

By Mark Breakey KB7RHI

PORTABLE
OPERATION WITH
SOLAR POWER 2018

THREE THINGS ABOUT HAM RADIO

1) Location agile, set up most anywhere

2) Frequency agile, lots of “channels”

3) Power agile, can provide 5 volts and 12 volts of emergency power

WHAT YOU WILL NEED TO START

There are many different levels in price for solar systems

I want your first step in getting a system to be affordable

I am going to present 4 different systems + talk about integrating some of our amazing technology

System #1 is a “Good Start”, buy some used equipment

You will need a solar panel, charge controller and an inline meter

You will also need a distribution block with Anderson connectors

Good example for used solar system would be a 75 watt solar panel and a simple cut-in/cut-out(shunt) charge controller...use your lead acid battery

The 75 Watt “Monocrystalline” type solar panel puts out about 4 amps

THREE TYPE OF SOLAR PANELS BY CONSTRUCTION, TWO TYPES BY DESIGN

- 1) Monocrystalline...best choice
- 2) Polycrystalline...good choice
- 3) Thin Film or Amorphous...ok choice, least efficient
- See my SEAPAC 2017 presentation for more info about solar panels and also lead acid battery info
- Two types of solar panels by design
 - 1) Off Grid nominal 12 volt panels, designed to maximize amperage, and are best for portable operations
 - 2) Grid Tie panels with higher voltage, designed to have the power transformed into 120 volts and go into the Grid



MODEL **SP75**
PHOTOVOLTAIC MODULE



30B9 LISTED

SPECIFICATIONS AT 1000 W/M² SOLAR IRRADIANCE, 25°C CELL TEMPERATURE.

NON-INCENDIVE CLASS 1 DIVISION 2
GROUP A,B,C,D HAZARDOUS LOCATION



MAX. POWER

75 WATTS

CURRENT
SHORT CKT. RATED

4.8A

4.4 A

MAX. SYST.
OPEN CKT. VOLTAGE

600 V

VOLTAGE
OPEN CKT. RATED

21.7 V

17.0 V

FIRE RATING

CLASS C

SERIES FUSE

15 A

FIELD WIRING

COPPER ONLY, 14 AWG MIN.
INSULATED FOR 90°C MIN.

BYPASS DIODE

INSTALLATION GUIDE
019831

SERIAL NUMBER

020854 E 1 37 01 01552

WHAT TO LOOK FOR IN A USED SOLAR PANEL

The Siemens SP-75 solar panel is a good quality example

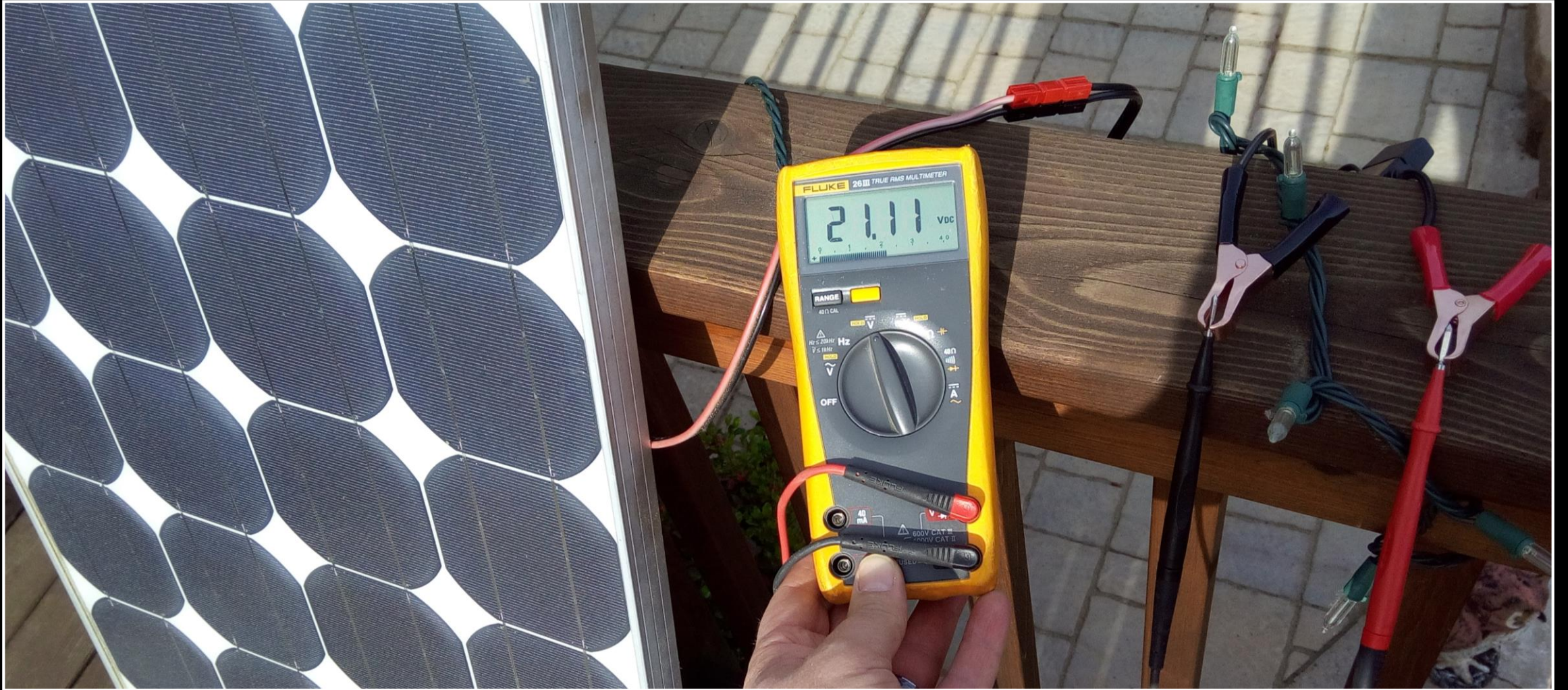
Monocrystalline panel, you should count 36 cells, each cell is about 0.5 volts and they are wired in series to make about 18 volts

Will show VOM to check “Open Circuit Voltage” while in the sun

Will show VOM to check “Short Circuit Current” amps while in the sun

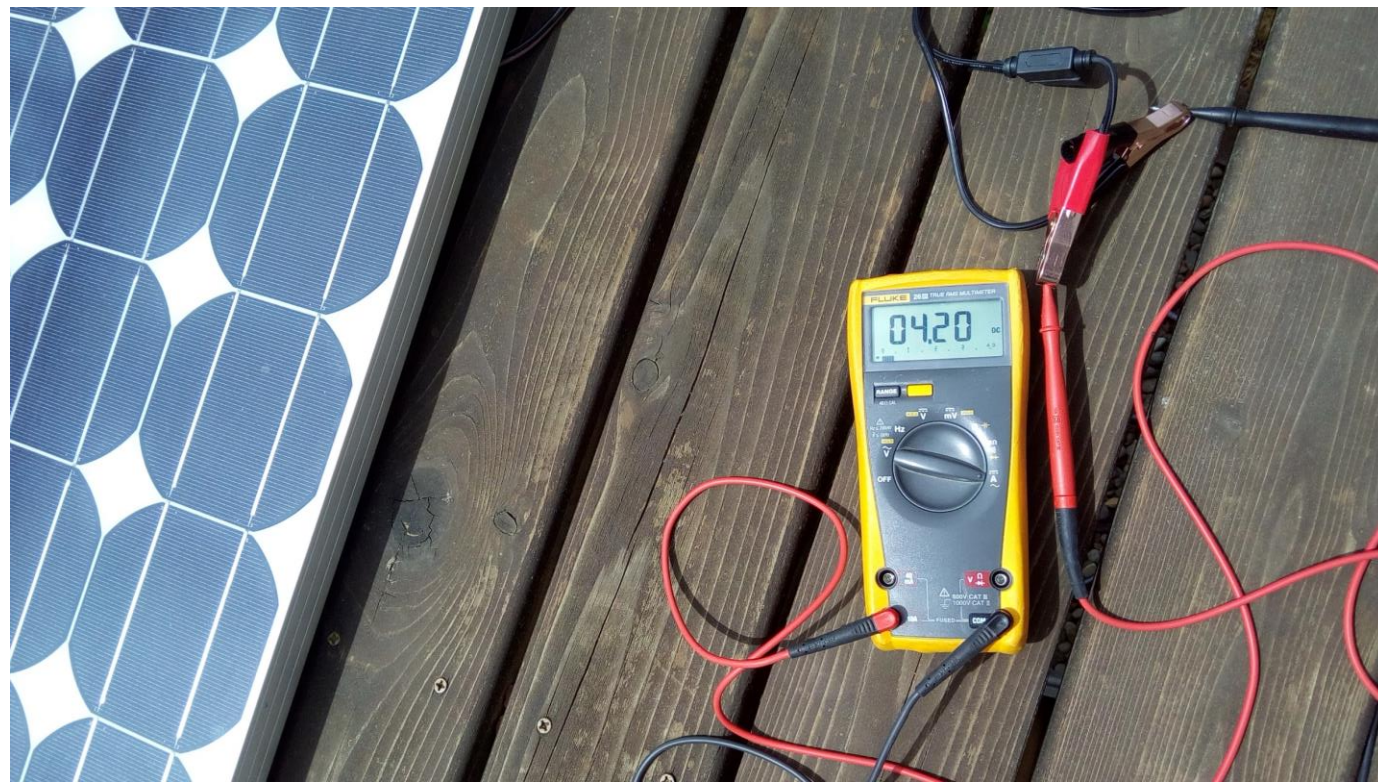
Note how much the amperage output drops when you shade just a portion of the solar panel

Some Monocrystalline panels had 32 cells, they were trying to match your battery voltage, not good in hazy or cloudy conditions or when the panel gets hot and the voltage sags



LATE AFTERNOON "SUN WITH SOME CLOUDS", V_{oc} OPEN CIRCUIT VOLTAGE, PANEL VOLTAGE

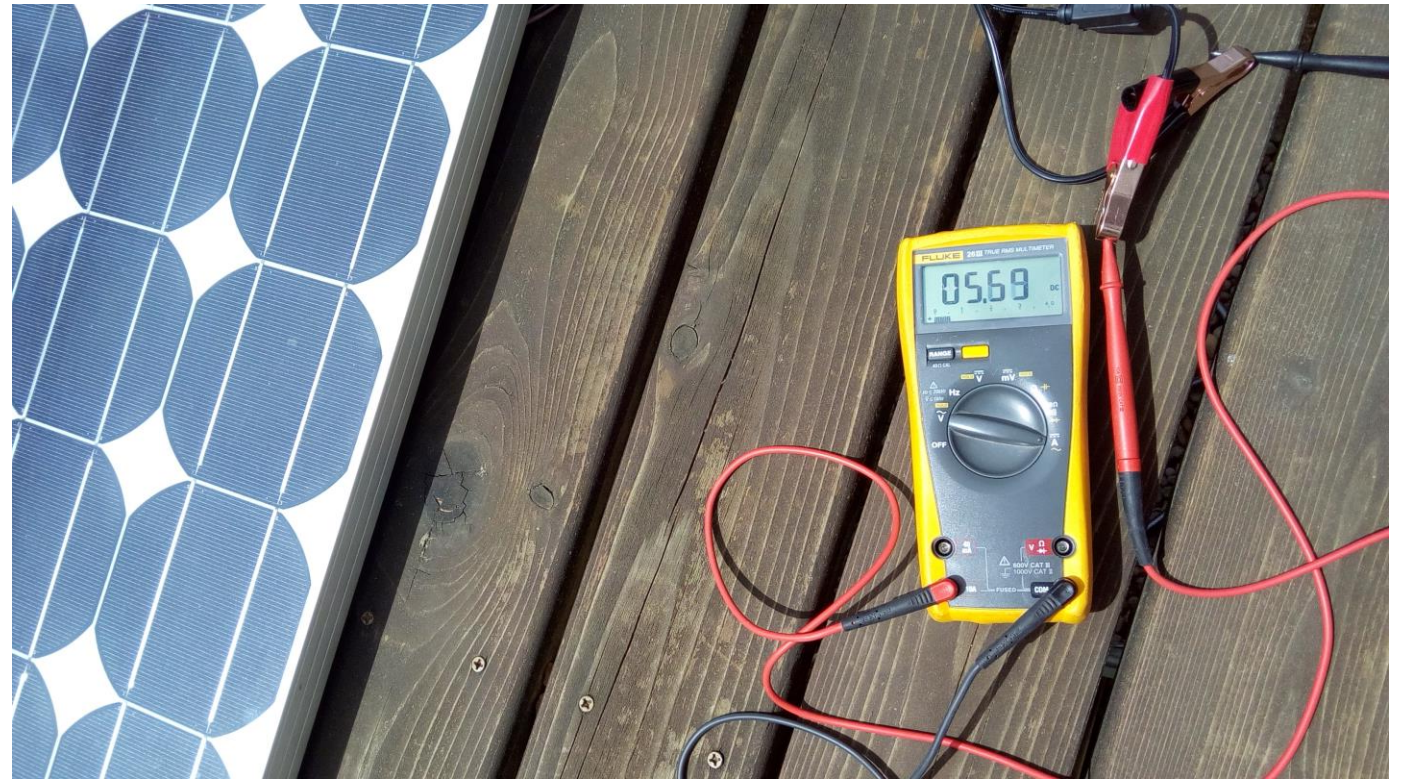
75W SOLAR
PANEL IN
THE SUN
PUTTING
OUT 4.2
AMPS



EDGE-OF-CLOUD EFFECT

- When measuring amperage on a sunny day with big fluffy clouds in the sky, you may notice a spike in amperage just as the sun comes out from behind a big cloud
- This is known as the edge-of-cloud effect
- The sunlight suddenly becomes very intense for a brief period due to concentration of sunlight
- Larger systems will factor this in by allowing for an additional 20%-25% of amperage being possible in the system when this happens
- Notice the spike in amperage on the next slide

75W SOLAR
PANEL
PUTTING OUT
5.69 AMPS
BRIEFLY
DURING AN
EDGE-OF-
CLOUD-EFFECT





Charged
Chargée

Charging
Sous charge

8 AMP
Charge Controller
Contrôleur de Charge

Load:	8A max
Charge:	
Cut-Out: Hors circuits:	14.2V
Cut-In: En circuits:	13V

60008

Made in China / Fabriqué en Chine

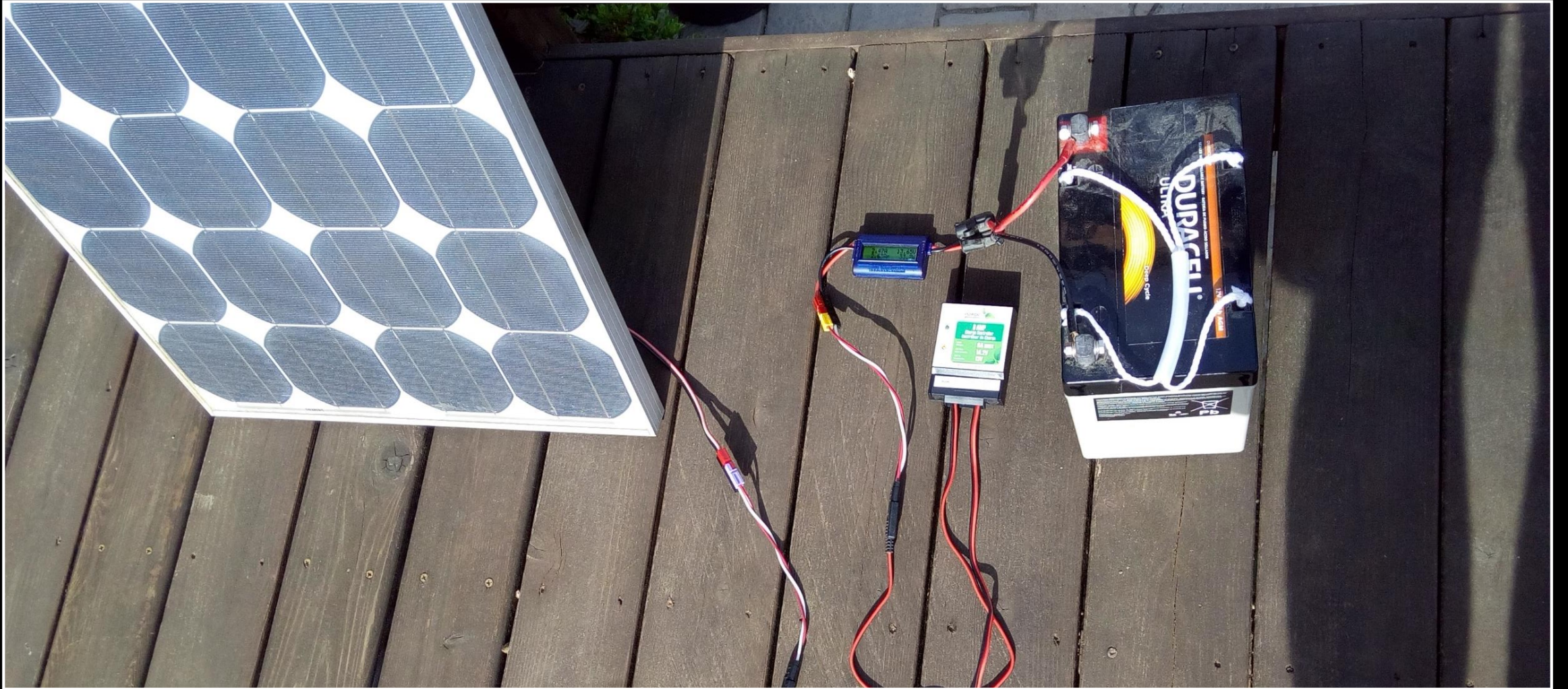
12V
Battery
Batterie

Solar Panel
Panneau Solaire

Used Cut-in/Cut-out Solar Charge Controller, Shorts The Panel At 14.2 Volts, Reconnects The Panel To The Battery At 13 Volts

THREE TYPES OF CHARGE CONTROLLERS

- 1) Basic cut-in/cut-out (shunt) controller, least efficient, but no RFI issues
- 2) PWM (Pulse Width Modulation), more precise measured amounts of power designed to maximize charging. Used at a lot at repeater sites without RFI problems, I use for portable operations without problems
- 3) MPPT (Maximum Power Point Tracking)...transforms the power from higher panel voltage down to the battery voltage...does DC to AC conversion, goes through a transformer which brings voltage down and raises the amperage...with transformers $\text{Power In} = \text{Power Out}$...most efficient, classic design produces massive RFI, must be specially designed to limit RFI...Genasun GV-10 and Genasun GV-5 are examples of quiet ones



LATE AFTERNOON "SUN WITH SOME CLOUDS", 75 WATT SOLAR PANEL WITH CUT-IN/CUT-OUT CHARGE CONTROLLER



INLINE METER READING, LATE AFTERNOON "SUN WITH SOME CLOUDS", (RC ELECTRONICS WATTS UP METER), YOU ADD THE ANDERSON CONNECTORS



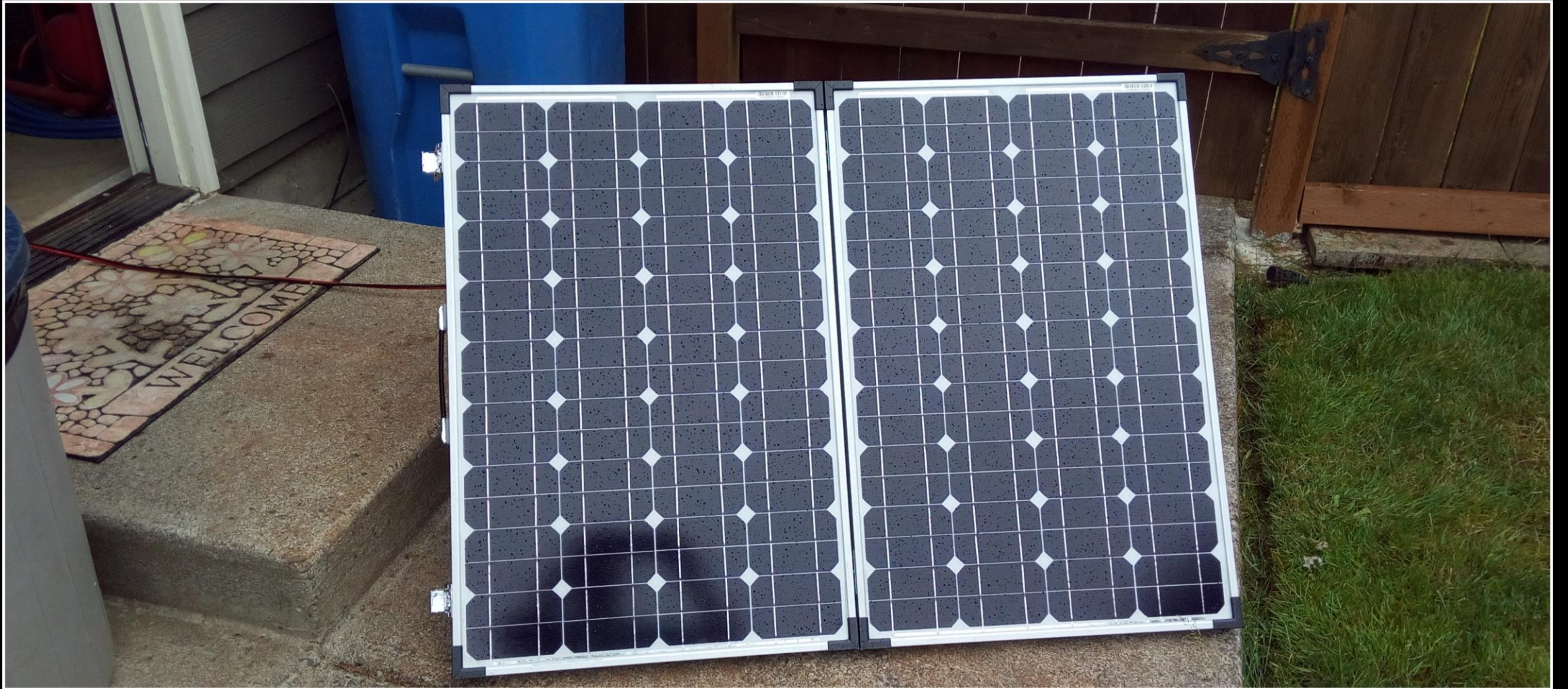
WATT'S UP INLINE METER DISPLAYS CURRENT, VOLTAGE AND WATTS + A ROTATING VALUE DISPLAY IN THE LOWER LEFT CORNER

WANT MORE
POWER, JUST
PARALLEL
CONNECT
MORE PANELS





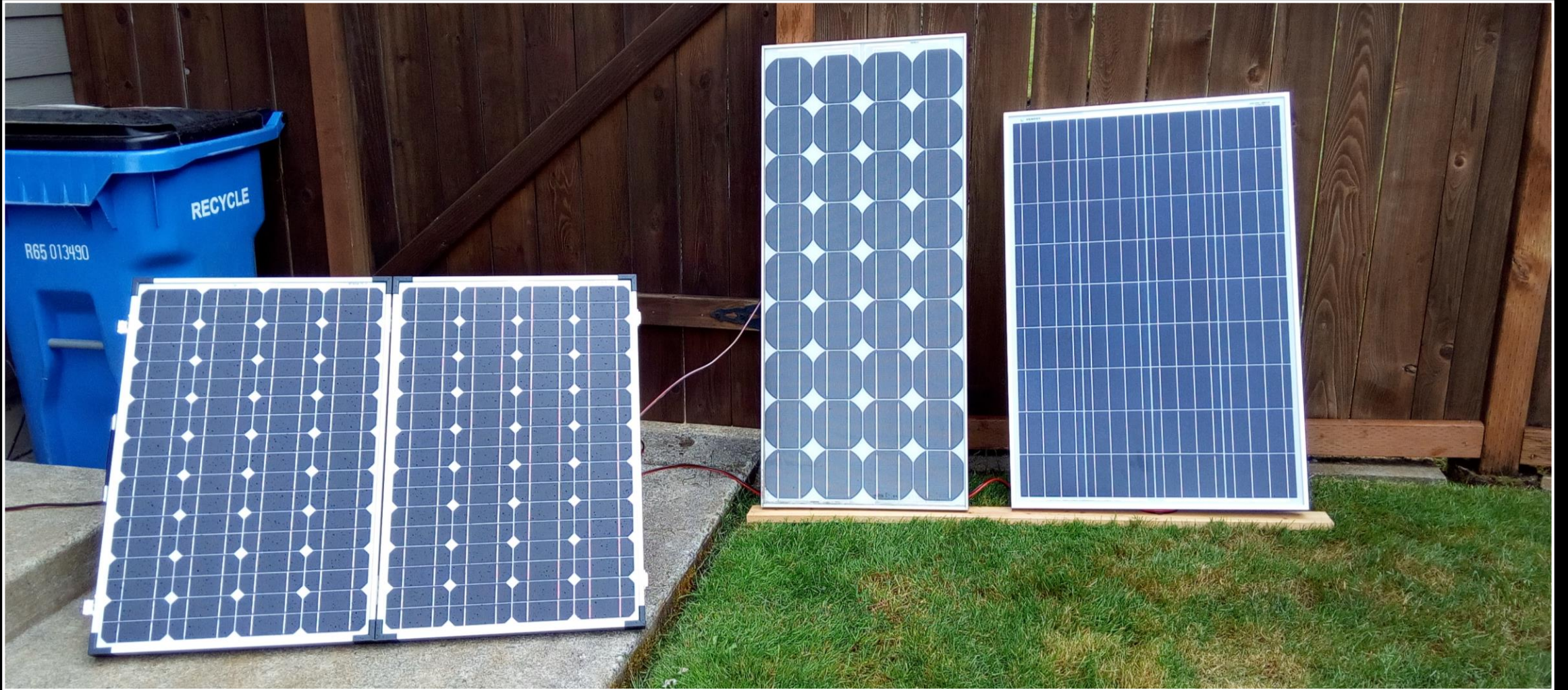
IN THE NW WE SEE "CLOUDS WITH NO DIRECT SUN AND SOME SPRINKELS OR RAIN", EXAMPLE WITH CLOUDY SKY AND SLIGHT SPRINKLE



BIOENNO POWER 120 WATT SOLAR PANEL WITH CLOUDY SKY, SLIGHT SPRINKLE



CLOUDY SKY WITH 120 WATT SOLAR AND GENASUN GV-10 MPPT CHARGE CONTROLLER, PANEL INPUT IS LEFT WATTS UP METER



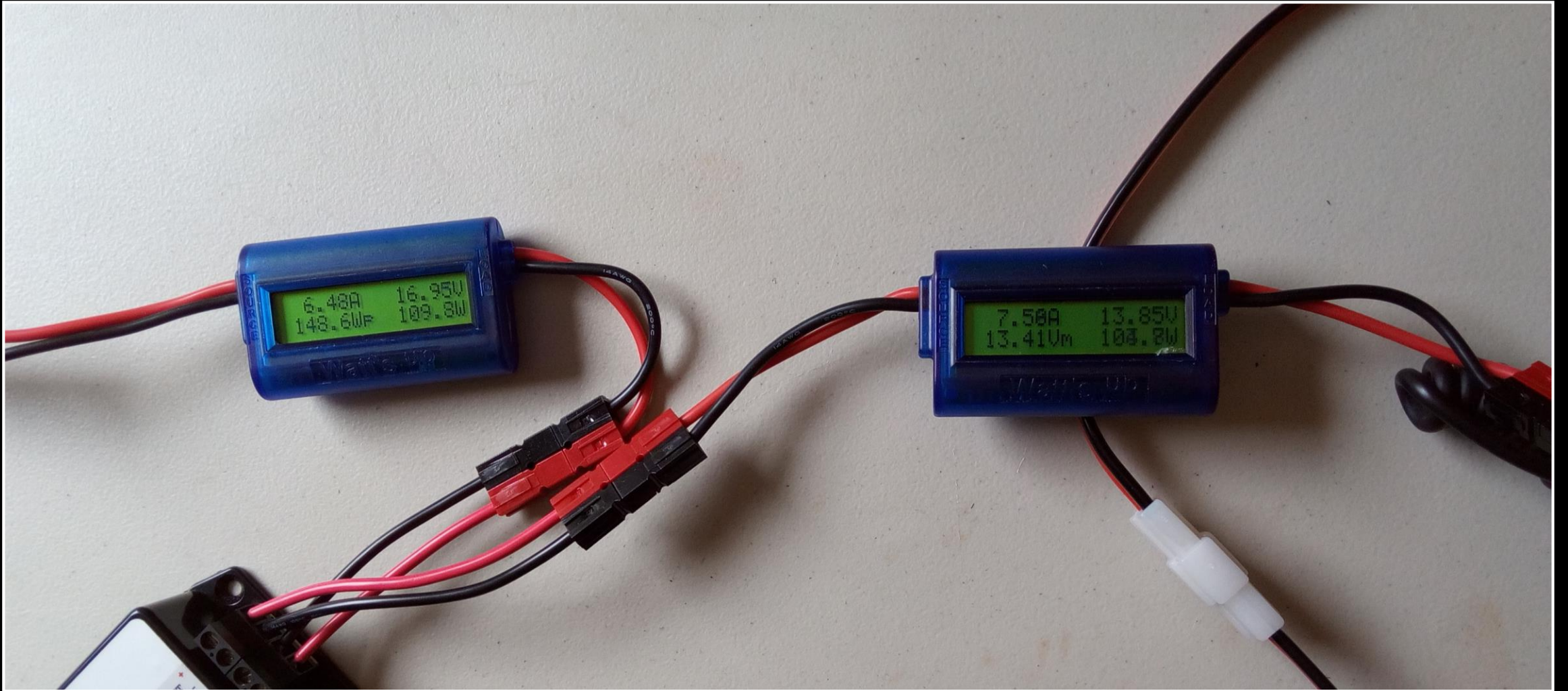
120W + 75w + 100W SOLAR PANELS WITH "CLOUDY SKY" = 295 WATTS TOTAL

SEPARATE SOLAR PANEL READINGS + ALL THREE SOLAR PANEL READINGS COMBINED ON A "CLOUDY DAY"

SOLAR PANEL SIZE	BEFORE MPPT INLINE METER AMPS/VOLTS/WATTS	AFTER MPPT INLINE METER AMPS/VOLTS/WATTS
75 WATTS	.43 AMPS/16.8 VOLTS/ 7.3 WATTS	.5 AMPS/13.4 VOLTS/6.7 WATTS
100 WATTS	.69 AMPS/16.8 VOLTS/11.6 WATTS	.8 AMPS/13.4 VOLTS/10.8 WATTS
120 WATTS	1.0 AMPS/17.2 VOLTS/17.1 WATTS	1.2 AMPS/13.4 VOLTS/15.7 WATTS
CONNECTED 75W + 100W + 120W ALL TOGETHER WITH A DISTRIBUTION BLOCK	2.1 AMPS/17.6 VOLTS/ 36.0 WATTS	2.5 AMPS/13.5 VOLTS/34 WATTS



THE SUN IS JUST STARTING TO PEAK THROUGH THE CLOUDS WITH 295 WATTS



295 WATTS WITH THE SUN JUST STARTING TO PEAK THROUGH THE CLOUDS

SOLAR POWER WHEN IT IS SNOWING 2018



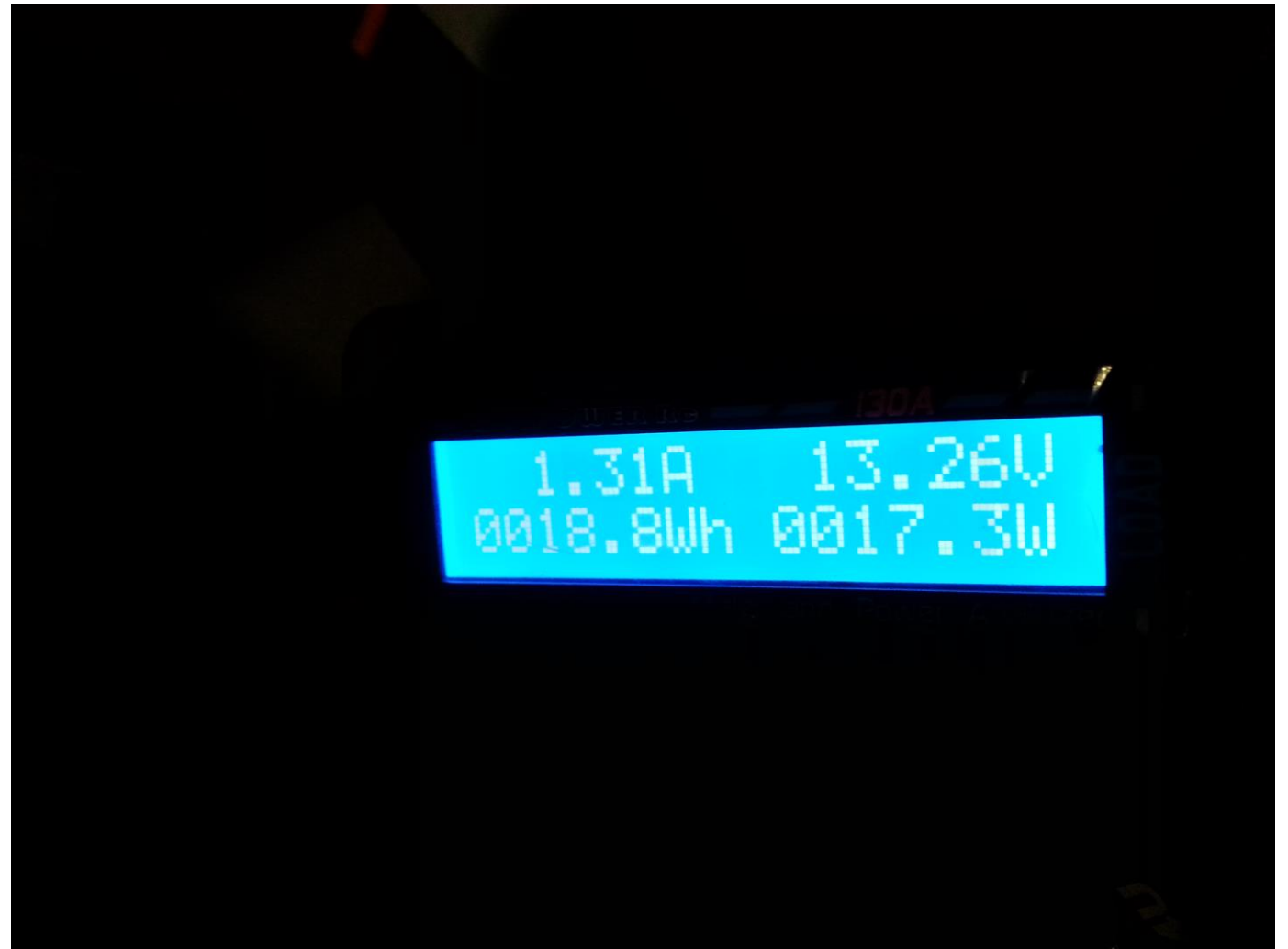
SOLAR POWER
WHEN IT IS
SNOWING SKY
PIC



SOLAR POWER WHEN
IT IS SNOWING
PARALLEL
CONNECTION OF
120W + 100W PANELS



SOLAR
POWER
WHEN IT IS
SNOWING
INLINE
METER
READING






SYSTEM #2 IS A RENOGY 100 WATT SOLAR PANEL AND MORNINGSTAR SUNSAVER 6 CHARGE CONTROLLER WITH DISTRIBUTION BLOCK AND METER

RENOGY 100 WATT
SOLAR PANEL CAN
PUT OUT ABOUT 5.5
AMPS IN FULL SUN,
LESS IN REAL HOT
WEATHER






 **RENOGY**
THE FUTURE OF CLEAN ENERGY

Address: 2775 E. Philadelphia St.,
Ontario, CA, 91761
Tel: 800-330-8678
Fax: 888-543-1164
Web: www.renogy.com

Module Type: RNG-100P

Max Power at STC (P_{max})	100 W
Open-Circuit Voltage (V_{oc})	22.4 V
Short-Circuit Current (I_{sc})	5.92 A
Optimum Operating Voltage (V_{mp})	17.8 V
Optimum Operating Current (I_{mp})	5.62 A
Temp Coefficient of P_{max}	-0.44%/°C
Temp Coefficient of V_{oc}	-0.30%/°C
Temp Coefficient of I_{sc}	0.04%/°C
Max System Voltage	600VDC (UL)
Max Series Fuse Size Rating	15 A
Fire Rating	Class C
Weight	7.5kgs / 16.5lbs
Dimensions	1010x680x35mm / 39.8x26.7x1.4in
STC	Irradiance 1000 W/m ² , T = 25°C, AM=1.5

WARNING: This module produces electricity when exposed to light. Please follow all applicable electrical safety precautions. Only qualified personnel should install or perform maintenance work on these modules. Beware of dangerously high DC voltages when connecting modules. Do not damage or scratch the rear surface of the module. Follow your battery manufacturer's recommendation.

CE    Module Application: Class A

RENOGY 100 WATT SOLAR PANEL NAME PLATE

System #3 BACKPACK PORTABLE WITH SOLAR POWER

Acopower 50 watt foldable solar panel

Genasun GV-5 MPPT solar charge controller...handle up to 5 amps

Bioenno Power 12Ah LFP battery...domestic flight carry on is ok

Radio...Yaesu FTM-400, dual band, dual receive, FM and digital

Powerpole distribution Block

RC Electronics WattsUp inline 12 volt meters x 2

WB6IQN DBJ-2 dual band roll up J-pole antenna...rated for 50 Watts

MFJ 1724B dual band mag mount antenna rated for 50 watts

BACKPACK PORTABLE WITH SOLAR POWER

Powerwerx ATC style inline fuse with
powerpole connectors

Cookie sheet as a portable ground plane

Powerpole to alligator clips...to access any
12 volt battery

Car power port to powerpole
adapter...power to/from a vehicle

USB buddy...12 volt powerpole to 5 volts
USB power

5 volt inline meter





BIOENNO POWER 12 AH LFP BATTERY



Bioenno Power 12 volt LFP Battery

Weight is 3.3 pounds

Max continuous current is 20 amps

Maximum peak pulse current is 40 amps (2 seconds)

Fairly flat discharge curve

Charging current = 5 amps

Operating temperature = -10C to 60C

High energy density

DID A SIMULATED LOAD TEST WITH THE BIOENNO
POWER 12 AH LFP BATTERY...VARIABLE RECEIVE
LOADS WITH RANDOM TRANSMIT LOADS...TEST
START IS 0607, AMP/HOURS SHOWS BATTERY
DRAIN STATUS

TIME	AMP/HOURS	LOAD	VOLTAGE UNDER LOAD
0634	1.0	16 AMPS RADIO TX	12.4 VOLTS
0650	2.0	14.4 AMPS RADIO TX	12.5 VOLTS
1007	11.3	2.6 AMPS RADIO RX	12.6 VOLTS
1014	12.0 ALL 12 AH USED SO FAR	19 AMPS RADIO TX FULL POWER STILL	11.7 VOLTS
1018	12.1	2.6 AMPS RADIO RX	12.6 VOLTS

SYSTEM #4,
OFF-GRID 120
WATT SOLAR
POWER WITH
30 AH LFP
BATTERY

Bioenno Power 120 watt foldable solar panel with fold out legs

Genasun GV-10 MPPT charge controller...ok for up to 140 watt panel

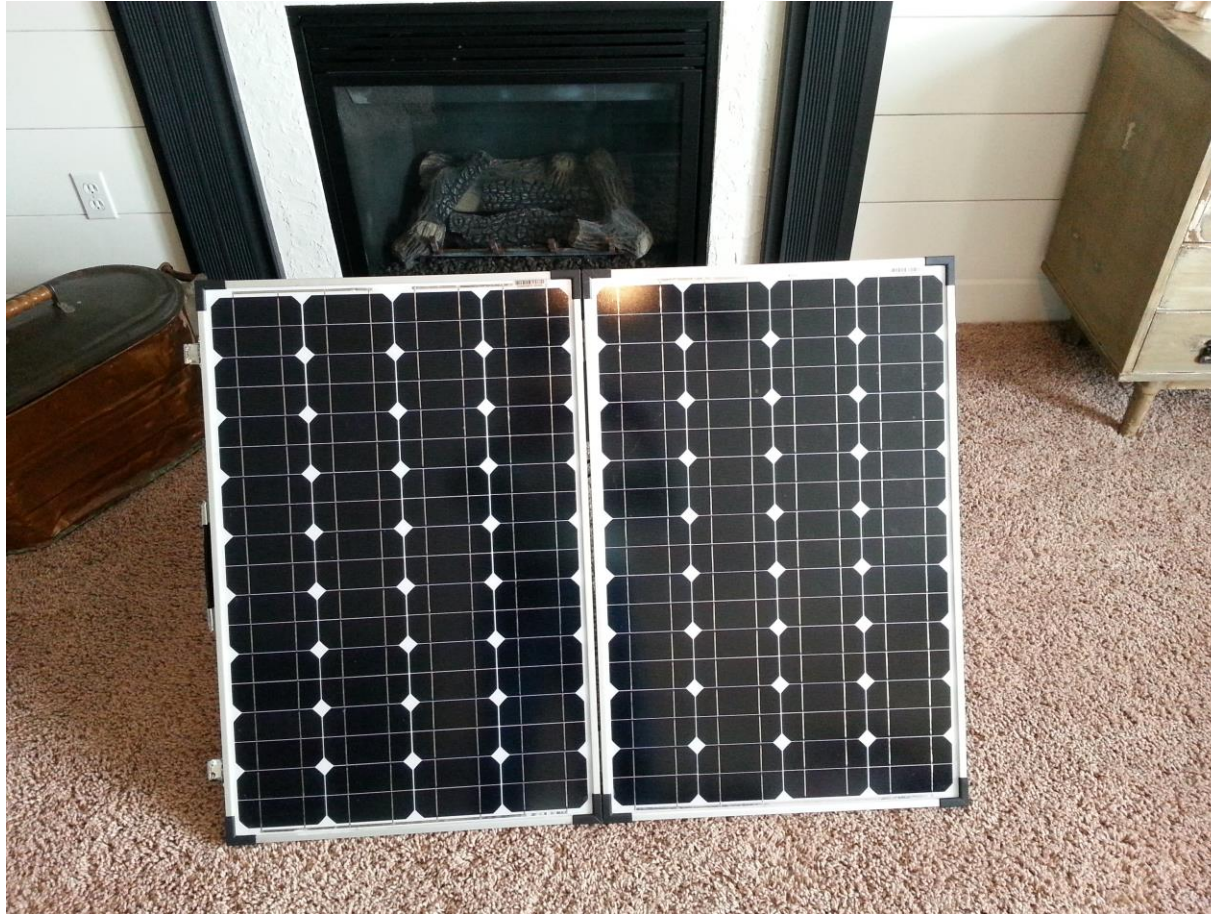
Bioenno Power 30Ah LFP battery

West Mountain Radio RIRunner 4004 USB power distribution block

RC Electronics WattsUp 12 volt inline meters x 2

Powerwerx ring terminal to powerpole ATC style fuse holder

BIOENNO POWER 120 WATT FOLDABLE SOLAR PANEL



BIOENNO POWER 120 WATT FOLDABLE SOLAR PANEL BACKSIDE VIEW



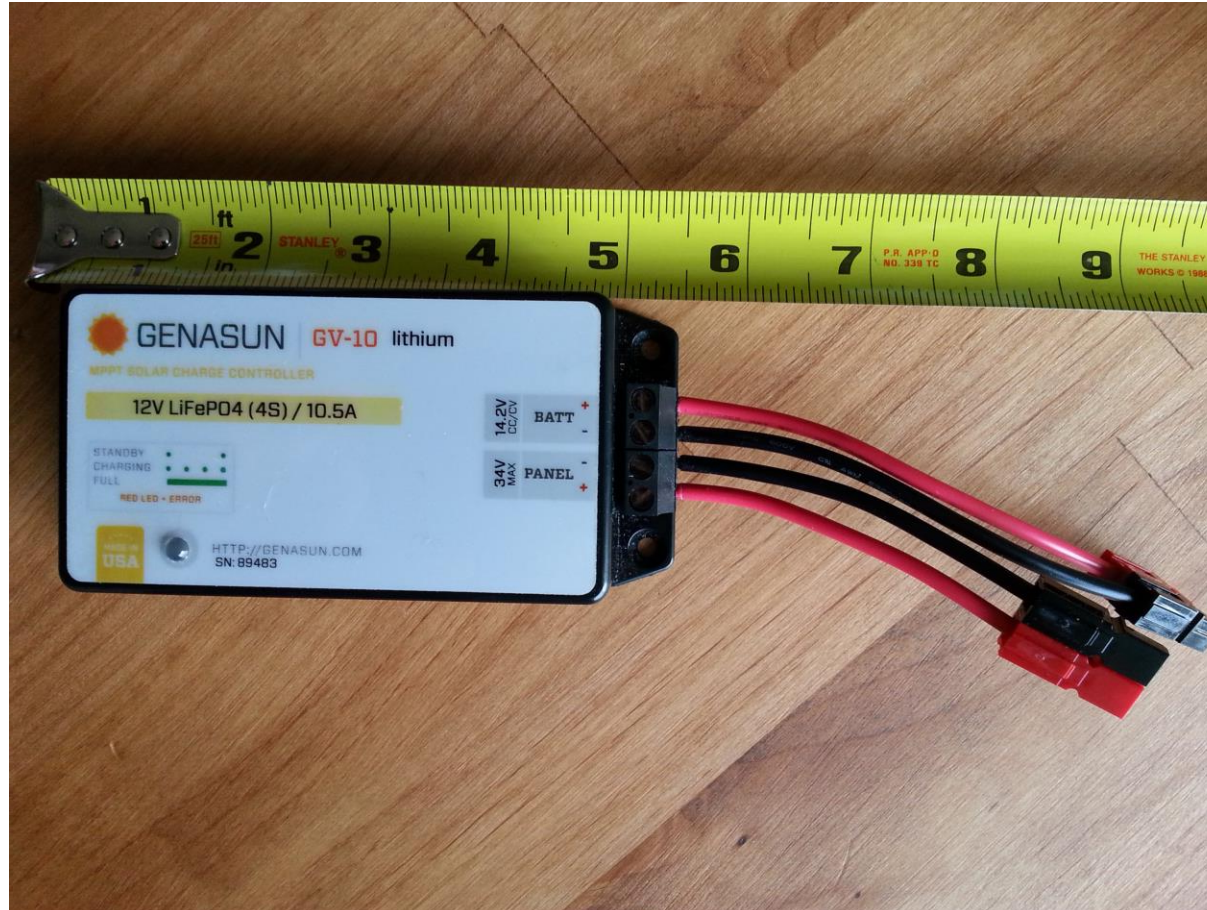
BIOENNO POWER 120 WATT FOLDABLE SOLAR PANEL IN THE SOFT CARRY CASE



BIOENNO POWER 30AH LFP BATTERY AND WEIGHS JUST 8.6 LBS



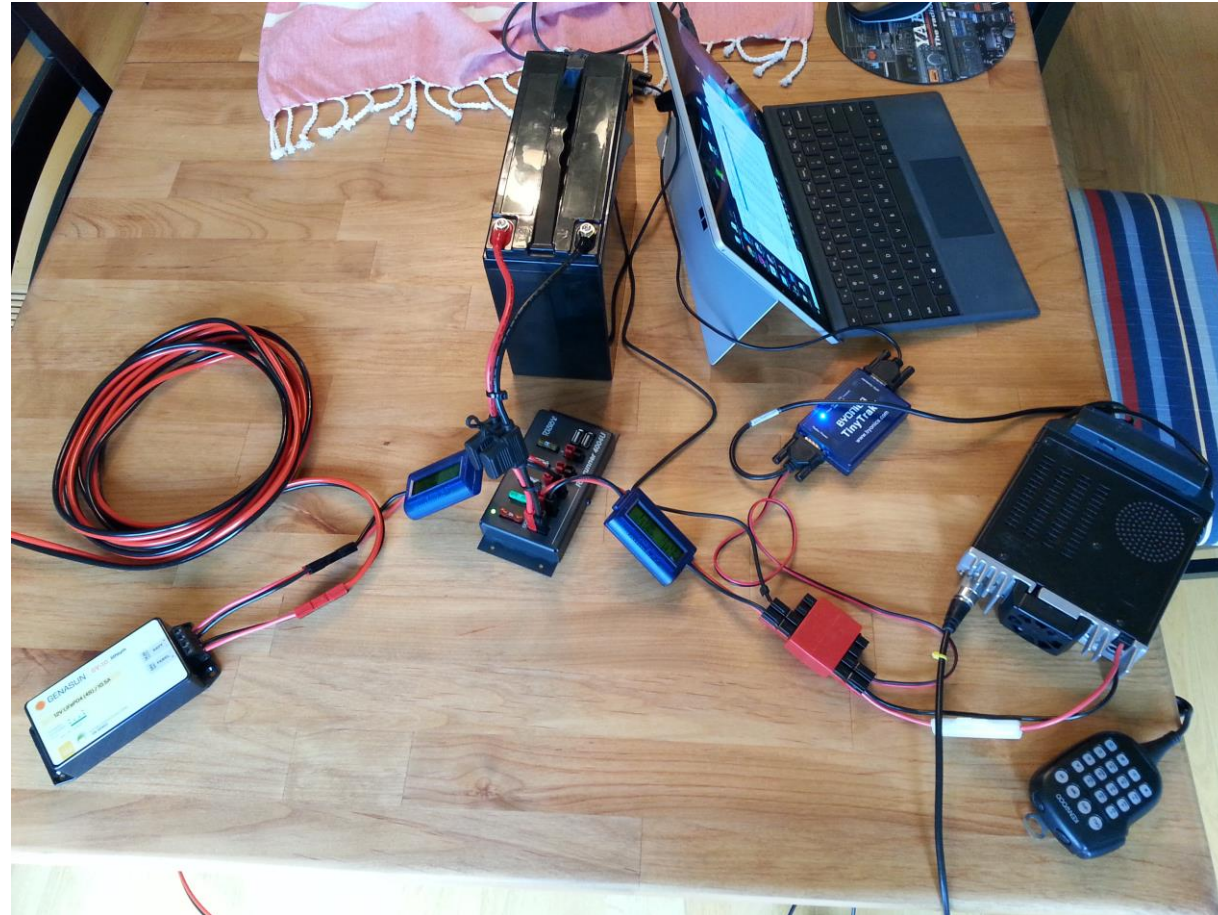
GENASUN GV-10 MPPT CHARGE CONTROLLER FOR LFP BATTERIES THAT IS RF QUIET



BIOENNO POWER 120W SOLAR PANEL



(120 WATT SOLAR PANEL) + GENASUN GV-10 MPPT CHARGE CONTROLLER, 30 AH LFP BATTERY AND YOUR DIGITAL WINLINK EXPRESS AD HOC STATION



LOAD EXAMPLE

Radio Rx current is 0.6 amps

Radio Tx current is 7.9 amps

Rx 80%/Tx 20%

Receive load is $0.6 \text{ amps} \times .8(80\%) = .5 \text{ average amps per hour}$

Transmit load is $7.9 \text{ amps} \times .2(20\%) = 1.6 \text{ average amps per hour}$

Total is about 2.1 average amps per hour

With your station, use an inline meter to see how many amp/hours you are using...the numbers above are just a benchmark to go by

30 Ah BATTERY WITH 2.1 Ah LOAD

Plan to use 90% of the SOC (State of charge) for your LFP battery calculations

$$30\text{Ah} \times .9(90\%) = 27\text{Ah}$$

27Ah LFP battery capacity available/2.1 amps per hour load = 12.8 hours of energy for after dark comms

If it is winter time, reduce the power output of your radio, use a gain antenna

Plan to meter the input and output of your system to track battery SOC

Note: Your regular lead acid deep cycle AGM 55Ah battery has about the same capacity as your LFP 30Ah battery, but the 55Ah battery is much heavier to carry around

PORTABLE OPERATION WITH SOLAR POWER PLAN

Need to know the maximum charge current your battery can accept

Plan to select a solar panel/charge controller combination that will not exceed the charge input amperage of your battery

Need to know the average load per hour for typical radio communications in the field, try to size the solar input to exceed the load

The 30Ah LFP battery/120W solar system peak amperage is about 9 amps, you will be able to charge other items during the day

LOAD BALANCING NOTE...if your battery is fully charged and you have a lot of midday sun, your solar panel will be throttled down to just meet your load, no where else for the extra power to go

Midday sun could be 9 amps potential from your solar panel and your load might just be 3 amps, plan to charge USB battery packs or some device during peak sun hours when your battery is topped off

Plan to top off your battery by the end of the day, if you anticipate needing to provide communications a lot at night

IN A REAL EMERGENCY WITH THE GRID DOWN, THE ABILITY TO CHARGE CELL PHONES CAN STILL BE IMPORTANT

1

In a Cascadia Subduction Zone type event, expect wide spread loss of most all types of communication and there being no grid power

2

Cell phones can still do many things

3

They can take pictures, provide addresses, use their GPS, take notes, be your calculator, provide in the moment instruction on first aid and survival with already downloaded apps

4

Ham radio operators can use the picture taking ability to help their local EOC

LARGE SCALE EARTHQUAKE HAS JUST HAPPENED AND SOME BRIDGES ARE DAMAGED OR DESTROYED, THE LOCAL EOC NEEDS SITUATIONAL AWARENESS INFO

In this scenario, roads are so damaged, no one can quickly run around and gather needed information for the local EOC and road department

Ham radio operator can set up an Ad Hoc digital Winlink station to feed information into the local EOC where a structural engineer can evaluate the damage

Your station now has portable operation with solar power, here is how your station can help with actionable information via pics

PORTABLE OPERATION WITH SOLAR POWER USING THE WINLINK PACKET RADIO SYSTEM

- 1) People with Android phones see critical structures damaged and take some pics
- 2) Of particular interest are bridges, but they are usually located at low elevation river crossings, location might be difficult to forward information by radio
- 3) Ham radio operators set up some portable stations around the county that have digital Winlink P2P capability, solar power helps keep them on the air day after day
- 4) Somebody takes some pics and then travels to the nearest field post where Ham radio operators have just set up their voice and digital station



HOW TO DO A PICTURE AD HOC TRANSFER USING YOUR ANDROID PHONE AND THE WINDOWS 10 OPERATING SYSTEM USING A LAPTOP WITH BT

- 1) Sort which picture or two might be of greatest interest to your local EOC
- 2) With your Windows 10 laptop on the bottom right of the screen, locate your up arrow “Show hidden icons” icon, and click on it
- 3) Locate and click on the blue colored “BT” symbol
- 4) In the pop up menu, scroll down about halfway to the “Receive a File” selection and click on it
- 5) The Bluetooth File Transfer page will open up, and you will see a message about “Waiting for a connection”
- 6) Ad Hoc (For this purpose only) has no complex pairing process to do



AD HOC FILE TRANSFER PROTOCOL PAGE 2

1) Go to the first selected pic on the Android phone

2) You can click on the BT symbol directly if you see it or click on the “Share via” symbol, looks like a V turned over on its right side with three big dots as part of the symbol, in the Share menu, then find and click on the BT symbol

3) If Bluetooth was not yet turned on, you will see a message about “Turn Bluetooth on to use Bluetooth services”, just select below the “Turn on” selection

4) You will then see “Available devices”, pick the name associated with your laptop, use Show Bluetooth Devices to see the name of your device if needed

5) You then see a File Transfer progress bar go green from left to right as your data flows from the phone to your laptop via BT

6) You then see a default location for your file to go to, use the “Browse” button to pick a selected site

USING WINLINK EXPRESS TO EMAIL A FILE ATTACHMENT VIA P2P PACKET RADIO

- 1) Open up Winlink Express
- 2) Click on the new message icon
- 3) Then click on “Attachments”
- 4) Then click on “Add”
- 5) Your file explorer will open, from there select the pic to send
- 6) When you click on the pic, your picture file name will show up and the size will be in red, it is currently too big to send by email using Winlink



EDIT AND RESIZE THE PIC

1) Select the “Edit/Resize-Image” button

2) When are done rotating and/or cropping your pic, then select resize

3) You will now see “Current file size”, you can now enter the desired file size, like 30 (kb), now hit save and then save again, you will see the file is now showing to be 30kb in size

4) Then hit close and notice your file attachment (Pic) is a part of your email

5) Remember to use the drop down menu to select this message as a “Peer-to-Peer Message”, fill in call sign under To, fill in Subject and Message, then “Post to Outbox”, the rest is per your training with Winlink



ACTUAL PICTURE
SENT EMAIL OVER
RADIO, 10 KB SIZE



ACTUAL PICTURE
SENT EMAIL OVER
RADIO, 20KB SIZE



ACTUAL PICTURE
SENT EMAIL OVER
RADIO, 30 KB SIZE



ACTUAL PICTURE
SENT EMAIL OVER
RADIO, 40 KB SIZE



10 KB SIZE BRIDGE
DECK PIC



20 KB SIZE PIC SENT
VIA EMAIL OVER
RADIO



30 KB SIZE PIC SENT

HOW TO KEEP THOSE VALUABLE CELL PHONES CHARGED WHEN THE GRID IS DOWN

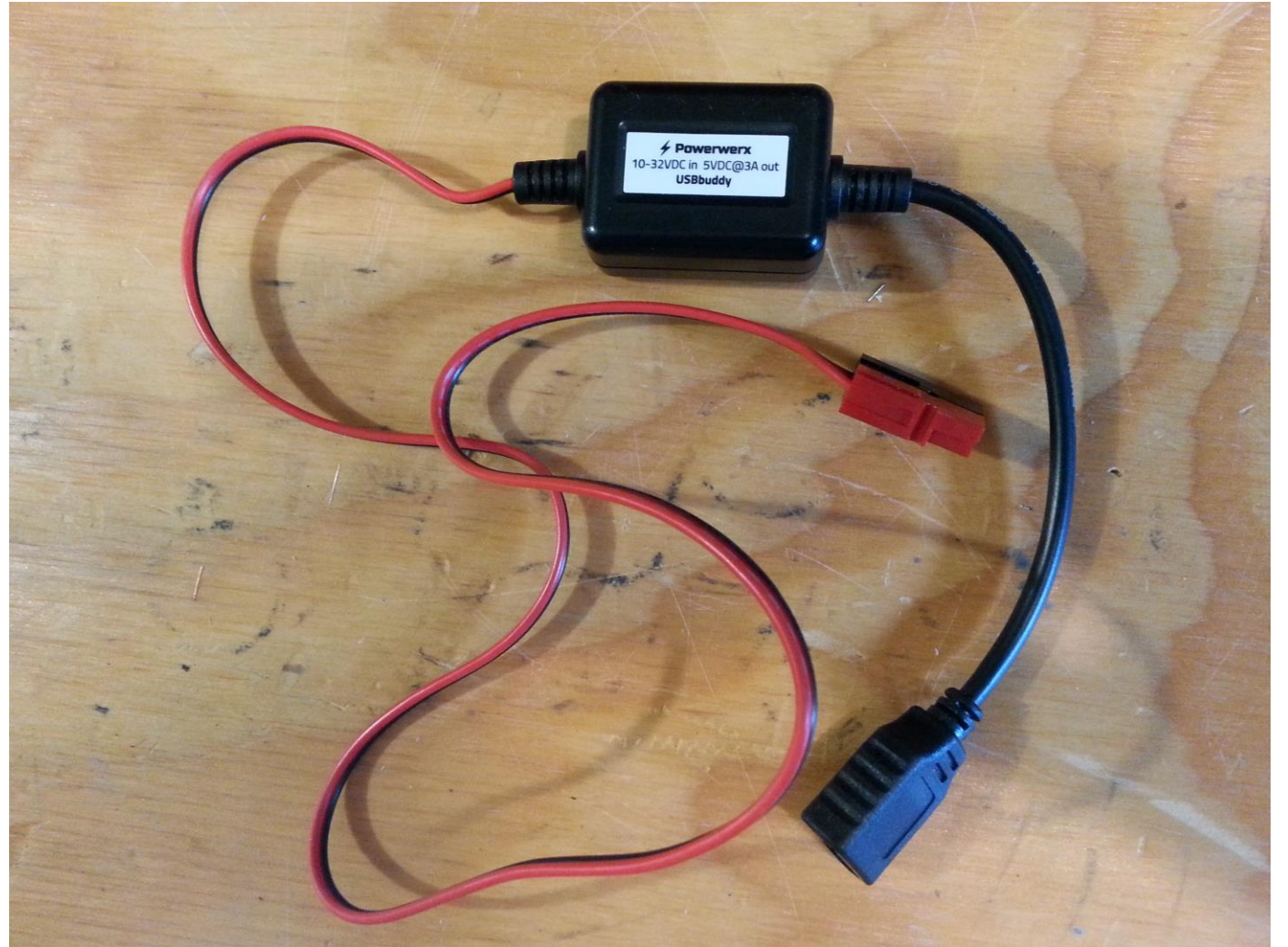
People will hold on to their cell phones to do all kinds of tasks during the day

If you have some USB Li-ion battery packs, you can charge the battery packs during the day with your excess power, then key people can charge their phones in the evening, go out again the next day

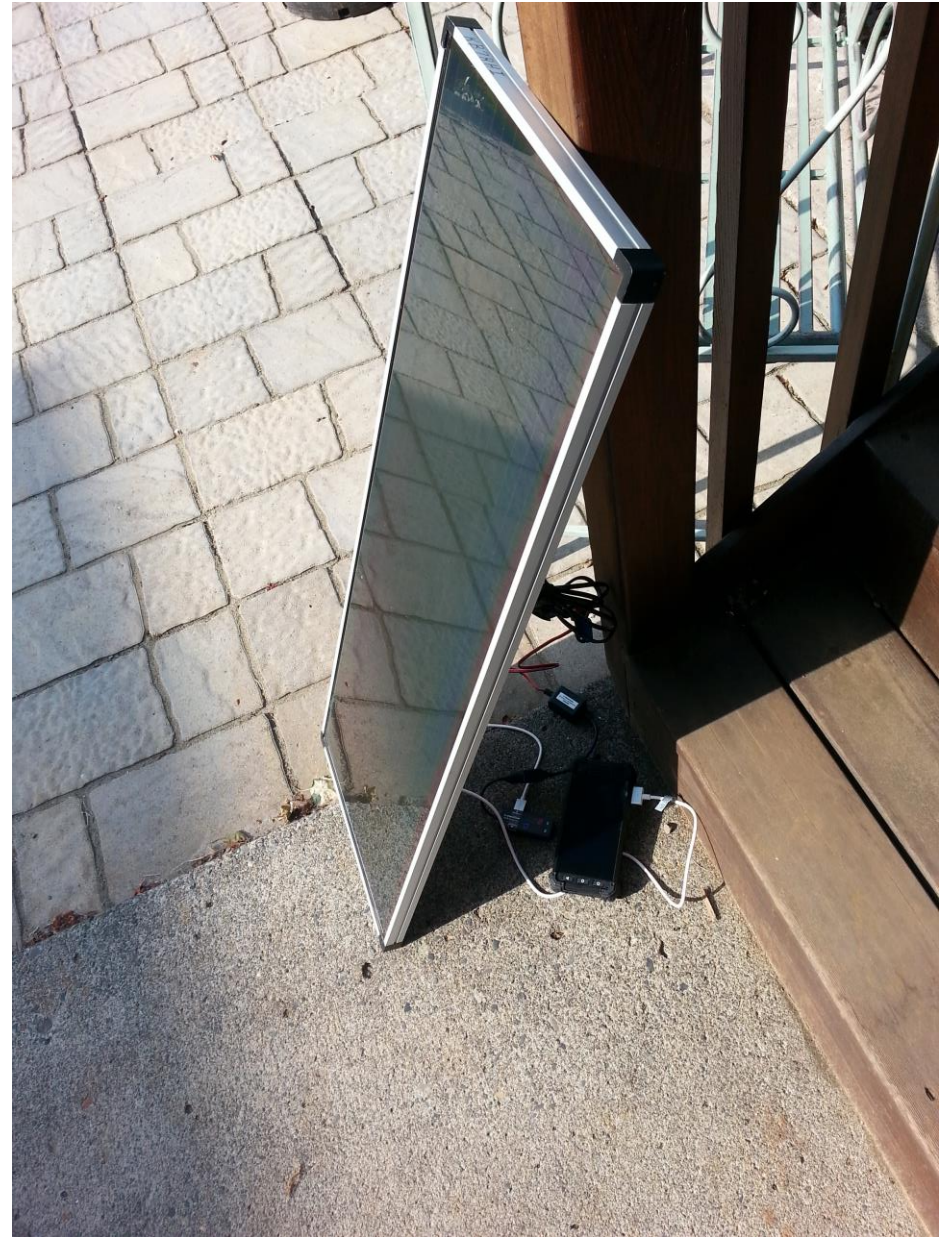
The Powerwerx USB buddy has a single 12 volt Anderson to USB port and the West Mountain Radio Rigrunner 4004U has two USB 5 volt power outputs

Powerwerx USB Buddy input is 32 volts and the output limit is 3 amps and can be directly connected to a “Harbor Freight” type 15 watt solar panel, think heavy, thin film, low efficiency solar panel

POWERWERX
USB BUDDY
ABOUT \$20



15 WATT "HARBOR
FREIGHT" THIN
FILM SOLAR PANEL
WITH
POWERWERX USB
BUDDY, DROK
INLINE METER
CHARGING A
PHONE DIRECTLY



POWER FROM A
15 WATT SOLAR
PANEL GOES
DIRECTLY INTO
THE POWERWERX
USB
BUDDY...DROK
INLINE METER...TO
YOUR USB DEVICE



CHARGE A USB DEVICE DIRECTLY FROM A SOLAR PANEL

- If a phone requires about 1.5 amps and 5 volts to charge, that is 5 amps x 1.5 volts = 7.5 Watts...Amps x Volts = Watts
- The Powerwerx USB Buddy takes 12 volts DC power and converts it to 5 volts DC power, (3 amps max output) but here is the interesting note
- The Powerwerx USB input voltage can be as high as 32 volts, so you can hook it directly to a low wattage, Off Grid solar panel and then charge your USB device
- Most automotive 12v to 5v converters are designed for a max input voltage of about 16 volts and can not be directly connected to a solar panel

USING AN
AUTOMOTIVE
CONVERTER
FOR POWER
PORT AND
USB OUTPUT



INPUT AND
OUTPUT
SPECS FOR
THE
AUTOMOTIVE
POWER
PORT/USB
CONVERTER



FORM FACTOR
IS OK, TWO 5V
USB PORTS
SIDE BY SIDE
WITH ONE
12V POWER
PORT



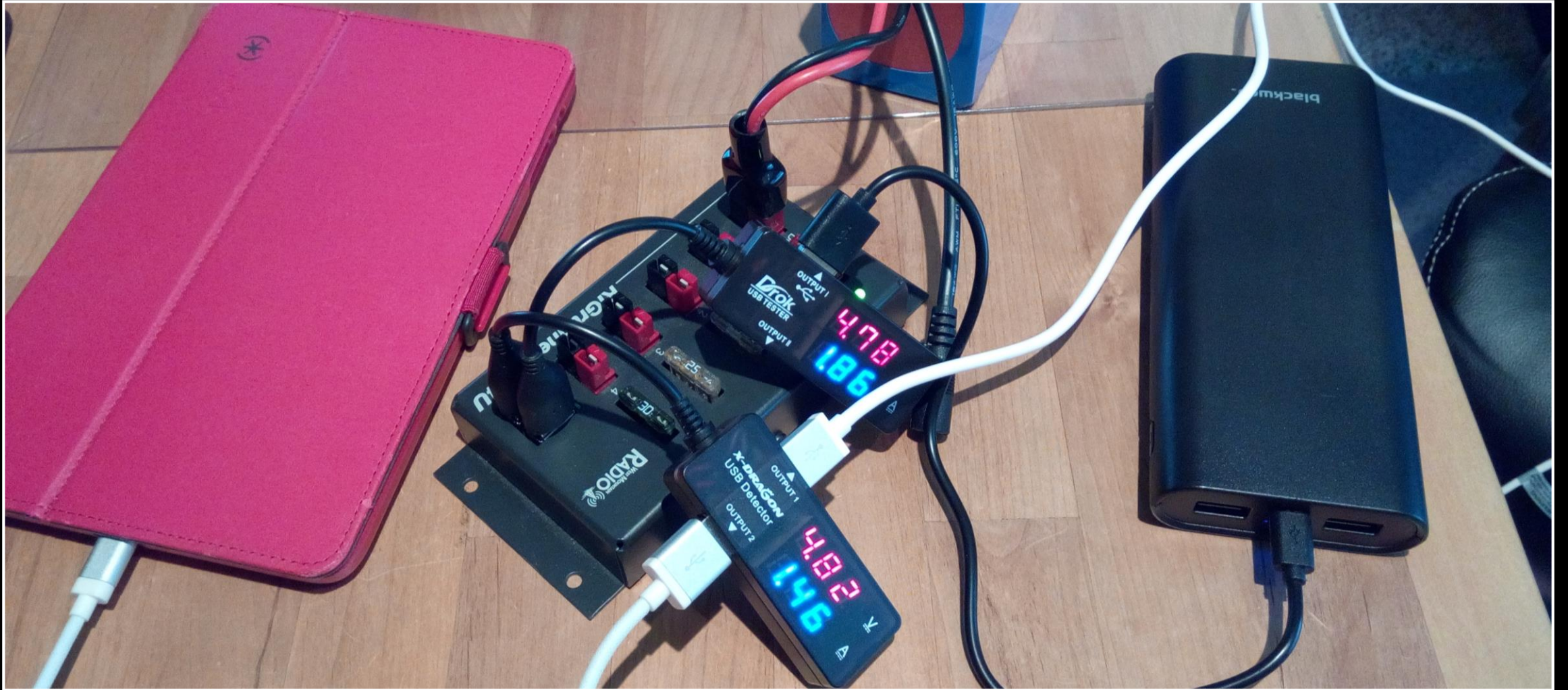
CAUTION
REGARDING
YOUR
RIGRUNNER
4004U

The West Mountain Radio Rigrunner 4004U can not be directly connected just to a solar panel with no battery

The circuit is rated for battery voltages only, your solar panel open circuit voltage could fry the 12 volt to 5 volt conversion circuit, you will need to also have a 12 volt battery connected

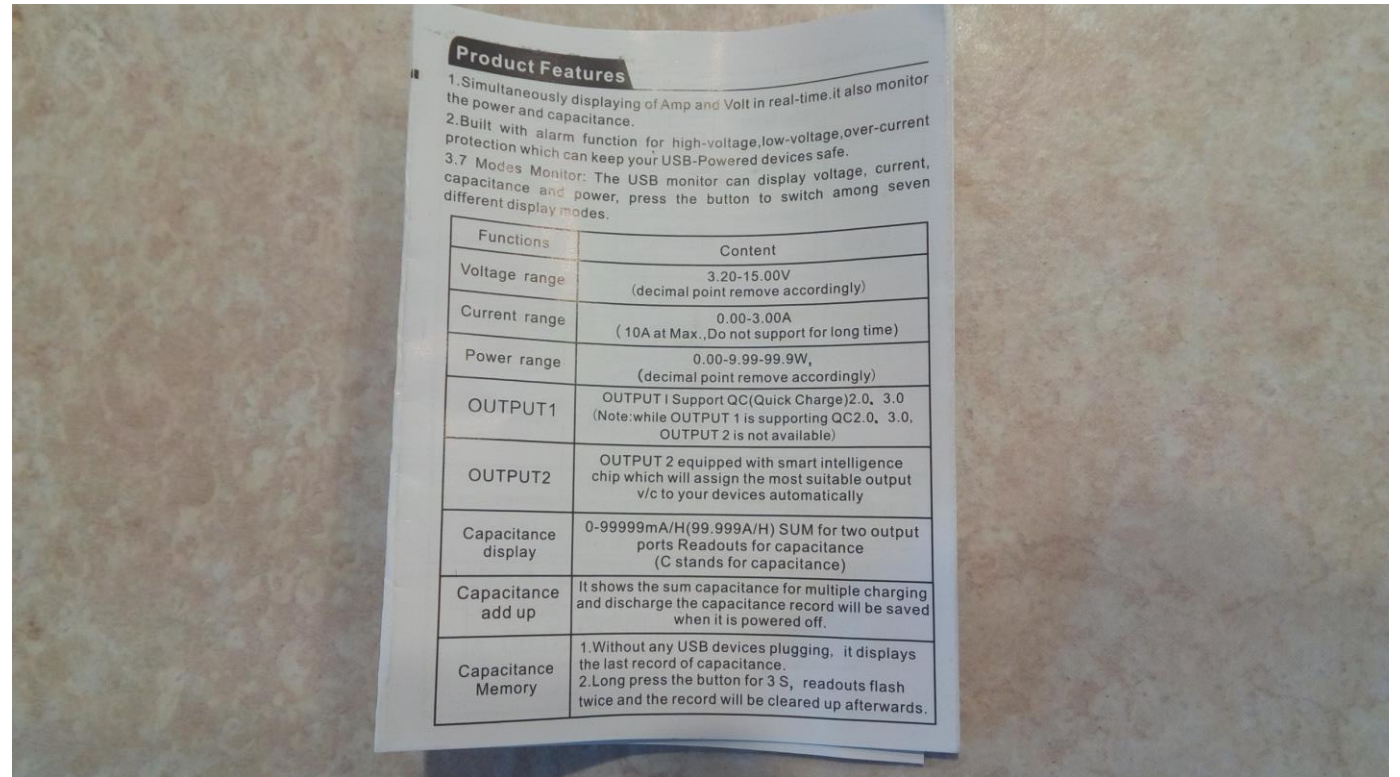
Using a Drok USB Tester for both USB ports you can charge up to 4 devices and see how much total amperage is being used

Total current output for EACH USB port is 2 amps, combined amperage can not exceed 4 amps on the 4004U



DROK USB INLINE 5 VOLT METERS PLUGGED INTO BOTH RIGRUNNER 4004U USB PORTS WITH DEVICE VOLTAGE AND AMPERAGE DISPLAYED

DROK 5V USB INLINE METER SPECS



MORE WAYS TO CHARGE YOUR USB DEVICES WITH SOLAR POWER

The Big Blue 28 watt solar panel with 3 USB ports is one choice, about \$58 on Amazon, note $\$58/28$ watts is about \$2 per watt

The Goal Zero Nomad 7 plus, 7 watt single USB port, goes for about \$80, $\$80/7$ watts is about \$11.42 per watt, designed to charge one device, Goal Zero prices the unit higher due to its form factor and design

Both are light weight enough to take with you during the day. Plan to adjust the panel for max sun angle from time to time

Important to see the cost per watt of power output on any solar product

GOAL ZERO NOMAD 7 PLUS PORTABLE SOLAR



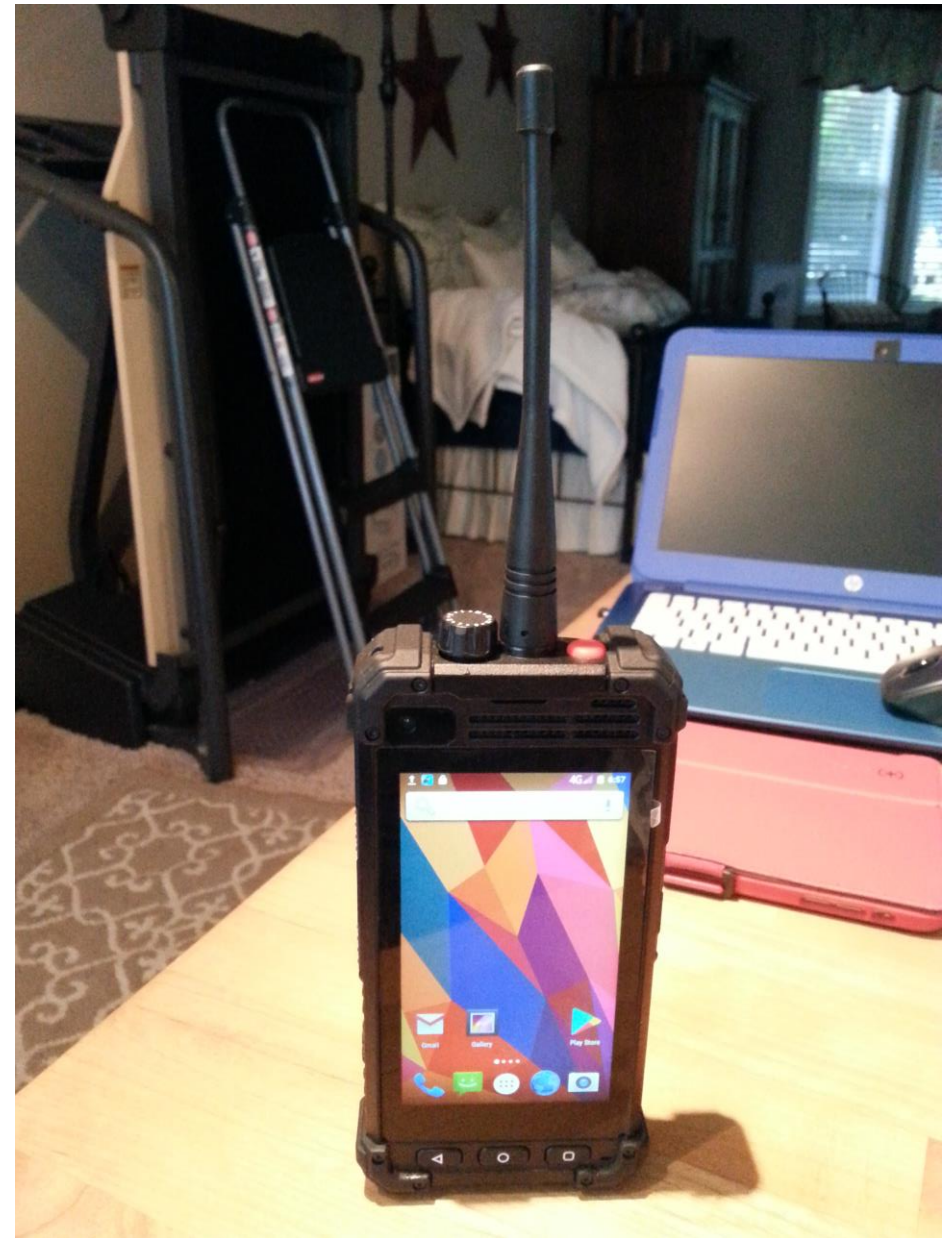
GOAL ZERO
NOMAD 7
PLUS
SIDE VIEW



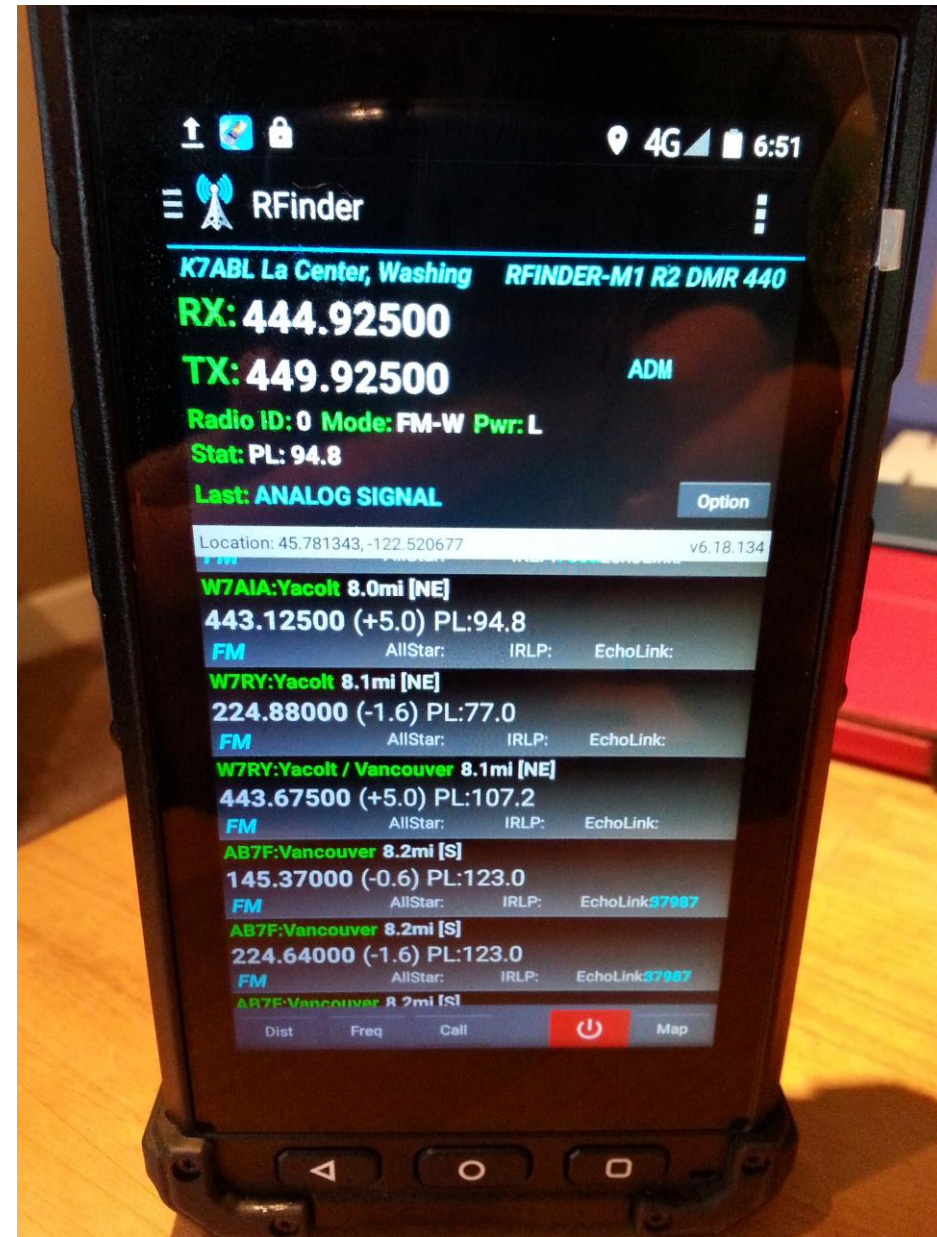


LEAK ZERO
100W

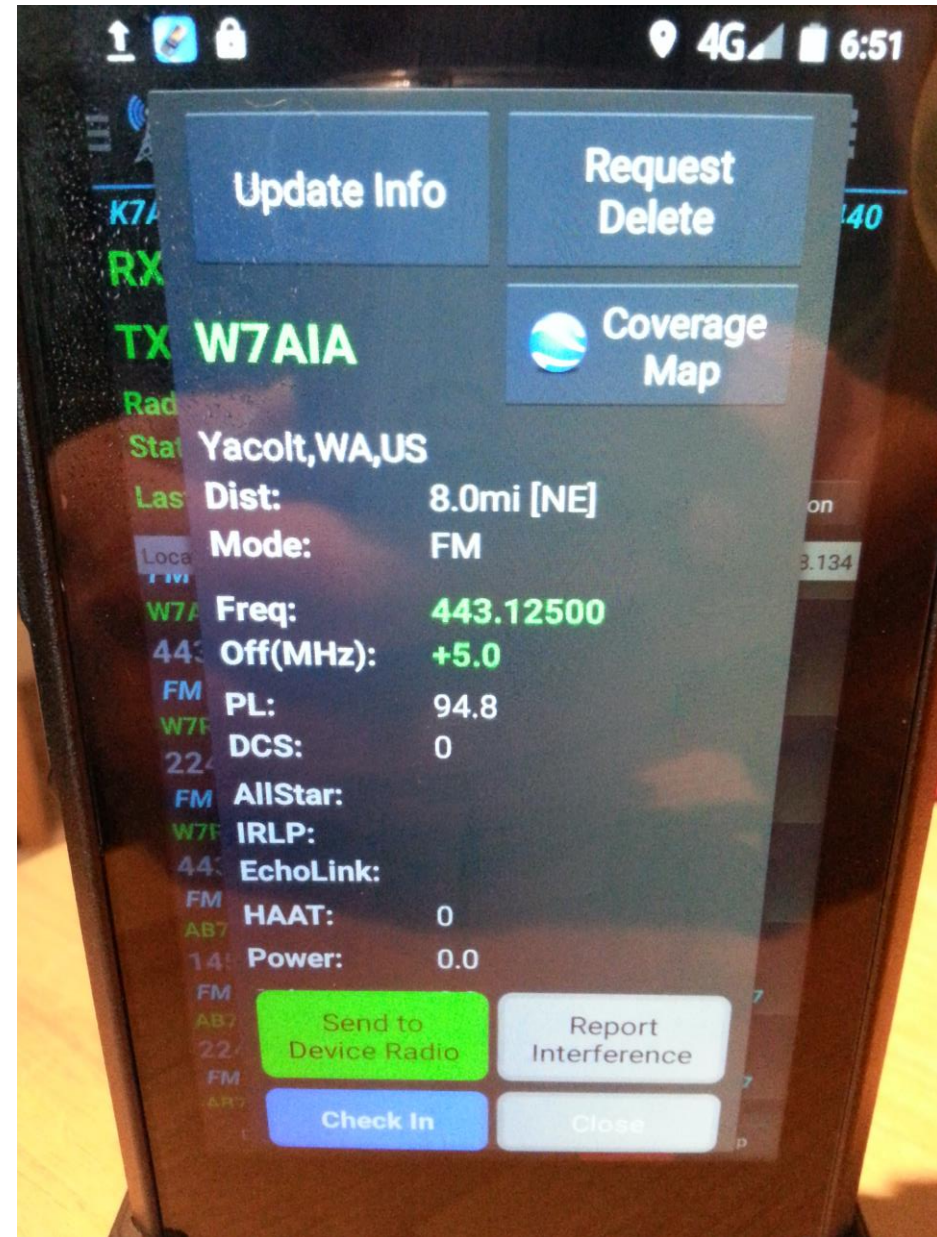
WOULDN'T IT BE NICE TO
JUST PUT AN ANTENNA
ON YOUR CELL PHONE
AND TRANSMIT ON AN
AMATEUR RADIO BAND
WHEN THERE IS NO
CELLULAR COVERAGE?



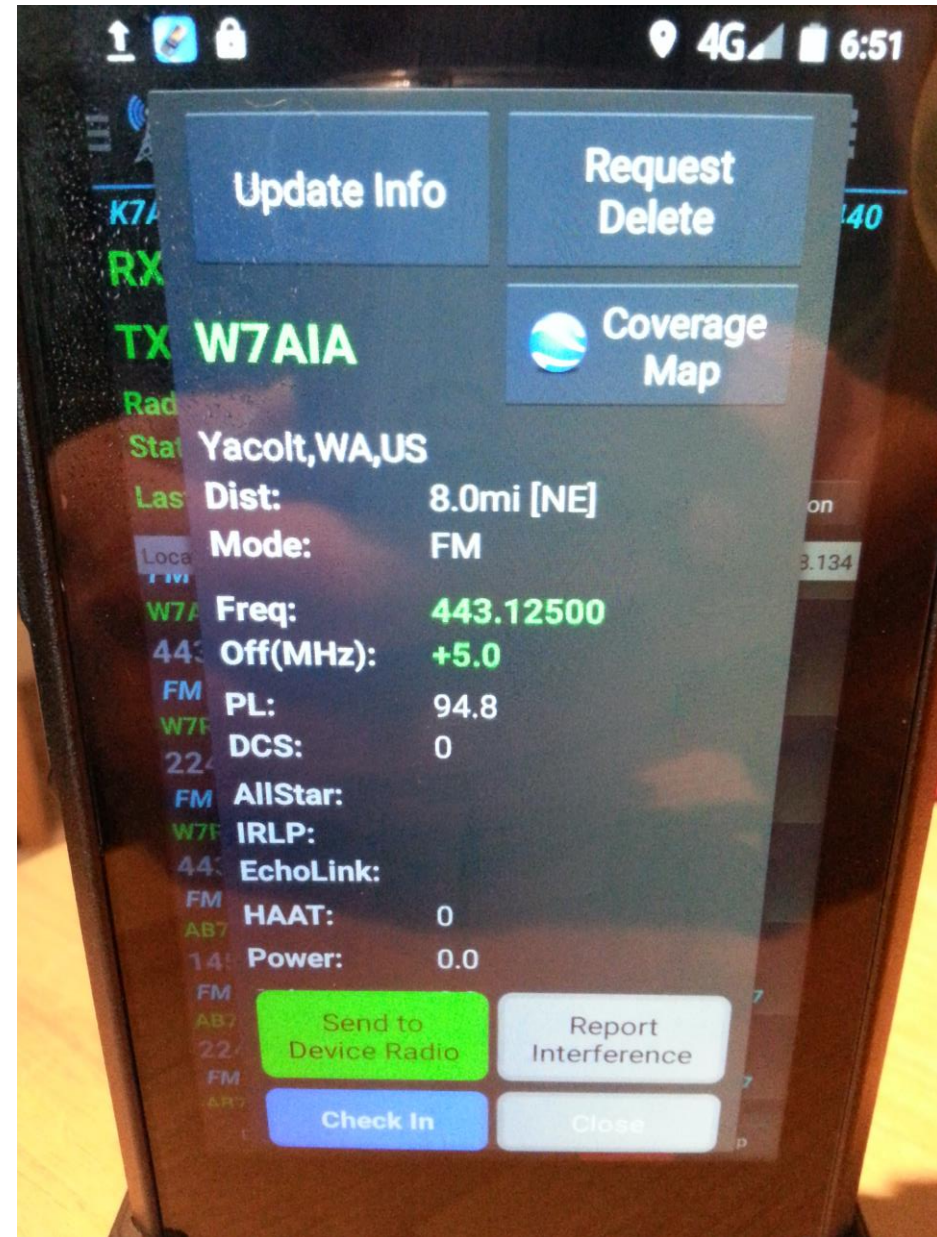
THE RFinder M1
FULFILLS THAT
WISH, IT IS ALSO
A 440 MHz
TRANSCEIVER



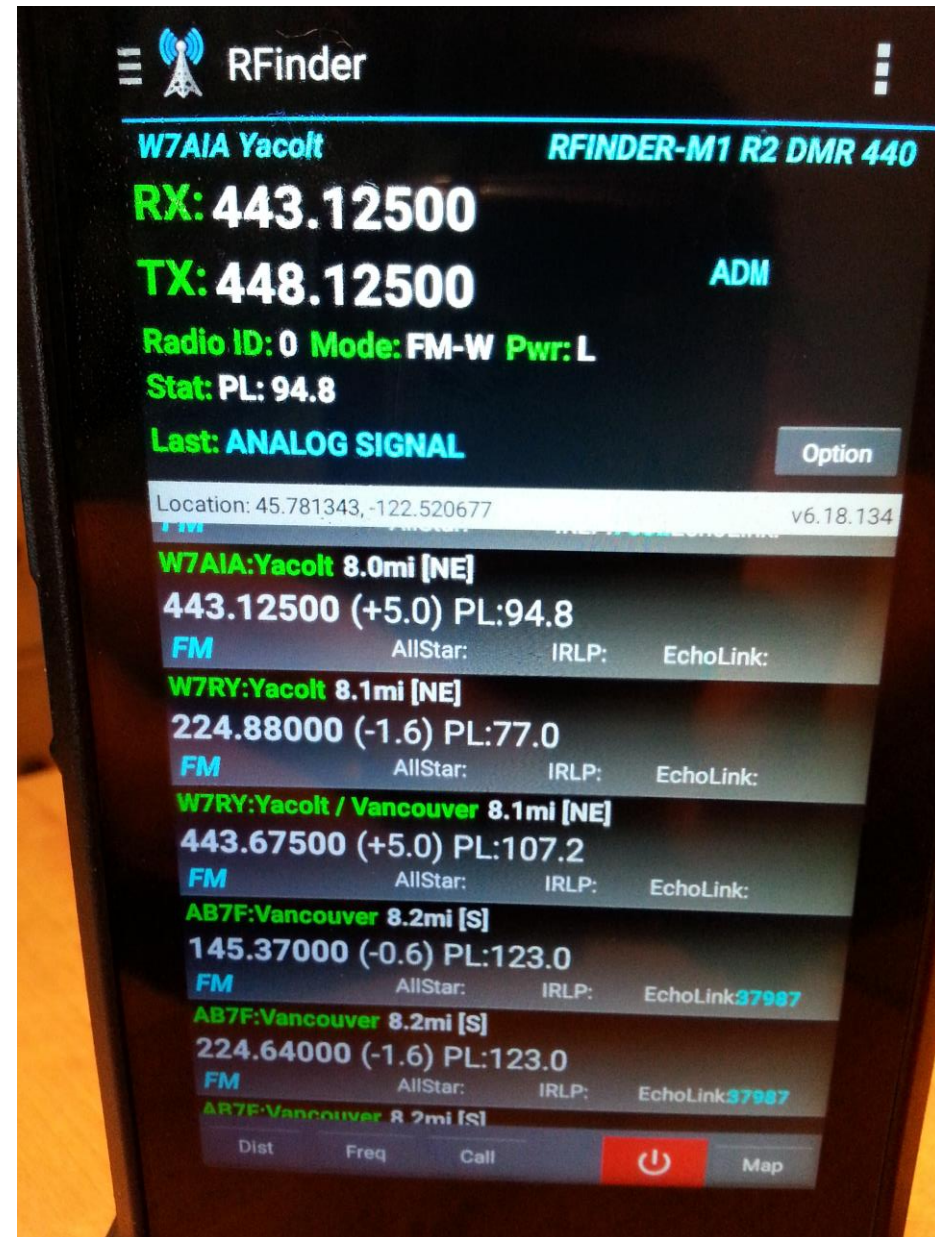
THE ANDROID PHONE WITH
THE Rfinder APP INSTALLED
HAS ALL THE REPEATERS FOR
A CONTINENT
DOWNLOADED, JUST PICK
THE CONTINENT YOU ARE
ON, PICK A REPEATER



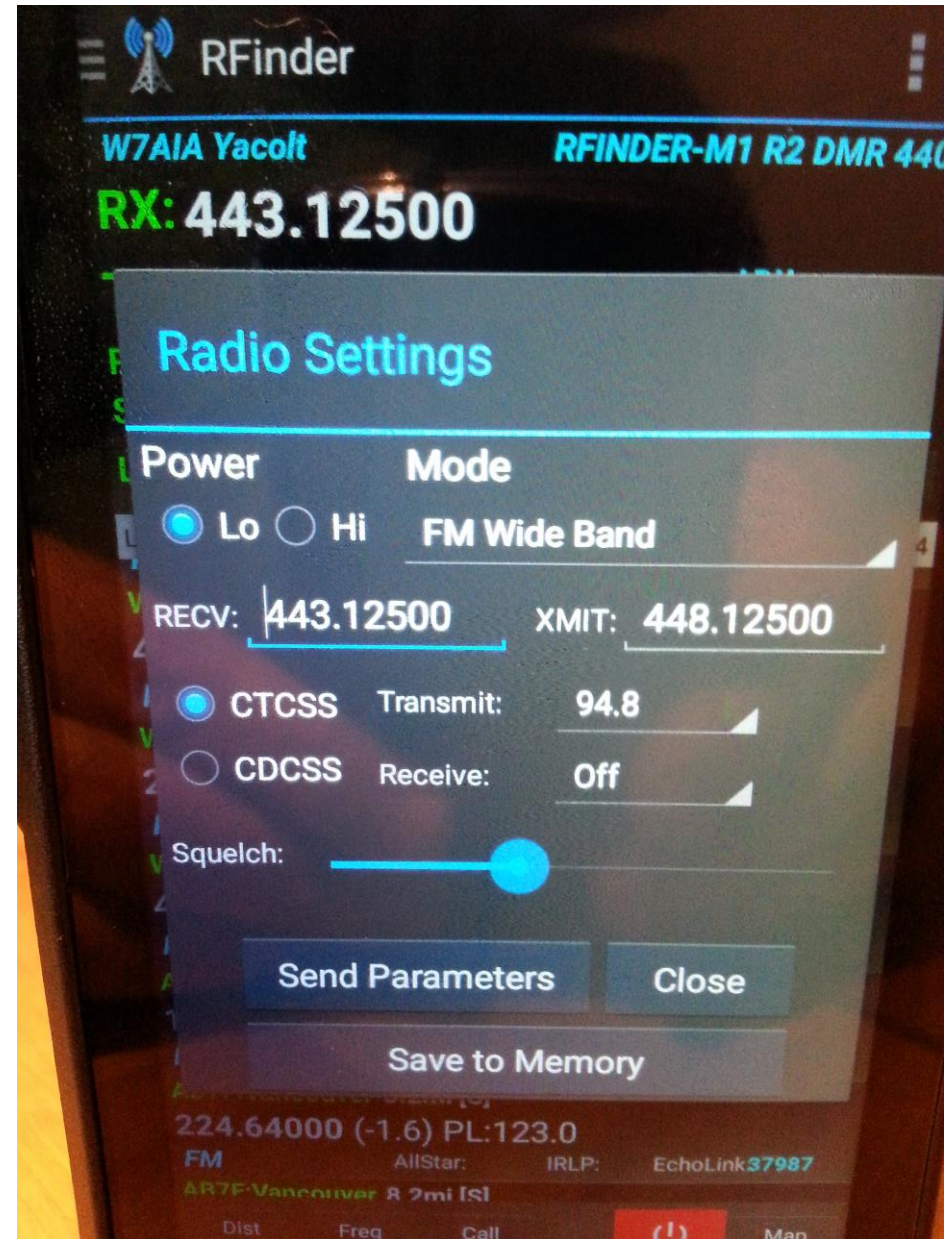
THE APP USES THE CELL PHONE'S GPS TO FIND THE CLOSEST REPEATER, SELECT AND THEN PUSH THE GREEN "SEND TO DEVICE RADIO" AND THEN CLOSE THE SCREEN



THE CHOSEN RADIO
SETTINGS ARE NOW
DOWNLOADED INTO THE
RADIO, TOP SCREEN ON
THE PHONE SHOWS THE
SELECTED SETTINGS



TAP ON THE TOP RADIO
SETTING SCREEN AND
THE PARAMETERS ARE
DISPLAYED, CHOSE
BETWEEN 1W AND 4W
ON A 440MHz
FREQUENCY



SOLAR POWER AND RFI CONCERNS

Recently the Clark County ARES group set up a radio station for a large drill, next thing you know, a fire truck pulls up and pulls out their generator and swamps the radio station with RFI and audible generator operation noise

Classic MPPT charge controllers will produce RFI, Genasun by design makes one of the most RF quiet MPPT charge controllers, GV-5 for 5 amps and GV-10 for 10.5 amps

Laptops used for digital comms may need to be charged by plugging their 110 wall power supply into an inverter. However, the inverter produces RF hash and causes lots of interference with the digital comms, try using USB powered and 12 volt direct powered laptops

Best if you can locate away from generators, use RF quieter MPPT units and stay away from inverters to keep your digital laptop station going

Firing up a genset can bring lots of company during an emergency, and that could create a security issue for you

LFP BATTERY FUN FACTS

TWO STEP CHARGING SEQUENCE

CC = CONSTANT CURRENT (CONSTANT PASS THROUGH OF PANEL CURRENT), YOUR WALL CHARGER SHOWS A RED COLOR

CV = CONSTANT VOLTAGE, STARTS WHEN YOUR WALL CHARGER SHOWS A GREEN COLOR, YOU ARE AT ABOUT 95% SOC AND THE CHARGING SHOULD BE DONE IN ABOUT 15-20 MINUTES, CELL BALANCING HAPPENS

PCM LOW VOLTAGE DISCONNECT HAPPENS AT 10 VOLTS +/- 0.5VOLTS

PCM HIGH VOLTAGE DISCONNECT HAPPENS AT 15.4 VOLTS +/- 0.5 VOLTS

MORE LFP
BATTERY
INFO FROM
BIOENNO
POWER

Bioenno Power chooses to over spec their batteries

The 12 Ah battery has 3.3 Ah cells times 4 cells

These LFP batteries are designed to handle over 2,000 cycles, at 2,000 cycles there should be 80% of capacity remaining

Marketing department can conservatively say more than 90% of the rated amp/hour is useable energy

The 12 volt LFP battery has a fairly flat discharge curve

BIOENNO POWER CHARGE CURRENT LIMITS

The ideal input current for charging your LFP battery is $.3(C)$, but can go as high as $.5(C)$

C = Capacity...the amp/hour capacity of your LFP battery

Example, if you have a 30Ah LFP battery, $.3C$ is $.3 \times 30 = 9$ amps

The maximum charge current for your LFP battery should not exceed $.5C$ or $.5 \times 30 = 15$ amps

If you exceed the maximum charge current for your LFP battery, the PCM will turn off the connection to the battery

If that happens, disconnect the battery and then reconnect it to begin charging again

BIOENNO POWER BATTERY CHARGING NOTE

The PCM (Protection Circuit Module) on a Bioenno Power LFP battery can stop the charge cycle correctly during charging if two things are present.

1) You have a power source that will restrict the output current to not exceed the recommended amperage input for your LFP battery

2) You have a power source that can be adjusted and stay regulated to 14.6 volts

If you can provide BOTH of the above, the LFP battery can be connected directly to the supply and then stop the charging when the battery is full

BRAND X CHARGE CONTROLLER SLEEP SYNDROME

If a new person to LFP batteries and solar power were to allow their LFP battery to discharge below the rated amp/hours (perhaps at night) they could find themselves in a pickle

What happens is the Low Voltage Disconnect will be activated by the PCM to protect the LFP battery cells from being damaged

The battery shuts off and there is no voltage noted at the battery terminals

The next morning, the customer expects the sun coming up in the morning to revive their battery, however, some charge controllers will not work until a voltage is present on the battery terminal side of the charge controller

The work around is to have a second battery with sufficient voltage to wake up the Brand X charge controller and get it working on charging your battery, instead of “sleeping while the sun shines”

IN AN
EMERGENCY,
SHOWING
YOUR GPS
LOCATION
COULD BE
VERY
HELPFUL

Winlink will allow GPS
position reports to be
sent

The Globalsat BU-353
USB GPS will plug right
into your laptop and
provide GPS coordinates

ADDITIONAL NOTE

- Have noted on a few occasions with UHF antenna CLOSE to the 30Ah LFP battery, some apparent RFI affecting the PCM and the battery turned off
- No issues noted with VHF and the 30Ah battery at CLOSE range
- Does not appear to be a problem when the UHF antenna is further away from the battery, (standard set up)
- No issues with VHF or UHF noted with the 12Ah “backpack size battery”, can use the antenna to transmit high power right next to the battery and no effect noted
- Will be interested in doing further testing

FRIEND STAYING
AT HIS PROPERTY
AND USING
SOLAR POWER
FOR HIS LIVING
QUARTERS

