Technical specification

EPCS-series PCS module

Document version 01-(20231102)

release date 2023-11-02

ENJOY
恩 玖 科 技

Trademark Statement


and other Enjoy trademarks are trademarks of Shenzhen Enjoy Technology Co., Ltd. (hereinafter referred to as " Enjoypowers").

All other trademarks or registered trademarks mentioned in this document are the property of their respective owners.

Notice

The products, services or features you purchase shall be subject to the commercial contracts and terms of Enjoypowers. All or part of the products, services or features described in this document may not be within the scope of your purchase or use. Unless otherwise agreed in the contract, Enjoypowers does not make any express or implied statement or warranty regarding the content of this document.

Due to product version upgrades or other reasons, the content of this document will be updated from time to time. Unless otherwise agreed, this document is only a guide for use, and all statements, information and suggestions in this document do not constitute any express or implied warranty.

Disclaimer

This document may contain forecast information, including but not limited to information about future finances, operations, product lines, new technologies, etc. Since there are many uncertain factors in practice, actual results may be significantly different from forecast information. Therefore, the information in this article is for reference only and does not constitute any offer or commitment. Enjoypowers may modify the above information without prior notice.

Shenzhen Enjoy Technology Co., Ltd.

Address:	Floor 5, Building 3, South Area 2, Zhongguan Honghualing Industrial Zone, Nanshan District, Shenzhen Postcode: 518071
Website:	www.enjoypowers.com
Email:	zhangka@enjoypowers.com
Mobile:	+86-18566639823

Catalog

1 Introduction

The energy storage converter PCS (Power Conversion System) can control the charging and discharging process of the battery and convert AC to DC. PCS consists of bidirectional AC/DC converter, control unit, etc. The PCS control unit receives control instructions through the communication interface, charges or discharges the battery, and adjusts the active power and reactive power of the power grid. The PCS can also be operated off-grid to provide voltage to the load.

The PCS control unit of the energy storage converter communicates with the BMS through the CAN interface to obtain the battery pack status information, realize protective charging and discharging of the battery, and ensure the safe operation of the battery. At the same time, the PCS communicates with the energy management system EMS through the RS485 interface to realize peak shaving and valley filling, peak regulation and frequency modulation, virtual capacity increase, and off-grid power backup for the power grid.

The energy storage converter PCS also supports multiple charging and discharging modes such as constant voltage, constant current and float charging.

Table 1 - 1 Name and model of energy storage converter

model	describe
EPCS50-AM	50kW PCS module
EPCS63-AM	63kW PCS module
EPCS80-AM	80kW PCS module
EPCS105-AM	105kW PCS module

1.1 Features

Efficient

- Zero battery power consumption in standby state.
- Charge and discharge conversion time ≤20ms.
- Max conversion efficiency≥98.5%.

Flexible

- Compatible with 3P3W/3P4W
- Customized communication bus can monitor all module data.

Battery friendly

- Different battery clusters can work completely independently, avoiding circulation between battery clusters and extending service life.
- Supports 20+ mainstream BMS protocols.

Strong applicability

- Supports pure on-grid, off-grid, and on/off-grid switching operating modes.
- Support L/HVRT, islanding, and black start.
- In off-grid working mode, it supports 100% three-phase unbalanced load.
- Support reactive power compensation, harmonic control, and three-phase unbalance compensation.

Easy maintenance

- Support string BESS, a faulty branch does not affect the operation of other branches.
- Hot- plugging versions are available for easy maintenance.

Safe and stable

- Complete fault protection function.
- Low battery circulation, automatic current sharing for multiple parallel machines.
- Support stable operation in a power grid environment with THDu of 20%.

1.2 Certification

TUV CE-EMC EN 61000-6-2:2019; EN 61000-6-4:2019

TUV CE-LVD EN 62477-1

TUV EN50549-1 for European Union, Netherlands, Belgium, and Greece

South Africa NRS097-2-1

2 Naming rules

2.1 Naming rules

Figure 2-1 Naming rule details

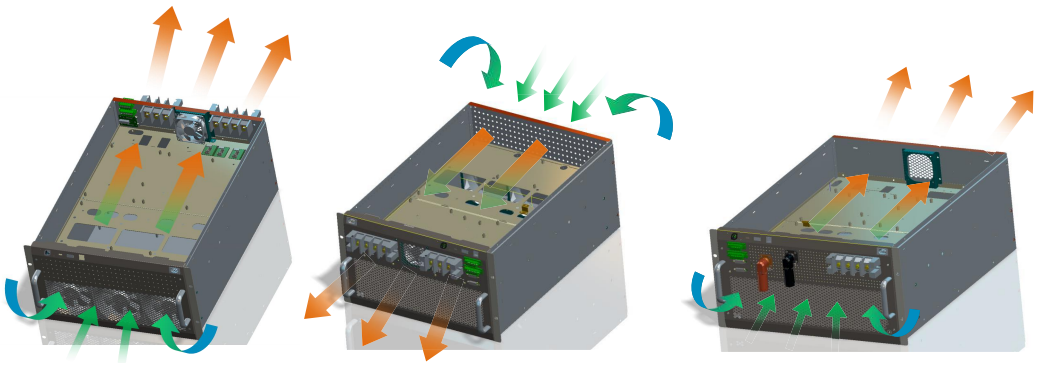
E	PCS	105	-	A	M
Enjoypowers	PCS	Rated power		Bi-directional AC/DC PCS	Module

3 Product structure

3.1 Energy storage converter PCS module structure

The energy storage converter PCS module has three versions according to the position of the terminals and the airflow direction, as shown in Figure 3-1: back terminals and airflow from front to back, front terminals and airflow from back to front, and front terminals and airflow from front to back.

Figure 3-1 : three PCS module structures



(1) back terminals and airflow from front to back

(2) front terminals and airflow from back to front

(3) front terminals and airflow from front to back

3.2 Appearance & Dimensions

Figure 3-2 105kW-PCS dimension (back terminals and airflow from front to back)

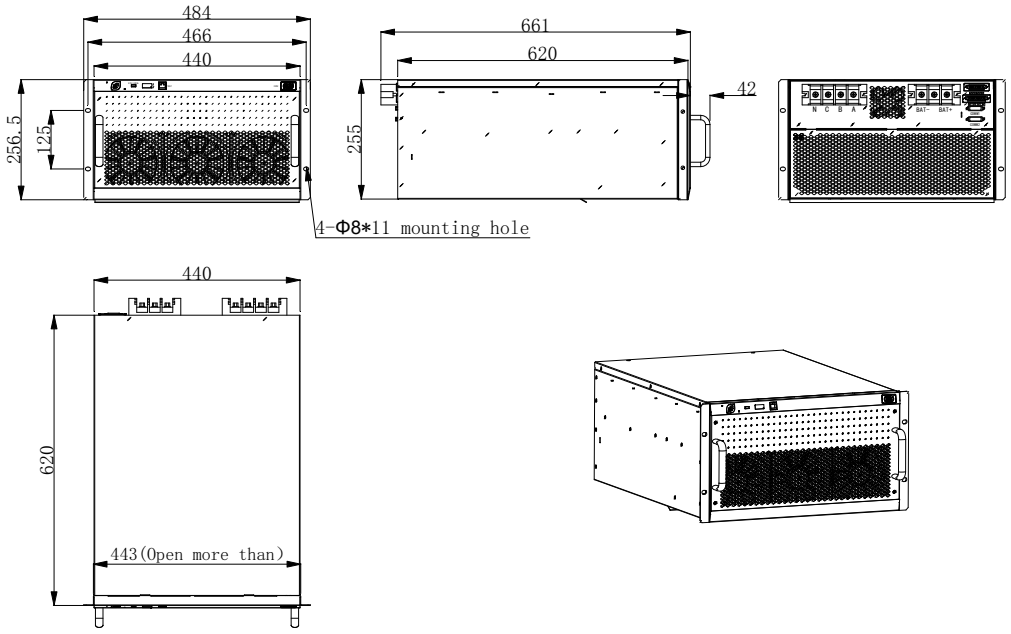


Figure 3-3 105kW-PCS dimension (front terminals and airflow from back to front)

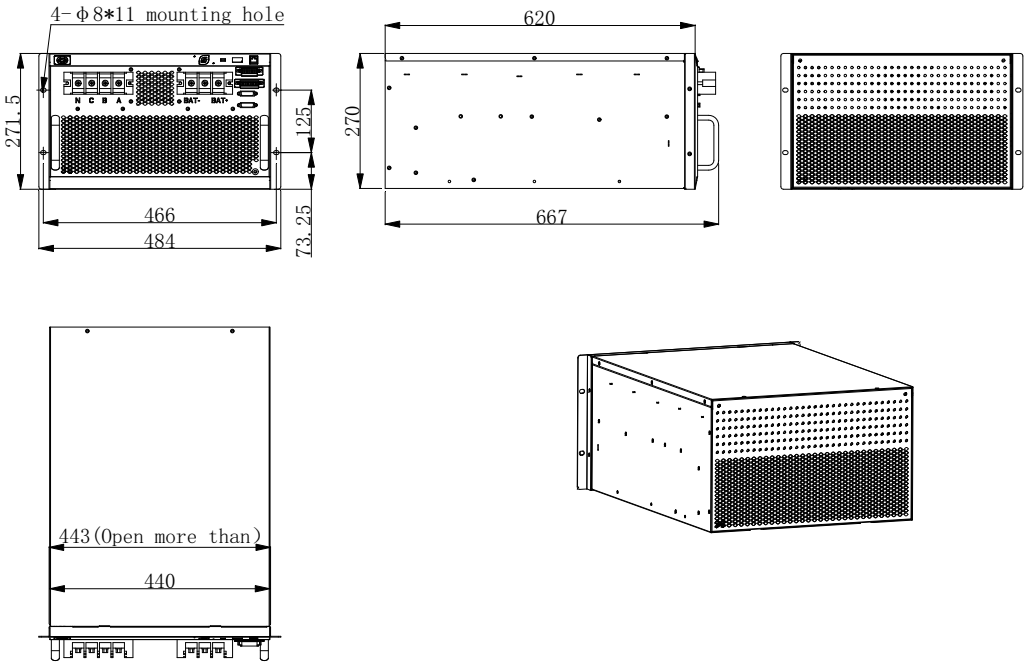


Figure 3-4 105kW-PCS dimension (front terminals and airflow from front to back, Plug Connector)

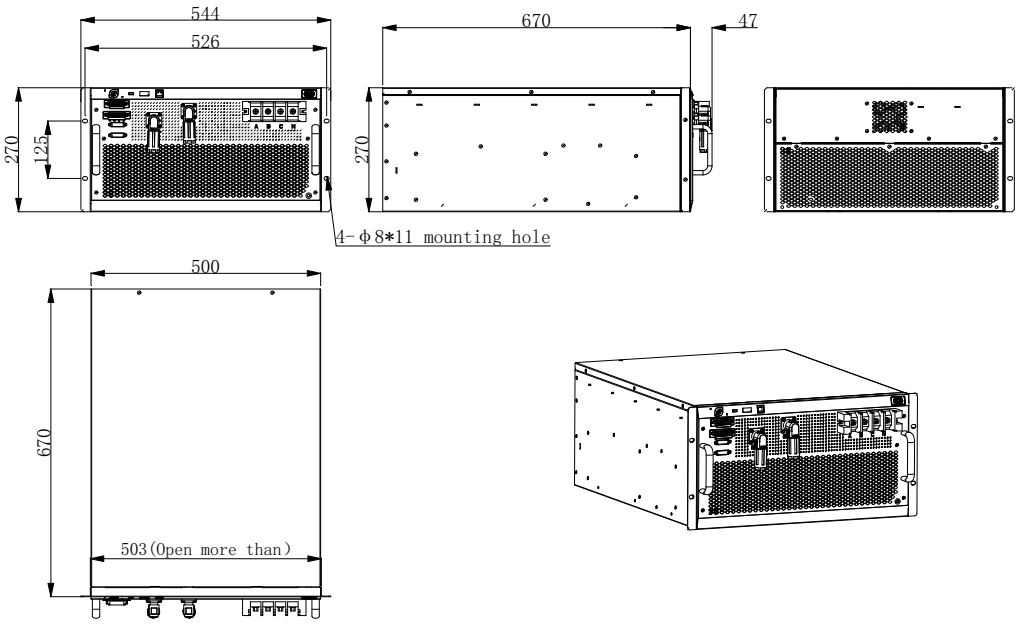
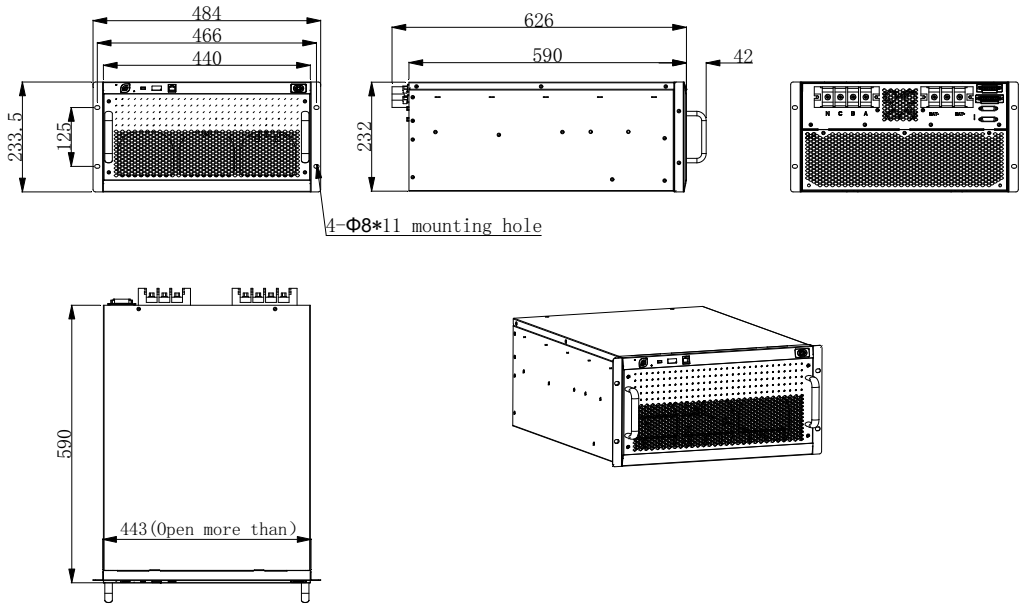


Figure 3-5 50kW/62.5kW/80kW-PCS dimension drawing (back terminals and airflow from front to back)



Note: The 50-80kw PCS module only has a structure version with back terminals and airflow from front to back.

4 Electrical Specifications

4.1 Specifications

Table 4-1 PCS module specifications

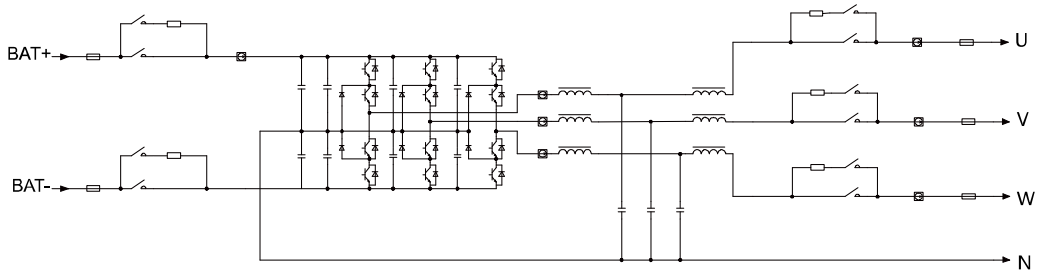
model	50kW	63kW	80kW	105kW
DC side				
Operating voltage range (V)	615~950 (3W+PE)/650~950 (3W+N+PE)			
Full load voltage range (V)	615~950 (3W+PE)/680~950 (3W+N+PE)			
Number of input channels	1			
Max current (A)	90	112	130	170
AC side (on-grid)				
Rated voltage (V)	230/400			
voltage range	-10%~+15%			
AC output type	(3W+PE) 3P3W/(3W+N+PE)3P4W			
Rated output power (kW)	50	63	80	105
Max output power (kW)	55	69	88	116
Max current (A)	80	100	130	167
Rated frequency (Hz)	50/60			
Power Factor	0.99			
Power factor range	1 (lead) ~ 1 (lag)			
THDi	<3% (rated power)			

DC component	0.5%			
Overload capacity	110% long term			
Max discharge efficiency	98.5%			
AC side (off-grid)				
Rated output voltage	230/400			
AC voltage harmonics	<3% (linear load)			
Rated frequency (Hz)	50/60			
Rated output power (kW)	50	63	80	105
Max apparent power (kVA)	55	69.3	88	116
Max output current (A)	80	101	128	167
Protection characteristics				
Functions	AC overcurrent protection, AC overvoltage protection, AC surge protection, AC short circuit protection, anti-islanding protection, DC reverse polarity protection, DC surge protection			
Physical				
Dimensions (W×D×H, mm)	484×668×233.5			484×703×256.5*
Weight (kg)	38			50
Altitude (m)	5000m (>3000m derated)			
Operating temperature	-30℃～55℃(>45℃ derating)			
storage temperature	-45℃～70℃			
humidity	0%RH~95%RH, no condensation			
cooling method	Intelligent forced air cooling			
Protection level	IP20			
Communication Interface	CAN/RS485			
Grid support	L/HVRT, active and reactive power control			

* The dimensions of 105kW back terminals and airflow from front to back.

4.2 Schematic diagram

Figure 4-2 Figure 4-1 PCS schematic diagram



4.3 Power curve

Figure 4-2 below shows the product derating curves in AC voltage, altitude and ambient temperature.

Figure 4-3 Derating curve

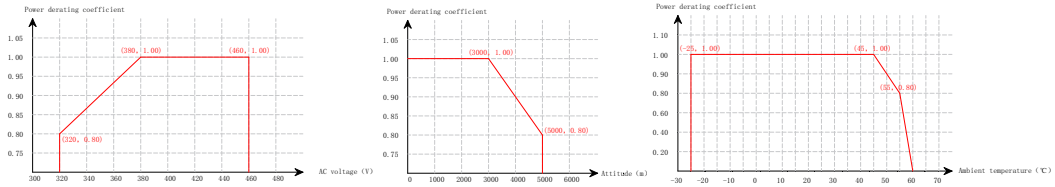
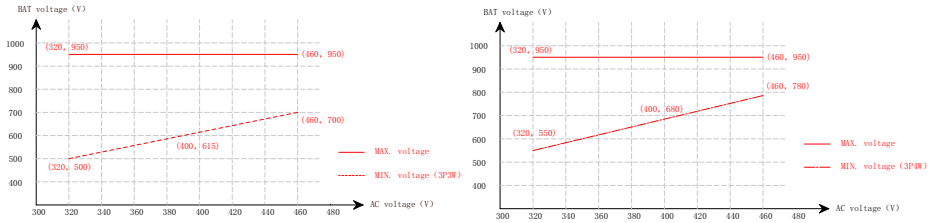


Figure 4-4 Figure 4-3 below shows the battery voltage range curves corresponding to different AC voltages for the PCS module in 3P3W and 3P4W situations. Battery voltage-AC voltage curve graph.



4.4 Efficiency curve of PCS module

Figure 4-5 Figure 4-4 shows the rectification and inverter efficiency of the PCS module at different battery voltages and load rates when the PCS module uses 3P4W wiring.

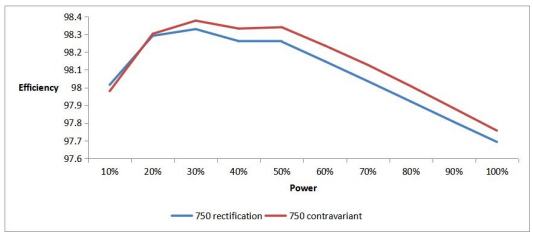
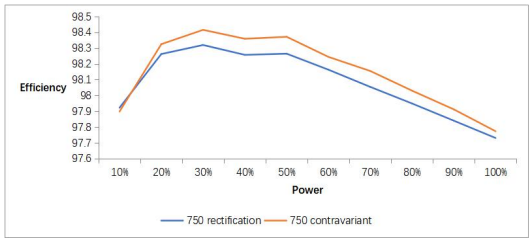


Figure 4-6 Figure 4-5 shows the rectification and inverter efficiency of the PCS module at different battery voltages and load rates when the PCS module uses 3P3W wiring.



Note: The above data are laboratory test results and are for reference only.

4.5 Certification specifications

4.5.1 Production Compliance

Table 4-2 Production Compliance

No.	Project		Standard	Remark
1	Hi-pot test	Power loop-earth	2120Vdc/1min	According to the IEC 62477-1 standard, it is 2120Vdc; the actual hi-pot testis 2820Vdc.
2	Insulation resistance	Input – Earth	1000Vdc，>10MΩ	
		Output - Earth		
3	touch current	Input – Earth	/	A large leakage current warning label is attached to the system
4	Ground resistance		<0.1Ω	
5	Production Compliance standards		IEC62477-1	
6	Certification requirements		CE/CQC	

4.5.2 Lightning protection requirements

Table 4-3 Details of lightning protection requirements

Project	requirements	Require
AC side	Line to line 1kV, line to ground 2kV	8/20us
Note: Add a lightning protector to the power distribution section on the grid side of the PCS.		

4.5.3 EMC requirements

Table 4-4 EMC requirement details

project	Indicator requirements		Remark
Conducted	Frequency	Limit AC power interface	

interference (CE)	(MHz)	Quasi-peak dB (μV)	Average dB (μV)	
	0.15~0.50	79	66	
	0.50~30	73	60	
Radiated interference (RE)	Frequency (MHz)	Quasi-peak dB (μV /m) measurement distance 10m		
	30~230	40		
	230~1000	47		
Radiated immunity	10V/m			Criterion A
Conducted immunity	10V			Criterion A
Fast transient burst (EFT)	±2kV			Criterion A
SURGE	Differential mode: ±1kV Common mode: ±2kV			Criterion B
Electrostatic (ESD)	±6kV CD ±8kV AD			Criterion B

4.5.4 Reliability environment requirements

Table 4-5 Detailed reliability environment requirements

No.	parameter	unit	Operating environment	Transportation environment	Storage environment	Remark
1	low temperature	℃	-30	-40	-40	derating >45℃
	high temperature	℃	+55	+70	+70	
2	low humidity	%	5	/	5	/
	high humidity	%	95	/	95	
	condensation	y/n	n	/	n	
3	low altitude	m	0	/	0	Derating >3000m
	high altitude	m	5000	/	5000	

5 Terminal and wiring

5.1 Terminal definition

The terminal of the PCS module is shown in Figure 5-1.

Figure 5-1 PCS back terminals and airflow from front to back version.

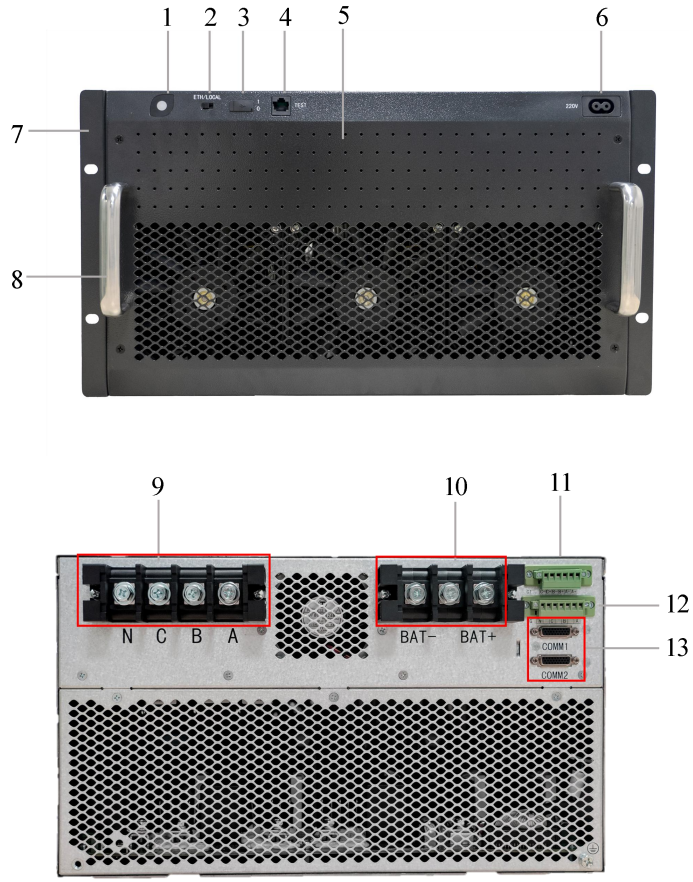


Figure 5-2 PCS front terminals and airflow from back to front version

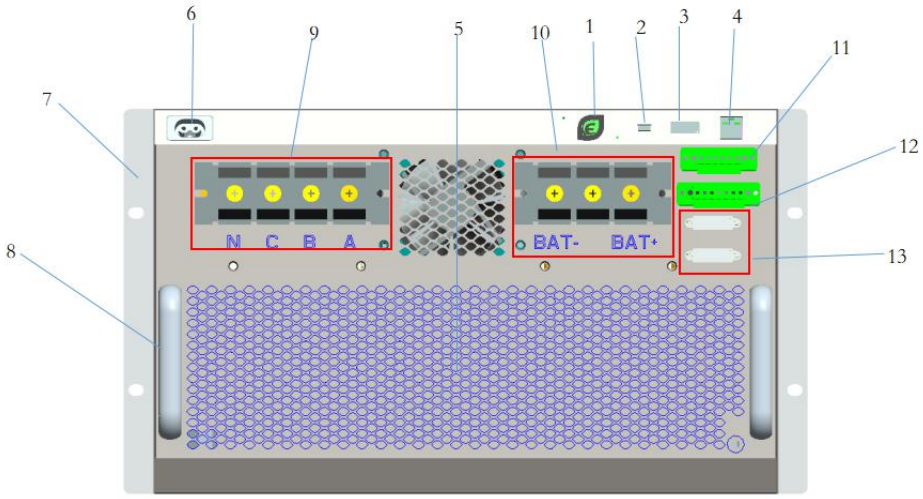


Figure 5-3 PCS front terminals and airflow from front to back version

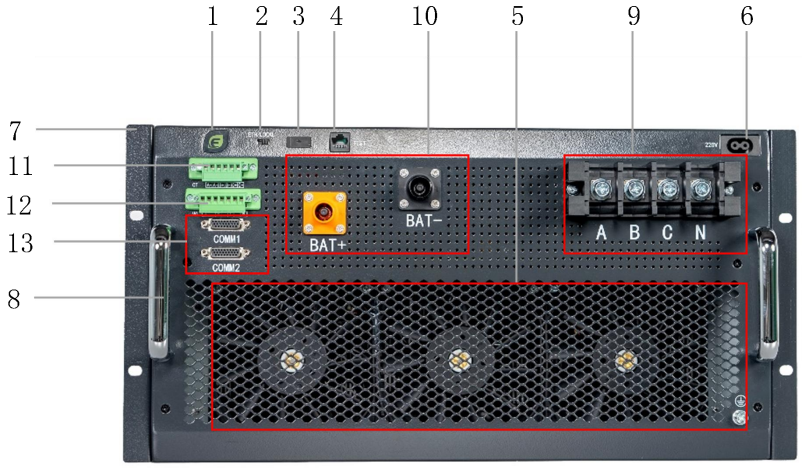


Table 5-1 Terminal description table

No.	Terminal	Function description
1	indicator light	The green light is always on when the output power is running. When in standby (0kW operation), the green light flashes quickly for 0.5s. When the machine is not powered on and there is no fault, the green light flashes slowly for 1s. The red light always lights up when there is a fault

2	ETH/LOCAL (reserved)	Ethernet/local debugging switch; dial LOCAL to the right for local debugging; dial ETH to the left
3	(IO) 6-bit DIP switch	Bits 1-2 are for CAN communication matching resistor access. 3-6 is the modbus address setting (binary) - the 6th bit is the lowest bit (from right to left)
4	TEST (internal only)	Factory background debugging communication port
5	vents	Air duct vents
6	220Vac power	220Vac input (for debug only)
7	fixed bracket	For fixing PCS modules in cabinets
8	handle	Drawer module handles, not for load-bearing purposes
9	AC terminal	AC terminal wiring
10	DC terminal	DC terminal wiring
11	Grid current sampling interface	(reserved)
12	Grid voltage sampling interface	(reserved)
13	Communication port	COM (26pin signal terminal) signal port

5.2 Power terminal

The PCS module power port can be divided into conventional wiring terminals and plug connector.

Figure 5-4 PCS power terminal (plug connector)

Figure 5-5 PCS power terminal (conventional wiring)

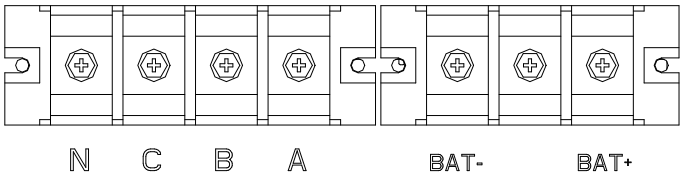


Table 5-2 PCS power terminal

Terminal symbol	Terminal function description	Screw specifications
BAT＋	DC positive terminal	M8
BAT-	DC negative terminal	M8
A	A phase input terminal	M8
B	B phase input terminal	M8
C	C phase input terminal	M8
N	3P4W neutral input terminal	M8

Table 5-3 Recommended power line diameter table for PCS modules

rated power	AC or DC	Recommended value of copper wire (mm^2)
80, 105kW	DC	Unipolar: ≥35 mm^2 single core, 50mm^2 (single core) recommended
80, 105kW	AC	Single phase: ≥35 mm^2 single core, recommended 50mm^2 (single core)
50, 63kW	DC	Unipolar: ≥25 mm^2 single core, 35mm^2 (single core) recommended

50, 63kW	AC	Single phase: ≥25 mm² single core, 35mm² (single core) recommended

5.3 COM communication port

Figure 5-6 COM (26pin signal terminal) signal port definition and wiring diagram

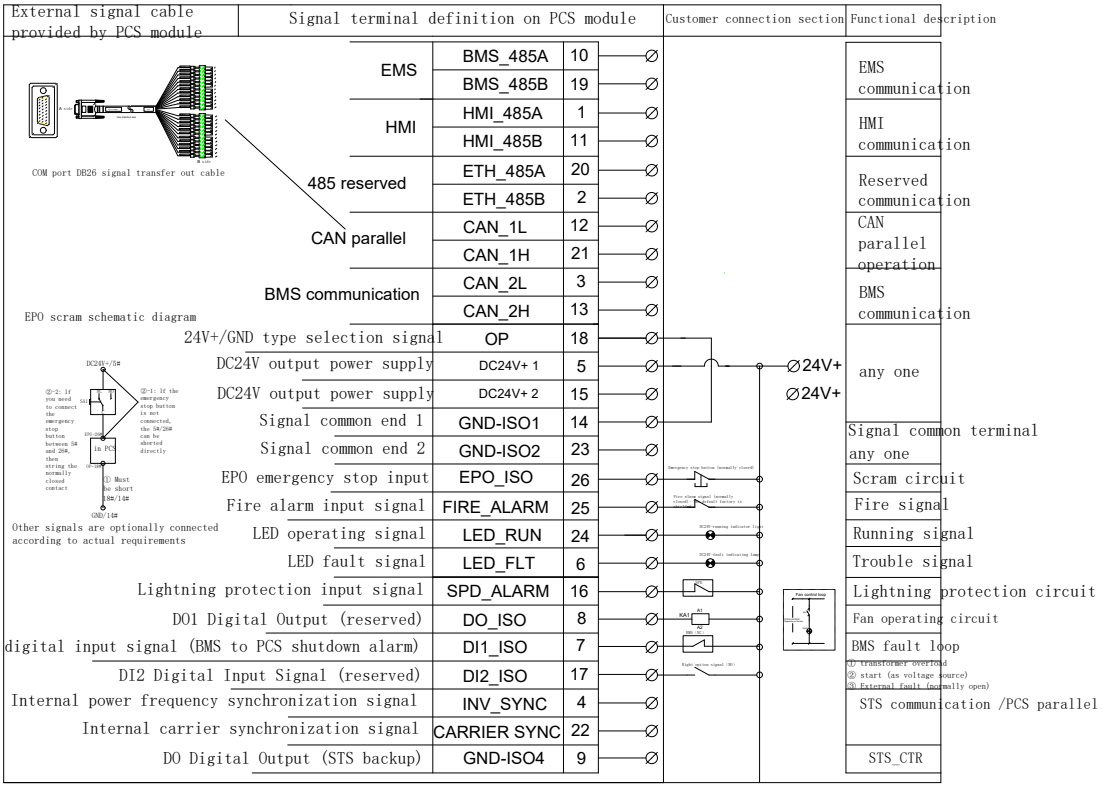
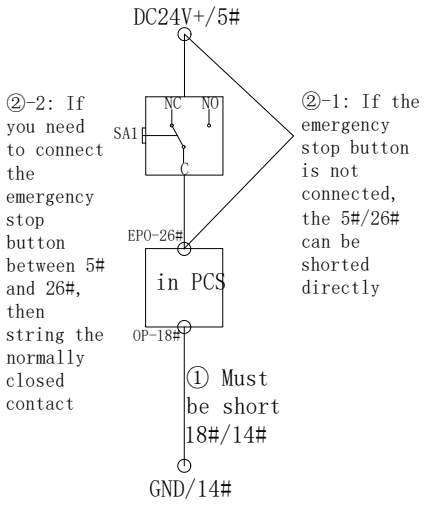


Figure 5-7 EPO emergencies stop signal wiring diagram.



Note 1: DB26 cable is supplied with the product, and the default length is 1.5m.

Note 2: DB26 cable can be customized according to customer needs.

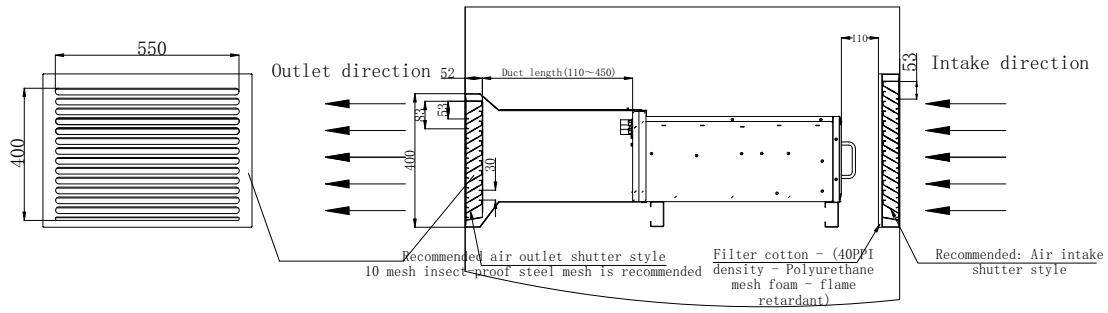
6 Air duct cooling reference

6.1 Air duct cooling reference

The energy storage converter PCS module adopts forced air cooling and has an independent heat dissipation duct. The module airflow is from front to back (105kW PCS have airflow from back to front version), which is required the cold air is sucked in through the mesh on the front door of the cabinet, and the hot air after absorbing heat is discharged through the mesh on the back door of the cabinet.

Installing PCS module in the PCS cabinet, sufficient air intake should be ensured. It is recommended that the PCS cabinet be installed with a heat exhaust fan to ensure that the heat emitted by the PCS module is discharged outside the PCS cabinet.

Figure 6-1 105kW-PCS air duct heat dissipation diagram



Schematic diagram of shutter size for inlet and outlet air door panels

The profile of PCS module in the cabinet

Table 6-1 PCS module ventilation parameter table

Model	air volume demand (CFM)	Wind speed (m/s)	Min air inlet area, mm^2	Min opening size of front and back door panels (mm)
EPCS50-AM	550	15.58	49800	383×130
EPCS63-AM	550	15.58	49800	383×130

EPCS80-AM	550	15.58	49800	383×130
EPCS105-AM	918	26.00	60200	430×140

Note: Note: The heat dissipation requirements of the PCS cabinet are shown in Table 6-2.

Table 6-2 Heat dissipation requirements for PCS cabinets

PCS cabinet power (kW)	Air inlet area (mm^2)	Remark
105	800×500	It is recommended to install a removable 1 0 mm thick aluminum alloy frame with built-in filter cotton (40PPI - polyurethane reticulated foam - flame retardant) on the side of the air inlet shutter.
250	650×400×2	
420	800×500×2	
525	840×660×2	
630	840×770×2	