EPCS Module

Technical specification

V2.9

2024-05-22

Catalogue

1 PCS Intro

PCS realizes rectifier and inverter through three-phase and three-level converter. The rectifier output is converted from three-phase AC to direct current and injected into the energy storage system. The inverter output is filtered by a filter to generate three-phase AC, which is used by AC load or incorporated into the power grid.

Table 1-1 PCS models

model	describe
EPCS50-AM	PCS-50kW-Rear connection
EPCS63-AM	PCS-63kW-Rear connection
EPCS80-AM	PCS-80kW-Rear connection
EPCS105-AM	PCS-105kW-Rear connection
EPCS105-AM-F	PCS-105kW-Front connection

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

Chinese standard CQC GB/T 34120-2017

China high and low voltage crossing CQC GB/T36547-2018;GB/T36548-2018

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

European safety regulation CE-LVD EN 62477-1

European grid connection EN50549-1:2019+AC:2019-04

Dutch grid connection EN50549-1:2019+AC:2019-04 Netherlands

Belgium grid connection EN50549-1:2019+AC:2019-04 Belgium

Grid connection in Greece EN50549-1:2019+AC:2019-04 Greece

Poland grid connection EN50549-1:2019+PSE:2018-12 Poland

South Africa grid connection NRS097-2-1:2017

2 Naming

2.1 Naming Rules

Figure 2-1 : PCS module structures

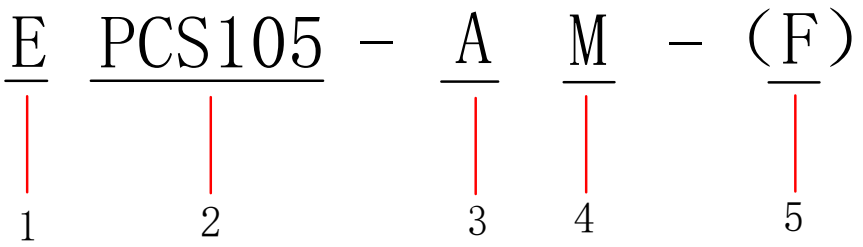


Table 2-1 Type description

identification	implication	description of value	remark
1	brand identity	brand identity	
2	power class	105kW	other specification modules 50kW/63kW/80kW
3	converter type	Three phase ACDC transformation	
4	assembly mode	module	
5	Connection position	Front connection	

3 Product structure

3.1 Module appearance

The heat dissipation wind direction of the PCS module of the energy storage converter is forward wind and rear wind, and only type C is rear air and front air, which can be divided into rear maintenance and front maintenance according to different positions of the wiring terminals, as shown in the following figure.

Figure 3-1 : A heat dissipation model drawing

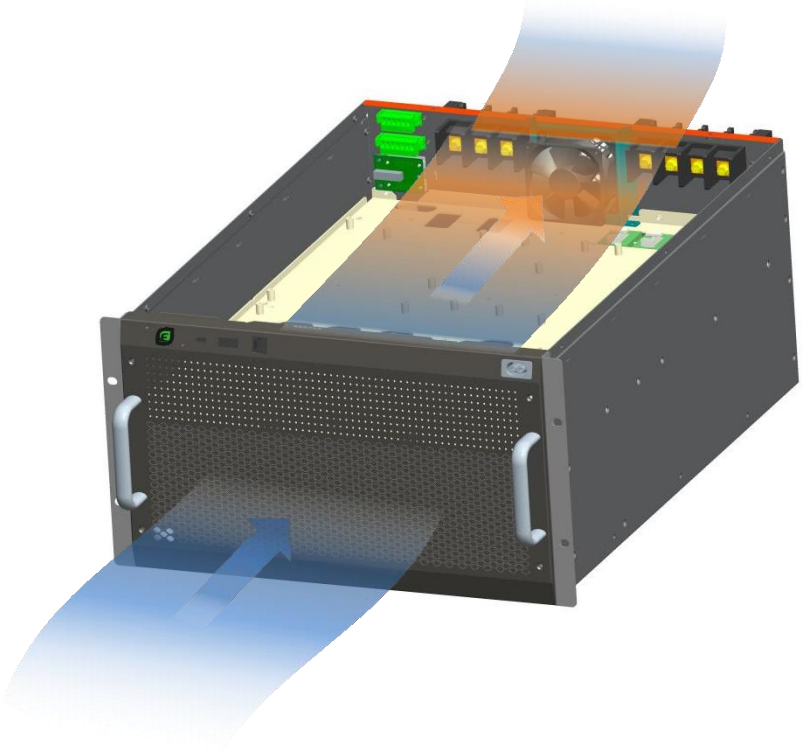
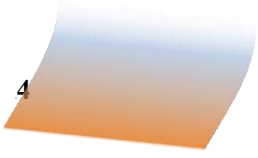


Figure 3-2 : B heat dissipation model drawing



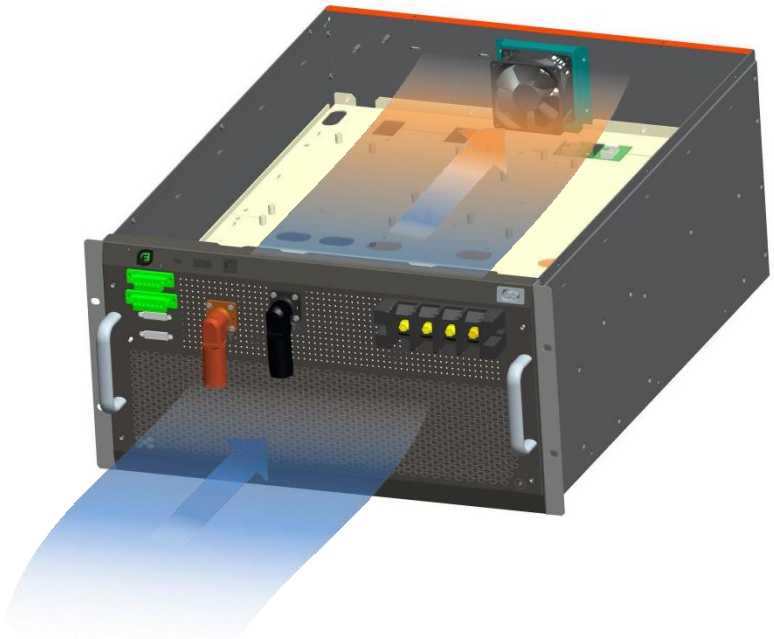
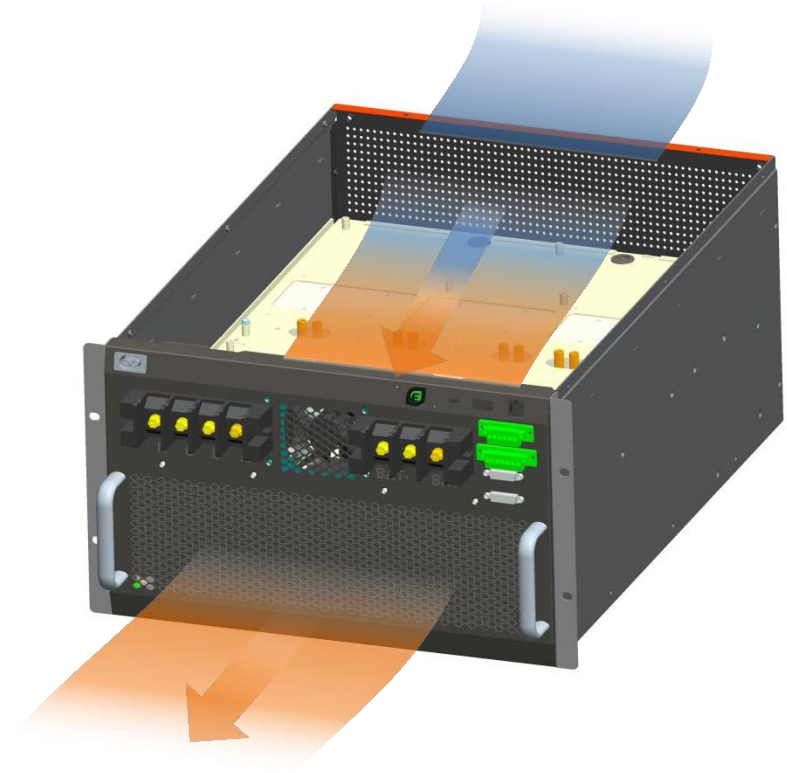


Figure 3-3 ：B heat dissipation model drawing



3.2 Structure Size

Table 3-1 Size sheet

<table>
<tr><th>specification</th><th>pattern</th><th>size（W×D×H，mm）</th><th>maintenance mode</th><th>Cooling wind direction</th></tr>
<tr><td>50kW、63kW、80kW</td><td>Same species</td><td>440×590×232</td><td>Post-maintenance (refer to Section A)</td><td rowspan="5">Advancing wind</td></tr>
<tr><td rowspan="4">105kW</td><td rowspan="2">A</td><td>A1：440×620×232</td><td rowspan="2">Post-maintenance</td></tr>
<tr><td>A2：440×620×255</td></tr>
<tr><td rowspan="2">B</td><td>B1：500×670×255</td><td rowspan="2">Front maintenance</td></tr>
<tr><td>B2：500×670×270</td></tr>
<tr><td>C</td><td>C：440×620×270</td><td>Front maintenance</td><td>Backward air</td></tr>
</table>

te: The "Dimension Diagram" in this section is listed according to the order of "Dimensions" in the table. The above dimensions are the minimum cabinet dimensions of the module, excluding external structural parts and terminals.

Figure 3-4 50/63/80kW size

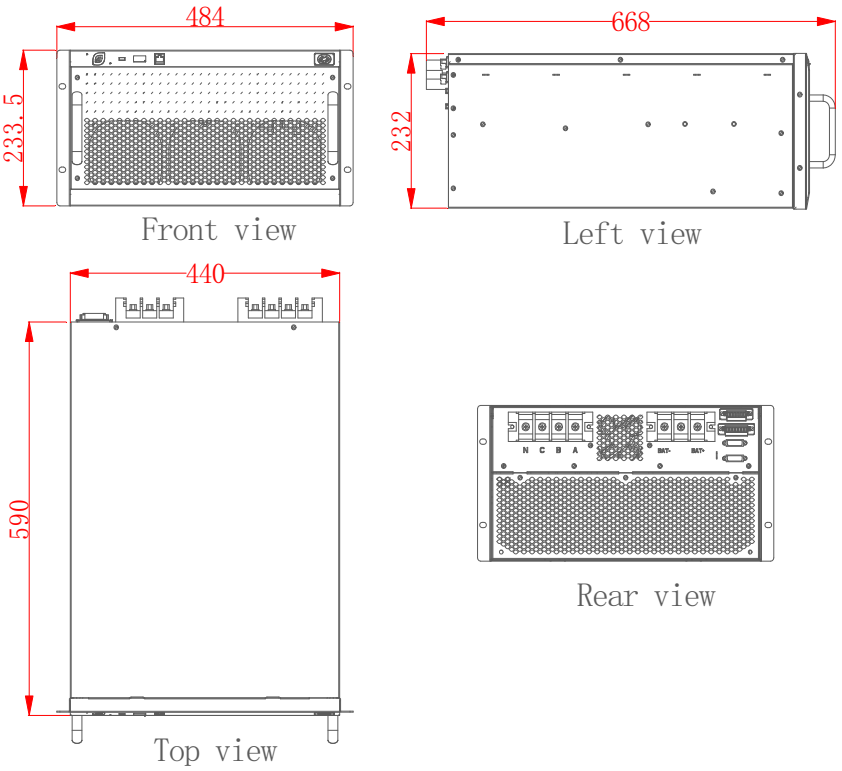


Figure 3-5 105kW-A1 size

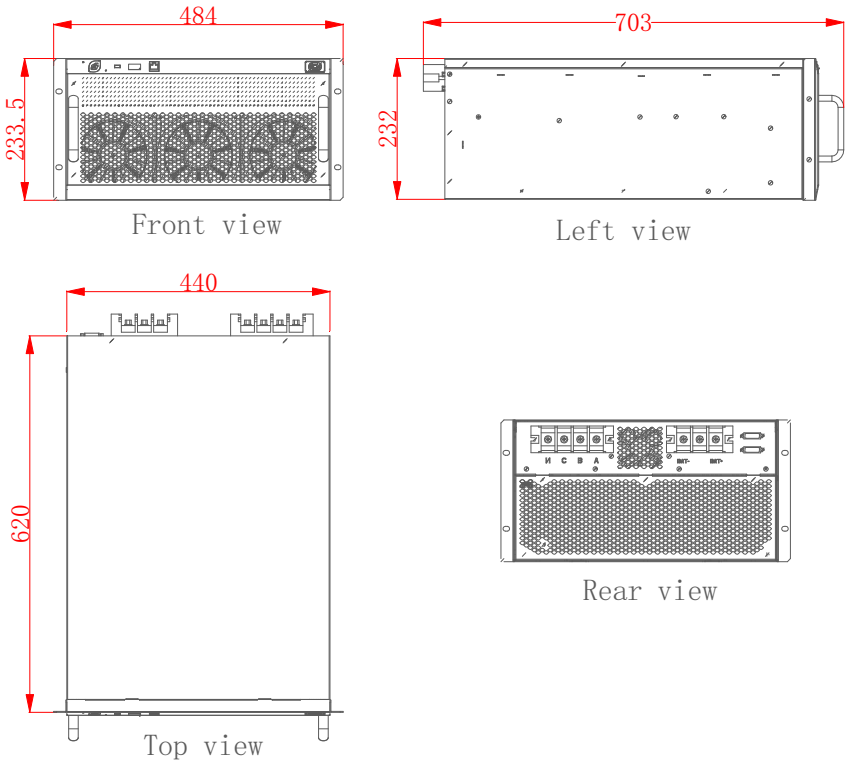


Figure 3-6 105kW-A2 size

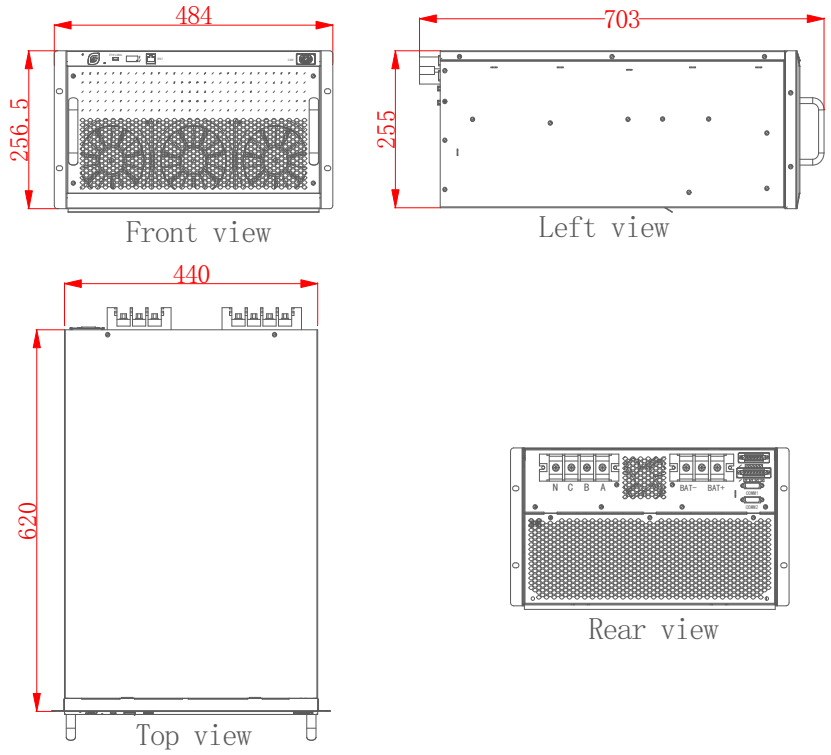


Figure 3-7 105kW-B1 size

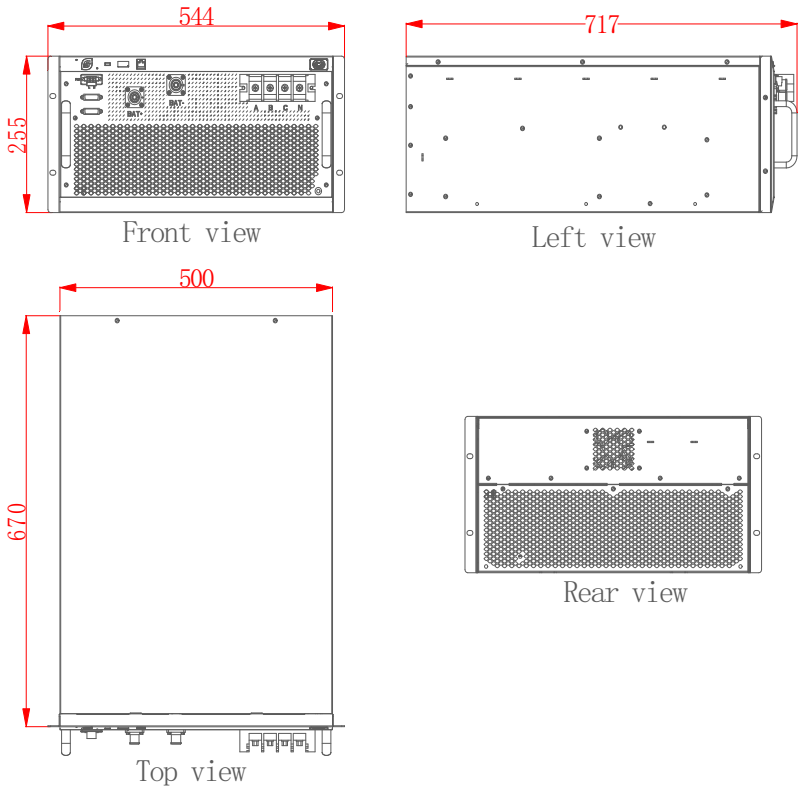


Figure 3-8 105kW-B2 size

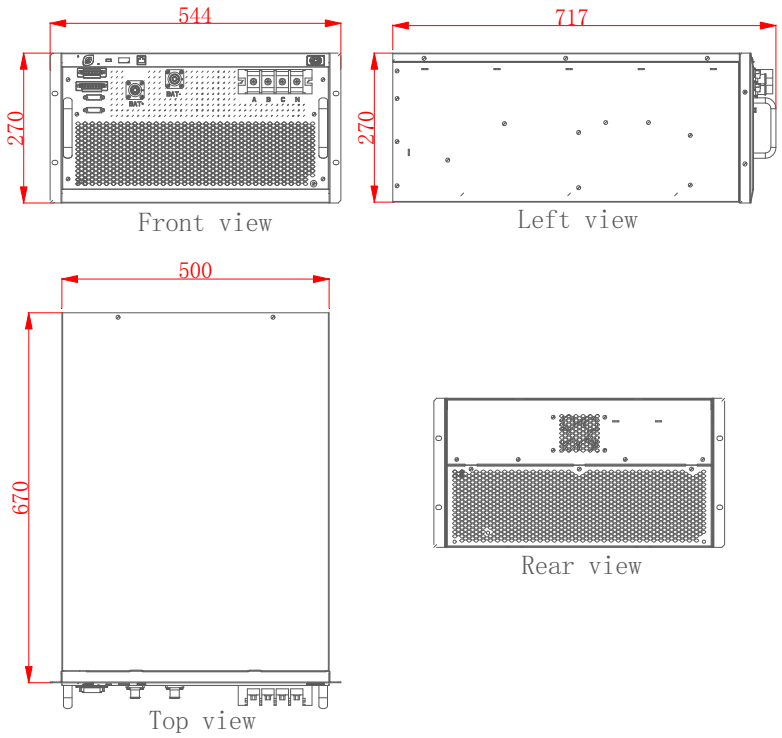
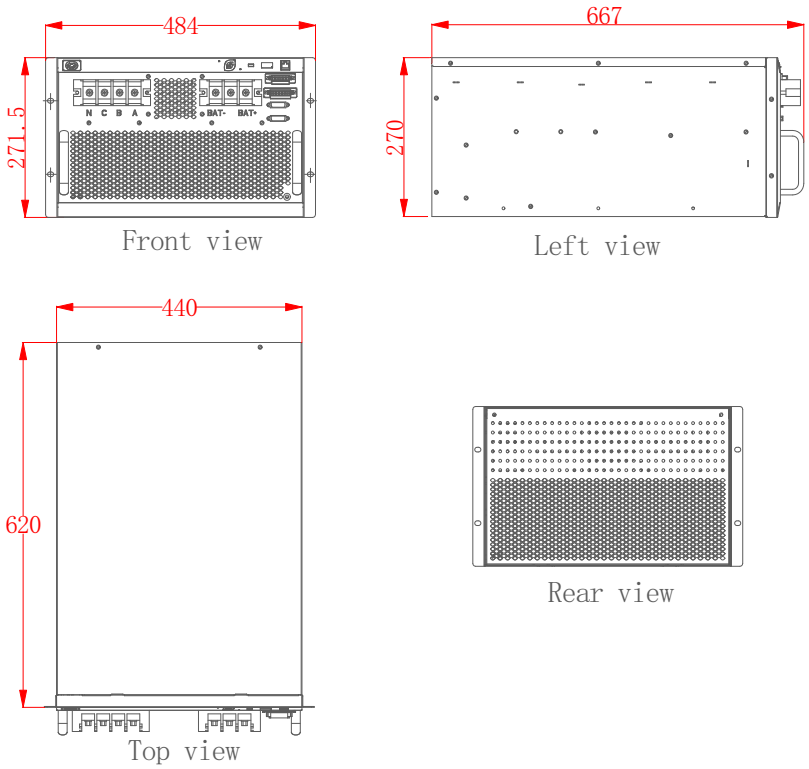


Figure 3-9 105kW-C size



4 Electrical specification

4.1 Parameter detail

Table 4-1 Parameter detail

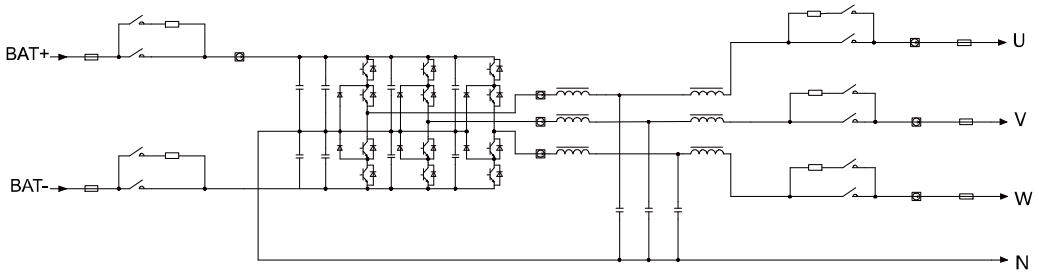
specification	50kW	63kW	80kW	105kW
Dc side				
Operating voltage (V)	615~950（3W+PE）/650~950（3W+N+PE）			
Full power voltage (V)	615~950（3W+PE）/680~950（3W+N+PE）			
Input path number	1			
Maximum current (A)	90	112	130	170
Ac side(connected to the grid)				
Rated voltage (V)	230/400			
Ac output type	-15%~+15%			
Rated output power (kW)	（3W+PE）/（3W+N+PE）			
Maximum output power (kW)	50	63	80	105
Maximum current (A)	55	69	88	116
Rated network frequency (Hz)	80	100	130	167
Power factor	50/60			
Power factor range	0.99			

Current distortion rate	1(lead) ~1(lag)			
Rated output power (kW)	＜2% (rated power)			
Dc component	0.5%			
Overload capacity	110%long-term			
Maximum 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
Maximum apparent power (kVA)	55	69	88	116
Maximum output current (A)	80	101	128	167
Protective characteristic				
Have function	Over current protection, over voltage protection, short circuit protection, surge protection, over temperature protection, etc			
Conventional parameter				
Altitude (m)	4000m（＞2000m Power reduction）			
Operating temperature	-30℃～55℃（＞45℃ Power reduction）			
Storage temperature	-45℃～70℃			
Humidness	5%RH~95% RH，non-condensing			
Cooling mode	Intelligent forced air cooling			
Class of protection	IP20			
Communication interface	CAN/RS485			

Maximum efficiency is the highest efficiency that can be achieved under the best working state of the high efficiency version.

4.2 Schematic diagram

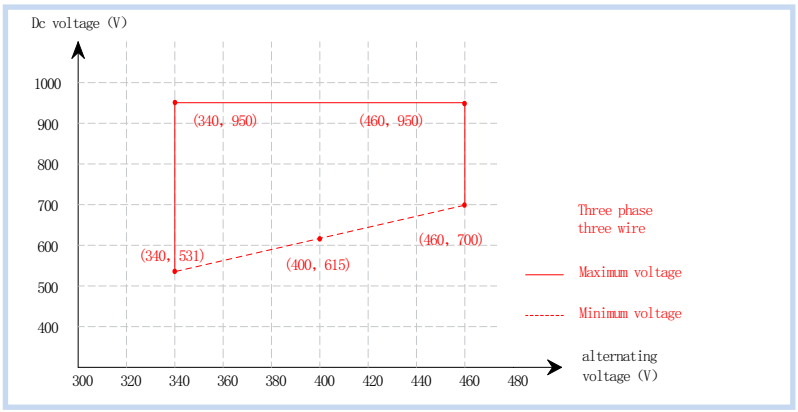
Figure 4-2 Topological graph



4.3 Operating voltage and power

Battery voltage - AC voltage relationship diagram for three-phase three-wire connection and three-phase four-wire connection.

Figure 4-3 Battery voltage-AC voltage diagram



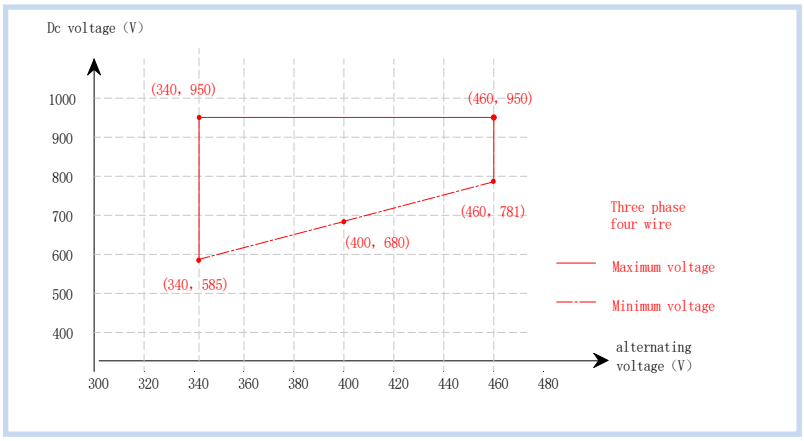
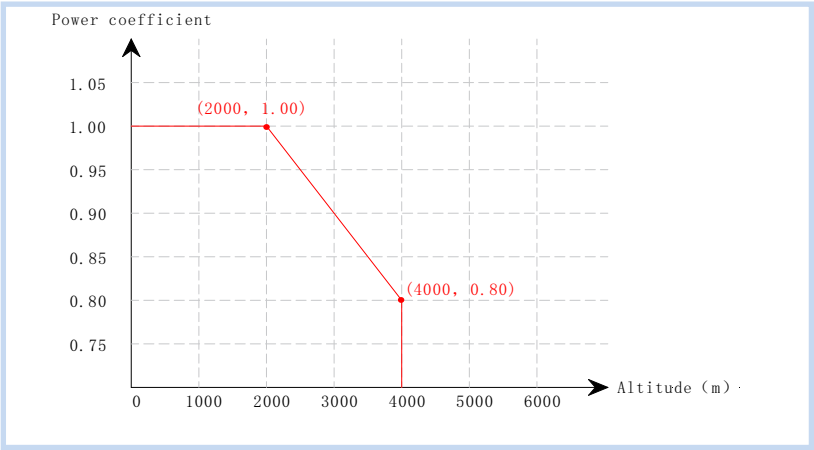
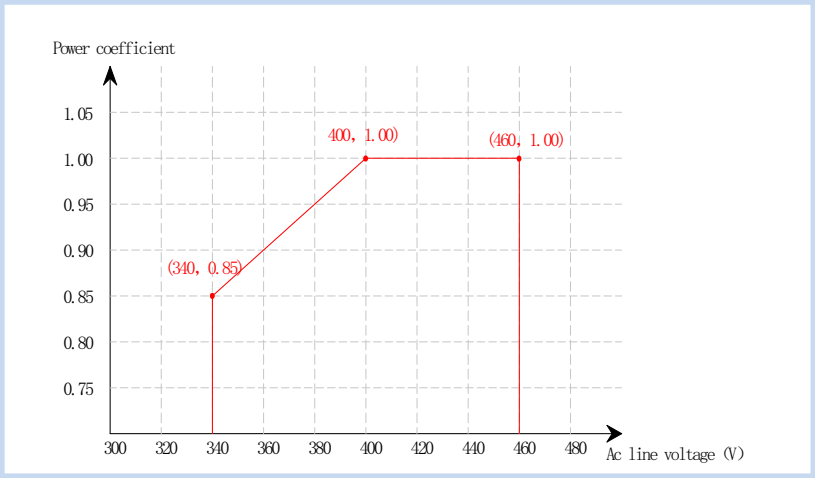
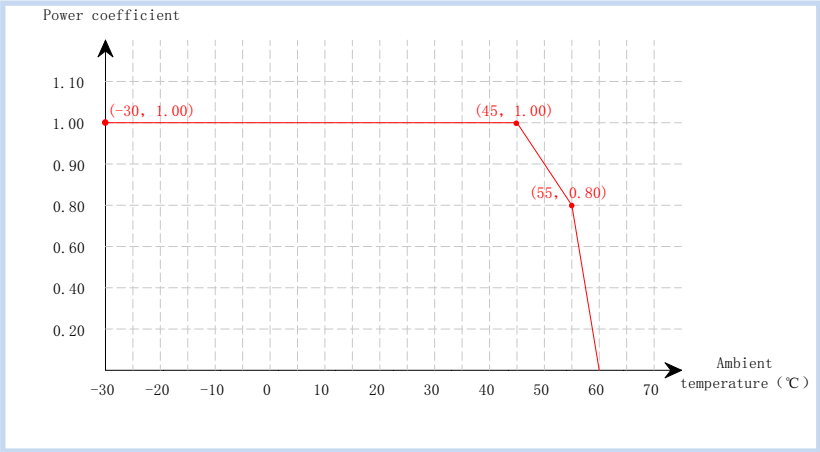


Figure 4-4 shows the power derating curves of AC altitude, AC line voltage, and ambient temperature in sequence.

Figure 4-4 Power reduction diagram



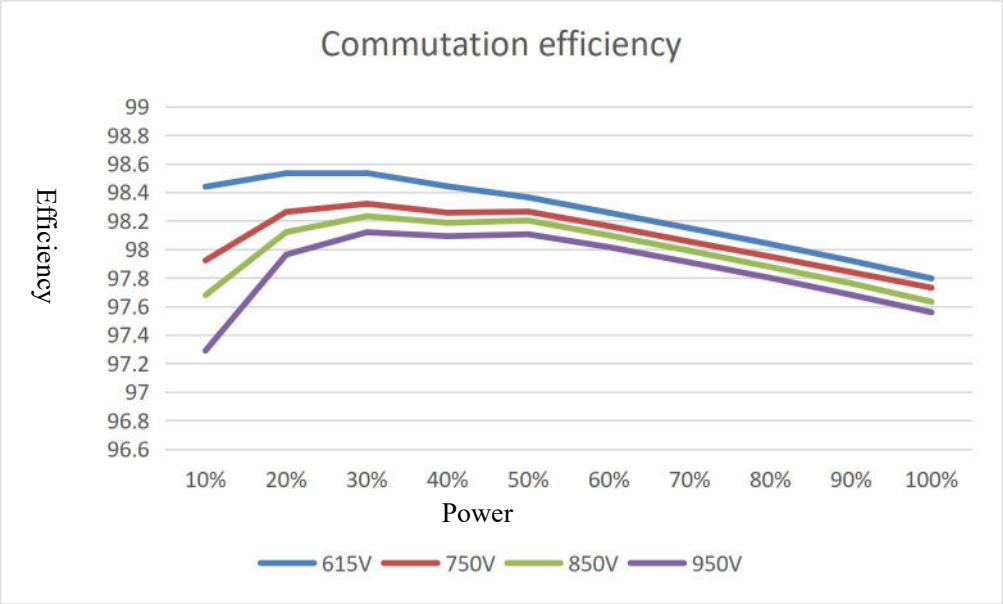




4.4 Efficiency curve

The following figure shows the rectification and inverter efficiency under different DC voltages (the AC side voltage is 400V rated voltage) when PCS is used as a current source with 3P3W connection.

Figure 4-5 Current Source (3P3W)



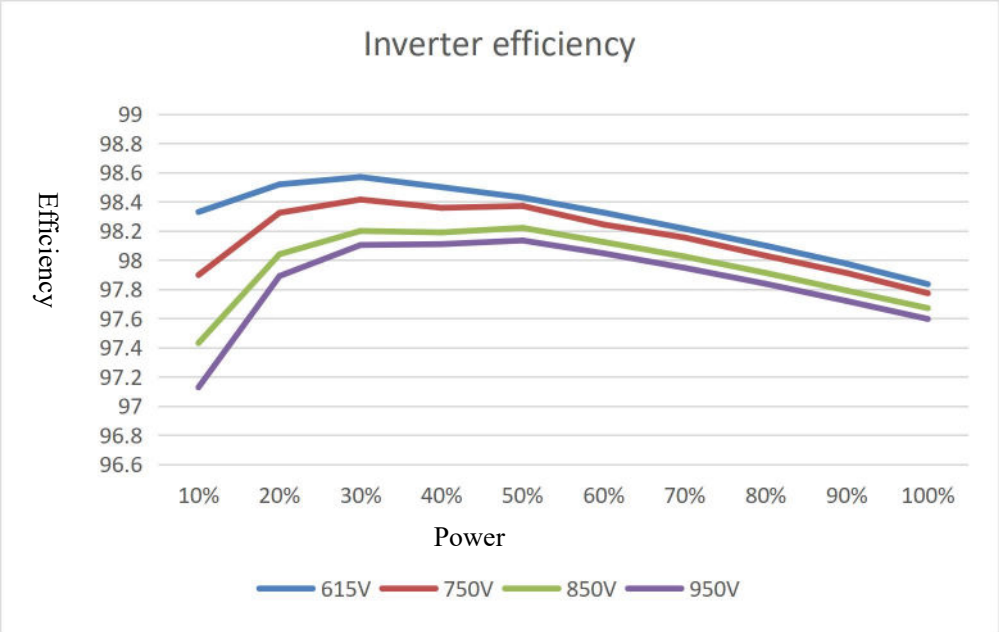
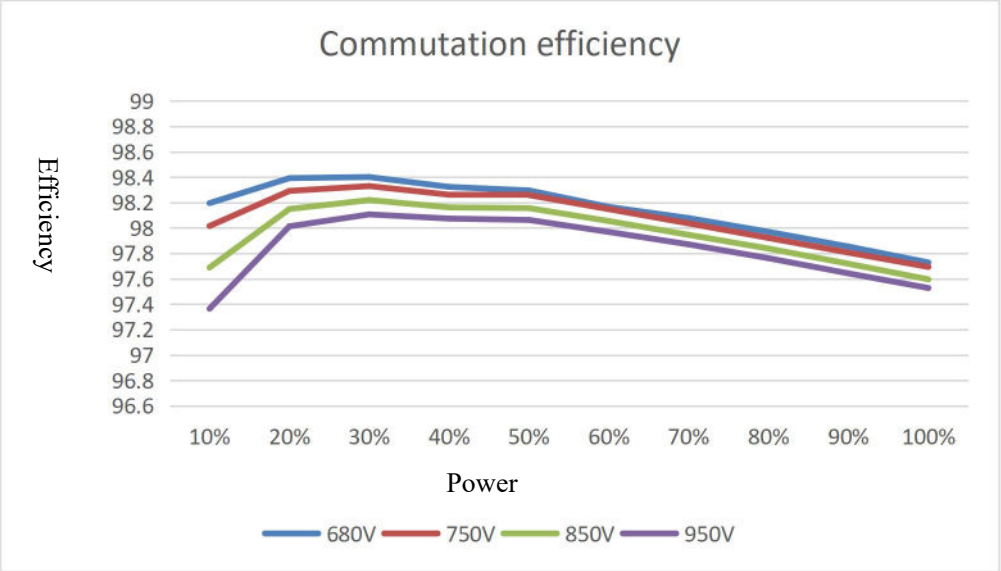


Figure analysis: The horizontal coordinate in the above figure represents different levels of power, the vertical coordinate represents different levels of efficiency, and the different lines in the figure represent different levels of DC voltage.

the following figure shows the rectifier and inverter efficiency under different DC voltages (the AC side voltage is 400V rated voltage) when PCS is used as a current source and 3P4W connection is adopted.

Figure 4-6 Current source（3P4W）



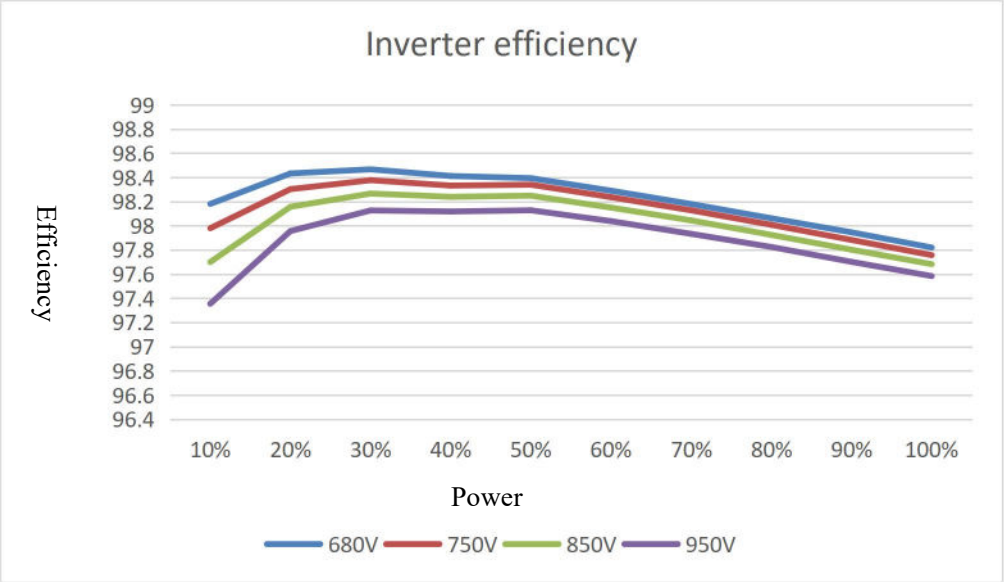


Figure analysis: The horizontal coordinate in the above figure represents different levels of power, the vertical coordinate represents different levels of efficiency, and the different lines in the figure represent different levels of DC voltage.

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，>1MΩ	
		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
AC side	Line to line 1kV, line to ground 2kV
Apply a 1.2/50us surge signal to the power port	

4.5.3 EMC requirements

Table 4-4 EMC requirement details

Project	Indicator requirements			Remark
Conducted interference (CE)	Frequency (MHz)	Limit AC power interface		
		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
	high temperature	℃	+55	+70	+70	>45℃
2	low humidity	%	5	/	5	/
	high humidity	%	95	/	95	
	condensation	y/n	n	/	n	
3	low altitude	m	0	/	0	Derating
	high altitude	m	5000	/	5000	>3000m

5 PCS module port definition

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.

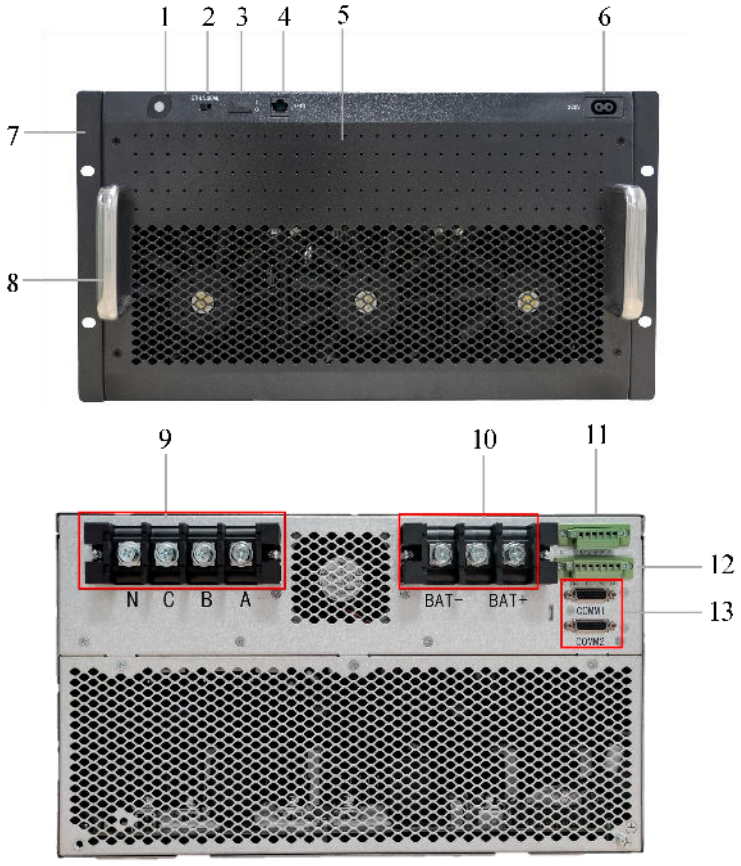


Figure 5-2 PCS front terminals and airflow from front to back version

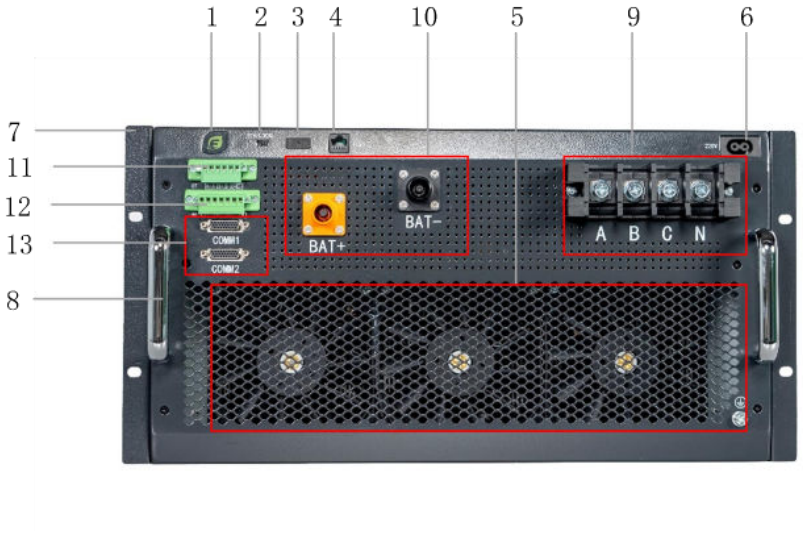


Table 5-1 Terminal description table

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 5-3 PCS power terminal (plug connector)

Figure 5-4 PCS power terminal (conventional wiring)

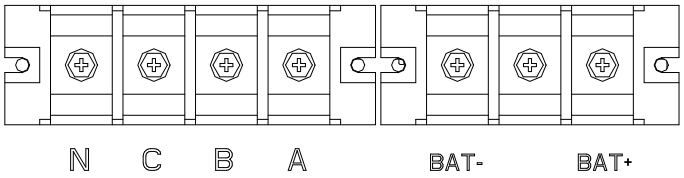


Table 5-2 PCS power terminal

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

PE	Ground interface	M6

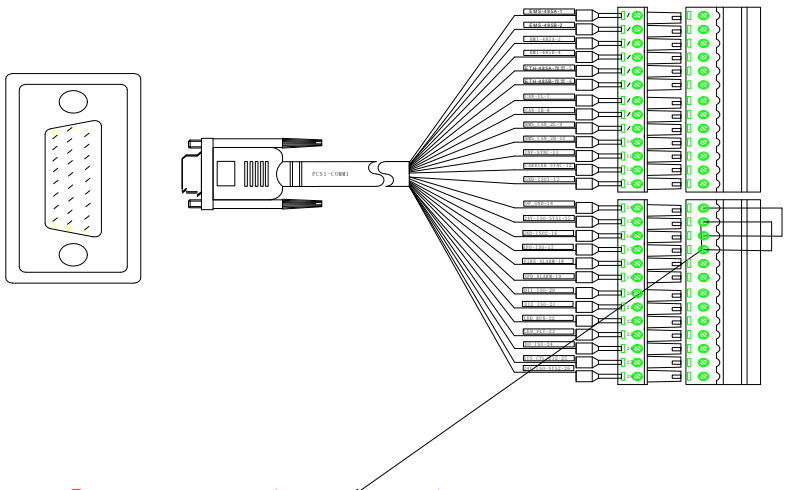
Table 5-3 Recommended power line diameter table for PCS modules

Rated power	AC or DC	Recommended value of copper wire (mm²)
80, 105kW	DC	Unipolar: ≥35 mm² single core, 50mm² (single core) recommended
80, 105kW	AC	Single phase: ≥35 mm² single core, recommended 50mm² (single core)
50, 63kW	DC	Unipolar: ≥25 mm² single core, 35mm² (single core) recommended
50, 63kW	AC	Single phase: ≥25 mm² single core, 35mm² (single core) recommended

Note: Select the cable diameter according to the local cable standards (yellow and green cables can only be used for grounding protection). Factors affecting cable selection include rated current, cable type, laying mode, ambient temperature, and maximum expected line loss.

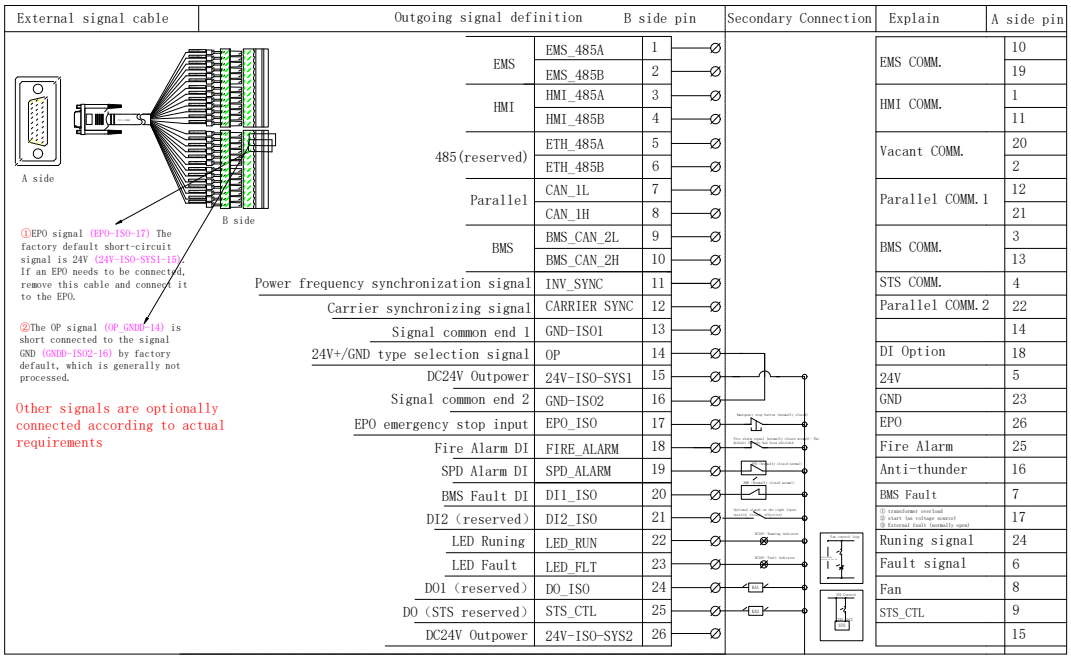
5. 3 COM communication port

Figure 5-5 EPO emergencies stop signal wiring diagram.



①EPO signal (EPO-ISO-17) The factory default short-circuit signal is 24V (24V-ISO-SYS1-15). If an EPO needs to be connected, remove this cable and connect it to the EPO.

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



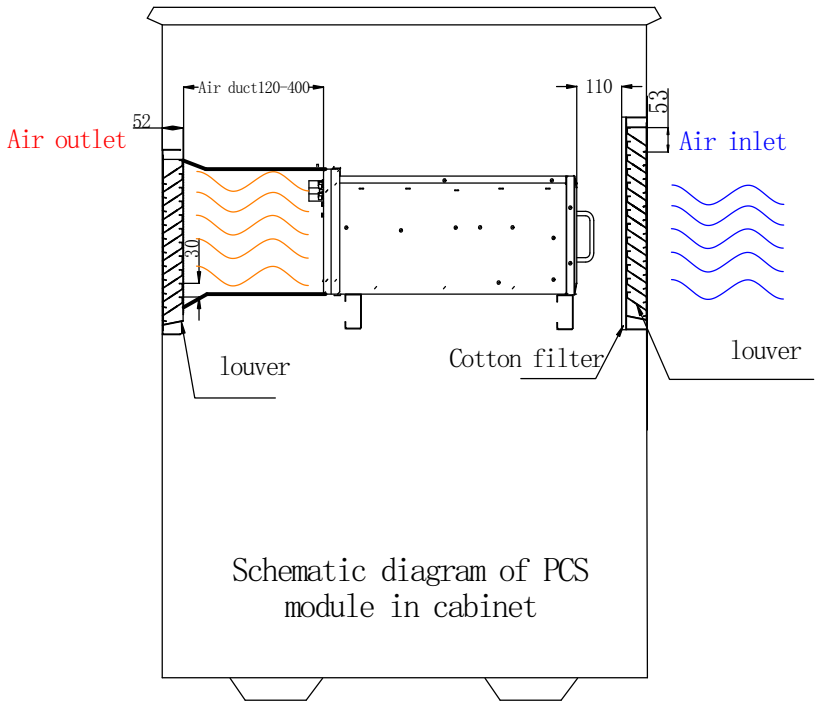
Note 1: DB26 cable is supplied with the product, and the default length is 1.5m.

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

6 Air duct cooling reference

The energy storage PCS module is cooled by forced air cooling. The heat dissipation mode for the module is forward air and out air. When installed in the integrated system, the air inlet and outlet of the cabinet must face the module, and the air inlet and outlet of the cabinet must be at least 110mm away from the cabinet.

Figure 6-1 105kW-PCS Cabinet heat dissipation diagram



It is recommended to use 40PPI density - polyurethane mesh foam - flame retardant filter cotton for air inlet louvers, and 10 mesh insect-resistant steel mesh for air outlet louvers. The following figure shows the heat dissipation reference diagram of 105kW-PCS module in the integrated cabinet.

If the air duct is not installed in the air outlet, you can choose to install a fan in the air outlet, and the corresponding fan selection should be selected according to 2 times the actual effective air volume (the nominal maximum air volume of the fan specification book is actually impossible to achieve, the actual work efficiency point is about 0.5 times the maximum air volume).

Table 6-1 Ventilation parameter table of PCS module in cabinet

Model number	Module actual effective air volume	Effective air intake	Area of the effective

	（CFM）	（m^3/min）	area of the cabinet（m^2）	air outlet of the cabinet（m^2）
EPCS50-AM	350	9.91	0.05	0.06
EPCS63-AM	350	9.91	0.05	0.06
EPCS80-AM	350	9.91	0.05	0.06
EPCS105-AM	556	15.75	0.06	0.072
EPCS105-AM-F	556	15.75	0.06	0.072

Note: 1. The actual effective air inlet/outlet area of the cabinet in the table above refers to the through hole area of the cabinet.

2. The preceding table applies only to a single PCS module. The heat dissipation of other components in the cabinet is not taken into account.