Pytes

User Manual

LiFePO4 Energy Storage Battery

HV48100

Information Version: 1.2

About This Document

This document describes the installation, electrical connections, commission, and trouble-shooting of HV48100 High Voltage Energy Storage System (hereinafter referred as ESS). Before installing and operating the ESS, read this document carefully to understand the safety information as well as functions and features of the ESS.

This document is intended for:

- Technical support engineers
- Hardware installation engineers
- Commissioning engineers
- Maintenance engineers

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1 Safety Information

Statement

Before transporting, storing, installing, operating, using, and/or maintaining the equipment, read this document, strictly follow the instructions provided herein, and follow all the safety instructions on the equipment and in this document. In this document, "equipment" refers to the products, software, components, spare parts, and/or services related to this document; "the Company" refers to the manufacturer (producer), seller, and/or service provider of the equipment; "you" refers to the entity that transports, stores, installs, operates, uses, and/or maintains the equipment.

The Danger, Warning, Caution, and Notice statements described in this document do not cover all the safety precautions. You also need to comply with relevant international, national, or regional standards and industry practices. The Company shall not be liable for any consequences that may arise due to violations of safety requirements or safety standards concerning the design, production, and usage of the equipment.

The equipment shall be used in an environment that meets the design specifications. Otherwise, the equipment may be faulty, malfunctioning, or damaged, which is not covered under the warranty. The Company shall not be liable for any property loss, personal injury, or even death caused thereby.

Comply with applicable laws, regulations, standards, and specifications during transportation, storage, installation, operation, use, and maintenance.

Do not perform reverse engineering, decompilation, disassembly, adaptation, implantation, or other derivative operations on the equipment software. Do not study the internal implementation logic of the equipment, obtain the source code of the equipment software, violate intellectual property rights, or disclose any of the performance test results of the equipment software.

The Company shall not be liable for any of the following circumstances or their consequences:

- The equipment is damaged due to force majeure such as earthquakes, floods, volcanic eruptions, debris flows, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, and other extreme weather conditions.
- The equipment is operated beyond the conditions specified in this document.
- The equipment is installed or used in environments that do not comply with international, national, or regional standards.
- The equipment is installed or used by unqualified personnel.
- You fail to follow the operation instructions and safety precautions on the product and in the document.
- You remove or modify the product or modify the software code without authorization.
- You or a third party authorized by you cause the equipment damage during transportation.
- The equipment is damaged due to storage conditions that do not meet the requirements specified in the product document.
- You fail to prepare materials and tools that comply with local laws, regulations, and related standards.

- The equipment is damaged due to your or a third party's negligence, intentional breach, gross negligence, or improper operations, or other reasons not related to the Company.

1.1 Personal Safety

Danger

Ensure that power is off during installation. Do not install or remove a cable with power on. Transient contact between the core of the cable and the conductor will cause electric arcs, sparks, fire or explosion, which may result in personal injury.

Non-standard and improper operations on the energized equipment may cause fire, electric shocks, or explosion, resulting in property damage, personal injury, or even death.

Before operations, remove conductive objects such as watches, bracelets, bangles, rings, and necklaces to prevent electric shocks.

During operations, use dedicated insulated tools to prevent electric shocks or short circuits. The dielectric withstanding voltage level must comply with local laws, regulations, standards, and specifications.

During operations, wear personal protective equipment such as protective clothing, insulated shoes, goggles, safety helmets, and insulated gloves.

General Requirements

- Do not stop protective devices. Pay attention to the warnings, cautions, and related precautionary measures in this document and on the equipment.
- If there is a likelihood of personal injury or equipment damage during operations, immediately stop, report the case to the supervisor, and take feasible protective measures.
- Do not power on the equipment before it is installed or confirmed by professionals.
- Do not touch the power supply equipment directly or with conductors such as damp objects. Before touching any conductor surface or terminal, measure the voltage at the contact point to ensure that there is no risk of electric shock.
- Do not touch operating equipment because the enclosure is hot.
- In the case of a fire, immediately leave the building or the equipment area and activate the fire alarm or call emergency services. Do not enter the affected building or equipment area under any circumstances.

Personnel Requirements

- Only professionals and trained personnel are allowed to operate the equipment.
  - Professionals: personnel who are familiar with the working principles and structure of the equipment, trained or experienced in equipment operations and are clear of the sources and degree of various potential hazards in equipment installation, operation, maintenance.
  - Trained personnel: personnel who are trained in technology and safety, have required experience, are aware of possible hazards on themselves in certain operations, and are able to take protective measures to minimize the hazards on themselves and other people.
- Personnel who plan to install or maintain the equipment must receive adequate training, be able to correctly perform all operations, and understand all necessary safety precautions and local relevant standards.

- Only qualified professionals or trained personnel are allowed to install, operate, and maintain the equipment.
- Only qualified professionals are allowed to remove safety facilities and inspect the equipment. Personnel who will perform special tasks such as electrical operations, working at heights, and operations of special equipment must possess the required local qualifications.
- Only certified high-voltage electricians are allowed to operate equipment.
- Only authorized professionals are allowed to replace the equipment or components (including software).
- Only personnel who need to work on the equipment are allowed to access the equipment.

1.2 Electrical Safety

Danger

Before connecting cables, ensure that the equipment is intact. Otherwise, electric shocks or fire may occur.

Non-standard and improper operations may result in fire or electric shocks.

Prevent foreign matter from entering the equipment during operations. Otherwise, equipment damage, load power derating, power failure, or personal injury may occur.

WARNING

For the equipment that needs to be grounded, install the ground cable first when installing the equipment and remove the ground cable last when removing the equipment.

General Requirements

- Follow the procedures described in the document for installation, operation, and maintenance. Do not reconstruct or alter the equipment, add components, or change the installation sequence without permission.
- Obtain approval from the national or local electric utility company before connecting the equipment to the grid.
- Observe the power plant safety regulations, such as the operation and work ticket mechanisms.
- Install temporary fences or warning ropes and hang "No Entry" signs around the operation area to keep unauthorized personnel away from the area.
- Before installing or removing power cables, turn off the switches of the equipment and its upstream and downstream switches.
- If any liquid is detected inside the equipment, disconnect the power supply immediately and do not use the equipment.
- Before performing operations on the equipment, check that all tools meet the requirements and record the tools. After the operations are complete, collect all the tools to prevent them from being left inside the equipment.
- Before installing power cables, check that cable labels are correct and cable terminals are insulated.
- When installing the equipment, use a torque tool of a proper measurement range to tighten the screws. When using a wrench to tighten the screws, ensure that the wrench does not tilt, and the torque error does not exceed 10% of the specified value.

- Ensure that bolts are tightened with a torque tool and marked in red and blue after double checking. Installation personnel mark tightened bolts in blue. Quality inspection personnel confirm that the bolts are tightened and then mark them in red. (The marks must cross the edges of the bolts.)
- After the installation is complete, ensure that protective cases, insulation tubes, and other necessary items for all electrical components are in position to avoid electric shocks.
- If the equipment has multiple inputs, disconnect all the inputs before operating the equipment.
- Before maintaining a downstream electrical or power distribution device, turn off the output switch on the power supply equipment.
- During equipment maintenance, attach "Do not switch on" labels near the upstream and downstream switches or circuit breakers as well as warning signs to prevent accidental connection. The equipment can be powered on only after troubleshooting is complete.
- If fault diagnosis and troubleshooting need to be performed after power-off, take the following safety measures: Disconnect the power supply. Check whether the equipment is live.

Install a ground cable. Hang warning signs and set up fences.

- Check equipment connections periodically, ensuring that all screws are securely tightened.
- Only qualified professionals can replace a damaged cable.
- Do not scrawl, damage, or block any labels or nameplates on the equipment. Promptly replace labels that have worn out.
- Do not use solvents such as water, alcohol, or oil to clean electrical components inside or outside of the equipment.

Grounding

- Ensure that the grounding impedance of the equipment complies with local electrical standards.
- Ensure that the equipment is connected permanently to the protective ground. Before operating the equipment, check its electrical connection to ensure that it is reliably grounded.
- Do not work on the equipment in the absence of a properly installed ground conductor.
- Do not damage the ground conductor.
- Ground the protective ground terminal on the equipment enclosure before connecting the power supply; otherwise, electric shock as a result of touch current may occur.

Cabling Requirements

- When selecting, installing, and routing cables, follow local safety regulations and rules.
- When routing power cables, ensure that there is no coiling or twisting. Do not join or weld power cables. If necessary, use a longer cable.
- Ensure that all cables are properly connected and insulated and meet specifications.
- Ensure that the slots and holes for routing cables are free from sharp edges, and that the positions where cables are routed through pipes or cable holes are equipped with cushion materials to prevent the cables from being damaged by sharp edges or burrs.
- If a cable is routed into the cabinet from the top, bend the cable in a U shape outside the cabinet and then route it into the cabinet.

- Ensure that cables of the same type are bound together neatly and straight and that the cable sheath is intact. When routing cables of different types, ensure that they are at least 30 mm away from each other.
- When cable connection is completed or paused for a short period of time, seal the cable holes with sealing putty immediately to prevent small animals or moisture from entering.
- Secure buried cables using cable supports and cable clips. Ensure that the cables in the backfill area are in close contact with the ground to prevent cable deformation or damage during backfilling.
- If the external conditions (such as the cable layout or ambient temperature) change, verify the cable usage in accordance with the IEC-60364-5-52 or local laws and regulations. For example, check that the current-carrying capacity meets requirements.
- When routing cables, reserve at least 30 mm clearance between the cables and heat generating components or areas. This prevents deterioration or damage to the cable insulation layer.
- When the temperature is low, violent impact or vibration may damage the plastic cable sheathing. To ensure safety, comply with the following requirements:
  - Cables can be laid or installed only when the temperature is higher than 0°C. Handle cables with caution, especially at a low temperature.
  - Cables stored at subzero temperatures must be stored at room temperature for at least 24 hours before they are laid out.
- Do not perform any improper operations, for example, dropping cables directly from a vehicle.

Otherwise, the cable performance may deteriorate due to cable damage, which affects the current-carrying capacity and temperature rise.

1.3 Environment Requirements

DANGER

Do not expose the equipment to flammable or explosive gas or smoke. Do not perform any operation on the equipment in such environments.

Do not store any flammable or explosive materials in the equipment area.

Do not place the equipment near heat sources or fire sources, such as smoke, candles, heaters, or other heating devices. Overheat may damage the equipment or cause a fire.

WARNING

Install the equipment in an area far away from liquids. Do not install it under areas prone to condensation, such as under water pipes and air exhaust vents, or areas prone to water leakage, such as air conditioner vents, ventilation vents, or feeder windows of the equipment room. Ensure that no liquid enters the equipment to prevent faults or short circuits.

To prevent damage or fire due to high temperature, ensure that the ventilation vents or heat dissipation systems are not obstructed or covered by other objects while the equipment is running.

General Requirements

Ensure that the equipment is stored in a clean, dry, and well-ventilated area with proper

temperature and humidity and is protected from dust and condensation.

Keep the installation and operating environments of the equipment within the allowed ranges. Otherwise, its performance and safety will be compromised.
Do not install, use, or operate outdoor equipment and cables (including but not limited to moving equipment, operating equipment and cables, inserting connectors to or removing connectors from signal ports connected to outdoor facilities, working at heights, performing outdoor installation, and opening doors) in harsh weather conditions such as lightning, rain, snow, and level 6 or stronger wind.
Do not install the equipment in an environment with dust, smoke, volatile or corrosive gases, infrared and other radiations, organic solvents, or salty air.
Do not install the equipment in an environment with conductive metal or magnetic dust.
Do not install the equipment in an area conducive to the growth of microorganisms such as fungus or mildew.
Do not install the equipment in an area with strong vibration, noise, or electromagnetic interference.
Ensure that the site complies with local laws, regulations, and related standards.
Ensure that the ground in the installation environment is solid, free from spongy or soft soil, and not prone to subsidence. The site must not be located at a low-lying land prone to water or snow accumulation, and the horizontal level of the site must be above the highest water level of that area in history.
Do not install the equipment in a position that may be submerged in water.
If the equipment is installed in a place with abundant vegetation, in addition to routine weeding, harden the ground underneath the equipment using cement or gravel.

1.4 Battery Safety

DANGER

Do not connect the positive and negative poles of a battery together. Otherwise, the battery may be short circuited. Battery short circuits can generate high instantaneous current and releases a large amount of energy, which may cause battery leakage, smoke, flammable gas release, thermal runaway, fire or explosion. To avoid battery short circuits, do not maintain batteries with power on.
Do not expose batteries at high temperatures or around heat sources, such as scorching sunlight, fire sources, transformers, and heaters. Battery overheating may cause leakage, smoke, flammable gas release, thermal runaway, fire or explosion.
Protect batteries from mechanical vibration, falling, collision, punctures, and strong impact. Otherwise, the batteries may be damaged or catch fire.
To avoid leakage, smoke, flammable gas release, thermal runaway, fire or explosion, do not disassemble, alter, or damage batteries, for example, insert foreign objects into batteries, squeeze batteries, or immerse batteries in water or other liquids.
Do not touch battery terminals with other metal objects, which may cause heat or electrolyte leakage.
There is a risk of fire or explosion if the model of the battery in use or used for replacement is

incorrect. Use a battery of the model recommended by the manufacturer.
Battery electrolyte is toxic and volatile. Do not get contact with leaked liquids or inhale gases in the case of battery leakage or odor. In such cases, stay away from the battery and contact professionals immediately. Professionals must wear safety goggles, rubber gloves, gas masks, and protective clothing, power off the equipment, remove the battery, and contact technical engineers.
A battery is an enclosed system and will not release any gases under normal operations. If a battery is improperly treated, for example, burnt, needle-pricked, squeezed, struck by lightning, overcharged, or subject to other adverse conditions that may cause battery thermal runaway, the battery may be damaged or an abnormal chemical reaction may occur inside the battery, resulting in electrolyte leakage or production of gases such as CO and H2. To prevent fire or device corrosion, ensure that flammable gas is properly exhausted.
The gas generated by a burning battery may irritate your eyes, skin, and throat. Take protective measures promptly.

WARNING
Install batteries in a dry area. Do not install them under areas prone to water leakage, such as air conditioner vents, ventilation vents, feeder windows of the equipment room, or water pipes. Ensure that no liquid enters the equipment to prevent faults or short circuits.
Before installing and commissioning batteries, prepare firefighting facilities, such as fire sand and carbon dioxide fire extinguishers, according to construction standards and regulations. Before putting into operation, ensure that firefighting facilities that comply with local laws and regulations are installed.
Before unpacking, storage, and transportation, ensure that the packing cases are intact and the batteries are correctly placed according to the labels on the packing cases. Do not place a battery upside down or vertically, lay it on one side, or tilt it. Stack the batteries according to the stacking requirements on the packing cases. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.
After unpacking batteries, place them in the required direction. Do not place a battery upside down or vertically, lay it on one side, tilt it, or stack it. Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.
Tighten the screws on copper bars or cables to the torque specified in this document. Periodically confirmwhether the screws are tightened, check for rust, corrosion, or other foreign objects, and clean them up if any. Loose screw connections will result in excessive voltage drops and batteries may catch firž when the current is high.
After batteries are discharged, charge them in time to avoid damage due to overdischarge.

Statement
The Company shall not be liable for any damage or other consequences to the batteries it provides due to the following reasons:
- Batteries are damaged due to force majeure such as earthquakes, floods, volcanic eruptions, debris flows, lightning strikes, fires, wars, armed conflicts, typhoons, hurricanes, tornadoes, and other extreme weather conditions.

- Batteries are damaged because the onsite equipment operating environment or external power parameters do not meet the environment requirements for normal operation, for example, the actual operating temperature of batteries is too high or too low, or the power grid is unstable and experiences outages frequently.
- Batteries are damaged, fall, leak, or crack due to improper operations or incorrect connection.
- After being installed and connected to the system, the batteries are not powered on in time due to your reasons, which causes damage to the batteries due to overdischarge.
- Batteries are damaged because they are not accepted in time due to your reasons.
- You set battery operating parameters incorrectly.
- You use batteries of different types together, causing acceleration of capacity attenuation. For example, you use our batteries together with batteries of other vendors or with batteries of different rated capacity.
- You maintain batteries improperly, causing frequent overdischarge; you expand the load capacity without notifying us; or you have not fully charged the batteries for a long time.
- You do not perform battery maintenance based on the operation guide, such as failure to check battery terminals regularly.
- Batteries are damaged because you do not store them in accordance with storage requirements (for example, in an environment that is damp or prone to rain).
- Batteries are not charged as required during storage due to your reasons, resulting in capacity loss or other irreversible damages to the batteries.
- Batteries are damaged due to your or a third party's reasons, for example, relocating or reinstalling the batteries without complying with the Company's requirements.
- You change the battery use scenarios without notifying the Company.
- You connect extra loads to the batteries.
- The battery storage period has exceeded the upper limit.
- The battery warranty period has expired. You are advised not to use a battery whose warranty period has expired, as this poses safety risks.

General Requirements

Before installing, operating, and maintaining batteries, read the battery instructions and comply with its requirements. The safety precautions specified in this document are highly important and require special attention.

Use batteries within the specified temperature range. When the ambient temperature of the batteries is lower than the allowed range, do not charge the batteries to prevent internal short circuits caused during low-temperature charging.

Before unpacking batteries, check whether the packaging is intact. Do not use batteries with damaged packaging. If any damage is found, notify the carrier and manufacturer immediately.

Install batteries within 24 hours after unpacking. If the batteries cannot be installed in time, put them in the original packaging and place them in a dry indoor environment without corrosive gases. Power on the ESS within 24 hours after installation. The process from unpacking batteries to powering on the system must be completed within 72 hours. During routine maintenance,ensure that the power-off time does not exceed 24 hours.

Do not use a damaged battery (such as damage caused when a battery is dropped, bumped, bulged, or dented on the enclosure), because the damage may cause electrolyte leakage or flammable gas release. In the case of electrolyte leakage or structural deformation, contact the installer or professional O&M personnel immediately to remove or replace the battery. Do not store the damaged battery near other devices or flammable materials and keep it away from non-professionals.

Before working on a battery, ensure that there is no irritant or scorched smell around the battery.

When installing batteries, do not place installation tools, metal parts, or sundries on the batteries. After the installation is complete, clean up the objects on the batteries and the surrounding area.

Do not install battery packs on rainy, snowy, or foggy days. Otherwise, the battery packs may be corroded by moisture or rain.

If batteries are exposed to water accidentally, do not install them. Instead, transport the batteries to a safe isolation point and dispose of them in a timely manner.

Before installing battery packs, check whether they are abnormal. A battery pack is deemed abnormal when any of the following symptoms occurs:

– The enclosure of the battery pack is obviously deformed or damaged.

– The voltage between the positive and negative electrodes of the battery pack is far below the specified range.

Check whether the positive and negative battery terminals are grounded unexpectedly. If so, disconnect the battery terminals from the ground.

Do not perform welding or grinding work around batteries to prevent fire caused by electric sparks or arcs.

If batteries are left unused for a long period of time, store and charge them according to the battery requirements.

Do not charge or discharge batteries by using a device that does not comply with local laws and regulations.

Keep the battery loop disconnected during installation and maintenance.

Monitor damaged batteries during storage for signs of smoke, flame electrolyte leakage, or heat.

If a battery is faulty, its surface temperature may be high. Do not touch the battery to avoid scalds.

Do not stand on, lean on, or sit on the top of the equipment.

In backup power scenarios, do not use the batteries for the following situations:

– Medical devices substantially important to human life

– Control equipment such as trains and elevators, as this may cause personal injury

– Computer systems of social and public importance

– Locations near medical devices

– Other devices similar to those described above

Short-Circuit Protection

When installing and maintaining batteries, wrap the exposed cable terminals on the batteries with insulation tape.

Avoid foreign objects (such as conductive objects, screws, and liquids) from entering a battery, as this may cause short circuits.

Leakage Handling

Electrolyte is corrosive and can cause irritation and chemical burns. If you come into direct contact with the battery electrolyte, do as follows:

Inhalation: Evacuate from contaminated areas, get fresh air immediately, and seek immediate medical attention.

Eye contact: Immediately wash your eyes with water for at least 15 minutes, do not rub your eyes, and seek immediate medical attention.

Skin contact: Wash the affected areas immediately with soap and water and seek immediate medical attention.

Intake: Seek immediate medical attention.

Recycling

Dispose of waste batteries in accordance with local laws and regulations. Do not dispose of batteries as household waste. Improper disposal of batteries may result in environmental pollution or an explosion.

If a battery leaks or is damaged, contact technical support or a battery recycling company for disposal.

If batteries are out of service life, contact a battery recycling company for disposal.

Do not expose waste batteries to high temperatures or direct sunlight.

Do not place waste batteries in environments with high humidity or corrosive substances.

Do not use faulty batteries. Contact a battery recycling company to scrap them as soon as possible to avoid environmental pollution.

Precaution

Please read this manual carefully before installation and any operation.

Charge the battery every 6 months to keep battery SOC > 90% if long term storage.

Battery must be charged within 12 hours when low voltage alarm triggered.

Each Battery module has an output voltage of over 48V. It is vital to pay attention to personal safety in any case when operating.

All battery terminals must be disconnected before maintenance.

Please contact with Pytes or its dealer within 24 hours if there is anything abnormal.

Battery being damaged directly or indirectly by above cases will result in warranty failure.

2 Product Description

HV48100 is a high voltage battery storage system based on lithium iron phosphate battery, which is one of the new energy storage products developed and produced by Pytes. By working with PCS (Power Conversion System), DC Chargers, Inverters and UPS etc., HV48100 can be applied in various scenarios including Micro-grid, Solar Energy Storage system, off-grid etc. It meets energy storage system demands for its long circle life, compact design, light weight, easy installation and wide compatibility with PCS.

HV48100 is equipped with built-in battery management system (BMS) to manage and monitor

voltage, current and temperature etc. of cells. The more important, HV48100 BMS is designed for balancing charging and discharging to prolong battery cycle life.

2.1 Features

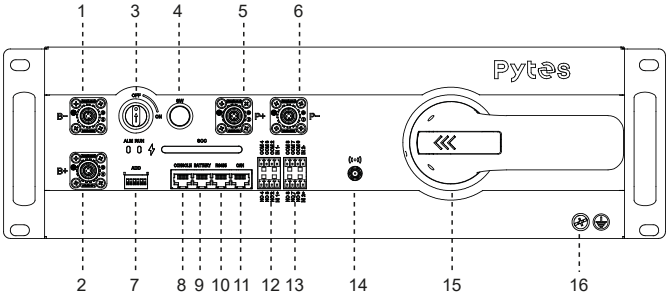
Non-Toxic, Pollution Free and Environment Friendly

- Safe and Long Cycle Life
- Multi Protection Including over Charging/Discharging, over-Current and High/Low Temperature by Battery management system (BMS)
- Charge/Discharging State self-Management and Cell Voltage Capacity Balancing
- Flexible Configuration with Wide compatibility with Various PCS
- More Reliable and Little System Noise with Nature cooling
- Wide Operation Temperature. Excellent Discharge Performance and Cycle Life
- Compact, Light Weight, Modular Design. Easy Installation, Maintenance and Replacement

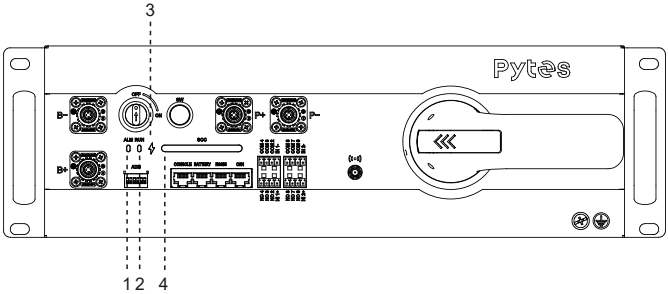
2.2 Components

Note: This document uses the 40kWh system as an example. The actual structure of a model may vary.

2.2.1 Main Control Unit

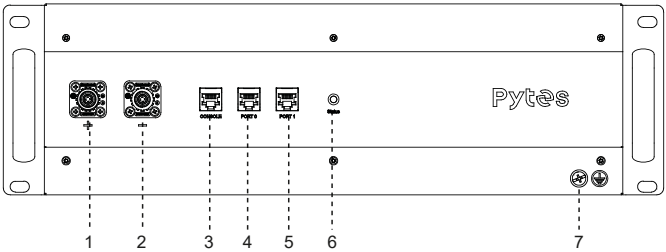


1	Battery Input Power (Negative)	To connect battery negative terminal.
2	Battery Input Power (Positive)	To connect battery positive terminal.
3	DC Power Button	Switch on/off battery power.
4	Soft Switch	Start the system
5	DC Output Power (Positive)	To connect inverter positive terminal.
6	DC Output Power (Negative)	To connect inverter negative terminal.
7	DIP Switch	Set DIP for different inverter
8	Console Port	RJ45 port, following RS232 protocol.
9	Battery Communication Port	To connect with battery module. RJ45 port, following CAN protocol.
10	RS485 Port	To connect with inverter. RJ45 port.
11	CAN Port	To connect with inverter. RJ45 port.
12	Dry Contact - 1	Reserved.
13	Dry Contact - 2	Reserved.
14	Antenna Port	To connect WiFi Antenna.
15	Isolation Switch	To cut off with external device.
16	Grounding Port	To connect grounding cable



1. Alarm Indicator
2. RUN Indicator (MCU)
3. Battery SOC indicator
4. Battery SOC indicator

2.2.2 Battery Module Unit



1	Battery Power Terminal (Positive)	To connect with Battery in series.
2	Battery Power Terminal (Negative)	To connect with Battery in series.
3	Console Port	RJ45 port, following RS232 protocol.
4	Link 0 Port	To connect with battery module. RJ45 port, following CAN protocol.
5	Link 1 Port	
6	RUN indicator	To show running condition.
7	Grounding Port	To connect grounding cable

2.3 Label Description

Battery Control Unit

Pytes

Product Model: HV48100 BCU
Ingress Protection Code: IP20
Rechargeable Li-ion Battery System

Protection Class: Class I
Rated/Maximum Current: 50A
Short-circuit Current: 4500A@1ms

Rated Capacity: 100Ah

Battery Model	Nominal Voltage	Operating Voltage Range	Rated Energy	Designation Code
☐ HV48100 BMU-5	256V	237.5V~288V	25.6kWh	IFpP54/150/120[((8S)2S)5S]E/-10+50/95
☐ HV48100 BMU-6	307.2V	285V~345.6V	30.72kWh	IFpP54/150/120[((8S)2S)6S]E/-10+50/95
☐ HV48100 BMU-7	358.4V	332.5V~403.2V	35.84kWh	IFpP54/150/120[((8S)2S)7S]E/-10+50/95
☐ HV48100 BMU-8	409.6V	380V~460.8V	40.96kWh	IFpP54/150/120[((8S)2S)8S]E/-10+50/95
☐ HV48100 BMU-9	460.8V	427.5V~518.4V	46.08kWh	IFpP54/150/120[((8S)2S)9S]E/-10+50/95
☐ HV48100 BMU-10	512V	475V~576V	51.2kWh	IFpP54/150/120[((8S)2S)10S]E/-10+50/95
☐ HV48100 BMU-11	563.2V	522.5V-633.6V	56.32kWh	IFpP54/150/120[((8S)2S)11S]E/-10+50/95
☐ HV48100 BMU-12	614.4V	570V~691.2V	61.44kWh	IFpP54/150/120[((8S)2S)12S]E/-10+50/95
☐ HV48100 BMU-13	665.6V	617.5V~748.8V	66.56kWh	IFpP54/150/120[((8S)2S)13S]E/-10+50/95
☐ HV48100 BMU-14	716.8V	665V~806.4V	71.68kwh	IFpP54/150/120[((8S)2S)14S]E/-10+50/95
☐ HV48100 BMU-15	768V	712.5V~864V	76.8kWh	IFpP54/150/120[((8S)2S)15S]E/-10+50/95

S/N:

Date:

MADE IN CHINA
Shanghai PYTES Energy Co., Ltd.

Battery Module Unit

Pytes

Battery Model	HV48100 BMU
Battery Cell Type	LFP Battery
Operating Voltage Range	47.5V~57.6V
Nominal Voltage	51.2V
Rated Energy	5.12kWh
Rated Capacity	100Ah
Rated Charge/Discharge Current	50A
Maximum Charge/Discharge Current	50A
Protective Class	Class I
Ingress Protection Code	IP20

CAUTION! IFpP54/150/120[(8S)2S]E/-10+50/95

- Do not dispose of batteries in a fire. The batteries may explode.
- Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.
- A Battery can present a risk of electric shock and burns by high short-circuit current.
- Failed batteries can reach temperatures that exceed the burn thresholds for touchable surface.

S/N:

Date:

MADE IN CHINA
Shanghai PYTES Energy Co., Ltd.

DANGER

Danger| High DC voltage inside
Danger| Arc flash & shock hazard

DANGER | Haute Tension Continue(DC) interne
DANGER | Risque d'arc électrique et d'électrocution

Charge the battery every six months to reach 90% SOC, in case of long-term storage.
Recharger la batterie tous les six mois jusqu'à 90% de l'état de charge (SOC) en cas de stockage prolongé.

ATTENTION!

Read the user manual carefully before connecting the wires.
Ensure the grounding connection is properly established before use.
Repairs must be performed by authorized and trained personnel only.
Keep the battery out of reach of children and pets.
Keep the battery away from open flames and flammable materials.
Avoid immersing the battery in or exposing it to water or other liquids.
Avoid exposure to direct sunlight and humid environments.
Do not dismantle the battery unless performed by qualified personnel.
Do not drop, crush, or strike the battery. Do not puncture or cut the battery with sharp objects.
Do not cover or wrap the battery.
Do not place heavy objects on or sit on the battery.
If the battery leaks, catches fire, or is damaged, switch off the breaker on DC side and stay away from the battery.
Contact your supplier immediately within 24 hours of any failure.

ATTENTION!

Lire attentivement le manuel d'utilisation avant de procéder au raccordement des conducteurs des câbles.
S'assurer de la mise à la terre est correctement établie avant toute mise en service.
Toute intervention de maintenance doit impérativement être réalisée par des techniciens certifiés et qualifiés.
Conserver la batterie hors de portée des enfants et des animaux.
Tenir la batterie à l'écart des flammes nues et des matières inflammables.
Éviter toute immersion de la batterie dans l'eau ou tout autre liquide.
Éviter toute exposition directe au soleil et aux environnements humides.
Ne pas démonter la batterie, sauf intervention par un personnel qualifié.
Ne pas laisser tomber, écraser ou heurter la batterie. Éviter tout percage ou coupure avec des objets tranchants.
Ne pas recouvrir ni envelopper la batterie.
Ne pas placer d'objets lourds sur la batterie ni s'asseoir dessus.
En cas de fuite, d'incendie ou d'endommagement de la batterie: Couper immédiatement le disjoncteur côté continu (DC) et S'éloigner de la batterie.
En cas de dysfonctionnement, veuillez contacter votre fournisseur dans les 24 heures suivant l'incident.

Warning! Avertissement!

Hazardous Voltage Circuits

Circuits a tension elevee

Warning! Avertissement!

Risk of Electric Shock or Serious Injury. Care Shall be taken when entering enclosure – Authorized personnel only.

Risque de choc electrique ou de blessure grave. Faire attention en entrant dans l'enceinte – Personnes autorisees uniquement.

Warning! Avertissement!

To Reduce the Risk of Injury, read all instructions.

Pour Prevenir les blessures, lire toutes les instructions.

Pytes

Energy Storage System
HV100 S30K

Max. PV Input	39000W
Nominal PV Voltage Range	150-500V
Max. Input Current per MPPT	36A
Nominal AC Output Voltage	120/208V
Max. AC Output Power	30000W
Max. AC Output Current	83.4A
Frequency	60Hz
Power Factor	- 0.8~+0.8
Battery Type	LFP
Battery Voltage Range	237.5Vdc-460.8Vdc
Battery Max. Charge/Discharge Current	100A
Battery Maximum Energy Output	655.36kWh
Duty cycle	6000 Cycles
Standard Charge Temperature	0°C - 57°C
Standard Discharge Temperature	-18°C - 57°C
Max. Weight	579.6kg
Battery Ingress Protection	IP20
Inverter Ingress Protection	IP65
Max. Efficiency	97.5%
Input Short-circuit Current Rating	10kA
Over Current Protective Device Rating	250A
Output Available Fault Current	1907A/2ms

*Grid Support Interactive Inverter.
*The system has been evaluated as a multi-part ESS.
*Suitable for Use in Residential Non-Habitable Spaces.
*The components of the system:
InverterSoi-Ark,30K-3P-208V*1pc
Battery:Pytes,HV48100 BMU-5/HV48100 BMU-6/HV48100 BMU-7/HV48100 BMU-8 for 1 battery cluster,up to 16 battery clusters in parallel.
Battery Box or Bracket(Optional):HV48100 Cabinet:HV48100 12S Cabinet:HV48100 1SS Cabinet:HV48100 1SS Bracket:Torus Nova Pulse

5min

Product Serial Number

Pytes

Energy Storage System
HV100 S60K

Max. PV Input	78000W
Nominal PV Voltage Range	150-850V
Max. Input Current per MPPT	36A
Nominal AC Output Voltage	277/480V
Max. AC Output Power	60000W
Max. AC Output Current	72.3A
Frequency	60Hz
Power Factor	- 0.8~+0.8
Battery Type	LFP
Battery Voltage Range	237.5Vdc-748.8Vdc
Battery Max. Charge/Discharge Current	100A
Battery Maximum Energy Output	1064.9kWh
Duty cycle	6000 Cycles
Standard Charge Temperature	0°C - 57°C
Standard Discharge Temperature	-18°C - 57°C
Max. Weight	923.6kg
Battery Ingress Protection	IP20
Inverter Ingress Protection	IP65
Max. Efficiency	97.5%
Input Short-circuit Current Rating	10kA
Over Current Protective Device Rating	250A
Output Available Fault Current	1927A/2ms

*Grid Support Interactive Inverter.
*The system has been evaluated as a multi-part ESS.
*Suitable for Use in Residential Non-Habitable Spaces.
*The components of the system:
InverterSoi-Ark,60K-3P-480V*1pc
Battery:Pytes,HV48100 BMU-5/HV48100 BMU-6/HV48100 BMU-7/HV48100 BMU-8/HV48100 BMU-9/HV48100 BMU-10/HV48100 BMU-11/HV48100 BMU-12/HV48100 BMU-13 for 1 battery cluster,up to 16 battery clusters in parallel.
Battery Box or Bracket(Optional):HV48100 Cabinet:HV48100 12S Cabinet:HV48100 1SS Cabinet:HV48100 1SS Bracket:Torus Nova Pulse

5min

Product Serial Number

Pytes

Energy Storage System
HV100 SI3.8K

Max. PV Input	6080W
Nominal PV Voltage Range	80-520V
Max. Input Current per MPPT	16A
Nominal AC Output Voltage	240V
Max. AC Output Power	3800W
Max. AC Output Current	15.8A
Frequency	60Hz
Power Factor	>0.99(+/-0.8 adj.)
Battery Type	LFP
Battery Voltage Range	237.5Vdc - 460.8Vdc
Battery Max. Charge/Discharge Current	25A
Battery Maximum Energy Output	655.36kWh
Duty cycle	6000 Cycles
Standard Charging Temperature	0°C ~ 57°C
Standard Discharge Temperature	-18°C ~ 57°C
Max. Weight	5743.8kg
Battery Ingress Protection	IP20
Inverter Ingress Protection	TYPE 4X
Max. Efficiency	98.5%
Input Short-circuit Current Rating	16A
Over Current Protective Device Rating	82.7A*76A
Output Available Fault Current	130A/150ms

*Grid Support Interactive Inverter
*The system has been evaluated as a multi-part ESS.
*Suitable for Use in Residential Non-Habitable Spaces.
*The components of the system:
InverterSolis, S6-EH1P3.8K-H-US*1pc
Battery:Pytes, HV48100 BMU-5 / HV48100 BMU-6 / HV48100 BMU-7 / HV48100 BMU-8 for 1 battery cluster, up to 16 battery clusters in parallel.
Battery Box or Bracket(Optional):HV48100 Cabinet, HV48100 12S Cabinet, HV48100 1SS Cabinet; HV48100 1SS Bracket

Product Serial Number

Pytes

Energy Storage System

HV100 S15K

Max. PV Input	8000W
Nominal PV Voltage Range	80-520V
Max. Input Current per MPPT	16A
Nominal AC Output Voltage	240V
Max. AC Output Power	3000W
Max. AC Output Current	20.8A
Frequency	60Hz
Power Factor	>0.99(+/- 0.8 adj.)
Battery Type	LFP
Battery Voltage Range	237.5Vdc - 460.8Vdc
Battery Max. Charge/Discharge Current	25A
Battery Maximum Energy Output	655.36WH
Duty cycle	6000 Cycles
Standard Charging Temperature	0°C ~ 57°C
Standard Discharge Temperature	-18°C ~ 57°C
Max. Weight	57.45.8kg
Battery Ingress Protection	IP20
Inverter Ingress Protection	TYPE 4X
Max. Efficiency	98.5%
Input Short-circuit Current Rating	16A
Over Current Protective Device Rating	82.7A/176A
Output Available Fault Current	130A/150ms

*Grid Support Interactive Inverter

*The system has been evaluated as a multi-part ESS.

*Suitable for Use in Residential Non-Habitable Spaces.

*The components of the system:

Inverter:Solis, S6-EH1P8K-H-US*1pc;

Battery:Pytes, HV48100 8kWh5 / HV48100 8kWh6-4 / HV48100 8kWh7-7 / HV48100 8kWh8-8 for 1 battery cluster, up to 16 battery clusters in parallel;

Battery Box or Bracket(Optional):HV48100 Cabinet, HV48100 125 Cabinet, HV48100 155 Cabinet; HV48100 155 Bracket

Product Serial Number

Pytes

Energy Storage System

HV100 S17.6K

Max. PV Input	12160W
Nominal PV Voltage Range	80-520V
Max. Input Current per MPPT	16A
Nominal AC Output Voltage	240V
Max. AC Output Power	7600W
Max. AC Output Current	31.7A
Frequency	60Hz
Power Factor	>0.99(+/- 0.8 adj.)
Battery Type	LFP
Battery Voltage Range	237.5Vdc - 460.8Vdc
Battery Max. Charge/Discharge Current	25A
Battery Maximum Energy Output	655.36WH
Duty cycle	6000 Cycles
Standard Charging Temperature	0°C ~ 57°C
Standard Discharge Temperature	-18°C ~ 57°C
Max. Weight	57.45.8kg
Battery Ingress Protection	IP20
Inverter Ingress Protection	TYPE 4X
Max. Efficiency	98.5%
Input Short-circuit Current Rating	16A
Over Current Protective Device Rating	82.7A/176A
Output Available Fault Current	130A/150ms

*Grid Support Interactive Inverter

*The system has been evaluated as a multi-part ESS.

*Suitable for Use in Residential Non-Habitable Spaces.

*The components of the system:

Inverter:Solis, S6-EH1P10K-H-US*1pc;

Battery:Pytes, HV48100 8kWh5 / HV48100 8kWh6-4 / HV48100 8kWh7-7 / HV48100 8kWh8-8 for 1 battery cluster, up to 16 battery clusters in parallel;

Battery Box or Bracket(Optional):HV48100 Cabinet, HV48100 125 Cabinet, HV48100 155 Cabinet; HV48100 155 Bracket

Product Serial Number

Pytes

Energy Storage System

HV100 S10K

Max. PV Input	16000W
Nominal PV Voltage Range	80-520V
Max. Input Current per MPPT	16A
Nominal AC Output Voltage	240V
Max. AC Output Power	10000W
Max. AC Output Current	41.7A
Frequency	60Hz
Power Factor	>0.99(+/- 0.8 adj.)
Battery Type	LFP
Battery Voltage Range	237.5Vdc - 460.8Vdc
Battery Max. Charge/Discharge Current	50A
Battery Maximum Energy Output	655.36WH
Duty cycle	6000 Cycles
Standard Charging Temperature	0°C ~ 57°C
Standard Discharge Temperature	-18°C ~ 57°C
Max. Weight	57.45.8kg
Battery Ingress Protection	IP20
Inverter Ingress Protection	TYPE 4X
Max. Efficiency	98.5%
Input Short-circuit Current Rating	16A
Over Current Protective Device Rating	82.7A/176A
Output Available Fault Current	130A/150ms

*Grid Support Interactive Inverter

*The system has been evaluated as a multi-part ESS.

*Suitable for Use in Residential Non-Habitable Spaces.

*The components of the system:

Inverter:Solis, S6-EH1P11.4K-H-US*1pc;

Battery:Pytes, HV48100 8kWh5 / HV48100 8kWh6-4 / HV48100 8kWh7-7 / HV48100 8kWh8-8 for 1 battery cluster, up to 16 battery clusters in parallel;

Battery Box or Bracket(Optional):HV48100 Cabinet, HV48100 125 Cabinet, HV48100 155 Cabinet; HV48100 155 Bracket

Product Serial Number

Pytes

Energy Storage System

HV100 S11.4K

Max. PV Input	18240W
Nominal PV Voltage Range	80-520V
Max. Input Current per MPPT	16A
Nominal AC Output Voltage	240V
Max. AC Output Power	11400W
Max. AC Output Current	47.5A
Frequency	60Hz
Power Factor	>0.99(+/- 0.8 adj.)
Battery Type	LFP
Battery Voltage Range	237.5Vdc - 460.8Vdc
Battery Max. Charge/Discharge Current	50A
Battery Maximum Energy Output	655.36WH
Duty cycle	6000 Cycles
Standard Charging Temperature	0°C ~ 57°C
Standard Discharge Temperature	-18°C ~ 57°C
Max. Weight	57.45.8kg
Battery Ingress Protection	IP20
Inverter Ingress Protection	TYPE 4X
Max. Efficiency	98.5%
Input Short-circuit Current Rating	16A
Over Current Protective Device Rating	82.7A/176A
Output Available Fault Current	130A/150ms

*Grid Support Interactive Inverter

*The system has been evaluated as a multi-part ESS.

*Suitable for Use in Residential Non-Habitable Spaces.

*The components of the system:

Inverter:Solis, S6-EH1P11.4K-H-US*1pc;

Battery:Pytes, HV48100 8kWh5 / HV48100 8kWh6-4 / HV48100 8kWh7-7 / HV48100 8kWh8-8 for 1 battery cluster, up to 16 battery clusters in parallel;

Battery Box or Bracket(Optional):HV48100 Cabinet, HV48100 125 Cabinet, HV48100 155 Cabinet; HV48100 155 Bracket

Product Serial Number

Manufacturer precautions for ESS Installation

1. Approved Installation Locations

The ESS is suitable for use in residential non-habitable spaces.

- Utility rooms or dedicated electrical rooms
- Basements
- Garages (attached or detached)
- Outdoor installations (if rated for environmental exposure, e.g., IP65)

Note: Installation inside habitable spaces (e.g., bedrooms, living rooms) is **Prohibited** unless explicitly approved by local codes and standards.

2. Location Requirements & Clearances

- Install the ESS in a well-ventilated area to prevent heat accumulation.
- Keep away from:
  - Direct sunlight
  - Heat sources (furnaces, water heaters)
  - Flammable or explosive materials
- Do not install in areas prone to:
  - Flooding
  - Excessive humidity
  - Corrosive environments (unless rated, e.g., C4-M)

3. Mounting & Structural Considerations

- Ensure the mounting surface can support the full weight of the ESS.
- Secure the unit to prevent tipping or movement (especially in seismic zones if applicable).

4. Fire Safety & Protection

- The ESS shall be installed in accordance with applicable fire codes
- Maintain required separation distances from:
  - Doors and windows
  - Means of egress
- Do not obstruct emergency access.

5. Electrical & System Integration

- Installation must be performed by qualified personnel.
- Follow all applicable electrical codes (e.g., National Electrical Code).
- Ensure proper grounding and overcurrent protection.
- Verify compatibility with inverter and other system components.

6. Environmental & Operating Conditions

- Operate within specified temperature and humidity ranges.
- For cold climates, ensure:
  Installation location minimizes prolonged sub-freezing exposure

7. Maintenance & Accessibility

- Install the ESS in a location that allows:
  - Easy inspection and servicing
  - Safe access for maintenance personnel
- Do not block:
  - Ventilation openings
  - Disconnect switches

8. Warnings & Precautions

⚠ Do not install near combustible materials or ignition sources
⚠ Do not expose the ESS to water ingress unless rated for outdoor use
⚠ Do not modify or disassemble the system
⚠ Always follow shutdown procedures before servicing

9. Compliance Statement (Optional for Manual)

This energy storage system is designed and tested in accordance with applicable safety standards, including UL 9540 and relevant fire testing such as UL 9540A. Installation shall comply with all local codes and Authority Having Jurisdiction (AHJ) requirements.

3 Transportation and Storage

3.1 Transportation Requirements

DANGER

Load or unload batteries with caution. Otherwise, the batteries may be shortcircuited or damaged (such as leakage and crack), catch fire, or explode.

WARNING

Do not move a battery by holding its terminals, bolts, or cables. Otherwise, the battery may be damaged.

Keep batteries in the correct direction during transportation. They must not be placed upside down or tilted, and must be protected against falling, mechanical impact, rains, snows, and falling into water during transportation.

Before unpacking, storage, and transportation, ensure that the packing cases are intact, and the batteries are correctly placed according to the labels on the packing cases. Do not place a battery upside down or vertically, lay it on one side, or tilt it.

Stack the batteries according to the stacking requirements on the packing cases.

Ensure that the batteries do not fall or get damaged. Otherwise, they will need to be scrapped.

Battery module is pre-charged to 50% SOC or custom required before shipment. The remaining capacity will be determined by storage time and condition before installation on the scene.

1. The battery modules meet UN38.3 standard.
2. Comply with laws towards dangerous goods transportation, in particular, the revised ADR (European Convention on the International Carriage of Dangerous Goods by Road).

3.2 Storage Requirements

DANGER

Ensure that batteries are stored in a dry, clean, and ventilated indoor environment that is free from sources of strong infrared or other radiations, organic solvents, corrosive gases, and conductive metal dust. Do not expose batteries to direct sunlight or rain and keep them far away from sources of heat and ignition.

If a battery is faulty (with scorch, leakage, bulge, or water intrusion), move it to a dangerous goods warehouse for separate storage. The distance between the battery and any combustible materials must be at least 3 m. The battery must be scrapped as soon as possible.

Place batteries correctly according to the signs on the packing case during storage. Do not place batteries upside down, lay them on one side, or tilt them. Stack batteries in accordance with the stacking requirements on the packing cases.

Store batteries in a separate place. Do not store batteries together with other devices. Do not stack batteries too high. If a large number of batteries are stored onsite, the site should be equipped.

CAUTION

Batteries should be used soon after being deployed onsite. Batteries that have been stored for an extended period should be charged periodically. Otherwise, they may be damaged.

- The storage environment must comply with local regulations and standards.
- The storage environment must be clean and dry. The product must be protected against rain and water.
- The air must not contain corrosive or flammable gases.
- The storage environment requirements are as follows:
  - Within 1month: -20°C~50°C(-4°F~122°F) 1-3months: -10°C~40°C(14°F~104°F) 3-12months: > 0°C~30°C(32°F~86°F); recommended storage temperature: 20–30°C
  - Relative humidity: 5% to 80%
- If equipment except battery packs has been stored for more than two years, it must be checked and tested by professionals before use.
- Proof that the product is stored according to the requirements must be available, such as temperature and humidity log data, storage environment photos, and inspection reports.
- Ensure that batteries are delivered based on the "first in, first out" rule. Ensure that the storage duration starts from the latest charge time marked on the battery packing case and that the latest charge time is updated after every charge.

4 System Installation

4.1 Checking Before the installation

Checking the Outer Packing

Before unpacking the battery, check the outer packing for damage, such as holes and cracks, and check the battery model. If any damage is found or the battery model is not what you requested, do not unpack the product and contact your dealer as soon as possible.

Checking Deliverables

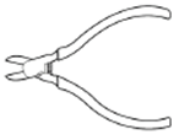
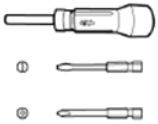
After unpacking the battery, check that the deliverables are intact and complete, and free from any obvious damage. If any item is missing or damaged, contact your dealer. For details about the number of deliverables delivered with the battery, see below Packing list.

Packing list

Category	Item	Description	Quantity
Battery Control Unit	Hex head screws	M6	4
	Battery power cable-Positive	4AWG, 146.5mm, Orange, Amphenol terminal*2	1
	Battery Power cable-Negative	4AWG, 1550mm, Black, Amphenol terminal*2	1
	External power cable-Positive	6AWG, 4000mm, Orange	1
	External power cable-Negative	6AWG, 4000mm, Black	1
	Communication cable	CAT6, 3500mm, Blue, RJ45*2	1
	Wifi antenna extension cable	500mm	1
	Ground cable	10AWG, 4000mm, Yellow/Green, SC6-6*2	1
	RJ45 terminal	RJ45	2
	Cascading cable	CAT6, 141mm, Blue, RJ45*2, 90 Degree	1
	Wifi Antenna		1
Battery Module Unit	hex head screws	M6	4
	Battery serial power cable	4AWG, 160mm, Orange, Amphenol terminal*2 (Positive + Negative)	1
	Battery cascading cable	CAT6, 163mm, Blue, RJ45*2	1
	Ground cable	10AWG, 150mm, Yellow/Green, SC6-6*2	1

4.2 Preparing tools and instruments

4.2.1 Tools

Diagonal pliers	Crimping tool	Cable tie
		
Torque screwdriver	**Torque wrench**	**Utility knife**
		
Multimeter	**Insulated gloves**	**Safety boots**

Notice

Use insulated tools to avoid electric shock or short circuits risks.

Alternatively, cover the entire exposing metal surface of tools with insulating tape if insulated tools are not available.

4.2.2 Fire-extinguisher system

The room where the system is installed must be equipped with fire extinguisher system.

The fire-extinguisher system should be regularly checked to ensure normal condition.

Note: Refer to local requirements for using and maintenance.

4.3 Determining the Installation Position

4.3.1 Installation Environment Requirements

WARNING

HV48100 is IP20. It must be installed in a restricted location.

HV48100 is high voltage DC system, it must be operated by qualified and authorized person only.

Cleaning

The battery system is equipped with high voltage connectors. Cleaning conditions will affect isolation characteristic of the system. Before system installation and operation, dust and iron scurf must be cleaned. An anti-dust environment is recommended. Turn off the system to clean if it's over operation conditions.

Operation Temperature

HV48100 system operation temperature: Charge： 0°C~57°C (32°F~134.6°F)，
Discharge: -18°C~57°C (-0.4°F~134.6°F);
Optimum range: 18℃~28℃.

WARNING

Out of operation temperature will lead to battery system over / low temperature alarm or protection, which reduces battery cycle life.

Grounding system

Make sure the system is well grounded before installation.
The resistance of the grounding system must ≤100mΩ

Installation Angle Requirement

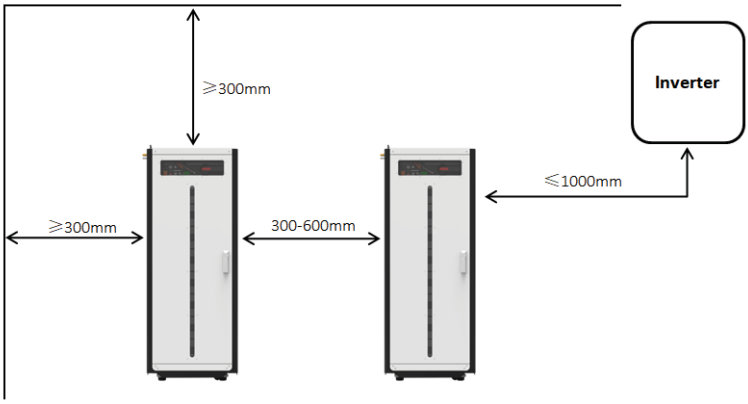
The battery can be floor-mounted only.
Do not install the battery at forward tilted, back tilted, side tilted, horizontal, or upside down positions.

4.3.2 Installation Position Requirements

Install the battery on a solid brick-concrete floor. If other types of floors are used, they must be made of fire-retardant materials and meet the load-bearing requirements of the equipment.

4.3.3 Installation Space Requirements

During installation, ensure that there are no other devices (except related Pytes devices and awnings) or flammable or explosive materials around the batteries. Reserve adequate space for heat dissipation and safety isolation.
Keep enough space for the batteries, recommended as below:



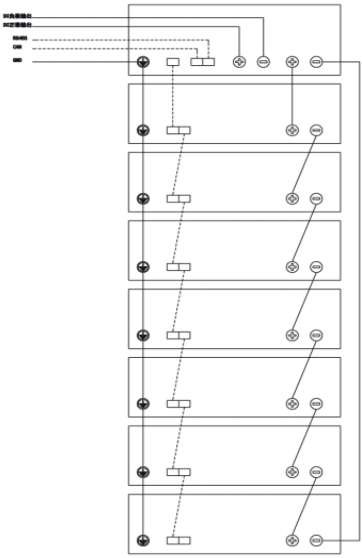
4.4 Equipment Installation

4.4.1 Battery module & Battery control unit installation

Step 1 Place first Battery modules into cabinet slot at the bottom, tighten 4 screws of mounting ear to fix the battery module on cabinet.
Step 2 Repeat Step 1 to install all battery modules in order from bottom to top.
Step 3 Place Battery control unit into cabinet slot at the top, tighten 4 screws of mounting ear to fix the battery control unit on cabinet.

Note: Single battery module is ≥ 43 kg. Be careful during whole procedure of handling and removal.
Note: The cabinet filled with whole battery modules is ≥ 446.9 kg . Be cautious during whole procedure of handling and removal.
Note: If a battery cabinet is not used, during installation ensure that the spacing between two adjacent batteries is at least greater than 10mm.

5 Electrical Connection



5.1 Internal Connections of the Battery

5.1.1 Installing an internal Ground Cable

Precautions

DANGER

Ensure that the PE Cable is securely connected. Otherwise, electric shocks may occur.
It is recommended that silica gel or paint be used around the ground terminal after PE cable is connected.

Step 1 Connect the PE cable to the cabinet ground point.

Note: The system grounding is achieved by cabinet grounding through metal surface direct touching of battery module, control module and rack/cabinet. if other cabinet is used, please make sure each battery is grounded.

5.1.2 Installing Internal communication cables

Step 1 Connect the Link 1 port of the first battery on the top to the next battery Link 0 port.
Step 2 Repeat step 1, make sure the connection from the former battery Link 1 port to later battery Link 0 port.
Step 3 Connect Battery communication port of BCU with Link 0 port of the first Battery module.

5.1.3 Installing internal DC Power cables

Step 1 Connect the first battery negative terminal(B-) with second battery positive terminal (B+) with battery power cable.
Step 2 Repeat Step 1 in order from top to bottom connect all battery modules in series.
Step 3 Connect the negative terminal (B-) of BCU with last battery negative terminal (B-) with negative battery power cable.
Step 4 Connect the positive terminal (B+) of BCU with first battery positive terminal (B+) with positive power cable.

5.2 External Electrical Connections of the Battery

5.2.1 Installing an external BMS cable

Step 1 Connect RS485/CAN port of BCU and Inverter BMS port with BMS cable.

Note:
Different Inverter will have different Communication protocol and Pin layout, consult installer for right one.
Port definition and Pin layout of BCU:

No.	CAN	RS485	RS232
1			
2			
3			TX
4	CAN_H		GND
5	CAN_L		
6			RX
7		485_A	
8		485_B	

5.2.2 Installing external DC power cable

Step 1 Connect Negative External power terminal (P-) of BCU with inverter Negative Battery terminal (-).
Step 2 Connect Positive External power terminal (P+) of BCU with inverter Negative Battery terminal (+).

5.3 Installing the Antenna

Step 1 Connect the Antenna cable with WiFi Port on BCU.

6 System Start Up

DANGER

Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits.

WARNING

During Power-on procedure, power off the batteries immediately if any fault is detected. Rectify the fault before proceeding with the procedure.

After batteries are used for system commissioning or batteries have discharged, charge the batteries in time. Otherwise, batteries may be damaged due to overdischarge.

Battery overdischarge and damage may occur if batteries with low SOC are stored. Batteries should be recharged in a timely manner.

NOTICE

Before the equipment is put into operation for the first time, ensure that the parameters are set correctly by professional personnel. Incorrect parameter settings may result in noncompliance with local grid connection requirements and affect the normal operations of the equipment.

6.1 Verification Before Power-On

Check items and acceptance criteria:

No.	Check Item	Acceptance Criteria
1	Battery installation	The installation is correct and reliable.
2	Cables Routing	Cables are routed properly as required by the customer.
3	Cable tie	Cable ties are evenly distributed, and noburr exists.
4	Grounding	The PE cable is connected correctly,securely, and reliably.
5	Switch	The DC switch and all switches connected to the battery are OFF.
6	Cable connection	The AC output power cable, DC input power cable, battery cable, and signal cables are connected correctly, securely, and reliably.
7	Unused terminal and port	Unused terminals and ports are locked by watertight caps.
8	Installation environment	The installation space is proper, and the installation environment is clean and tidy.

6.2 System Power-On

Step 1 Set the right DIP according to corresponding PCS brand. DIP setting as below:

DIP switch

code bit						PCS
1	2	3	4	5	6	
0	0	0	1	0	0	Afore
0	1	0	0	0	0	Deye
0	0	0	0	0	1	Hoymiles
0	0	0	0	1	0	Ingeteam
0	0	1	1	0	0	Luxpower
1	1	1	1	0	0	Megarevo
1	0	0	0	1	0	Solark
0	1	0	1	0	0	Solis
1	0	0	0	0	0	Voltronic
1	0	1	0	1	0	Sinexcel
1	1	0	0	0	1	Solinteg
0	0	1	0	0	1	Sineng

Notes: code bits 1, 2, 3, 4, 5, 6 in the schematic represent DIP switches from left to right facing front panel.Dialing up = “1”, Dialing down = “0”. *PYTES may update new compatible inverters without further notice.

Step 2 Turn on External Switch and inverter according to inverter guidance.
Step 3 Turn on Isolation switch on BCU.
Step 4 Turn on Power knob on BCU, indicator lights on the knob switch turn to green.
Step 5 Short press the SW button on BCU, the RUN light will flash. All battery will start up.

6.3 LED Indicator Instructions

Battery status	Protection / Alarm / Normal	ALM	RUN	Capacity LED						Descriptions
		●	●	●	●	●	●	●	●	
Shut down		OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	All off
Power-on	Normal	ON	ON	ON	ON	ON	ON	ON	ON	All lights on one second at same time.
Standby	Normal	OFF	Blink 1	OFF	OFF	OFF	OFF	OFF	OFF	Indication standby
	Alarm	Blink 3	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Battery low voltage
Charging	Normal	OFF	Light	Based on capacity						
	Alarm	Blink 3	Light							
	Protection	Light	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Stop charging, protect start
Discharge	Normal	OFF	Blink 3	Base on capacity						
	Alarm	Blink 3	Blink 3							
	Protection	Light	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Stop discharge, protect start

Note: The blinking descriptions: Blink 1“0.3s on/3.7s off”; Blink 2 “0.5s on /0.5s off”;Blink 3“0.5s on / 1.5s off”; Blink 4“0.7s on / 9.3s off”

7 System Maintenance

DANGER

Wear personal protective equipment and use dedicated insulated tools to avoid electric shocks or short circuits.

WARNING

Do not maintain batteries with power on. To power off the batteries before performing operations such as checking and tightening screw torques, explain the risks to the customer, obtain the customer's written consent, and take effective preventive measures.

After batteries are discharged, charge them in time to avoid damage due to overdischarge.

Before moving or reconnecting the equipment, disconnect the mains and batteries and wait for five minutes until the equipment powers off. Before maintaining the equipment, check that no hazardous voltages remain in the DC bus or components to be maintained by using a multimeter.

CAUTION

Do not connect two or more cables to the positive or negative power port of a battery in parallel.

Stay away from the equipment when preparing cables to prevent cable scraps from entering the equipment. Cable scraps may cause sparks and result in personal injury and equipment damage.

7.1 System Power-Off

Step 1 Turn off the AC switch between the inverter and the power grid.
Step 2 Turn off the DC switch between battery and inverter.
Step 3 Turn off the DC switch between PV and inverter.
Step 4 Press SW button on BCU for 3 seconds. And wait for 20s for all battery shutdown.
Step 5 Turn off Power button on BCU.
Step 6 Switch off Isolation switch.

CAUTION

Do not turn off the External power switch during system running.

Before battery module replacement service, charge/discharge the replaced battery to same voltage as the other modules in the system. Otherwise, it will take a long time for the system to balance the module.

7.2 Routine Maintenance

System Cleanliness

Check item	Check method	Maintenance interval
System cleanliness	Check periodically that cabinet are free from obstacles and dust.	Once every 6 to 12 months
System running status	Check that the battery is not damaged or deformed. Check that the battery parameters are correctly set when the battery is running.	Once every 6 months
Electrical Connection	Check that cables are secured. Check that cables are intact, and that in particular, the parts touching the metallic surface are not scratched. Check that unused DC input terminals, battery terminals, and other ports are locked by caps.	The first inspection is 6 months after the initial commissioning. From then on, the interval can be 6 to 12 months.
Grounding reliability	Check that ground cables are securely connected.	The first inspection is 6 months after the initial commissioning. From then on, the interval can be 6 to 12 months.

7.3 Troubleshooting

DANGER

HV48100 is a high voltage DC system, operated by qualified and authorized person only.

Before checking the failure, make sure all cable connections and switches are in correct condition and the system can be turned on normally.

No.	Problem	Possible Reasons	Solution
1	Turn on the BMS. The Status LED lights in red. All battery module status LED Lights in green.	This battery string is under protection. It is possible Over Current Protection or Failure Protection. No external communication with upper controller.	Through the monitor or maintenance software check the battery cell, battery module has alarm or not. Check communication with upper controller and communication cable wiring. Reversed connection is seriously danger!
2	The BMS's Status LED is lighting red, and some the battery module's status LED is lighting green, but some is lighting red.	This battery string is under protection. It is possible Over Current, Over Voltage, Low Voltage, Over Temperature, Low Temperature or Failure Protection.	Use the monitor or maintenance software to check the battery cell, battery module has protection and failure or not.

7.4 Replacement of main component

DANGER

HV48100 is a high voltage DC system, operated by qualified and authorized person only.
The power cables and plugs always carry high voltage DC power from serial connected battery modules.
Be cautious to handle the power plugs.

7.4.1 Replacement of battery module

Step 1 Use a charger to charge the new battery module and existing modules, both to full (SOC 100%);
Step 2 Turn off the power of whole system. Make sure there's no power at P+ or P- terminals.
Step 3 Pull out the Plugs of Power Cable +/-. and communication cables.
Step 4 Dismantle the 4 screws from front panel of battery module.
Step 5 Handle the battery module out of the rack and put it in place.
Step 6 Install the new battery module and connect the cables.
Step 7 Power on the system.

7.4.2 Replacement of control Module (BMS)

Step 1 Turn off the power of whole system. Make sure there's no power at P+ or P- terminals.
Step 2 Pull out the Plugs of Power Cable +/-. and communication cables.;
Step 3 Dismantle the 4 screws from front panel of battery module.
Step 4 Install the new control module (BMS) and reconnect all the cables.
Step 5 Power on the system by referring to chapter4.

CAUTION

Mark the cable numbers before pulling out the communication cables, to avoid cable wrong connection later.

7.5 Battery Storage and Recharge

For long-term storage, the battery cells should be stored in the environment with temperature range of 0°C~30°C(32°F~86°F), relative humidity <65% and no corrosive gas.
It is recommended to discharge and charge the battery every 3 months. The longest discharge and charge interval shall not exceed 6 months and SOC is charged to not less than 90% of each charging.

CAUTION

If above instructions are not followed for long term storage, battery cycle life will significantly reduce.

8. Emergency Handling

8.1 Batteries Leaking

DANGER

The leaked electrolyte is a colorless viscous liquid that may evaporate rapidly and is flammable, turning into white salt residues. The electrolyte has a pungent smell and is corrosive, irritating to eyes and skin. Avoid contacting with it.

When handling chemical leakage incidents, professional maintenance personnel and firefighters must wear necessary protective equipment such as air-purifying respirator and other PPE. For household members, if battery leakage occurs, you are advised to follow the following steps:
(1) Stop the ESS immediately and set the battery power control module (DCDC) switch to OFF.
Turn off the AC circuit breaker of the inverter and set the inverter DC switch to OFF.
(2) Indoor installation scenario: Indoor personnel should quickly evacuate, open the doors, windows, and ventilation devices of the room, and turn off indoor fire sources during the evacuation. Outdoor installation scenario: Notify outdoor personnel to stay away from the site and set up a warning sign to isolate the area.
(3) After evacuating to a safe area, notify professional maintenance personnel or firefighters to handle the emergency.

Avoid contact with electrolytes or released gases. In the case of contact, take the following measures:

- Inhalation: Evacuate from contaminated areas, get fresh air immediately, and seek immediate medical attention.
- Eye contact: Immediately wash your eyes with water for at least 15 minutes, do not rub your eyes and seek immediate medical attention.
- Skin contact: Wash the affected areas immediately with soap and water and seek immediate medical attention.
- Intake: Seek immediate medical attention.

Install a plastic electrolyte collection container at the bottom of the battery to ensure that leaked electrolyte can be effectively directed to a safe location, preventing it from flowing towards adjacent battery packs and equipment.

8.2 Catching Fire

DANGER

In case of smoke or fire, if there is a large amount of smoke in the battery storage room, do not open the door to prevent explosion risks and toxic gas inhalation.
If a lithium battery catches fire, flammable and toxic gases will be released. Therefore, during the extinguishing process, all firefighters must wear a full set of protective suites, including flame retardant/fireproof clothing, air-purifying respirator or breathing apparatus, firefighter helmet and mask, and insulated shoes.
A lithium battery fire may last for several hours. After it is extinguished, the fire may be reignited by the heat generated from residual ingredients due to internal cell damage. After an open flame is extinguished, continue spraying water to cool the batteries. Wait until the battery temperature drops to the room temperature±10°C and monitor for 24 hours to ensure that there is no sign of temperature rise before removing the batteries. Move the removed batteries to a safe place (an open and safe outdoor place is recommended).

Procedure

1. If batteries emit smoke or catch fires, notify all household members to evacuate immediately.
2. After evacuating to a safe outdoor area (20 m away is recommended), call the fire department immediately. While waiting for the fire rescue, contact the installer and Pytes technical support.

3. Firefighters arrive at the site and extinguish the fire.
4. After the fire is extinguished, set up a warning sign to isolate the area and spray water to reduce the battery temperature to the room temperature±10°C. (You can use an infrared thermometer or thermal imager.)
5. Observe the batteries for 24 hours and ensure that there is no sign of temperature rise before removing the batteries. (Only professionals are allowed to remove the batteries.)
6. After removing the batteries, move them to a safe place (an open and safe outdoor place is recommended), place them in the fire sand box or salt water. These operations must be performed by professionals who must take insulation measures, such as wearing insulated gloves, insulated shoes, and personal protective equipment (PPE).
7. After the battery fire is extinguished, if there is no potential risk onsite, the battery must be handled and recycled by professionals in accordance with local laws and regulations.

8.3 Soaking

If the battery pack is wet or submerged in water, cut off all power switches on inverter side, no further access. Contact Pytes or an authorized dealer for technical support.

8.4 Battery Falling or Strong Impact

DANGER

If a battery is dropped or violently impacted during installation, it may become faulty and cannot be used. Using a faulty battery will cause safety risks such as cell leakage and electric shock.

If a battery has obvious damage or abnormal odor, smoke, or fire occurs, evacuate the personnel immediately, call emergency services, and contact the professionals. The professionals can use fire extinguishing facilities to extinguish the fire under safety protection.

If the appearance is not deformed or damaged, and there is no obvious abnormal odor, smoke, or fire, contact the professionals to transfer the battery to an open and safe place, or contact a recycling company for disposal.

9 Technical Specifications

Product	**Battery Control Unit (BCU)**
System Working Voltage Range	200~870V
System Working Current	50A
Monitoring Communication	RS232
Battery Communication	CAN, RS485
External Communication	CAN, RS485, Dry Contact, WiFi
Self-consumption Power	7.56W
Dimensions (W*D*H)	484*510*140mm / 19.1*20.1*5.5 inch
Weight	13.3 kg / 29.3 lbs
Protection Rate	IP20

WIFI Module	RF Band Range: 2.412GHz-2.472GHz
	Transmit power 802.11b: +17 +/-1.5dBm(@11Mbps); 802.11g: +15+/-1.5dBm(@54Mbps); 802.11n: +14+/-1.5dBm(@HT20, MCS7)
	Antenna Type: External WIFI Sticker, I-PEX to SMA 3dBi
	Gain: 3dBi

Product	**Battery Module Unit (BMU)**
Cell Type	LFP
Nominal Energy	5.12 kWh
Nominal Voltage	51.2 V
Nominal Capacity	100 Ah
Continuous Operation Current	50 A
Voltage Range	47.5~57.6V
Expansion	5-15pcs
Depth of Discharge	90%
Dimensions (W*D*H)	484*530*140 mm / 19.1*20.9*5.5 inch
Weight	43 kg / 94.8 lbs
Cycle Life	≥6000 cycles
Operation Temperature	Charge: 0°C~57°C(32°F~134.6°F), Discharge: -22°C~57°C(-7.6°F~134.6°F)
Storage Temperature	Within 1month: -20°C~50°C(-4°F~122°F) 1-3months: -10°C~40°C(14°F~104°F) 3-12months: > 0°C~30°C(32°F~86°F)
Protection level	IP20
Certifications	CE, IEC62619, UL1973, UL9540, UL9540A, UN38.3

Remarks:

* In case of 1C continuous charging and discharging, double check with PYTES for operation environment investigating is required. Improper conditions may trigger system protection.

** 18°C~28°C operation temperature is suggested for best cycle performance purpose.

10 System Debug

Debug steps	Content
Preparation	It is forbidden to turn on loads before turn on HV48100. Remarks: Follow instruction manuals of other equipment for turn on process other than HV48100.
System Function	Function Debug: **Communication**: Check communication between HV48100 and devices, if it's normal or alarm. **Power Conversion System**: Before conjoint, it is a must that PCS or Inverter System runs normally and parameters meet HV48100 requirement. **System Operation**: Charge/Discharge, charging stop, discharging stop, current limiting, etc. **Caution**: Set up all parameters of PCS and EMS before turn on HV48100.
Monitor Function	Connect to console terminal of main control to check whether data of HV48100 normally displays on the monitor system.
Operation Trial	After the system debugged, run the system a period with low load for trial operation, to test the high voltage DC system fits to requirement.

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