ROCKSOLAR

3000W 24V Off-Grid Solar System

1.2 kW Solar Array + 24V 200Ah LiFePO4 Battery Bank

System Item	Configuration
Inverter	3000W / 24V pure sine wave off-grid inverter with integrated MPPT charge controller
Solar Array	2 x 600W Philadelphia Solar panels = 1,200W total
PV String Configuration	ONE string of TWO panels connected in series (2S)
PV Cable	20 ft 10 AWG PV cable
Battery Bank	2 x 12V 200Ah LiFePO4 batteries connected in series = 24V 200Ah bank
Application	Cabins, RVs, cottages, remote properties and off-grid backup applications

CRITICAL PV WIRING The two supplied 600W Philadelphia Solar panels must be connected in SERIES as one 2-panel string (2S). Do not connect the two panels in parallel unless the system has been redesigned and approved.

CRITICAL BATTERY WIRING The two supplied 12V 200Ah LiFePO4 batteries must be connected in SERIES to create a 24V battery bank. Do not connect them in parallel for this 24V inverter system.

Installation and commissioning must be performed by qualified personnel.

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1. Introduction and Intended Use

Thank you for choosing the ROCKSOLAR 3000W 24V Off-Grid Solar System. This revised system configuration combines a 3000W 24V pure sine wave inverter with integrated MPPT solar charging, two 600W Philadelphia Solar modules, and two 12V 200Ah LiFePO4 batteries connected as a 24V battery bank.

The system is intended for off-grid cabins, RVs, cottages, workshops, remote properties, and backup-power applications where a compact 24V energy system is appropriate. Solar energy can supply connected loads and recharge the battery bank during daylight. Stored battery energy can supply loads when solar production is unavailable or insufficient. The inverter is generator-connection ready when installed according to its manufacturer instructions.

IMPORTANT This is a system-level user manual. It does not replace the current inverter, battery, solar-panel, or electrical-protection manufacturer manuals. If any instruction conflicts with the current component documentation or the requirements of the authority having jurisdiction (AHJ), follow the current component documentation and applicable code.

2. System Components

Component	Qty.	Description
Off-grid inverter	1	3000W, 24V pure sine wave inverter with integrated MPPT charge controller
Philadelphia Solar panel	2	600W each; 1,200W total array
LiFePO4 battery	2	12V 200Ah each; connected in series for 24V system voltage
PV cable	1 set	20 ft 10 AWG PV cable
Battery interconnect cable	As supplied	Used for the series connection between Battery 1 and Battery 2
Battery-to-inverter cable	As supplied	Use only appropriately rated cables for the 24V inverter current
Battery disconnect switch	1	Install in the battery circuit as designed
PV disconnect / protection	As supplied	Use the revised kit protection device(s) and ratings specified on the shipped equipment
Solar mounting hardware	As supplied / optional	Use only hardware suitable for the installation structure
User documentation	Included	Inverter, battery, panel and system instructions

CONFIGURATION NOTE Older product-page listings may show four 440W panels and 40 ft PV cable. This manual reflects the revised configuration specified for this system: 2 x 600W panels and 20 ft of 10 AWG PV cable.

3. System Specifications

Item	Specification
Rated inverter output	3,000 W
DC battery system	24V nominal class
AC waveform	Pure sine wave
Solar array	1,200 W total from 2 x 600W panels
PV string configuration	2 panels in series (2S), one string
Battery configuration	2 x 12V 200Ah batteries in series
Battery-bank capacity	24V, 200Ah nominal
Solar charging	Integrated MPPT charge controller
Generator connection	Supported when configured per inverter instructions

Exact inverter MPPT voltage/current limits, PV maximum input voltage, battery charge-current limits, AC output voltage/frequency, cable ampacity, breaker ratings, and torque values must be taken from the current component labels and manuals supplied with the equipment.

4. Safety Information

DANGER - ELECTRICAL SHOCK	PV conductors can remain energized whenever the solar panels are exposed to light. The battery bank can deliver very high fault current even when the inverter is switched off. Verify de-energization with properly rated test equipment before service.

- Installation, commissioning, service, and electrical modifications must be performed by qualified personnel.
- Use appropriate PPE, insulated tools, lockout/tagout procedures, and properly rated test instruments.
- Verify polarity before making any PV or battery connection.
- Provide grounding, bonding, disconnects, overcurrent protection, and conductor sizing required by code and manufacturer instructions.
- Do not bypass the battery BMS, inverter protections, or required disconnects.
- Do not work on damaged, swollen, leaking, flooded, or fire-exposed lithium batteries.
- Keep children and unauthorized persons away from electrical equipment.
- Do not install the inverter or batteries where standing water, corrosive vapours, uncontrolled heat, or mechanical impact are expected.

Fire and emergency conditions

If a battery thermal event, fire, heavy smoke, flooding, arcing, or severe equipment damage occurs, keep people away from the equipment and contact emergency services. Inform responders that the site contains a LiFePO4 battery energy-storage system.

5. System Architecture

The system uses one 2-panel PV series string feeding the inverter MPPT input, a 24V LiFePO4 battery bank made from two 12V batteries in series, and AC output from the 3000W inverter.

```
PV PANEL 1 (600W)  ->  PV PANEL 2 (600W)
       SERIES CONNECTION - ONE 2S PV STRING
                     |
          PV DISCONNECT / PROTECTION
                     |
        3000W / 24V INVERTER + MPPT
           |                    |
       AC LOADS          24V BATTERY BANK
                         Battery 1 + Battery 2
                         12V 200Ah + 12V 200Ah
                         SERIES = 24V 200Ah
```

SYSTEM RULE	PV panels are in series. Batteries are also in series. These are separate circuits: never connect the PV string directly to the battery bank.

6. Site Planning and Equipment Location

- Mount the inverter in a clean, dry, ventilated, accessible location on a solid non-combustible surface.
- Locate batteries on a stable surface with adequate protection from impact, water, direct heat and prolonged sunlight.
- Maintain manufacturer-required clearances around the inverter and batteries.
- Route PV and battery conductors to minimize mechanical damage and unnecessary voltage drop.
- Place disconnects where they remain accessible during an emergency.

- For rooftop arrays, confirm roof condition, attachment method, flashing, structural capacity and local wind/snow requirements.

7. Solar Array Installation

The revised array consists of two matching 600W Philadelphia Solar modules for a nominal 1.2 kW DC array. Install both modules in an unshaded location using racking approved for the roof or ground-mount structure.

- Use matching modules and keep both panels at similar orientation and tilt where practical.
- Inspect modules, junction boxes, leads and connectors for shipping damage before installation.
- Support PV conductors and keep them away from sharp edges, standing water and high-temperature surfaces.
- Use compatible PV connectors; do not mate incompatible connector brands or types.
- Do not walk on the solar panels or modify module frames.
- Before final wiring, verify each panel Voc, Vmp, Isc and Imp from the exact 600W module label/datasheet.

8. PV Wiring - Two 600W Panels in Series

REQUIRED CONFIGURATION	The two supplied 600W Philadelphia Solar panels must be connected as ONE string of TWO panels in SERIES (2S). Do not connect the two panels in parallel. Do not use Y-branch connectors for this specified one-string configuration.

```
PANEL 1 (600W)                      PANEL 2 (600W)
   (-) ------------------------------ remaining STRING (-)
   (+) -------- SERIES -------- (-)
                             (+) --- remaining STRING (+)

STRING (+) and STRING (-) -> 20 ft 10 AWG PV cable -> PV protection -> inverter PV input
```

8.1 Series connection procedure

1. Keep the PV disconnect/protection device open and the inverter PV input isolated.
2. Identify the positive (+) and negative (-) leads on both solar panels.
3. Connect Panel 1 positive (+) to Panel 2 negative (-). This creates the series link between the two modules.
4. The remaining Panel 1 negative (-) lead becomes the PV string negative conductor.
5. The remaining Panel 2 positive (+) lead becomes the PV string positive conductor.
6. Label the two end leads as STRING + and STRING -.
7. Using a properly rated DC meter, verify string polarity before connecting to the inverter.
8. Measure open-circuit voltage (Voc) of the complete 2-panel series string and verify it is within the current inverter MPPT/PV input limits under the coldest expected site temperature.
9. Route the string through the 20 ft 10 AWG PV cable and the specified PV disconnect/protection device to the inverter PV input.
10. Secure all connectors and terminals before energizing the PV circuit.

COLD-WEATHER CHECK	Solar-panel Voc increases as temperature falls. The installer must calculate maximum cold-weather string Voc using the exact 600W module temperature coefficient and verify the 2-panel string remains below the inverter maximum PV input voltage.

9. Battery Bank Wiring - Two 12V Batteries in Series

REQUIRED CONFIGURATION	The two supplied 12V 200Ah LiFePO4 batteries must be connected in SERIES to form a 24V 200Ah battery bank. Do not connect the batteries in parallel for this 24V inverter system.

```
BATTERY 1 - 12V 200Ah           BATTERY 2 - 12V 200Ah
Bank (-) -> [  -      + ] ---- [  -      + ] -> Bank (+)
                         SERIES LINK

Result: 24V nominal system voltage, 200Ah capacity
```

9.1 Battery connection procedure

11. Turn the inverter OFF. Isolate PV input and AC loads. Open the battery disconnect.
12. Confirm both batteries are matching 12V 200Ah LiFePO4 units approved for series operation.
13. Position the batteries so the series interconnect can be short, protected and mechanically secure.
14. Connect Battery 1 positive (+) to Battery 2 negative (-) using the supplied/approved battery interconnect cable.
15. The remaining Battery 1 negative (-) terminal becomes the 24V bank negative.
16. The remaining Battery 2 positive (+) terminal becomes the 24V bank positive.
17. Verify the complete bank voltage and polarity with a properly rated meter before connecting to the inverter.
18. Connect the battery bank to the inverter through the required battery disconnect and overcurrent protection using appropriately sized conductors.
19. Tighten battery and inverter terminals to the manufacturer-specified torque and install terminal covers where provided.

BATTERY SAFETY	Never short the battery terminals, reverse polarity, open the battery enclosure, bypass the BMS, or connect the two 12V batteries in parallel to this 24V inverter.

In a series battery connection, voltage adds while amp-hour capacity remains the same. Therefore, two 12V 200Ah batteries form a 24V 200Ah battery bank (nominal values).

10. AC Output and Generator Connection

The inverter converts energy from the 24V battery bank into pure sine wave AC power for connected loads. The exact AC output voltage, frequency, receptacle/terminal configuration, transfer behavior and generator-input requirements must be taken from the inverter label and current inverter manual.

- Use appropriately rated AC breakers, conductors, receptacles or load-panel equipment.
- Follow the inverter manual for neutral and grounding/bonding requirements.
- Never backfeed a utility circuit or generator receptacle through an unapproved connection.
- Before connecting a generator, verify generator voltage, frequency, grounding, capacity and waveform compatibility.
- Motors, pumps, refrigerators, air conditioners and compressors can have starting surges substantially higher than running power; confirm surge compatibility before use.

11. Initial Commissioning and Startup

Commissioning should be performed by the installer after all mechanical and electrical inspections are complete.

Pre-start checklist

- Inverter and batteries are securely mounted.
- Grounding and bonding are complete.
- PV array contains exactly 2 x 600W panels connected in series.
- PV string polarity and open-circuit voltage have been verified.
- 20 ft 10 AWG PV cable is correctly routed and protected.
- Battery 1 and Battery 2 are connected in series to create a 24V bank.
- Battery-bank polarity and voltage have been verified.
- Battery disconnect and required overcurrent protection are installed.
- AC wiring and generator input wiring (if used) have been verified.
- Inverter battery type and charge settings are correct for LiFePO4.
- All covers, cable glands, terminal guards and labels are secure.

Typical startup sequence

Use the exact sequence in the current inverter and battery manuals. A typical controlled sequence is: battery bank ON -> inverter ON -> verify/configure battery and charging settings -> enable AC source/generator if used -> enable PV input -> energize AC loads gradually.

12. Normal Operation and Energy Flow

Operating condition	Typical behavior
Sunny daytime	Solar energy can support loads and recharge the battery bank subject to inverter settings and available sunlight.
Cloudy / high-load periods	Available solar and battery energy may work together to serve the load.
Night operation	Battery energy supplies loads until the configured low-voltage/SOC threshold is reached.
Low battery	A connected generator may support loads and/or charging when configured and permitted by the inverter.
Full battery / low load	The MPPT controller limits charging and manages available PV energy according to its programmed settings.

Load management

A 3000W inverter can support many cabin, RV and small-home loads, but simultaneous demand matters. High-surge appliances may exceed inverter capability even when their normal running power appears acceptable. Stagger larger loads whenever practical.

13. Monitoring and User Controls

Use the inverter display and controls described in the current inverter manual to review operating status, charging source, battery voltage, load level and alarms. If the inverter model supports external or remote monitoring, follow the monitoring accessory instructions supplied with the system.

- Review battery condition before adding large discretionary loads.
- Watch for unusual drops in solar charging that may indicate shading, snow, an open PV disconnect, a connector issue or incorrect PV voltage.
- Investigate repeated fault codes rather than repeatedly resetting the inverter.

- Limit changes to battery-charge, protection and transfer settings to qualified personnel or users familiar with the manufacturer requirements.

14. Controlled Shutdown and Emergency Shutdown

Controlled shutdown

Follow the exact current component procedure. A typical controlled shutdown is: reduce/disconnect major AC loads -> disable generator/AC input if used -> open the PV disconnect/protection device -> switch the inverter off -> open the battery disconnect.

ENERGY MAY REMAIN PRESENT	Turning off the inverter does not make PV wiring or battery conductors inherently safe. Solar panels can remain energized in daylight and batteries retain stored energy.

Emergency shutdown

If there is fire, smoke, severe overheating, flooding, arcing, exposed conductors, or damaged battery equipment, do not approach or touch the equipment. Keep people away, evacuate the immediate area as needed, and contact emergency services. If safe to do so from an accessible disconnect location, isolate AC loads, PV input and the battery bank.

15. Routine Maintenance

Interval	Recommended check
Monthly	Review inverter/battery status, alarms and solar-charging trends. Check that inverter ventilation openings are unobstructed.
Every 3-6 months	Visually inspect accessible PV cables, connectors, disconnects, battery cases and mounting hardware for damage, corrosion, moisture or overheating.
Seasonally	Manage snow, vegetation and shading using methods that do not damage solar panels or wiring.
Annually	Have a qualified technician inspect electrical terminations, protection devices, grounding/bonding, battery condition, cable integrity and system performance.

Solar-panel cleaning

Clean modules only when necessary using clean water and soft, non-abrasive materials. Do not walk on modules, use metal scrapers, or use cleaning methods that can damage glass, frames, seals or cables.

16. Troubleshooting

Condition	Possible cause	Recommended action
Inverter will not start	Battery bank isolated/depleted or incorrect 24V connection	Check battery disconnect, measured bank voltage, polarity and inverter

Condition	Possible cause	Recommended action
		power controls.
No solar charging	PV disconnect open, inadequate sunlight or PV wiring issue	Confirm daylight, PV disconnect status and measured 2-panel string voltage. Have a qualified technician check the PV circuit.
PV input alarm	Incorrect polarity, excessive/insufficient PV voltage, connector or insulation issue	Open PV disconnect and have the installer verify polarity, string Voc, cold-weather design voltage and connectors.
Battery not charging	Battery setting, protection or temperature issue	Verify LiFePO4 charge settings, battery BMS status, battery temperature and available PV/generator source.
Frequent low battery	Loads too high or solar production insufficient	Reduce loads, verify both panels are producing and evaluate additional storage/generation if needed.
Overload trip	Load or motor starting surge exceeds inverter capability	Disconnect nonessential loads and assess high-surge appliances.
Repeated fault code	Persistent system or component condition	Record the exact fault code and operating condition, then contact ROCKSOLAR support or a qualified installer.

17. System Expansion and Changes

Any change to PV panel count, series-string length, battery voltage, battery count, inverter size, generator capacity or AC distribution must be reviewed before installation.

- Do not add another panel to the 2-panel series string without recalculating maximum cold-weather Voc and confirming the inverter MPPT operating window.
- Do not convert the two-panel PV array to parallel wiring without a new PV current/protection design.
- Do not add another 12V battery in series; that would change the bank voltage from 24V to 36V and may damage the inverter.
- Additional battery capacity at 24V requires a manufacturer-approved 24V battery-bank design; do not improvise series/parallel arrangements.
- Any inverter or AC-distribution upgrade requires appropriate protection, conductor sizing and commissioning.

18. Technical Support and Commissioning Checklist

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When requesting support, have the order number, inverter model/serial number, battery serial numbers, fault code, photos of the installation, and measured battery/PV string voltages available when safely obtainable.

Commissioning Item	Initial / Date
Equipment mounting complete	
Grounding and bonding verified	
AC conductors and breakers verified	
Battery interconnect and battery-to-inverter cables verified	
Battery 1 + Battery 2 series connection verified	
24V battery-bank polarity and voltage recorded	
PV Panel 1 + Panel 2 series connection verified	
PV string polarity and Voc recorded	
20 ft 10 AWG PV cable installed and protected	
PV disconnect/protection labelled	
Inverter LiFePO4 battery settings confirmed	
Generator settings confirmed if used	
Customer startup/shutdown orientation completed	

Source basis and configuration notice

This manual is based on the ROCKSOLAR 3000W 24V off-grid system product family and the revised configuration specified for this document: 2 x 600W Philadelphia Solar panels connected in series, 20 ft 10 AWG PV cable, and 2 x 12V 200Ah LiFePO4 batteries connected in series for a 24V battery bank. Some older/current product-page content may show a different panel count or PV cable length. For numeric electrical limits and installation details not reproduced here, use the exact component labels and latest manufacturer manuals supplied with the revised kit.