qapasity

BETTER ENERGY STORAGE

qapasity - Arctic Series

User Manual version 1.2

Index

Notes:

A Swedish Quick Guide is available on Senergias website for convenience. However, in case of discrepancies or uncertainties, this English manual shall prevail.

Update history.

Version	Change history	Author	Update date
1.0		Erik Lindström	2025-06-10
1.1	* Add description of battery heating function in section 2.2. * Add description of CAN-interfaces in section 4.4.2.2.	Erik Lindström	2025-08-29
1.2	* Section 4.1 changed distance to 500 meter for coastal areas (salt water)	Erik Lindström	2025-09-02

1. Safety

1.1 General safety

Statement

When installing, operating and maintaining the device, please read this manual first, and follow the signs on the device and all safety precautions in the manual. The "instructions", "precautions", "warnings" and "dangers" in the manual do not represent all safety precautions that should be observed but only serve as a supplement to all safety precautions. The company does not assume any responsibility for violating the general safety operation requirements or the safety standards for design, production and use of the device.

The device shall be used in an environment that meets the requirements of design specifications, otherwise it may cause device failure, and the resulting device function abnormality or component damage, personal safety accident, property loss, etc. are not within the scope of device quality assurance.

The installation, operation and maintenance of the device shall comply with local laws, regulations and specifications. The safety precautions in the manual are only a supplement to local laws, regulations and specifications.

The Company shall not be liable for any of the following circumstances.

- Do not operate under the service conditions described in this manual.
- The installation and user environment do not comply with the provisions of relevant international or national and regional standards.
- Unauthorized disassembly, change of product or modification of software code.
- Failing to operate according to the operating instructions and safety warnings in the product and documents.
- Device damage caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, flood, debris flow, etc.).
- Transportation damage caused by customer's own transportation.
- Damage caused by storage conditions that do not meet the requirements of product documents. λ Damage to device hardware or data due to customer negligence, improper operation or intentional damage.
- System damage caused by third parties or customers, including handling and installation that do not meet the requirements of this manual, and damage caused by adjustment, change or removal of identification marks that do not meet the requirements of this manual.

There are several safety marks in the Manual. The detailed explanation is as follows:

Symbol	Description
	Indicates a hazard with a high level of risk which. if not avoided, will result in death or serious injury.
	This instruction indicates a potential hazard during operation. Failure to comply with this warning may result in personal injury or death.
	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results.
	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	The battery system must be disposed of at a proper facility for environmentally safe recycling.
	Do not dispose of the battery together with household waste.
	Read the enclosed documentation.
	Keep the battery system away from children
	Keep the battery system away from open flames or ignition sources.
	Caution, risk of danger
	Caution, risk of electric shock.
	Protect the location of the ground wire.

General requirements

Please standardize the operation:

- It is strictly prohibited to install, use and operate outdoor devices and cables (including but not limited to handling the device, operating the device and cables, plugging and connecting to outdoor signal interface, working at height, outdoor installation, etc.) in bad weather such as lightning, rain, snow, and gale 6.
- Please observe the warning signs, warnings and protective measures on the device.
- Please follow the requirements of this manual, use the correct tools, and master the correct use of tools.
- It is forbidden to carry out installation, wiring, maintenance and replacement with power.
- Do not wash the device with water.
- Please check whether the device is free of damage, such as whether there are other signs of damage such as drop, collision or shell dent.
- Before contacting any conductor surface or terminal, measure the voltage at the contact point to confirm that there is no danger of electric shock.
- Paint scratches during device transportation and installation must be repaired in time. It is strictly forbidden to expose the scratched part to the outdoor environment for a long time.
- It is forbidden to affect the battery terminal parts during handling, and it is not allowed to lift and carry them through the battery terminal bolts.
- In any case, do not change the structure and installation sequence of the device without the permission of the manufacturer.
- In case of fire, evacuate the building or device area and press the fire alarm bell or dial the fire alarm telephone. Under any circumstances, it is forbidden to re-enter the burning building.
- During transportation, turnover, installation, wiring and maintenance, the requirements of laws and regulations and relevant standards of the country and region must be met.
- The materials provided by the user and the tools needed in the operation process must meet the requirements of the laws, regulations and relevant standards of the country and region where they are located.

1.2 Personnel requirements

- The personnel responsible for the installation and maintenance of the device must first receive strict training, understand various safety precautions and master the correct operational methods.
- Only qualified professionals or trained personnel are allowed to install, operate and maintain the device.
- Only qualified professionals are allowed to remove safety facilities and repair the device.

- Personnel operating the device, including operators, trained personnel and professionals, should have special operations required by the local country.
- Qualifications, such as high-voltage operation, climbing, special device operation qualifications, etc.
- The replacement of the device or components (including software) must be completed by professional or authorized personnel.

Explain

- Professional personnel: those who have training or experience in operating the device and can understand the potential sources and magnitude of various hazards during device installation, operation and maintenance.
- Trained personnel: the personnel who have received corresponding technical training and have necessary experience can be aware of the risks that maybe brought to him when carrying out an operation and can take measures to minimize the risks to himself or other personnel.
- Operators: operators who may come into contact with the device except for trained personnel and professionals.

1.3 Electrical Safety

Grounding requirements

- For the device to be grounded, the protective ground wire must be installed first; When removing the device, the protective ground wire must be removed finally.
- Do not damage the grounding conductor.
- It is forbidden to operate the device without installing the grounding conductor.
- The device shall be permanently connected to the protective ground. Before operating the device, check the electrical connection of the device to ensure that the device is reliably grounded.

General requirements

Before making electrical connections, please ensure that the device is not damaged, otherwise it may cause electric shock or fire.

- All electrical connections must meet the national/regional electrical standards.
- You must obtain the permission of the power department of your country/region before you can connect to the grid for power generation.
- User-provided cables shall comply with local laws and regulations.
- Use special insulating tools for high-voltage operation.

DC operation

DANGER It is forbidden to install and remove the power line with power. The power cord core will produce electric arc or spark at the moment of contact with the conductor, which may cause fire or personal injury.

- Before electrical connection of the device, if it is possible to touch live parts, the corresponding breaking device of the previous level of the device must be disconnected.
- Before connecting the power cord, make sure that the power cord label identification is correct before connecting.
- If the device has multiple inputs, all inputs of the device shall be disconnected, and the device can be operated after the device is fully powered off.

Wiring requirements

- The use of cables in a high temperature environment may cause aging and damage of the insulation layer. The distance between the cable and the periphery of the heating device or heat source area shall be at least 30mm.
- Cables of the same type shall be bound together, and cables of different types shall be laid at least 30mm apart. It is forbidden to wind or cross each other.
- The position of the cable through the pipe or wire hole must be protected to prevent the cable from being damaged by sharp edges, burrs, etc.
- When the temperature is too low, severe impact and vibration may cause brittle cracking of the plastic sheath of the cable. To ensure construction safety, the following requirements shall be followed:

  – All cables shall be laid and installed above 0 ℃. Cables should be handled with care when handling, especially in low temperature environment.

  – If the storage environment temperature of the cable is below 0 ℃, the cable must be moved to room temperature for more than 24h before laying.

Anti-static requirements

NOTICE

The static electricity generated by the human body will damage the static sensitive components on the boards, such as large-scale integrated circuits (LSI).

- Wear anti-static gloves when contacting the device. It is forbidden to wear clothes that are easy to generate static electricity.

1.4 Battery Safety

Statement

The company will not be responsible for the devices function abnormality or component damage, personal safety accident, property loss, etc. caused by the following reasons:

- The battery is not charged in time due to the customer's reason, which causes the battery to be stored beyond the time limit and causes the capacity loss or irreversible damage to the battery.
- Battery damage, drop, liquid leakage, etc. caused by improper operation or failure to connect the battery as required.
- The battery was installed on site and connected to the system, but due to customer reasons, it was not turned off in a timely manner, resulting in battery over discharge and damage.
- The user did not set the battery operation management parameters correctly.
- The customer or a third party may change the battery use scenario without knowing the company. For example, connect additional load to the battery; Mix the battery provided by the company with other batteries, including but not limited to; mix with other brands of batteries, mix with batteries with different rated capacity, etc.
- Direct damage to the battery due to on-site device operation environment or external power parameters failing to meet the environmental requirements for normal operation. Including the actual operating temperature of the battery is too high or too low, and the power grid is unstable, and power failure is frequent.
- Improper maintenance by customers leads to frequent over-discharge of batteries, on-site capacity expansion or long-term inability to fully charge.
- The customer did not properly maintain the battery according to the operation manual of the supporting device, including but not limited to; did not regularly check whether the battery terminals were locked.
- The battery is stolen.
- Battery exceeding the warranty period.

Basic Requirements

It is prohibited to install or remove power cords with electricity. At the moment of contact with the conductor, the power cord core can generate an arc or spark, which can cause fire or personal injury.

- Do not expose the battery to a high temperature environment or heating device, such as sunlight, fire source, transformer, heater, etc. The overheated battery may cause fire and explosion.
- It is forbidden to disassemble, modify or damage the battery (such as inserting foreign matters, immersing them in water or other liquids), to avoid liquid leakage, overheating, fire or explosion of the battery.
- Lithium-ion battery energy storage system has high fire risk.

The following safety risks shall be fully considered before battery operation:

- The battery electrolyte is flammable, toxic and volatile.
- The thermal runaway of the battery will produce combustible gas, as well as CO, HF and other harmful gases.
- There is a risk of deflagration and explosion due to the accumulation of combustible gas generated after the thermal runaway of the battery.
- The battery must be stored separately and in the outer package. It should not be mixed with other items, stored in the open air and stacked too high. λ The battery beyond the warranty period shall not be used.
- Do not remove the outer package of the battery under normal conditions. If the battery needs to be recharged, it needs to be recharged by professional personnel as required. After the power supply is completed, the battery still needs to be packed back.
- When carrying the battery, it shall be carried in the direction required by the battery, and it is prohibited to put it upside down or tilt it.
- The battery shall avoid impact.
- Do not carry out welding, grinding and other similar work around the battery to avoid fire and other hazards caused by electric sparks and arcs.
- Please use the battery within the operating temperature range specified in this manual.
- Do not use the damaged battery (the battery falls, collides or has other damage such as shell dent). Damaged batteries may cause the release of flammable gases. Do not store damaged batteries near undamaged products.
- The storage location of damaged batteries should not contain flammable materials, and non-professional personnel should not be nearby.
- During the storage of damaged batteries, the damaged batteries shall be monitored to ensure that there are no signs of smoke, flame, electrolyte leakage or heat.

Personal safety

- Wear appropriate personal protective device during device operation. In case of any fault that may cause personal injury or device damage, immediately

terminate the operation, report to the person in charge and take effective protective measures.

- Before using tools, please master the correct use of tools to avoid personal injury and device damage.
- When the device is running, the shell temperature is high and there is a risk of burns. Do not touch it.
- To ensure personal safety and normal use, reliable grounding shall be conducted before use.
- In case of battery failure, the temperature may exceed the burn threshold of the touchable surface, and contact should be avoided.
- Do not open or damage the battery. The released electrolyte is harmful to the skin and eyes and should be avoided from contact.
- Do not place irrelevant items on the top of the device or insert them into any position of the device.
- Do not place flammable substances around the device.
- Do not put the battery in the fire to avoid explosions and endanger personal safety.
- Do not put the battery module in water or other liquids.
- Do not short circuit the battery terminals, which will cause combustion.
- The battery may cause electric shock and large short-circuit current. When using the battery, pay attention to the following precautions:
  a) Remove the watch, ring and other metal objects.
  b) Tools with insulated handles.
  c) Wear rubber gloves and boots.
  d) Do not place tools or metal parts on the top of the battery.
  e) Disconnect the charging power before connecting or disconnecting the battery terminals.
  f) Determine whether the battery is accidentally grounded. If accidentally grounded; remove the power supply from the ground.
- Do not use water or detergent to clean the internal and external electrical components of the cabinet.
- Do not stand or lean or sit on the device.
- Do not damage the device modules.

Battery installation requirements

- Before installing the battery, check whether the package is intact, and the battery with damaged package cannot be used.
- During the battery installation, pay attention to the positive and negative poles. It is forbidden to short the positive and negative poles of the battery.

- During installation, use a torque wrench to ensure that the screws are tightened without looseness, and check regularly.
- After installing the device, empty packaging materials in the device area, such as cartons, foam, plastics, ties, etc., shall be removed.

Hazard and toxicity description

DANGER

- Danger: contact of battery terminals with other metals may cause heat or electrolyte leakage. Electrolytes are flammable. If the electrolyte leaks, avoid contact with high temperatures and open flames.
- Toxicity: The steam generated by battery combustion may irritate eyes, skin and throat.

Emergency measures for abnormal battery

DANGER

- In case of electrolyte leakage or abnormal smell, avoid contact with leaked liquid or gas. Non-professional personnel are not allowed to approach. Please contact professional personnel immediately. Professionals should wear goggles, rubber gloves, gas masks, protective clothing, etc. to prevent the harm caused by electrolyte overflow.
- Electrolytes are corrosive and contact may cause skin irritation and chemical burns. In the case of contact with battery electrolyte, the following measures shall be taken.
- Inhalation: evacuate the contaminated area, inhale fresh air immediately, and seek medical help immediately.
- Eye contact: immediately wash the eyes with plenty of water for at least 15 minutes, do not rub them, and seek medical help immediately. Skin contact: immediately wash the contact area with plenty of water and soap, and seek medical help immediately.
- Ingestion: Seek medical help immediately.

Fire emergency measures

DANGER

- In case of fire, the system should be powered off under the condition of ensuring safety.
- Use carbon dioxide, FM-200 or ABC dry powder extinguisher to extinguish the fire.

- Firefighters need to avoid contact with high-voltage components during firefighting; otherwise, electric shock risk may be caused.
- If the temperature of the battery is too high, it will lead to deformation and damage of the battery, the electrolyte overflow and the leakage of toxic gas. You should wear respiratory protective the device and keep away from it to avoid skin irritation and chemical burns.

Flood emergency measures

⚠ DANGER

- Under the condition of ensuring personal safety, power down the system.
- If any part of the battery is flooded, do not touch the battery to avoid electric shock.
- Do not use the battery that has been flooded by water. Contact the battery recycling company for disposal.

Emergency measures for battery falling

⚠ DANGER

- When installing the battery, if the battery falls or is strongly impacted, it may cause internal damage to the device. It is strictly prohibited to continue using it, otherwise there will be safety risks (cell leakage, electric shock injury, etc.).
- After the battery falls, if there is obvious odor, damage, smoke, fire, etc., evacuate the personnel immediately, call the police in time, contact the professional personnel, and the professional personnel will use the firefighting facilities for firefighting and other treatment under the condition of ensuring safety.
- After the battery falls, if there is no obvious deformation or damage in the appearance and there is no obvious odor, smoke or fire, contact professional personnel to transport the battery to an open and safe place or contact the recycling company for treatment.

Battery recycling

- Please dispose of waste batteries according to local laws and regulations, and do not dispose of batteries as domestic garbage. Improper disposal of batteries may cause environmental pollution.
- If the battery leaks or is damaged, please contact technical support or battery recycling company for scrapping.
- When the battery becomes unavailable beyond its service life, please contact the battery recycling company for scrapping.

- Avoid exposing waste batteries to high temperatures or direct sunlight.
- Avoid exposing waste batteries to high humidity or corrosive environment.

1.5 Storage requirements

General requirement description

- During storage, record the storage requirements, such as temperature, humidity and storage environment, in accordance with this manual.
- Long-term storage of batteries is not recommended. Long term storage of lithium-ion batteries may result in capacity loss. After 12 months of storage at the recommended storage temperature, the irreversible capacity loss of lithium-ion batteries is generally 3% to 10%.
- The storage environment must meet local laws and standards.
- Expired storage needs to be checked and tested by professional personnel before put into use.
- When batteries are stored, they should be placed correctly according to the label on the packing case. Do not put them upside down or sideways.
- When stacking battery packing cases, they should comply with the stacking requirements on the outer packaging.
- The battery should be handled with care. It is strictly prohibited to damage the battery. Storage environment requirements:
- Recommended storage temperature: 0 ℃ ~ 25 ℃.
- Relative humidity: 35%RH ~ 85%RH.
- Store in a dry, clean, ventilated place, and prevent dust and water vapor erosion. Do not suffer from rain or water erosion of the ground area.
- Avoid contact with corrosive organic solvents, gases and other substances.
- Avoid direct sunlight.

1.6 Handling and transportation requirements

NOTICE

This product is available through UN38.3 (UN38.3: Section 38.3 of the sixth Revised Edition of the Recommendations on the Transport of Dangerous Goods: Section 38.3 of the sixth revised edition of the recommendations on the transport of dangerous goods. Loading and unloading requirements: The energy storage system must be loaded and unloaded according to local laws, regulations, and industry standards. Rough loading and unloading may cause short circuits or damage to batteries in the container, which may result in battery leakage, rupture, explosion, or fire.

Conditions of departure

Before shipment, it is necessary to check that the battery is intact and undamaged, and there is no obvious odor, smoke, or fire. Otherwise, shipment is prohibited.

Explanation

The product can be shipped directly to the site, meeting the transportation requirements of vehicles, ships, etc. The transportation packaging box must be firm. During loading, unloading, and transportation, care should be taken, and moisture-proof measures should be taken. Due to external environmental influences (such as temperature, transportation, storage, etc.), the specifications and parameters of the product are based on the date of manufacture. Transportation process requirements:

- The energy storage system does not support railway transportation or air transportation.
- Maritime transportation shall comply with the transportation requirements of IMDGCODE and the International Maritime Dangerous Goods Code.
- Land transportation shall comply with ADR or JTT617 transportation requirements.
- Meet the regulatory requirements of transportation regulatory authorities in the country of origin, destination, and destination.
- Comply with international regulations for the transportation of dangerous goods and the regulatory requirements of corresponding national transportation regulatory authorities. During handling or transportation, it is prohibited to:
- Direct rain or snow exposure or falling into the water.
- Falling or mechanical impact.
- Invert or tilt.

Explanation

If the above abnormal situations occur, please handle them according to emergency measures.

1.7 Installation environment requirements

- The installation and use environment shall comply with the provisions of local laws and regulations and relevant international national and regional standards for lithium products.
- The installation location is inaccessible to children and far away from daily work and living areas, including but not limited to the following areas: studio, bedroom, lounge, living room, music room, kitchen, study, game room, home theater, sunshine room, bathroom, shower room, laundry room and attic.
- Garage installation should be far away from the direction of vehicle travel.

- When installing it in the basement, it is necessary to maintain ventilation and ventilation. Do not place flammable and explosive materials around the device.
- It shall be installed in a dry and well-ventilated environment, and the device shall be fixed on a solid and flat support surface.
- Please select a sheltered installation site or build a sunshade to avoid direct sunlight or rain.
- The environment around the installation site is clean and free of a large amount of infrared radiation, organic solvents and corrosive gases.
- For areas with frequent natural disasters such as floods, debris flows, earthquakes, typhoons, corresponding preventive measures shall be taken for installation.
- The installation location shall be far away from fire and heat sources. Do not place flammable and explosive materials around the device.
- The installation location should avoid water accumulation, and be far away from water sources such as faucets, sewer pipes, sprinklers, etc. to avoid water infiltration.
- It is forbidden to place the device in an environment of flammable, explosive gas or smoke, and it is forbidden to carry out any operation in this environment.
- It is prohibited to install it in the mobile scene of ships, trains, cars, etc.
- Do not use the power supply for the following purposes in the standby scenario.
  a. Medical devices directly related to human life.
  b. Used for trains, elevator and other control devices, which may cause personal injury.
  c. For computer systems of social and public importance.
  d. Used in the vicinity of medical devices.
  e. Devices similar to the above description.
- Energy storage will be corroded when installed in salt hazard areas. Do not install it outdoors in salt hazard areas. Salt damage area refers to the area within 500m from the coast or affected by sea breeze. The area affected by sea breeze varies according to meteorological conditions (such as typhoon, seasonal wind) or terrain (with dams and hills)
- The operation and service life of energy storage are related to the working temperature. Please install the energy storage at a temperature equal to or better than the ambient temperature.
- The charging temperature range of this product is 5~50 ℃, and the discharge temperature range is -15~50 ℃. If installed in a cold environment, series will activate the built-in thermal control system to heat the battery for better performance. The heating process will consume rechargeable power, meaning a short-term reduction in system energy efficiency.

- If stored in a cold environment (such as 0°C) before installation, Series require some time (<2 hours) to heat before charging. It is recommended to place the Series in a warm location before installation to help with efficient testing.
- When the ambient temperature of Series exceeds 45 ℃ or is below -10 ℃, the battery charging and discharging power will decrease.

1.8 Mechanical safety

Drilling safety

The following safety precautions should be considered when drilling holes on the wall and ground

- Wear goggles and protective gloves when drilling.
- During drilling, the device shall be shielded to prevent debris from falling into the device, and the debris shall be cleaned and cleaned in time after drilling.

Safety in handling heavy objects

- When carrying heavy objects, be prepared to bear weight to avoid being crushed or sprained by heavy objects.
- When handling device by hand, wear protective gloves to avoid injury.

1.9 Test new device

When the device is powered on for the first time, professional personnel shall set the parameters correctly. The wrong setting may cause the device to be inconsistent with the certification of the country/region and affect the normal operation of the device.

1.10 Maintenance and replacement

During the operation of the device, there is high voltage, which may cause electric shock, resulting in death, serious personal injury or serious property loss. Therefore, before carrying out any maintenance work, the device must be powered off and operated in strict accordance with the safety precautions listed in these manual and other relevant documents.

- Please maintain the device when you are familiar with and understand the contents of this manual and have appropriate tools and test devices.
- Before carrying out maintenance work, please power off the device first, and then follow the instructions of the delayed discharge label, wait for the corresponding time to ensure that the device has been powered off before operating the device.

- In the process of maintenance, please try to avoid irrelevant personnel entering the maintenance site. Temporary warning signs or fences must be erected for isolation.
- If the device fails, please contact your dealer in time.
- The device can only be powered on again after the fault has been handled, otherwise the fault may be expanded, or the device may be damaged.
- Do not open the cover without authorization, otherwise there is a risk of electric shock, and the resulting failure is not covered by the warranty.
- Operation and maintenance personnel and professional technical personnel shall receive sufficient training on safe use and device maintenance and shall operate with sufficient preventive measures and personal protective device (PPE).
- When it is necessary to move or re-wire, the power input must be cut off. After waiting for 5 minutes, the internal energy of the machine is discharged, and the DC bus and the parts to be repaired inside the machine are confirmed with a multimeter that there is no dangerous voltage, the maintenance can be started.
- The maintenance of the battery shall be carried out or supervised by personnel familiar with the battery and the required preventive measures.
- When replacing the battery, please replace the same type of battery or battery pack.
- After the maintenance operation, check immediately to ensure that no tools or other parts are left in the device.
- If you do not use the device for a long time, you need to store the battery and supplement the power according to this manual.

2. Product Information

2.1 Product Specifications

Product Model	Qapacity 2 module	Qapacity 3 module	Qapacity 4 module	Qapacity 5 module	Qapacity 6 module	Qapacity 7 module
Electrical Parameter						
Battery Chemistry	Hybrid Electrolyte Solid State LFP					
Module Parameter	5,427 kWh					
Battery Capacity	53Ah					
System Configuration	64S1P	96S1P	128S1P	160S1P	192S1P	224S1P
Total Energy	10,84 kWh	16,28 kWh	21,71 kWh	27,14 kWh	32,56 kWh	37,99 kWh
Nominal Voltage	204,8V	307,2V	409,6V	512V	614,4V	716,8V
Voltage Range(V)	179,2-229,12	268,8-343,68	358,4-458,24	448-572,8	537,6-687,36	627,2-801,92
Max.Charge/Discharge current	53A/53A					
Cycle Life	>6000 cycles					
Communication	CAN					
Monitoring Type	4G					
General Parameter						
Size (W*D*H) mm	600x435x591	600x435x765	600x435x939	600x435x1113	600x435x1287	600x435x1461
Weight	<118 kg	<163 kg	<208 kg	<253 kg	<298 kg	<343 kg
Installation Method	Outdoor/ lndoor ; Floor Mounted					
Cooling Method	Natural Cooling					
Certification	IEC62619;IEC60730-1;EN62477;EN IEC62040-1;CE;UN38.3					
Environment Parameter						
IP Protection	IP65					
Humidity	0~95%RH (No condensation)					
Operating Temperature w/o heating	Charge 5-50℃ Discharge -15-50℃					
Storage Temperature Range	-10℃~35℃					
Altitude	3000m (＞2000m Power Derating)					

2.2 BMS functional characteristics

A battery management system (hereinafter referred to as BMS) is an electronic system that manages a rechargeable battery. A battery module is a type of electrical battery which can charge or discharge loads. In case of one tower, the whole system mainly comprises a BMS, battery module(s) and Base.

1. The operating voltage input range is 9~32V, with typical values of 12V or 24V, catering to the needs of various energy storage scenarios.
2. Summarizes individual cell data from battery packs (i.e., cell voltage, temperature), utilizing proprietary comprehensive algorithms to estimate SOC/SOH for both individual cells and battery clusters, achieving excellent accuracy under both dynamic and static conditions of the battery cluster.
3. Capable of acquiring total battery cluster voltage with high precision and speed, ensuring data reliability through comparison between individual cell summation and total voltage acquisition.
4. Equipped with total battery cluster current acquisition, utilizing shunt-based methods for high-precision and fast acquisition.
5. Features precise insulation resistance measurement to ensure the safety and reliability of the battery system, allowing the insulation resistance measurement function to be enabled or disabled based on system configuration requirements.
6. Offers CAN/RS485 communication interfaces for data exchange with external devices such as PCS, EMS, 4G cloud platforms, etc.
7. Provides high-side and low-side drive outputs, with continuous load ≥1A and transient load ≥5A@100ms. Internal output voltage diagnosis enables hardware self-testing.
8. Includes dry contact output control, satisfying diverse safety control requirements such as effective isolation of strong and weak electricity.
9. Possesses digital DO/DI functions, enabling high-voltage interlock detection.
10. Supports NTC (10K) temperature acquisition within the high-voltage box, including fault diagnosis for battery temperature acquisition disconnection and short circuits.
11. Enables BCU automatic addressing.
12. Supports real-time SOC/SOH estimation for battery clusters.
13. Incorporates fault detection capabilities, including voltage, current, temperature, SOC, SOH threshold alarm functions, and loop cut-off protection for severe alarm thresholds.
14. Offers data storage functions, supporting local storage and power-off preservation of system operation data.

15. Supports Bootloader upgrades or remote upgrades, as well as firmware upgrades online via the CAN communication bus.
16. Meets the application requirements of 1000V energy storage systems and possesses IEC/UL certifications.
17. Equipped with battery heating control function.
    Basic parameter: Heating power range 100~200W.
    Trigger logic: Close heating relay when -25℃ ≤ minimum cell temperature ≤5℃.
    Cut-off logic: Cut off the heating relay if:
    ① minimum cell temperature ≥10℃,
    ② current ≤-0.8A, or
    ③ cell temperature difference ≥15℃;
    prioritize cut-off if trigger and cut-off conditions coexist.

    Alarm correlation: Deactivate heating for all level-1 alarms (except "low temperature during charging"); level-2/3 alarms do not affect heating activation (alarm notification same as Item 13).
    Configurable Upper Threshold: The heating upper threshold can be set within the range of -40°C to 15°C via WiFi.

2.3 BMS compatible inverter manufacturers

Number	CAN type	485 type
1	PYLON	PYLON
2	Growatt	Growatt
3	Victron	SRNE
4	GOODWQ	Deye
5	Solis	Voltronic Power
6	Pace Electronics	Pace Electronics
7	SOFAR	-
8	KSTAR	-
9	SMA	-
10	MEGAREVO	-
11	Afore	-
12	INVT	-

2.4 Performance and Test Conditions

Standard Test Conditions

- The storage environment must meet local regulations and standards. Test should be conducted with new batteries within one week after shipment from our factory and the batteries shall not be cycled more than five times before the test. Unless otherwise specified, test and measurement shall be done under temperature of 20±5℃ and relative humidity of 45~85%. If it is judged that the test results are not affected by such conditions, the tests may be conducted at temperature 15~30℃ and humidity 25~85%RH.

Measuring Instrument or Apparatus

- Dimension Measuring Instrument
  The dimension measurement shall be implemented by instruments with equal or more precision scale of 0.01mm.
- Voltmeter
  Standard class specified in the national standard or more sensitive class havinginner impedance more than 10kΩ/V
- Ammeter
  Standard class specified in the national standard or more sensitive class. Total external resistance including ammeter and wire is less than 0.01Ω.
- Impedance Meter
  Impedance shall be measured by a sinusoidal alternating current method (1kHz LCRmeter).
- Standard Charge :
  Charge at constant current 42.4A until any cell reaches 3.55V, then charge at constant current 2.65A until any cell reaches 3.58V.
- Standard Discharge :
  Constant current (53A) discharge to any single cell to 2.85V.
  If not otherwise specified, the rest time between charging and discharging is 30min.

Appearance

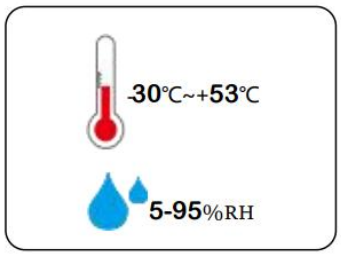
There shall be no such defect as crack, rust, leakage, which may adversely affect commercial value of battery.

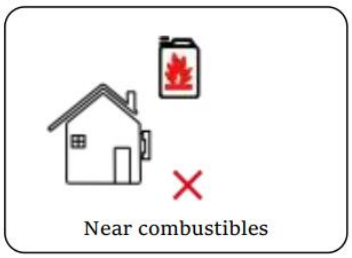
3. Application Scenario

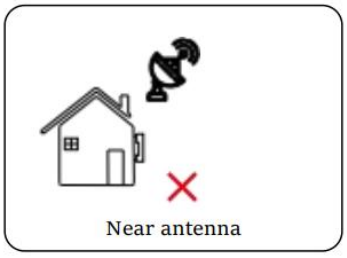
This product is suitable for villas, nomadic areas, farms, and households.

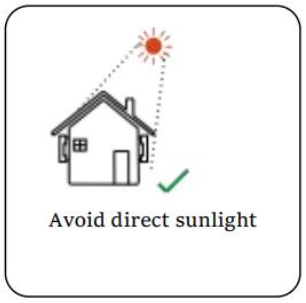
- To prevent fire due to high temperature, ensure that the ventilation vents or heat dissipation system are not blocked when the equipment is running.
- Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.
- Ensure that the area is completely waterproof, and the floor is flat and level.
- Ensure that the temperature and humidity are maintained at a constant level, and there is minimal dust and dirt in the area.

Notice!
• For outdoor installation, precautions against direct sunlight, rain exposure and snow laying up are recommended. • Exposure to direct sunlight raises the temperature inside the battery. This temperature rise poses no safety risks but may impact the battery performance.









4. System Installation

4.1 Inspection before installation

Check the outer packaging

Before disassembling the outer packaging of energy storage, please check whether the outer packaging has visible damage, such as holes, cracks or other signs of internal damage, and check the energy storage model. If there is any abnormal packaging or the energy storage model is not consistent, please do not disassemble it and contact your dealer as soon as possible.

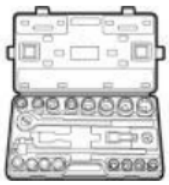
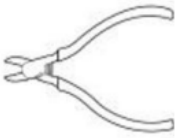
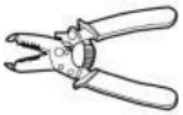
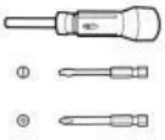
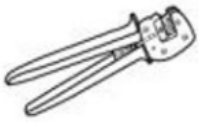
Check deliverable

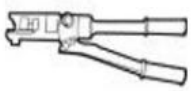
After unpacking the outer packaging of energy storage, please check whether the delivered parts are complete and free of any obvious external damage. If any items are missing or damaged, please contact your dealer. When assembling the system, avoid touching the battery terminals with any metal object or bare hands. According to the design principles, the product will provide safe and reliable energy. Improper operation and equipment damage may cause overheating and electrolyte leakage. Therefore, the above-mentioned safety precautions and warning information mentioned in this part shall be strictly observed. If you have any questions, please contact customer service. Before installation, make sure that the installation site meets the following conditions.

- The building can stand up to earthquakes.
- The site shall be over 500 meter away from the sea, to avoid damage caused by salt water and humidity;
- The floor shall be flat;
- No inflammable and explosive goods are placed within at least of 3 feet (1m);
- The ambiance shall be shady and cool, and avoid heat sources and direct sunlight;
- The temperature and humidity remain at a constant level;
- The installation site requires less dust and dirt;
- There are no corrosive gases, including ammonia and acid vapor.
  If the ambient temperature exceeds the operating range, the battery pack will stop running to protect itself. The optimal temperature range for running is 15°C to 30°C. In the allowable range, the relative humidity range should be between 5% and 95%RH. Frequent exposure to harsh temperatures may deteriorate the performance and lifetime of the battery.

4.2 Preparing Tools and Meters

Installation and maintenance personnel must operate according to applicable federal, state, and local regulations as well as industry standards regarding product installation. Personnel must wear safety gear as indicated below in order to avoid short circuit and personal injury.

Type	Tools and Instruments		
Install	 Percussion drill	 Torque socket wrench	 Torque wrench
	 Diagonal pliers	 Wire stripper	 Torque screwdriver
	 Rubber hammer	 Tool knife	 Wire nippers
	 Crimping pliers	 Cold pressing terminal crimping pliers	 Disassembly and assembly tools
	 Cable tie	 Vacuum cleaner	 A multimeter
	 marking pen	 Steel tape	 Level ruler

	 hydraulic clamp	 Heat shrinkable sleeve	 Hot air gun
Personal protective equipment	 Safety gloves	 Protective glasses	 Anti-dust masks
	 Safety shoes		

4.3 Select the installation position

Installation angle requirements

Energy storage supports floor mounting. Installation angle requirements:

- It is not allowed to install the stored energy devices forward, horizontally, upside down, backward and sideways.

Installation position requirements

Please select solid brick-concrete structure, concrete wall and ground for installation. If other types of wall and ground are selected, the wall and ground must be made of flame-retardant materials and can meet the load bearing requirements of the device.

Installation space requirements

- When installing energy storage, ensure that there are no other devices and flammable and explosive materials around, and reserve enough space to ensure the installation heat dissipation and safety isolation requirements.

Installation instructions

- After unpacking batteries, place them in the required direction. Do not place them upside down, sideways, upright, tilted, or stacked to avoid battery damage or loss caused by impact or fall.
- The battery pack should be moved slowly to prevent collision and bump.

- When installing batteries, align the plug-in holes from bottom to top, and use screws to connect battery containers and the base.

Battery precautions

- Never short circuit battery. It generates very high current which causes heating of the battery and may cause electrolyte leakage, gassing or explosion that is very dangerous.
- The poles may be easily short-circuited by putting them on conductive surface.
- Such outer short circuit may lead to heat generation and damage of the battery.
- An appropriate circuitry with PCM shall be employed to protect accidental short circuit of the battery pack.
- Falling, hitting, bending, etc. may cause degradation of battery characteristics.
- The warranty period of the battery is 12 months from the date of shipment. If it is proved that the defect of the battery is formed during the manufacturing process rather than due to user abuse and misuse, the company is responsible for returning and replacing the battery.
- The batteries should be stored at room temperature, charged to about 30% to 50% of capacity.
- We recommend that batteries be charged about once per three months to prevent over-discharge.
- Because batteries utilize a chemical reaction, battery performance will deteriorate over time even if stored for a long period of time without being used. In addition, if the various usage conditions such as charge, discharge, ambient temperature, etc. are not maintained within the specified ranges the life expectancy of the battery may be shortened or the device in which the battery is used may be damaged by electrolyte leakage. If the batteries cannot maintain charge for long periods of time, even when they are charged correctly, this may indicate it is time to change the battery.

4.4 Installation Instructions

4.4.1 Installing Devices

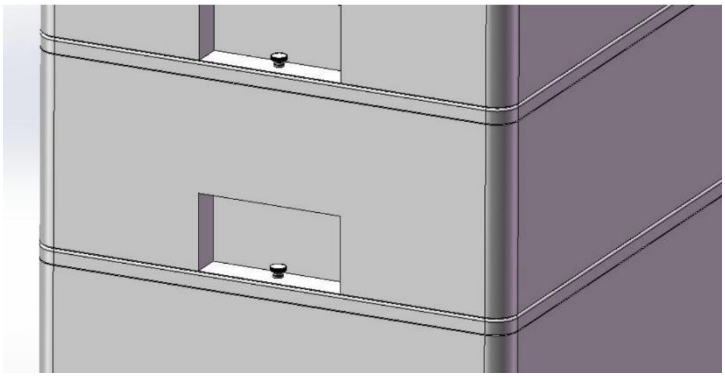
Base mounting

Remove the base from the box and place it on a level level, making sure the ground is hard, Adjust the base to level with adjusting screws.

Module installation

According to the actual situation of the installation site, use manual or machine handling modules; It is recommended that at least two people carry it together, and wear anti-smashing shoes and non-slip gloves when installing it. When the system

consists of multiple battery modules, the battery modules are installed layer by layer from the bottom up after the base is firmly installed. There is an M5 screw hole at the handles on both sides of the battery container for securing the connection between the containers.

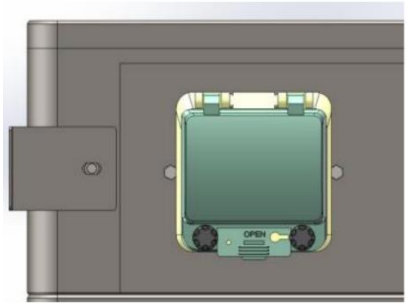


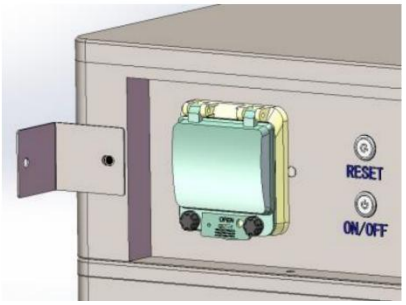
High Voltage BMS installation

After installing the battery box, install the High Voltage BMS box. Lock the screw on both sides of the handle of the High Voltage BMS box by open wrench and ensure that the screws are tightened. In order to prevent the product from tipping, metal sheets can be used to fix the High Voltage BMS box on the wall, m6 screws can be used to lock the metal sheet on the High Voltage BMS box, and m6 expansion screws can be used to lock the metal sheet on the wall.

Use of expansion screws:

1. Make a hole in the wall with a depth of 50mm and a diameter of 8mm.
2. Put the expansion screw into the hole, tighten the screw, and pull the screw out of the hole.
3. Put the metal piece in the hole, then add the gasket, and finally lock the screw.





4.4.2 Electrical installation

4.4.2.1 Tool Introduction

The following tools are required for electrical connections, as shown in Table :

Item	Tool		
Tool	Multimeter 	Protective gloves 	Flat-head screwdriver 
	Electric screwdriver 	Phillips screwdriver 	Socket wrench 

4.4.2.2. Interface definition

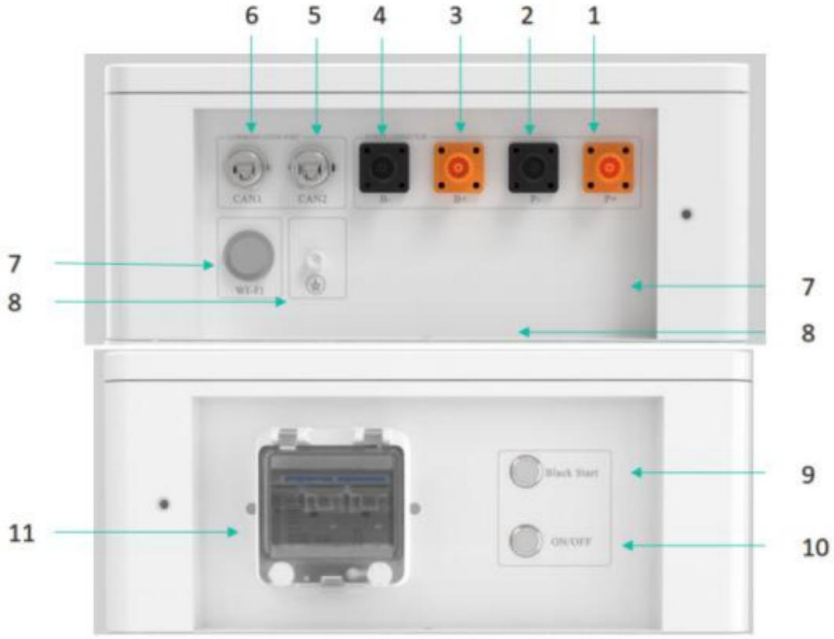


Table Interface definition

Item	Name	Model	Remarks
1/2	PCS connector		1500V/65A
3/4	Battery connector		1500V/65A
5	Communication port (**up-link**)	RJ45	CAN To PCS RS485 Internal Connection
6	Communication port (**down-link**)	RJ45	CAN to Parallel battery stack
7	Wifi		Ø 32.00±0.5 M25
8	Grounding terminal		
9	Black start switch		When the grid loses external power supply, the energy storage systemis able to utilize its own energy storage equipment to supply power, long press the start button for6-8seconds, hear the sound, black start successfully
10	Power switch		
11	Circuit breaker	4P MX+OF	1200V 80A

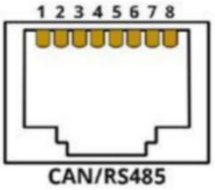


Table RJ45 Port Definition

CAN	**Description**	
	Pin 1: CAN2-H	**Pin 2: CAN2-L**
	Pin 3, 6: GND	**Pin 4: CAN_H**
	Pin 5: CAN_L	**Pin 7, 8: NC**

Table Communication Cable Requirements

Cable Gauge	Strip Length	Maximum Cable Length
CAT5 or better (22 AWG)	RJ-45 connector	45 m

Table Power Cable Requirements

Size	Diameter	Max. Voltage	Max. Current	Max. Current Remark
7AWG	3.665mm	1000 V	47.5A	

Table Output/Internal cable definition

Cable	Type	Recommended Specification	Length(m)	Source
DC output power cable (inverter to battery, Negative)	Common outdoor DC cable in the industry	Conductor cross-sectional area: 7AWG;	Depends	Prepared by the customer
DC output power cable (inverter to battery, Positive)			Depends	Prepared by the customer
Signal cable (inverter to battery)	Outdoor shielded twisted pair cable	CAT5 or better, Conductor cross-sectional area: 0.20–0.35mm2; Cable outer diameter: 6.2–7mm;	1,5m	Prepared by the customer
Ground cable				Prepared by the customer

4.4.2.3 Wire harness connection

The positive and negative poles adopt a fast plug interface, which can be distinguished by color (orange represents the positive pole, black represents the negative pole). The installation personnel can directly manually connect the power harness to the positive and negative poles of the product without the need for other tools while wearing protective gloves.

The power harness is connected to the product through a fast plug interface and to the inverter through a ring terminal. Insert the circular terminal of the power harness smoothly into the inverter ground battery connection port and ensure that the bolts are tightened. Ensure that the polarity of the battery charge is correctly connected.

Power harness connection steps

1. Confirm that the inverter is turned off, the mains circuit is open, and the PV circuit is open.
2. Confirm product shutdown.
3. The circular terminal of the wiring harness is connected to the positive and negative poles of the DC terminal of the inverter.
4. Connect the negative quick plug interface to the negative electrode of the product.
5. Connect the positive pole quick plug interface to the product positive pole.

Warning: Before installing the power harness, it is necessary to ensure that the product and inverter are in a shutdown state.

Procedure for disconnecting the power harness

1. The inverter mains circuit is open, and the PV circuit is open.
2. Turn off the inverter.
3. Click the power button to turn off the product.
4. Remove the negative power harness quick connector.
5. Remove the fast plug interface of the positive power harness.
6. Remove the circular terminal of the power harness.

Warning: Strictly follow the steps for operation. And ensure good interface contact.

Warning: The installation and disconnection of wiring harnesses should be operated by qualified installation personnel, and users are not allowed to operate privately.

Warning: The power harness may transmit high current, please ensure that children cannot come into contact with the power harness.

4.4.3 Operating System

4.4.3.1 Startup inspection

After installation or maintenance, it is necessary to start the lithium battery system. Before starting, please carefully check if the wiring harness is connected correctly to ensure there are no errors. All electrical connections must be made according to the electrical diagram in the manual, and the connections must be tightened.

4.4.3.2 System startup

1. Open the miniature circuit breaker.
2. Turn on the switch on the product.
3. Turn on the inverter

When the product establishes communication with the inverter, the information on the inverter software or its screen should be green.

4.4.3.3 System shutdown

Before a malfunction or repair occurs, the battery system must be shut down. The shutdown procedure is:

1. Turn off the inverter
2. Turn off the switches and circuit breakers on the household storage.

- During the operation of the energy storage system, only disconnecting the circuit breaker does not completely power down the system, and maintenance operations on the energy storage cannot be carried out at this time.

5.Fault Handling

	Fault Type	Reason	Handle
1	Individual voltage too high	The voltage of the individual cell exceeds the threshold	The system prohibits charging
2	Single cell voltage too low	Single cell voltage below threshold	The system prohibits discharge
3	Excessive individual pressure difference	The voltage difference between battery cells is greater than the threshold	The system automatically starts the balancing mechanism
4	Total voltage too high	The overall system voltage is above the threshold	The system prohibits charging
5	Total voltage too low	The overall system voltage is below the threshold	The system prohibits discharge
6	Battery discharge temperature too high		Reduce system discharge power
7	Battery discharge temperature too low		The system prohibits discharge
8	Battery charging temperature too high		Reduce system charging power
9	Charging current too high		Reduce system charging current
10	Discharge current too high		Reduce system discharge current
11	Battery pack SOC too low	Insufficient remaining battery in the system	Timely charging
12	Insulation fault	Reduction or loss of insulation resistance	Contact service
13	Communication failure	Communication error with PCS	Check the communication harness
14	Main positive relay malfunction	Relay adhesion or damage	System shutdown power switch
15	Total negative relay failure	Relay adhesion or damage	System shutdown power switch
16	Pre charge failed	Relay adhesion or damage	Check the pre charge circuit relay
17	Excessive ambient temperature		Reduce system charging and discharging power
18	Low ambient temperature		The system prohibits charging and discharging
19	Individual temperature fault	Temperature sensor malfunction	Contact service

Notes:

A Swedish Quick Guide is available on Senergias website for convenience. However, in case of discrepancies or uncertainties, this English manual shall prevail.

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www.senergia.se