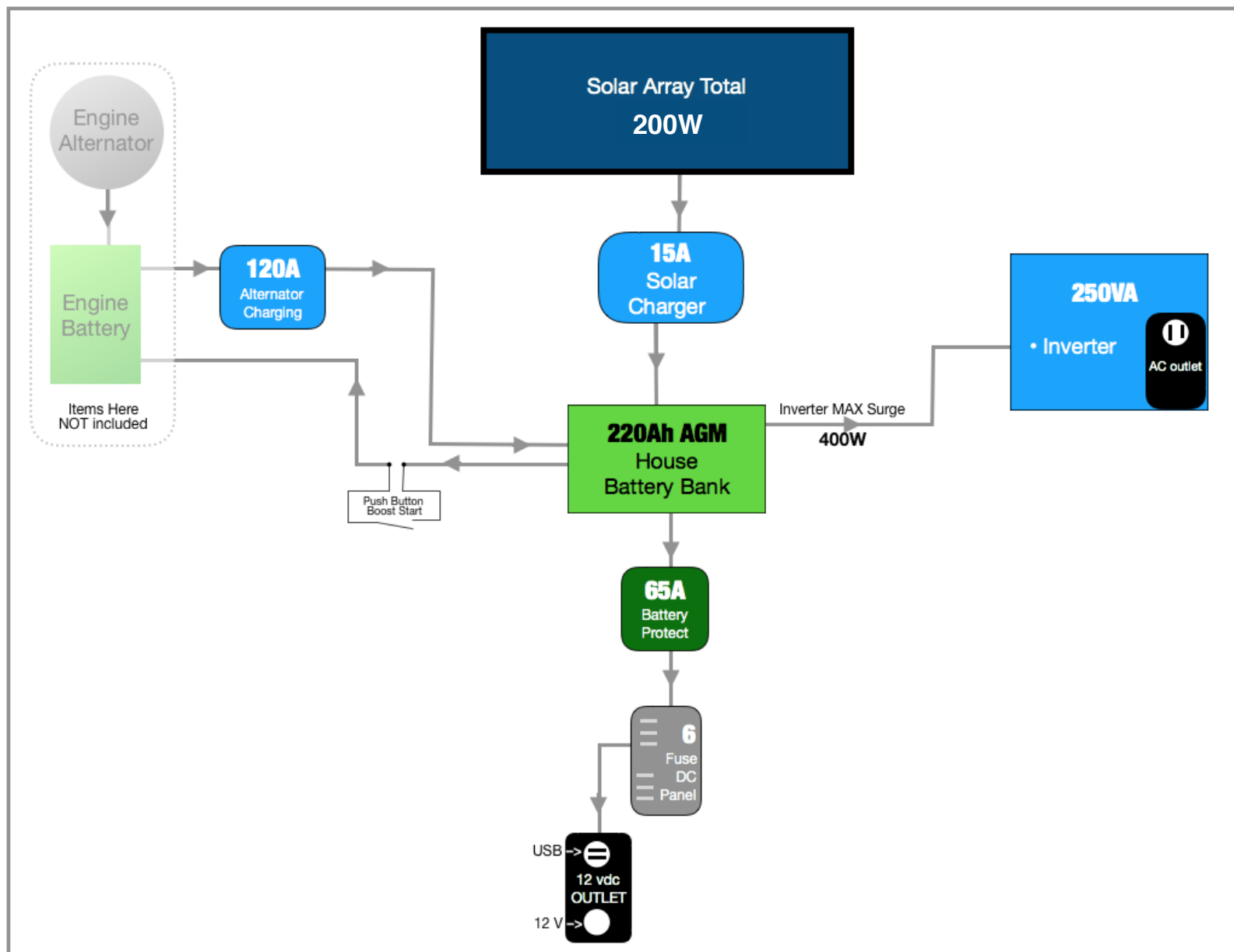




## Installation Guide



Online Guide



## Table of Contents

<b>Tips and Tricks -----</b>	Helpful tips and suggestions to ensure a successful installation and give you an accurate understand of what you are getting yourself into
<b>Tools-----</b>	Tool suggestions to prepare for the work ahead along with some friendly advice
<b>System Overview -----</b>	Diagram showing all of the various components, cables & connectors, detailing connections for each subsystem in the kit
<b>Bill Of Materials -----</b>	Complete bill of materials broken down by subsystem listing quantities, part numbers and descriptions with QR codes to link data sheets for major components
<b>Complete Schematic -----</b>	Detail of the entire system
<b>Installation: Battery Bank -----</b>	Detail of the Battery Bank subsystem connections and components
<b>Installation: Solar Charging -----</b>	Detail of the Solar Charging subsystem connections and components
<b>Installation: Alternator Charging &amp; Boost -----</b>	Detail of the Alternator Charging subsystem connections and components
<b>Installation: AC Input and Output-----</b>	Detail of the AC Input and Output subsystem connections and components
<b>Installation: DC Distribution-----</b>	Detail of the DC Distribution subsystem connections and components
<b>Programming &amp; Commissioning Your System -----</b>	Detail of how to program the various different components of your system



## General Guidelines and Tips

Congratulations on your purchase of a power system designed by AM Solar! We have assembled this kit to take the guess work out of putting together a complete solar solution. Now the fun begins - It's time for installation. Please read the guidelines below to help ensure a smooth project completion.

### ***Stay safe***

Remember that you will be working with both AC and DC power, so whenever possible avoid working with "live" components. Always use caution when working with electricity. When this guide is followed, you'll have a safe and successful installation. Be careful, not frightful - The installation can be fun when following these instructions and not cutting corners.

### ***Keeping a realistic time frame for installation is important***

This installation might take 4 to 5 days for an experienced AM Solar technician. So, establishing a realistic goal for completing the installation is helpful and avoids rushing aspects of the project. You'll want to stay consistent with your work beginning to end, without the need to rush.



### ***Don't rush the layout and planning of component placement***

The design/layout part of your build is the most important thing you'll do. Skoolies, by design, are great since they start empty and give you many different installation options. Grab some chalk, cardboard, rope and a ball of string - We're going to make some component placement templates. Use chalk to outline spots for smaller items such as breakers and the fuse panel. Use the string to make the small wire runs, rope for heavy gauge, and label them (tape and stickers works well). Then layout the all the components that fit the interior of your rig to prepare for installation.

### ***Keep it organized***

Stay organized by making your work tidy and well planned. Read the included product guides / instructions and **ABC** (Always Be Checking). If you are installing and find that something was missed during your layout and planning and can't be installed correctly or safely, don't worry! Just backtrack to that stage in your layout design, and find an alternative placement before moving forward.



### ***Making it last***

No matter how long you plan on keeping this kit, it's only going to be useful and have value if it's in good order. This equipment doesn't react well to neglect or abuse. When planning and performing the installation, use proper technique and plan for the long run. Using duck tape to secure a part in place might be a good emergency fix, but you'll want to start as "clean" as possible from the beginning.



### ***Component Proximity***

Always keep high current lines as short as possible. The battery to inverter cable should be under 10 feet, 5 feet would be ideal. If you are mounting all the equipment in a very small area, be aware of the distance between all "connection points" - If a component comes loose and shifts for any reason, you will want to ensure it will not result in components touching each other and possibly causing a short.



## Suggested Tools For Installation

Here is a list of some of the tools that might be needed for your installation. If you feel this list is too ambiguous or potentially intimidating, now would be a great time to schedule your installation work with the professionals at AM Solar.

- Sturdy Ladder
- Hammer Crimper
- Hammer
- Heat Gun
- Wire Crimper
- Wire stripper
- Cable Cutter
- Multimeter
- Screwdriver
- Smartphone
- Drill
- Box knife
- 91% Isopropyl Alcohol
- Cleaning rags
- Crescent wrench
- Safety glasses





# Bill Of Materials

## 99-VANESS Down By The River Van

Rev.20190911



Solar Panels



Charge Controller



Battery Kit



Phoenix Inverter

	QTY	AMS PN	Description
SOLAR CHARGING	2	SOLAR-ZS100	100 Watt Solar Panel
	2	PLUG-2POLEFLAT-BATTS	2 Pole Plug, Battery Side
	2	STRN-MC4LN	Liquid Tight Strain Relief MC4 w/Locknut
	2	91M-ZBZ	Z Bigfoot Mount Set Zamp
	1	SEAL-SKF	Sikaflex 221
	1	20-ROOF	Roof Combiner Box
	1	CCTLR-VT-MPPS-7515	Victron BlueSolar Smart MPPT 75/15 (15A)
	20	CABLE-8GA-2-GRY	Duplex-8/2
	1	92C-INTR	Interior Wire Harness Acc. Kit
	1	93T-NEG-8GA	8ga Negative Terminal Kit
	1	93T-POS-8GA	8ga Brkr Pos Term Kit
	1	BRKR-DC-BRKR-030A	30A DC Circuit Breaker
BATTERY BANK	1	MONITOR-VTBMV-S	Victron Battery Monitor BMV-712 Smart
	2	BATTAGM-6V-220A	AGM-GPL-4CT 6V 220Ah
	4	LUG-2/0-RING-3/8	2/0 Lug-3/8" Ring
	3	93H-B3/4	Heat Shrink Black 1.5" x 3/4"
	1	93H-R3/4	Heat Shrink Red 1.5" x 3/4"
	2	CABLE-2/0-1-BLK	Cable-2/0
ALTERNATOR CHARGING	1	RELAY-VTCX120	Victron Cyrix-ct 12/24V-120 Intelligent battery cmb
	2	LUG-18GA-FAST-F	Female Fast-on 18 ga.
	2	LUG-2GA-RING-1/4	2 ga. Lug-1/4" Ring
	4	LUG-2GA-RING-3/8	2/0 Lug-3/8" Ring
	30	CABLE-2-1-BLK	Cable-2 ga. Black
	40	CABLE-18GA-1-RED	18 ga. Red Wire
	20	CABLE-18GA-1-BLK	18 ga. Black Wire
	2	LUG-18GA-RING-BR	18-22 ga. Ring-Bare
	1	HS-BLK-DWALL-1/8	Heat Shrink 1/8" Black
	1	SPLICE-14-BUTT-SD	14-16 ga. Butt Step-Down
	1	FUSEHLDR-MINI	Mini Fuse Holder & Cap
	2	FUSE-MINI-005A	Mini Fuse-5 Amp
	1	LUG-10GA-RING-HS	10-12 ga. Ring-H.S.
	1	BRKR-DC-BRKR-200A	200A DC Circuit Breaker
	2	HS-RED-HD-3/4	Heat Shrink 3/4" Red
	1	SWITCH-ESSCLD	Essential black momentary switch
	1	PLATE-MOM	Faceplate for Momentary Switch
	4	FSTSCW-612	Screw-#6x1/2" PHP BLK OX

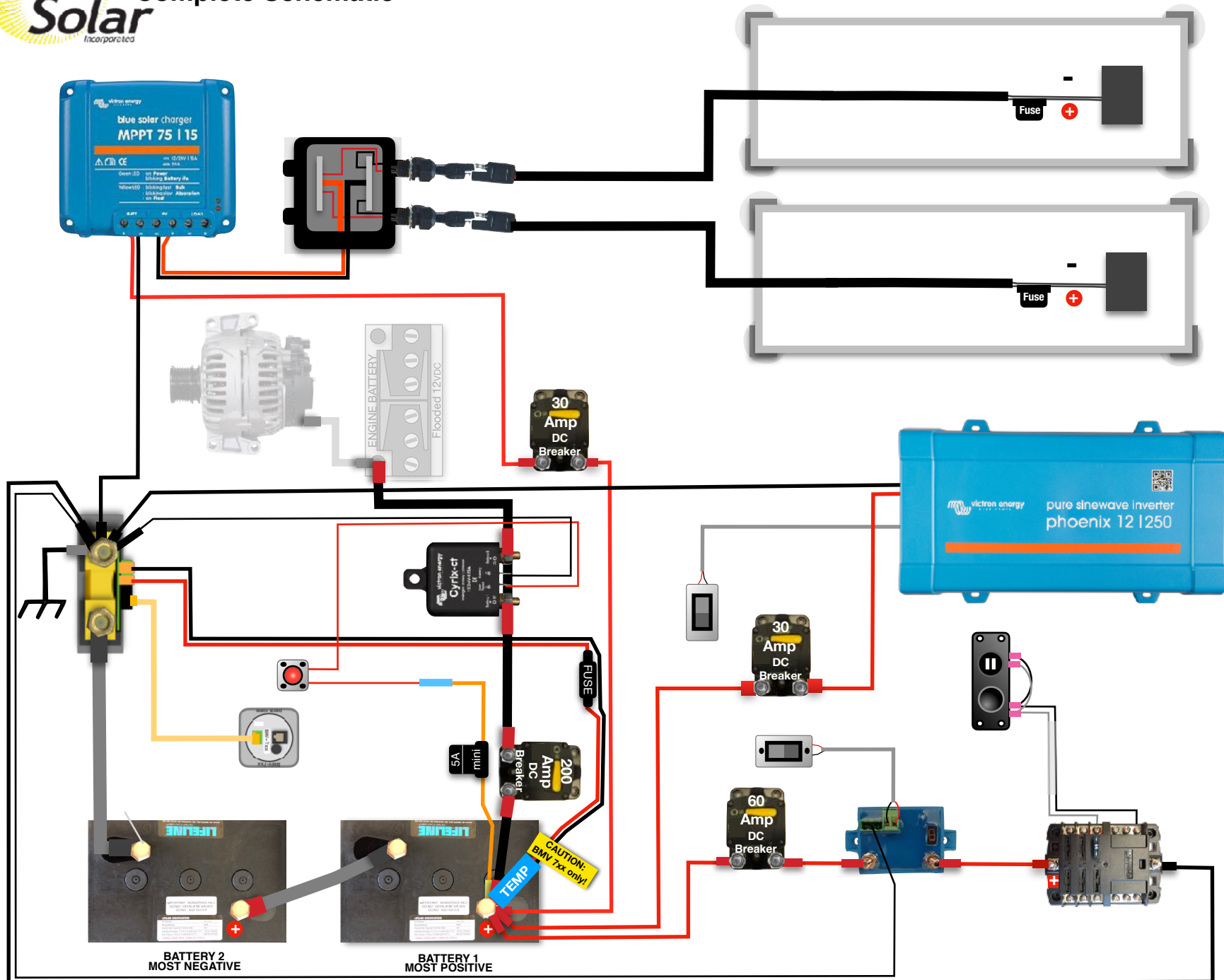
	QTY	AMS PN	Description
AC OUTPUT	1	INV-VT-250	Victron Phoenix 12/250-120V VE.D Invrtr
	4	FSTSCW-1034Z	Screw-#10x3/4" PHP SMS Z
	4	FSWASH-FLT-1/2	Flat Washer 1/2" OD- #10 ID Z
	5	CABLE-10GA-2-WHT	Duplex-10/2 600V
	1	LUG-10GA-RING-HS	10-12 ga. Ring-H.S.
	1	93F-ATC-030A	30A ATC Fuse Kit
	1	SWITCH-WALL	12V Wall Switch, Chrm
	2	FSTSCW-612-SS	Screw-#6x1/2" PHP SS
	2	LUG-18GA-DISC-F	Female Disconnect 18 ga.
	20	CABLE-18GA-2-GRY	Duplex-18/2
DC OUTPUT	15	CABLE-6GA-2-GRY	Duplex-6/2
	1	FUSEHLDR-MULT	ST Fuse Block 6 Circuit
	1	BRKR-DC-BRKR-040A	40A DC Circuit Breaker
	1	RELAY-VTSMBP65	BatteryProtect 12/24V-65A
	6	LUG-6GA-RING-3/8	6 ga. Lug-3/8" Ring
	6	HS-RED-DWALL-1/2	Heat Shrink 1/2" Red
	2	HS-BLK-HD-1/2	Heat Shrink 1/2" Black
	2	LUG-6GA-RING-1/4	6 ga. Lug-1/4" Ring
	2	LUG-10GA-SPD-8	10-12 ga. #8 Block Spade-Bare
	1	OUTLET-12USB	12V/USB Outlet
	10	CABLE-10GA-2-WHT	Duplex-10/2 600V
	1	HS-RED-DWALL-1/4	Heat Shrink 1/4" Red
	1	HS-BLK-DWALL-1/4	Heat Shrink 1/4" Black
	4	LUG-10GA-DISC-F	Female Disconnect 10 ga.



# Complete Schematic

## 99-VANESS Down By The River Van

Rev.20190911





## Battery Bank

The battery bank is the heart of the system. Its components usually take up the most space and all other subsystems connect to it. That's why we recommend installing it first. This battery bank consists of two 400Ah 6V batteries and a battery monitoring system. By connecting the two batteries in series the voltage sums and you end up with a 400Ah 12V battery bank. The Bluetooth battery monitor reads all charging and discharging current through a shunt and is able to interpret that data to compute battery usage, remaining energy, percent charge, etc. When a shunt is used, the load side of the shunt becomes the new negative battery terminal and no negatives will connect to the actual battery.

1. **Mount the batteries** securely in a custom made cabinet, or use straps. They are very heavy and not something you want tumbling around during a wreck. Weight distribution and maintaining balance may also be a concern for your installation.
2. **Mount the shunt** and connect the battery side (polarity matters) to the negative terminal of the most negative battery using heavy cable.
3. **Mount the display** in a convenient place and connect it to the shunt with the communication cable. This can be mounted on a wall or hidden away. Since the display communicates over Bluetooth, you don't actually need to interact with it.
4. **Connect the temperature sensor.** The temperature sensor also serves as the positive leg to power the battery monitor, therefore it must be connected to the positive terminal of the most positive battery.
5. **Check the connections** to make sure they are correct and tight.
6. **Series connect the batteries** by running a heavy cable from the positive of the most negative battery to the negative of the most positive battery. Ideally, this cable is as short as possible, but it is possible to use a longer cable and separate the batteries.
7. **Test the system** by checking that the battery monitor display is working. You can skip ahead to the programming section of this manual to program the battery monitor at this time.



**Battery Bank Schematic**





## Solar Charging

This solar charging kit uses individually fused solar panels, connected in parallel inside a combiner box to optimize partial shade performance. The output of the combiner box is routed to a master disconnect switch, then to an MPPT charge controller with Bluetooth programming and monitoring. The output of the charge controller is protected by a resettable breaker and fed onto the battery bank.

1. **Plan the placement of the components.** By using the cardboard boxes that the panels shipped in, you can strategize your optimum array layout and avoid shade from other roof-mounted obstructions. The combiner covers the roof penetration, so plan it's placement with the wire route to the battery bay in mind. The charge controller should be mounted adjacent to or inside the same enclosure as your battery bank for temperature sensing. If this isn't possible, contact AM Solar for a remote temp sensor.
2. **Prep the panels by installing the output cable.** In some cases your panels may come shipped already prepped. The DIY INSTRUCTIONS page on our website, or the link on the #1 QR Code to the left will provide detailed instructions.
3. **Attach panel mounts** according to the video linked by the #2 QR Code to the left.
4. **Install the panels** according to the video linked by the #3 QR Code to the left. On a metal roof, penetrations are rarely required. Don't let any part of the panel overhang the leading edge of the roof.
5. **Install the combiner box** by following the video instructions linked by the #4 QR Code to the left. It's a good idea to check polarity before making any connections.
6. **Route the roof cable** from the combiner box, through the roof penetration down to the battery bay. Install the Master Disconnect switch with the switch in the OFF position and connect to the charge controller. It may be difficult to connect thick cables to the charge controller. If you have trouble, follow the #5 QR Code to a PDF diagram.
7. **Connect to the batteries** by routing a segment of remaining roof cable from the charge controller to the breaker to the battery bank.
8. **Permanently mount components** and verify all connections.
9. **Activate your solar charger** by turning on the breaker then the Master Disconnect switch. Skip ahead to the programming section of this manual to program the charge controller.



Solar Wiring Schematic



CABLE OUTPUT  
INSTALLATION VIDEO

1



ROCKER FOOT MOUNT  
INSTALLATION VIDEO

2



SOLAR PANEL  
INSTALLATION VIDEO

3



ROOF COMBINER BOX  
INSTALLATION VIDEO

4



If the connections seem  
tight on the MPPT, that is  
normal. Scan here for  
assistance.





## Alternator Charging

The alternator charging kit uses a device called a Cyrix that interrupts the circuit connecting your starter battery and your house battery bank. When your vehicle isn't running, this connection will be open, to allow your two battery banks to sit at their separate resting voltages. When the ignition is started and the alternator starts sending current, the Cyrix will detect the higher voltage on the starter battery and close the connection between the battery banks. Since the alternator charge will be at a higher voltage than both battery banks, current will only be flowing into batteries from the alternator, not from one battery to another. The boost button overrides the alternator voltage sense of the Cyrix and manually connects the battery banks. This is fine for short periods of time and it is used in situations when your starter battery is dead and you need to use your house battery to start your ignition.

1. **Position components** so cable routes can be planned.
2. **Connect the 2ga cable** between either that starter battery positive, the positive output of the alternator, or some other attachment point with continuity to those two points. Make the connection to whatever position allows for the easiest cable route to your house battery bank. (Do not connect the cable to the house battery bank yet.)
3. **Install the DC breaker** along the 2ga cable in an easily accessible location near the house battery. Polarity is important, meaning that the LOAD post of the breaker should go to the house battery bank, matching the diagram. Keep the breaker in the OFF position for now.
4. **Install the Cyrix** between the alternator/starter battery and the breaker. Plug in the pigtail.
5. **Install the boost button** in a location accessible from the driver's seat (you will be holding it while you turn your ignition key). Connect a red wire between one lead of the boost button (polarity doesn't matter) and the red wire in the pigtail coming off the Cyrix.
6. **Connect a black wire** between the load side of the shunt and the black wire in the pigtail coming off the Cyrix.
7. **Install the fuse holder** (with the fuse removed) onto the positive battery terminal, and splice a red wire on the other end of the fuse holder. Connect the other end of that red wire to the remaining lead on the boost button.
8. **Activate the system** by checking that all the connections are correct and tight, permanently mounting components, installing the fuse and turning ON the breaker.
9. **Test the system** by turning on the ignition and verifying with the battery monitor that current is flowing into the house battery bank. Then, turn off the system and push the boost button for a couple seconds to see current flowing out of the house battery.



Alternator Charging Schematic



## AC Input & Output

The AC Input/Output system is capable of plugging into a standard 30A shore power outlet. (Note: Adapters from 30A to 15A outlets can be purchased at hardware or RV supply stores). The shore power charges the battery bank and can also be passed through the inverter to the AC loads. If the loads draw more current than the shore power connection can provide, the inverter can meet the demand up to the rating of the inverter by simultaneously drawing from the battery bank. When not plugged into shore power, the inverter will draw from the battery bank to power the AC loads.

1. **Position the components** prior to connecting the cables. The cable run from the battery bank to the inverter has the potential for the highest current in the entire system, therefore it is important to keep these cable run as short as possible, ideally less than 5'.
2. **Install the AC Input cable** from the shore power inlet to the Main AC Panel with the breaker (in the OFF position) to the inverter. Be sure to use the strain reliefs around the cable.
3. **Install the AC Sub Panel** with its three duplex breakers and connect the AC outlet. Additional outlets and AC loads can be connected to the panel. Be sure the current rating of the load is less than the rating of the breaker it is connected to. Make sure all the breakers are in the OFF position.
4. **Connect to the battery bank** with the master disconnect switch in the OFF position. Make sure the Class-T fuse is between the master disconnect switch and the positive terminal of the most positive battery. Secure your spare fuse nearby with a zip tie. Connect the temperature sensor to the battery negative.
5. **Verify Connections**, check polarity, tighten terminals and permanently secure all components.
6. **Activate the system** by turning on all the breakers.



**Inverter Schematic**



### DC Distribution

A Victron Smart Battery Protect 65 (BP65) monitors the voltage of the house battery bank and disconnects the DC fuse block when the battery voltage gets low. This protects the battery bank from being accidentally over-discharged when a load like a light or fan are left on too long. The BP65 can be manually opened with a remote switch which serves as a master disconnect for all DC loads (a convenient feature for safely storing your vehicle for extended periods of time). The BP65 and cable to the six position fuse block are protected by a 60A resettable DC breaker. One DC outlet with dual USB and standard 12V is included. Additional outlets can be connected to the fuse block or wired in parallel to the existing outlet.

1. **Position the components** so cable routes can be planned. The BP65 should be within about 12" of the shunt.
2. **Install the negative cable** from the load side of the shunt to the negative post of the DC fuse block.
3. **Connect the positive cable** from the positive side of the DC fuse block to the LOAD post of the breaker. Turn the breaker to the OFF position.
4. **Install the outlet** and connect it to the fuse block. A parallel connection between the two sets of outlet posts will have to be made by fitting two sets of cable into a positive and a negative female spade lug.
5. **Install the positive cable** from the breaker LINE post to the OUT post of the BP65.
6. **Connect the black cable** that comes with the BP65 from the load side of the shunt to the center position on the BP65 three position green terminal block.
7. **Connect the switch to the BP65** with the 18ga duplex cable. Polarity doesn't matter.
8. **Install the red cable** between the BP65 IN post and the positive terminal of the most positive battery.
9. **Verify the connections** to make sure that they are correct and tight.
10. **Remove the black jumper wire** that bridges the remote ports.
11. **Activate the system** by turning the DC breaker to ON. This would be a good time to program the BP65. If the DC loads do not work, toggle the DC load master switch.



DC Power Kit Schematic



## Programming / Commissioning Your System - The BMV-712 Smart Battery Monitor

We recommend you interface with the BMV-712 through the Victron app on your phone, and change the settings from there. The app is named "VictronConnect". Ensure your Bluetooth is enabled before entering the app. Once inside the app you will see your BMV-712 displayed, click on it to change the applicable settings:

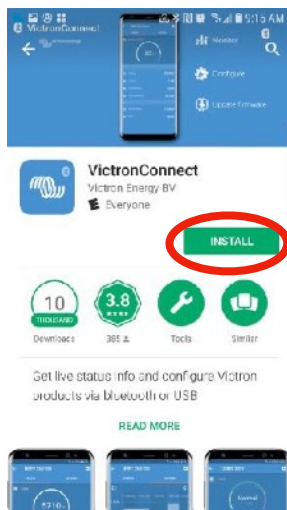
### Programming on the BMV-712 Battery Monitor:

1. Download "Victron Connect" from the Google Play Store (picture 1).
2. Turn on your Phone's Bluetooth, and get as close as possible to your Victron Component(s).
3. Open the Victron Connect app, and after it takes a moment to scan it will recognize your BMV-712.

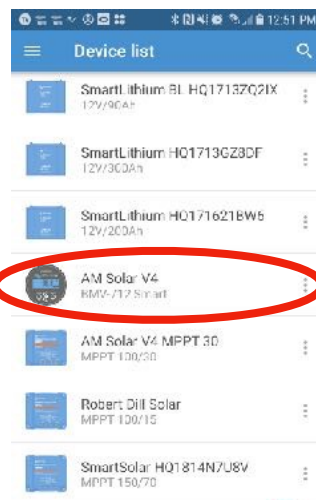
NOTE: If your device is not shown, it is probably signal interference. Try closing the app and moving to a different location before re-entering the app in a location that can pick up the BMV signal.

4. Select the BMV-712 on the Device List (picture 2).
5. Press the gear icon in the top right corner (picture 3).
6. Enter "Battery Settings" and change the values below (similar to picture 4):
7. **Changing Battery Capacity:** Enter the number of Ah of your entire battery bank
8. **Charge Voltage:** 14.1
9. **Tail Current:** 2%
10. **Peukert Exponent:** 1.1
11. **Charge Efficiency Factor:** 97%
12. **Temperature Unit:** "FAHR" Fahrenheit
13. **Aux Input:** User Option ("Temp")
14. Exit from the device.

NOTE: Only one phone can be connected to each device at a time. Be sure to completely disconnect and close the app to log out from the device.



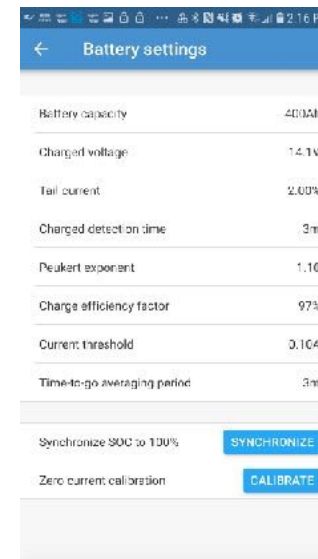
1



2



3



4

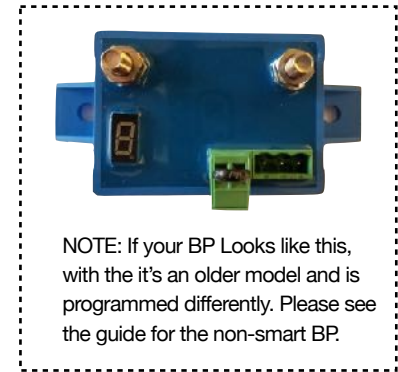
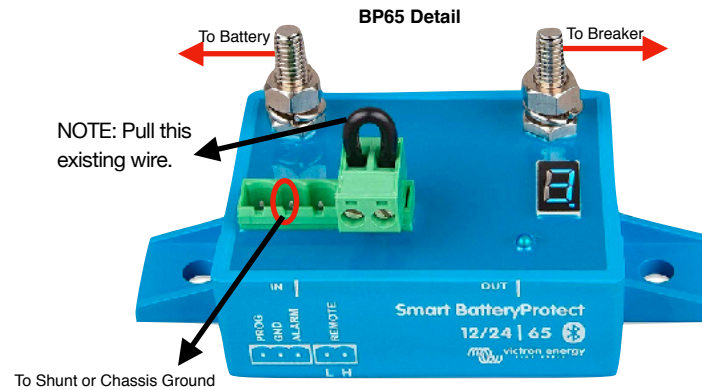
### Program Settings for AGM Batteries

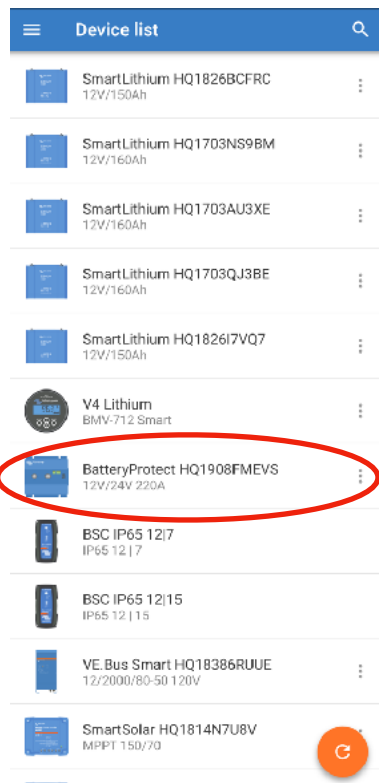
- **Battery Capacity:** Enter the total battery capacity in Amp Hours.
- **Charge Voltage:** 14.1
- **Tail Current:** 2%
- **Peukert Exponent:** 1.1
- **Charge Efficiency Factor:** 97%
- **Temperature Unit:** "CELC" (Celsius) or "FAHR" Fahrenheit
- **Aux Input:** User Option ("Temp" works best)

NOTE: To change the PIN code from the app, go back to the device list page in the app. Click on the three circles to the right of your device, and select "Reset PIN code".

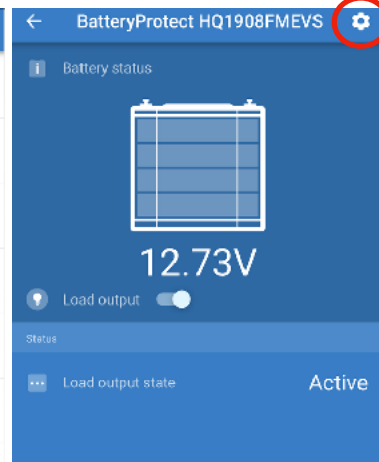
## Programming / Commissioning Your System - The Smart BP-65 Battery Protection

1. Supply 12V power to the BP (+ to IN post, - to GND pin).
2. Open VictronConnect and select the Battery Protect.
3. The first screen has a switch to manually toggle the relay.
4. Click the gear in the top right to enter Settings.
5. Select "user defined" from the Preset menu.
6. Enter the following values:  
Shut down: 11.5v  
Restart: 12.3v
7. Mode: Leave on "B"
8. Alarm output: Select "Relay" from the menu.

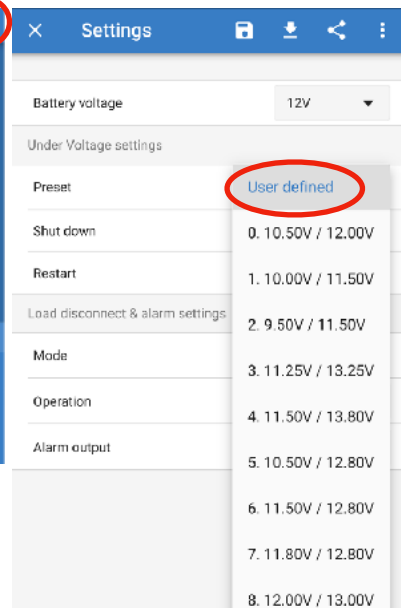




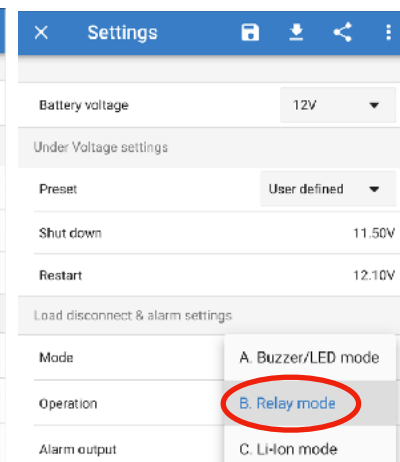
2. Select BatteryProtect from VictronConnect



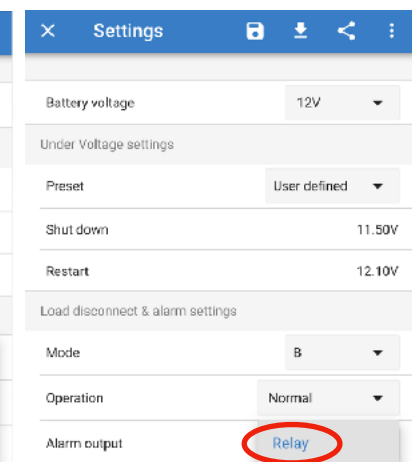
4. Select the gear icon



5. Select "User defined" from the Preset menu



7. Mode should be set to "Relay mode"



8. Alarm output: Select "Relay"

**NOTE:** These setting were chosen on the conservative side, but can be adjusted depending on your needs. Do not lower the shut down voltage until you are very familiar with your system, since dropping below 12v may result in battery degradation.

If your battery protect shuts down your loads, it's important you recharge your batteries up to a full charge as soon as possible.





## Programming / Commissioning Your System - The Charge Controller

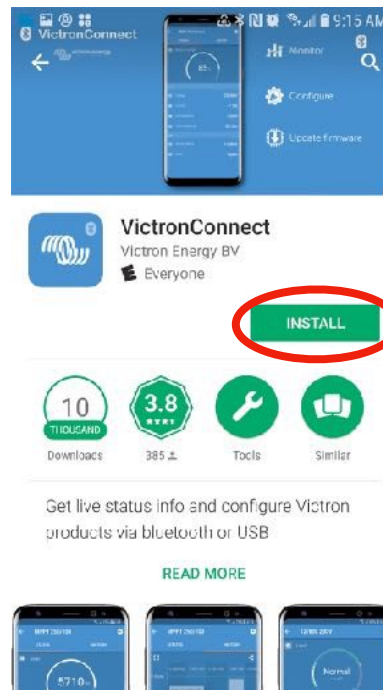


### Charge Control Settings for AGM Batteries:

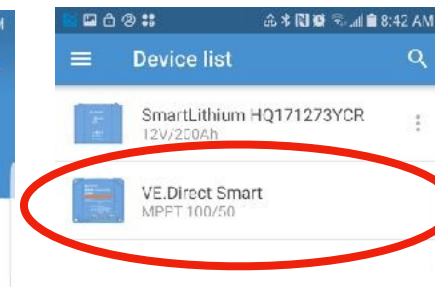
1. Download the "VictronConnect" App to your phone.
2. Open the App.
3. You'll see a selection for your SmartSolar MPPT Charger, select it.
4. Type **000000** to login for the first time.  
NOTE: To change the PIN code, go back one step to the main screen. Click on the 3 buttons to the right of the controller image, and select "Reset PIN Code".
5. Click on the **gear** in the top right corner.
6. Click on "Battery".
7. Click on the settings and adjust them accordingly to match below:

- Battery voltage: 12V
- Max charge current: 15A (In this example)
- Use default charge settings: OFF
- Charger: ON
- Absorption voltage: 14.40 V
- Absorption Time Limit: 02:00
- Float voltage: 13.30 V
- Equalization voltage: 15.20 V
- Auto Equalization: DISABLE (OFF)
- Temperature Compensation: ON
- Temperature Compensation: -20.00

Absorption Voltage	14.40V
Absorption Time limit	2:00
Float Voltage	13.30V
Equalization Voltage	15.20V
Auto Equalization	OFF
Temperature Compensation	ON
Temperature Compensation	-20.00mV/°C



Download VictronConnect  
In App Store



Device List within  
VictronConnect



MPPT Charge Controller  
Screen



## Creating The Network

1. When in the Victron Connect App, click on one of your devices.
2. Go to “Settings” (shown as a gear symbol in the top right, picture 1).
3. Go to “VE.Smart networking” (picture 2).
4. Go to “Create Network” (picture 3).
5. Enter a name for your network (picture 4).

## Linking Each Device:

1. Enter the Victron Connect App and click on a device.
2. Go to “Settings” (shown as a gear symbol in the top right, picture 1).
3. Go to “VE.Smart networking” (picture 2)
4. Go to “Join Existing Network” (picture 3)
5. Select the network you just created (picture 5).
6. This device is now joined to the network (picture 7). Repeat this step for every other bluetooth enabled device.

