Portable Power Box

My journey building a box
and a guide to building your own.

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Portable Power Box Presentation Overview

- What are they?
- Use Cases and Examples.
- Components you will need.
- Tools you will need.
- Optional Items to consider
- Other Useful Info….

Portable Power Box Uses:

- **Emergency 12v / 5v USB Power**
- **Charge or Power HT / Mobile Radios**
- **Charge Cell Phones / Laptops**
- **Charge or Power Flashlights / Lighting**
- **Portable Power in the Field**
- **Portable Test Bench Power Supply**
- **It has many uses, not just in Ham Radio**

- **Comment: The next slide shows a top view of the battery box with a little small dual-band mobile radio powered from it. More about this radio later on...**


ON-OFF
DC
13.2
V
QC 3.0
LOCK POINT
ATECH

- **Comment: The next slides show some examples of some different boxes is various shapes, sizes, and connections. As well as some commercially made ones.**

They Come in All Shapes and Sizes!

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Commercial Power Stations = $$$$

Want to build your own portable power box?

Remember:

Your only limitation is your own imagination! ☺

The Key Components you will need:

- **Utility or Tool Box of some kind.**
  (with a handle or wheels preferably)

- **Electrical Adapters, Sockets, Plugs, Connectors**
  (The things on the box you will connect stuff to)

- **12V Battery - SLA (Gel/AGM) or LiFePo (Lithium)**

  Or – Deep Cycle / Marine Battery (flooded cell)

Other / Optional Accessories

- 2nd/ Additional Battery = Longer Run Time
  Connected in Parallel – NOT Series!
- Power Inverter for AC power
- LED Lighting
- Voltage / Battery Level Indicator
- USB 5V Power Supply Outlet

1st Decide on a Box

What do you want or need to power?

The Bigger the Box, the more battery(s) you can have.

= Longer Run Time

BUT – Heavier and harder to carry

Mini Utility Box

This is the box I used.

Med. / Lg. Utility Case

Tool Boxes
With Wheels!

Ordinary Auto/Boat Battery Box

2nd What types of Connectors?

- Banana Screw Terminals / Binding Posts
- 5V USB Connector / Ports
- Cigarette-Style Plug Sockets
- Anderson Power Poles
- Barrel Jacks / Charging Ports
- T-Style Connectors

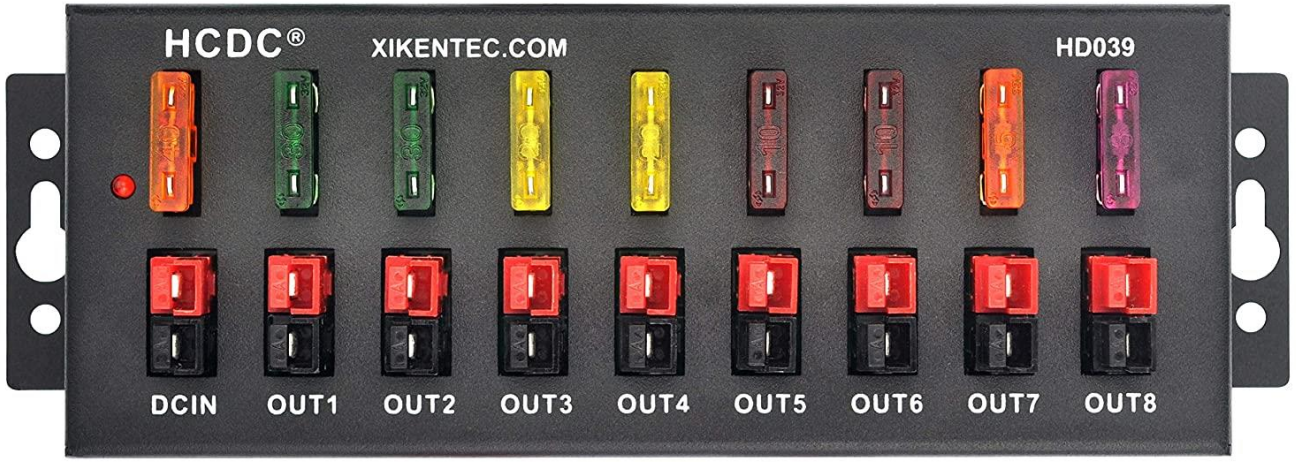
- **Comment: Most of these connectors, etc. can be found relatively inexpensive on Amazon and eBay.**

Banana Screw Terminals / Binding Posts

5V USB Connector / Ports

Cigarette-Style Plug Sockets

Anderson Power Pole



Fuse Block

12V Plug Adapters

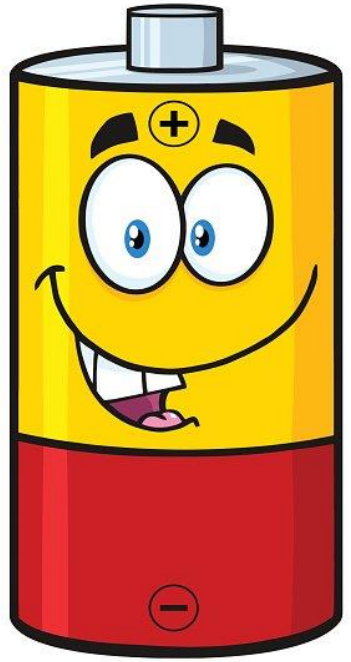
✓Box Selected

✓Connections Selected

Now What ? 

BATTERY SELECTION

- Battery selection will significantly increase cost
- The battery is the life blood of the power box
- Higher Amp-Hour rating = Longer run time
- Consider multiple batteries connected in parallel
- 12V batteries only!
- LiFePo Batteries Recommended.



Battery Types

Sealed Lead Acid (SLA)

Types of Lead Acid Battery

Flooded

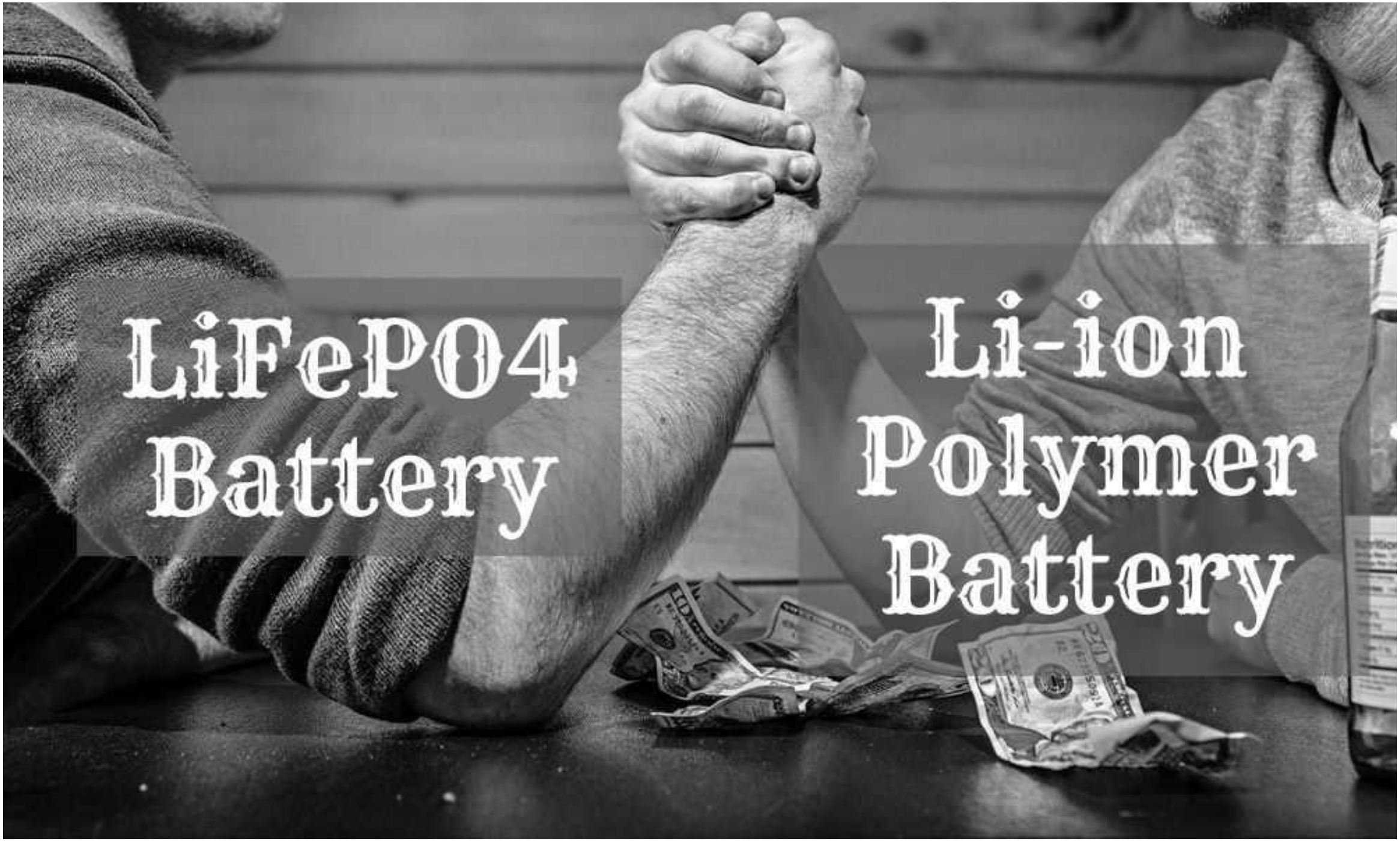
(Require Maintenence)

AGM
Absorbent Glass Mat

Gel

(No Maintenence)

Deep Cycle batteries are available for all three types


LiFePO4
Battery
Li-ion
Polymer
Battery

LiFePO4 Batteries

- It is the safest battery currently available.
- It is small in size and light weight.
- Life cycle can reach 2000 to 3000 cycles or more
- Can reach 100% depth of charge. (DOD)
- Perfect replacement for SLA batteries. (in some cases)
- A good LiFePO4 battery can be used for 3 to 7 years, so the average cost is very affordable.

Recommended Type Battery
LiFePO4 (Lithium Iron Phosphate)

This is the battery I am using – from Amazon.

- **Comment: The next few slides are examples of Lithium-Ion battery packs. These are generally NOT recommended for running mobile radios. However, they are good for charging batteries for HT radios.**
- **There is one exception though… Discussed later.**

12V / 5V USB Lithium-Ion 3000mAh Battery Pack


MENU
Bioenno Power
12VDC LIP battery
Allison
Transmission
Byron Klemesrud
Electrician
Charger
Bioenno power
12VDC LIP battery

Common Tools You Will Need

- Wire Cutters / Strippers
- Crimping tool
- Soldering Iron & Solder
- Drill / Hole Saw
- Screwdrivers.
- Electrical Tape & Heat-Shrink Tubing
- Digital Multi-Meter (or Analog…)
- Rotary Moto-Tool (Dremel)
- Cable Ties (Zip Ties)

Crimp Tool & Wire Connectors

Heat-Shrink Tubing

Electrical Tape

Screwdrivers

Drill

Cable / Zip Ties

Soldering Iron /Station

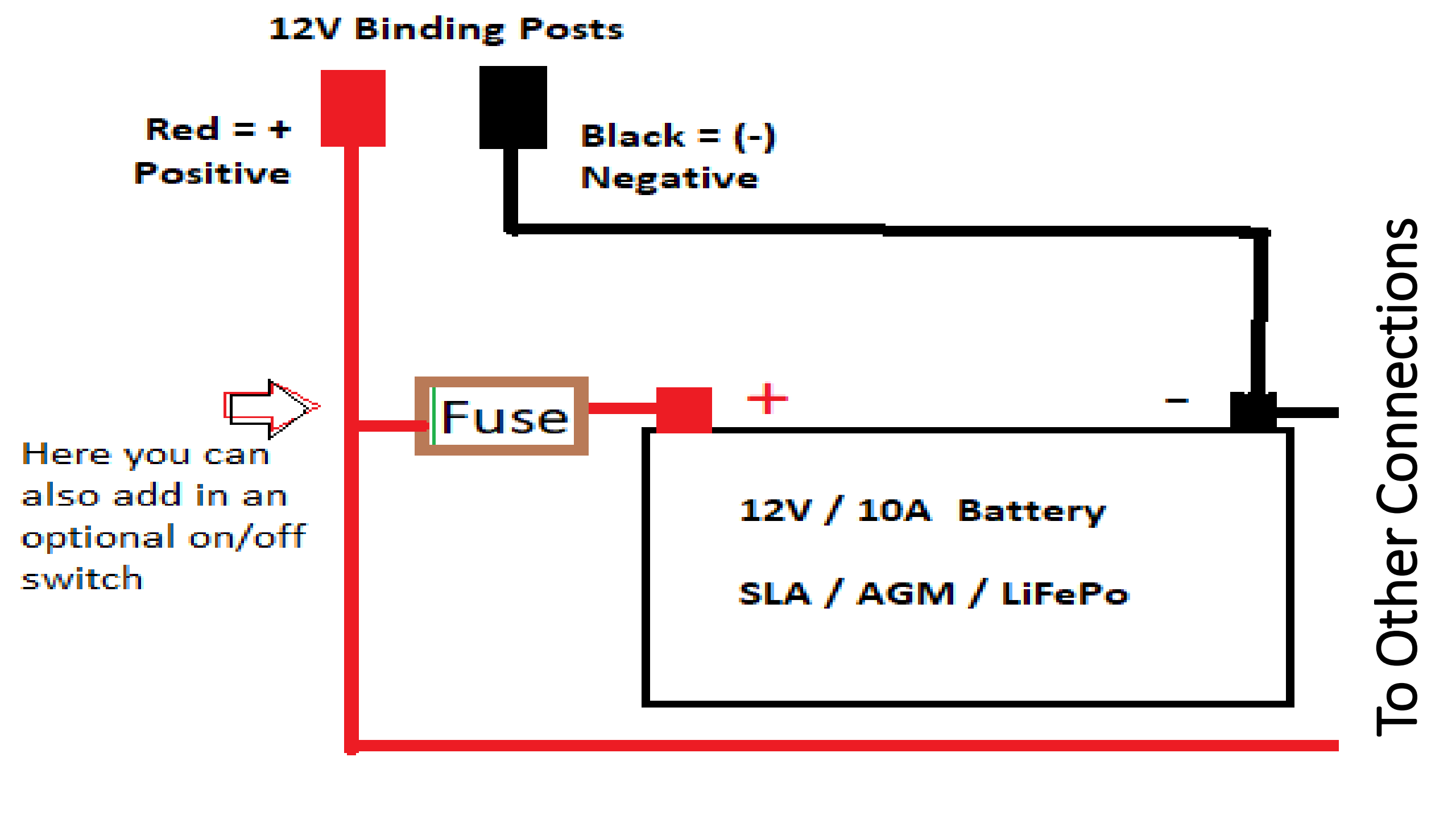
Digital Multimeter

Dremel Rotary Tool

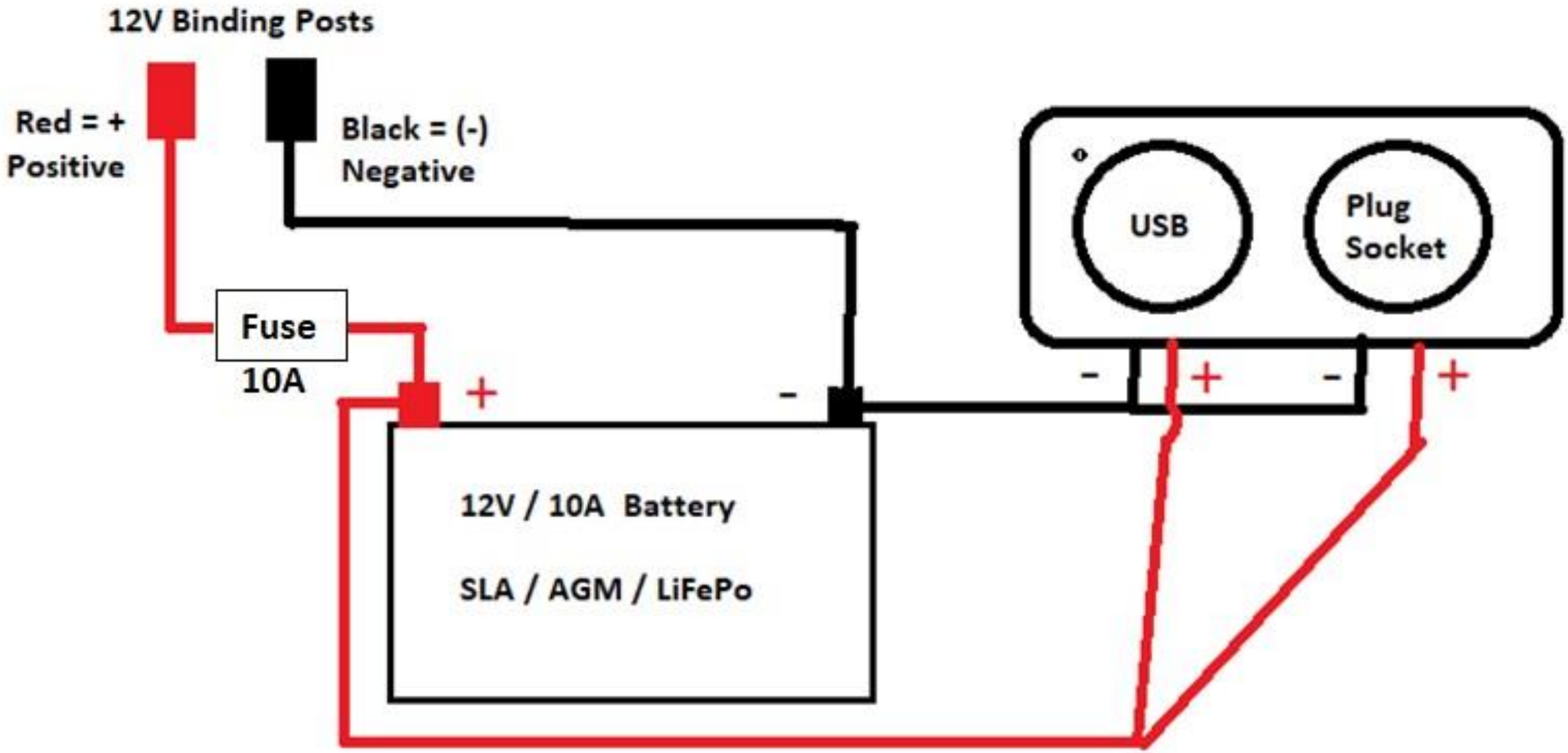
- **Comment: Next up – Wiring info…. What is shown is based on the battery box I put together. Depending on what you make, your can be significantly different. This is just a basic circuit example.**

Length (feet)	Current (amps)									
	5	10	15	20	25	30	40	50	60	70
15	16	12	10	10	8	8	6	6	4	4
20	14	12	10	8	8	6	6	4	4	4
25	14	10	8	8	6	6	4	4	2	2
30	12	10	8	6	6	4	4	2	2	2
40	12	8	6	6	4	4	2	2	1	1/0
50	10	8	6	4	4	2	2	1	1/0	1/0
60	10	6	6	4	2	2	1	1/0	2/0	2/0
70	10	6	4	2	2	2	1/0	2/0	2/0	3/0
80	8	6	4	2	2	1	1/0	2/0	3/0	3/0
90	8	4	4	2	1	1/0	2/0	3/0	3/0	4/0

American Wire Gauge (AWG)


12V Binding Posts
Red = +
Positive
Black = (-)
Negative
Fuse
+
–
Here you can also add in an optional on/off switch
12V / 10A Battery
SLA / AGM / LiFePo
To Other Connections

Wiring Diagram



- **Comment: Next slides – Battery charging. You likely will be using a LiFePo battery. If so, you want to make sure the charger is designed to work with Lithium-type batteries. They will often times be called "Smart Chargers". They have different circuitry specifically designed for these types of batteries. Normal charger are OK for SLA-type batteries. Always check the specs/details of the charger to be sure you are getting the correct type. Same thing goes with Solar chargers.**

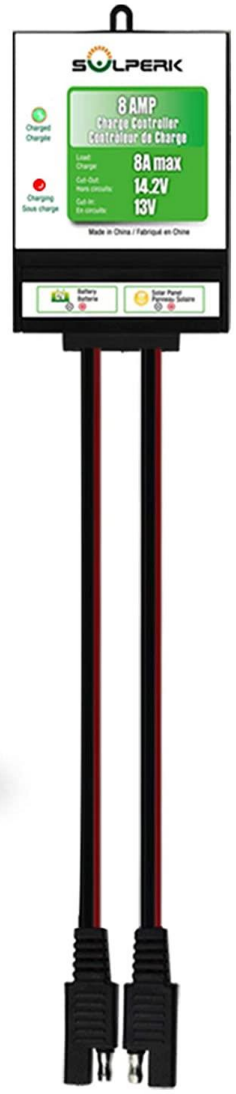
BATTERY CHARGING

- **Make sure the charger is compatible with the battery!**

Get a “Smart” Charger. This is what I have.

Solar Chargers

- MPPT Charge Controllers Preferred over PWM
- Higher Wattage = Faster Charging

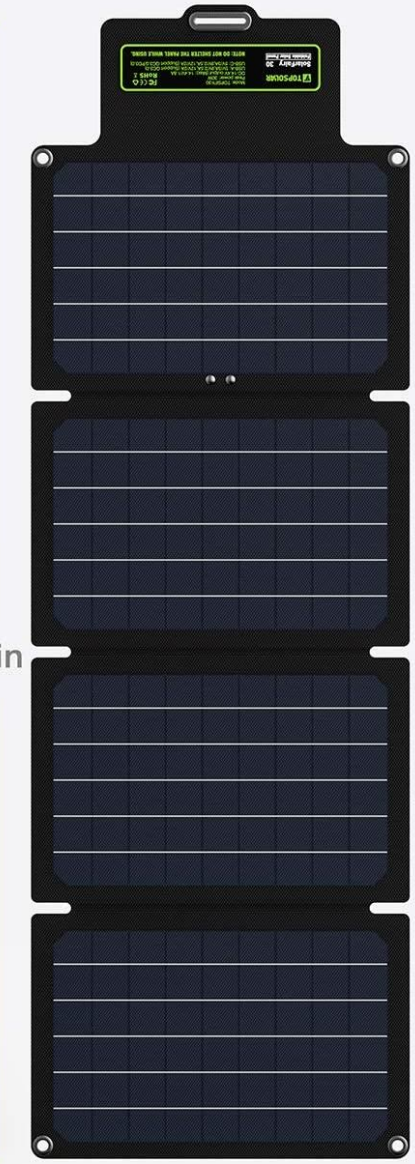


I have one of these and works great.

Powering USB-A & USB-C Devices

Travel Ready

Foldable solar panel
Solarfairy 30

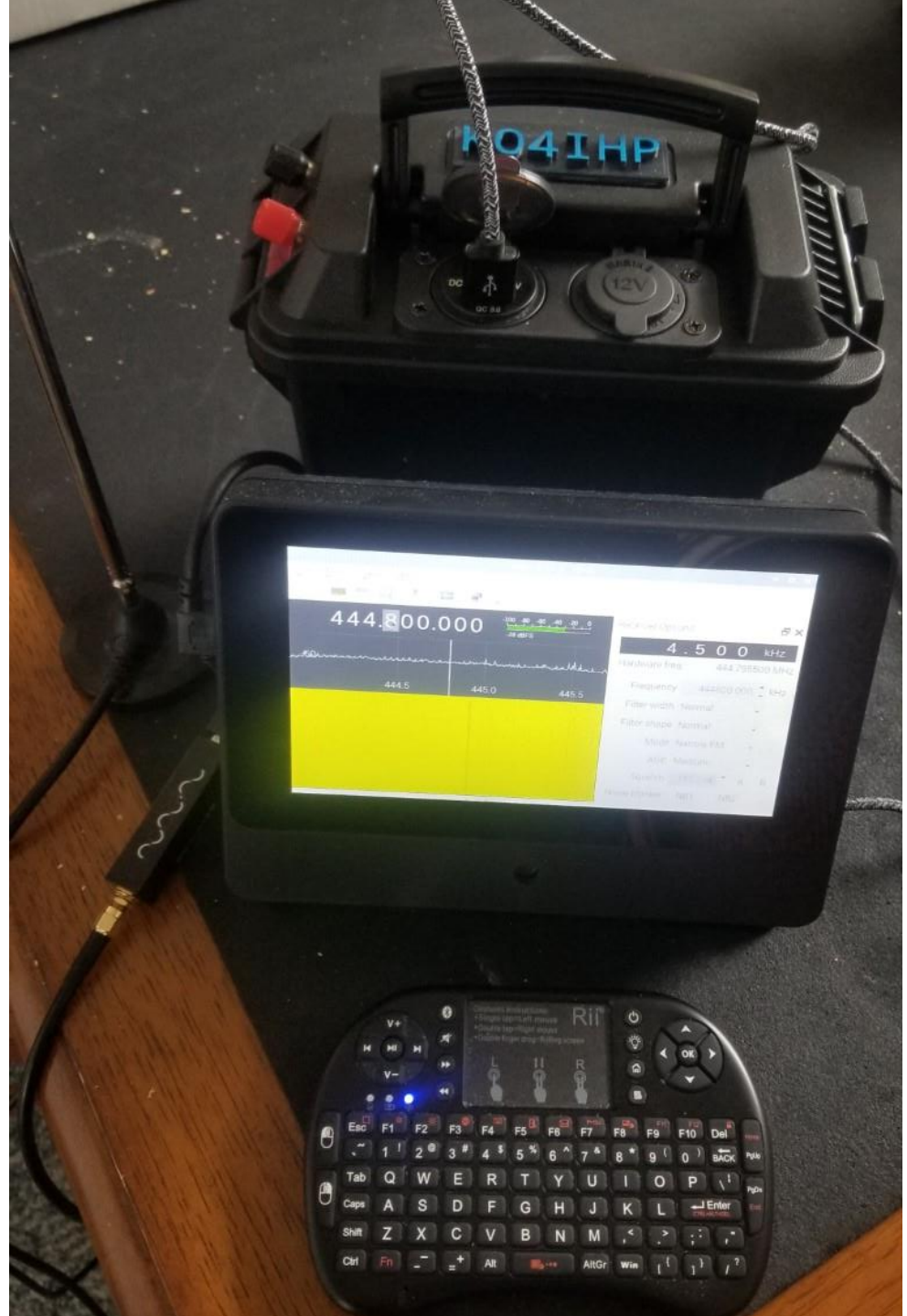


- **Comment: The next slides show the inside of the box and then the finished product with the charger. The 3D-printed call sign on the top adds a nice touch.**


ESC
1!


K04IHP
ON-OFF
DC
13.3
V
QC 3.0
12V
SMART BATTERY CHARGER
POWER

- **Comment: The next slide shows the battery box being used to power my Raspberry-Pi Go-Box computer. This is originally what I made the battery box for. To power the computer as well as charge/power cell phones and other small electronics.**


444.800.000
4.500 kHz
444.5
445.0
445.5

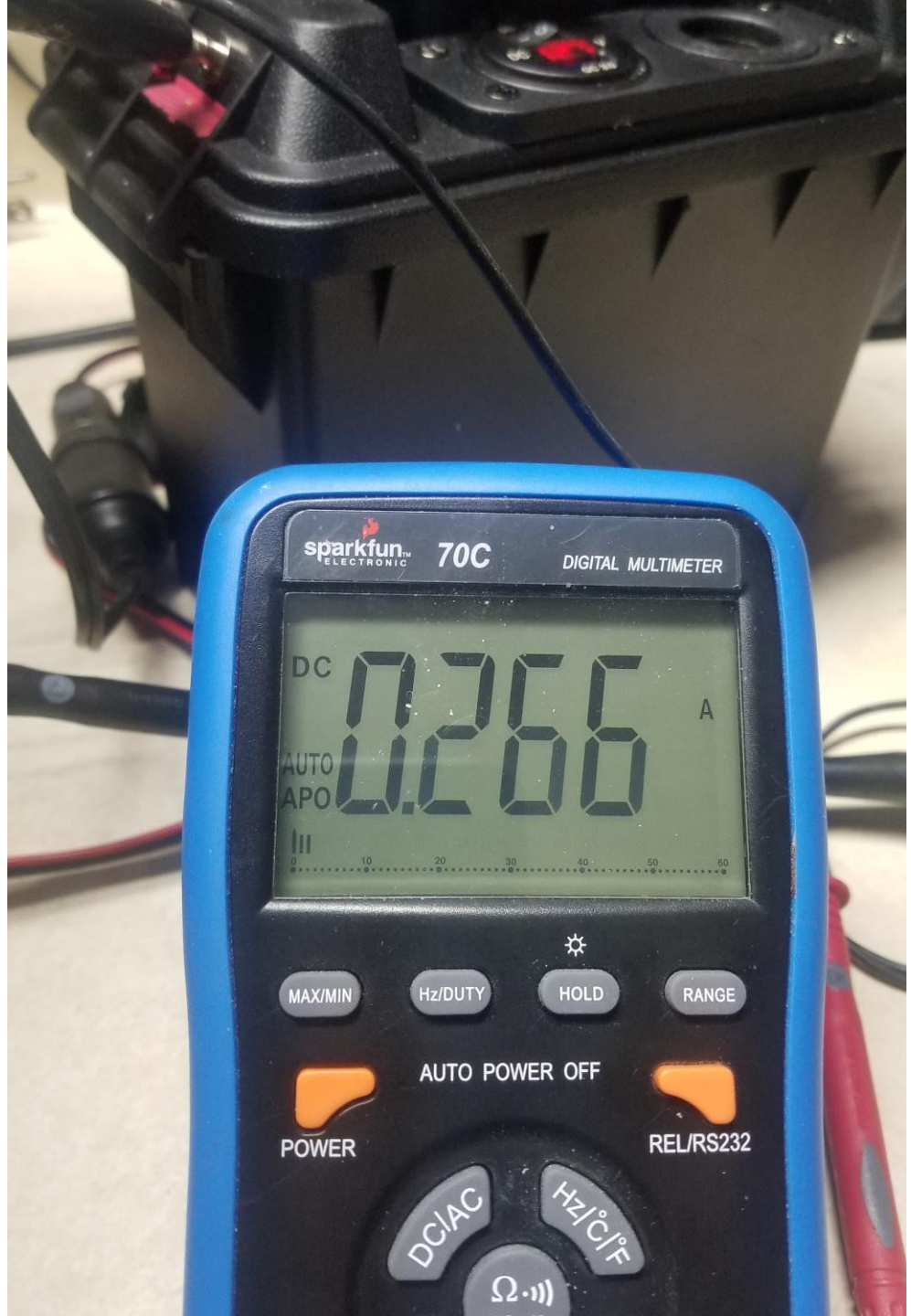
- **Comment: The next slide shows the battery box powering a small AC inverter which is running a small lamp. The lamp has a 5W bulb used in a typical nightlight. It powered the lamp on the inverter along with the little computer for hours.**

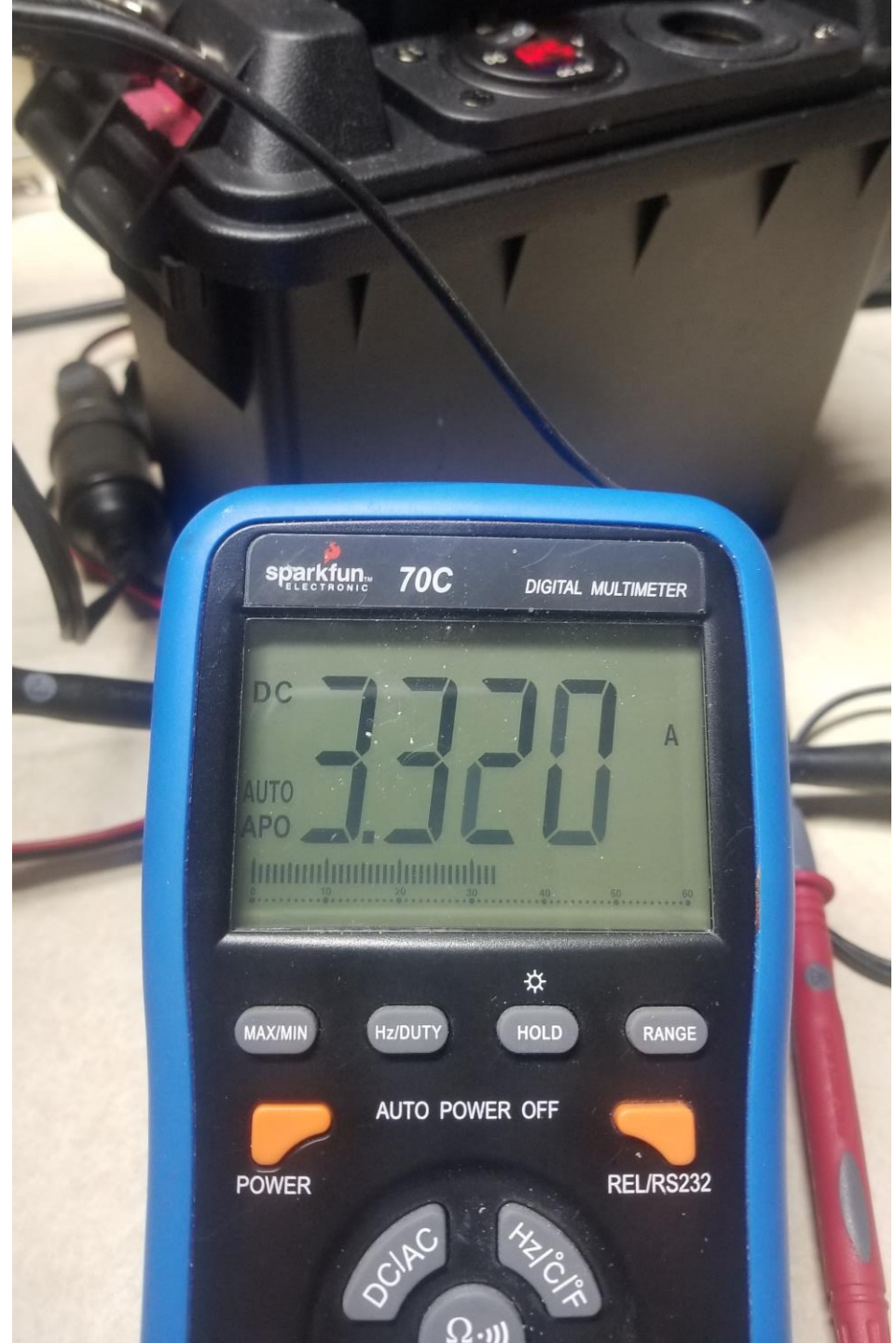

GO BOX Pi
Trash
CHIRP
Chrome
Firefox
Gqrx
CubicSDR
FoxtrotGPS
Pulse Audio
KO4IHP
Rii
ULTRAPOWER
CHARGER
SMART BATTERY

- **Comment: The next slide shows the battery box powering a small Mini Mobile Radio made by BTECH. It outputs 20 watts on high power and draws just over 3 Amps power. It works great running off of a cigarette plug adapter. I ran this radio all day running idle for the most part and later at night checked into a few Nets. It worked fantastic!**
- **This radio was discontinued by BTECH but another company QYT now makes similar ones for under $100. Not a bad little backup Go-Kit radio to have that will do 20 watts on a little battery. It even works on the Lithium-Ion battery pack shown earlier. The battery pack will fit in your pocket and the radio in the palm of your hand.**


BTECH
UV-2501
MARC1
442.300
V/M
EXIT/AB
FM
POWER
ON
OFF
OUTPUT:13.8V DC
BTECH

- **Comment: Digital Multimeter showing the amperage drawn from the little radio running idle. It draws about a quarter of an amp. Then when transmitting it is drawing just over 3 amps.**


sparkfun ELECTRONIC
70C
DIGITAL MULTIMETER
DC
0.266
A
AUTO
APO
MAX/MIN
Hz/DUTY
HOLD
RANGE
AUTO POWER OFF
POWER
REL/RS232
DC/AC
Hz/°C/°F


sparkfun ELECTRONIC
70C
DIGITAL MULTIMETER
DC
3.320
A
AUTO
APO
MAX/MIN
Hz/DUTY
HOLD
RANGE
AUTO POWER OFF
POWER
REL/RS232
DC/AC
Hz/°C/°F

Comment: The next slide shows that little radio with a Signalink. They make for a nice little compact portable WinLink rig. Powered by the battery box which will also power or charge a small computer needed as well.


SignaLink™ USB
PWR
PTT
TX
RX
DLY
Integrated USB Sound Card
KT-8900
F
CALL
MONI
144.950
446.775
V/M
EXIT/AB
FM
TS

Some useful link with info on Batteries and calculating Amp-Hours

How to Calculate Battery Amp Hours - Deep Cycle Battery Store

Difference between LiFePO4 battery and Li-Ion battery

Lithium-ion vs LiFePO4 - OH8STN Ham Radio

How to charge Lithium Iron Phosphate lithium ion battery packs

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The End ☺