**1. Introduction to JéGO Commercial and Industrial BESS**

This user manual provides comprehensive technical support for the JéGO 1.5MWh\_500kW\_420kWp Commercial and Industrial Battery Energy Storage System (BESS).

**1.1 Overview**

Our commercial and industrial BESS is composed of a high-performance energy storage battery, a PCS with digital control technology, intelligent hot and cold air conditioning, a perfluorohexanone fire protection system, and a high-speed on-off grid switching system. The system adopts three-level control technology to efficiently improve power quality. An isolation transformer is integrated inside the microgrid control cabinet, providing strong load adaptability.

**1.2 Features**

The BESS incorporates the following features:

* Full digital voltage and current double closed-loop control with advanced SPWM technology, outputting a pure sine wave.
* Two output modes: grid bypass and inverter output, with uninterrupted power supply function.
* Accepts grid dispatch via RS485, CAN, and other communication methods.
* Reactive power compensation function.
* Black start function.
* LCD screen design displaying system operation mode and status.
* Full automatic temperature control system.
* 105% long-term overload capacity.
* Cabin-level perfluorohexanone fire protection system.
* Supports peak shaving and valley filling, self-use mode, battery priority mode, and manual mode.
* Supports high-speed on-grid and off-grid switching, ensuring normal use of load-side electrical appliances during grid power-off.
* Complete short-circuit protection, over-voltage protection, overload protection, and overcurrent protection.

**1.3 General Introduction of BESS Components**

A complete BESS consists of the following parts:

* **Battery system:** Uses 3.2V314Ah high-energy density lithium iron phosphate batteries. 12 packs of 64V 314A (20S1P) battery modules are connected in series to form a 768V 314Ah battery cluster. The battery energy storage system comprises 5 clusters of 768V314Ah. The BMS adopts a three-level architecture for comprehensive battery management.
* **Inverter system:** Features modular converter design for flexible layout, convenient installation, and easy maintenance. Can be operated individually or in parallel.
* **Thermal management system:** Includes 2 sets of 10kW industrial air conditioners with strong environmental adaptability and heating function, ensuring the battery system operates in a suitable environment.
* **Fire protection system:** Offers cabin-level detection, real-time monitoring of cabinet temperature, smoke, CO, combustible gas, and other parameters.
* **EMS (Energy Management System):** Exchanges information with BMS, PCS, air conditioning, fire protection, water immersion, temperature, and other equipment/instruments, dispatching the system's equipment according to customer working conditions.
* **On&off-grid system:** Realizes working mode switching function of the SPCS system through intelligent control of the static switch module.
* **Photovoltaic control module:** Utilizes MPPT (maximum power point tracking) technology to extract maximum power from the photovoltaic array, ensuring maximum utilization of solar energy.

**1.4 Technical Specifications**

|  |  |  |
| --- | --- | --- |
| **Items** | **Parameter** | **Remark** |
| **Battery Parameter** |  |  |
| Battery Type | LFP, 3.2V314Ah |  |
| Battery Module | 64V314Ah, 20.096kWh |  |
| Battery Cluster | 768V 314Ah (240S1P) |  |
| Battery Cluster Rated Energy | 241.152kWh |  |
| Battery System Rated Energy | 1.5MWh |  |
| Rated Voltage | 768V |  |
| Voltage Range | 696-852Vdc | Cell: 2.9-3.55Vdc |
| Charge&Discharge Rate | ≤0.5C |  |
| Rated Charge&Discharge Current | 785A |  |
| DOD | 95% |  |
| BMS COM. Port | CAN, RS485, Ethernet |  |
| Fire Protection System | Perfluorohexanone |  |
| AC Side Active Power | 500KW |  |
| AC Side Max. Power | 550kVA |  |
| Grid Rated Frequency | 50/60Hz |  |
| PV Voltage MPPT | 250VDC-850VDC |  |
| PV Power | 420KW |  |
| Total Weight | 1900$\pm$100KG | (include the container) |
| Dimensions | L6058×W2438×H2896mm |  |
| Operating Temperature Range | −20∼+55∘C | (>45°C derating) |
| Working Humidity Range | 0-95% (Non-condensing) |  |
| Max. Operating Altitude | 4000m | (> 2000m derating) |
| Cooling Method | Battery: Air Cooling; Inverter: Natural Cooling |  |
| Communication Interface | RS485, Ethernet |  |
| Communication Protocol | Modbus RTU, Modbus TCP, IEC104 |  |
| Standards and certificates | GB/T 34120, IEC62477, EN61000, EN62116 |  |

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**2. Safety Information**

**2.1 Personal Safety**

This product contains high voltage, and unauthorized personnel should not open the system due to electric shock risk. Installation and debugging must be performed by company-authorized technicians to avoid product failure or personal injury. Read the manual and safety precautions thoroughly before installation and use. This product cannot be used as a power source for life support equipment. Do not place the battery in fire, as it may explode.

**2.2 Battery Safety**

* If stored or unused for long periods, the battery must be in a dry, clean, and specified temperature range environment. The device should be connected to the power grid for charging within three months.
* The product must be used in a suitable working environment, avoiding high altitude, extreme temperatures, humidity, conductive dust, corrosive gases, salt spray, flammable gases, vibration, collision-prone areas, heat sources, or strong electromagnetic interference.

**2.3 Disclaimer**

The company is not responsible for defects or failures due to: exceeding product usage scope/environment, unauthorized modification/repair, incorrect installation, improper operation, force majeure, or other violations of the product manual.

**2.4 Safety Matters**

This manual covers installation, use, and maintenance of the commercial and industrial BESS. Read carefully to ensure proper procedures. The company is not responsible for problems arising from violations of these safety precautions.

**Danger Warnings**

* Do not expose the product to fire or heat.
* Do not immerse in water or wet with liquids.
* Do not puncture the battery shell, hammer, or step on the product.
* Disassembly is prohibited due to non-safe internal voltage.
* Do not disassemble the battery.
* Do not hit, throw, or subject to mechanical vibration.
* Do not connect input and output incorrectly.
* Do not short-circuit positive and negative poles or insert metal objects into air inlet.
* The 380/400VAC output exceeds human safe voltage and can cause electric shock.

**Warning Messages**

* Battery discharge temperature range is −20∘C to 50∘C, and charging is 5∘C to 50∘C. Do not use outside this range.
* Air conditioning heating activates below 15∘C, decreasing system efficiency.
* Strictly forbidden to use above 50∘C.
* Shell temperature increases significantly during operation; do not touch.
* Built-in battery pack is for this device only.
* AC input/output parameters must meet technical requirements.
* External electrical connections must be reliable and firm, with tightened screws to prevent energy loss or safety problems.

**Precautions**

* Contact after-sales service if the product malfunctions.
* Do not use if damaged during transport (broken shell, electrolyte gas smell/leakage).
* Do not use if it emits odor, deforms, changes color, or has any other abnormal phenomenon. If in use, immediately turn off power.
* If electrolyte enters eyes, rinse with clean water or seek medical help immediately; do not wipe.
* If electrolyte gets on skin or clothes, wash immediately with running water to prevent skin inflammation.
* This warning sign indicates a situation that could result in personal injury/death.
* Read all instructions carefully before using the energy storage system.

**3. Hybrid Inverter Working Modes**

The hybrid inverter working mode can be set on the touchscreen. Users can select the working mode via "Operation Mode" in "Menu" → "System" → "DC/AC Parameter Setting".

**3.1 Self-Generated and Self-Use Mode**

* When PV power > load power, excess power charges battery; if fully charged, remaining power feeds to grid or PV controller limits power.
* When PV power < load power, PV and battery supply power to load simultaneously.

**3.2 Battery Charging Priority Mode**

* PV generated power prioritizes battery charging; excess power powers the load; remaining power feeds to grid.
* If PV generated power is insufficient to charge battery and power load simultaneously, the grid charges battery and powers the load at the same time.
* When PV is disconnected or on a cloudy day, the grid charges the battery and powers the load simultaneously.

**3.3 Optimal Mode**

* When PV generated power is sufficient, PV will power the load and battery simultaneously; remaining power feeds to grid.
* When PV generated power is insufficient, PV charges battery and powers load with priority; the grid supplements power to the load.
* If PV generated power is insufficient, PV charges battery with priority. If load power < AC side setting power, AC side powers the load, and the grid charges the battery.
* If PV generated power is insufficient and load power > AC side setting power, AC side available power powers the load, and PV supplements insufficient energy; if PV is insufficient, the battery powers the load.
* When PV is disconnected or on a cloudy day and load power < AC side setting power, the grid charges the battery and powers the load simultaneously. AC side powers the load, and the grid charges the battery.
* When PV is disconnected or on a cloudy day and load power > AC side setting power, the grid charges the battery and powers the load simultaneously. AC side and the battery power the load simultaneously.

**3.4 Hybrid Mode**

The "hybrid mode" primarily functions as follows:

* **Economic mode:**
  + **Peak period:** Executes "self-generation and self-use" mode, and the battery powers the load.
  + **Flat period:** Executes "self-generation and self-use" mode, and the power grid powers the load.
  + **Valley period:** Executes "battery priority" mode, where the power grid charges the battery and powers the load simultaneously.
* **Peak shaving and valley filling:** Controls battery charging and discharging based on positive (discharge) and negative (charge) set power values. Can also control generator start/stop by selecting "generator action".
* **Anti-backflow function:** If enabled, the system will not supply power to the grid in self-generated and self-used, peak load shifting, or battery priority modes; it can only be used in the microgrid area.
* **Transformer protection:** When the transformer is running at high load, the energy storage system automatically reduces charging power or stops charging to avoid overload (requires gateway meter installation).

**4. EMS Scheduling Mode**

In EMS dispatching mode, customers can program the operating status of the battery energy storage system for 24 hours based on the actual application scenario of the photovoltaic and battery storage system. This programming control allows setting battery charging and discharging times, effectively improving battery cycle efficiency. It helps users buy low and sell high by leveraging local peak-valley electricity price differences. During battery charging periods, PV generated power prioritizes charging the battery. When EMS is automatically controlled, the BESS has an anti-reverse flow function when discharging.

**4.1 Schedule Time Table Setting**

Users can edit charging and discharging period strategies through the solar energy storage cloud platform and remotely send them to the local dispatching management machine for implementation. This ensures operation even if network failure causes disconnection between the cloud platform and the dispatching management machine.

**Setting Steps:**

1. Log in to the Solar Storage Cloud Platform.
2. Go to "Device Management" and click the scheduling management machine node in the device tree.
3. Click "Add Schedule" to add charging and discharging period definitions; a period definition window will pop up.
4. Enter the time period, corresponding charging/discharging action, execution cycle, unit (seconds), and electricity price. Click "OK" to add the strategy.
5. After all time period definitions are complete, click "Send schedule table" to send the strategy to the scheduling management machine for execution.
6. To activate EMS automatic control mode, ensure the hybrid inverter menu is set to "Manual mode: remote control" and the EMS controller's Scheduling switch is "ON".

**Parameter Description:**

|  |  |
| --- | --- |
| **Parameter name** | **Related instructions** |
| Name | Fill in a meaningful time period name (e.g., battery charging) |
| Time period | Separated by colons in hours, minutes, and seconds (e.g., 07:00:10--10:00:00). Composed of a start and end time |
| Action | Select the action from a drop-down list (e.g., charging, resting, energy storage system discharge) |
| Scheduling power | Unit: kW. Positive value indicates battery discharge; negative value indicates battery charging. This value is critical, ensure symbol is correct |
| Action type | Single execution or periodic execution. Single execution runs once; periodic execution runs once per cycle second |
| Period (seconds) | Controls the execution cycle of the instruction for this time period (e.g., send an instruction every x seconds) |
| Electricity price | The electricity price corresponding to this time period, used for revenue statistics |
| Billing attributes | Peak, highest peak, valley, and flat. Unit price must be consistent for the same billing attribute to avoid command failure |

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**Remarks on Scheduling:**

* Each policy modification requires remotely restarting the scheduling management machine to take effect.
* If the scheduling switch is off, the set schedule will not take effect.
* Time periods can be modified or deleted using the tool button for maintenance.
* Scheduling time parameters are only editable via PC background or APP to ensure consistency; local EMS is for Browse only.

**5. Mechanical Installation Instructions**

**5.1 Safety Warning**

* Leave sufficient space around the ESS for heat dissipation.
* At least two professionals must install this product, complying with local electrical installation standards.
* Set up a safety sign "Under construction, do not close the switch" at the upstream switch.
* The energy storage system contains batteries; non-professionals are not allowed to open or operate it.
* Wear insulating gloves, and ensure installation tools are well insulated.

**5.2 Installation Process**

The installation process follows these steps:

1. Begin
2. Pre-installation preparation
3. Mechanical installation
4. Electrical installation
5. Installation completion inspection
6. Trial run testing
7. End

**5.3 Preparation: Installation Tools**

Installation tools include:

* Screwdriver
* Wire cutters
* Electrical tape
* Multimeter
* Socket Tool Set
* Electric drill

**5.4 Installation Environment Requirements**

| No. | Items | Condition | | :-- | :------ | :-------------------------- | | 1. | Temperature | −20∼+50∘C | | 2. | Humidity | 0-95% (No condensation) | | 3. | Altitude | <4000m (>2000m Derating) | | | | Stay away from electromagnetic radiation sources | | | | Stay away from radioactive and flammable materials | | | | Stay away from dust, oil, water, etc. |

**5.5 Transportation Requirements**

When hoisting the BESS cabinet, use hoisting equipment or cranes matching the BESS weight to avoid danger. The total weight of the BESS (including container) is 19.2T.

**5.6 Installation Space Requirements**

* Avoid direct sunlight, excessive humidity, high heat sources, strong magnetic fields, and corrosive gas.
* Ensure the equipment is well grounded, with grounding resistance <4$\Omega$.
* Ensure the installation ground is flat and has good bearing capacity; reinforce the foundation if necessary.
* Ensure maintenance space before and after equipment is >1.1m.
* Outdoor installation is recommended to use the bottom outlet of the equipment and trench routing to protect cables from damage.

**6. Electrical Installation Instructions**

**6.1 Cable Requirements**

The AC input/output power is 500kW, and PV max. input power is 600kW.

* Current carrying capacity of 1mm2 copper cable conductors should not exceed 3A.
* Communication cables should use 22AWG cables.
* Current carrying capacity of 1mm2 copper conductors for low-voltage weak-point power supply cables is recommended to be no more than 8A.
* Cable design must consider local installation specifications, laying methods, and climatic conditions.

**Recommended Cable Specifications:**

| No. | Items | Phase line (Each phase) | Neutral Wire | Ground wire | | :-- | :---------- | :-------------------------- | :----------- | :---------- | | 1. | Grid Input | ≥185mm2∗3 | ≥185mm2 | ≥95mm2 | | 2. | Load Output | ≥185mm2∗3 | ≥185mm2 | ≥95mm2 | | 3. | PV | ≥50mm2∗10 | | |

**6.2 Terminal Connection**

Use the terminal connection method to ensure firm locking of cables, terminals, and copper bars. Terminal size should match outer diameter of cables.

* **A:** Copper busbar
* **B:** Terminal
* **C:** Screws
* **D:** Spring pad
* **E:** Large flat pad
* **F:** Nut

**6.3 Wiring Specifications**

Lay communication cables and power cables separately, with distance >300mm. When crossing, maintain a 90° angle. When parallel, maintain a certain distance.

**Wiring Distance (Communication Line and Power Line):**

| No. | Parallel line length (m) | Minimum space distance (m) | | :-- | :----------------------- | :--------------------------- | | 1. | 200 | 0.3 | | 2. | 300 | 0.5 | | 3. | 500 | 1.2 |

Shielded twisted pair cables are recommended for communication, with outer shield grounded.

**6.4 Cable Fixing**

Ensure fastening screws have sufficient torque to prevent loosening, poor contact, heating, or fire.

**Screw Torque:**

| Screw type | M4 | M5 | M6 | M8 | M10 | M12 | M14 | M16 | | :--------- | :- | :-- | :- | :-- | :--- | :--- | :--- | :--- | | Torque (N.m) | 2 | 3.2 | 7 | 16 | 34 | 46 | 58 | 68 |

**6.5 Cable Protection**

* **Communication cables:** Easily broken; recommended to connect power cable first, then communication. Use cable trough or cable ties for fixing. Avoid heating components and strong electric field circuit cables.
* **Power cables:** Avoid scratches/damage to insulation during installation to prevent short circuits. Must be properly fixed.

**6.6 Hybrid Inverter Switch Baffle Removal & Bottle Baffle Installation**

Remove the four screws on the switch baffle to remove it and begin wiring. Open the front door as shown in Fig.3-1. The power terminal for battery energy inverters allows M8/M10/M12 screws after baffle removal. Check external terminal connection material; use special copper and aluminum connectors if materials differ.

**6.7 DC Wiring**

1. Verify all inverter terminals are powered off with a multimeter.
2. Identify and mark positive and negative cable poles.
3. Connect battery pack positive and negative poles to "BAT+" and "BAT-" terminals.
4. Connect PV positive and negative poles to "PV+" and "PV-" terminals.

* **Danger:** Wiring must be done without electricity. DC switch must be off, and multimeter used to confirm DC side wiring is not live.
* **Warning:** DC input voltage must not exceed 850VDC; exceeding this limit can damage the inverter, and such damage is not covered by quality assurance.

**6.8 AC Side Wiring**

1. Confirm all terminals are powered off using a multimeter.
2. Confirm cable phase sequence and mark them (A,B,C,N with yellow, green, red, black insulation).
3. Connect grid phases A, B, and C correctly according to Table 3-5.
4. Connect load phases A, B, and C correctly according to Table 3-6.

**Grid Connection:**

| | | | :---------------- | :---------------- | | A | Connect Grid Phase A | | B | Connect Grid Phase B | | C | Connect Grid Phase C | | N | Connect Grid Phase N |

**Load Connection:**

| | | | :--------------- | :-------------- | | A | Connect Load phase A | | B | Connect Load phase B | | C | Connect Load phase C | | N | Connect Load phase N |

**6.9 System Grounding**

The grounding copper busbar needs to be reliably connected with the grounding cable. It is already connected to the hybrid inverter casing in the container. Connect it to the equipotential bonding device at the installation site or electrical control room. Resistance must be ≤4Ω, and grounding cable diameter ≥16mm2.

**6.10 Installation Completion**

After all mechanical and electrical installations are complete, reinstall the removed switch baffle and bottom enclosure of the hybrid inverter. Power-on operation is allowed only after confirmation.

**7. Trial Operation**

**7.1 Inspection Before Operation**

Before commissioning, conduct a thorough inspection of the equipment installation, especially checking DC and AC voltages, polarity, and phase sequence. Verify all connections meet standards and the system is well grounded. Grounding resistance is crucial for safety and must meet requirements before the first trial operation.

* **Caution:** Ensure all AC side switches are disconnected before operation.

**Inspection Steps:**

1. **Check hybrid inverter:** Inspect installation and wiring per Chapter 3. Ensure all AC and DC circuit breakers are disconnected.
2. **Check AC side voltage:** Verify correct three-phase connection to the power grid. Check if phase and line voltages are within range and record values. Measure total harmonic distortion (THD) if possible; severe distortion may prevent inverter operation.
3. **Check DC side voltage:** Ensure correct input polarity for each battery pack connected to the battery inverter and each PV group connected to MPPT.
   * **Warning:** Battery side voltage must not exceed 850V. PV side must not exceed 1000V. Voltage deviation >3% may indicate load fluctuation, cable damage, or loose cables.
4. **Check other content:** Confirm all connections are per Chapter 3, protective shield is installed, emergency shutdown button is released, and AC/DC circuit breakers are "OFF". Verify AC/DC side voltages meet starting conditions and no overvoltage danger exists. Ensure cabinet door is closed and key is secured.
   * **Warning:** For long downtime inverters, conduct a thorough check of all indicators before starting.

**7.2 Start-Up Operation**

After all conditions are met, the hybrid inverter can be turned on.

1. Ensure correct DC and AC side wiring.
2. Turn on AC and DC circuit breaker switches.
3. Turn on lightning protection switch KS, then KB1, KB2, KB3.
4. On touchscreen: Click "Menu" → "DC/DC converter on" (until screen displays "MPPT"); then click "DC/AC converter on" (until screen displays "charge or discharge the inverter").
5. After normal startup, check machine status via touchscreen.
6. Close cabinet door and secure key.

**Detailed Startup Steps:**

1. **PV Input:** Confirm photovoltaic input, turn on PV input switches QDC1-QDC5. Monitor screen will start if black. (Measure each photovoltaic channel to prevent short circuit).
2. **Battery System:** Power on the battery system.
3. **DC Contactor:** After PV input and battery are on, the DC contactor will close, and the PV controller status on the monitoring interface will change from "off" to "converter x standby".
4. **KS Switch:** Open cabinet door, turn on KS, wait ~30 seconds for battery voltage data to display.
5. **Alarm Check:** Verify no red alarm signal in the upper right corner before proceeding.
6. **MPPT Turn On:** Click "Menu" → "Power On/Off" → "DCDC Converter On". PV controller status changes from "Standby" to "Inverter XMPPT", indicating normal operation.
7. **BESS Turn On:** Click Battery inverter "Menu" → "Switch" → "DCAC Converter On". DC contactor will close, converter will soft start, then AC contactor will close. Converter status will change to "Converter Off-Grid Discharge", "Converter Grid Charging", or "Converter Grid Discharge", indicating normal operation.

**7.3 Turn Off Process**

**7.3.1 Normal Shutdown**

For normal maintenance or overhaul, follow these steps:

1. Turn off all external loads powered from the hybrid inverter.
2. On battery inverter touchscreen: Click "menu" → "DCDC converter off", then "DCAC Converter Off".
3. After AC contactor disconnects and touchscreen displays "Converter off", manually disconnect DC side circuit breaker or load switch to "OFF".
4. Disconnect converter fan switch, auxiliary power switch, and lightning protection switch.
5. Disconnect converter AC side circuit breaker to "OFF".
6. Wait for busbar capacitor to discharge completely, touchscreen to go off, and energy storage converter to shut down.
   * **Warning:** When the machine is working normally, strictly forbidden to disconnect the circuit breaker directly to avoid dangerous arc damage or inverter damage.

**Detailed Hybrid Inverter Shutdown Steps:**

1. **MPPT Controller:** Click "Menu" → "Switch" → "DCDC Converter Off". PV controller status changes from "Converter XMPPT" to "standby".
2. **Battery Inverter:** Click "Menu" → "Switch" → "DCAC Converter Off". AC contactor disconnects, converter status changes to "Converter closed". Hybrid inverter stops working.

**7.3.2 Emergency/Failure Shutdown**

In case of emergency or failure:

1. Press the emergency shutdown button "EPO".
2. Disconnect the machine's DC side circuit breaker or load switch, and AC side circuit breaker.
3. Reset the EPO button after confirming danger/fault is removed and operation is needed.
   * **Warning:** Emergency shutdown button is only for machine failure or emergency. For normal shutdown, use touchscreen instructions. In crisis, press EPO directly for prompt response.

**7.3.3 Maintenance Bypass Use**

The maintenance bypass circuit breaker (MAINTENANCE) is normally off. It is used to ensure the load remains powered (if grid electricity is available) during inverter overhaul or fault. After enabling bypass, connect diesel generator or grid to the load.

* **Specific Operation Steps:**
  1. Confirm diesel generator is normal or grid has electricity.
  2. Turn off DCAC, DCDC per 4.3.1.
  3. Disconnect PV switch and DC switch (QDC).
  4. Turn off hybrid inverter, remove baffle plate on maintenance bypass circuit breaker.
  5. Turn on maintenance bypass → "Disconnect Grid Switch" → "Disconnect load switch".
* **Remark:** After maintenance/fault recovery, turn on "grid switch", then "load switch". Screen will show "on GRID" (grid connection successful); then disconnect maintenance bypass switch. Install maintenance bypass baffle for normal hybrid inverter use.

**8. Hybrid Inverter Touch Screen Introduction**

**8.1 Hybrid Inverter Basic Information**

**8.1.1 Indicator Status:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Indicator** | **Function** | **Status** | **Description** |
| **BESS Introduction** |  |  |  |
| **B1. Overview** | This commercial and industrial battery energy storage system is composed of high-performance energy storage battery, PCS with digital control technology, intelligent hot and cold air conditioning, perfluorohexanone fire protection system and high-speed on-off grid switching system. The system adopts three-level control technology to efficiently improve the power quality. At the same time, the isolation transformer is integrated inside the microgrid control cabinet, which has strong load adaptability. |  |  |
| **1.2. Features** | It adopts full digital voltage and current double closed-loop control, advanced SPWM technology, and outputs pure sine wave. It has two output modes: grid bypass and inverter output, and has uninterrupted power supply function. It can accept grid dispatch, including RS485, CAN and other communication methods. It has reactive power compensation function. It has black start function. LCD screen design, display system operation mode and operation status. It has full automatic temperature control system. It has 105% long-term overload capacity. It adopts cabin-level perfluorohexanone fire protection system. It supports peak shaving and valley filling, self-use mode, battery priority mode, and manual mode. It supports high-speed on-grid and off-grid switching. When the grid is powered off, it does not affect the normal use of load-side electrical appliances. It has complete short-circuit protection, over-voltage protection, overload protection, overcurrent protection, etc. |  |  |
| **1.3. General Introduction of BESS Components** | A complete BESS consists of the following parts: 1. Battery system: The battery system uses 3.2V314Ah high-energy density lithium iron phosphate batteries. 12 pks 64V 314A (20S1P) battery modules are connected in series to form a 768V 314Ah battery cluster. The battery energy storage system consists of 5 clusters of 768V314Ah. The BMS adopts a three-level architecture to achieve comprehensive management of the battery. 2. Inverter system: Modular converter design, featured with flexible layout, convenient installation and convenient maintenance. It can be operated individually or in parallel to form a small energy storage system. 3. Thermal management system: 2 sets10kW industrial air conditioners with strong environmental adaptability, wall-mounted installation, and heating function, can ensure that the battery system always works in a suitable environment. 4. Fire protection system: Cabin-level detection, real-time monitoring of cabinet temperature, smoke, CO, combustible gas and other parameters. 5. EMS: EMS exchanges information with BMS, PCS, air conditioning, fire protection, water immersion, temperature and other equipment/instruments, and dispatches the equipment in the system according to customer working conditions. 6. On&off-grid system: Through intelligent control of the static switch module, the working mode switching function of the SPCS system can be realized. 7. Photovoltaic control module: Using MPPT (maximum power point tracking) technology, the maximum power is extracted from the photovoltaic array to ensure maximum utilization of solar energy. |  |  |
| **1.4 Technical Specifications** | \* **Battery Parameter**: Battery Type: LFP, 3.2V314Ah; Battery Module: 64V314Ah, 20.096kWh; Battery Cluster: 768V 314Ah (240S1P); Battery Cluster Rated Energy: 241.152kWh; Battery System Rated Energy: 1.5MWh; Rated Voltage: 768V; Voltage Range: 696-852Vdc (Cell: 2.9-3.55Vdc); Charge&Discharge Rate: ≤0.5C; Rated Charge&Discharge Current: 785A; DOD: 95%; BMS COM. Port: CAN, RS485, Ethernet. \* **Fire Protection System**: Perfluorohexanone. \* **AC Side Active Power**: 500KW. \* **AC Side Max. Power**: 550kVA. \* **Grid Rated Frequency**: 50/60Hz. \* **PV Voltage MPPT**: 250VDC-850VDC. \* **PV Power**: 420KW. \* **Total Weight**: 1900$\pm$100KG (include the container). \* **Dimensions**: L6058×W2438×H2896mm. \* **Operating Temperature Range**: −20∼+55∘C (>45∘C derating). \* **Working Humidity Range**: 0-95% (Non-condensing). \* **Max. Operating Altitude**: 4000m (>2000m derating). \* **Cooling Method**: Battery: Air Cooling; Inverter: Natural Cooling. \* **Communication Interface**: RS485, Ethernet. \* **Communication Protocol**: Modbus RTU, Modbus TCP, IEC104. \* **Standards and certificates**: GB/T 34120, IEC62477, EN61000, EN62116. |  |  |
| **2. Safety Information** |  |  |  |
| **2.1 Personal Safety** | This product contains high voltage inside. Unauthorized personnel or technicians not authorized by the company should not open the system, as there is a risk of electric shock. This product must be installed and debugged by technicians authorized by the company, otherwise it may cause product failure or endanger personal safety. Before installing and using this product, be sure to read the manual and safety precautions in detail, otherwise it may cause product failure or endanger personal safety. This product cannot be used as a power source for any life support equipment. Do not place the battery of this product in fire, as it may explode and endanger personal safety. |  |  |
| **2.2 Battery Safety** | If the battery is stored or not used for a long time, the product must be placed in a dry, clean, and specified temperature range environment. The device should be connected to the power grid for charging within three months. This product should be used in a suitable working environment and should not be used in the following working environments: Places with high altitude, high temperature, low temperature, or humidity beyond the technical specifications of the product; Places with conductive dust, corrosive gases, salt spray, or flammable gases; Places with vibration or prone to collision; Places close to heat sources or with strong electromagnetic field interference. |  |  |
| **2.3 Disclaimer** | We are not responsible for defects or failures caused by the following reasons: Beyond the scope of use and working environment specified for the product; Unauthorized modification or repair, incorrect installation, and improper operation; Force majeure; Other matters violating the provisions of this product manual. |  |  |
| **2.4 Safety Matters** | This manual covers the installation and use of commercial and industrial battery energy storage system. The manual must be read carefully before installation, use, and maintenance. Please read the following safety precautions carefully before use to ensure proper installation, use, and maintenance. The company will not be responsible for any problems arising from violations of the following matters. |  |  |
| **2.4.1 Danger Warnings** | Do not expose the product to fire or heat it; Do not immerse the product in water or wet it with liquids such as seawater, beverages, etc.; Do not use or store the product near heat sources (such as fire or heaters); Do not puncture the built-in battery shell with nails or other sharp objects, and do not hammer or step on the product; The product contains non-safe voltage inside, and disassembly is prohibited to avoid personal injury; Do not disassemble the battery in any way; Do not use the product in fire or extremely hot conditions; Do not hit, throw, or subject the product to mechanical vibration; Do not connect the input and output of the product incorrectly; Do not short-circuit the positive and negative poles of the battery output, and do not insert iron wires, wires, or other metal objects into the product's air inlet; The rated output voltage of the product is 380/400VAC, which exceeds the safe voltage that the human body can withstand. Human contact may cause electric shock. |  |  |
| **2.4.2 Warning Messages** | The battery discharge temperature range is −20∘C to 50∘C and the charging temperature range is 5∘C to 50∘C. Please do not use this products when its temperature is exceed the temperature range. It will activate the air conditioning heating function when the environment is below 15∘C which will cause the system efficiency to be decreased; It is strictly forbidden to use this product when the environment temperature is higher than 50∘C; When the product is working, the shell temperature will increase significantly, please do not touch it; The built-in battery pack is only used on this device and should not be used for other purposes; The AC input/output parameters should meet the technical requirements of this product; When this product is connected to the outside electrical connection, the electrical connection points must be in reliable and firm contact, and the screws must be tightened, otherwise energy loss will be caused due to poor contact, which may cause safety problems in serious cases. |  |  |
| **2.4.3 Precautions** | If the product does not work properly, please contact after-sales service in time; If the product is damaged by impact or other reasons during transportation, if any abnormal characteristics of the product are found, such as broken shell, smell of electrolyte gas, electrolyte leakage, etc., the product must not be used; If the product emits odor, deforms, changes color or has any other abnormal phenomenon, it must not be used; if the product is in use, it should be stopped by turning off the power immediately; If the battery leaks and the electrolyte accidentally enters the eyes, do not wipe it, rinse with clean water or seek medical help immediately. If not handled in time the eyes will be damaged; If the battery leaks and the electrolyte gets on the skin or clothes, immediately, wash the affected area with running water, otherwise it may cause skin inflammation. This warning sign indicates a situation that could result in personal injury/death. Thank you for purchasing our energy storage system. Before using this product, please read the relevant information carefully and follow all instructions completely. |  |  |
| **3. Hybrid Inverter Working Modes** | The hybrid inverter working mode can be set on the touchscreen. The user can select the working mode according to different needs by clicking the "Operation Mode" in the "Menu" → "System" → "DC/AC Parameter Setting" (The below is for your reference) |  |  |
| **3.1 Self-Generated and Self-Use Mode** | The PV generated power the load priority. When the PV power > the load power, the excess power will charge the battery, if the battery is fully charged, the remaining power will feed to grid or the PV controller will limit the power. The PV generated power the load priority. When the PV power < the load power, the PV and the battery supply power to the load at the same time. |  |  |
| **3.2 Battery Charging Priority Mode** | The PV generated power charge the battery priority, the excess power will power the load. The remaining power will feed to grid. The PV generated power is not enough to charge battery and power the load at same time, the grid charge the battery and power the load at the same time. When PV disconnected or cloudy day, the grid charge the battery and power the load at the same time. |  |  |
| **3.3 Optimal Mode** | When the PV generated power is enough, PV will power the load and battery at the same time. And the remaining power will feed to grid. When the PV generated power is not enough, PV will charge battery and power the load priority. And the grid will power the load at the same. When the PV generated power is not enough, PV will charge battery priority. If the load power < AC side setting power value. AC side will power the load, and the grid will charge battery. When the PV generated power is not enough, and the load power > AC side setting power value. AC side available power will power the load, and PV will supplement the remaining insufficient energy; if the energy supplemented by PV is insufficient, the battery will power the load. When PV disconnected or cloudy day and load power < AC side setting power value, the grid charge the battery and power the load at the same time. AC side will power the load, and the grid will charge battery. When PV disconnected or cloudy day and load power > AC side setting power value, the grid charge the battery and power the load at the same time. AC side and the battery will power the load at the same time. |  |  |
| **3.4 Hybrid Mode** | The "hybrid mode" mainly has the following functions: 1. Economic mode. a. Peak period: execute the "self-generation and self-use" mode, and the battery power the load. b. Flat period: execute the "self-generation and self-use" mode, and the power grid power the load. c. Valley period: execute the "battery priority" mode, the power grid charges the battery and power the load at the same time. 2. Peak shaving and valley filling: control the charging and discharging the battery according to the positive and negative (positive discharge and negative charge) of the set power value. Secondly, you can control the start/stop of the generator by selecting "generator action"." Notice! If the anti-backflow function is set to be enabled, the system will not supply power to the grid once it enters the three working modes of self-generated and self-used, peak load shifting, and battery priority. |  |  |
| **4. EMS Scheduling Mode** | In addition to the hybrid inverter have its own working mode, there is also an EMS dispatching mode. In this mode, customers can program the operating status of the battery energy storage system for 24 hours according to the actual application scenario of the photovoltaic and battery storage system. Through programming control, customers can set the battery charging and discharging time which can effectively improve the battery cycle efficiency. Make full use the user's local peak-valley price difference of electricity, the grid charge the battery when the electricity price is cheap. The battery energy feed to the grid when the electricity price is expensive; during the battery charging period, PV generated power charge the battery priority. It mainly achieve that users expect to buy low, sell high and capture the difference. When EMS is automatically controlled, the battery energy storage system has an anti-reverse flow function when discharging. When the anti-reverse flow is turned on, it will not be allowed to sell electricity to the grid, and it can only be used in the microgrid area. When charging, the energy storage system can also protect the transformer. When the transformer is running at high load, it automatically reduces the charging power or stops charging to avoid transformer overload (Note: the anti-reverse flow protection function and transformer protection function require the installation of a gateway meter to take effect). |  |  |
| **4.1 Schedule Time Table Setting** | Users can edit charging and discharging period strategies through the solar energy storage cloud platform and remotely send them to the local dispatching management machine which will implement its control. Even if a network failure causes a disconnection between the cloud platform and the dispatching management machine, it will not affect the operation of the battery energy storage system. |  |  |
| **4.1.1 Setting Steps** | \* Select control mode: set Enter hybrid inverter menu-1.System 2.Mode, Set manual mode: remote control 4. Enter EMS controller, Scheduling switch: Set to ON then execute. EMS automatic control mode takes effect. \* Log in Solar Storage Cloud Platform. \* Device Management, click the scheduling management machine node. \* Add Schedule to add the charging and discharging period definition, and the following period definition window will pop up. \* Enter the time period and the corresponding charging and discharging action, execution cycle, unit (seconds), corresponding electricity price, click the "OK" button, and add a period control strategy. \* When all time period definitions are completed, click Step 4. Send schedule table to send the strategy to the scheduling management machine for execution. |  |  |
| **4.1.2 Parameter Description** | \* **Name**: Fill in a meaningful time period name according to your needs. For example: battery charging. \* **Time period**: The time period is separated by colons in hours, minutes and seconds to represent a moment, and a time period is composed of a start time and an end time, such as 07:00:10--10:00:00. \* **Action**: You can select the action to be performed by the energy storage system from the drop-down list, such as charging, resting, energy storage system discharge, etc.. \* **Scheduling power**: Unit: kW, positive discharge and negative charge, that is, positive value indicates battery discharge, negative value indicates battery charging, this value is very critical, don't get the symbol wrong. \* **Action type**: Single execution or periodic execution, if it is a single execution, the action defined later is executed once, if periodic execution is selected, the instruction is executed once per cycle second. \* **Period (seconds)**: Control the execution cycle of the instruction corresponding to this time period, that is, send an instruction every how many seconds. \* **Electricity price**: The electricity price corresponding to this time period is used for revenue statistics. \* **Billing attributes**: Peak, highest peak, valley, and flat, the same billing attribute, the unit price needs to be set consistent, otherwise the command will fail to be issued. |  |  |
| **4.1.3 Remarks on Scheduling** | \* Each time a policy is modified and issued, you need to remotely restart the scheduling management machine make it effective. \* If the scheduling switch of the scheduling management machine is turned off, the set scheduling schedule will not take effect. \* Click the tool button Step 5 on the right side of each time period to modify and delete the added time period for later maintenance and modification of the scheduling schedule. \* To ensure the consistency of the scheduling time parameters in the background and the scheduling management machine, the scheduling time table is only allowed to be edited, modified and issued through the PC background or APP. The local EMS can only be browsed but not edited. |  |  |
| **5. Mechanical Installation Instructions** |  |  |  |
| **5.1 Safety Warning** | During installation, be sure to leave enough space around the ESS for better heat dissipation; At least two professionals must be present to install this product at the same time, and all electrical installations must comply with local electrical installation standards; During installation, a safety sign "Under construction, do not close the switch" must be set up at the upstream switch; The energy storage system contains batteries, so non-professionals are not allowed to open and operate it. Please wear insulating gloves, and the installation tools must be well insulated. |  |  |
| **5.2 Installation Process** | The installation process is as follows: Begin → Pre-installation preparation → Mechanical installation → Electrical installation → Installation completion inspection → Trail run testing → End. |  |  |
| **5.3 Preparation: Installation Tools** | Installation tools list: Screwdriver, Wire cutters, Electrical tape, Multimeter, Socket Tool Set, Electric drill. |  |  |
| **5.4 Installation Environment Requirements** | \* **Temperature**: −20∼+50∘C |  |  |