

ROCKSOLAR

12 kW Premium Whole-Home Off-Grid Solar System

10.56 kW Solar Array + 20 kWh LiFePO4 Energy Storage

Inverter	Growatt SPE 12000US
AC Output	12,000 W, 120/240 VAC split-phase
Solar Array	24 x 440 W bifacial panels = 10,560 W
Battery Storage	4 x 5 kWh Growatt ALP LV-US = 20 kWh total
PV String Configuration	THREE strings of EIGHT panels in series (8S + 8S + 8S)

CRITICAL PV WIRING

The 24 supplied solar panels are configured as three separate 8-panel series strings. Each string must contain exactly 8 panels in series. Do not connect all 24 panels in one series string. Do not use unequal string lengths. The three strings must be landed on the inverter PV inputs only in a configuration verified against the current Growatt SPE 12000US manual and input-current limits.

System-level operating and installation guidance. This manual does not replace the current Growatt inverter, battery, solar-module, electrical-code, or local authority requirements.

ROCKSOLAR USA

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1. Introduction and Intended Use

Thank you for choosing the ROCKSOLAR 12 kW Premium whole-home off-grid solar system. This package combines a Growatt SPE 12000US split-phase inverter, a 24-panel 10.56 kW bifacial solar array, and a 20 kWh Growatt ALP LV-US lithium battery bank. It is intended for off-grid homes, large cabins, rural properties, workshops, and backup-power applications where 120/240 VAC split-phase output is required.

The inverter supports solar, battery, grid, and generator energy sources and includes dual MPPT tracking and smart monitoring. The system should be installed and commissioned by qualified personnel familiar with photovoltaic systems, lithium batteries, split-phase electrical distribution, and applicable Canadian electrical requirements.

Important This manual is a system-level guide. Always follow the latest component manuals and the requirements of the authority having jurisdiction (AHJ). If any instruction conflicts with the current manufacturer documentation or electrical code, follow the current manufacturer documentation and applicable code.

2. System Components

Item	Specification
Inverter	1 x Growatt SPE 12000US, 12 kW split-phase off-grid inverter
Solar panels	24 x 440 W bifacial monocrystalline solar panels
Battery storage	4 x Growatt ALP LV-US 5 kWh 48 V LiFePO4 battery modules (20 kWh total)
Monitoring	1 x Wi-Fi monitoring module
PV cable	3 x sets of 40 ft 10 AWG PV-to-inverter cable
Battery cable	1 x set of 10 ft 2 AWG battery-to-inverter cable
PV protection	3 x 600 V / 20 A DC circuit breakers
Breaker enclosure	1 x circuit breaker box
Mounting	Solar mounting rack may be optional depending on package configuration
Documentation	Inverter, battery, and solar-panel manufacturer manuals

3. System Specifications

System-level ratings below are based on the current ROCKSOLAR product configuration.

Item	Specification
Rated inverter output	12,000 W continuous
AC output	120/240 VAC split-phase
Battery system	48 V class; Growatt ALP modules are approximately 51.2 V nominal each
Battery energy	20 kWh nominal total from 4 x 5 kWh modules

Item	Specification
Solar array	10,560 W total from 24 x 440 W panels
PV tracking	Dual MPPT
Power waveform	Pure sine wave
Supported sources	Solar, battery, grid, and generator
Monitoring	Wi-Fi/GPRS capable
Parallel expansion	Product literature indicates support for up to 6 compatible inverter units

Actual operating limits, charge/discharge currents, MPPT voltage windows, and breaker sizing must be taken from the current Growatt inverter and battery documentation supplied with the equipment.

4. Safety Information

DANGER - ELECTRICAL SHOCK

PV conductors can remain energized whenever modules are exposed to light. Batteries can deliver very high fault current even when the inverter is off. Verify de-energization with suitable 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 work on damaged, swollen, leaking, flooded, or fire-exposed batteries.
- Do not bypass the battery BMS, inverter protections, or required DC disconnects.
- Keep children and unauthorized persons away from electrical equipment.
- Do not install the battery or inverter where standing water, corrosive vapours, or excessive heat are expected.

Fire and emergency conditions

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

5. System Architecture

The system uses three independent 8-panel PV strings, a Growatt SPE 12000US inverter with dual MPPT tracking, a 48 V-class lithium battery bank, and 120/240 VAC split-phase output. Each PV string is protected separately before connection to the inverter PV input terminals. Final allocation of the three strings across the inverter dual MPPT inputs must follow the current Growatt wiring diagram and input-current limits.

PV String 1 8 x 440 W in series	600 VDC / 20 A breaker	Growatt SPE 12000US 12 kW split-phase inverter	120/240 VAC Loads
PV String 2 8 x 440 W in series	600 VDC / 20 A breaker	Dual MPPT PV inputs per Growatt manual	Grid / Generator Input when configured
PV String 3 8 x 440 W in series	600 VDC / 20 A breaker	48 V Battery Bank 4 x 5 kWh ALP modules	20 kWh Storage

6. Site Planning and Equipment Location

Before installation, confirm that the site can safely support the solar array, inverter, batteries, disconnects, and electrical distribution equipment. Consider structural loading, snow and wind exposure, service clearances, fire access, cable routing, drainage, and future maintenance access.

- Mount the inverter on a solid surface in a dry, ventilated, accessible location.
- Keep battery modules in a clean, dry area protected from impact and prolonged direct sunlight.
- Provide manufacturer-required clearances around the inverter and batteries.
- Route DC and AC conductors to minimize physical damage and unnecessary voltage drop.

- Do not place disconnects where they are inaccessible during an emergency.
- For rooftop arrays, confirm roof condition, attachment method, flashing, structural capacity, and local snow/wind design requirements.

7. Solar Array Installation

The array consists of 24 matching 440 W bifacial modules for a nominal 10.56 kW DC array (marketed as a 10,000 W-class array on the ROCKSOLAR product page). Panels should be installed in an unshaded location and mounted using hardware approved for the roof or ground-mount structure.

Bifacial modules can generate additional energy from reflected light reaching the rear surface. Maintain appropriate rear clearance and avoid placing opaque materials directly against the rear active area when the mounting design permits.

Before wiring, inspect every module and connector for transport damage, cracked glass, loose junction boxes, damaged leads, or contaminated connector contacts.

8. PV Wiring - Three 8-Panel Series Strings

REQUIRED CONFIGURATION

The 24 supplied panels must be arranged as THREE separate strings of EIGHT panels in series: String 1 = 8S, String 2 = 8S, and String 3 = 8S. Each string is routed through its own 600 VDC / 20 A DC breaker before connection to the inverter PV inputs. Final allocation of the three strings across the inverter dual MPPT inputs must follow the current Growatt SPE 12000US manual and input-current limits.

Do not connect all 24 panels in one continuous series string. Do not create unequal string lengths such as 7 + 8 + 9 or 10 + 7 + 7. Do not alter the string design without approval from ROCKSOLAR or a qualified solar designer who has checked the current inverter and module electrical limits.

STRING 1 - 8 PANELS IN SERIES

P1 -> P2 -> P3 -> P4 -> P5 -> P6 -> P7 -> P8
Remaining string leads: STRING 1 (+) and STRING 1 (-)
-> 600 VDC / 20 A DC Breaker 1 -> Inverter PV Input

STRING 2 - 8 PANELS IN SERIES

P9 -> P10 -> P11 -> P12 -> P13 -> P14 -> P15 -> P16
Remaining string leads: STRING 2 (+) and STRING 2 (-)
-> 600 VDC / 20 A DC Breaker 2 -> Inverter PV Input

STRING 3 - 8 PANELS IN SERIES

P17 -> P18 -> P19 -> P20 -> P21 -> P22 -> P23 -> P24
Remaining string leads: STRING 3 (+) and STRING 3 (-)
-> 600 VDC / 20 A DC Breaker 3 -> Inverter PV Input

IMPORTANT: The SPE 12000US has dual MPP trackers. Allocate the three protected strings across the available PV input terminals only as shown in the current Growatt wiring diagram and within the published per-input/MPPT current limits.

Series-string connection method

- Connect the positive lead of Panel 1 to the negative lead of Panel 2, then continue through Panel 8. The two unconnected end leads become String 1 positive and String 1 negative.
- Repeat the same series method for Panels 9 through 16 to create String 2.
- Repeat the same series method for Panels 17 through 24 to create String 3.
- Route each complete 8-panel string through its own 600 VDC / 20 A DC breaker/disconnect circuit.
- Connect the three protected string outputs to the inverter PV input terminals exactly as shown in the current Growatt SPE 12000US wiring diagram. Do not assume one string per MPPT because the

inverter has dual MPP trackers while this kit uses three PV strings.

- Before energizing, measure and record polarity and open-circuit voltage of each string with a properly rated meter.
- Confirm each string is within the inverter input limits under the coldest expected site temperature using the solar module temperature coefficient.
- Do not connect or disconnect PV connectors under load unless the connector system and procedure specifically permit it.

Installer Verification	The product page confirms a dual-MPPT inverter and three PV breaker circuits. The exact MPPT voltage/current limits and the panel Voc/Vmp/Isc/Imp values must be verified against the current component datasheets before energization.
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9. Battery Installation and Communication

The standard 20 kWh configuration uses four Growatt ALP LV-US 5 kWh LiFePO4 modules. The modules form a 48 V-class battery bank and must be connected using the battery manufacturer-approved parallel, power, grounding, and communication arrangement.

The battery BMS protects the cells and communicates operating limits and state information to the inverter. Correct communication setup is essential for coordinated charging and discharging.

- Install all battery modules on a stable floor or approved wall/floor mounting system.
- Keep battery modules switched off while making power and communication connections.
- Confirm all four modules are the same compatible model and firmware family unless the manufacturer explicitly allows otherwise.
- Use the approved battery bus, interconnect cables, fusing/disconnects, and CAN/communication cabling specified by Growatt.
- Verify battery polarity before connecting to the inverter.
- Do not mix incompatible battery chemistries or nominal voltages on the same inverter battery bus.
- After power wiring is complete, configure the master/slave or addressing arrangement exactly as required by the current ALP manual.

Battery Safety	Never short battery terminals, reverse polarity, open the battery enclosure, bypass the BMS, or work on energized battery conductors without appropriate controls.
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10. AC Output, Grid and Generator Connections

The SPE 12000US provides 120/240 VAC split-phase output suitable for whole-home distribution when installed correctly. The inverter also supports AC input from grid or a compatible generator when the system is designed for auxiliary charging, bypass, or backup operation.

- Use a properly rated split-phase load panel or transfer arrangement designed by a qualified electrician.
- Keep neutral and grounding/bonding arrangements consistent with the current inverter manual and applicable electrical code.
- Provide appropriately sized AC overcurrent protection and disconnecting means.
- Confirm generator voltage, frequency, grounding, and waveform compatibility before connection.
- Do not backfeed a utility service or generator receptacle through an unapproved connection.

- Large motors, pumps, compressors, electric heating, EV charging, and other high-demand loads must be considered in system sizing and load management.

11. Initial Commissioning and Startup

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

Pre-start checklist

- All equipment is securely mounted and service clearances are maintained.
- Grounding and bonding are complete.
- All AC and DC conductors are correctly sized, protected, torqued, and labelled.
- PV String 1 contains exactly 8 panels in series and is connected through its designated PV breaker.
- PV String 2 contains exactly 8 panels in series and is connected through its designated PV breaker.
- PV String 3 contains exactly 8 panels in series and is connected through its designated PV breaker.
- All three PV string polarities and open-circuit voltages have been verified and recorded.
- Battery polarity, communication wiring, module addressing, and battery disconnects are correct.
- AC output, utility input, and generator input wiring (if used) have been verified.
- Inverter battery type and charging parameters match the installed Growatt battery system.

Typical startup sequence

Follow the current Growatt manuals for the exact sequence. A typical controlled commissioning sequence is: Battery system ON -> inverter ON -> configure battery/BMS communication -> enable AC source if used -> enable PV Strings 1, 2, and 3 -> energize AC loads gradually.

12. Normal Operation and Energy Flow

Once commissioned, the inverter automatically manages solar generation, battery charging/discharging, connected loads, and any configured grid or generator source according to the selected operating priorities.

Item	Specification
Sunny daytime	Solar typically supplies loads first and may charge the battery with surplus energy, depending on settings.
Cloudy / high-load periods	Solar and battery may work together to support the load.
Night operation	Battery supplies loads until the configured reserve or low-SOC threshold is reached.
Low battery	Configured grid or generator input may support loads and/or charge the battery.
Full battery / low load	The inverter limits charging and manages available PV power according to system settings.

Load management

A 12 kW inverter can power substantial household loads, but simultaneous demand still matters. Electric water heaters, ranges, dryers, space heating, large pumps, EV chargers, welders, and compressors can quickly use available capacity. Staggering major loads can improve runtime and reduce nuisance overloads.

13. Monitoring and User Controls

The included Wi-Fi monitoring module can be used to view operating information such as solar production, battery state of charge, load demand, operating mode, and alarms. Follow the current Growatt monitoring-module instructions for app/account setup and network pairing.

- Review battery state of charge before adding large discretionary loads.
- Watch for unusual drops in PV production that may indicate shading, snow, a tripped breaker, or a string issue.
- Investigate repeated inverter or battery warnings rather than repeatedly resetting the equipment.
- Keep firmware updates and configuration changes under the control of qualified personnel when they affect charging or protection settings.

14. Controlled Shutdown and Emergency Shutdown

Controlled shutdown

Use the exact sequence required by the current Growatt manuals. A typical controlled shutdown is: reduce/disconnect major AC loads -> disable grid/generator input if used -> open all three PV DC breakers/disconnects -> switch the inverter off -> isolate the battery system.

Emergency

If there is fire, smoke, severe overheating, flooding, arcing, or damaged battery equipment, do not approach or touch the equipment. Evacuate the immediate area as needed and contact emergency services.

Turning the inverter off does not make PV wiring or batteries inherently safe. PV strings can remain energized in daylight, and batteries retain stored energy.

15. Routine Maintenance

Item	Specification
Monthly	Review inverter/battery status, alarms, and production trends. Check that ventilation openings are unobstructed.
Every 3-6 months	Visually inspect accessible PV wiring, connectors, conduit, disconnects, battery enclosures, and mounting hardware for damage, corrosion, moisture, or overheating.
Seasonally	Remove shading vegetation where permitted. Manage snow accumulation using safe methods that do not damage modules.
Annually	Have a qualified technician inspect electrical terminations, breaker/disconnect condition, grounding/bonding, battery condition, fault history, and system performance.

Solar-module cleaning

Use clean water and non-abrasive materials when cleaning is necessary. Do not walk on modules, use metal scrapers, or use cleaning methods that could damage glass, frames, seals, or cables.

16. Troubleshooting

Item	Specification
Inverter will not start	Check battery disconnect/status, battery voltage, and inverter power controls. Contact installer if the battery/BMS does not initialize.
No solar charging	Confirm all three PV breakers are on, daylight is adequate, and the inverter shows PV voltage. A qualified technician should test each string separately.
Reduced PV power	One 8-panel string, breaker, PV input, or connection may be unavailable. Compare all three string/PV input readings where monitoring allows.
PV input alarm	Open all three PV disconnects and have the installer verify string polarity, voltage, cold-weather design voltage, connectors, and insulation.
Battery not charging	Check BMS communication, battery state, temperature, inverter charge settings, and available solar/AC charging source.
Frequent low battery	Reduce loads, adjust operating strategy, confirm all three PV strings are producing, or evaluate additional storage/generation.
Overload trip	Reduce simultaneous loads and identify high-starting-current equipment.
240 V load not operating	Have a qualified electrician verify split-phase output, breaker panel wiring, and load circuit.
Wi-Fi offline	Check internet/router status, module power, pairing, and monitoring configuration.
Repeated fault code	Record the exact code and operating conditions, then contact ROCKSOLAR support or a qualified installer. Do not repeatedly reset a persistent fault.

17. Expansion and System Changes

The inverter platform and battery system are designed to support expansion within manufacturer limits. Any change to the number of panels, PV string length, battery modules, inverter count, generator size, or AC distribution must be engineered before installation.

- Do not add panels to any 8-panel string without recalculating maximum cold-weather Voc and confirming current inverter limits.
- Do not create unequal MPPT strings unless the design is specifically approved.
- Additional batteries must be compatible with the existing battery system and configured according to the current Growatt battery manual.
- Parallel inverter expansion requires compatible units, communications, protection, conductor sizing, and commissioning procedures.
- Electrical permits and inspections may be required for system modifications.

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, screenshots of monitoring data, and PV string measurements available.

Commissioning Item	Initial / Date
Equipment mounting complete	
Grounding and bonding verified	
AC conductors and breakers verified	
Battery power wiring verified	
Battery BMS communication verified	
String 1 = exactly 10 panels in series	
String 1 polarity and Voc recorded	
String 2 = exactly 10 panels in series	
String 2 polarity and Voc recorded	
String 1 connected to designated MPPT/PV input	
String 2 connected to designated MPPT/PV input	
PV breakers/disconnects labelled	
Inverter battery profile confirmed	
Grid/generator settings confirmed if used	
Monitoring paired and operating	
Customer startup/shutdown orientation completed	

Source basis

This manual is based on the current ROCKSOLAR 12 kW premium off-grid system configuration: Growatt SPE 12000US inverter, 24 x 440 W panels, 4 x Growatt ALP LV-US 5 kWh batteries, dual MPP tracking, three sets of PV cable, three 600 V / 20 A DC circuit breakers, and the accessories listed on the ROCKSOLAR product page. The three-string, 8-panels-per-string PV configuration is specified by ROCKSOLAR for this manual. For numeric electrical limits and installation details not reproduced here, use the latest manufacturer datasheets and user manuals supplied with the kit.