Briefcase-Sized Solar Generator/Power Pack Project

Rev 1 3/26/2025

This document describes a homemade briefcase-sized solar generator/power pack project. The goal of the project was to provide a highly portable power pack that would provide sufficient power to run a laptop computer, a ham radio, and other small electrical devices when operating at a location away from utility power or during a utility power outage. Another goal was to be able to recharge the batteries in the unit either from an AC battery charger or from solar panels, and to be able to use additional external batteries in the event that the internal batteries are exhausted.

The design of the power pack was cloned from a previous solar generator project that has much higher battery capacity and higher power output capabilities. That previous project occupies three stackable Ridgid brand toolboxes and is powered by three 40 AH LiFePO4 batteries and has multiple output voltages including 1000 Watts of pure sine wave 120 VAC power output. While the previous project is somewhat portable, its size and weight makes it a unit that is not very convenient to move from location to location.

The features of this briefcase-sized power pack include:

- Two automotive cigarette lighter outlets providing regulated 12VDC at a max of 6A
- Four USB-C QC 3.0 outlets
- Four USB-PD outlets
- Two 12 VDC unregulated power output posts fused at 25A
- One Neutrik Quick disconnect output socket providing 12 VDC unregulated power fused at 25A
- Two 120VAC power outlets limited to 350 Watts total from a 400-Watt modified sine wave inverter
- One Neutrik Quick disconnect input socket for connection of up to 220 Watts of solar panels
- One Victron MPPT solar charge controller with Bluetooth communications
- Two power posts for connection of an external AC battery charger (14.6 Volt, 9 Amp limit)
- Three 12.8 Volt 6 AH LiFePo4 batteries totaling 18 AH at 12.8 VDC
- One recording DC load meter displaying load Volts, Amps, Watts, WH, AH, and total run time
- One recording DC charge meter displaying charge Volts, Amps, Watts, WH, AH, and total run time
- Main battery On/Off switch rated at 50 Amps
- Main inverter On/Off switch rated at 50 Amps
- Miscellaneous On/Off rocker switches to control the power pack (all rated at 20 Amps)

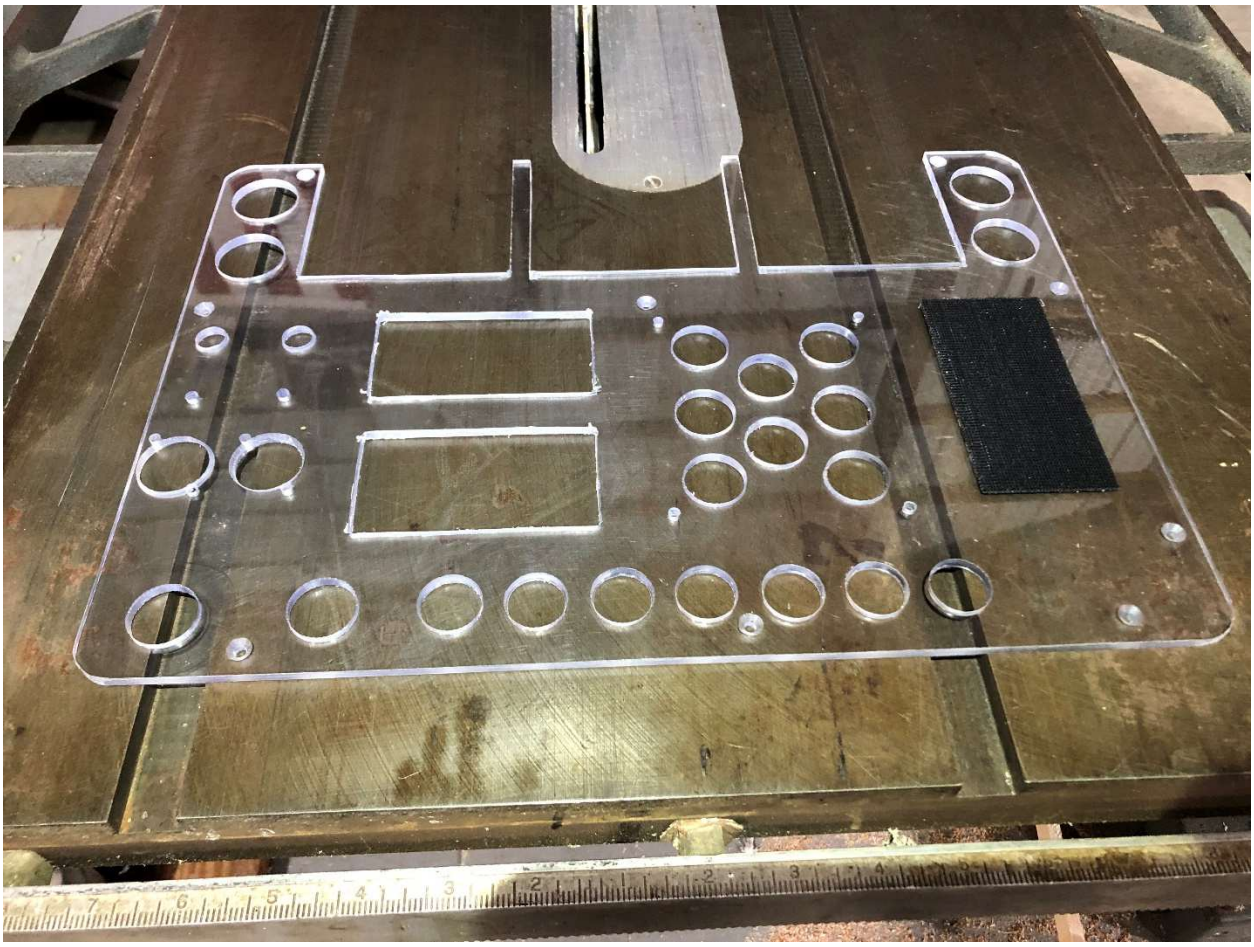
- An audible low battery voltage alarm
- Ability to disconnect internal batteries and connect an external battery as needed
- Proper circuit protection via approx 20 automotive type fuses
- Ability to quickly and easily remove the chassis of the power pack from the carrying case for service purposes by first disconnecting and removing the three batteries and then lifting the whole chassis out of the case
- Full set of documentation stored in an envelope fastened to the inside of the top lid of the case
- Total weight of the case is just over 20 pounds
- Accessories stored separately from the case are an 8 Amp LiFePO4 battery charger, two 100-Watt solar panels, solar panel connection cables, external battery connection cables, a power cable for a Yaesu FT-991A ham radio, various USB and lightning plug cables, and several other power cables with various connectors and terminations on them

The length of time that this power pack can power any given device is limited by the 18 AH internal battery capacity (and the availability and size of an external battery), whether or not solar panels are connected and the amount of sunshine, and upon the current draw of the connected load. Just to give some real-world examples though, this power pack has powered an FT-991A radio continuously (on receive only) for about 8 to 10 hours and has powered a laptop computer for approximately 15 to 20 hours, all with no solar panel input. During daytime use, with solar panel input, run times are of course greatly extended.

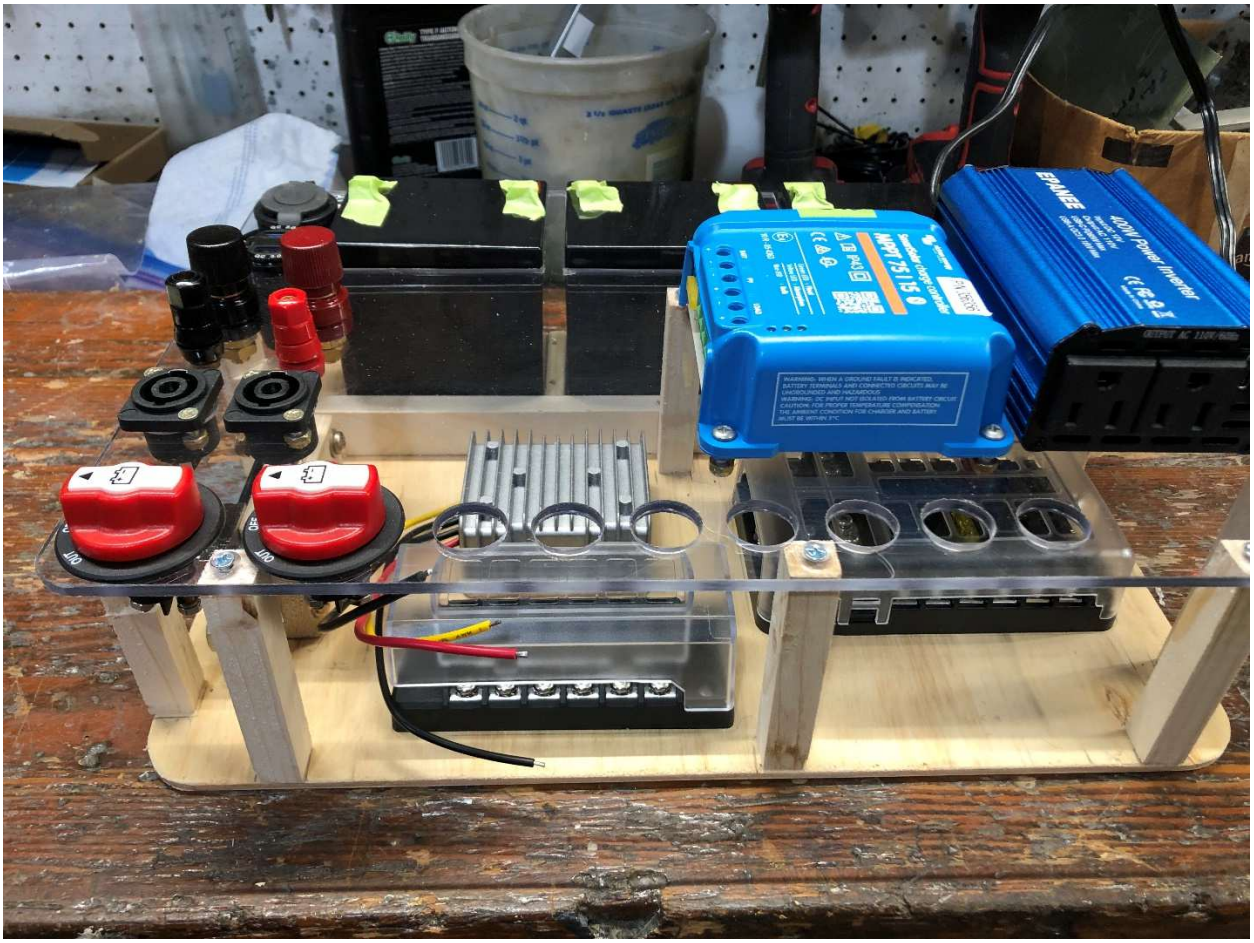
When needed, runtime duration is extended by connecting an external 20 AH or 100 AH LiFePO4 battery via a specially fabricated “two to six” wiring harness that allows the positive and negative terminals of the external battery to be connected to the three positive and three negative leads that normally connect to the internal batteries. These connections are made via insulated male and female spade lugs. Of course, the power pack must be shut down while making this battery swap.

Below are some photos of the power pack being built, followed by some photos of the finished product.

The top panel of the power pack was fabricated from ¼ inch thick polycarbonate sheet. The black rectangle on the right is a Velcro pad that mounts the 400-Watt inverter. Once all of the switches and devices to be mounted on this panel were test-fitted, they were removed and the bottom side of the sheet was spray painted black and the top side of the sheet had labels applied.

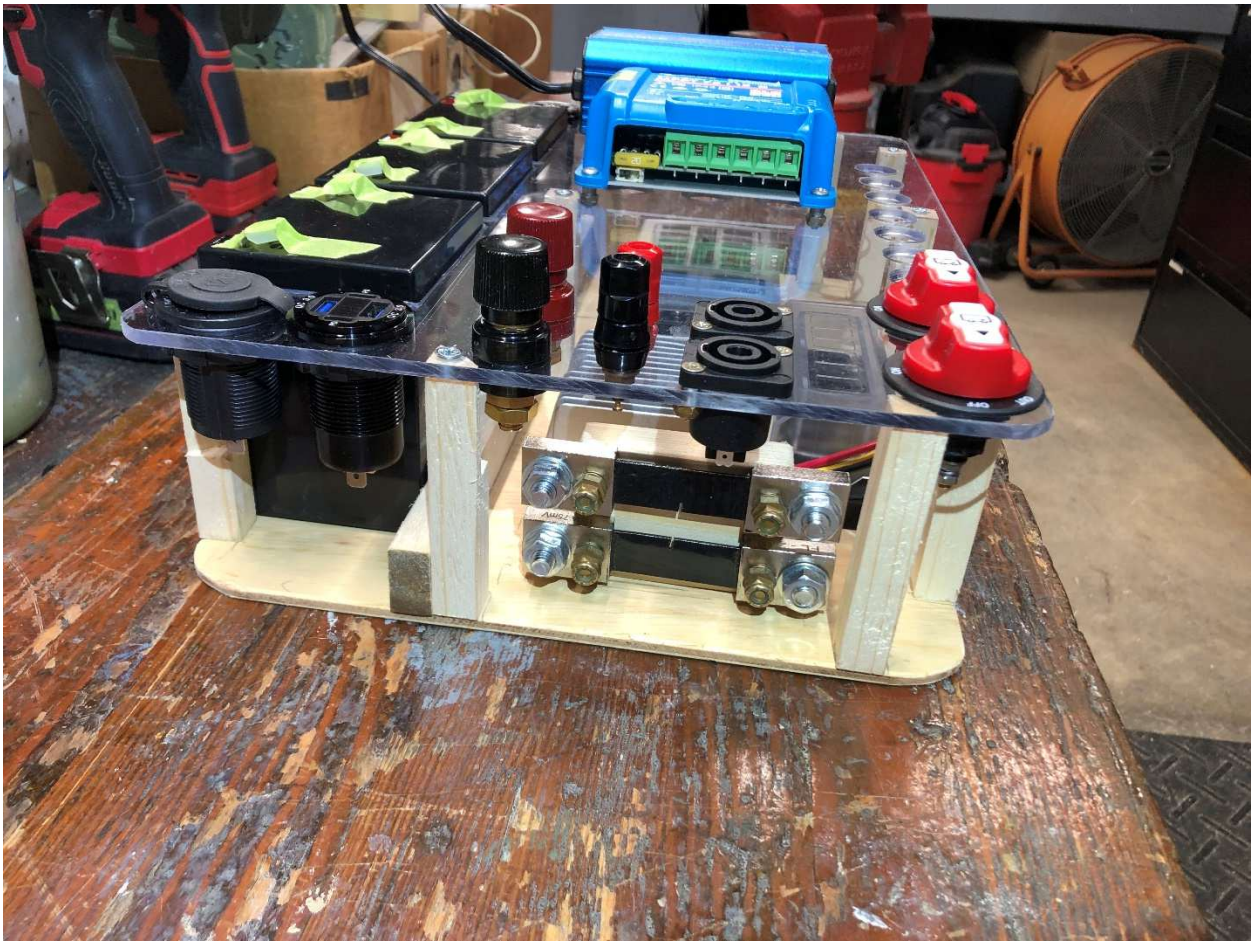


Here the components are being test-fitted and mounted to the chassis. The chassis of the power pack was fabricated from ¼ inch thick plywood and wooden stand-offs. The wooden stand-offs are screwed and glued to the plywood bottom. The polycarbonate sheet is attached to the stand-offs with countersunk head wood screws to allow for relatively easy disassembly.

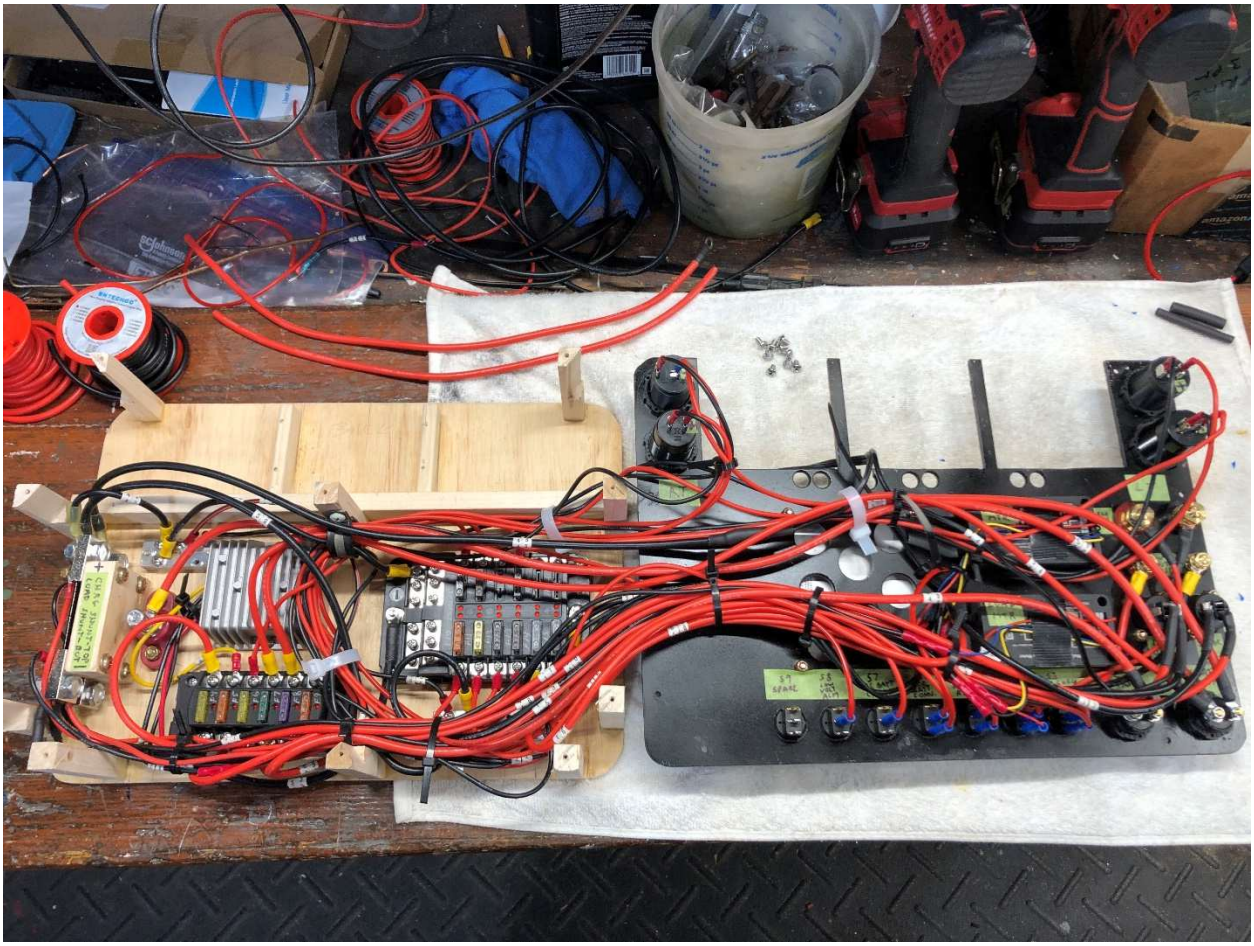


This photo shows how the chassis fits into the case. The three batteries are a friction fit with the case and the cut-outs in the polycarbonate sheet. The case is a Harbor Freight Apache 3800 weatherproof protective case. The silver-colored finned device is a 6 Amp 12 VDC voltage regulator.

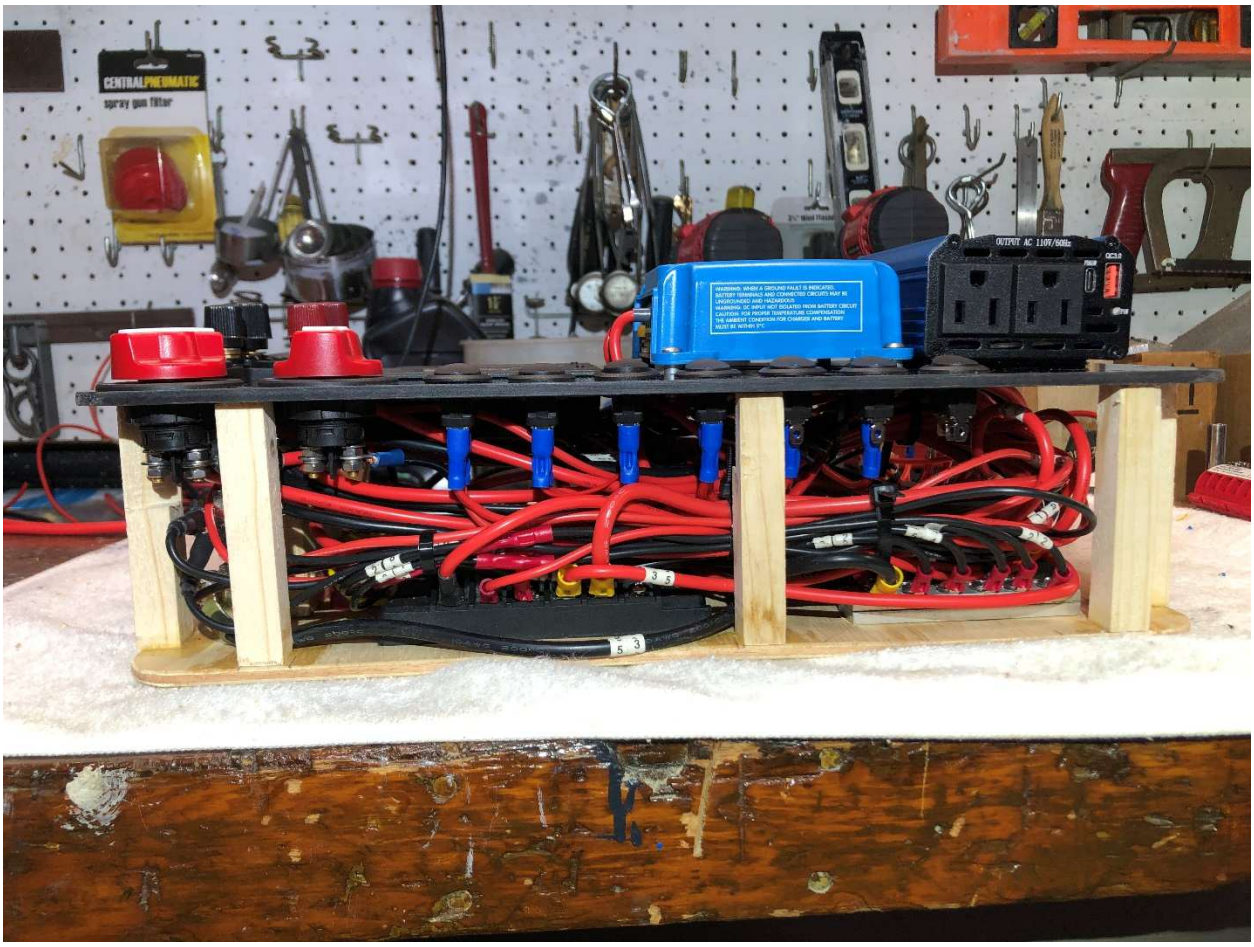
This photo shows the batteries in place and more components being mounted. The two silver colored bars with the black centers are the load shunt and the charge shunt. They are mounted on a wooden spacer block.



This photo shows the wiring being installed. Because there is very limited room to work between the top panel and the plywood bottom panel, the wiring was designed to allow the top panel to be lifted up and folded over to the side and laid flat. The wiring between the top and bottom has enough slack and is routed to allow the top to be folded back over onto the bottom. Also visible in this photo is the two fuse blocks, one with fuses for isolated circuits and one with fuses for non-isolated circuits.



This side view shows how tightly packed the wiring is between the top and bottom panels. Accessing and changing fuses is a bit of a challenge but can be accomplished by removing the screws that hold the top plate to the wooden stand-offs and folding the top over to the side as shown in a previous photo. Removing the whole chassis from the plastic carrying case is easy because there are no attachments or penetrations into the case and the entire chassis lifts right out.

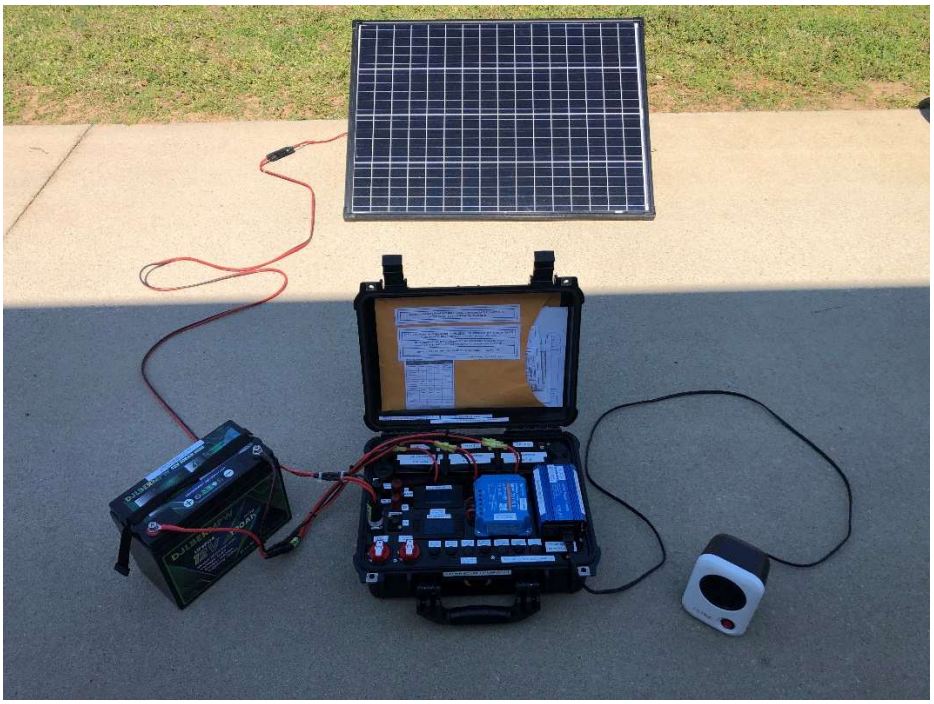


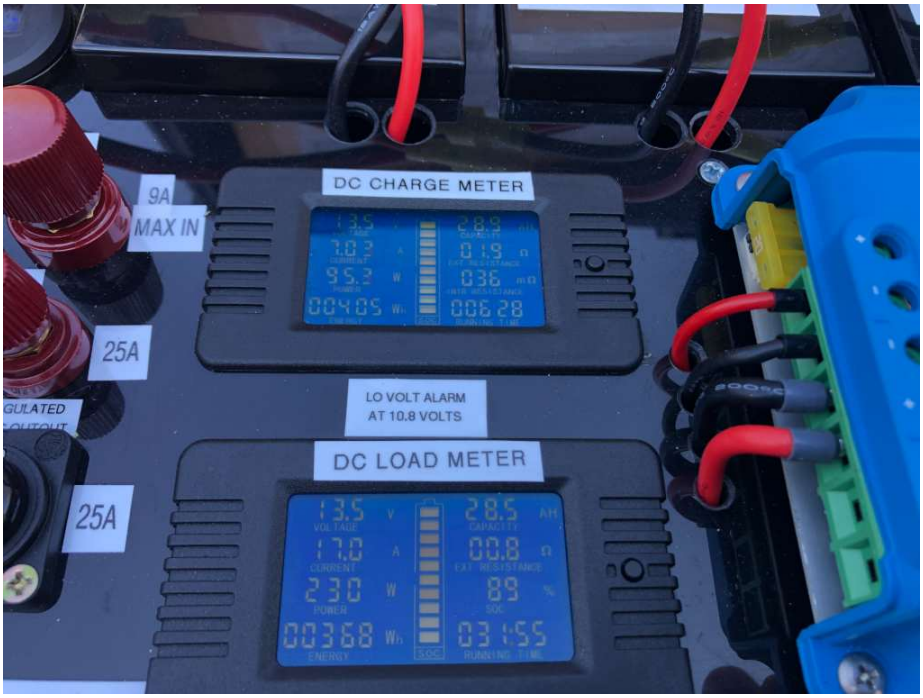
Below are some photos of the completed solar generator/power pack.

This photo shows the solar generator connected to a single 100-Watt solar panel. Up to two of these solar panels can be connected in parallel for 200 Watts of solar input. Solar panel location is limited only by the length of the solar panel cable available. With a long enough solar panel cable, the solar generator can be located inside the house and the solar panel(s) outside. Of course, with longer cable runs, a heavier gauge cable is desirable to avoid excessive voltage drop in the cable. This single 100-Watt solar panel has been seen to charge the batteries at up to 7 Amps depending upon the amount of solar energy available and the state of charge of the battery. Alternatively, an external AC powered battery charger can be used to recharge the batteries if a source of 120 VAC power is available. Maximum allowable charging current for the set of three internal batteries (which are connected in parallel) is 9 Amps.

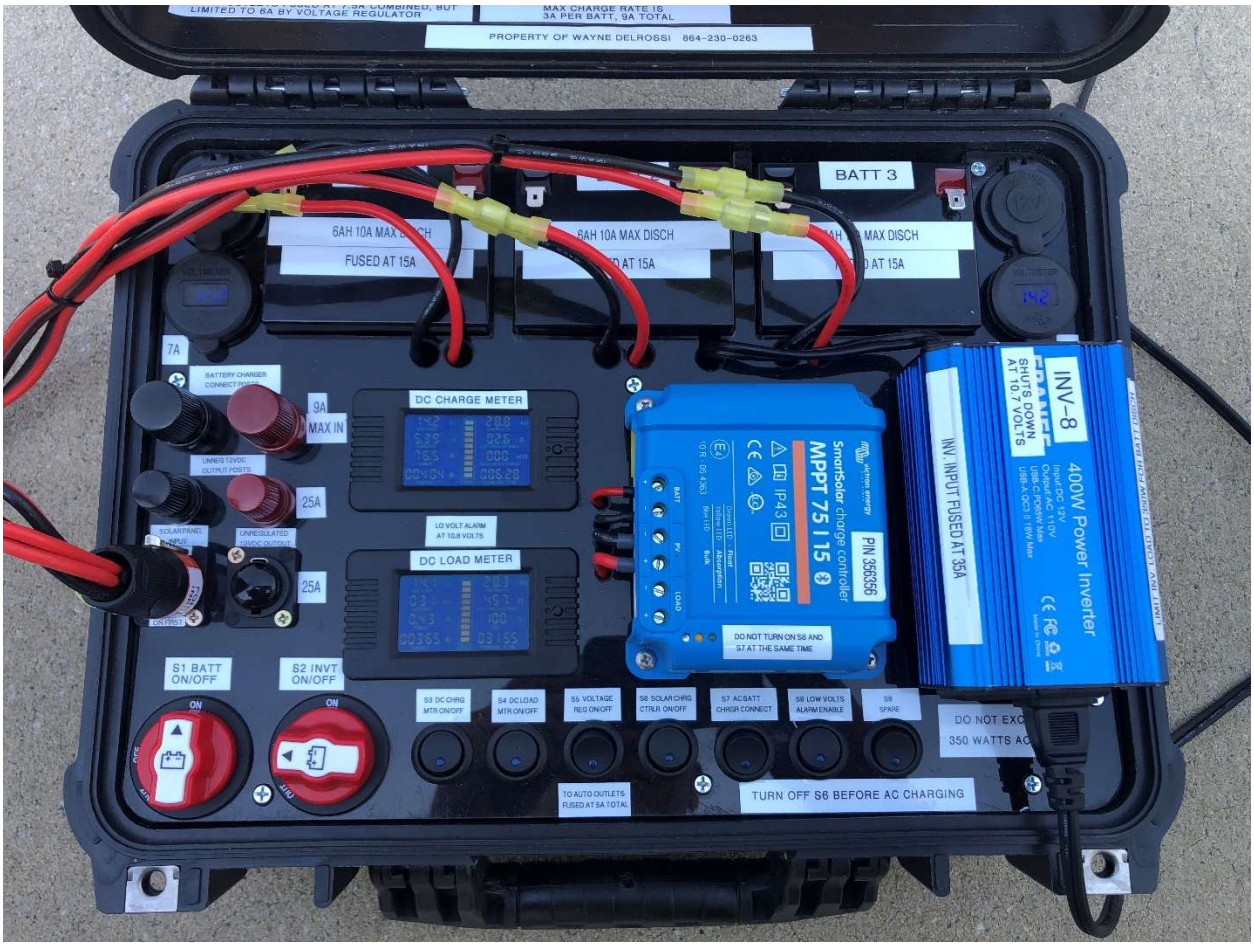
With exterior dimensions of 16.5” x 13” x 6.75” and a weight of just over 20 pounds, the case is very easy to transport. The case provides excellent protection for the components inside.

In these photos the solar generator has a 100 AH LiFePO4 battery connected in place of the three internal 6 AH batteries. The solar panel is adding power to this battery through the Victron solar charge controller at a rate of 7 Amps, while the 400-Watt inverter is drawing about 17 Amps to power the attached 200-Watt heater. Under these conditions, the 100 AH battery will run the heater or other 200-Watt load for approximately 10 hours before it is exhausted. The load meter and charge meter allow the status of the battery to be continuously monitored.

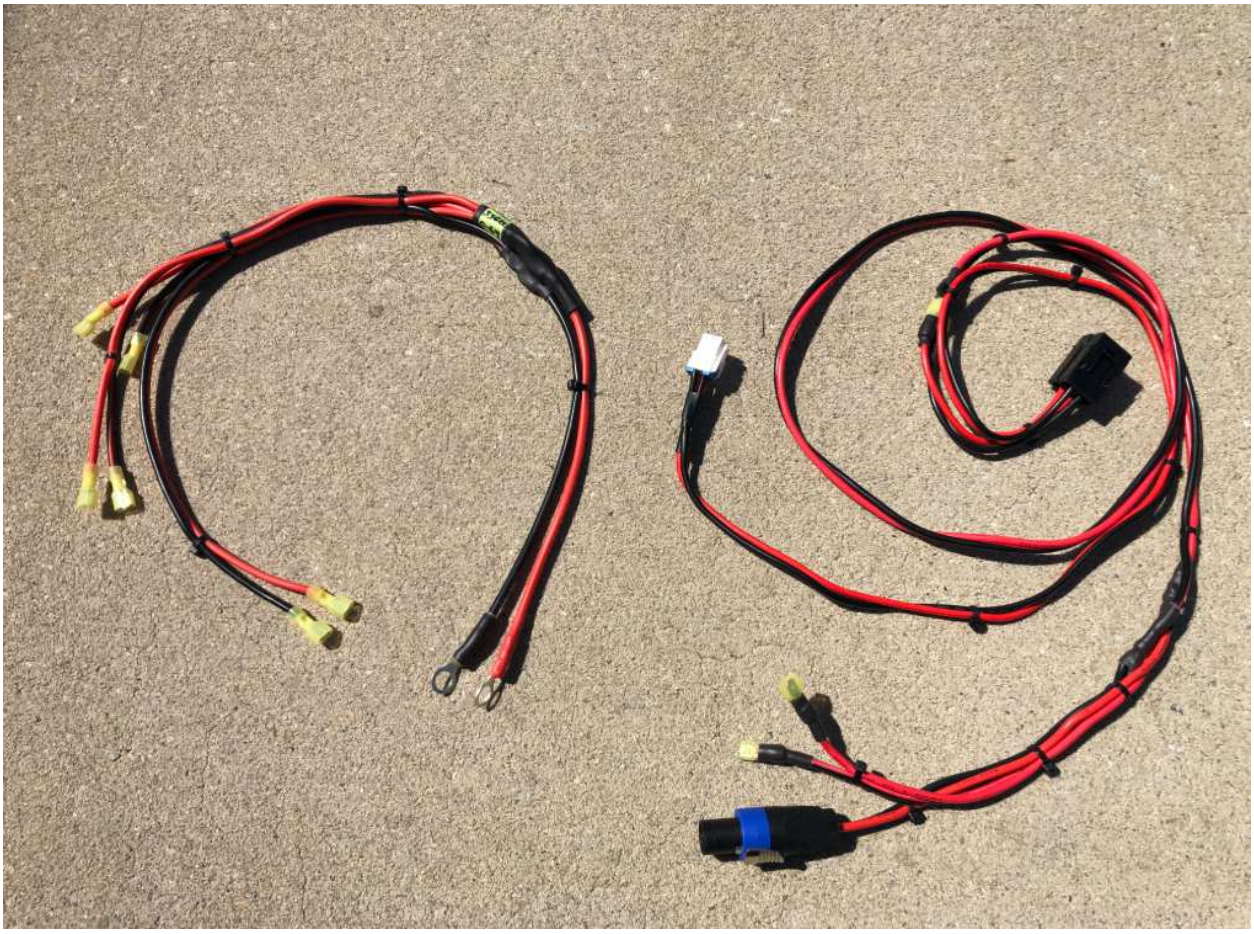




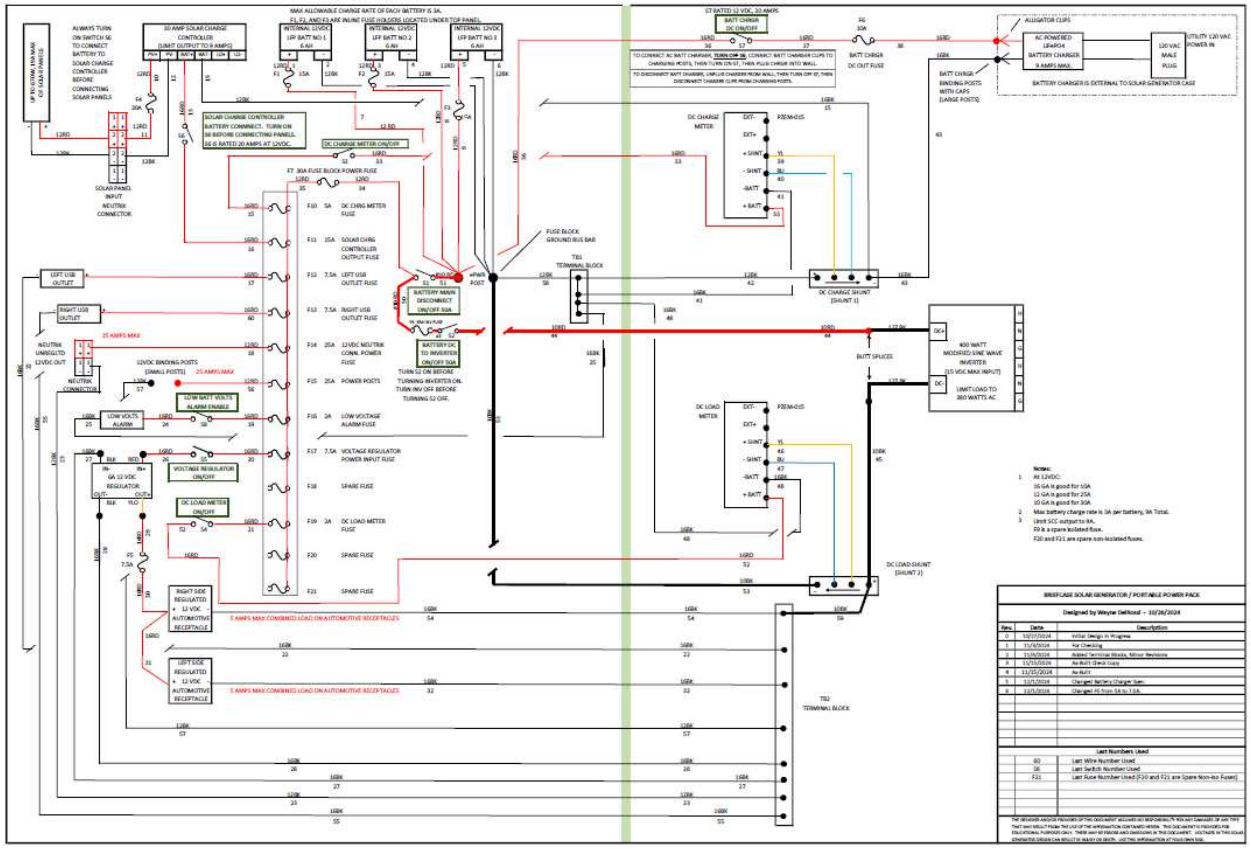
This photo shows the top panel of the solar generator and the cable connections that allow an external battery to be connected to the leads that normally connect to the three internal batteries. The connector just above the S1 BATT ON/OFF switch is the Neutrik connector for the solar panel input.

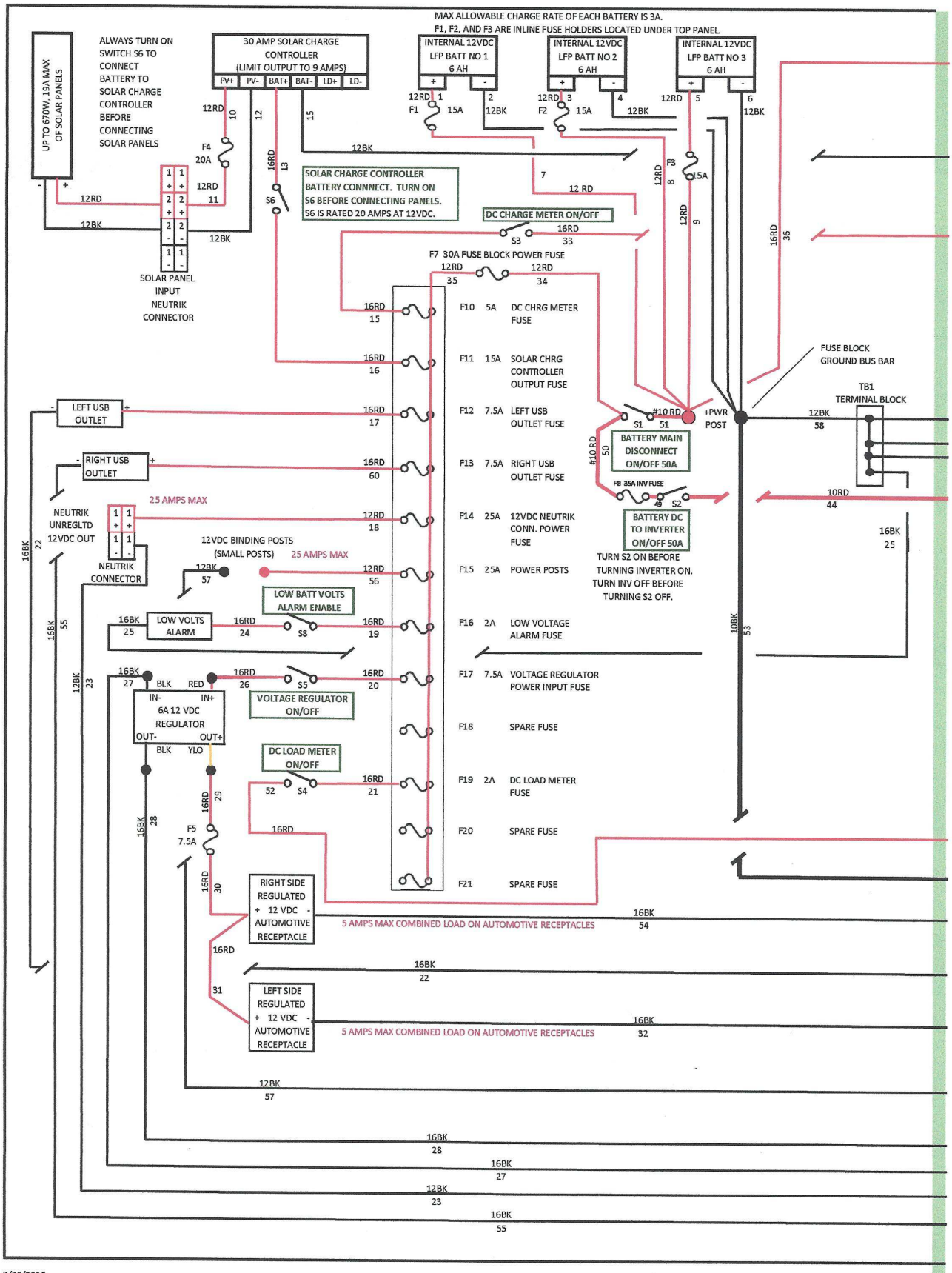


The “two to six” battery cable for connecting an external battery is shown on the left. On the right is a cable that allows connection between the Neutrik Quick disconnect 12 VDC output socket (or a 12-volt battery with F2 spade lugs) and a Yaesu FT-991A ham radio.



Below is an overview of the wiring diagram of the power pack. A larger, more readable version is shown on the next two pages.




MAX ALLOWABLE CHARGE RATE OF EACH BATTERY IS 3A.
F1, F2, AND F3 ARE INLINE FUSE HOLDERS LOCATED UNDER TOP PANEL.
UP TO 670W, 19A MAX OF SOLAR PANELS
ALWAYS TURN ON SWITCH S6 TO CONNECT BATTERY TO SOLAR CHARGE CONTROLLER BEFORE CONNECTING SOLAR PANELS
30 AMP SOLAR CHARGE CONTROLLER (LIMIT OUTPUT TO 9 AMPS)
PV+ PV- BAT+ BAT- LD+ LD-
INTERNAL 12VDC LFP BATT NO 1 6 AH
INTERNAL 12VDC LFP BATT NO 2 6 AH
INTERNAL 12VDC LFP BATT NO 3 6 AH
F4 20A
F1 15A
F2 15A
F3 15A
S6
SOLAR CHARGE CONTROLLER BATTERY CONNNECT. TURN ON S6 BEFORE CONNECTING PANELS. S6 IS RATED 20 AMPS AT 12VDC.
DC CHARGE METER ON/OFF
S3
F7 30A FUSE BLOCK POWER FUSE
SOLAR PANEL INPUT NEUTRIK CONNECTOR
F10 5A DC CHRG METER FUSE
F11 15A SOLAR CHRG CONTROLLER OUTPUT FUSE
F12 7.5A LEFT USB OUTLET FUSE
F13 7.5A RIGHT USB OUTLET FUSE
F14 25A 12VDC NEUTRIK CONN. POWER FUSE
F15 25A POWER POSTS
F16 2A LOW VOLTAGE ALARM FUSE
F17 7.5A VOLTAGE REGULATOR POWER INPUT FUSE
F18 SPARE FUSE
F19 2A DC LOAD METER FUSE
F20 SPARE FUSE
F21 SPARE FUSE
FUSE BLOCK GROUND BUS BAR
TB1 TERMINAL BLOCK
+PWR POST
BATTERY MAIN DISCONNECT ON/OFF 50A
FB 35A INV FUSE
BATTERY DC TO INVERTER ON/OFF 50A
TURN S2 ON BEFORE TURNING INVERTER ON. TURN INV OFF BEFORE TURNING S2 OFF.
LEFT USB OUTLET
RIGHT USB OUTLET
NEUTRIK UNREGLTD 12VDC OUT
NEUTRIK CONNECTOR
25 AMPS MAX
12VDC BINDING POSTS (SMALL POSTS)
25 AMPS MAX
LOW BATT VOLTS ALARM ENABLE
LOW VOLTS ALARM
S8
6A 12 VDC REGULATOR
IN- IN+ OUT- OUT+
VOLTAGE REGULATOR ON/OFF
S5
DC LOAD METER ON/OFF
S4
RIGHT SIDE REGULATED + 12 VDC - AUTOMOTIVE RECEPTACLE
LEFT SIDE REGULATED + 12 VDC - AUTOMOTIVE RECEPTACLE
5 AMPS MAX COMBINED LOAD ON AUTOMOTIVE RECEPTACLES
5 AMPS MAX COMBINED LOAD ON AUTOMOTIVE RECEPTACLES
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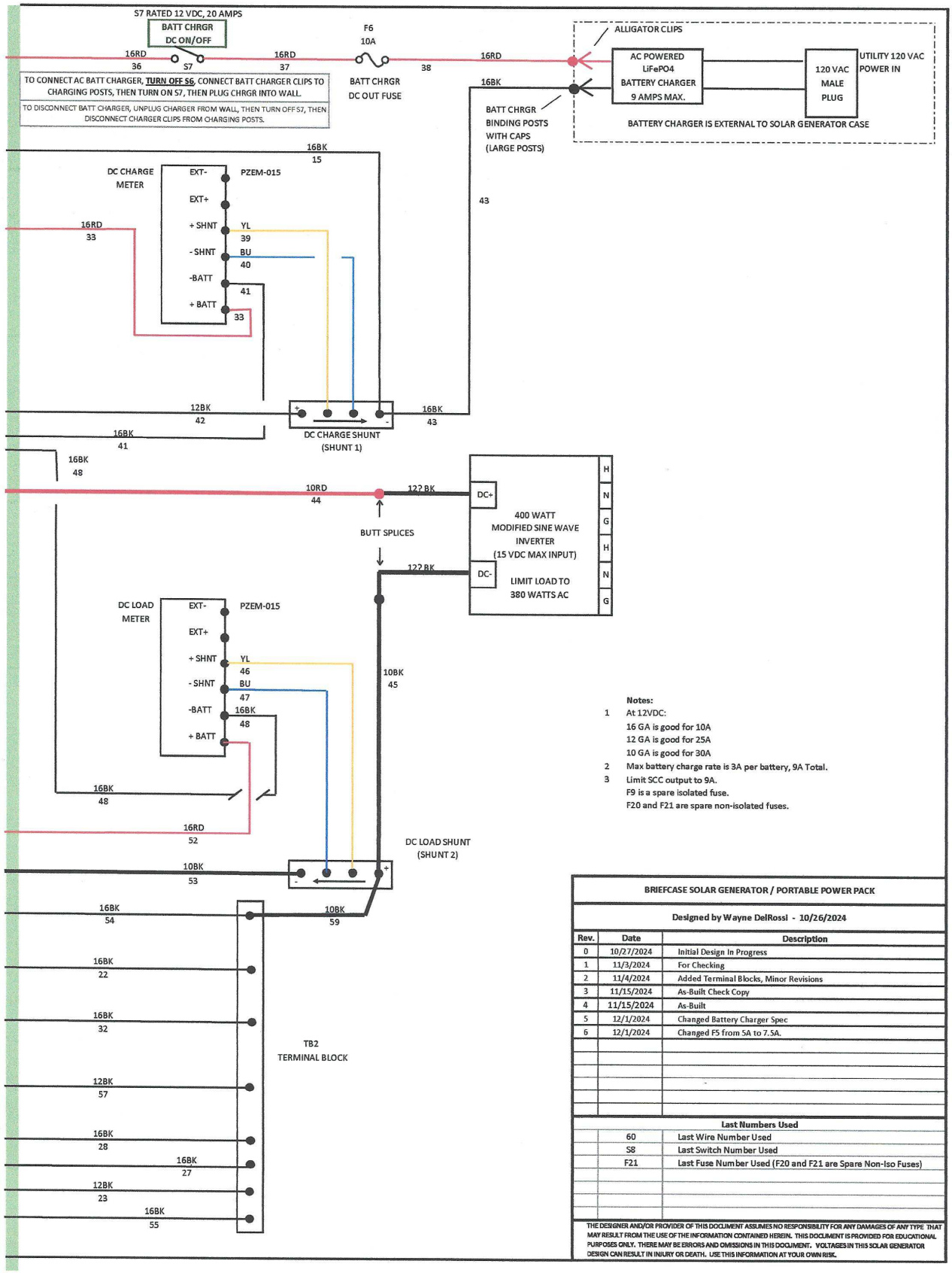

Notes:

1 At 12VDC:
16 GA is good for 10A
12 GA is good for 25A
10 GA is good for 30A

2 Max battery charge rate is 3A per battery, 9A Total.

3 Limit SCC output to 9A.
F9 is a spare isolated fuse.
F20 and F21 are spare non-isolated fuses.

BRIEFCASE SOLAR GENERATOR / PORTABLE POWER PACK

Designed by Wayne DelRossi - 10/26/2024

Rev.	Date	Description
0	10/27/2024	Initial Design In Progress
1	11/3/2024	For Checking
2	11/4/2024	Added Terminal Blocks, Minor Revisions
3	11/15/2024	As-Built Check Copy
4	11/15/2024	As-Built
5	12/1/2024	Changed Battery Charger Spec
6	12/1/2024	Changed F5 from 5A to 7.5A.

Last Numbers Used	
60	Last Wire Number Used
S8	Last Switch Number Used
F21	Last Fuse Number Used (F20 and F21 are Spare Non-Iso Fuses)

3/26/2025

Briefcase SG Wiring Diagram and Components List Rev 6 12_1_2024 2000.xlsx

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