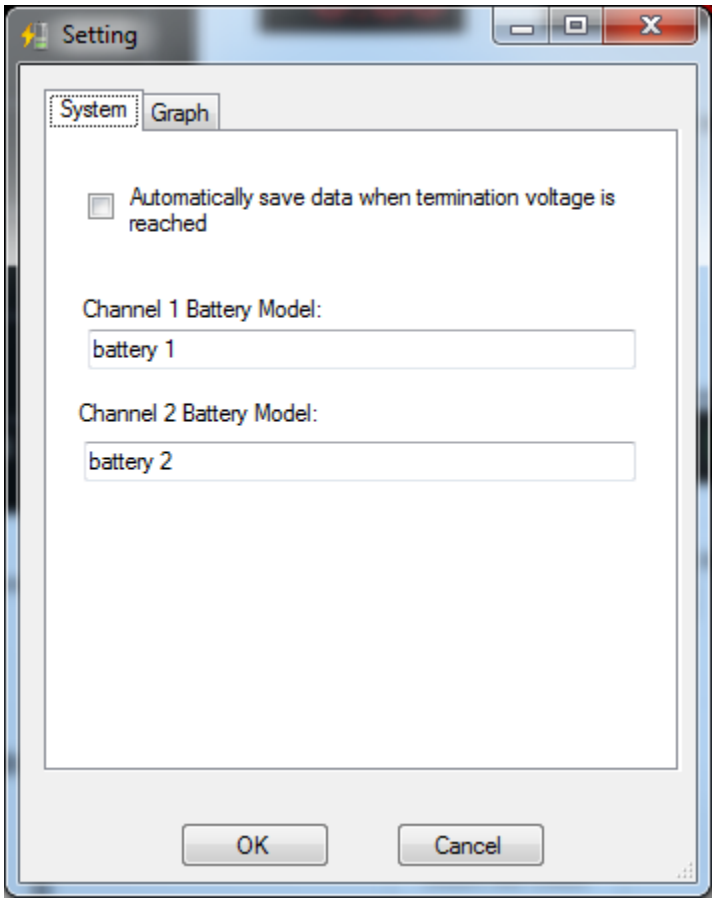
Set the termination voltage and discharge current. If you do not know what termination voltage to set, you can set it to a higher value first and perform repeated tests with reduced termination voltage. The discharge current depends on the intended usage of the battery and the test scenario.

Click “Start Discharge” and the analyzer will start discharging the battery and record the data. When the termination voltage is reached, the analyzer will stop discharging. If both channels are active but only one channel has reached the termination voltage, the terminated channel will stop discharging but the recording will continue until the other channel also reaches termination voltage. The curve for the channel after termination will have yellow color.

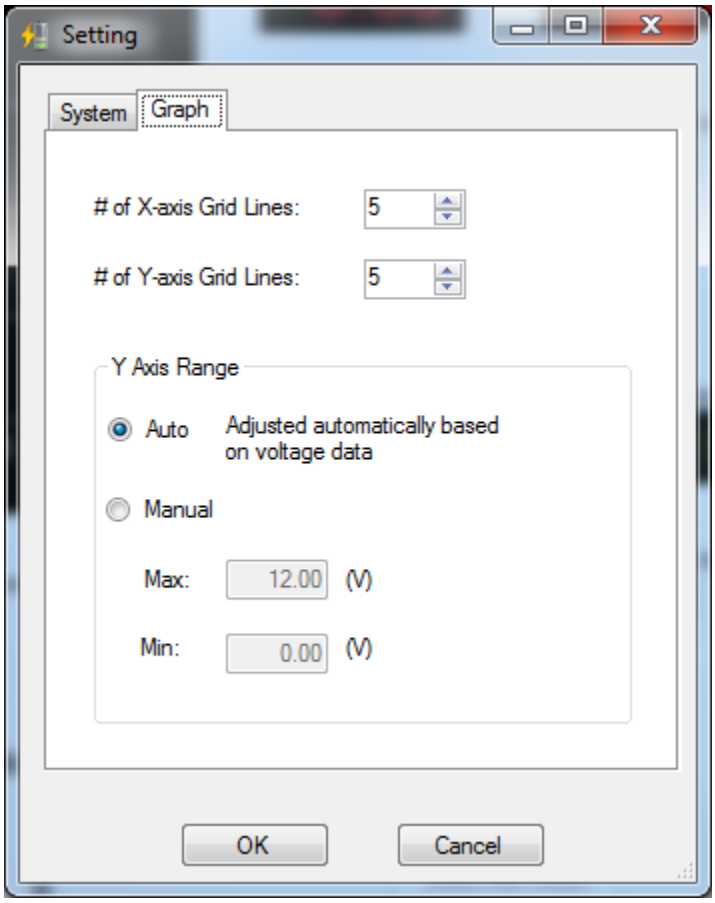
Once discharging is terminated. You can save data by using the Save Data action in the File drop down menu. You can also save the whole window as a graph, pretty much like the Print Screen function. The saved data can be loaded back to the software at a later time.

Software Settings

The Setting tab brings up the Setting screen where there are two tabs:



On the System tab, the Auto Save Data checkbox is much self-explanatory. You can also set the name of the batteries which will be displayed in the main interface as well as saved with the data.



The Graph tab has several options to control how the graph is plotted.

If you have any questions/comments on this product, please feel free to contact us at support@handheldsci.com. We love to hear from you.