



ENDLESS ENERGY WE SHARE!



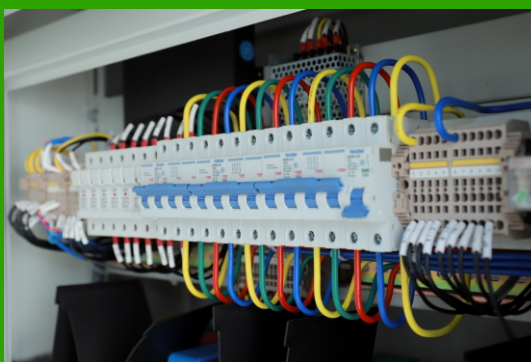
40ft container system, 500kW/1500kWh
MICRO GRID SOLUTION



Shenzhen Enershare Technology Co.,Ltd

www.enersharepower.com

Address: Room 702B, Huitong Building, No10 Longgang Road Pingnan
Community, Longgang District, Shenzhen, P.R.C



CONTENT

Preface	1
System Design	1
Storage Inverter Configuration	2
Energy Storage System Configuration	5
EMS Configuration	7
System Device List	7

1. Preface



This file is made as per energy storage station's technology standards. It includes product's general description, hardware application environment, detailed feature demands and other relevant supportive information.

And it serves for the developers who focus on energy storage field. The target objects for this file are project manager, software or hardware developer, maintenance engineer and testing engineer.

1.1 Project background

According to the project's real demand, it is a micro grid energy storage system project. The whole system is composed by the load, Lithium battery, hybrid storage inverter and solar panel. This project is basically expected to adopt 1 x 500kW hybrid storage inverter and 1548.3kWh battery. The ESS will be installed in IP54 1x 40ft container system, accurate design will be determined by actual scenario..

The PCS could work with the diesel generator or the utility. When the utility is not stable, the BESS could work as the back-up power system. When there is no utility, the BESS could get power from PV to support load and use the Diesel generator to charge the battery in emergency situation. The whole system will be managed and controlled by EMS to achieve automatic running. There would be the online monitoring system for user to watch.

1.2 Terminology

AC: alternative current.

DC: direct current.

ESS: energy storage system.

EMS: energy management system.

BMS: battery management system, responsible for the battery's management and control. It includes BMU, BCMU, control master and so on.

PCS: power conversion system.

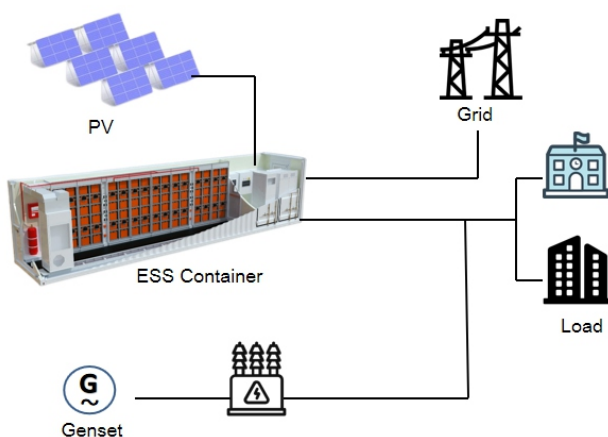
SOH: state of health (of battery), expressed in percentage.

DOD: depth of discharge, the rest battery capacity, expressed in percentage.

EOD: end of discharging.

SOC: state of charge (of battery).

1.3 System Conceptional Topology



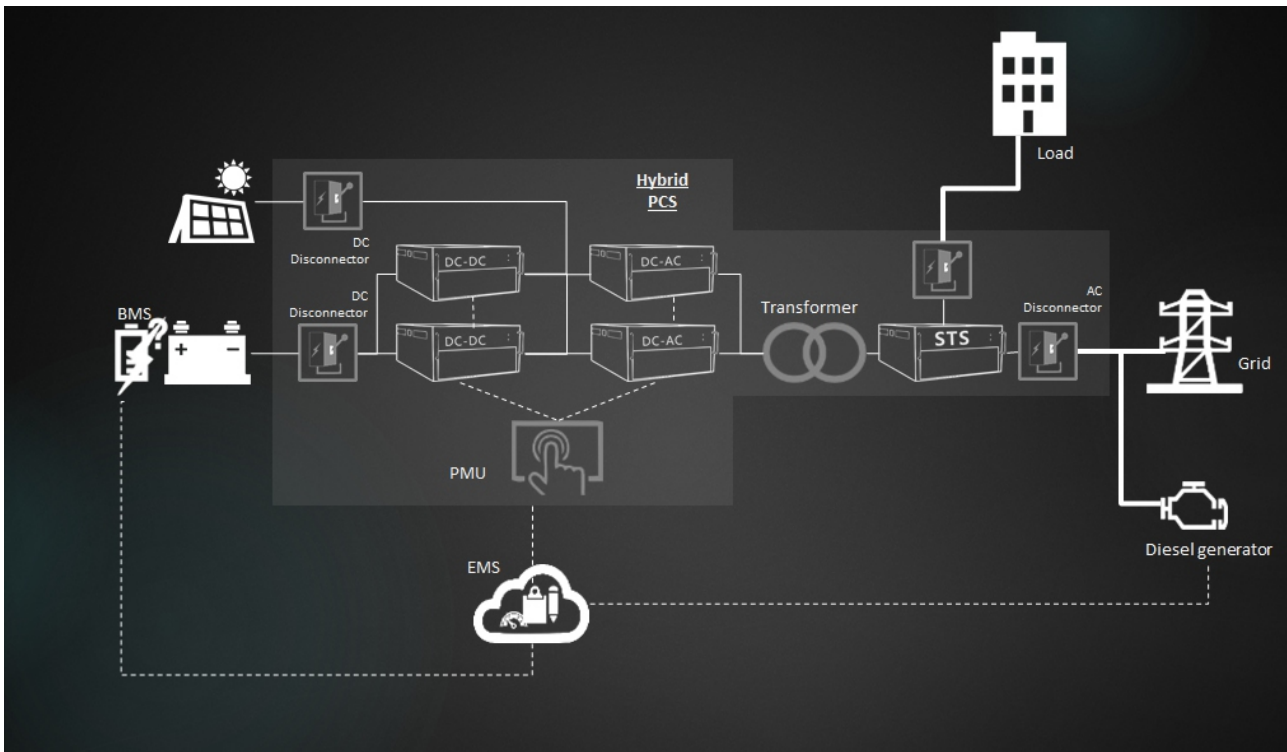
2. System Design

2.1 System description

1. This whole system includes 1548 KWh battery system, 500KW hybrid storage inverter, EMS and other relevant auxiliary systems.
2. All devices are installed in the IP54 container. The container is divided in to two parts, battery room and electric devices room.
3. PCS would run in on-grid and off-grid modes and built-in STS module would work as the auto switching device.

2.2 System diagram

Please refer to the following system diagram. This whole system is controlled by the EMS. EMS will detect load demand in real time and initiate command to PCS to output corresponding power. opology



2.3 System running

For this project, here are two running modes for PCS, on-grid and off-grid modes. When main grid is normal, PCS runs as a current source and control P/Q. When main grid fails, PCS runs as a voltage source and control V/F. PCS can run in local manual and remotely control modes. When local manual is set, PCS will run as per the setting parameter in the HMI. When remote control mode is set, PCS will receive the command from EMS or other upper systems to run.

3. Storage Inverter Configuration

3.1 Specification for PCS

The PCS specification is as follow. And it can accept EMS's command by RS485 or Ethernet communication ports.

Product Model	PCS500
DC PORT - BATTERY	
Battery Voltage Range	500V-850V(Rated 400V)
DC.Max Current1	128A
DC.Max Power	550kW
DC PORT - PV	
PV Voltage Range	200~850V
DC.Max Current	1100A
DC.Max Power	550kW
AC GRID-TIE PARAMETER	
Rated Output Power	500kW
AC. Max Power	550kVA
Rated Voltage	400V
Voltage Range	±15%
Rated Frequency	50Hz/60Hz
Frequency Range	±2.5Hz
AC. Rated Current	722A
Output THDi	≤3%
Power Factor	-1~+1
AC OFF-GRID PARAMETER FOR LOAD	
Voltage	400V
Voltage adjustable range	±10%
Frequency	50Hz/60Hz
Output THDu	≤2%
SYSTEM PARAMETER	
Peak Efficiency	PV conversion 95.5%, battery conversion 94.8%, PV to battery conversion 98.2%
Wiring Mode	3Phase 4Wire
Isolation Mode	Transformer-isolation
Cooling	Forced air cooling with replaceable fan module

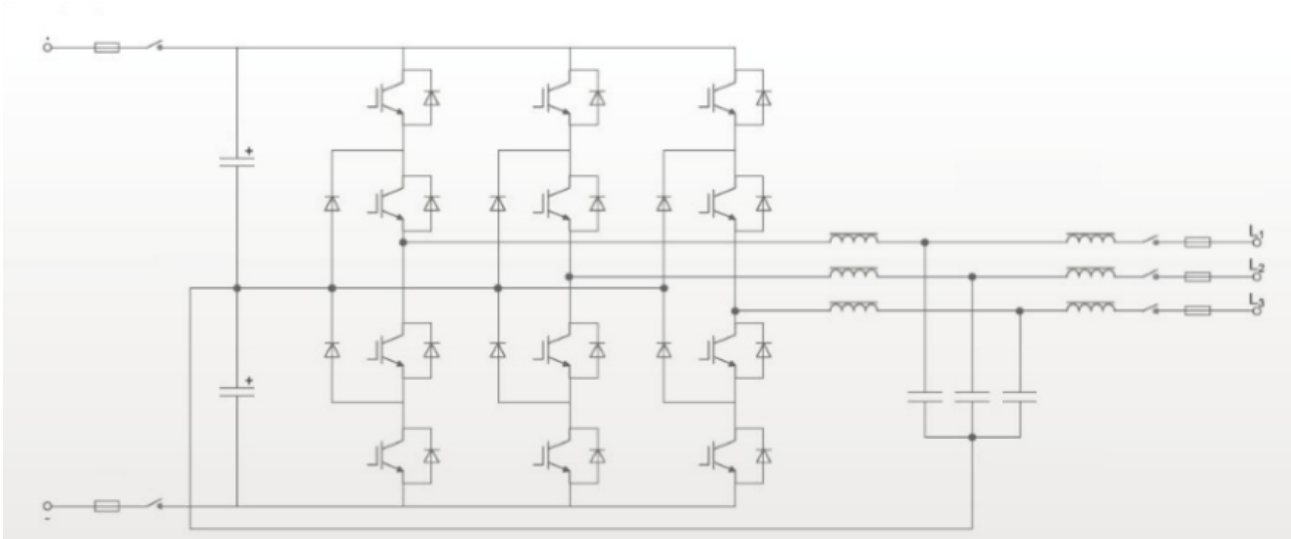
Noise	70dB
Working Temp	-20℃~50℃
IP Degree	Ip20
Max Elevation	3000M
Humidity Range	0~95%
Size (W*D*H)	2800*800*2050mm
Weight	3520kg
COMMUNICATION	
Display	Touch Screen
Communication Protocol	Modbus TCP/IP
Communication Socket	RJ45、RS485、CAN

3.2 PCS feature and function

- 1) PCS can run in on-grid and off-grid modes. When main grid is normal, PCS runs as a current source. When main grid fails, PCS runs as a voltage source.
- 2) When PCS runs in off-grid mode, PCS can dispatch power automatically according to the capacity of load.
- 3) Built-in energy monitoring or external energy management system is required.
- 4) Local operation and remote control.
- 5) Design and wide power range in single cabinet.
- 6) PCS can be out-door applied within container.
- 7) Independent air tunnel for cooling on heat components.
- 8) Different kinds of batteries can be adapted, such as LiFePO4, Lead-acid, Lead-carbon, NCA lithium, flow battery and super-capacitor battery and so on. During charging battery, there are three different charging processes, pre-charging, equal charging and float charging.
- 9) Modular design contributes to highly efficiency after-sales maintenance and improvement of system stability.
- 10) Multiple branches design makes system more flexible and stable. When one of these branches appears fault, other branches wouldn't be effected and can keep running.
- 11) Independent charging/discharging strategy can be realized in different strings of PCS. And the running mode of storage inverter can be controlled remotely or manually.
- 12) Absorb and release active/reactive power in four-quadrant.
- 13) The automatic grid-tied / off-grid switching in millisecond degree can be achieved by STS.

3.3 PCS principle of operation

Please refer to the following topology for PCS. The energy storage inverter adopts the modular and three level design. This kind of design can increase switch frequency, the efficiency of conversion, system stability and so on, comparing with two level design's product. The capacity for each power module is fixed. The configuration of PCS can be associated flexibly. At the same time, the capacity of PCS is easy to expand in the future.



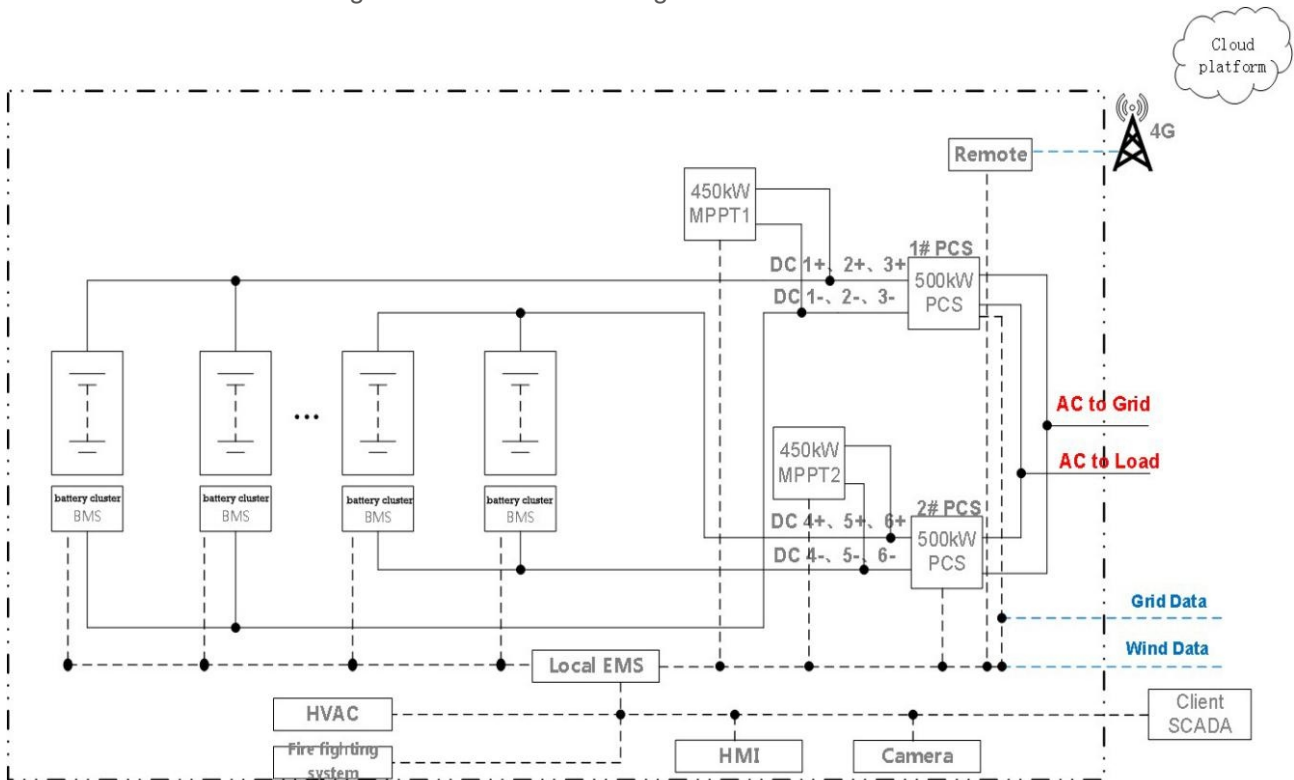
3.4 PCS display

The product picture of 500KW hybrid storage inverter is as follow. The DC battery input range is 500V to 850V. And the PV input is 200V to 850V. The AC output is 400V. The dimension of this hybrid storage inverter is 2800*800*2050(W*D*H) mm.



3.5 Electric diagram

Please refer to the following electric schematic diagram:



4. Energy Storage System Configuration



4.1 Battery configuration

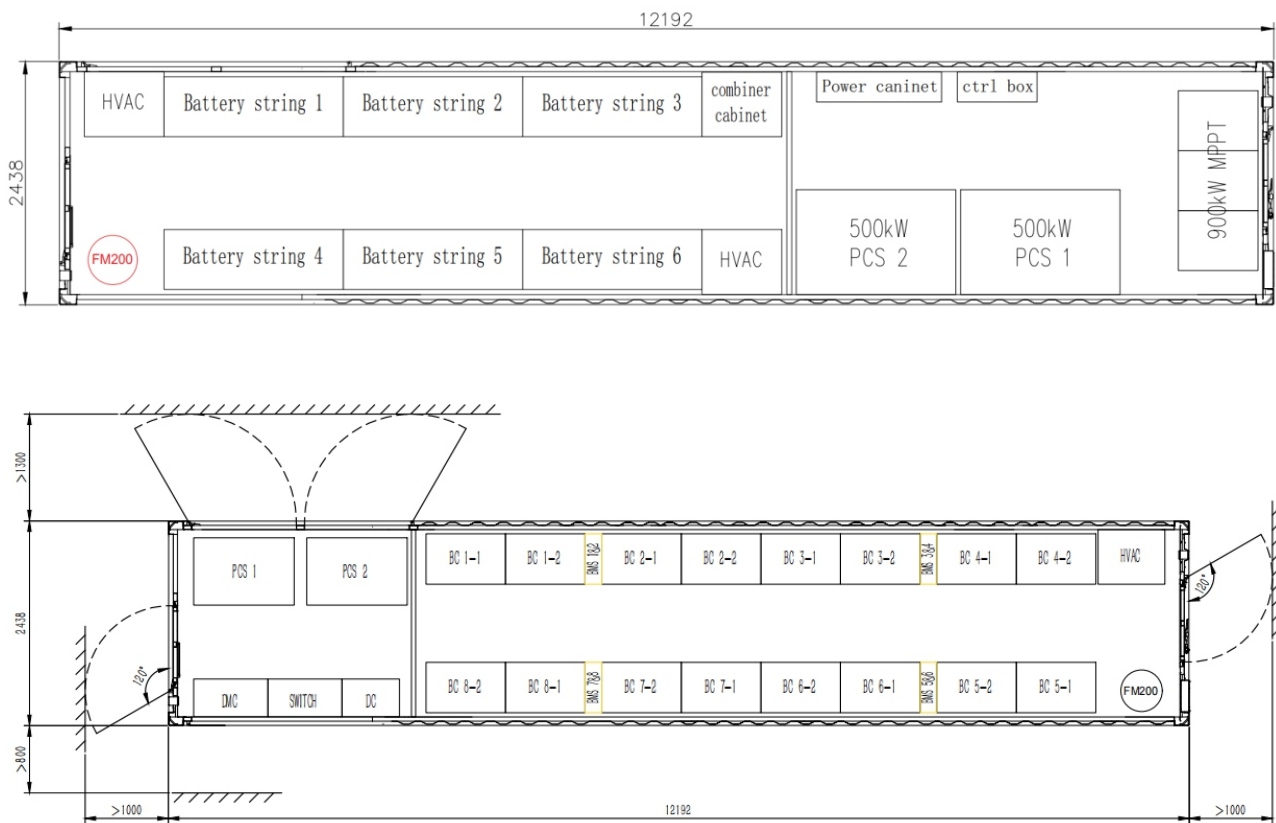
This proposal adopts LiFePO₄ Battery. Each battery module is 28.8V, 320Ah. 21 battery module in series connection make up a battery string, and 8 battery string in parallel connection make up the battery system.

Each battery string: (28.8V 320Ah) * 21 = 193.536KWH

Battery system: 193.536KWH * 8 = 1548.3KWH

4.2 Container system layout

Please refer to the below container system layout.



4.3 System detailed information inside container

4.3.1 Heat radiation

Commercial air-condition is installed in container to keep device running environment temperature. The choice of air-condition needs to consider the heat rate during battery discharging, the container standing heat degree and so on.

4.3.2 Fire solution

In order to ensure devices and operator's safety inside container, seven fluorine propane fire system is adopted. When emergency suddenly happens, gas can fill with the entire room in 8 seconds and achieve effective fire extinguishing. Sound, light alarm and gas discharging indicators are also configured inside container. Considering high temperature

environment and producing heat during devices running, special air flowing channel for each device is designed and air-condition is installed.

There is also a perfect overheating protection and short circuit protection. Starting fire system is a very extreme operating way. And there are smoke sensors, once the alarm signal is detected, system will use dry powder fire extinguisher to fight fire.

4.3.3 Access system and lighting solution

All rooms in container will configure normal lighting system and emergency light system. Lighting system also will cooperate with this access system of container. When container door is open, the lamp on the ceiling will brighten, otherwise it will keep dark. Emergency lighting system also will be combined with the power supply system inside container. Emergency lighting system could keep running at least 30 minutes after container loses power supply.

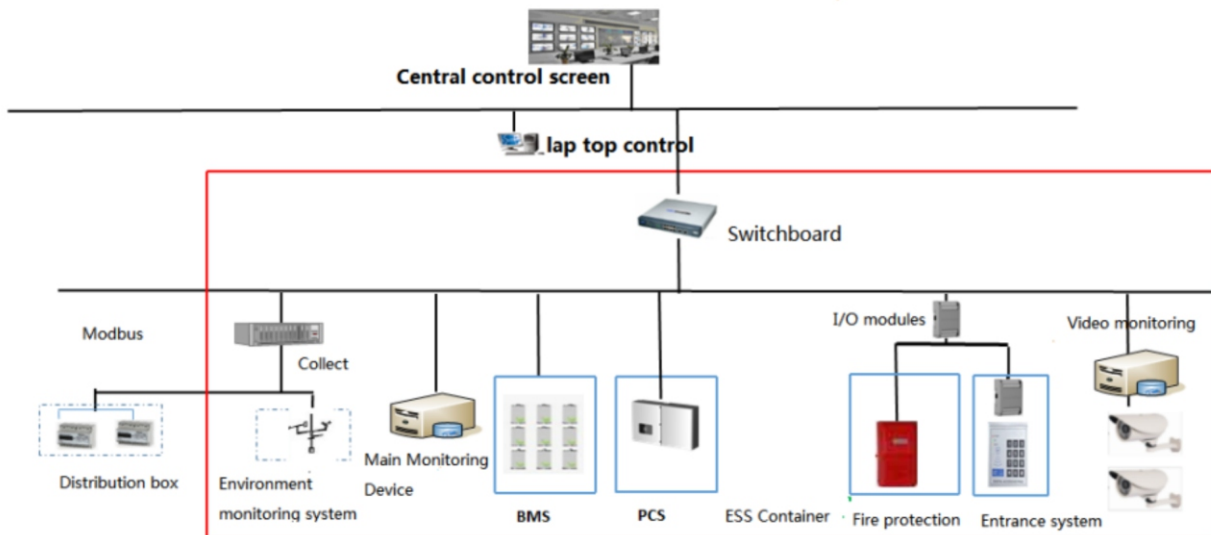
4.3.4 Electric distribution system design

The internal power supply inside container is AC 220V. It mainly has fire system, smoke system, lighting system and air-condition emergency system power supply.

5. EMS Configuration



Energy management system is one of the most important part in micro grid control system, it always services for micro grid system in system data management, monitoring, controlling, and optimization. At the same time, it also guarantees the system work with high efficiency. Two layer structure in EMS communication topology in micro grid energy storage system. Top layer is central monitoring and the bottom layer is device, Power conversion system(PCS), battery management system(BMS), environment monitoring device, fire control system, air conditional and entrance guard system. All of them are connected to monitoring system.



Monitored system	Explanation
Power conversion system(PCS)	Accept the command from EMS Initiate the real time power controlling commands to PCS
Temperature/Humidity collector	Collect the temperature & humidity in container

Air conditional system	Accept the command from auxiliary system Respond for temperature regulation Feedback the state of air conditional Feedback related temperature data.
Battery management system(BMS)	Management all the BCMS in battery system unit Feedback all the information collected from battery, and alarm if any battery is in state of abnormal Protect the battery in working in safety state
Other system	Fire protection, video monitoring, entrance protection

6. System Device List



AC GRID			
PCS	PCS500 with built-in STS, 2800*2050*800(W*H*D)mm Battery input 500V~850V; PV input 200V~850V;	1pcs	500KW
Battery	LFP-9S,(28.8V 320Ah)	168pcs	1548.3KWh
EMS	Micro grid & off-grid application, remote monitoring	1set	/
Container	40ft customized container, Container system with auxiliary electricity distribution system, light system, cooling system and so on.	1set	/