



SOLAR STIK®



PGA Power Module Training



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Introductions

- Your name?
- Position?
- How long they have been with company?
- One thing you want to get out of the class?



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PGA Power Module Objectives

1. Safety (Personnel and equipment)
2. Identify major components and purpose
3. Understanding internal components
4. Understanding Faceplate (UI) operations
5. Understanding configuration options
6. Understanding AC/DC power flow
7. Troubleshooting (Error Recovery)
8. Practice setup
9. Practical (Hands-On)
10. Q/A



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PGA Power Module

SAFETY

People and Equipment



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People Safety

Electric Shock Hazard

⚠ WARNING

Standing water around the electrical equipment and / or intrusion of water into the System components can increase the risk of electrical shock.

DON'T LET THIS BE YOU!





People Safety

2-Person Lift





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Battery Safety

- Do not short (+) and (-) terminal with conductors.
- Do not connect in series.
- Do not reverse the polarity.
- Do not mix different type batteries or mix new and old ones together.
- Do not open the battery module.
- Do not submit to excessive mechanical stress.
- Do not puncture battery module.
- Do not submerge the Module in water.
- Do not heat directly, solder, or throw into fire. Such unsuitable use can cause leakage or spout vaporized electrolyte fumes and may cause fire or explosion.
- Immediately disconnect the batteries if, during operation, they emit an unusual smell, feel hot, change shape, or appear abnormal in any other way.



Battery Safety

3. Hazards Identification

The rechargeable lithium-ion batteries described in this Product Safety Data Sheet are sealed units which are not hazardous when used according to the recommendations of the manufacturer and as long as their integrity is maintained.

Do not short circuit, puncture, incinerate, crush, immerse in water, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion.

Under normal conditions of use, the active materials and liquid electrolyte contained in the cells and batteries are not exposed to the outside, provided the battery integrity is maintained and seals remain intact. Risk of exposure only in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. Electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow, depending upon the circumstances.

4. First Aid Measures (in case of leaking or accidentally opened cells)

In case of accumulator breakage or burst, please evacuate employees from the contaminated area and ensure maximal ventilation in order to break-up corrosive gas, smoke and unpleasant odors.

If it occurs, by accident, following measures must be taken:

Inhalation	Not anticipated under normal use. Remove from exposure. Remove to fresh air. Rest and keep warm. In severe cases obtain medical attention.
Skin contact	Not anticipated under normal use. Wash off skin thoroughly with water. Remove contaminated clothing and wash before reuse. In severe cases obtain medical attention.
Eye contact	Not anticipated under normal use. Irrigate thoroughly with water for at least 15 minutes. Obtain medical attention.
Ingestion	Not anticipated under normal use. Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.
Further treatment	All cases of eye contamination, persistent skin irritation and casualties who have swallowed this substance or been affected by breathing its vapours should be seen by a doctor.

Battery Safety

Thermal Runaway

5. Fire Fighting Measures

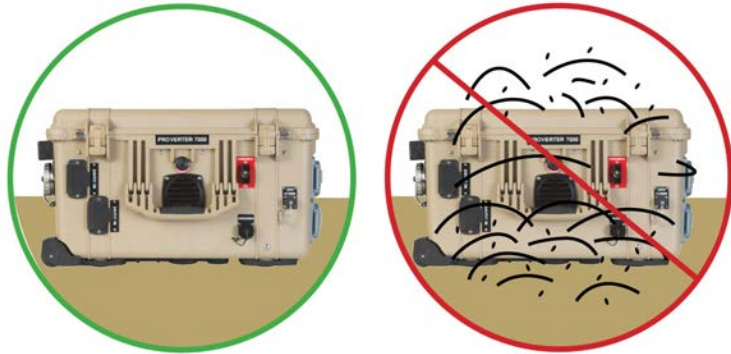
Dry chemical type or CO₂ extinguishers, Halon, or copious quantities of water or water-based foam can be used to cool down burning Li-ion cells and batteries. During water application, caution should be exercised as burning pieces of flammable particles may be ejected from the fire.

In case of fire, it is recommended to wear self-contained breathing apparatus, to avoid contact with irritant fumes. Evacuate all persons from immediate area of fire.

Do not re-enter the area until it has been adequately purged of the fire vapour and extinguishing agent.

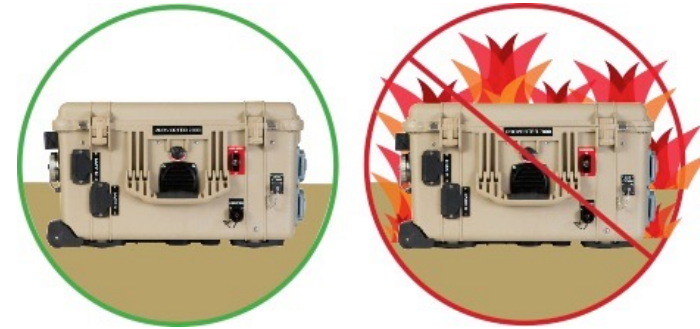
Environmental Precautions

Avoid these hazards to improve the performance, prevent failures, and prolong the operational life of the Power Module.



Dust

- Air intake filters should be cleaned or replaced once per month, or more frequently when conditions warrant.
- As a general rule, minimize exposure to high levels of particulates by exercising common-sense placement.

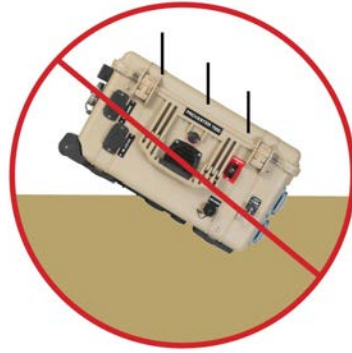


Heat

Heat and solar loading reduce efficiency, cause Power Module derating, and shorten life expectancy. Shade the Power Module to prevent the negative effects of heat. Dirty air filters will also increase heat.

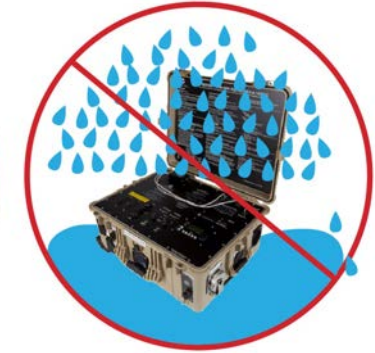
Environmental Precautions

Avoid these hazards to improve the performance, prevent failures, and prolong the operational life of the Power Module.



Impact

- Do not drop Power Module onto hard surfaces.
- Minimize vibration during transport.



Water

Power Module lid should only be open to access operator controls and closed at all other times.

Handling Precautions

Avoid these hazards to improve the performance, prevent failures, and prolong the operational life of the Power Module.

Stacking

Stack no more than three boxes high during long distance transport. Must be strapped adequately.



Stack no more than two high during on-course transport. Must be strapped adequately.



Do not stack on either end for any type of transport or storage.



Handling Precautions

Avoid these hazards to improve the performance, prevent failures, and prolong the operational life of the Power Module.

Sliding across ground

- Use only case handles to slide the case across ground or other surfaces.
- Do not drag case by pulling on connected cables or vent shrouds.



Handling Precautions

Avoid these hazards to improve the performance, prevent failures, and prolong the operational life of the Power Module.

Replace connector caps when not in use

Yes



No



Handling Precautions

Avoid these hazards to improve the performance, prevent failures, and prolong the operational life of the Power Module.

Use wheels for transport only on solid surfaces, not in grass or sand/dirt.



The vent can scoop up detritus which restricts airflow and increases internal heat.



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PGA Power Module

Identifying major components and purpose



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Major Components

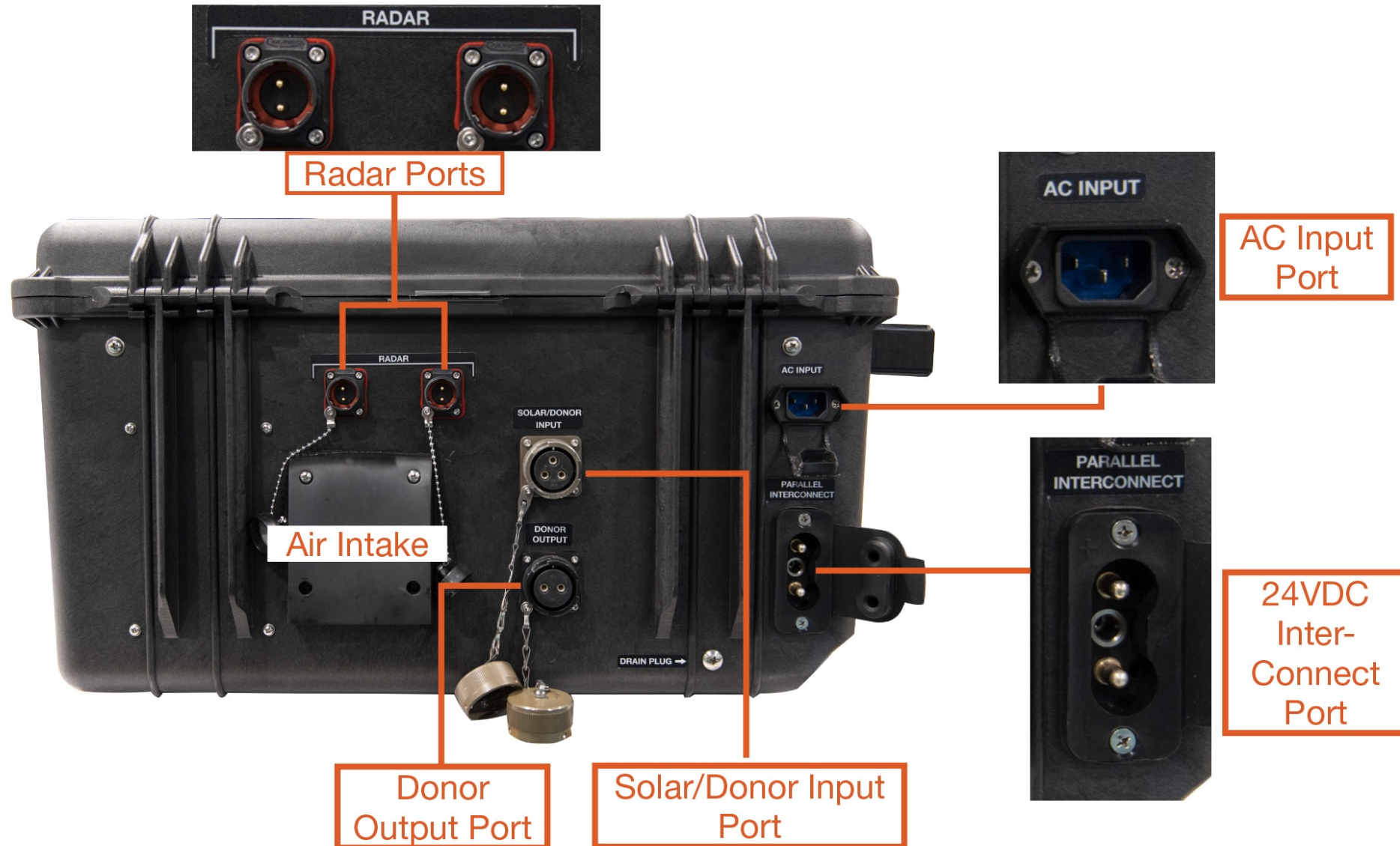
24VDC PGA Tour Power Module





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Major Components

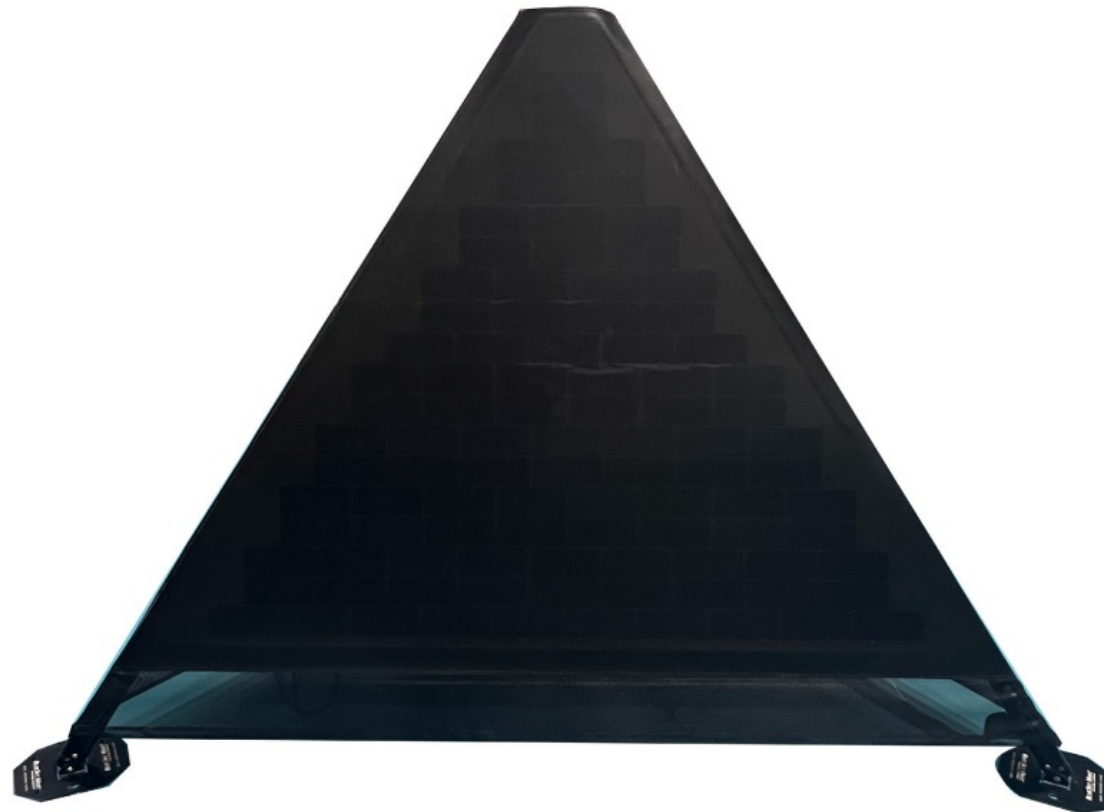




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Major Components

SOLAR SKIRT





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Major Components

Cables

Solar

13-1000459



Energy Storage Expansion

13-0000032



Donor Charging

13-1000452



AC Power Charging

13-1000454





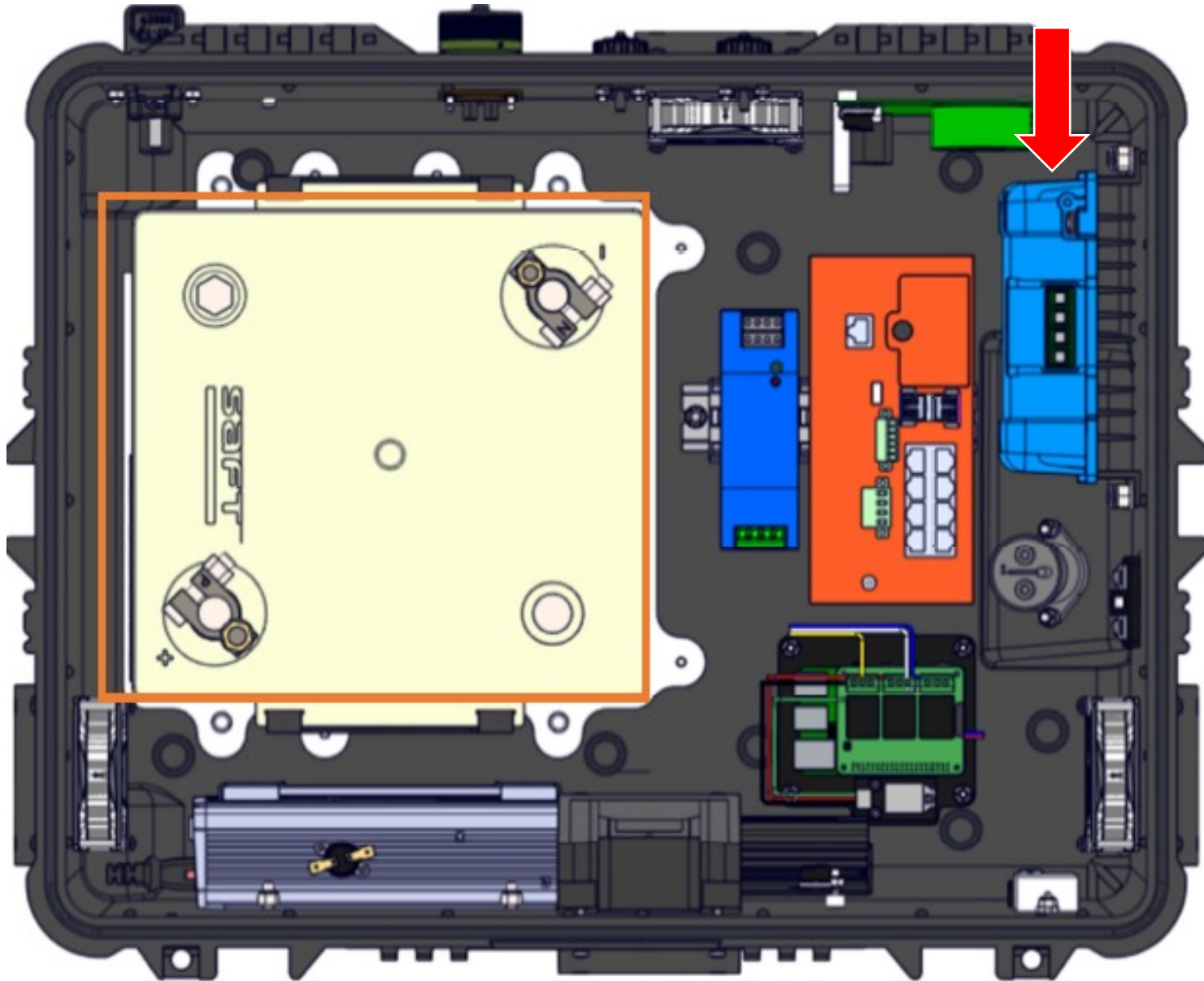
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Internal components

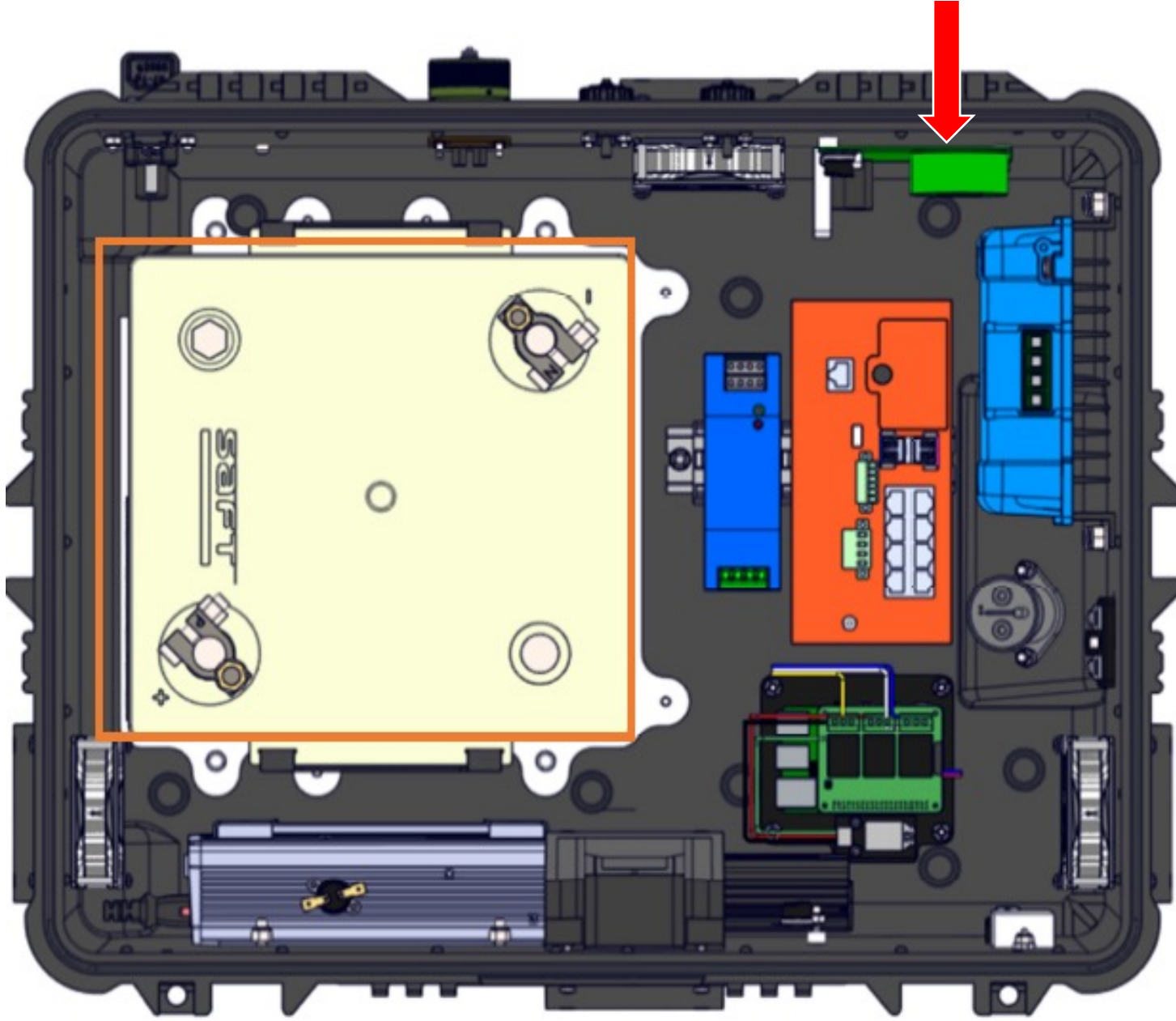


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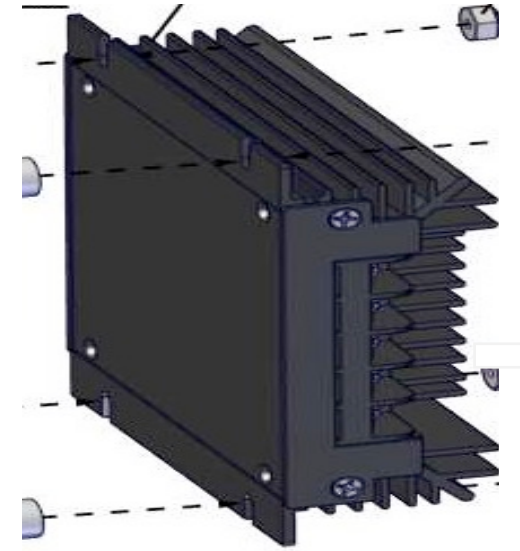
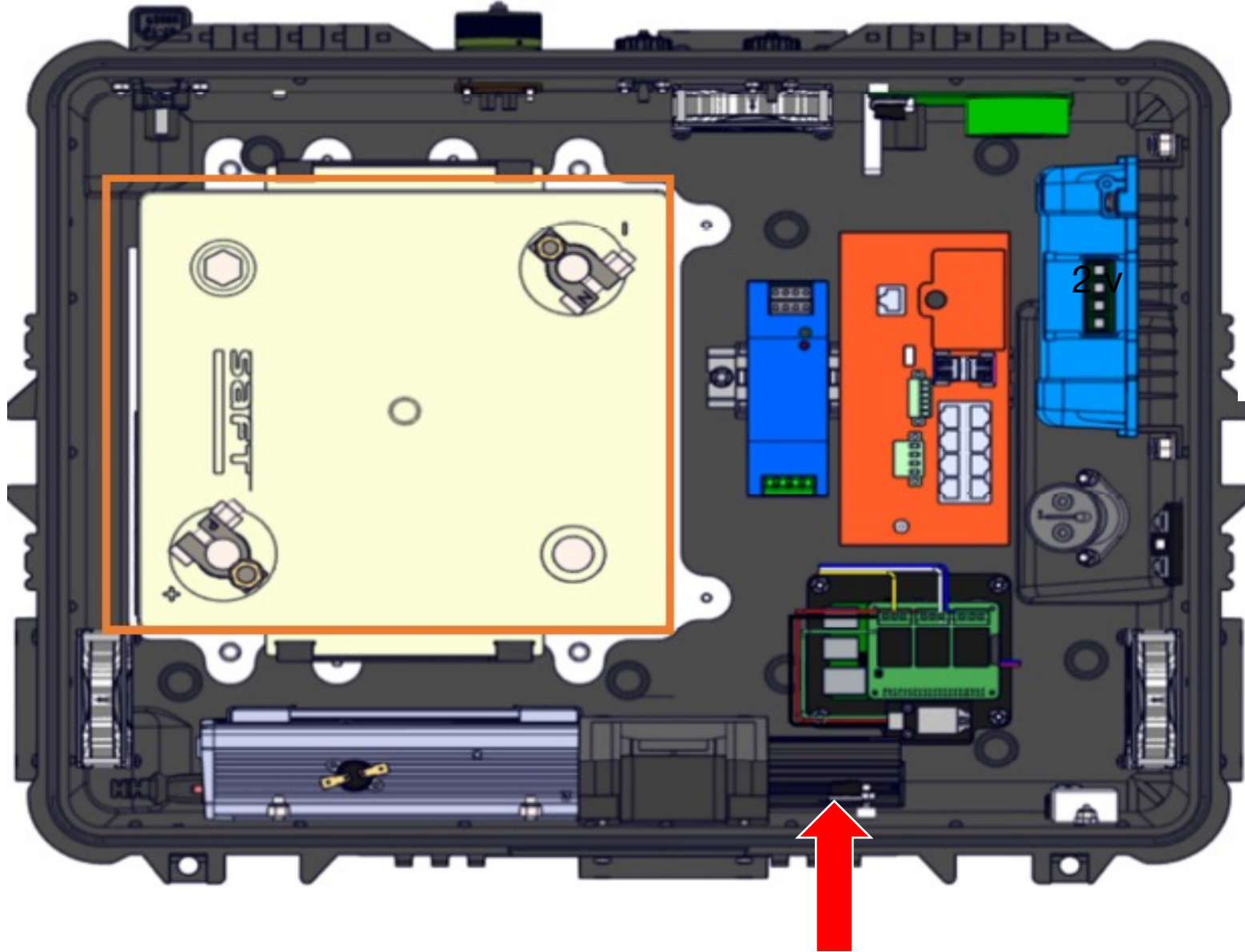
Power Supply (Solar Charger)



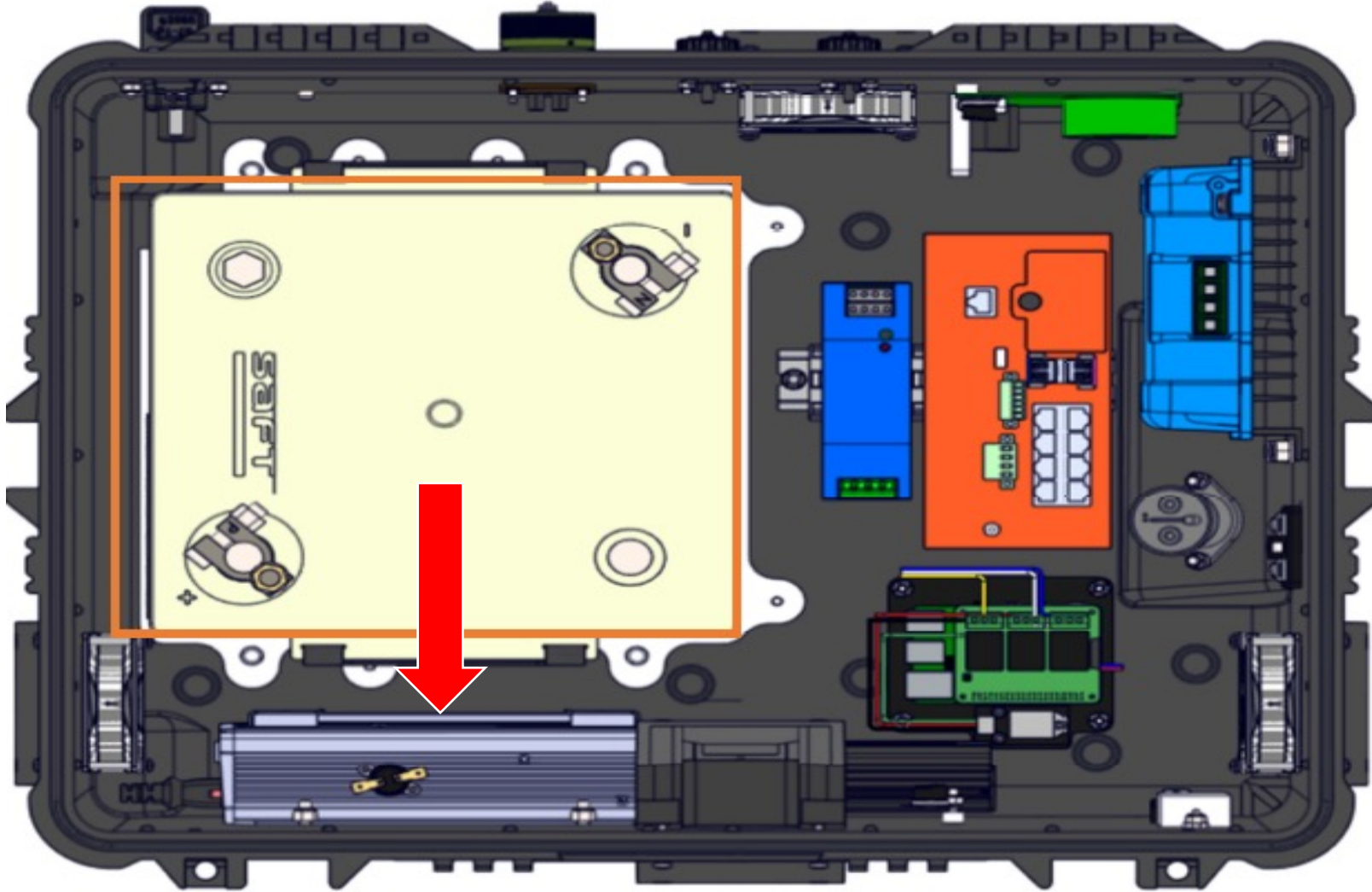
Step-Up Converter 24 > 48 VDC



DC / DC Converter 24 to 22VDC



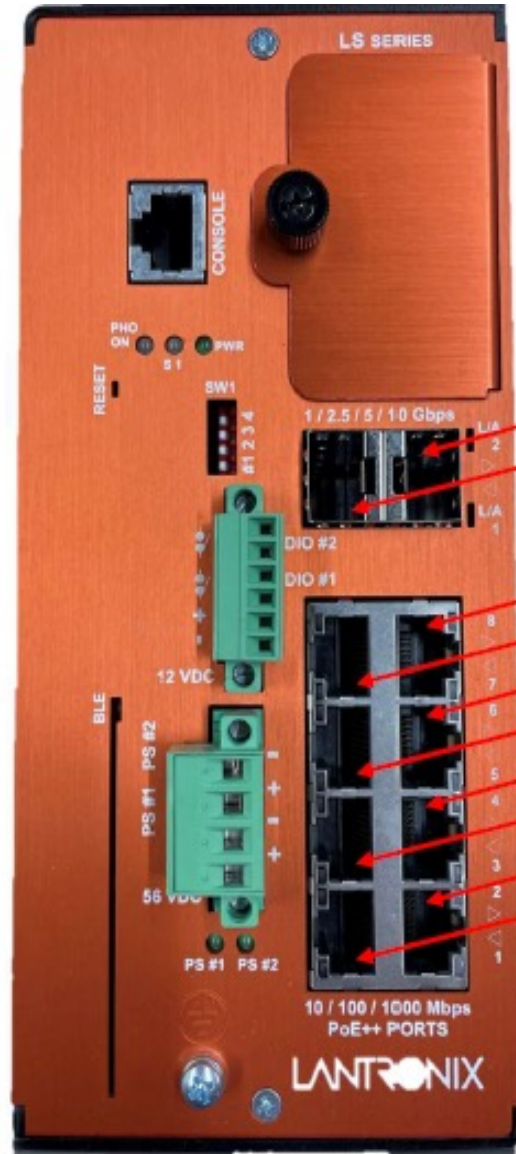
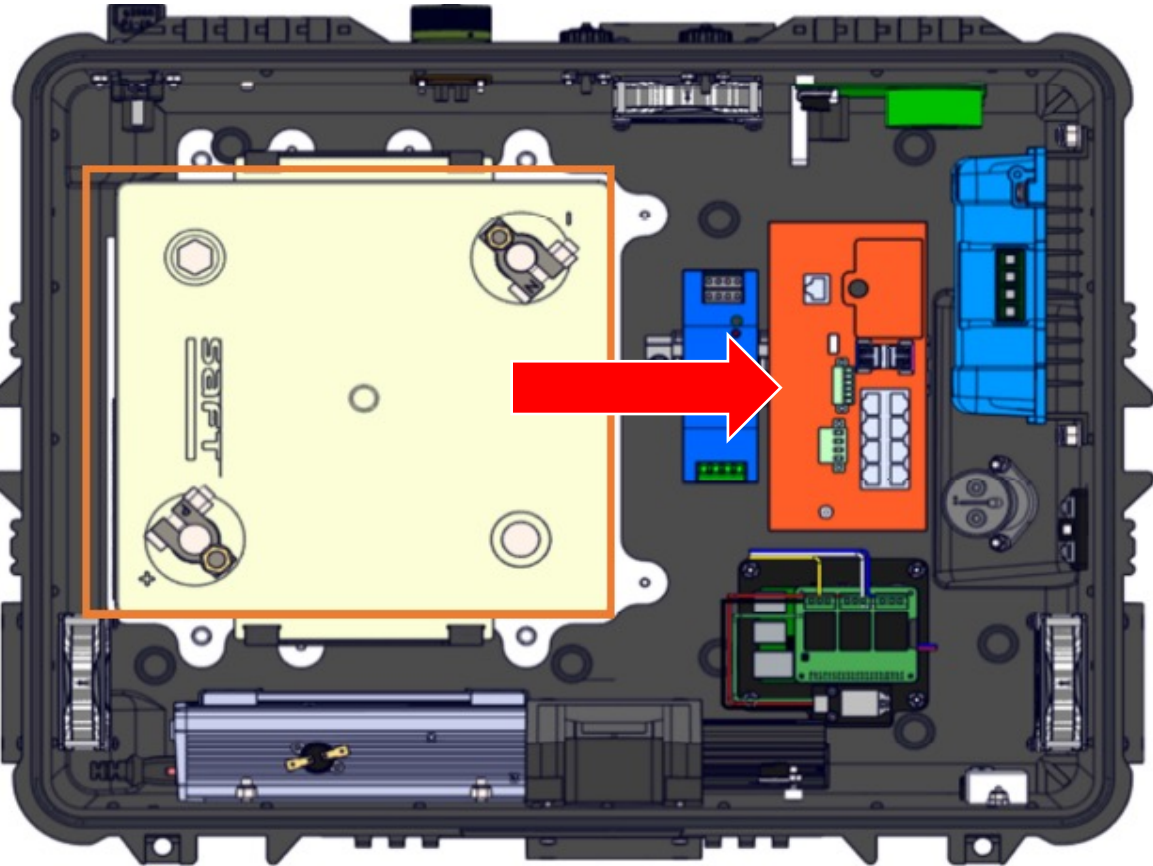
AC Battery Charger





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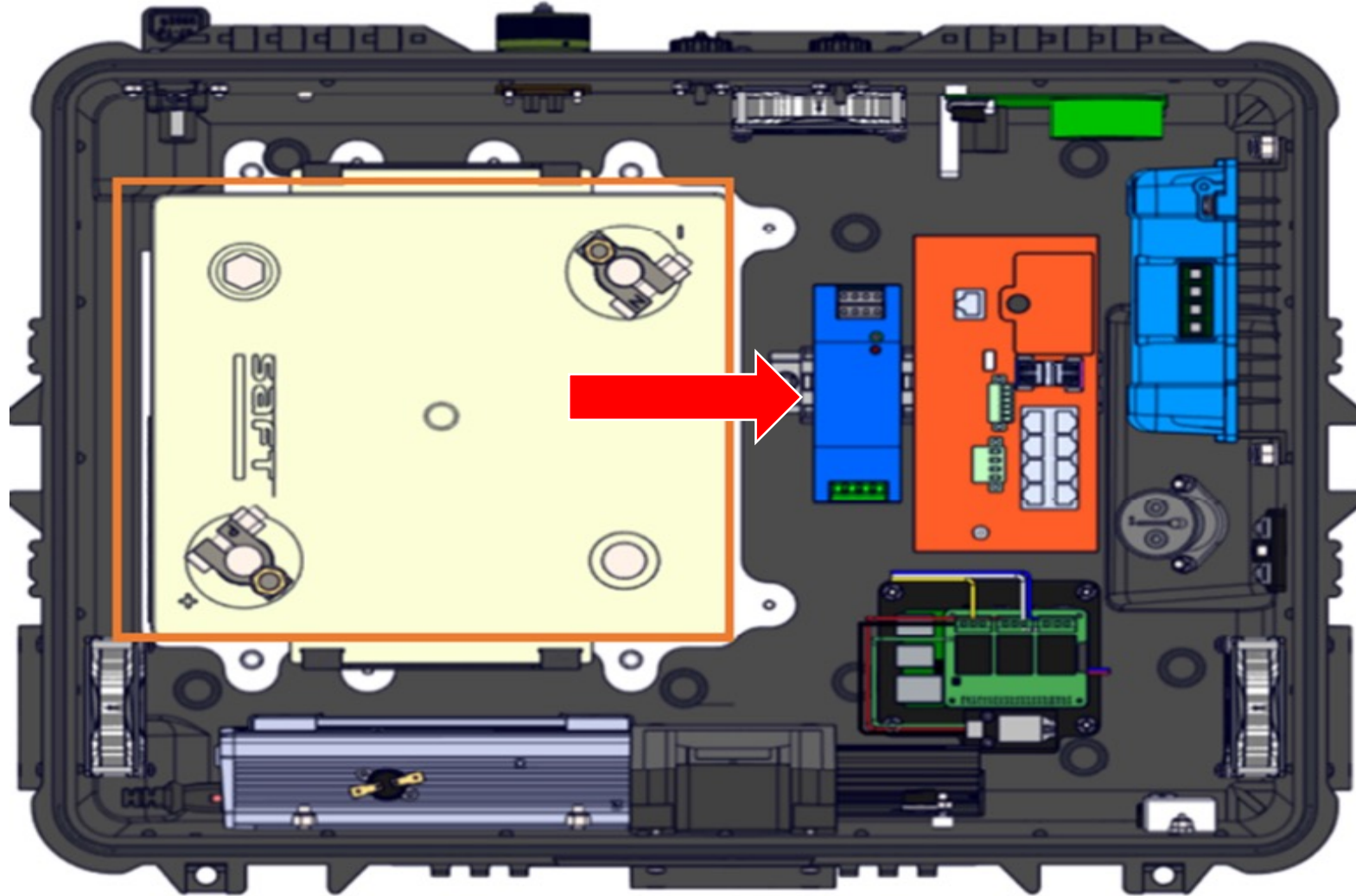
Shot Link/Switch



Fiber Optic, Down (L/A 2) Uses Purple SFP Connector
Fiber Optic, Up (L/A 1) Uses Blue SFP Connector

Raspberry Pi (8)
Radar (7)
Radar (6)
Camera 3 (5)
Camera 2 (4)
Camera 1 (3)
AP (2)
AP (1)

Shot Link Power Supply





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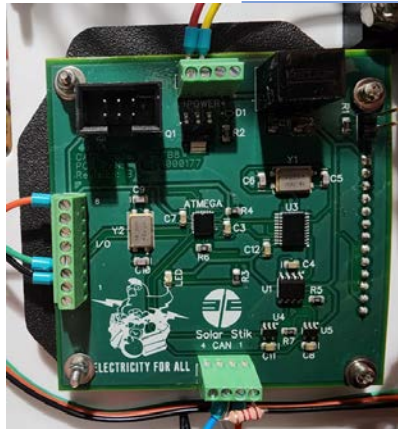
Faceplate Components



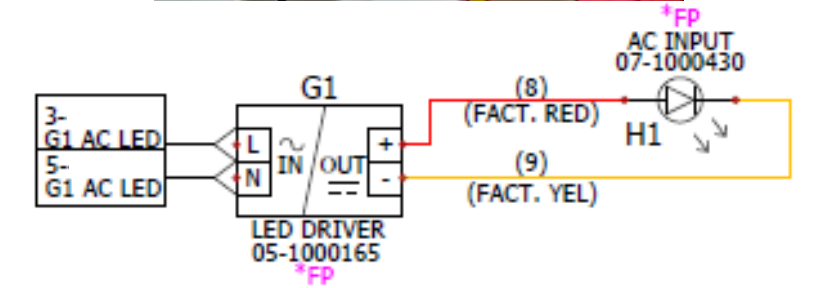
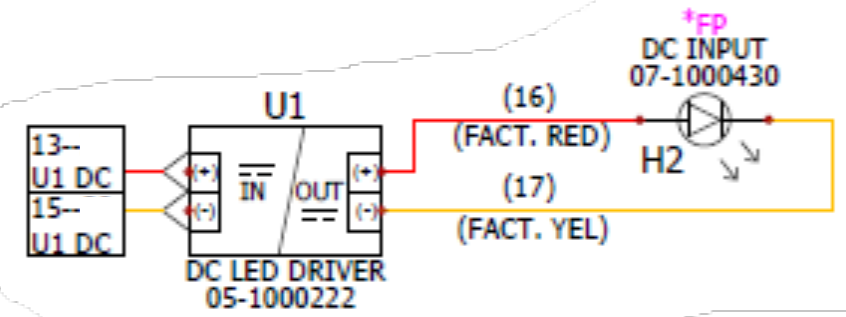
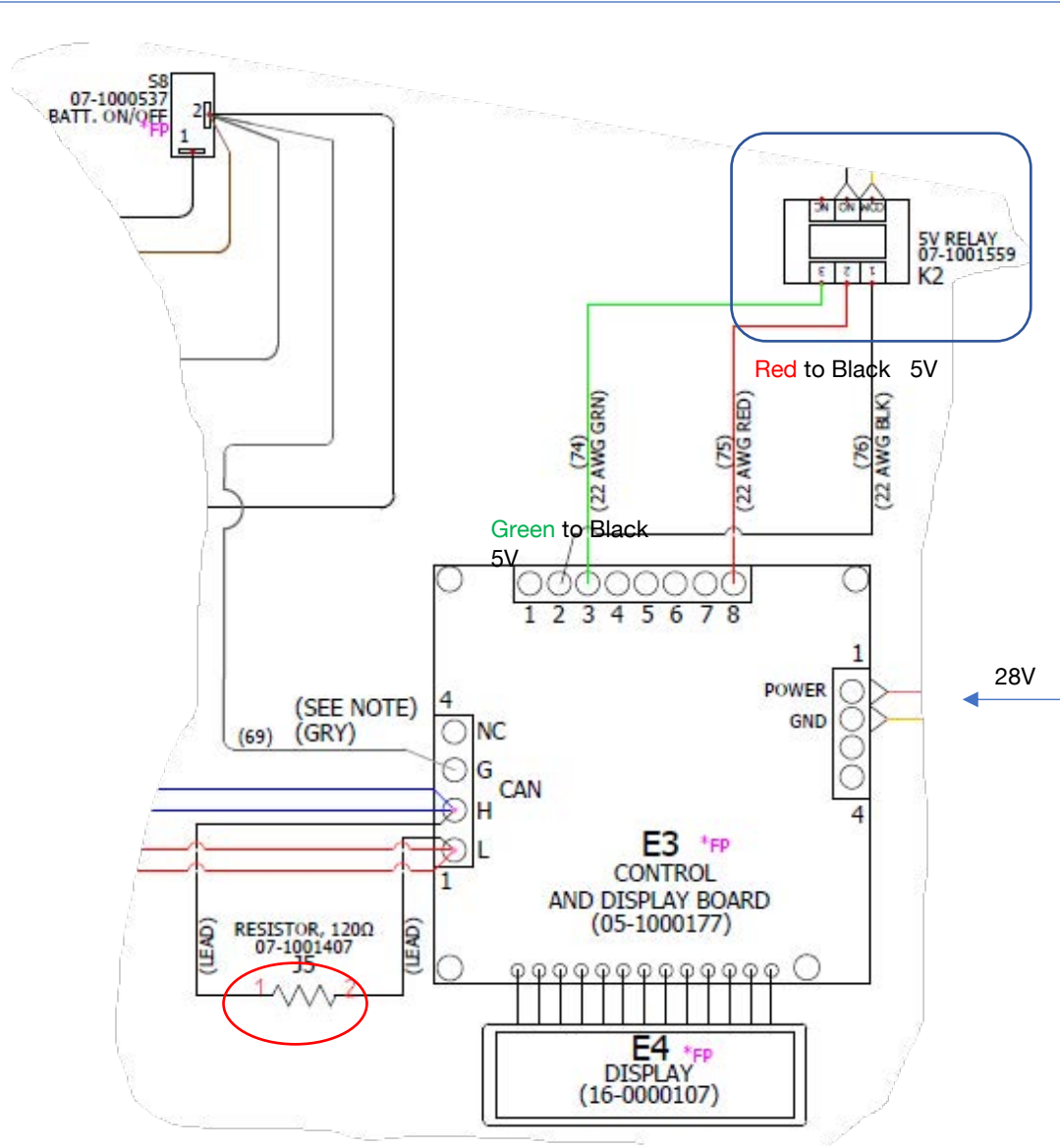


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28V



5V
↑



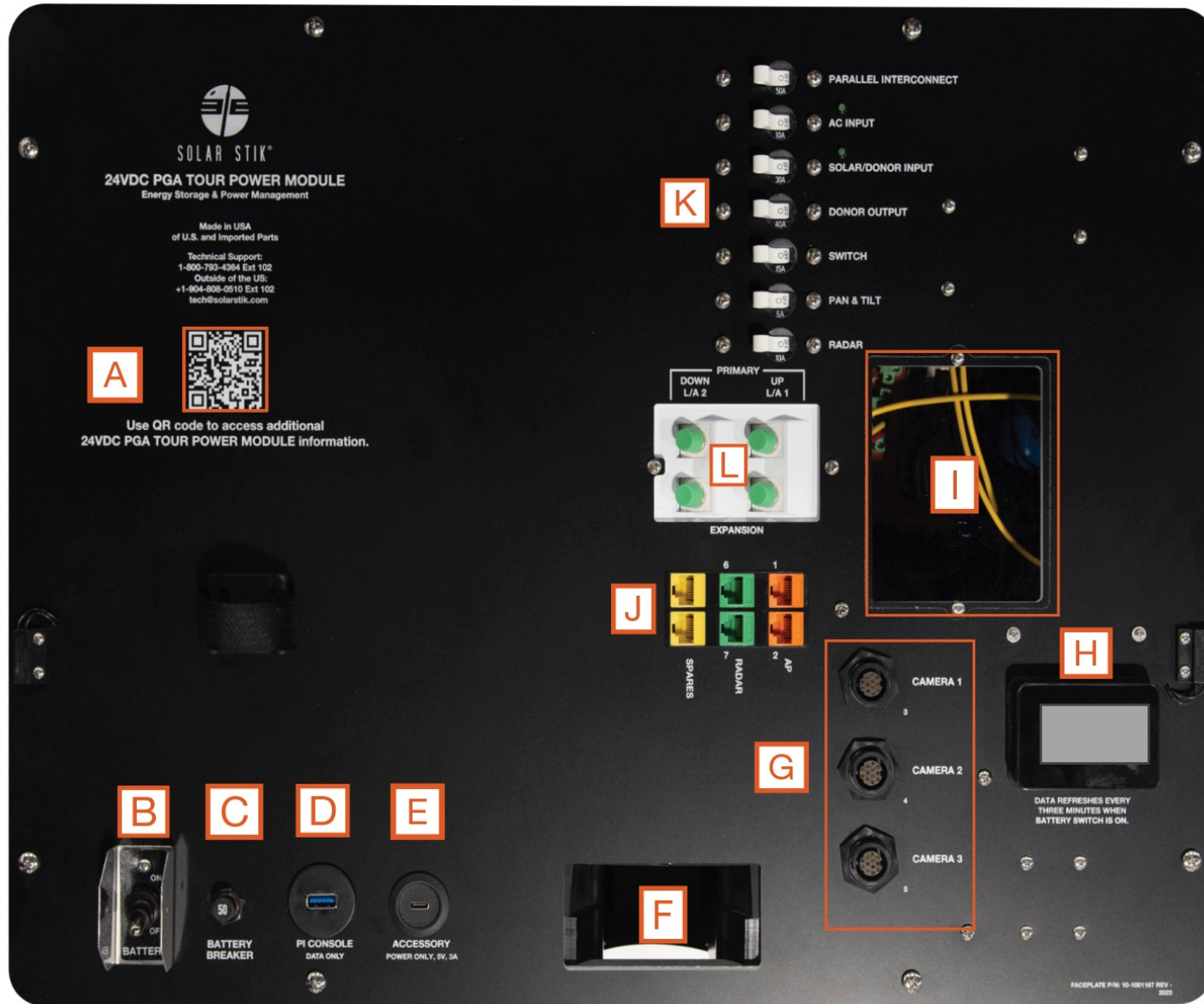


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PGA Power Module

Understanding Faceplate (UI) operations

Faceplate



- A. Specifications Via QR Code
- B. Battery Toggle Switch
- C. Battery Breaker 50 A
- D. USB A PI Console port exclusively used for data communication with Raspberry PI
- E. USB C Accessory Power Only 5V, 3A
- F. Cable Passthrough
- G. Camera Connectors
- H. E Display
- I. Clear window for viewing internal communication operations
- J. AP and Radar ports
- K. Breaker Status LEDs
- L. Fiber optic connectors



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Battery Status Meter



After the Power Module is turned off, this meter will continue to display the last-recorded status. It will not update when the BATTERY switch is toggled to OFF.



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Breakers

Circuit Breakers





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Solar Charging

Shading the solar array (trees, buildings, bushes, people etc., may significantly reduce power output.





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Donor Charging

Donor Power Box

Donor Charging Cable

Recipient Power Box





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AC Power Charging



120 VAC Power Source:
Generator, Mains



AC Power Charging Cable



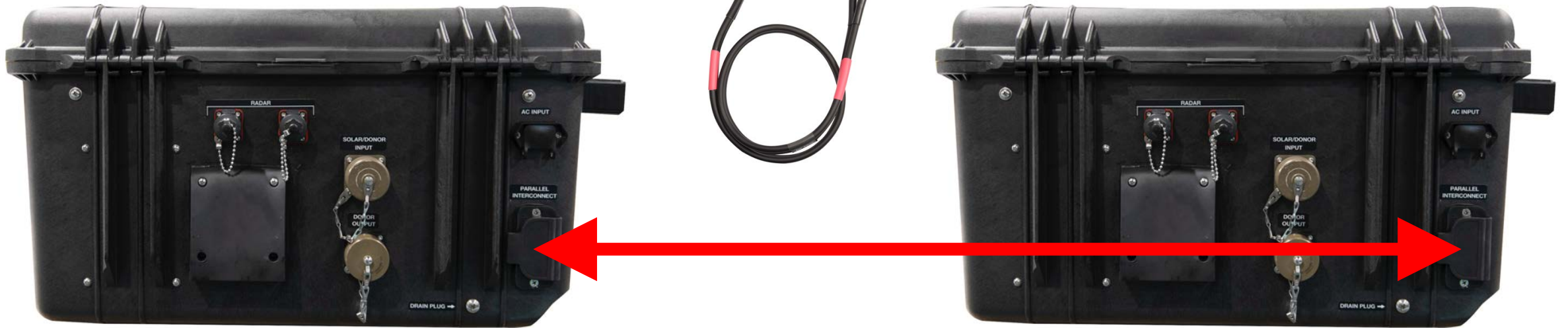
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Energy Storage Expansion

Donor Power Box

Energy Storage
Expansion Cable

Recipient Power Box



- Do not connect two modules if the SOC difference them is greater than 25%.

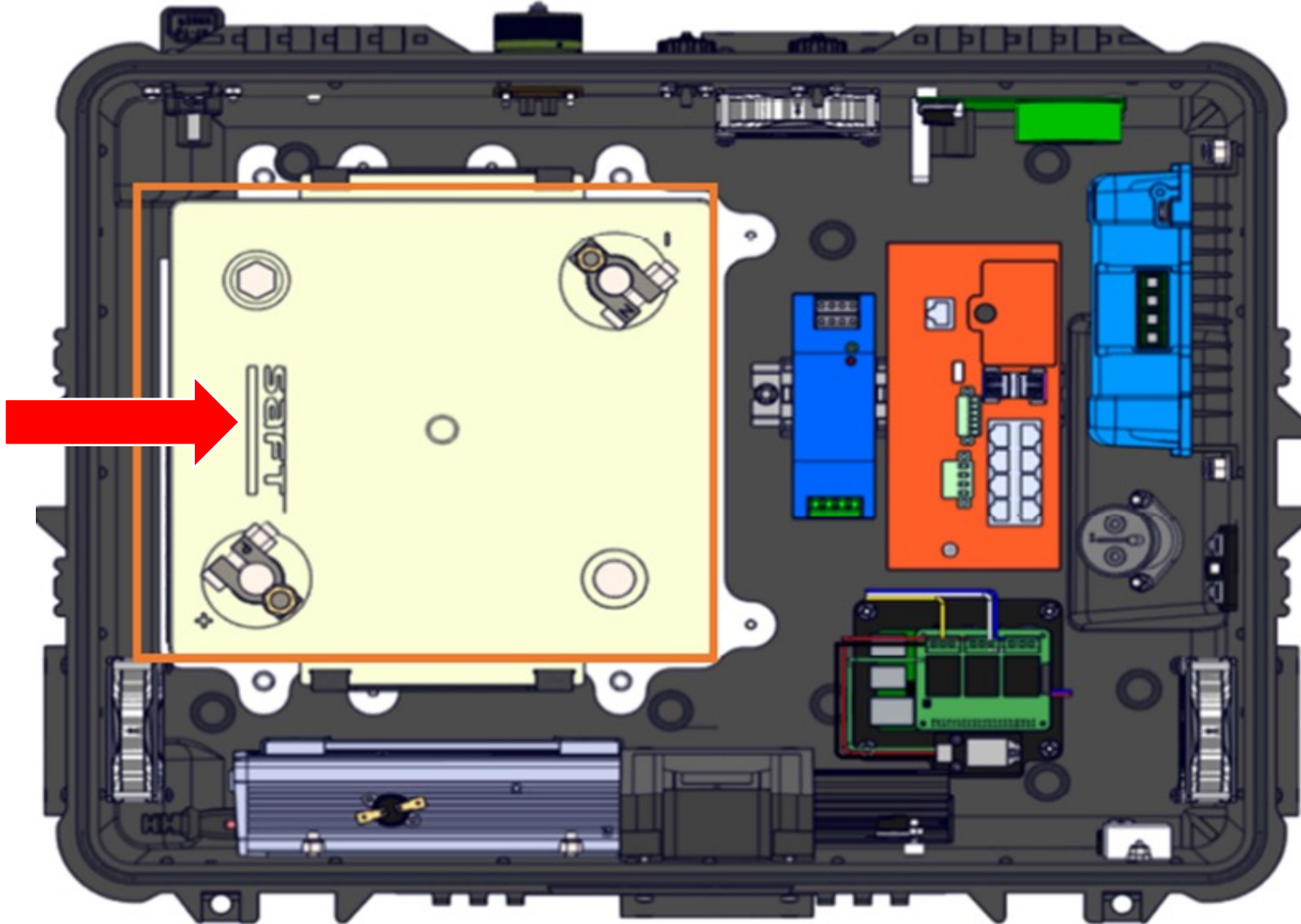


Preventive Maintenance and Care

General

- To minimize heat-related derating, shade the Power Module from direct sun.
- To reduce the potential for impact-related damage, do not drop the Power Module.
- To maintain health and longevity of internal battery, charge fully before storage or transport. Do not allow the SOC to drop below 20%.
- To maintain the coolest possible interior temperature, do not obstruct air vents and replace filters regularly.
- Keep the case lid closed when not in use to prevent water and dust intrusion.
- Keep connector covers closed when not in use to prevent water and dust intrusion.
- Check the integrity of electrical connectors before each deployment.

Battery Maintenance



Energy Storage Capacity
60 Ah, ~ 1650 Wh (@27.6 VDC)



Battery Maintenance Storage and Transportation The Rules:

- Charge battery to ~100% SOC before storage or transportation.
- Do not let the battery SOC drop below 20% during storage or transportation or any other time.
- The Battery Status Meter will display the battery SOC at the time when the BATTERY SWITCH was turned OFF not the current SOC when the battery is in storage.

Battery Maintenance

Charging Options

AC Power Charging: Connect the Power Module to AC grid power or a fuel-driven generator via the AC INPUT port. Toggle on the AC INPUT breaker located on the Faceplate.

Solar Power Charging: Connect the Solar Skirt to the Solar/Donor INPUT port. Place System in a location that provides optimum exposure to sun.

Donor Power Charging: Connect a Donor Power Module using a bayonet cable between the 24 VDC Donor OUTPUT port of the Donor Module and the Solar/Donor INPUT port on a separate receiver PGA Power Module.





Battery Maintenance

Storage and Transportation

In-storage SOC% Check and Charging Instructions

1. Toggle BATTERY switch to ON. (The battery status monitor continues to display the last-acquired values after the BATTERY switch has been turned on. It does NOT refresh automatically when the BATTERY switch is OFF.)
2. Wait for Battery Status Meter to refresh.
3. Note SOC%. If approaching 20% SOC, recharge to 100%. AC-power Charging is best option when in storage or prior to transport.
4. Keep a record stating date of last full charge.

Heat shortens battery lifespan

- The electrochemical reaction that discharges a battery continues even when the battery is turned OFF.
- Heat increases the rate of the electrochemical reaction; self-discharge is faster.

How frequently should you check SOC%? It depends on the storage temperature!

70 – 90 °F: Every 30 days

91 – 140 °F Every 7 days



Battery Maintenance

Normal Operating Parameters

Battery Charging

Battery Discharging

Battery issues when connecting two PGA Power Modules

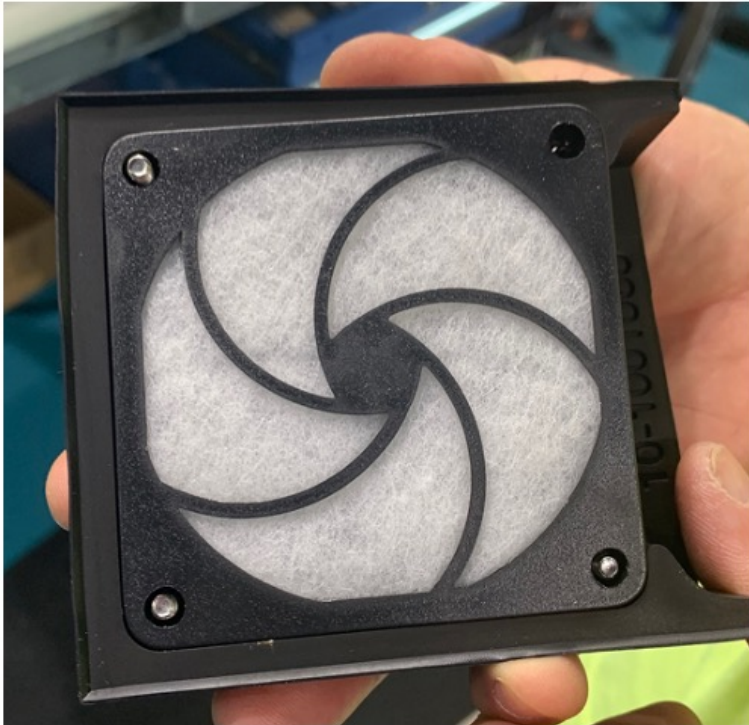
Important Specifications	
AC Input (Typical Operating Conditions)	3.2 A - 3.75 A (@115 VAC)
AC Input (Extreme Operating Conditions)	4.5 A (MAX @115 VAC; High Temp Environments)
Battery Undervoltage Protection	Low Voltage Cut Off (LVCO, 20% SOC) recharge modules within 48 hrs to prevent battery from entering LBCO Low Battery Cut Off (LBCO, approx 10% SOC) recharge modules within 24 hrs to prevent potential battery damage
Parallel Inter-Connect	Designed to connect two batteries together to double the capacity available to the System. Connection is intended between two modules at the same State of Charge (SOC). Connection can be made between two modules as long as the SOC difference between those two modules is not greater than 25%.



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Air Intake Filter Maintenance

Correct Filter Orientation



Incorrect Filter Orientation



Solar Panel Maintenance

Cleaning the Solar Panels



Clean panels = more free power



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PMCS Schedule

Item #	Item to be Inspected	Interval* at 91-140 °F (33-60 °C) Storage Temp	Interval* at 77-90 °F (≤ 25-32 °C) Storage Temp	Procedures	Non-mission Capable
1	Visual inspection of Power Module	Each time unit is packed up for transport or storage	Each time unit is packed up for transport or storage	<ol style="list-style-type: none"> Inspect case for visible damage and missing items. Clean excessive dust or dirt accumulation from the exterior and ports. Close all unused port covers. 	If the case is broken or split or if ports are damaged, contact Solar Stik Technical Support for advice on how to proceed.
2	In-storage maintenance charging	Weekly	Monthly	<ol style="list-style-type: none"> Toggle BATTERY switch to ON. Wait for Battery Status Meter to refresh. Note SOC%. If approaching 20% SOC, recharge immediately to 100%. Keep a written record that states date of last full charge for each Power Box. 	If the Power Module E Display indicates zero net charge after 48 hours of charging, contact Solar Stik Technical Support.
3	Check Vent Shrouds and Filters	Each time unit is packed up for transport or storage	Each time unit is packed up for transport or storage	<p>Visually examine vent shrouds to ensure they are properly seated and that they are not clogged with grass, dirt or other obstructive material.</p> <p>Remove vent shroud from air intakes, examine filters. If dirty, clean or replace.</p> <p>Filter part number 14-1000071</p>	If vent shroud and filter assembly are missing, the unit is NMC. Exposed fan blades pose a hazard to personnel; an unprotected vent may “inhale” debris that can damage the Power Module.
4	Clean Solar Panels	Each time unit is packed up for transport or storage	Each time unit is packed up for transport or storage	Use a water-dampened microfiber cloth or similar to wipe dust and debris from the panels taking care not to scratch the surface. Do not use cleaning agents such as soap, windex, vinegar or other organic solvents.	If a clean panel has no measurable output when exposed to full sun, the panel is NMC.



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PGA Power Module

Troubleshooting–Error Recovery



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PGA Power Module

Troubleshooting–Error Recovery

- **No 48 VDC from solar donor**
- **No AC charging**
- **Display not updating**
- **No power to PI**
- **AC LED ON but no current during charging**

