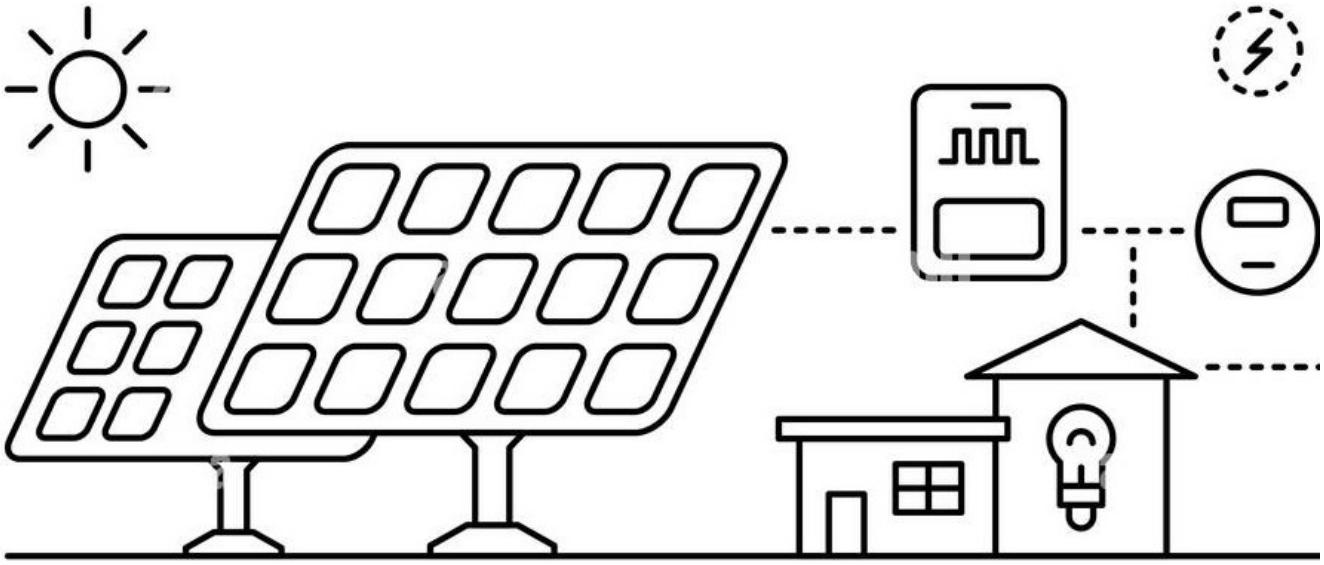
Solar System Operations Guide



Revision 02/18/2026

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- Solar System Start-Up -

Cold Start-Up : This procedure is designed to start the solar system from a “cold” state, meaning no part of the solar system is “ON”. To ensure a safe and optimized start-up there is no AC load applied to the solar system until the solar system is 100% up and running. Additionally, the AC loads are brought on-line gradually to prevent any surge to the inverters.

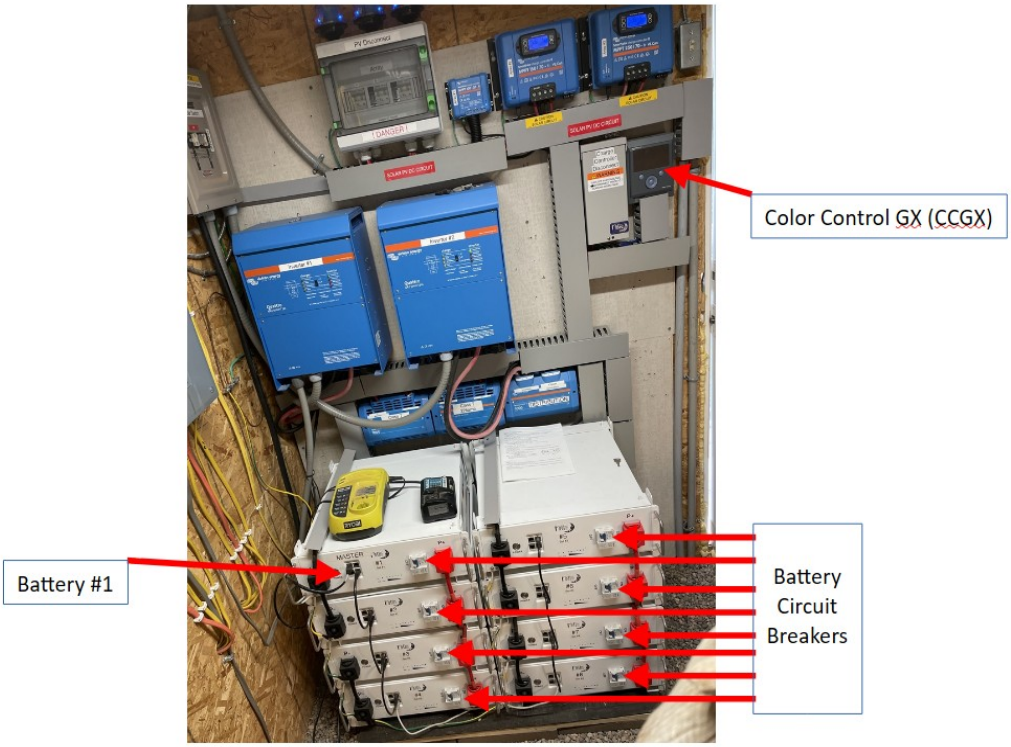
This process assumes the entire solar system has been shut-down completely and totally. There is no part of the solar equipment that is “ON”. It also means that no part of the AC side of the system is “ON” or energized...the house circuit breakers are all “OFF”, no generator is running, Transfer Switch is set to “solar”, AC Service Main Disconnect is “OFF”, etc..

IMPORTANT : Make sure that the arrays are all powered down before beginning this process. They can be powered down at the exterior array combiner boxes located on each array. They should also be powered down at the interior PV Disconnect box. It’s more convenient to turn “ON” each array at the exterior combiner box but leave the arrays “OFF” at the interior PV Disconnect box. You do NOT want the arrays powered “ON” at the charge controllers before the charge controllers are turned “ON” by providing power to them from the batteries in Step #3.

Victron Connect : For best results and to observe proper start-up operation you could have Victron Connect (VC) up and running. You can verify each step of the process once there is power to the Victron Color Control GX.

Step #1 (Batteries) -

The first step is to turn on the batteries, and deliver power to the “brain” of the system, Victron Color Control GX (CCGX). All the battery circuit breakers should be “OFF” and no lights appearing on the batteries.



1. Turn on each battery circuit breaker starting with battery #1 and proceed to battery #8.

2. On battery #1, press and hold the POWER button for 3 seconds. The battery lights (RUN & SOC) should come on. The RUN light should be green and flash about 1x per second. The SOC lights should be green and showing 1-6 green lights indicating SOC. The ALM light should not be showing red.
    - If the ALM light is red do not proceed in turning on subsequent batteries. Refer to the MNPowerflo5 user manual for troubleshooting.
3. For each subsequent battery (#2 - #8) press the POWER button and ensure the green RUN light comes on and flashes about 1x per second. The SOC lights should not come on. The ALM light should not be showing red.
    - If the ALM light is red do not proceed in turning on subsequent batteries. Refer to the MNPowerflo5 user manual for troubleshooting.
    - The SOC lights on batteries #2 - #8 should not come on and should not show SOC. The SOC of the entire battery bank will be indicated by the SOC lights on battery #1. All eight batteries have effectively become a single battery controlled by the BMS in battery #1 communicating with the BMS's in batteries 2 – 8.

4. Verify that all 8 batteries are showing the RUN light flashing green, no red ALM lights are on, battery #1 SOC lights are indicating a SOC via green lights.
    - To know what the SOC is via the SOC lights refer to page 18 of the MNPowerflo5 user manual.
    - If the ALM light is red refer to the MNPowerflo5 user manual for troubleshooting.
5. Allow time for the Victron Color Control GX device to power on and display its screen. Be patient, it takes a minute or two.

Step #2 (Inverters) -

This step brings power from the batteries to the inverters.

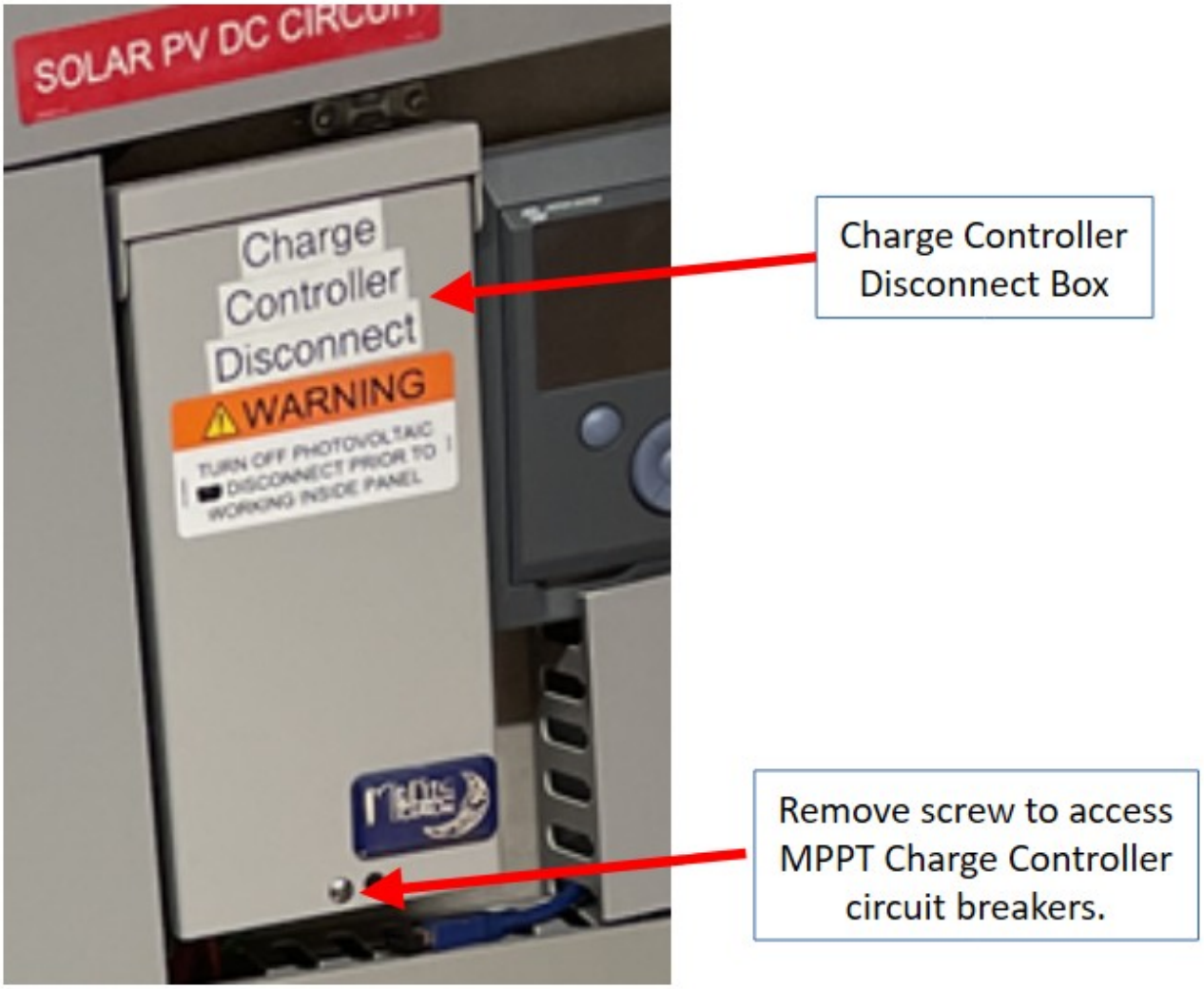
1. Turn on inverter #1. The green “INVERTER ON” light should come on. If any other light comes on refer to the Quattro user manual for troubleshooting.
2. Turn on inverter #2. The green “INVERTER ON” light should come on. If any other light comes on refer to the Quattro user manual for troubleshooting.

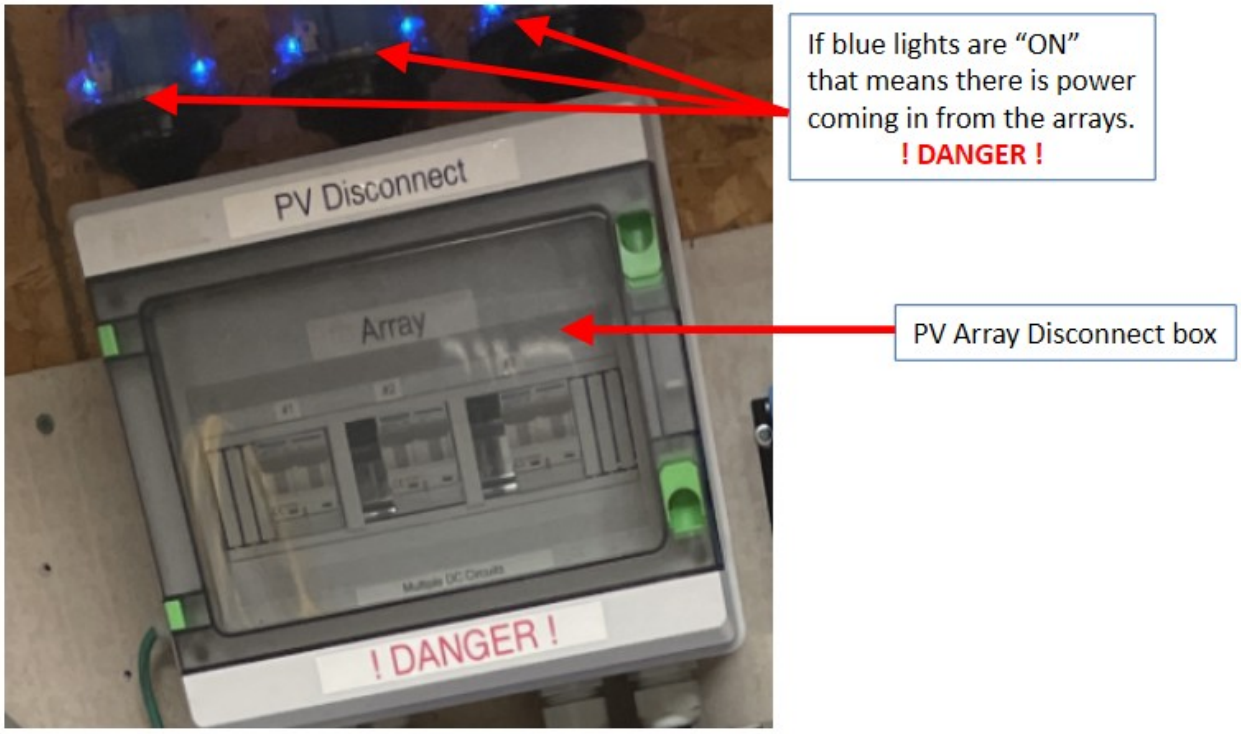
Note: It is common for multiple lights to flash when first turning on the inverter, especially Inverter #1 is turned “ON” while Inverter #2 has not yet been turned “ON”. Do not worry about it, wait until both inverters are “ON”, only the Inverter On light on both inverters should be lit. If any other lights are “ON” or either inverter Inverter On Light is “OFF” refer to the Quattro user manual for troubleshooting.

Step #3 (Charge Controllers) -

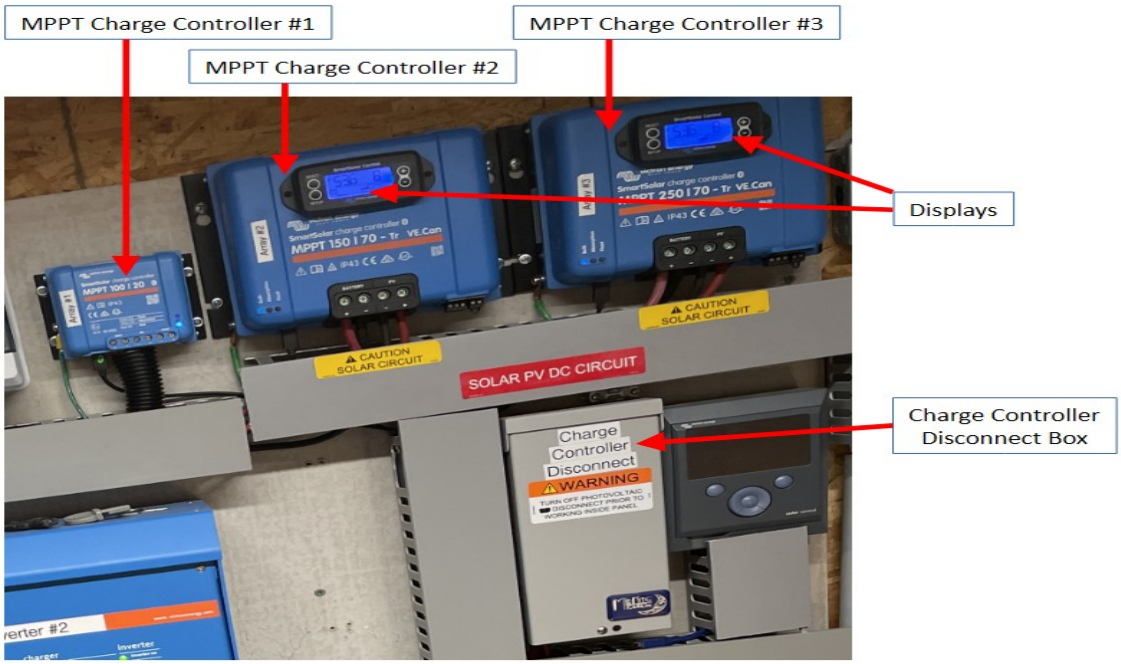
This step turns on each of the MPPT charge controllers (CC). Give each CC time to power on and communicate with the CCGX and with each other. The CCs are networked (VE.Smart Network) together to allow them to work in conjunction with each other to more efficiently charge the batteries.

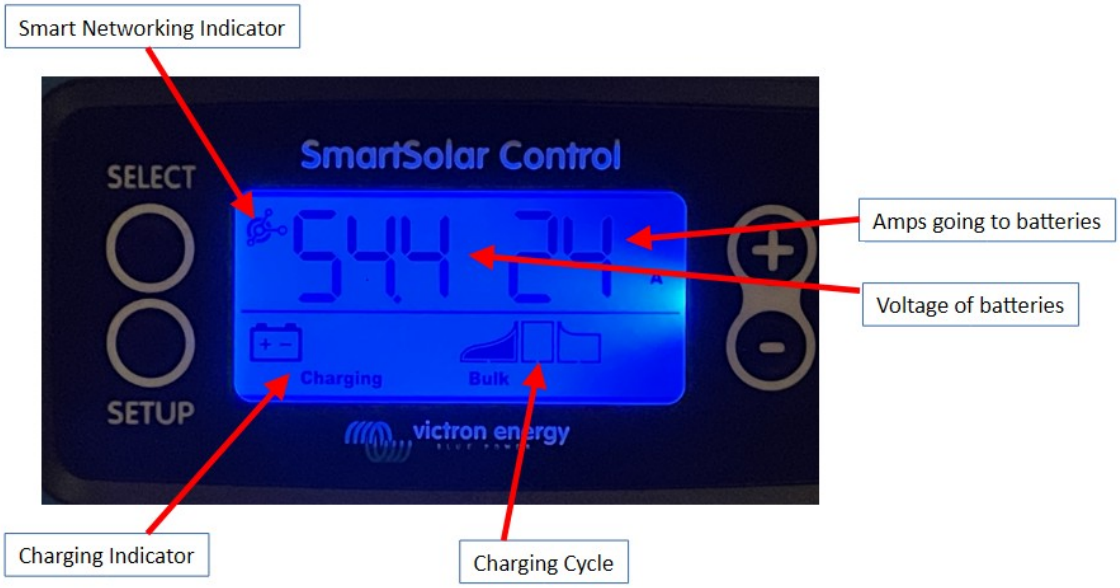
Note: To access the circuit breakers that turn on each array it is necessary that you have access to them. They are located inside of the Charge Controller Disconnect box. It may be necessary to use a philips head screwdriver to remove the screw to access the MPPT Charge Controller circuit breakers located inside the box.





1. **IMPORTANT - At the PV Disconnect box ensure each array is “OFF”.**

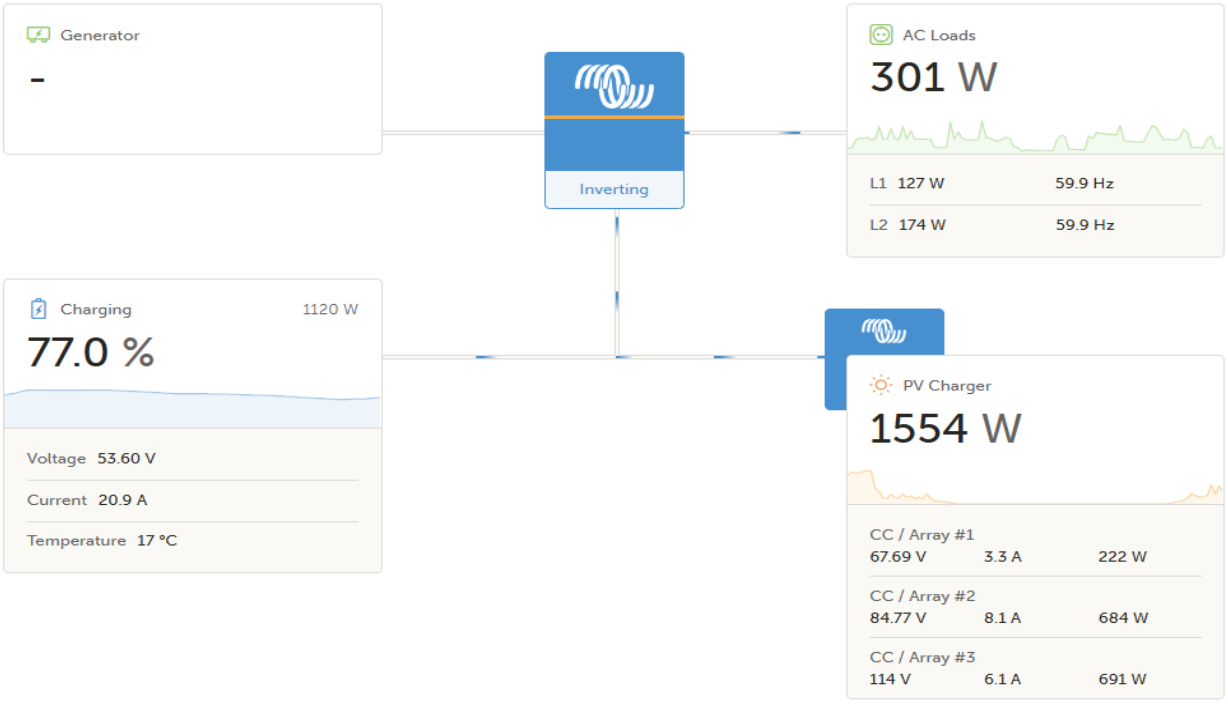




2. In the Charge Controller Disconnect box turn on #2, watch the CC for Array #2 display to power on and show a charge curve on its display.
3. In the Charge Controller Disconnect box turn on #3, watch the CC for Array #3 display to power on and show a charge curve on its display.
    - At this point there should also be a smart network icon on the CC for Arrays #2 & CC #3 displays.

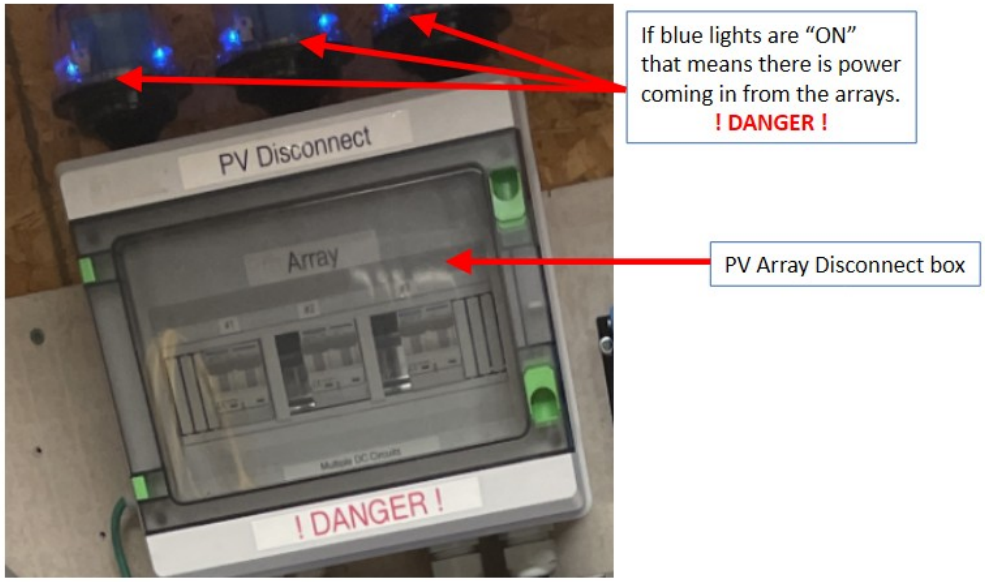
4. In the Charge Controller Disconnect box turn on #1. There is no display on CC for Array #1. However, a status light should indicate that the CC is on and functioning.

- You can verify that each CC is on and functioning via VC “PV Charger” panel.
- The voltage on the displays (CC #2 & CC #3) is the current battery voltage.
- The amp on the displays (CC #2 & CC #3) is the current amperage output of the CC to the batteries.



Step #4 (Arrays) -

This step will provide power to the CCs from the arrays.



1. At the PV Disconnect box ensure each array is "OFF". Each circuit breaker should be in the down position and no blue lights should be lit.
2. At the exterior array combiner boxes check to see if the arrays are powered. If not, power on each string, then turn "ON" the combiner's main circuit breaker for each array.
   - At this point the blue lights on each surge protection device should have both blue lights lit.
3. Ensure that each CC is properly running. Display on #2 & #3 should show volts, all three CCs should have a status light lit.
   - Note: they may be flashing as well, that is okay.
4. At the PV Disconnect box turn on the circuit breaker for Array #2.
   - Allow time for the CC to process the incoming array power and adjust its operation accordingly. Should take about a minute or so.
   - If there is power coming in from the array you should see the "charging" icon displayed on the CC display panel.
5. At the PV Disconnect box turn on the circuit breaker for Array #3.
   - Allow time for the CC to process the incoming array power and adjust its operation accordingly. Should take about a minute or so.
   - If there is power coming in from the array you should see the "charging" icon displayed on the CC display panel.
6. At the PV Disconnect box turn on the circuit breaker for Array #1.

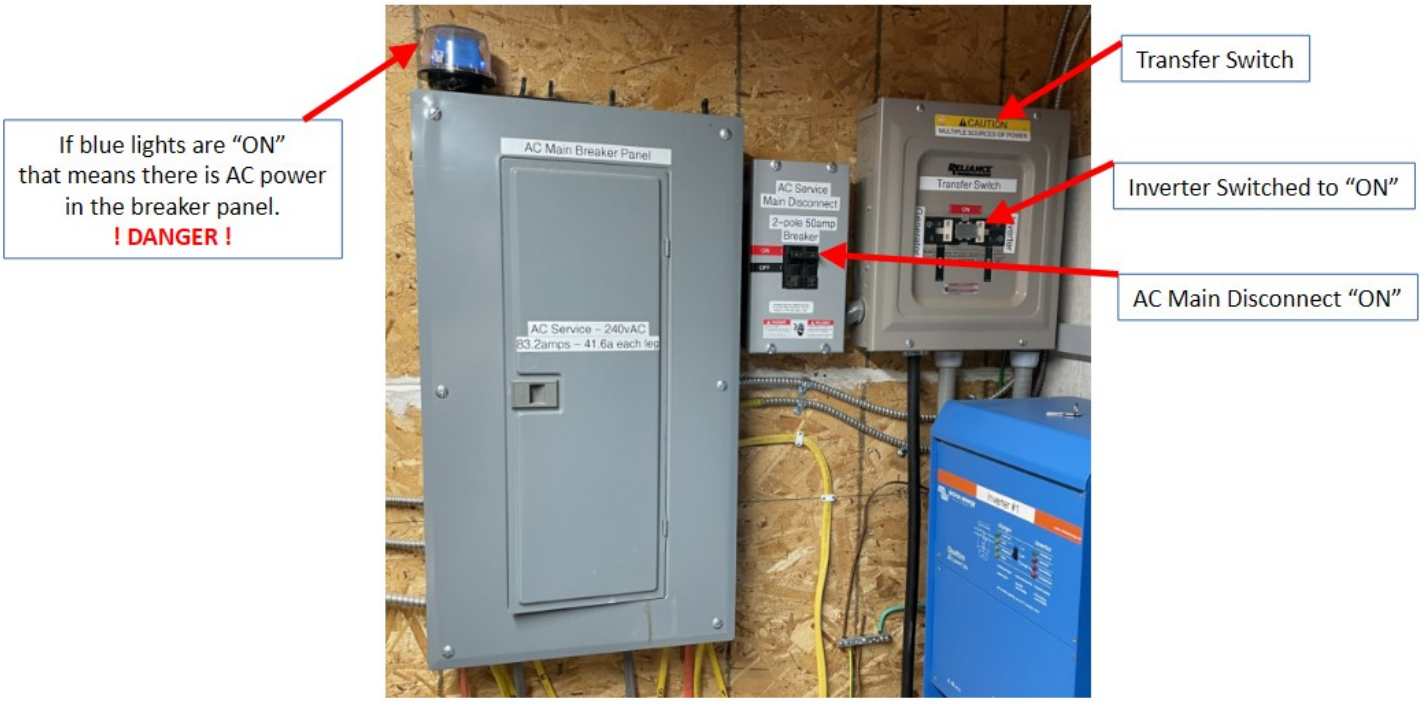
    - Allow time for the CC to process the incoming array power and adjust its operation accordingly. Should take about a minute or so.

Notes:

- You can verify that each CC is on and the associated PV array is powered via VC “PV Charger” panel.
- You can also see each array’s incoming voltage, amperage, and wattage in the same VC “PV Charger” panel.
- It is most likely that each array will have different voltages, amperages, and wattages.
- At this point, if there is power coming in via the arrays and the batteries are on at not at 100% SOC, you should see a SOC light on Battery #1 flashing indicating that the battery bank is being charged.

Step # 5 (AC System) -

This step will provide power from the solar system inverters to the house AC circuits.



1. For best results, and safer operation, it is best to:
    - Have all AC circuit breakers in the AC Main Breaker Panel "OFF"
    - Have the AC Service Main Disconnect should be "OFF".
    - Have the Transfer Switch set for "Inverter". Breaker lever towards the center "ON" position for "Inverter".
2. Ensure that the solar side of the system is operating correctly and no alarms are indicated on the CCGX or the batteries.
3. At the AC Service Main Disconnect turn it "ON".
4. At the AC Main Breaker Panel turn "ON" the circuit breaker for the "Utility Room". Verify that the power came on by turning on the light switch (next to the door) in the utility room.
5. If the light did not come on, troubleshoot.
6. If the light came on, in the AC Main Breaker Panel, begin turning on the circuit breakers one at a time, leave the highest power draw breakers for last (mini-split & water pump).

System Verification -

- Check each AC circuit breaker is in the “ON” position and not *tripped*.
- Check the CC displays for any abnormalities.
- Check the inverters for only the “Inverter On” light is lit.
- Via the Victron Connect “dashboard” verify that all system components are operating correctly.

- Solar System Shutdown -

Shutdown : This procedure is designed to shutdown the solar system from fully operational or a fault state to a cold shutdown state. A cold shutdown state means there is no power “ON” to any part of the solar system and it is not connected to the AC system.

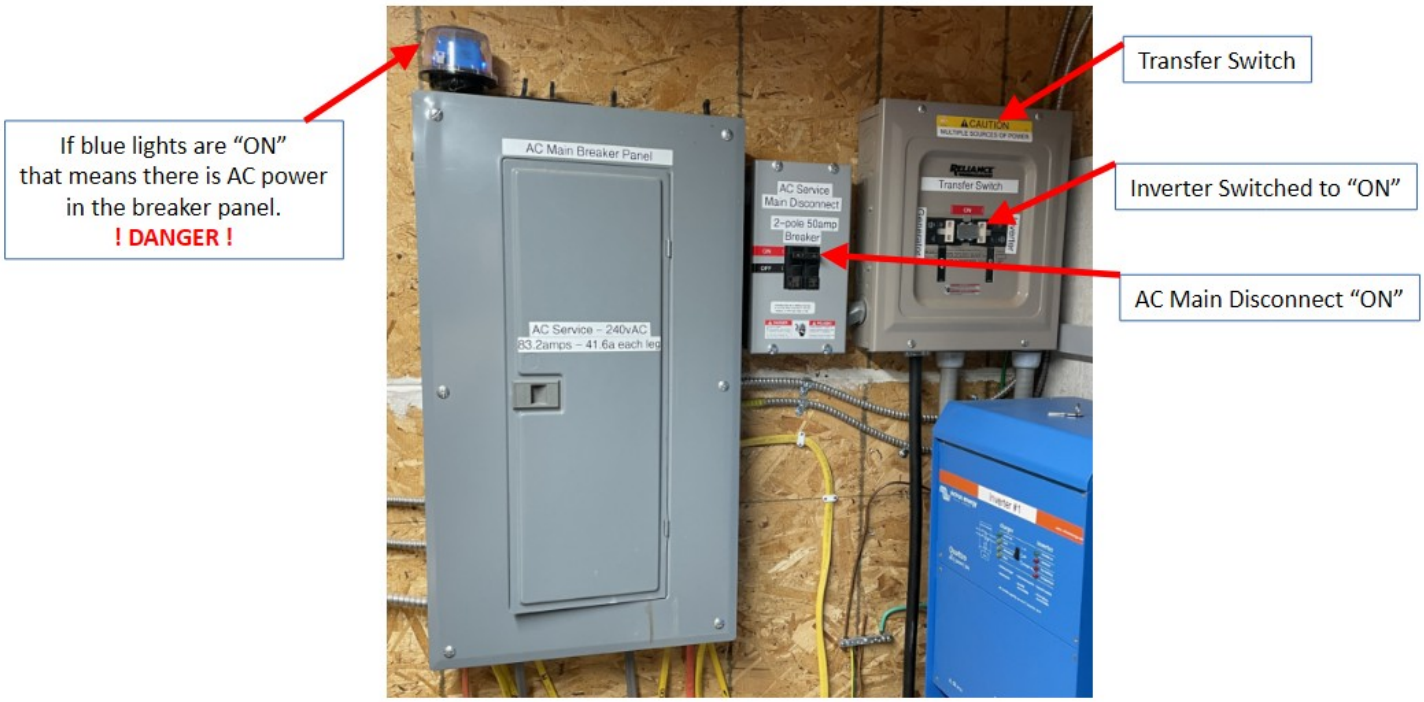
To ensure a safe and optimized shutdown the AC loads are taken off-line gradually to prevent any surge events with the inverters.

This process assumes the entire solar system has been, or is, fully operational with power coming in from the arrays and going out to the AC system. This procedure also applies to shutting down the solar system when a fault has occurred.

Victron Connect : For best results and to observe proper shutdown operation you should have Victron Connect (VC) up and running, and set to “dashboard”. You can verify each step of the process if there is power to the Victron Color Control GX.

Step #1 (AC Power) -

This step will remove power from the solar system inverters to the house AC circuits.



1. In the AC Main Breaker Panel check each AC circuit breaker for *tripped* position. This will give you a clue if there has been a fault in the AC system. Make a note if any breaker is in the "TRIPPED" position.
2. In the AC Main Breaker Panel turn each AC circuit breaker "OFF" one at a time. It doesn't matter if you turn on the higher amperage breakers first or last; same applies to the 220v breaker being turned off first or last.
3. Turn "OFF" the AC Service Main Disconnect. The blue lights in the surge protection device on the AC Main Breaker Panel should go out.
   - The surge protection device blue lights should now be off.
   - **DANGER :** On AC Main Breaker Panel if the surge protection device blue lights are still "ON" (lit) after turning "OFF" the AC Service Main Disconnect there is still power in the AC Main Breaker Panel. Troubleshoot to figure out where the AC power is coming from.
4. At the Transfer Switch turn the Inverter breaker lever to the "OFF" position.
   - That means the lever is pointed to the left. It will also indicate that the Generator breaker lever is now turned to the center "ON" position.
   - **DANGER :** If the surge protection device (on AC Main Breaker Panel) blue lights are still "ON" (lit) after turning "OFF" the Transfer Switch there is still

power in the AC Main Breaker Panel. Troubleshoot to figure out where the AC power is coming from.

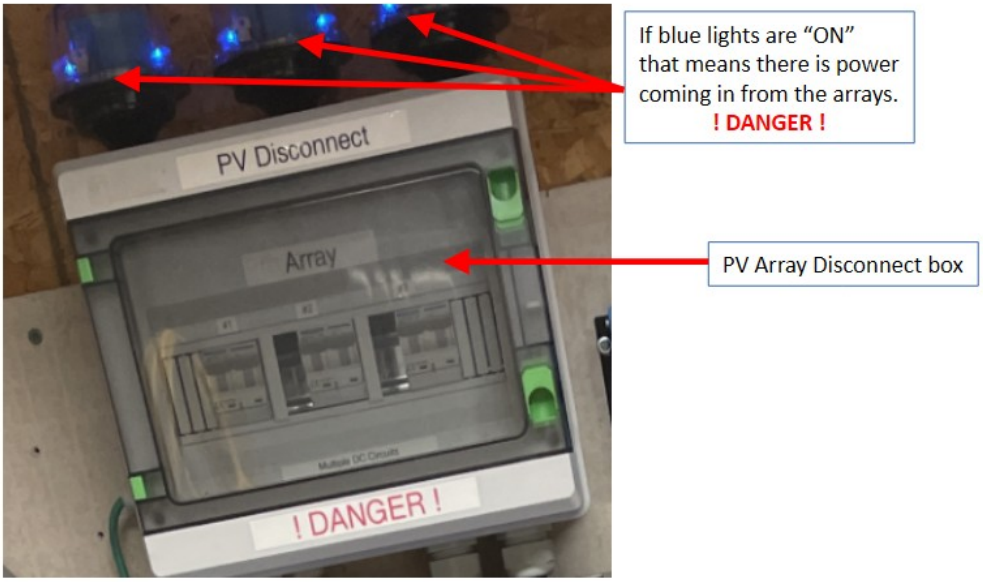
At this point the surge protection device (on AC Main Breaker Panel) blue lights should be “OFF” indicating that there is no longer any power in the AC side of the system beyond the Transfer Switch.

DANGER : If the surge protection device (on AC Main Breaker Panel) blue lights are still lit there is still power in the AC panel. Troubleshoot to figure out where the AC power is coming from before working on the AC circuits.

DANGER : If there is still power to the AC system, indicated by the surge protection device (located on the AC Service Main Disconnect) blue lights are still “ON” (lit), it means there is still AC power at/in the house. DO NOT work in the AC Main Breaker Panel, AC Service Main Disconnect, the Transfer Switch, or any interior house AC circuits until you are able to turn off the AC power source.

Step # 2 (Arrays) -

This step will remove power from the arrays to the charge controllers.



There are two methods of shutting down the arrays to the charge controllers; 1) shutting down the arrays at the interior PV Disconnect Box only, 2) shutting down the arrays at the PV Disconnect Box and at each exterior arrays' combiner boxes.

Turning off the exterior arrays' combiner boxes ensures that no power from the arrays is entering the utility room or the PV Disconnect Box. This is the safest mode. There will be no power even in the PV Disconnect box. This can be verified by no blue lights showing "ON" at the PV Disconnect box surge protection devices.

To shutdown the arrays only at the PV Disconnect Box skip to #3.

1. At each array's exterior combiner box turn "OFF" the combiner's circuit breaker. This breaker disconnects the entire box from the PV Disconnect box. You can verify this by viewing the blue lights in the surge protection device at the PV Disconnect Box. If the lights are "ON", the array(s) is/are still providing power to the PV Disconnect Box.
    - Further, if you want to take an additional step to ensure there is no power from the array going into the utility room or PV Disconnect, then "OPEN" each fuse holder in the exterior array combiner box. Only open the fuse holder once the combiner box circuit breaker has been turned "OFF". If the circuit breaker is "ON" an arc may be occur when opening the fuse holder.

- NOTE: If you are going to be performing any work on the array you must turn each array string “OFF”. You do so by opening the fuse holder for each string and ensuring the power is longer present on the load side of the fuse. Only open the fuse holder once the combiner box circuit breaker has been turned “OFF”. If the circuit breaker is “ON” an arc may be occur when opening the fuse holder.
- DANGER: However, each string may still be producing power on the line side of the fuse; check accordingly.

2. At the PV Disconnect Box turn “OFF” each circuit breaker for each array. You can verify that power is no longer coming into the system by viewing the blue lights in the surge protection device at the PV Disconnect Box. If the lights are “ON”, the array(s) is still providing power to the PV Disconnect Box.

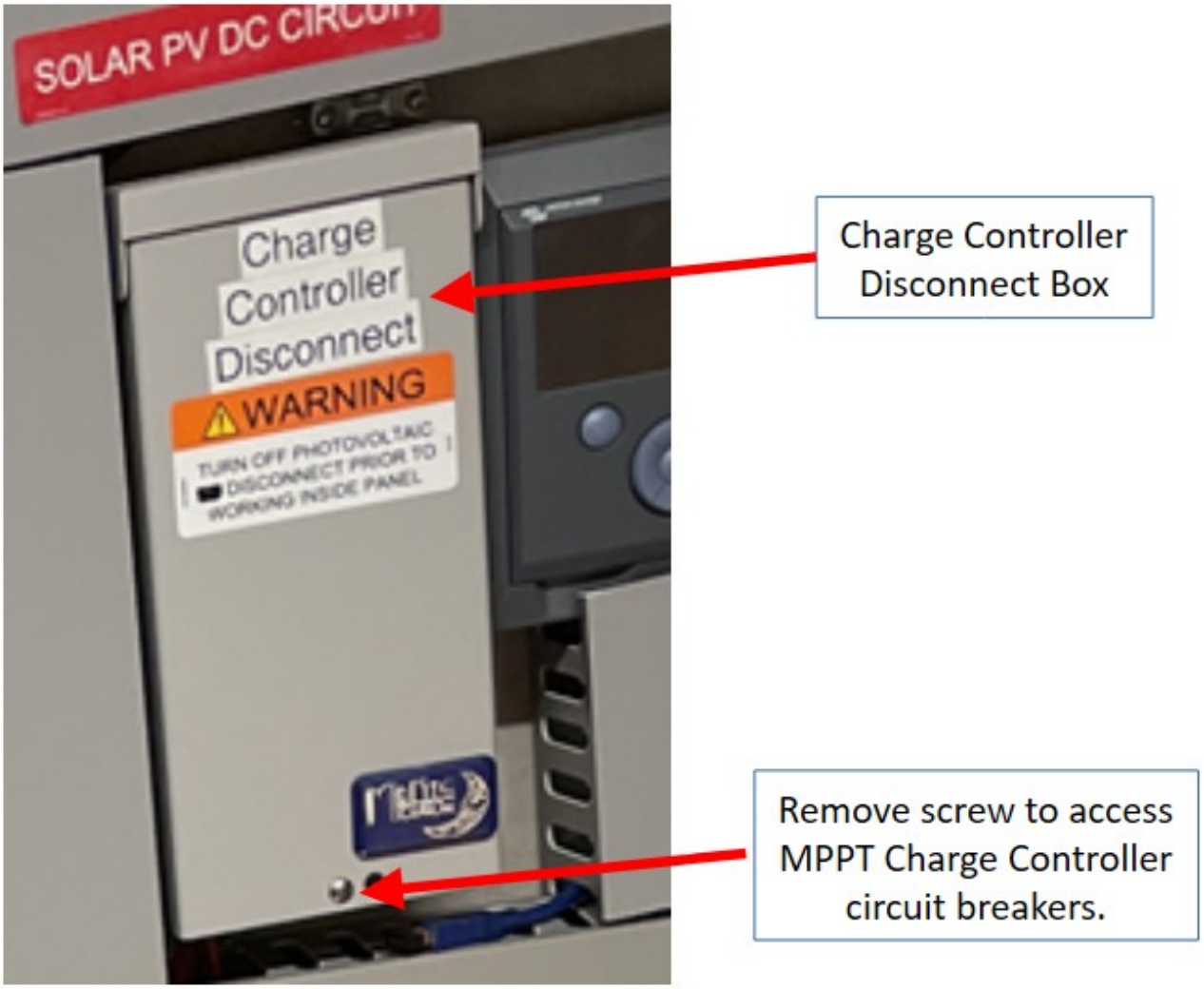
    - It doesn’t matter which array gets turned “OFF” first.

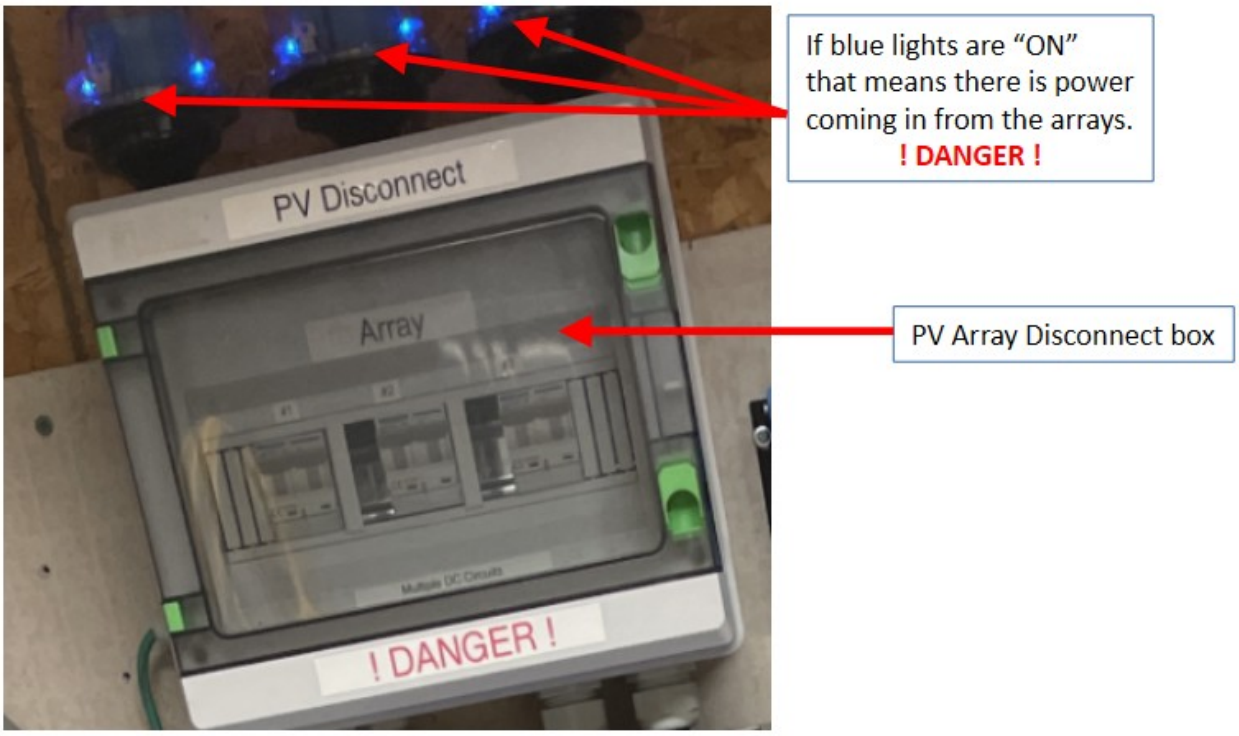
At this point all the surge protection devices’ blue lights should be “OFF” (not lit). This indicates that all power coming in from the arrays should not be present.

Step #3 (Charge Controllers) -

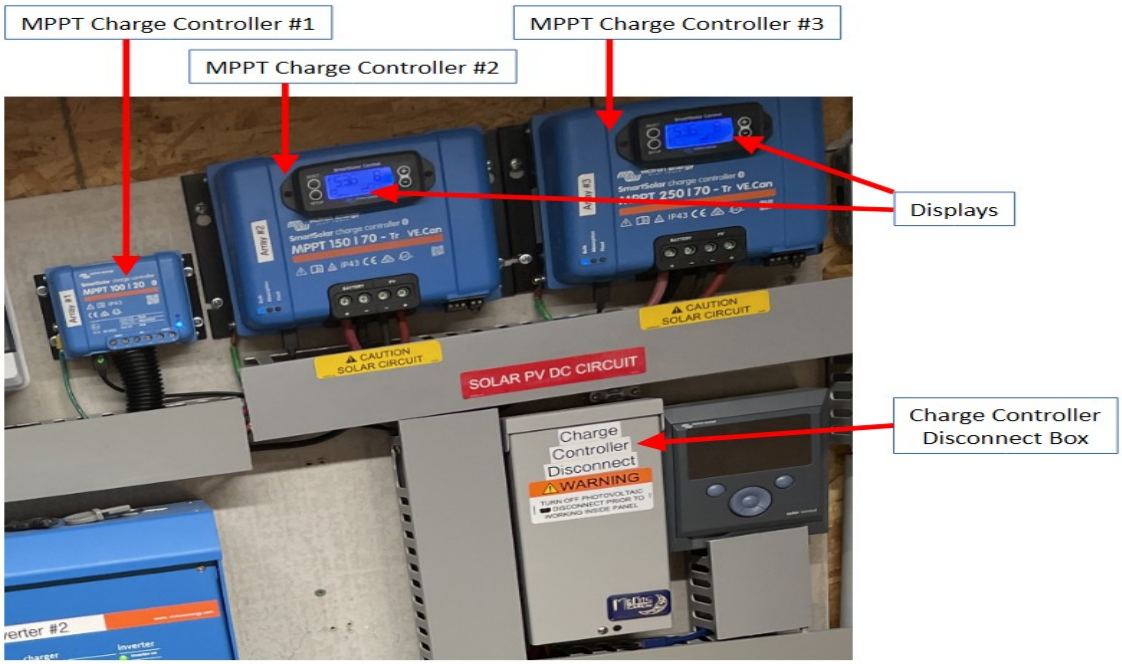
This step turns off each of the MPPT charge controllers (CC).

Note: To access the circuit breakers that turn off each array it is necessary that you have access to them. They are located inside of the Charge Controller Disconnect box. It may be necessary to use a philips head screwdriver to remove the screw to access the MPPT Charge Controller circuit breakers located inside the box.





1. **IMPORTANT - At the PV Disconnect box ensure each array is “OFF”.**



2. In the Charge Controller Disconnect box turn “OFF” the circuit breaker #1. There is no display on MPPT Charge Controller #1 so there is nothing to observe going dark other than the charging stage indicator light will go out.
3. In the Charge Controller Disconnect box turn “OFF” the circuit breaker #3, observe the MPPT Charge Controller #3 display to watch it go dark.
4. In the Charge Controller Disconnect box turn “OFF” the circuit breaker #2, observe the MPPT Charge Controller #2 display to watch it go dark.

- You can verify that each MPPT Charge Controller is off via VC “PV Charger” panel.

Step #4 (Inverters) -

This step terminates AC power being generated by the batteries, and stops DC power coming from the batteries to the inverters.

1. Turn off inverter #2. The green “INVERTER ON” light should go out. Other lights may appear at this point, they are indicating a fault but will go out once Inverter #1 is turned off.
2. Turn off inverter #1. The green “INVERTER ON” light should go out.

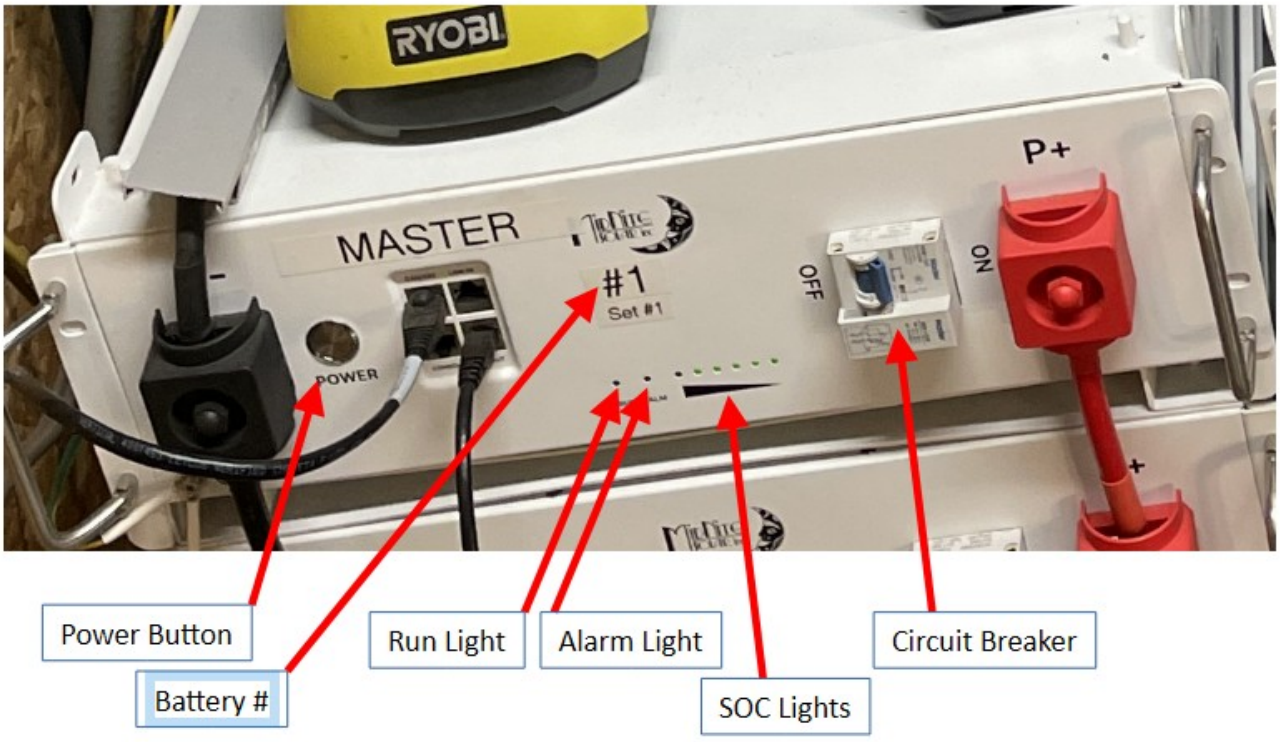
- All lights on both inverters should be out at this point.

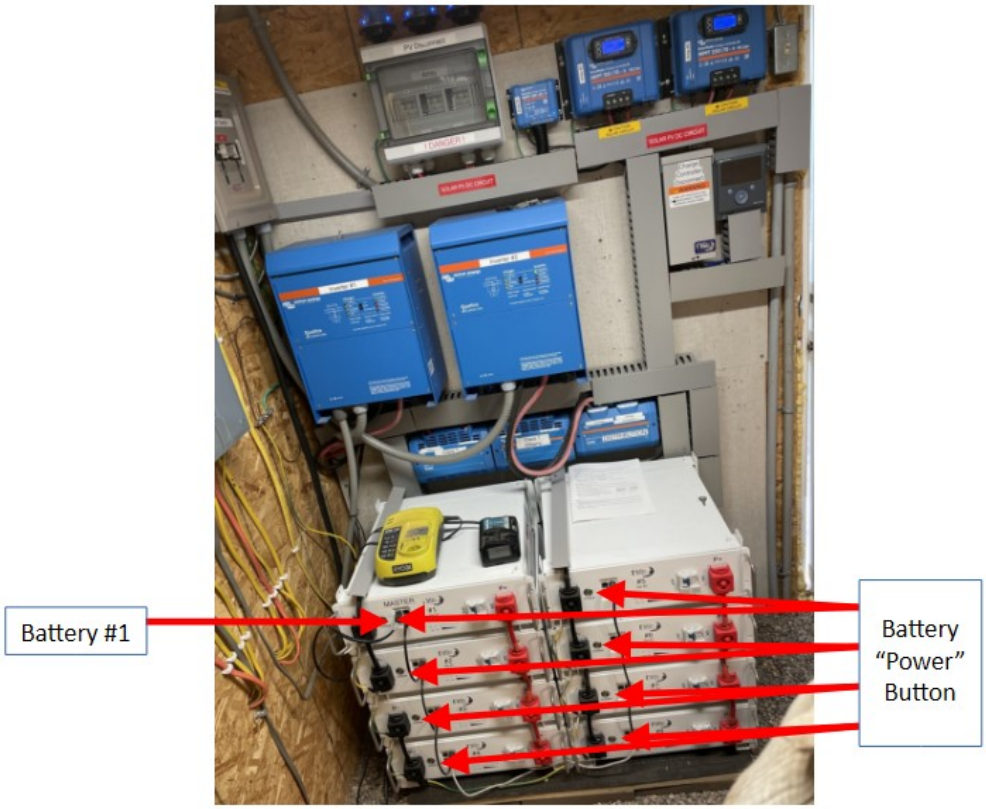
Step #5 (Batteries) -

This step turn off the batteries, and stops power to the “brain” of the system (Victron Color Control GX (CCGX)). At this point you should see:

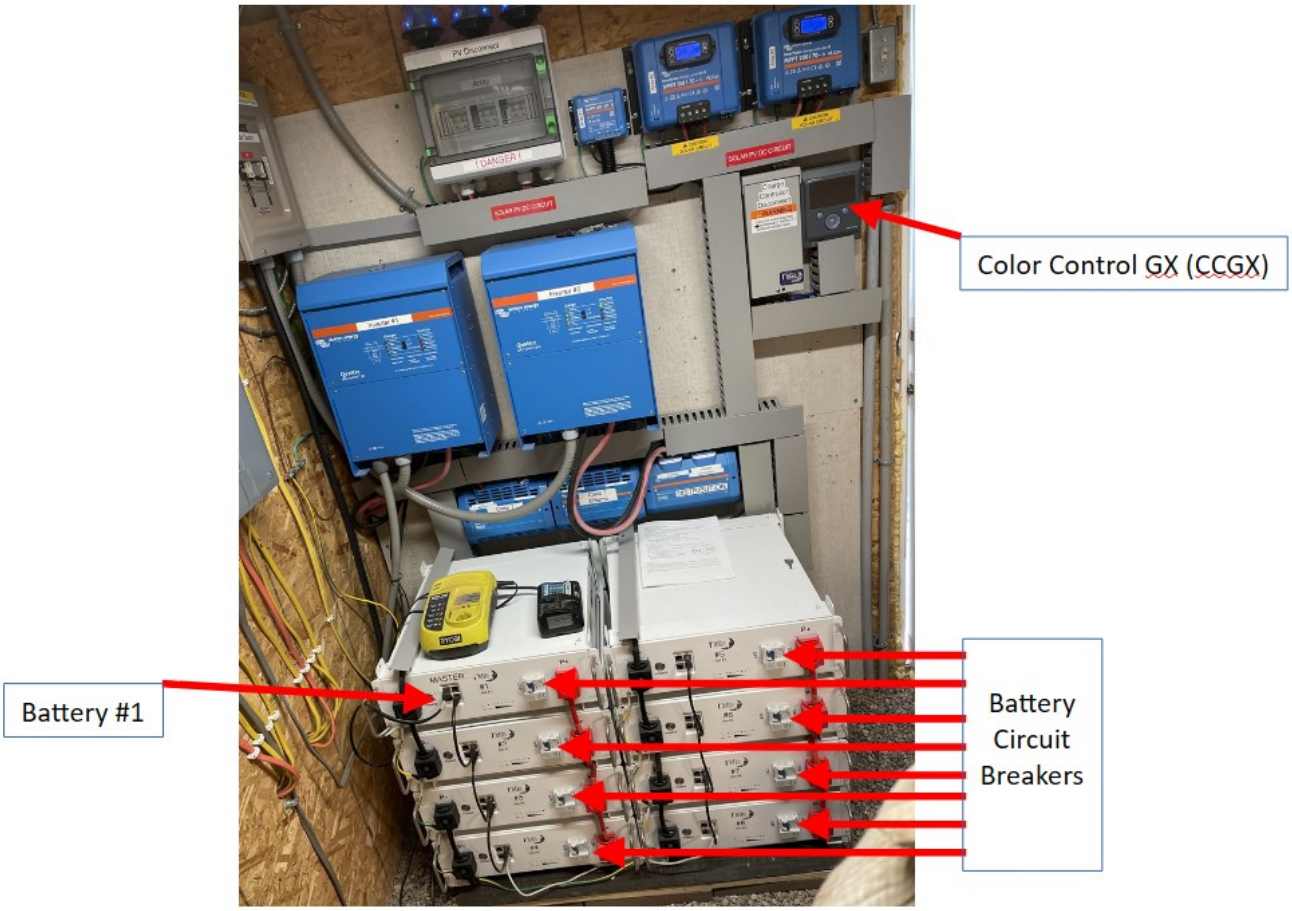
- All the battery circuit breakers should be “ON”,
- All the battery RUN lights appear green on the batteries,
- The SOC on Battery #1 should be indicating the appropriate SOC of the battery bank.

If there are any ALM lights lit and red there are one or more faults and battery troubleshooting will be required. Refer to the MNPowerflo5 user manual. Or, you can proceed with shutting down the batteries and wait for start-up to see if the fault reoccurs.





1. On battery #8, press and hold the POWER button for 3 seconds. The battery lights (RUN) should turn off. Perform the same operation for batteries #7 - #2.
2. For battery #1 press the POWER button and ensure the green RUN & SOC lights turn off.



3. Turn “OFF” each battery circuit breaker starting with battery #8 and proceed to #1.

At this point:

- All lights on all batteries should be “OFF”, no lights showing on any battery.
- The CCGX should be “OFF” (display panel will be dark).
- All lights on both inverters should be “OFF”, no lights showing on either inverter.
- The displays on MPPT Charge Controller #2 & #3 should be dark.
- No charging status lights should be showing on MPPT Charge Controller #1, #2, and #3.
- The blue lights on the PV Disconnect Box should be “OFF”, no lights showing on any of the surge protection devices.

- Generator Operations -

Switch to Generator :

These instructions are for switching from solar system power to 120vAC generator (genset) only power.

Note: There will be no 220vAC power available running only on the generator.

Background:

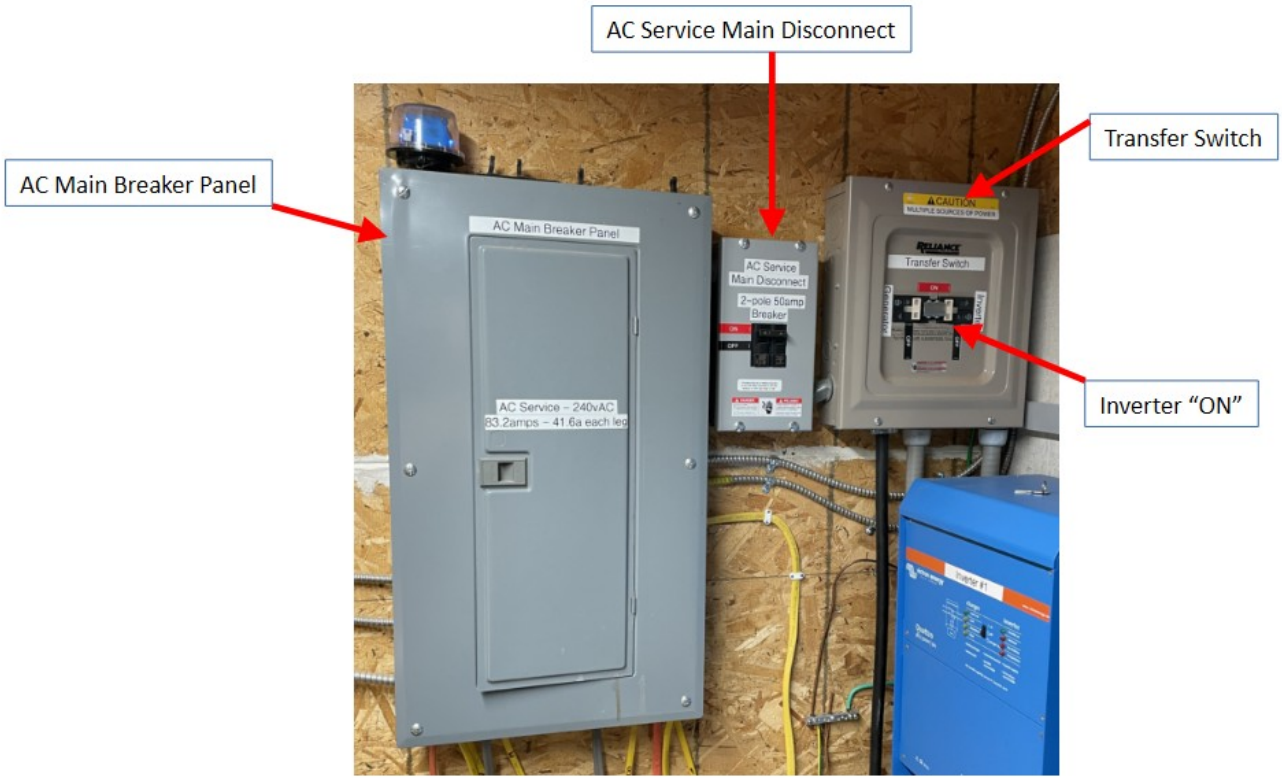
- The house runs on 120v/220v AC power.
- The solar system produces 120v/220v AC power.
- The generator (genset) produces 120vAC power only into Inverter #1.
- The house system is designed to have the genset supplement the solar system or power the house independent of the solar system.
- When the genset is powering the house independent of the solar system only “L1” circuits will have power. No 220vAC power will be available and no “L2” circuits will have power. Any 220vAC circuit breaker must be turned off.
- There are two outside “inlets” both are NEMA L5-30P (3-prong 30amp)
  - The upper inlet is for by-passing the solar system and running the house off of generator.
  - The lower (bottom) inlet is for supplementing the solar system (Inverter #1) with the generator power.
  - Inverter #1 is set to only accept up to 17aAC @ 120vAC from the generator. That equates to about a max of 34aDC @ 58vDC. The incoming generator power goes first to assisting Inverter #1 with delivering AC power; any excess incoming generator power then goes to charge the batteries.

Step #1 -

- Prepare genset with fuel, oil, and warm-up the genset for 1 – 2 mins using the “eco-mode”.
- Acquire the correct #10awg extension cord for the 30a genset outlet and 30a house inlet. Alternatively, you can use a genset 20a outlet. An adaptor may be required to use the extension cord.
- Turn-off “eco-mode”.

Step #2 -

- Plug-in extension cord into genset.
- Plug-in extension cord to upper house inlet.



Step #3 -

- In the AC Main Breaker Panel turn off all 220v circuit breakers (yellow).
- In the AC Main Breaker Panel turn off all “L2” circuit breakers (blue).
- The only circuit breakers that should be “ON” are “L1” (red).
- Ensure that the utility room light is “ON”.

- Ensure there are no heavy loads in the house (i.e. pump). If there are, turn off that specific circuit breaker.

Step #4 -

- At the Transfer Switch move the lever from Inverter “ON” to Generator “ON”.
- Turn on any “L1” circuit breakers that had to be turned off due to heavy load(s).

Notes:

1. You may see a very brief flicker of the utility room lights as you move the Transfer Switch lever, that is normal.

2. The utility room light should have remained on after moving the Transfer Switch to “ON” since the utility room is on a “L1” circuit breaker.

3. Only a single blue light should be visible on the AC Main Breaker Panel surge protection device.

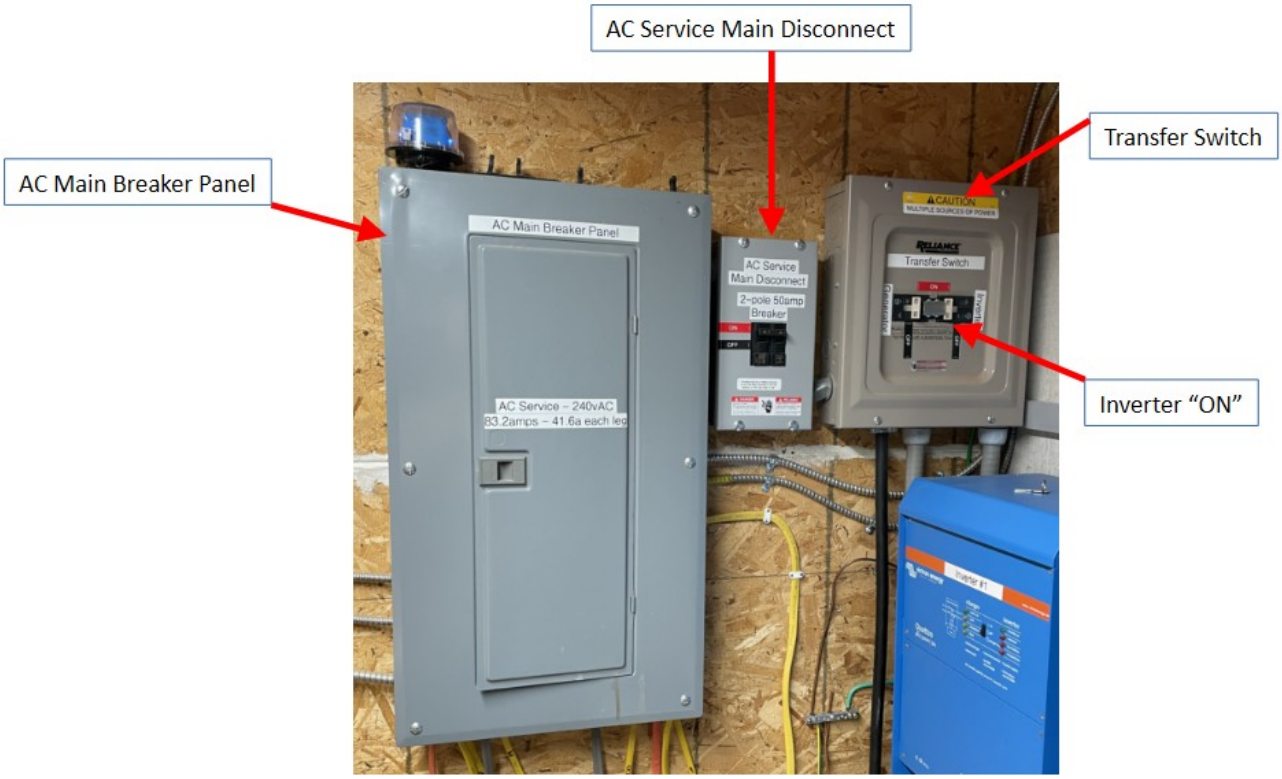
4. If the genset runs out of fuel go to Step #1 of this section and follow each step.

Switch off of Generator – to Solar System:

These instructions are for switching from 120v generator only power to solar system power.

Background:

- The house runs on 120v/220v AC power.
- The solar system produces 120v/220v AC power.
- The generator (genset) produces 120vAC power only into Inverter #1.
- The house system is designed to have the genset supplement the solar system or power the house independent of the solar system.
- When the genset is powering the house independent of the solar system only “L1” circuits will have power. No 220vAC power will be available and no “L2” circuits will have power. Any 220vAC circuit breaker must be turned off.
- There are two outside “inlets” both are NEMA L5-30P (3-prong 30amp)
    - The upper inlet is for by-passing the solar system and running the house off of generator.
    - The lower (bottom) inlet is for supplementing the solar system (Inverter #1) with the generator power.
    - Inverter #1 is set to only accept up to 17aAC @ 120vAC from the generator. That equates to about a max of 34aDC @ 58vDC. The incoming generator power goes first to assisting Inverter #1 with delivering AC power; any excess incoming generator power then goes to charge the batteries.



Step # 1 -

- Ensure the solar system is fully operational and functioning correctly.

Step #2 -

- Ensure all “L2” circuit breakers are off.
- Ensure there are no heavy loads in the house (i.e. pump) on “L1” circuit. If there are, turn off that specific circuit breaker.

Step #3 -

- At the Transfer Switch move the lever from Generator “ON” to Inverter “ON”.
- Verify that both “L1” and “L2” circuits have power by ensuring that there are two blue lights visible on the AC Main Breaker Panel surge protection device.
  - If there is only one light there is a problem, troubleshoot as needed.

Step #4 -

- Turn on any “L1” circuit breakers that had to be turned off due to heavy load(s).
- One-by-one turn on “L2” circuit breakers until all are “ON”.
- If any 220v circuit breakers are “OFF”, turn them “ON”.
- Verify that “L2” & 220v circuits are functioning.

Step # 5 -

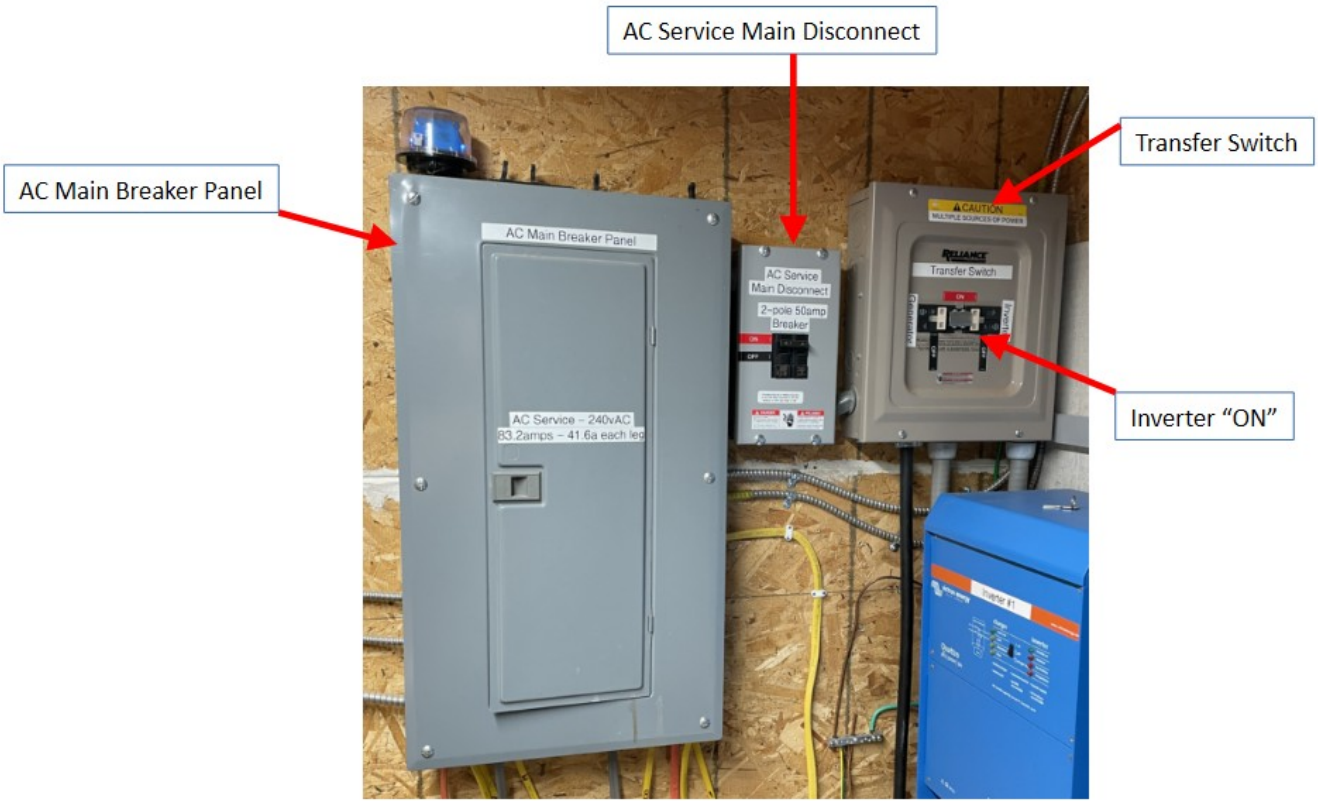
- Turn “ON” the genset “eco-mode”.
- Disconnect extension cord from house.
- Disconnect extension cord from genset.
- Turn “OFF” the genset.

Supplement Solar System with Generator :

These instructions are for supplementing solar system power with 120v generator power.

Background:

- The house runs on 120v/220v AC power.
- The solar system produces 120v/220v AC power.
- The generator (genset) produces 120vAC power only into Inverter #1.
- The house system is designed to have the genset supplement the solar system or power the house independent of the solar system.
- When the genset is powering the house independent of the solar system only “L1” circuits will have power. No 220vAC power will be available and no “L2” circuits will have power. Any 220vAC circuit breaker must be turned off.
- There are two outside “inlets” both are NEMA L5-30P (3-prong 30amp)
  - The upper inlet is for by-passing the solar system and running the house off of generator.
  - The lower (bottom) inlet is for supplementing the solar system (Inverter #1) with the generator power.
  - Inverter #1 is set to only accept up to 17aAC @ 120vAC from the generator. That equates to about a max of 34aDC @ 58vDC. The incoming generator power goes first to assisting Inverter #1 with delivering AC power; any excess incoming generator power then goes to charge the batteries.



Step #1 -

- Prepare genset with fuel, oil, and warm-up the genset for 1 – 2 mins using the "eco-mode".
- Acquire the correct #10awg extension cord for the 30a genset outlet and 30a house inlet. Alternatively, you can use a genset 20a outlet. An adapter may be needed.
- Turn-off "eco-mode".

Step #2 -

- Plug-in extension cord to genset.
- Plug-in extension cord to lower house inlet.

Step #3 -

- It will take about 10 – 15 seconds for Inverter #1 to sense the incoming genset AC power and assess that it is "clean" and stable.

- Once Inverter #1 senses the incoming genset AC power and assess that it is “clean” and stable it will start accepting about 7aAC and slowly ramp up to the setting for incoming AC power that has been set in the CCGX.
- Once the batteries are at full charge the system will only accept enough AC power from the genset to match AC usage of the house.

- NOTES -

1. If there is a problem with the solar system and you don’t know what it is, perform a “Solar System Shutdown”.
2. If at any time there is a burn wire smell shut down (turn “OFF”) the AC Main Disconnect and perform a “Solar System Shutdown”.