



# RaVolt Installation Guidelines

## Generation 2

Version 2.2 Dated 06/05/2023





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All information contained below shall be used as a guide and not intended as complete instructions.

**All installation activities shall be carried out by a qualified and properly trained electrician and all personnel must wear appropriate PPE.**

All installation means and methods shall be per Scope of Work (SOW), stamped Design Documents and manufacturer installation guides.



**For further support please contact the RaVolt team.**

**Service Line:** 1 (844) RAVSERV/ 1 (844) 728-7378

**Email:** [service@ravolt.com](mailto:service@ravolt.com)



## 1.) Recommended Tools & Materials

The following list of tools and materials are recommended, but not required. Installations may require additional materials based on design.

### Tools:

#### 1.) Hand Tools

- Phillips head screwdriver
- Flat head screwdriver
- Small precision screwdriver
- 5/16" nut driver
- Wire strippers
- Cable cutters
- Linesman pliers
- Crimpers
- Shovel
- Tamper
- Level
- Hammer
- 6 foot ladder
- Meter
- Ground rod attachment

#### 2.) Power Tools

- Knockout set or hole-saw set
- Cordless hammer drill
- Bandsaw or Sawzall
- Impact gun

#### 3.) Rigging

- 6' rigging straps
- Shackle
- Refer to *Ravolt Lifting Diagram*





#### 4.) Anchoring

- Refer to *RaVolt Anchoring Diagram*

#### Materials:

##### 1.) Conduit

- PV Input to DC Disconnects (1 list per string)
  - (1) 1" weatherhead
  - (1) 1" sch. 40 cut to length (roughly 12-18")
  - (1) 1" TA/MA
  - (1) 1" bushing
  - (1) 1" locknut
- Generator Circuit
  - (1) 2" non-metallic flexible conduit cut to length (roughly 6')
  - (1) 2" sch. 40 cut to length (roughly 4')
  - (1) 2" sch. 40 to be placed in trench
  - (2) 2" 90° sch. 40 fittings
  - (2) 2" flexible straight fittings
  - (2) 2" flexible 90° fittings
  - (2) 2" locknuts
  - (2) 2" bushings
- AC Output Circuit
  - (1) 2" MA/TA
  - (1) 2" expansion joint
  - (1) 2" locknut
  - (1) 2" bushing
  - (1) 2" 90° sch. 40 fitting
  - 2" sch. 40 to be placed in trench to AC disconnect according to design

##### 2.) Miscellaneous Materials

- Unistrut hardware
- Unistrut straps
- Colored electrical tape
- All weather code-compliant conduit glue



## 2.) Installation Overview

The RaVolt installation follows a standard process consisting of the following steps:

1.) Unloading Equipment-Trucks will arrive with a palletted enclosure, palletted generator, concrete pads, and batteries. It is recommended to level and set pads first, and then set the enclosure and generators directly off the truck.

2.) Placing the Enclosure & Generator Pads-Choosing a desired location for both pads, typically on the northern side of the array, about 6 feet apart (Minimum gap for generator exhaust is 4'6"). This step also consists of leveling and compacting the designated pad locations.

3.) Placing the Enclosure & Generator- Using slings and shackles on a capable machine (skid steer, mini excavator, or tractor), rig and place the equipment on their dedicated concrete pads.

4.) Trenching & Conduit- There will be 2 main trenches, the AC Out trench and the generator circuit. The AC Out trench will be from the load center on the side of the unit, to the AC disconnect on the side of the home. The generator circuit will be from the generator to the enclosure.

5.) Terminations- The RaVolt unit arrives with pre-installed and pre-configured equipment. There are roughly 10 additional terminations to make on a standard project.

6.) QA/QC, Commissioning, Photos- Installers will inspect the work using the QA/QC guidelines. There is a short commissioning process to ensure process functionality, followed by some photos for product warranties.

These 6 steps are broken down in greater detail throughout this installation guide.



### 3.) Unloading Equipment

**Recommended Tools & Materials:** Weight rated slings, weight rated shackles, ratchet strap.

1. Determine a safe, flat location for the truck to park for unloading.
2. The truck will arrive with the RaVolt enclosure banded to a pallet and any additional batteries in crates.
3. **Operators must ensure sufficient lifting capacity of the machine to be used.**

Estimated equipment weights are below:

- a. Estimated weight without batteries- 600 lbs
  - b. Estimated weight with batteries - 1100 lbs
  - c. Single Cabinet Weight – approx. 1100 lbs
  - d. Paralleled Cabinet Weight – approx. 2300 lbs
4. If using a mini excavator for unloading the equipment, utilize properly weight rated slings and properly weight rated shackles. The unit will arrive with 4 lifting points present on the top of the enclosure. Operator must use extreme caution to not bend or break these lifting points, which may interfere with the enclosure’s NEMA 3R rating. Straps with too severe of an angle will lead to bends on the lifting points. Ensure lifting force is as vertical as possible at all times. If using a forklift or skid steer for unloading the equipment, utilize properly rated 4 foot forks for lifting the pallets.
  5. If using a forklift or skid steer for unloading the equipment, utilize a ratchet strap to secure the equipment to the mast of the machine when transporting.
  6. Place equipment in a flat, safe location until the crew is ready to progress.



## 4.) Placement of Enclosure Pad

### RaVolt Enclosure Pad Dimensions:

*Single Enclosure 4' L x 3' W*

*Dual Enclosure 4' L x 6' W*

**Recommended Tools & Materials:** Shovel, rake, hand tamper, crushed gravel, 4 foot level.

1. Determine the best location for the placement of the RaVolt enclosure. Refer to the project specific design documents when determining the general location. The precise location should be flat and protected from erosion and other weather factors.
2. Level and compact the determined location for the concrete pad. It is recommended to utilize gravel or crushed stone for compaction to create a firm base. (See below photos.)
3. If precast pad is provided, using a two-man lift, place the concrete pad on the level and compacted location.
4. If pouring pad, refer to diagram.







**Notes:**

Pads can be placed in any homeowner-desired orientation. Units are usually installed on the north side of the solar array for ground mount applications, or near the meter for rooftop applications.

Installer must ensure the enclosure placement is in compliance with all applicable local and national codes (Gas line setbacks, utility easements, etc.)

Installer must ensure placement allows for a 3-foot serviceable radius in front and on the sides of the RaVolt enclosure. If there will be a generator present, ensure that there is 4'6" feet between the enclosure and the generator exhaust (4' gap is acceptable on the non-exhaust side of the generator).

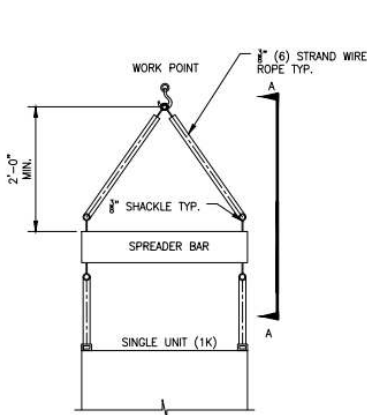
## 5.) Placement and lifting of Enclosure



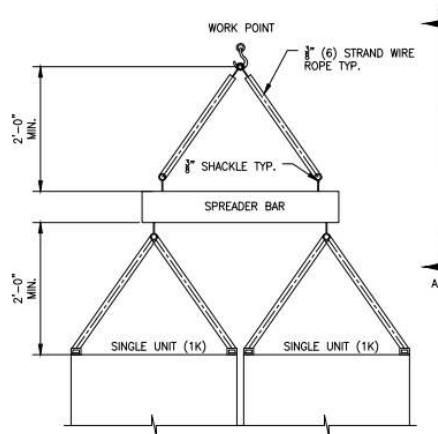
(Gen 1 Enclosure Pictured)

### **Recommended Tools & Materials:** Slings, shackles, straps, snips

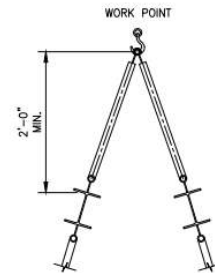
1. After the pad has been placed in its determined location, operator will begin to properly rig and lift the enclosure for placement. It is recommended to transport the unit on its pallet to the determined location, before removing bands for lifting and placing.
2. Please refer to lifting diagram to lifting instructions:
  1. For Single Cabinet Installation all 4 lifting eyes on the RaVolt unit and appropriate rigging, lift the RaVolt enclosure off the shipping pallet and place the enclosure on top of the placed or poured pad.
  2. For a Paralleled Cabinet Installation, Strapping must run through all 8 lifting eyes, 4 in front and 4 in back.



LIFT DIAGRAM:  
SINGLE UNIT CONFIGURATION  
SCALE:  $\frac{1}{2}$ "=1'-0"



LIFT DIAGRAM:  
DOUBLE UNIT CONFIGURATION  
SCALE:  $\frac{1}{2}$ "=1'-0"



SECTION AA  
SCALE:  $\frac{1}{2}$ "=1'-0"

3. Installers must ensure the unit is centered on the concrete pad.
4. Utilize the provided anchoring hardware to secure the unit to the pad.
5. Install the supplied drip edge after the enclosure has been set to ensure the NEMA 3R rating is upheld. The drip edge will fit in the three holes on the top of the enclosure, on both the front and back of the unit.
6. These T30 bolts are already installed on the enclosure. Simply remove these bolts, place the drip edge so the holes line up on the enclosure, and replace these bolts.



## 6.) Trenching & Conduit

**It is a requirement to contact diggers hotline prior to any excavations and confirm location of any unmarked utility or private owned utilities.**

1.) After placement of the enclosure and other project components, utilize a trencher or mini excavator for trenching.

2.) Trenches will be in three main locations:

**Generator/Grid Input:** RaVolt Enclosure to Generator or Service Disconnect

**AC Output:** RaVolt Enclosure to the AC Disconnect at the home

**PV Input:** RaVolt Enclosure to the Solar Array (if necessary)

3.) Install 2" sch. 40 conduit within the trench, utilizing a 90° fitting to stub up to the above locations prior to backfilling. Ensure that all-weather code-compliant conduit glue is being used for connections.





4.) The following locations typically use these fittings to land into the RaVolt Enclosure:

**Generator/Grid Input:** Conduit stub->Female adapter->Straight flex fitting->Flexible conduit->90° flex fitting->Bushing & locknut into disconnect on RaVolt Enclosure

**AC Output:** Conduit stub->Female adapter-> Straight flex fitting-> Flexible conduit-> Straight flex fitting->Bushing & locknut into loadcenter on RaVolt Enclosure

**PV Input (Underground):** Conduit stub->Coupler->Sch. 40 conduit cut to length->LB fitting-> Sch. 40 conduit cut to length ->Male adapter->Bushing & locknut into the DC disconnects on the RaVolt Enclosure

**PV Input (Weatherhead):** 1" Weatherhead->1" Conduit cut to length->1" Male adapter->Bushing & locknut into DC Disconnect





**Notes:**

Installers can use either flexible conduit or sch. 40 for all incoming conduit connections, material lists will vary slightly.

Trenches must be 18"-24" deep, per code.

Installers must use warning tape above place conduit or direct burial cable before backfilling.

Trenches must be backfilled with clean fill, free of large rocks or sharp objects.

Conduit should be secured per NEC code.



## 7.) Terminations

1. Install ground rod(s) at the enclosure. Ground and bond to NEC code at the disconnect.
2. After all trenching and conduit has been completed, pull wire to all designated locations according to design. Ensure wire sizing is per NEC code based on system sizing.

**IMPORTANT:** Power output to load from RaVolt enclosure **MUST** be protected at the home service entrance or prior to connecting to a load with a circuit breaker of **NO MORE THAN 200AMPS**. Failure to do so could result in fire, damage, injury or death.

### **Generator/Grid Input:**

1. Ensure there is no power on the grid/generator cables using a voltmeter.
2. Remove screws and remove the front plate from the disconnect.
3. All external AC power sources will be terminated within the disconnect on the side of the RaVolt enclosure. This external AC power can be from the grid, a generator, or a combination of the two.
4. After cable has been pulled from the service disconnect or the generator to the disconnect on the side of the RaVolt enclosure, begin to make terminations in the appropriate locations, per NEC code. ***Utilize the one line document for detailed termination direction.***
5. Label the incoming cable and ensure the two hot legs have been terminated in the correct lugs. Ensure the lugs have been torqued to manufacturer specifications.  
**NOTE:** If installing on a paralleled inverter RaVolt system a set of Polaris lugs will be pre-installed to the GRID input of the Sol-Ark inverters. Your incoming utility (or generator) line will land on the polaris lugs to facilitate a parallel input into the sol-ark units.
6. Ensure both the neutral and ground have been terminated in their correct locations and torqued to manufacturer specifications.
7. If there will be both a grid and generator input, land the grid input on the line side of the disconnect. The generator input will be terminated on the "GEN" breaker on the Sol-Ark.
8. The RaVolt enclosure arrives pre-wired and pre-configured to allow the load side of this disconnect to flow through the inverter, into the load center and into the home. After landing the grid and/or generator inputs, this disconnect is complete.



### **AC Output:**

1. Ensure there is no power to the load center using a voltmeter.
2. Remove screws and remove the front plate from the load center.
3. After cable has been pulled from the load center on the RaVolt enclosure to the AC disconnect on the side of the home or dwelling, begin to make terminations in the appropriate locations within the load center (200A feed thru lugs)
4. Ensure cables have been labeled and terminated on the load side of the 200 A breaker according to the manufacturer specifications, and per NEC code.
5. Ensure both the neutral and ground have been terminated in the correct locations within the load center.
6. The RaVolt enclosure arrives pre-wired and pre-configured to connect the load center to the inverter. After terminating this AC out cable, this load center is complete.

### **PV Input:**

1. Ensure there is no power on the incoming PV cable. *DO NOT MAKE MC4 HOME RUN CONNECTIONS BEFORE TERMINATING THIS DC DISCONNECT.*
2. Ensure cables have been correctly labeled to clearly indicate different strings, positive and negative.
3. Run PV cables from the array, into a drip loop, into the weather head. This will run directly into the DC disconnect on the side of the enclosure.
4. Place the switch in the “off” position and remove the screws from the DC disconnect cover. Remove the cover.
5. Begin to make terminations within the DC disconnect according to the manufacturer specifications. ***Refer to the one line document for detailed termination instructions.***
6. After terminations are made and verified, replace screws and DC disconnect cover.
7. The RaVolt enclosure arrives pre-wired and pre-configured to connect the DC disconnects to the MPPT’s on the Sol-Ark inverter. After the incoming wires have been terminated, these disconnects are done.

### **Two Wire Start:**

1. If a generator is present, it will likely need a two wire start circuit. This circuit will typically consist of 2 #10 AWG THHN/THWN wires.

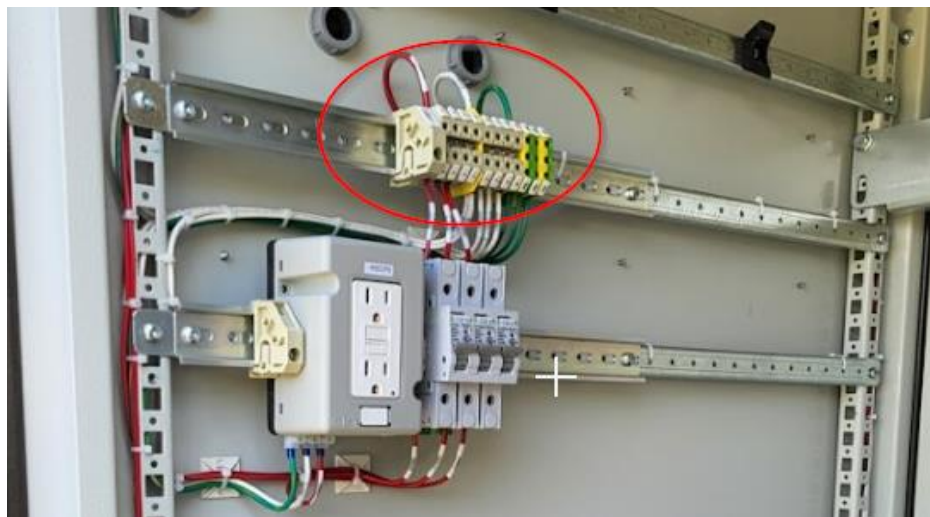




2. Run these wires from the generator, through the disconnect, and into the RaVolt enclosure.
3. Ensure there is no power to the Sol-Ark.
4. Terminate these wires on the Sol-Ark inverter using pin terminals at terminal blocks 7 +8. Please refer to the Sol-Ark manual for further instruction if necessary.
5. Terminate the generator side of the two wire start circuit at the designated two wire start terminals. Refer to the generator's manufacturer manual and specifications for specific instructions.

### Trickle Charge Circuit

1. If a generator is present, it will likely need a trickle charge circuit to continuously charge the battery of the generator. This circuit will typically consist of 3 #10 AWG THHN/THWN wires.
2. Run these wires from the generator, through the disconnect, and into the RaVolt enclosure.
3. Ensure there is no power to the terminal blocks within the RaVolt enclosure.
4. Label these wires and terminate at the terminal blocks at the top right corner of the RaVolt enclosure. The hot wire will be terminated at block 1, neutral at block 2, ground at block 3.
5. Terminate the generator side of the trickle charge circuit at the designated 120 VAC input location. Refer to the generator's manufacturer manual and specifications for specific instruction.



(Terminal Block Location)

## Dual Cabinet Terminations

If (2) Paralleled cabinets are on site you will have received the cabinet and a second pallet with additional batteries. Only the bottom battery in each cabinet has been installed.

6. Install remaining batteries in provided racks.
7. Connect double lugged positive terminal to the top left terminal of each battery bank.
8. Connect two battery banks together using the provided interconnecting wires on both positive and negative terminals.
9. Use provided Buss bars to connect all Battery terminals together.
10. Connect battery terminal touch safe covers provided.
11. Connect ethernet cable from Master inverter, to canbus port of Host Battery.
12. **Connect custom ethernet cable from host battery to submodule 1 (cable is labeled host to sub).**
13. Connect remaining batteries via standard ethernet provided.
14. Final setup should look like the below set of pictures.
  - a. Left side is the Master Cabinet, Right side is the slave cabinet.



15. Set dial switches per the below table:

**(PowerSync DIP Switch Settings)**

**6-BIT TOGGLE SWITCH SETTINGS**

**HOSTMODULE TOGGLE SWITCH SETTINGS**

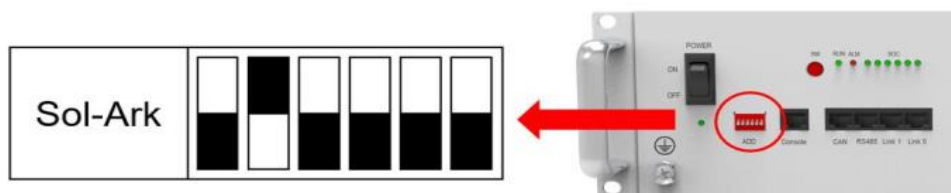
	#1	#2	#3	#4	#5	#6	Inverter
Host Option 1	OFF	OFF	OFF	OFF	OFF	ON	Sol-Ark, Pylon, Goodwe
Host Option 2	OFF	OFF	OFF	OFF	ON	ON	Victron, SMA

**SUB-MODULE TOGGLE SWITCH SETTINGS (1-29 MODULES)**

Module	#1	#2	#3	#4	#5	#6
1	ON	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF	OFF
5	ON	OFF	ON	OFF	OFF	OFF
6	OFF	ON	ON	OFF	OFF	OFF
7	ON	ON	ON	OFF	OFF	OFF
8	OFF	OFF	OFF	ON	OFF	OFF
9	ON	OFF	OFF	ON	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF
11	ON	ON	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON	OFF	OFF
13	ON	OFF	ON	ON	OFF	OFF
14	OFF	ON	ON	ON	OFF	OFF
15	ON	ON	ON	ON	OFF	OFF
16	OFF	OFF	OFF	OFF	ON	OFF

**(Pytes Dip Switch Settings)**

Figure 2.3 Sol-Ark inverter DIP Switch Setting



**3. Set the DIP Switch**

Single

**Note:** Set the DIP switch based on the inverter you installed.

Multiple

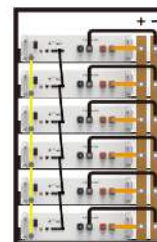
**Note:** Only the DIP switch of master battery need to be set.



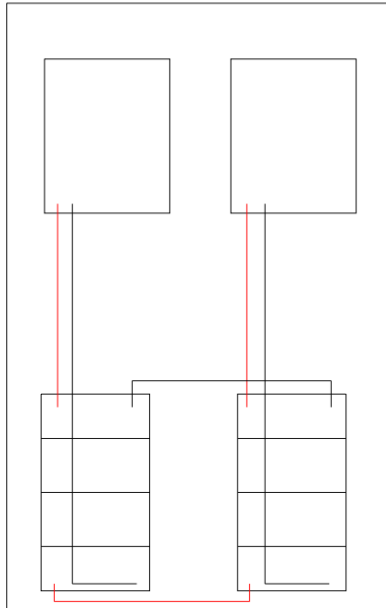
Compatibility list

Victron	Deye	Afore	Soils
Votronic	sol-ark	SRNE	Empty
Goodwe	Sitender	SMT	SMA
Megawatt	KeLong	Empty	Ladouce
	Growatt		

Graphic: The black part is the lever



**MultiStack Wiring Detail**



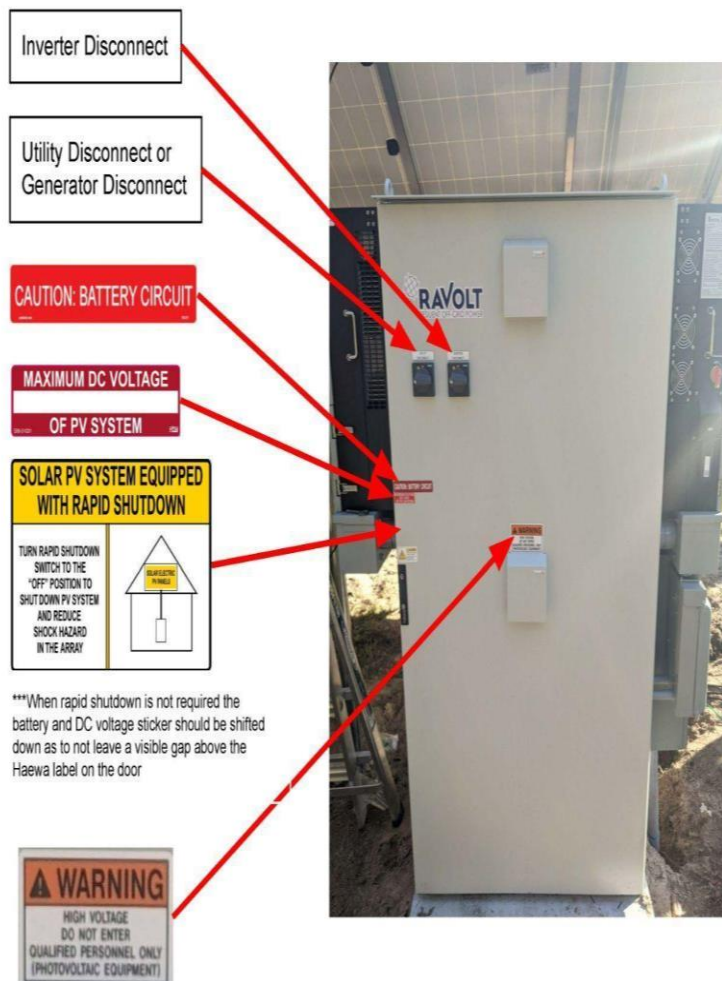


## 8.) Enclosure Labeling

1. The RaVolt enclosure will arrive with a packet of required labels. Ensure the labels are present and not damaged.
2. Place the labels at their appropriate locations on the RaVolt enclosure. See the below photo for location references.

***This is the minimal labeling required, please confirm with AHJ and local utility that all labeling requirements have been met. Please see the last page of guidelines for additional labeling that may be required.***

### RaVolt Unit Labeling



## RaVolt Unit Labeling (Field Crew)

### AC Disconnect Labeling



**PHOTOVOLTAIC AC DISCONNECT**  
RATED AC OUTPUT CURRENT:   
NOMINAL OPERATING AC VOLTAGE:

### DC Conduit Labeling



**⚠ WARNING DUAL POWER SOURCE  
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM**

\*\*\*Utility must always be consulted to confirm if there are any Utility Specific labeling requirements. These additional labels are generally placed on the meter unless otherwise specified

### Meter Labeling (ONLY REQUIRED ON GRID TIED SYSTEMS)



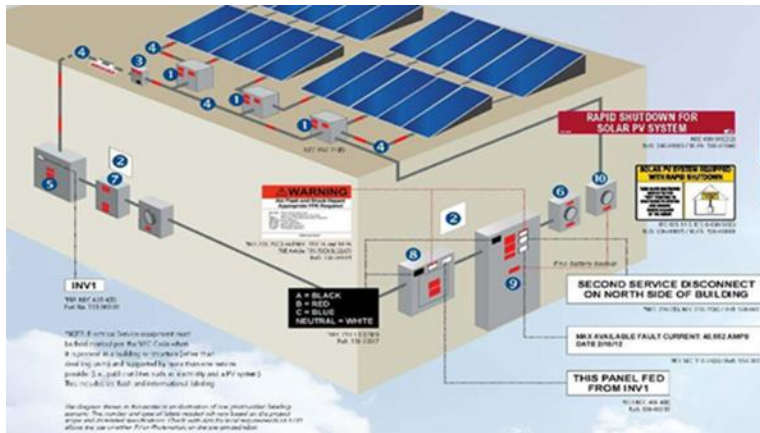
**PHOTOVOLTAIC  
DC DISCONNECT**

### DC Disconnect Labeling (Rooftop Jobs Only)



**SOLAR PV DC CIRCUIT**

\*\*\* When multiple inverters are installed this sticker is required on every DC Conduit entering the inverters



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# PHOTOVOLTAIC SYSTEM LABELING REQUIREMENTS

NEC 2020 Article 690

### Adhesive Fastened Signs

ANSI Z535 4-2011 Product Safety Signs and Labels, provides guidelines for suitable font sizes, words, colors, symbols, and location requirements for labels. NEC 110.21(B)(1) The label shall be of sufficient durability to withstand the environment involved. NEC 110.21(B)(3) Adhesive fastened signs may be acceptable if properly adhered. Vinyl signs shall be weather resistant. IFC 605.11.1.3

<p><b>1. Combiner Box / Circuits / Conduit Combiner Box / Enclosures / EMT Enclosures</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD DO NOT OPEN OR WORK INSIDE PANEL</p> <p><b>WARNING</b> TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL</p>	<p><b>2. DC Disconnect / Breaker / Recombiner Box</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p> <p><b>DC DISCONNECT</b></p>	<p><b>3. Inverter</b></p> <p><b>WARNING</b> DO NOT OPEN OR WORK INSIDE PANEL TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p>	<p><b>4. Breaker Panel / Pull Boxes</b></p> <p><b>WARNING</b> TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p><b>WARNING</b> TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p>	<p><b>5. Main Service Disconnect</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p><b>WARNING</b> TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL</p> <p><b>WARNING</b> SINGLE LINE VOLT SUPPLY DO NOT CONNECT MULTIPLE BRANCH CIRCUITS</p> <p><b>DO NOT DISCONNECT UNDER LOAD</b></p> <p><b>CAUTION</b> DUAL POWER SOURCE</p> <p><b>WARNING</b> DUAL POWER SOURCE</p>	<p><b>6. Main Service Disconnect / Utility Meter</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p><b>WARNING</b> TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL</p> <p><b>WARNING</b> SINGLE LINE VOLT SUPPLY DO NOT CONNECT MULTIPLE BRANCH CIRCUITS</p> <p><b>DO NOT DISCONNECT UNDER LOAD</b></p> <p><b>CAUTION</b> DUAL POWER SOURCE</p> <p><b>WARNING</b> DUAL POWER SOURCE</p>
<p><b>7. Building / Structure</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD DO NOT OPEN OR WORK INSIDE PANEL</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p>	<p><b>8. AC Disconnect / Breaker / Points of Connection</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p>	<p><b>9. Production / Net Meter (Bi-directional)</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD DO NOT OPEN OR WORK INSIDE PANEL</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p>	<p><b>10. Energy Storage Systems</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION</p> <p><b>WARNING</b> TURN OFF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL</p> <p><b>WARNING</b> SINGLE LINE VOLT SUPPLY DO NOT CONNECT MULTIPLE BRANCH CIRCUITS</p> <p><b>DO NOT DISCONNECT UNDER LOAD</b></p> <p><b>CAUTION</b> DUAL POWER SOURCE</p> <p><b>WARNING</b> DUAL POWER SOURCE</p>	<p><b>11. EMT / Conduit Rerays</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD DO NOT OPEN OR WORK INSIDE PANEL</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p>	<p><b>12. Solar PV DC Circuit</b></p> <p><b>WARNING</b> ELECTRICAL SHOCK HAZARD DO NOT OPEN OR WORK INSIDE PANEL</p> <p><b>PHOTOVOLTAIC AC DISCONNECT</b></p>

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### LABELING REQUIREMENTS FOR ARTICLE 690

**NEC 690.13(B)** Lock PV system disconnects must clearly indicate whether the system is a closed circuit and the disconnect must be clearly marked "PV SYSTEM DISCONNECT". A warning label must be placed between the switch and the disconnect. The PV system disconnect must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(C)** Locking devices that are used to secure the disconnect must be clearly marked "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(D)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(E)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(F)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(G)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

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**NEC 690.13(K)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(L)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(M)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 690.13(N)** The labels on disconnects must be clearly marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

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### REQUIREMENTS FOR ELECTRICAL INSTALLATIONS (FIELD MARKING)

**NEC 110.14** Enclosures for equipment that are not listed shall be field marked to meet qualified persons of a particular field.

**NEC 110.14(A) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(B) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(C) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(D) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(E) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(F) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(G) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(H) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

**NEC 110.14(I) Area Finish:** Electrical enclosures shall be field marked with the words "DO NOT OPEN OR WORK INSIDE PANEL" and "PHOTOVOLTAIC AC DISCONNECT".

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## **9.) QA/QC Walkthrough**

1. After all conduit, trenching, terminations, and labeling has been completed to a satisfactory level, begin the QA/QC walkthrough using the “RaVolt QA/QC Inspection Sheet”.
2. Thoroughly inspect all aspects of the completed work. The inspection sheet highlights all important components to be inspected.
3. The “RaVolt QA/QC Inspection Sheet” must be completed and signed off on by a representative of the install team for warranty registration.
4. Correct any issues seen during the inspection and document these corrections on the inspection sheet.





## **10.) Commissioning & Photos**

Take photos of the following items for documentation:

1. RaVolt enclosure and pad placement
2. Installed anchoring hardware
3. Drip edge installed on top of enclosure
4. All conduit connections
5. All grounding & neutral to ground bond
6. Load center terminations (AC Output-2 hot, 1 neutral, 1 ground)
7. Disconnect terminations (Grid/Gen Input-2 or 4 hot, 1 or 2 neutral, 1 or 2 ground)
8. DC Disconnect terminations (Each PV string within disconnect)
9. Two wire start termination at Sol-Ark inverter
10. Trickle charge termination at terminal blocks within RaVolt enclosure
11. Battery communication cables
12. Heater setting
13. Fan setting
14. Any notable issues or blemishes on equipment
15. All placed labels
16. All communication connections
17. Functioning Wi-Fi dongle
18. Any additional RaVolt options (Project specific details)

### **Commissioning Steps**

- 1.) After all terminations are made and the QA/QC walkthrough has been successfully completed, the RaVolt system is ready to be turned on. Follow the steps in order to ensure equipment is safe and functional.
- 2.) Make sure ALL breakers and disconnects are set to OFF prior to powering up any aspect of the system.

### **Battery Commissioning**

1. Ensure all battery switches are in the "OFF" position. Also check to make sure all communication cables are connected.



2. Turn one battery on and verify the voltage using a voltmeter. Check to make sure the Sol-Ark is reading a similar voltage. If batteries are reading 0V please restart the battery unit and retake the voltage measurement
3. Once Battery Voltage is confirmed to be reading correctly you may turn on the rest of the batteries in the system. If battery voltages differ across battery units the system will automatically balance all battery cells during its first 1-2 days of operation
4. Ensure battery Dip Switch settings are accurate per the diagram shown in the Powersync installation manual. (also available in the “Dual Cabinet Terminations” section of this document)
5. Verify that the “LI-Batt Info” tab is visible under the system setup options. Click that Li-Batt Info tab to confirm that we are reading real data and not just showing all zeros (please photograph this screen for confirmation)

### **PV Commissioning**

1. Make the MC4 home run connections on string one at the array to provide DC power to the DC disconnect.
2. Use a voltmeter to measure voltage on string one.
3. Disconnect string one and repeat this process on all available pv strings coming to the DC disconnect.
4. Once all string voltages are verified and correct, replace the DC disconnect cover and make all MC4 homerun connections at the array.
5. Turn the DC disconnect dial from the “OFF” position to “ON”. This will send power to the Sol-Ark inverter.
6. Turn the PV disconnect switch on the Sol-Ark inverter (Located on the left side of the inverter, inside the RaVolt Enclosure) from the “OFF” position to “ON”. (Disconnect switch is “ON” in the horizontal, depressed position. “OFF” is the vertical position.)
7. The inverter should recognize the incoming DC voltage and light up the screen. Verify the voltage reading on the inverter are the same voltages verified with the voltmeter. The PV voltages can be seen by pressing the battery icon on the Sol-Ark.

### **Disconnect Commissioning**

1. Turn off all batteries and the Sol-Ark. Remove the cover from the disconnect.



2. With all disconnects, breakers, and equipment off, turn on the incoming power to the disconnect. This may be a generator or the grid, test individually if both.
3. With the disconnect set to "OFF" use a voltmeter to check the incoming voltage on the line side of the disconnect. Check both phase to ground and phase to phase voltage to ensure the incoming voltage is balanced.
4. After voltages are verified from both the grid and gen inputs at the disconnect, turn the power back off to the disconnect. Replace the cover to the disconnect.
5. Turn the power on to the disconnect. After power is on, throw the disconnect switch to allow power to the Sol-Ark.
6. Flip the "Grid" and "Gen" disconnects on the Sol-Ark to "ON". The Sol-Ark should recognize the power and turn on.
7. Verify voltage readings on the Sol-Ark screen coming from the grid and gen.
8. With the battery disconnect off, turn the batteries on individually.
9. Turn the battery disconnect on and verify that the grid and/or gen input is charging the batteries.

**IMPORTANT! Ensure that neutral and ground are bonded together at exactly ONE location in the entire electrical system. This will be in the Load Center on the side of the RaVolt enclosure.**

### **Load Center Commissioning**

1. Remove the cover of the load center.
2. Using a voltmeter, measure the voltage of the load side. Measure both phase to ground and phase to phase voltages to verify that the voltages are balanced.
3. Operate the manual bypass switch of the load center and verify the voltages of the feed thru lugs to verify load side voltage.
4. Confirm that the green screw, located in the bottom right of the Load Center, has been tightened down in order to create a Neutral-Ground Connection for the circuit
5. Replace the cover of the load center.

### **Grid Connected Generator Function**

In a Grid connected scenario the generator is available as a backup (for charging batteries only) in instances where the grid becomes unavailable. In standard operation where the grid is present the grid will be used as the power source to recharge the batteries as necessary. The generator will only supply power to the RaVolt system/home when the



batteries are at a low charge during a grid outage scenario. With this configuration, the generator cannot power the house directly without passing through the inverters.

### **Generator/Grid Battery Charging**

1. Go into the Sol-ark Battery settings' charge tab and set the Start % value to 90%. If batteries are already below 90% SOC then set this value to a percentage 1%-3% below the current battery SOC. Manipulate settings within the Sol-Ark to a grid start & gen start value slightly below the current battery charge.
2. Go into the Grid setup/Limiter tab and uncheck the Time of Use box in order to deactivate this function.
3. Set the PV disconnects to "OFF".
4. Confirm that the system is running off only battery power.
5. Run loads at the house or the enclosure until the state of charge drops to the grid/gen start values. Once the grid/gen start value is reached the generator should automatically turn on, if off grid, or you should see power coming from the grid to charge the batteries if grid connected.
6. Once it is verified that the generator or grid has been called for and we see charging on the batteries the battery charging commissioning is complete
7. YOU MUST MAKE SURE TO RESET THE START % TO THE VALUE INDICATED IN THE ORIGINAL SETTINGS (LIKELY 10% FOR OFF-GRID INSTALL) AND BE SURE TO RE-ENABLE TIME OF USE BY RE-CHECKING THE BOX INDICATED IN STEP 28 ABOVE

### **Wi-Fi Dongle Set-Up**

(Home Wifi Network must have 2.4 GHz band available)

1. Follow directions within the Sol-Ark manual for detailed instructions.
2. Confirm that the Wifi dongle is receiving power. A red light should be visible on the dongle if it is receiving power from the inverter.
3. Using a phone or computer, enter the Wi-Fi settings section of the device. You should see a network named "EAP-####". Connect to this network. Ignore any popup that tells you that this wifi network does not have internet access
4. Enter the password "12345678" when prompted to connect to the EAP wifi network
5. Open a web browser on your device and enter "10.10.10.1" into the web address bar. This will bring you to the dongle's setup page.



6. Scroll to the bottom of the screen and find the Wi-Fi list. Press “Scan” to search for any available wifi networks.
7. Click on the name of your home wifi network (or cell modem network if applicable) and enter your password when prompted. It will say “Set Success!”, and the dongle will be online.
8. in order to confirm that the wifi is properly connected to the dongle you should see a solid green light now visible on the dongle next to the red light indicating power. If the green light is blinking repeatedly that may indicate a VPN or firewall issue.
9. Optional - If wifi is connecting but we are not receiving internet there may be an ISP issue. Homeowner should contact their ISP to confirm that both Port 80 and Port 51100 are open.

### **Settings**

1. The RaVolt unit will arrive to site pre-configured with settings. Verify that all settings match the customer’s needs. Contact the RaVolt team for further help if necessary.
2. See [RaVolt Standard settings Doc](#) to confirm settings are accurately set from factory





Send completed form to [service@ravolt.us](mailto:service@ravolt.us)

**QA/QC DOCUMENT**

Inspector Name:

Company Name:

Date of Final Inspection:

**Instructions:** Prior to beginning any QA/QC inspection, please stay aware of any possible safety risks that may be present. Please complete the inspection form thoroughly, marking all necessary items throughout each section. If there are exceptions, or an unsatisfactory item, please explain the issue in the “Notes” box of the section. This document is intended to be completed only by an authorized installer of RaVolt, LLC. Pictures are encouraged throughout the inspection.

**Electrical:**

Item:	Description:	Pass:	Fail:	Notes:
Enclosure Condition	The RaVolt enclosure has not been damaged during installation and all lifting points remain in shipped condition.			
Enclosure Pad	The concrete enclosure pad has been placed on a secure, compacted gravel/sand base.			
PV Wire	All modules have been installed using the proper PV Wire, per local and national code.			
Wire Management	All wire has been neatly organized throughout the array using consistent stainless steel module clips.			
MC4 Connectors	All MC4 connectors have been properly crimped into place with an MC4 crimp tool, to ensure no loose connections.			
Drip Loop	All PV wire has been neatly run into a designed drip loop, utilizing split loom and entering a weather head.			
Conduit	All conduit is installed and strapped into place per code.			
PV Terminations	PV wire has been terminated within the RaVolt enclosure, ensuring the correct polarity upon installation.			
Trenching	All trenches are at a minimum depth of 24", with electrical warning tape 12" above conduit. Trenches were compacted and filled with clean fill.			
Anchoring	The RaVolt enclosure has been anchored to the concrete pad, per provided spec.			

	Unistrut has also been installed between enclosure and racking.			
Electrical Equipment	All switches, disconnects, batteries, and other electrical equipment has been installed to code.			
Labels	All necessary labels have been installed on equipment.			
Terminations	All terminations have been made with ring terminals.			

**Grounding and Bonding:**

Item:	Description:	Pass:	Fail:	Notes:
Enclosure Grounding	Enclosure is properly grounded using a lug and ground rod, per NEC code.			
Ground Rod	Ground rod is installed and connected at the enclosure, and the racking system to the home.			
Bonding 1	Racking is bonded to ground rod, per manufacturer spec.			
Bonding 2	Racking is bonded to inverter(s), per code.			
Bonding 3	RaVolt enclosure is bonded to ground rod, using ground lug installed near CBI.			
Neutral to Ground Bond	Neutral to ground bond is present in *ONLY ONE* location, specifically the AC disconnect. This neutral to ground bond includes the entire system, home service panel, and home load panels.			

**Generator (if applicable):**

Item:	Description:	Pass:	Fail:	Notes:
Generator Set-Up	Generator is set up properly for gas line installation in designed location, per design plans and manufacturer's instructions.			
Conduit	Conduit is installed, strapped, and ran from generator to the RaVolt enclosure.			
Electrical	Generator two wire start and charging wires have been installed and terminated in designed location using ring terminals.			

Battery	Generator battery is a 12v group 51, with a minimum rating of 500 cold cranking amps at 0° F.			
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**Inspector Name:**

**Inspector Signature:**

**Date:**


-- FIELD WIRING CONNECTIONS --

ID	Lug Description	Conductor Qty / Size Range	Tightening Torque	
DISC1	Load & Neutral	Cu/Al cable, (1) 6-250 kcmil	135 lb-in	
	Service Ground	Cu/Al cable, (1) 14-1/0 AWG	45 lb-in, 6-4 AWG	50 lb-in, 3-1/0 AWG
	Line	Cu/Al cable, (1) 6-300 kcmil	275 lb-in	
DISC2	Line	Cu/Al cable, (5) 12-6 AWG	9-16 lb-in	
DISC3	Line	Cu/Al cable, (5) 12-6 AWG	9-16 lb-in	
DISC4	Line	Cu/Al cable, (5) 12-6 AWG	9-16 lb-in	
OLC1	A, B, N1	Cu/Al cable, (1) 4-300 kcmil	250 lb-in	
	G, N2	Cu/Al cable, (1) 4-2/0 AWG	110 lb-in	

-- Fuse Chart --

Identifier	Part Number	Amperage	Class
FU1-FU2	TR200R	200	R


--- Indicates wiring installed in the field.

 Indicates DIN rail mount feed-thru 30A terminal block.

 Indicates twisted pair wiring.

All enclosure wiring shall be 600V UL rated, of copper or tinned-copper.

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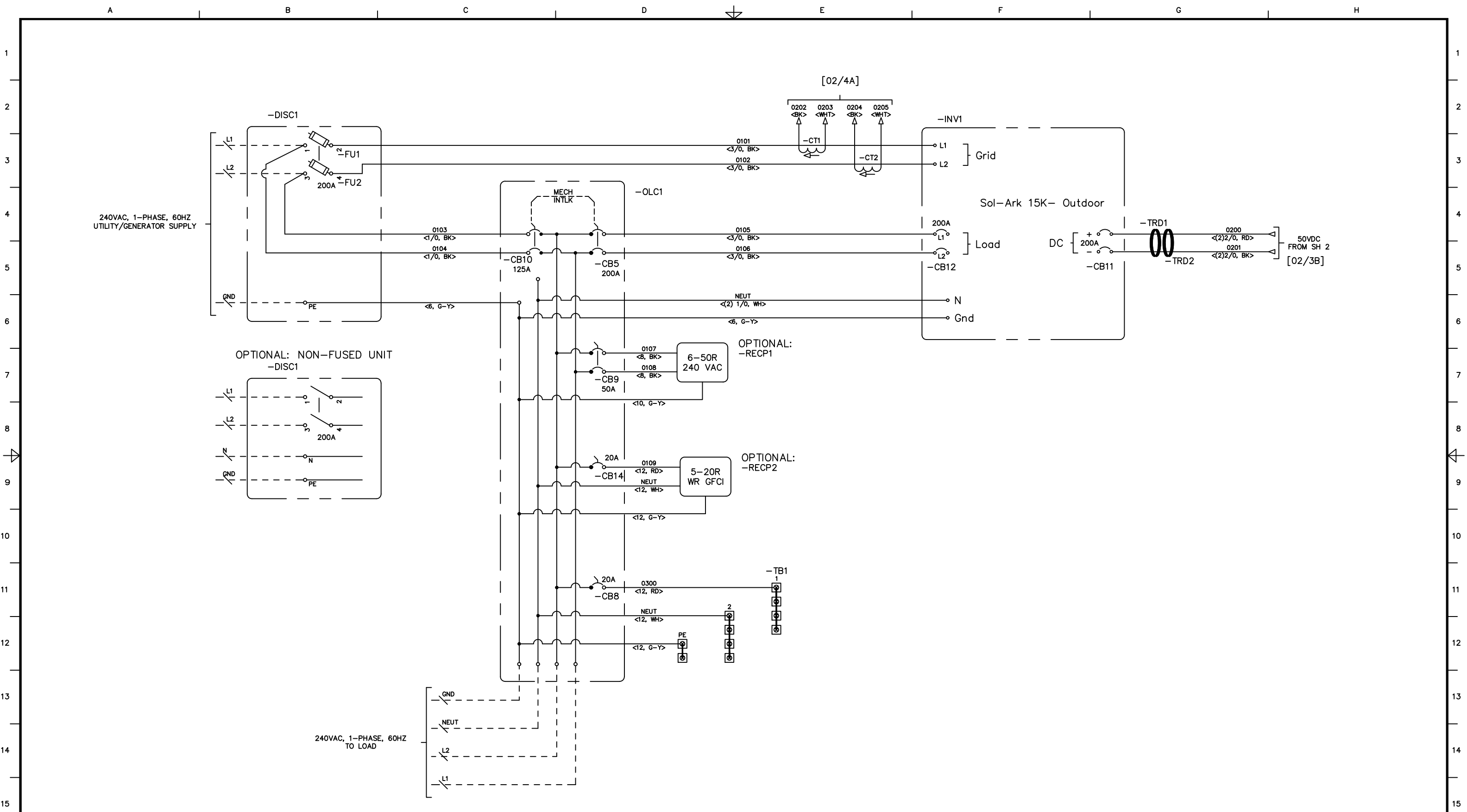
ISS	DATE	DESCRIPTION	DWN	CHK	APR	ISS	DATE	DESCRIPTION	DWN	CHK	APR	THIRD ANGLE PROJ 	CUSTOMER: CUST. ORDER NO.:	Confidential Property of RaVolt, LLC					
00	12/21/22	INITIAL RELEASE		MSA										PA ORDER NO.:	TABLES & NOTES	SIZE B	DRAWING/PART NO. GEN2-1-1	TBD	SHEET 01

Line	Part Number	Qty	Description	Identifier	Brand
10	BT-BB-I	4	PowerSync battery bus bar jumper	BT1:1, BT2:1	PowerSync
20	AU-250	2	Mechanical Lug, Conductor Range 250-6, 2 Ports, 1 Hole, 3/8in Bolt Size, Tin Plated, UL, CSA	BT1:2, BT3:2	IlSCO
30	LFP3250-LV512100	3	HIGH POWER LIFEP04 BATTERY MODULE, 51.2V, 100Ah	BT1-BT3	PowerSync
40	Q2125	1	Miniature Thermal Mag Circuit Breakers - Type QP/MP, 2-Pole, 120/240VAC	CB10	Siemens
50	5SJ4102-8HG41	1	Miniature circuit breaker 240 V 14kA, 1-pole, 2A, UL 489	CB15	Siemens
60		1	Miniature circuit breaker 240 V 14kA, 1-pole, 6A, UL 489	CB16	Siemens
70		1	Miniature circuit breaker 240 V 14kA, 1-pole, 15A, UL 489	CB17	Siemens
80	MBK200A	1	1-Phase main breaker.. Rated (200 - 225A) AIR: 22 KA	CB5	Siemens
90	ECSPBK10	1	Standby Power Systems Type: Manual Transfer Interlock Kit	CB5:1	Siemens
100	Q120	1	BREAKER 20A 1P 120V 10K QP	CB8	Siemens
110	Q250	1	BREAKER 50A 2P 120/240V 10K QP 10 KAIC	CB9	Siemens
120	27250	1	7ft (2.1m) Cat5e Snagless Shielded (STP) Ethernet Network Patch Cable - Gray	COMM1	C2G
130	6BITCOMM	1	Network Patch Cable - Gray	COMM2	PowerSync
140	03965	1	2ft (0.6m) Cat5 Snagless Unshielded (UTP) Ethernet Network Patch Cable - Gray	COMM3	C2G
150		2	Current Transformer supplied with "INV1" unit from its manufacturer	CT1-CT2	SolArk
160	DG224URK	1	General duty non-fusible safety switch, single-throw, 200 A, NEMA 3R, Rainproof, Painted galvanized steel, Two-pole, Two-wire, 240 V	DISC1	Eaton
170	GF224NR	1	Safety Switch: 200 A Amps AC, 60 HP @ 240V AC, 3R, 2 Poles, 3 Wires, Fusible	DISC1	Siemens
180	PB2-300	2	Aluminum Panelboard Lug, Dual Rated, Conductor Range 300-6AWG, 2 Ports, 1 Hole, 5/16in Bolt Size, Tin Plated, UL, CSA	DISC1:1	IlSCO
190	SI32-PEL64R-4	3	Switch Disconnect, Rotary Actuator, 4 Pole, 600 V, 32 A, IP66, Screw, Front Mount	DISC2-DISC4	IMO
200	3142-0148-01-17	1	Nema 3R Cooling fan, 6x6, 115V, 15W, 27CFM	FAN1	Haewa
210	TR200R	2	250V 200A 7 1/8x1 9/10 TD	FU1, FU2	Mersen
220	EHT00037	1	Tubular Enclosure Heater: 120V AC, 500 W Watts, 1 9/16 in Wd, 3 5/8 in Ht, 1 Phase	HTR1	Tempco
230	SolArk-15K-Outdoor	1	Inverter	INV1	SolArk
240	BR816B200RF	1	BR style 1-inch loadcenter, main circuit breaker, feed-through lug, 200A, single-phase, 16-pole, 16 circuits, 8 spaces, 120/240V	OLC1	Eaton
250	PNW0816B1200TC	1	LOAD CENTER. MAIN BREAKER WITH 8 1-INCH SPACES ALLOWING MAX 16 CIRCUITS. 1-PHASE 3-WIRE SYSTEM RATED 120/240V (200A) 22KAIC. SPECIAL FEATURES: COPPER BUS, FEED THRU LUGS, GREY TRIM NEMA TYPE 3	OLC1	Siemens
260	PSS-3804	1	Receptacle: Industrial, Single, Flush Mount, 50 A, 250V AC, NEMA 6-50R, Black	RECP1	Pass&Seymour
270	1492-REC15G	1	Receptacle, Ground Fault Circuit Interrupter, 15A, DIN Rail Mounting	RECP3	Allen Bradley
280	52156	1	3ft (0.9m) Serial RS232 DB9 Cable with Low Profile Connectors M/F	SRL1	C2G
290	3150-2060-02-27	1	Adjustable Cooling thermostat, NO contact	TAS1	Haewa
300	3150-1060-02-27	1	Adjustable Heating thermostat, NO contact	TAS2	Haewa
310	8WA1011-1DH11	8	TER BLK,SCREW,THROUGH-TYPE,6,BEIGE	TB1	Siemens
320	8WA1808	4	End retainer thermoplast, 10 mm	TB1:3	Siemens
330		2	Toroidal Ferrite supplied with "INV1" unit from its manufacturer	TRD1, TRD2	SolArk
340		1	WiFi Dongle supplied with "INV1" unit from its manufacturer	WCM1	SolArk
350	8WA1011-1PH00	2	PE TERMINAL BLOCK,SCREW,THROUGH-TYPE, 6	TB1	Siemens
360	8WA1888	1	TERMINAL BLOCK JUMPER BAR, 10 POLE	TB1:1	Siemens
370	8WA1820	1	TERMINAL BLOCK BARRIER	TB1:2	Siemens
380	3142-0148-00-07	1	6X6, 3R Exhaust vent		Haewa
390	WP-39*15	1	WP-39 Polycarbonate NEMA Enclosure, 6.30 x 6.30 x 3.52 in		Polycase

Component substitution with functionally equivalent, rated and labelled components allowed based on market conditions.

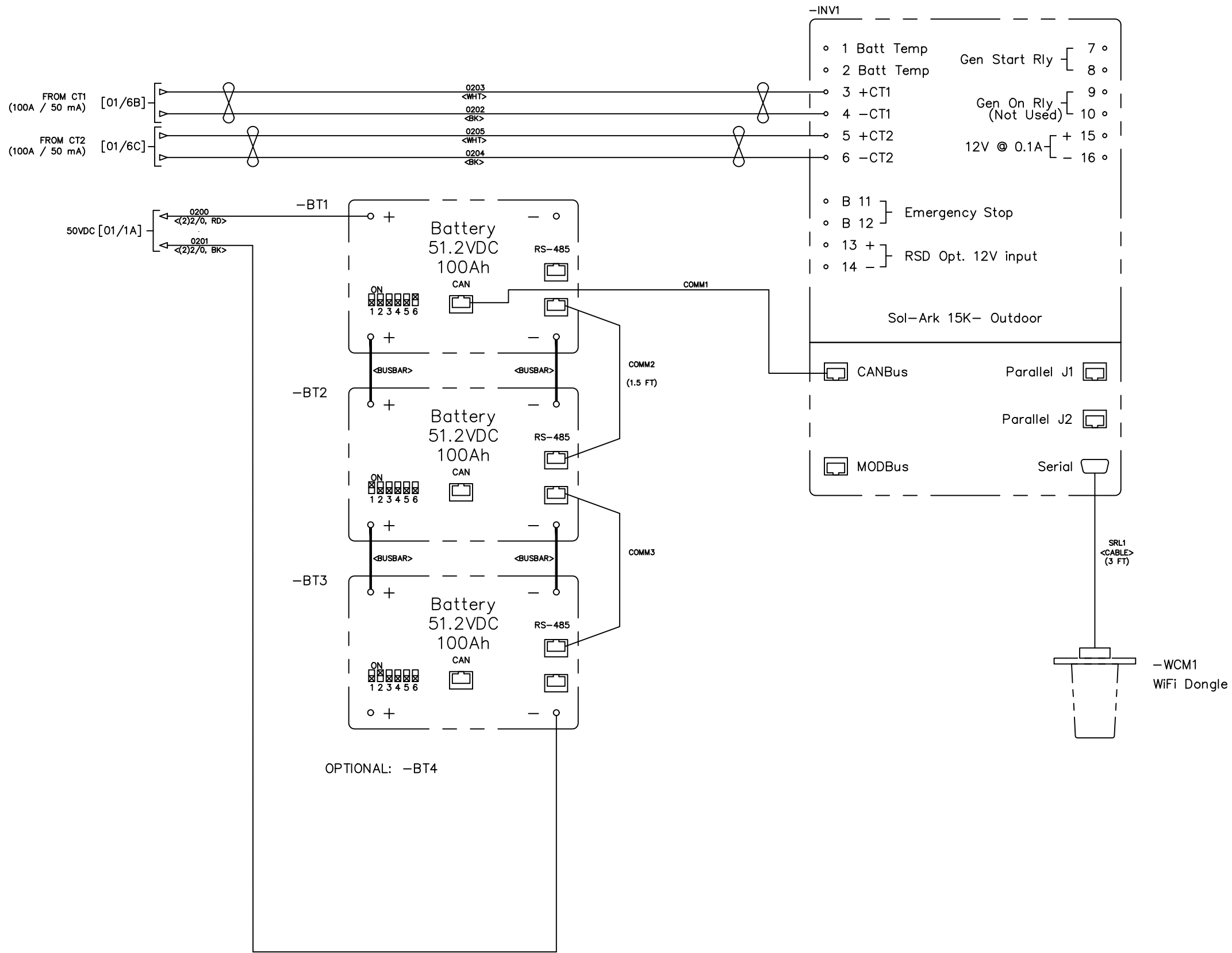
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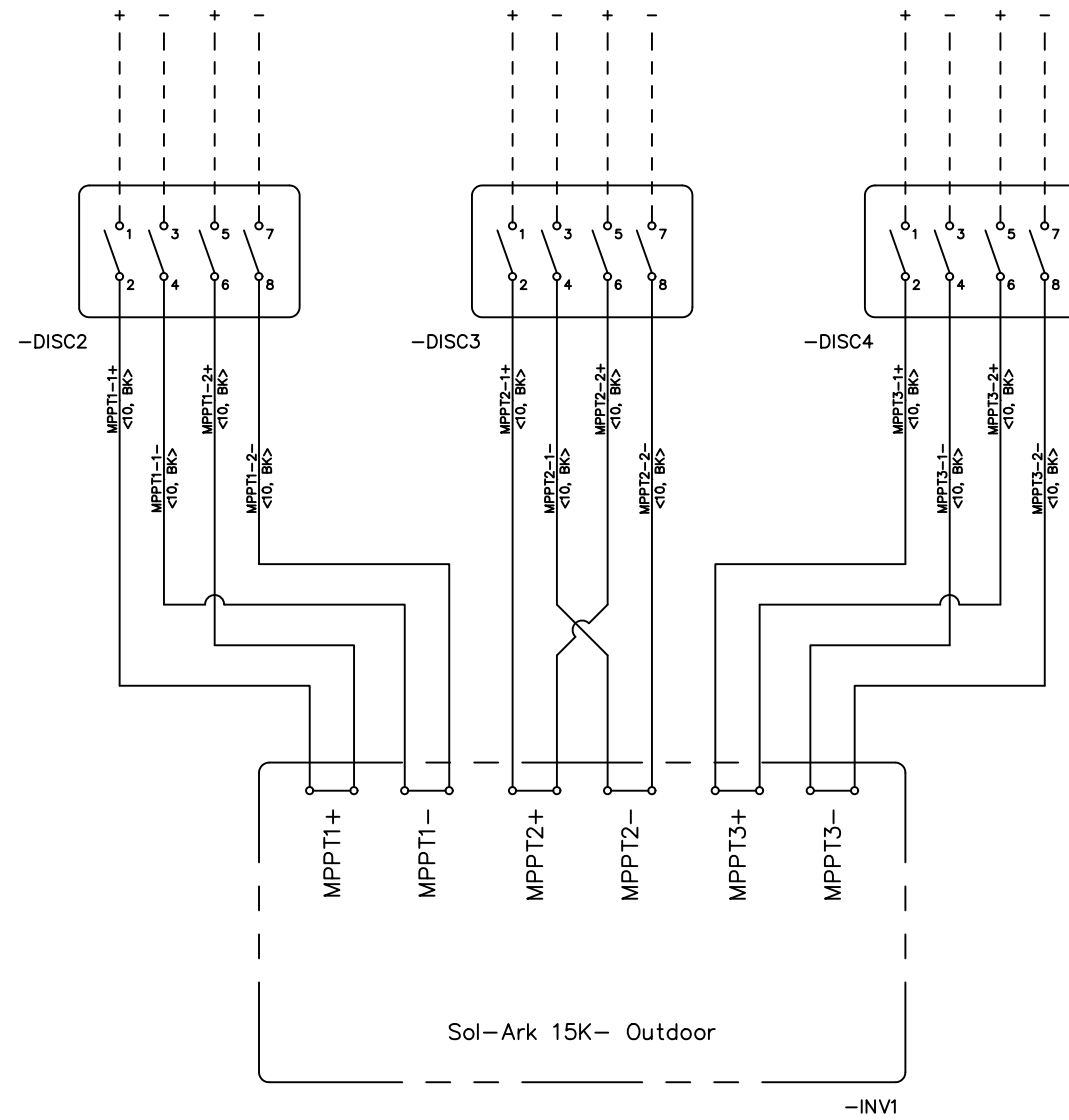
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ISS	DATE	DESCRIPTION	DWN	CHK	APR	ISS	DATE	DESCRIPTION	DWN	CHK	APR	THIRD ANGLE PROJ	CUSTOMER: CUST. ORDER NO.: PA ORDER NO.:	Confidential Property of RaVolt, LLC		SHEET	CONT	
00	12/21/22	INITIAL RELEASE		MSA								THIRD ANGLE PROJ	BATTERIES, CT'S & COMMUNICATION	SIZE B	DRAWING/PART NO. GEN2-1-1	TBD	04	05

# SOLAR PANEL (PV) INPUT CONNECTIONS

MAX PV Input:

- 5.67kW per MPPT
- 500Voc PV
- 26A Isc per MPPT



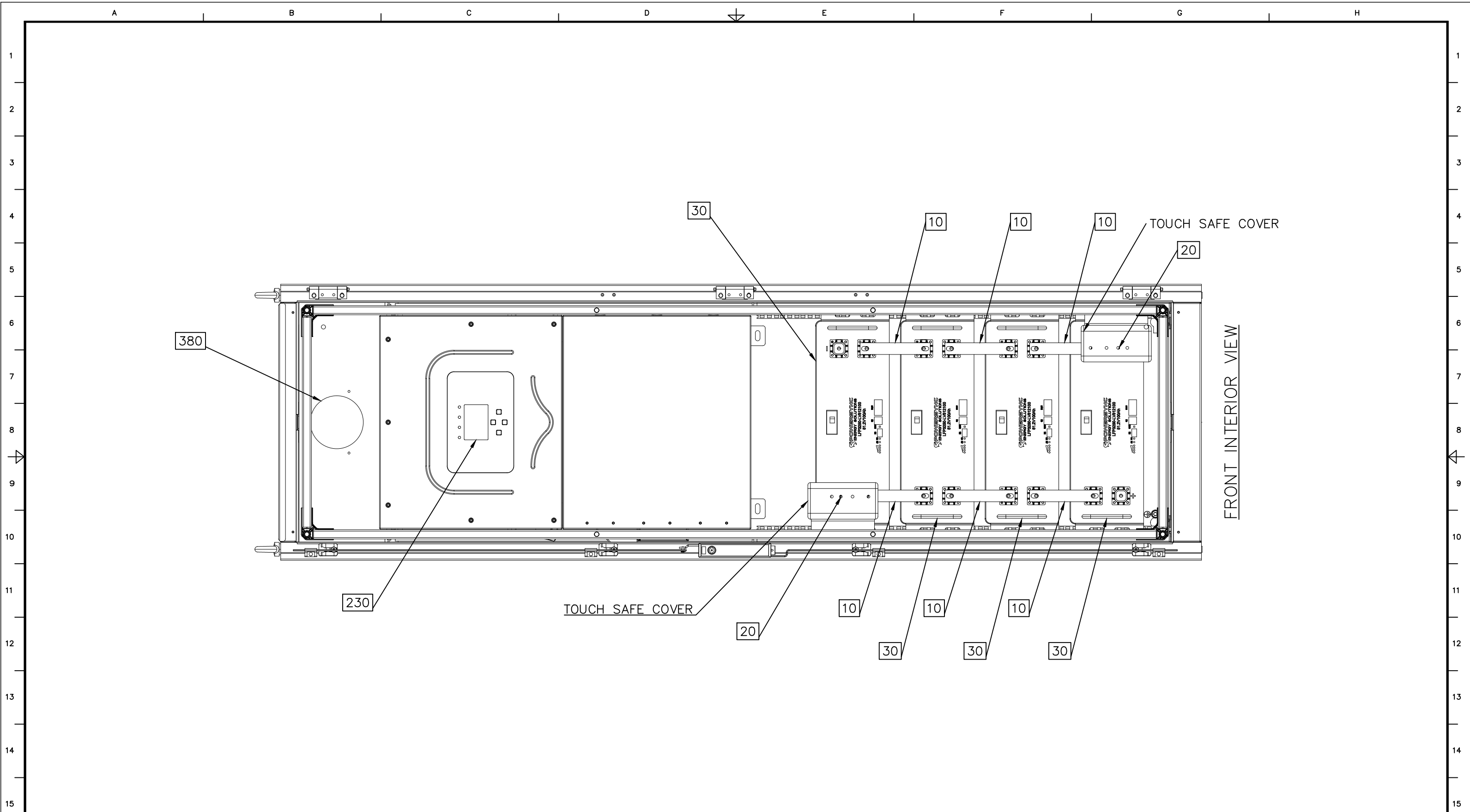
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00	12/21/22	INITIAL RELEASE		MSA								THIRD ANGLE PROJ		R a V o l t , L L C	B	GEN2-1-1	05	06
													SOLAR PANEL INPUT CONNECTIONS		TBD			









FRONT INTERIOR VIEW

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00	12/21/22	INITIAL RELEASE		MSA									MECHANICAL INTERNAL	PA ORDER NO.:	SIZE B	DRAWING/PART NO. GEN2-1-1		





