APstorage Sea Family
ELS Series PCS
ELS-3K/5K
Installation & User Manual

（For EMEA）

Rev3.6 2025-06-05

Table of Contents

1. Important Safety Instructions

This manual contains important instructions to be followed during installation and maintenance of the APstorage PCS. To reduce the risk of electrical shock and ensure the safe installation and operation of the APstorage PCS, the following symbols appear throughout this document to indicate dangerous conditions and important safety instructions.

DANGER: This indicates a hazardous situation, which if not avoided, will result in death or serious injury.

WARNING: This indicates a situation where failure to follow instructions may be a safety hazard or cause equipment malfunction. Use extreme caution and follow instructions carefully.

NOTE: This indicates information that is very important for optimal system operation. Follow instructions closely.

1.1 Safety Instructions

IMPORTANT SAFETY INSTRUCTIONS. SAVE THESE INSTRUCTIONS. This guide contains important instructions that you must follow during installation and maintenance of the PCS. Failing to follow any of these instructions may void the warranty. Follow all of the instructions in this manual. These instructions are key to the installation and maintenance of the APstorage PCS. These instructions are not meant to be a complete explanation of how to design and install APstorage PCSs. All installations must comply with national and local electrical codes and standards.

DANGER:
- Only qualified professionals should install and/or replace the APstorage PCS.
- Perform all electrical installations in accordance with local codes.
- To reduce risk of burns, do not touch the body of the PCS.

WARNING:
- Do NOT attempt to repair the APstorage PCS. If it shows abnormal performance, Contact APsystems Customer Support to obtain adequate support. Damaging or opening the APstorage PCS will void the warranty.

NOTE:
- Before installing or using the APstorage PCS, please read all instructions and Cautionary markings in the technical documents and on the APstorage PCS.

1.2 Radio Interference Statement

This equipment could radiate radio frequency energy which might cause interference to radio communications if you do not follow the instructions when installing and using the equipment. But there is no guarantee that interference will not occur in a particular installation. If this equipment causes interference to radio or television reception, the following measures might resolve the issues:

A) Relocate the receiving antenna and keep it well away from the equipment.

B) Consult the dealer or an experienced radio / TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate the equipment.

1. Important Safety Instructions

1.3 Communication Disclaimer

The EMA system provides a friendly interface to monitor the working status of the whole energy storage system. At the same time, it can also help to locate problems during system maintenance. If communication has been lost for more than 24 hours, please contact the technical support of APsystems.

1.4 Symbols replace words

	Caution, risk of electric shock.
	Caution, hot surface.
	NOTICE, danger! This device directly connected with electricity generators and public grid.
	After the inverter is turned off, wait for at least 5 minutes before opening the PCS or touching live parts.
	Refer to the operating instructions.
	Products shall not be disposed as household waste.
	CE mark.
Qualified personnel	Person adequately advised or supervised by an electrically skilled person to enable him or her to perceive risks and to avoid hazards which electricity can create. For the purpose of the safety information of this manual, a "qualified person" is someone who is familiar with requirements for safety, electrical system and EMC and is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures. The inverter and storage system may only be commissioned and operated by qualified personnel.

Hereby, [ALTENERGY POWER SYSTEM INC.] declares that the radio equipment type [ELS-5K, ELS-3K] is in compliance with Directive 2014/53/EU.
The full text of the EU declaration of conformity is available at the following internet address:
https://emea.apsystems.com/resources/library/

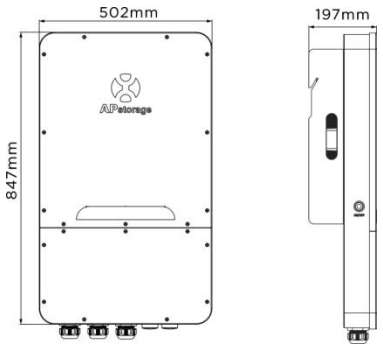
2. APstorage PCS Introduction

ELS series PCS is APtorage's Sea family product and the PCS is a battery Power Conversion System.
APsystems PCS, together with a compatible battery (not offered by APsystems), becomes a complete and independent AC coupling storage solution for residential PV installations. It can be used with any new or already installed PV systems without changing equipment in place.

One PCS can be connected multiple batteries. (please refer to local regulations for details)
When multiple battery packs are connected, they need to be connected in parallel. (see connection diagram in the Battery User Manual)

APstorage will help home-owners to optimize their utility bill, offering full flexibility to manage their Electrical consumption. Several modes are available. (Backup power supply mode, Self-consumption mode and Advanced mode)

2.1 Dimensions



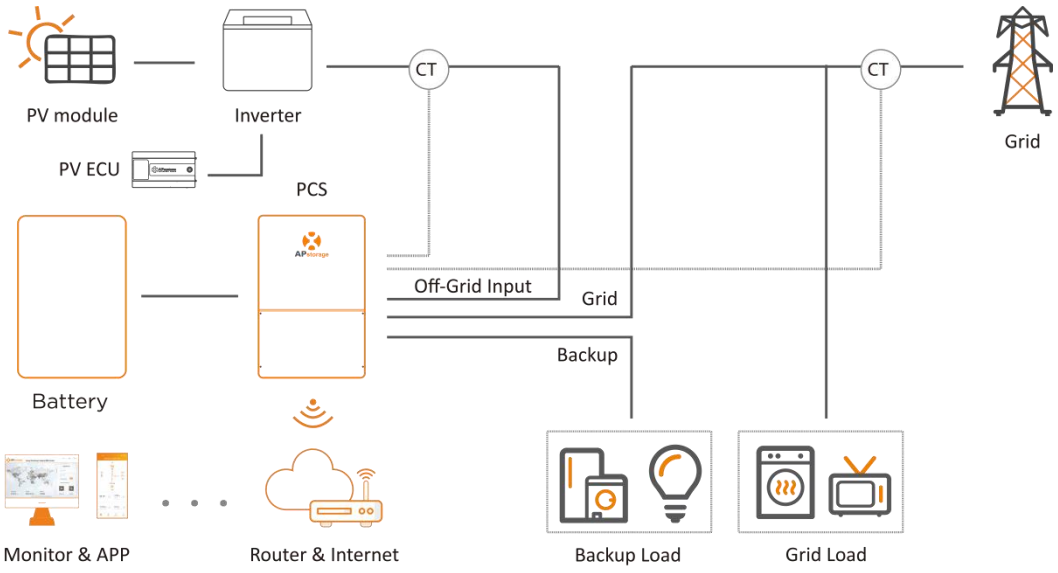
2.2 Basic System Architecture

A typical APstorage system includes two main elements:

- **APstorage PCS, which is a smart battery Power Conversion System.**

  The PCS includes an integrated ECU (Energy Communication Unit) to ensure monitoring of the overall system once up and running.
- **A compatible Battery pack (see battery compatibility list).**

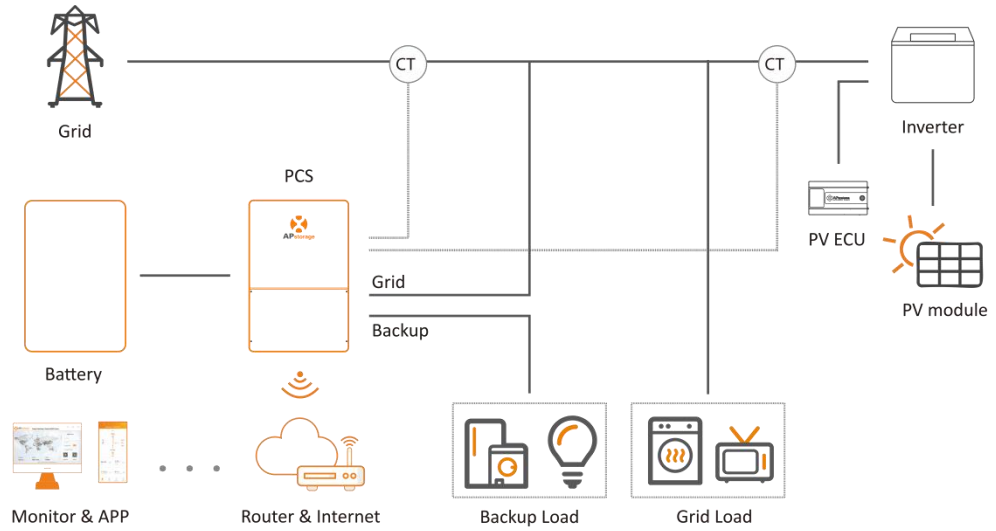
Option 1 : PV system working off-grid



ELS-5K/3K can control APsystems DS3&DS3D inverters through frequency control, and it can also control other inverters through external relays.

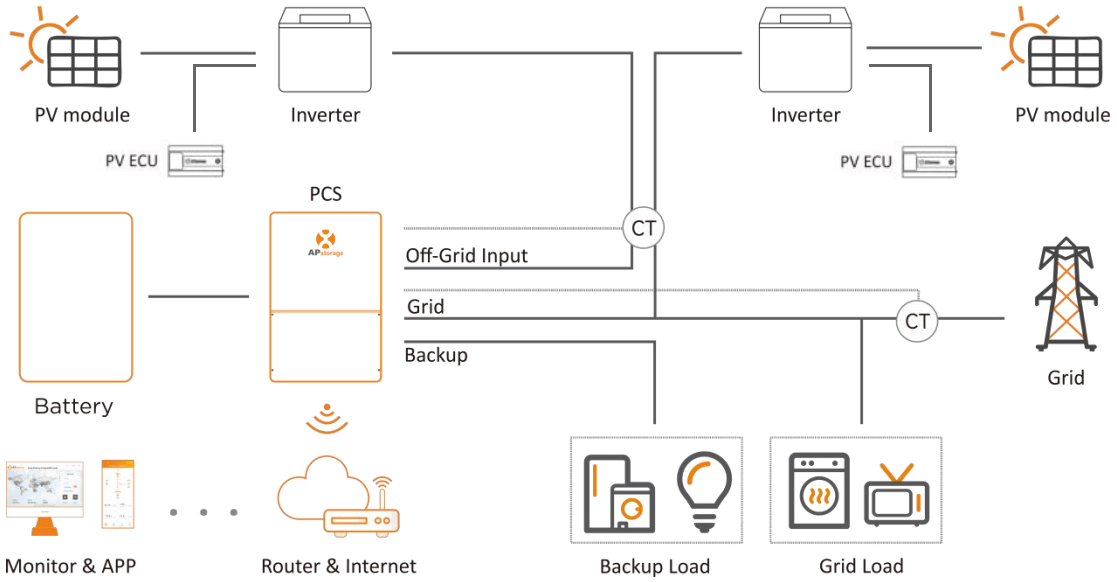
2. APstorage PCS Introduction

Option 2 : PV system working grid



NOTE: If the wireless signal in the area where the PCS is weak, it is necessary to add a Wi-Fi signal booster at a suitable place between the router and the PCS.

Option 3 : mix of option 1 and 2 following the conditions above



NOTE: In a Storage System with APstorage PCS, the battery is one of the key components. Therefore, it is necessary to keep the installation environment well ventilated, please refer to Battery user manual.

2. APstorage PCS Introduction

2.3 LED

There are eight LED indicators on the PCS unit, indicating the working state of the PCS.

LED	Condition	Description
SYSTEM	▬▬▬	The system is operating
	▮ ▮ ▮ ▮	The system is starting up
	———	The system shutdown
GRID	▬▬▬	The grid exists and is connected
	▮ ▮ ▮ ▮	The grid exists but is not connected
	———	The grid does not exist
BACK UP	▬▬▬	The backup system is operating
	———	The backup is off
ENERGY	▬▬▬	Buy energy from grid
	▮ ▮ ▮ ▮	Zero output
	▮▮▮▮▮▮▮▮▮	Supplying energy to grid
	———	The grid is not connected or system is not operating
BATTERY	▬▬▬	The battery is charging
	▮ ▮ ▮ ▮	The battery is discharging
	▮▮▮▮▮▮▮▮▮	The battery SOC is low
	———	The battery is disconnected
WI-FI	▬▬▬	The WiFi is connected to the router
	▮ ▮ ▮ ▮	The WiFi is not connected to the router
	———	The WiFi function is closed
COM	▬▬▬	The battery and the internet communication are normal
	▮ ▮ ▮ ▮	The battery communication is normal, but the internet communication is abnormal
	▮▮▮▮▮▮▮▮▮	The battery communication is abnormal, but the internet communication is normal
	———	The battery and the internet communication are abnormal
FAULT	▬▬▬	Fault has occurred
	▮ ▮ ▮ ▮	Back up output overload
	———	No fault

▬▬▬ : Light on

——— : Light off

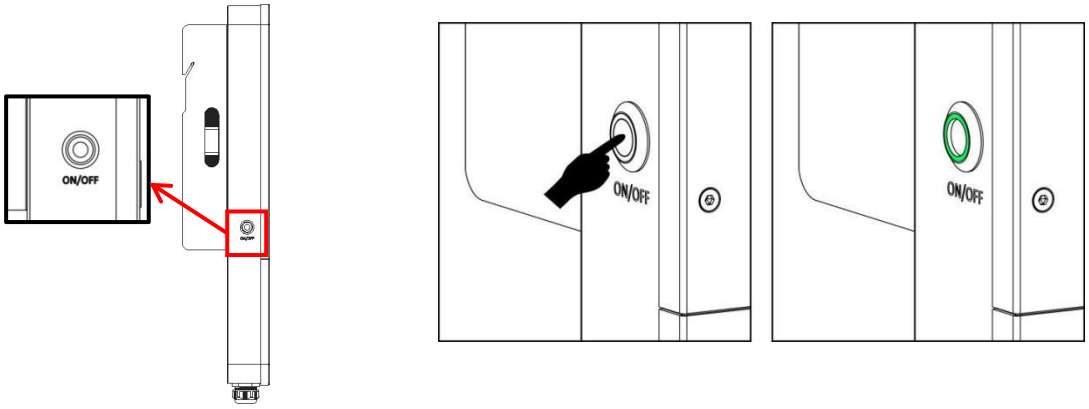
▮ ▮ ▮ ▮ : Every 5 seconds light on for 1 second.

▮▮▮▮▮▮▮▮▮ : Every 2 seconds light on for 1 second.

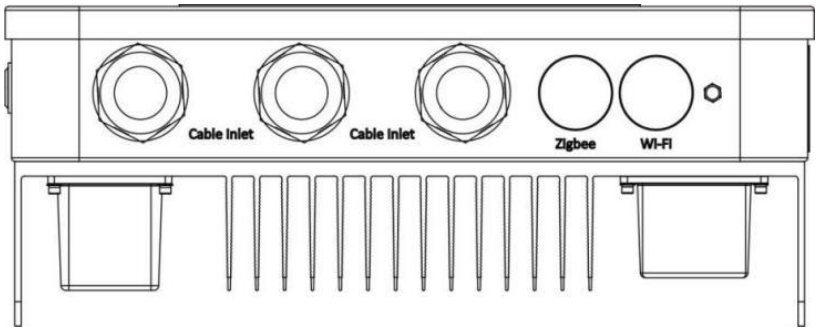
2. APstorage PCS Introduction

2.4 PCS Power ON/OFF

Once the PCS has been properly installed and the batteries are connected well, press On/Off button (located on the left side of the case) , wait 1 minute for the button's green light turns on indicating the PCS startup; press again to shut down.



2.5 PCS Connection Port



Cable Inlet:

① DC cable: Connect the positive and negative terminals of the battery.
② AC cable: AC grid port is connected to power grid and AC backup port is off grid output.
③ Internet cable: Connect the Internet port into the router.
④ CT cable: Connect the PV CT or Grid CT cable to the PCS.
(Both cable ports are available)

Zigbee:

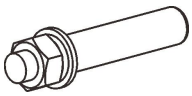
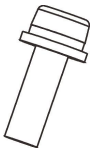
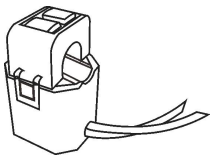
Use for Zigbee communication.

Wifi:

Use for Wifi communication.

3. Installation

3.1 Packing List

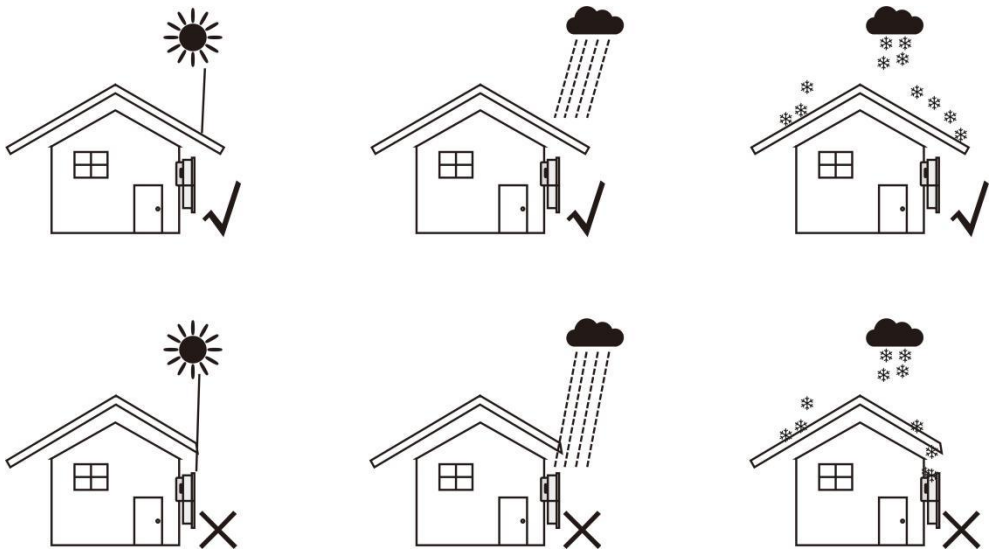
 PCS x1	 Wall-mounted Bracket x1	 Expansion screw (M8*70) x3
 Fixing screw (M6×22) x1	 CT（Current transformer）×2	 Quick Installation Guide ×1

NOTE: The expansion screws are applicable only to cement concrete walls. For other types of walls, install expansion screws based on the wall type.

NOTE: The customer will need to purchase a combiner box for parallel connection of the batteries. Combiner box requirements: rated current of each connector ≧ 100A.

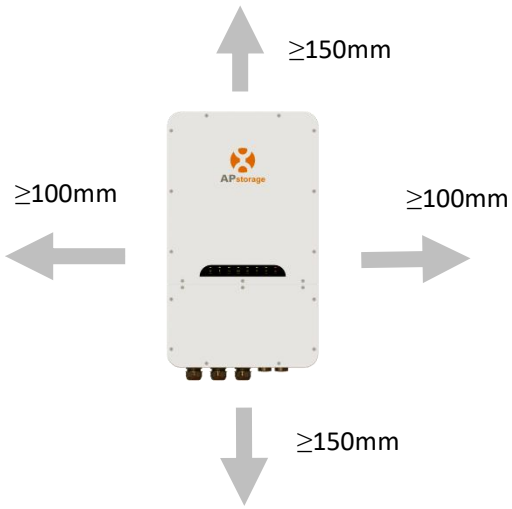
3.2 Select Mounting Location

1. PCS should be installed on a solid surface, where is suitable for PCS's dimensions and weight.
2. Do not install PCS in a confined space with no ventilation.
3. If the PCS is installed outside, it should be protected under shelter from direct sunlight or bad weather conditions (like snow, rain, lightning, etc). Fully shielded installation locations are preferred.



3. Installation

4. Install the APstorage vertically on the wall.
5. Make sure that the PCS is mounted “face-up”: Product logo is visible after installation.
6. Leave enough space around APstorage. The specific requirements are as follows:



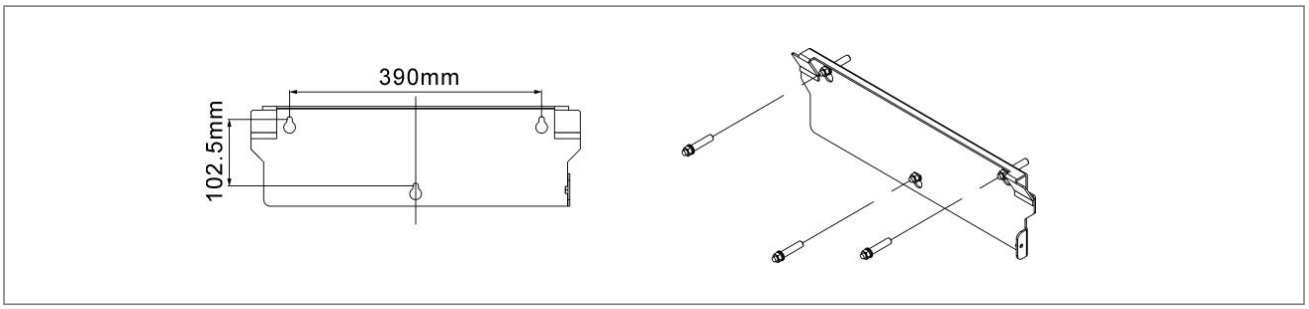
WARNING: APstorage PCS cannot be installed near flammable, explosive or strong electro-magnetic equipment.

3. Installation

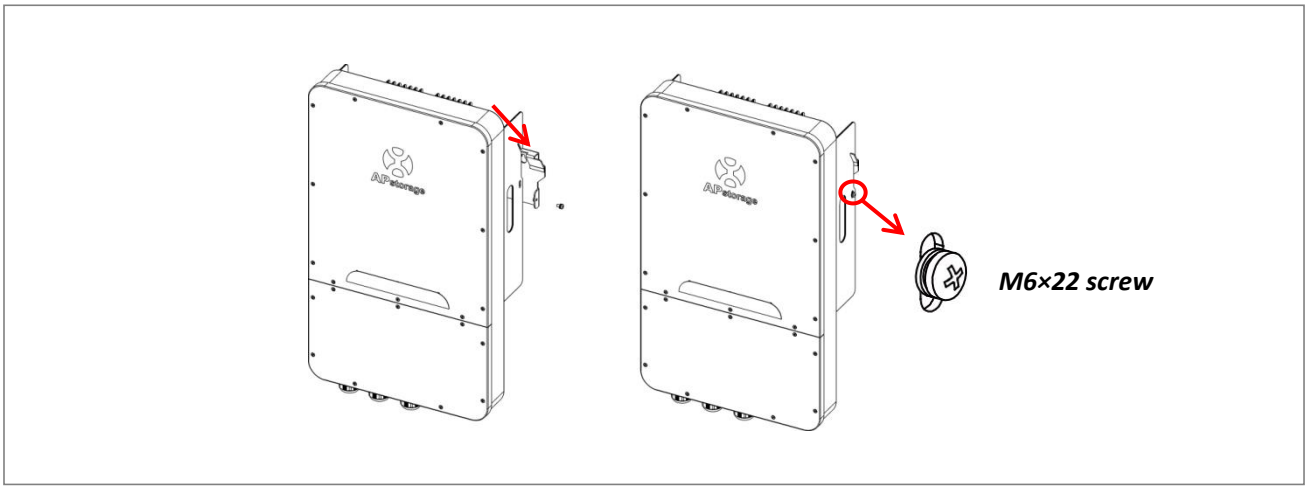
3.3 PCS Installation Steps

① Mark the holes position on the wall and drill holes according to wall type and expansion screws type. The configured expansion screw is drilled with a diameter of 12mm(0.5”) and a depth of 50-55mm(1.9-2.2”).

② Put the expansion screws into the holes on the wall. Use a wrench to tighten the hex nuts, so that the expansion screws sleeve are fully expanded. Then remove the hex nuts. Hang the wall mounting bracket into the expansion screws, and use the hex nuts to fix it firmly. Make sure that the wall mounting bracket is horizontal after installation.



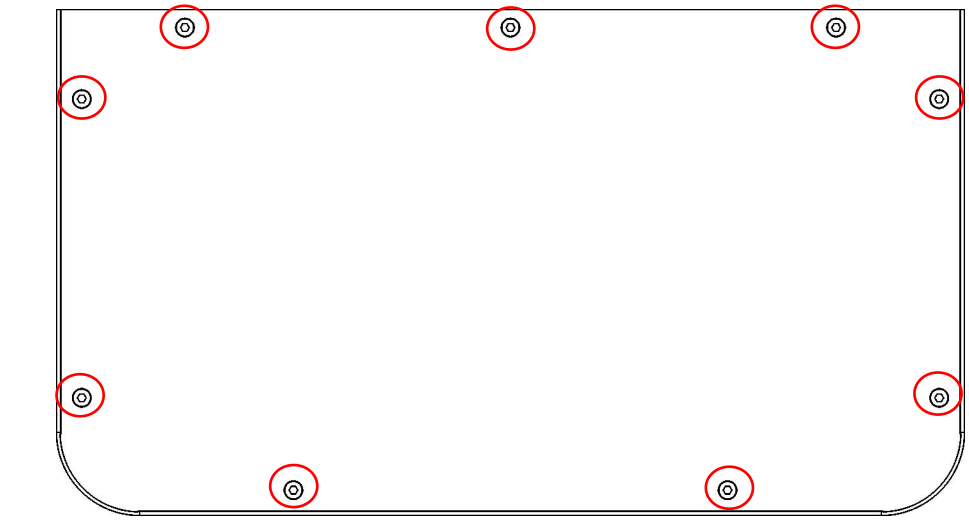
③ Lift the PCS to hang it into the wall mounting bracket, and fix the PCS on wall mounting bracket with the M6×22mm screw.

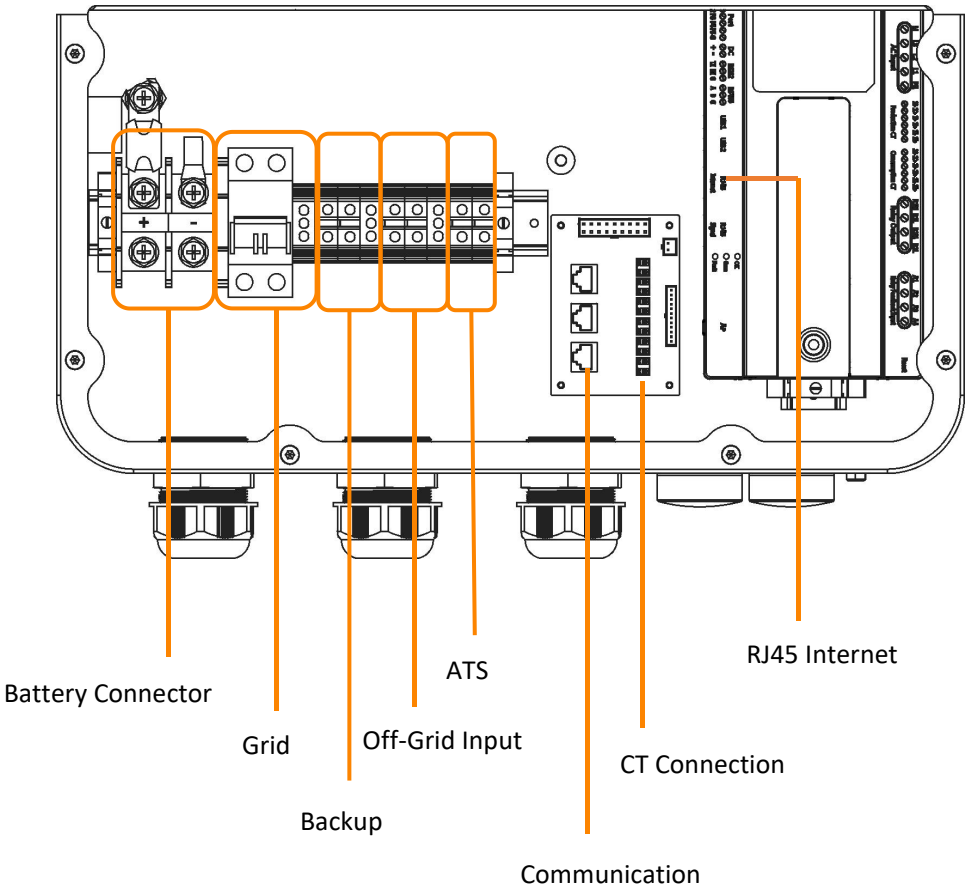


3. Installation

3.4 PCS Wiring

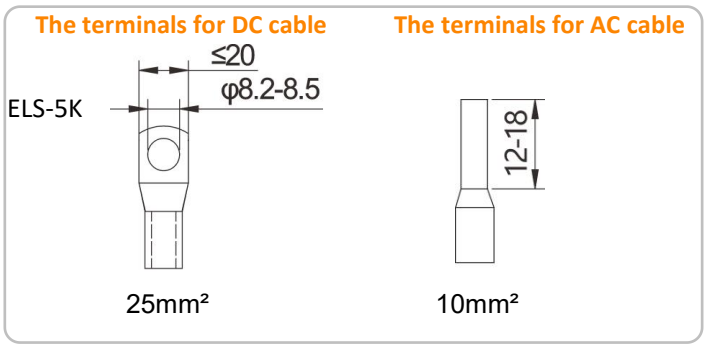
When wiring, you need to remove the lower cover first, just unscrew the 9 locking screws.

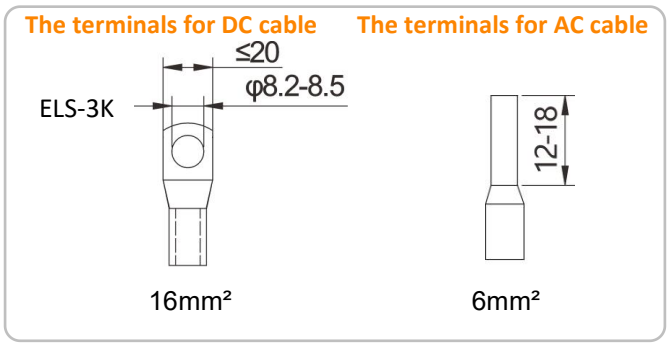




3. Installation

When wiring, you need to crimp appropriate terminals on the cable (as shown for dimensions). The cables and terminals need to be prepared by yourself or purchased from APsystems.

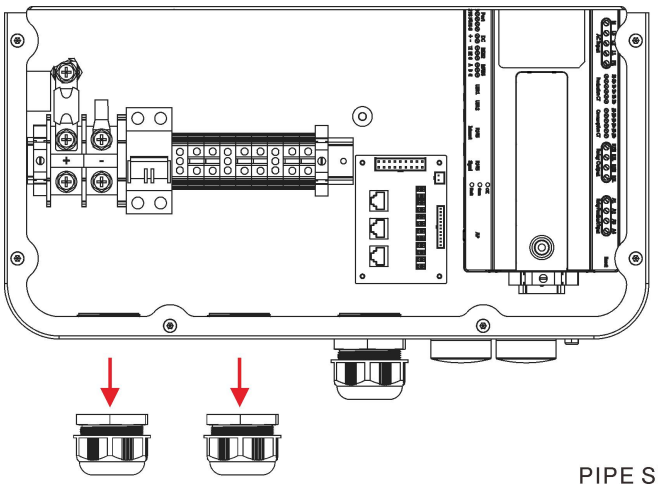


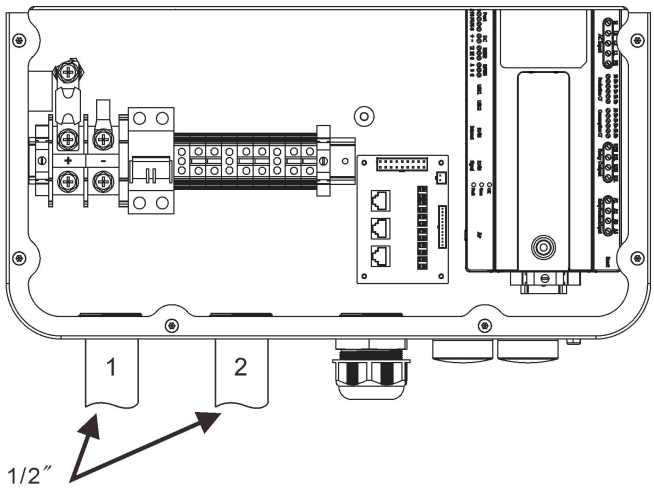


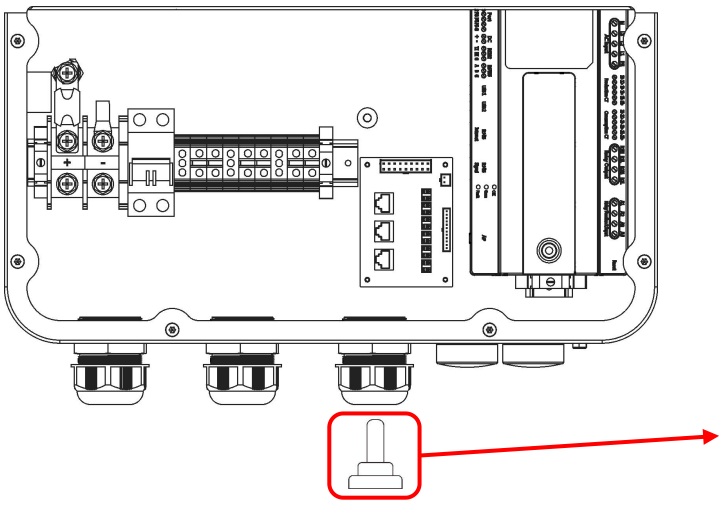
ELS-5K recommend minimum cable：DC cable 25mm² / AC cable option 1 or 3 : 10 mm², option 2 : 4mm² (see chap 2.2)
ELS-3K recommend minimum cable：DC cable 16mm² / AC cable option 1 or 3 : 6 mm², option 2 : 4mm² (see chap 2.2)

PCS has been installed with cable glands before delivery. If connection is required through pipe **(prepare pipe yourself)**, remove cable glands on the casing first.

NOTE: Suggest using waterproof pipe.







If the two cable inlets are not sufficient, take out the stopper of the cable gland, the third cable inlet can be used.

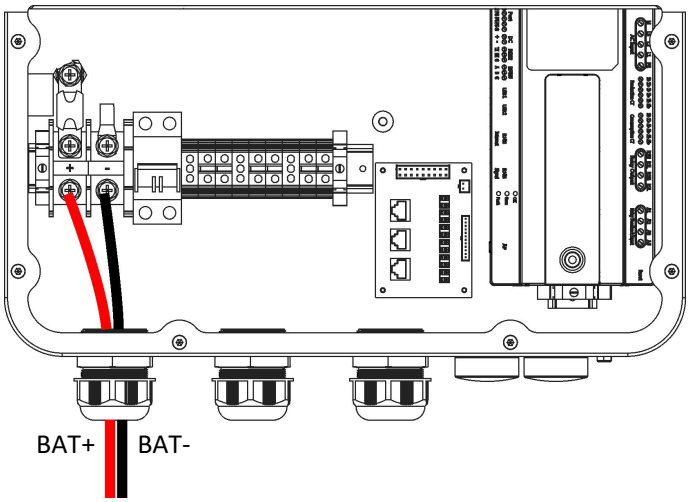
WARNING: Do not drill holes in the casing at any location, otherwise we will not provide warranty.

3. Installation

3.4.1 DC Wiring

Connect the DC cable to the PCS through the cable gland. As shown, connect wire + & - to Battery connector.

Torque value：40lb.in



BAT+: Red/Orange

BAT-: Black

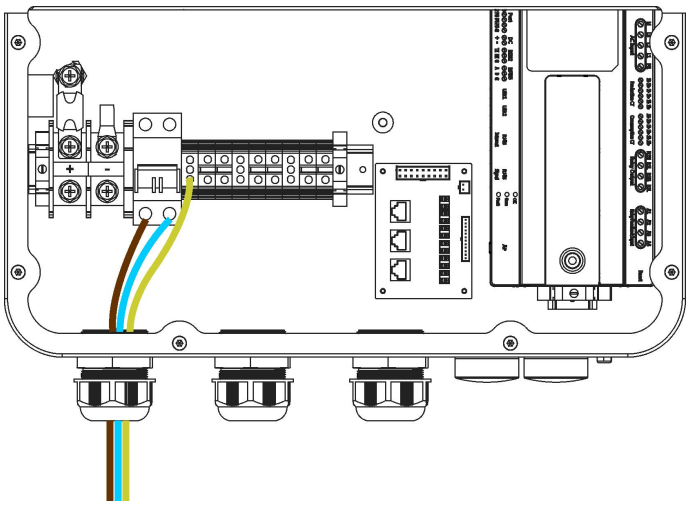
NOTE: APstorage ELS/ELT series PCS are DC/AC isolated, so the battery ground should not be connected to AC ground. Leave battery ground point floating could ensure the system working safely and stably.

3.4.2 AC Wiring

3.4.2.1 Connect the grid AC cables to the PCS through the cable gland. As shown, connect wire L and N to grid breaker, connect wire PE to the earth terminal block.

Torque value：10.53lb.in

Do not loosen the screw to the end when removing wires, otherwise the terminal may be damaged.



L-Brown

N-Blue

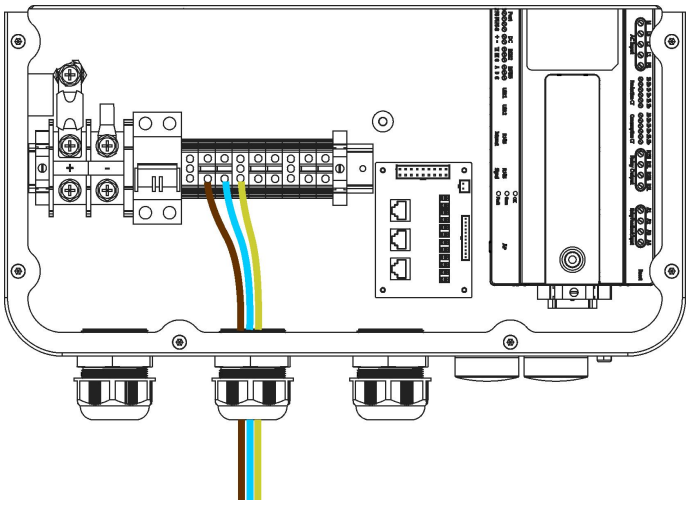
PE-Yellow&Green

3. Installation

3.4.2.2 Connect the backup AC cables to the PCS through the cable gland. As shown, connect wire L and N to the terminal block , and connect wire PE to the earth terminal Block.

Torque value： 10.53lb.in

Do not loosen the screw to the end when removing wires, otherwise the terminal may be damaged.



L N PE

BACKUP

L-Brown

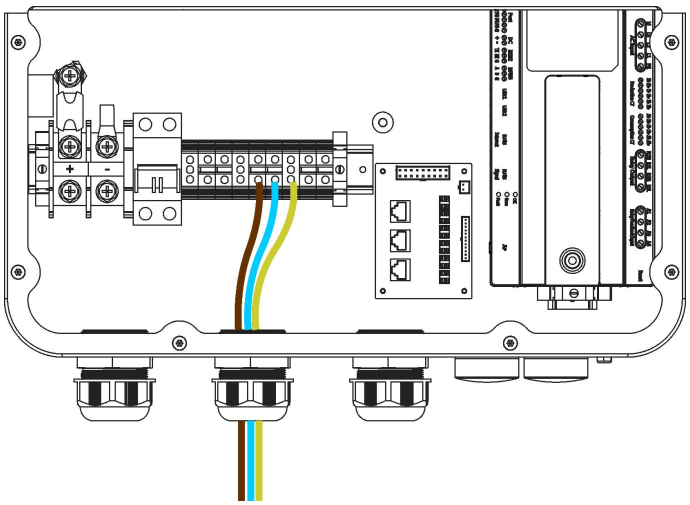
N-Blue

PE-Yellow&Green

3.4.2.3 Connect the Off-Grid PV AC cables to the PCS through the cable gland. As shown,connect wire L and N to terminal Block , and connect wire PE to the earth terminal Block.

Torque value： 10.53lb.in

Do not loosen the screw to the end when removing wires, otherwise the terminal may be damaged.



L N PE

Off-Grid Input

L-Brown

N-Blue

PE-Yellow&Green

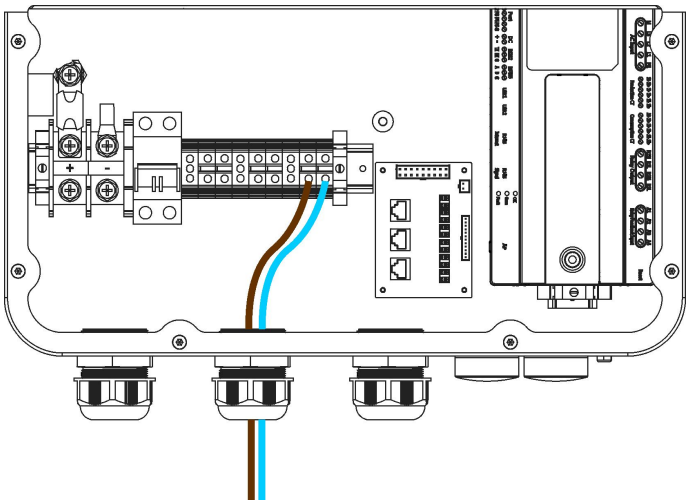
NOTE: Make sure to connect the live wire to L, connect the neutral wire to N, otherwise the precision of the CT will be affected.

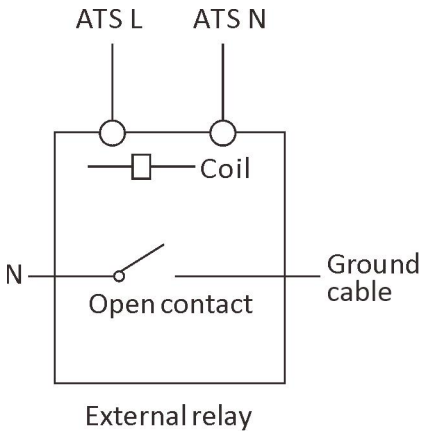
3. Installation

3.4.2.4 According to local installation requirements, off grid neutral can be grounded internally or externally. Connect the ATS cables to the PCS through the cable gland. As shown, connect wire L and N to terminal Block.

Torque value： 10.53lb.in

Do not loosen the screw to the end when removing wires, otherwise the terminal may be damaged.





ATS: 230V output port when inverter is on.

L-Brown

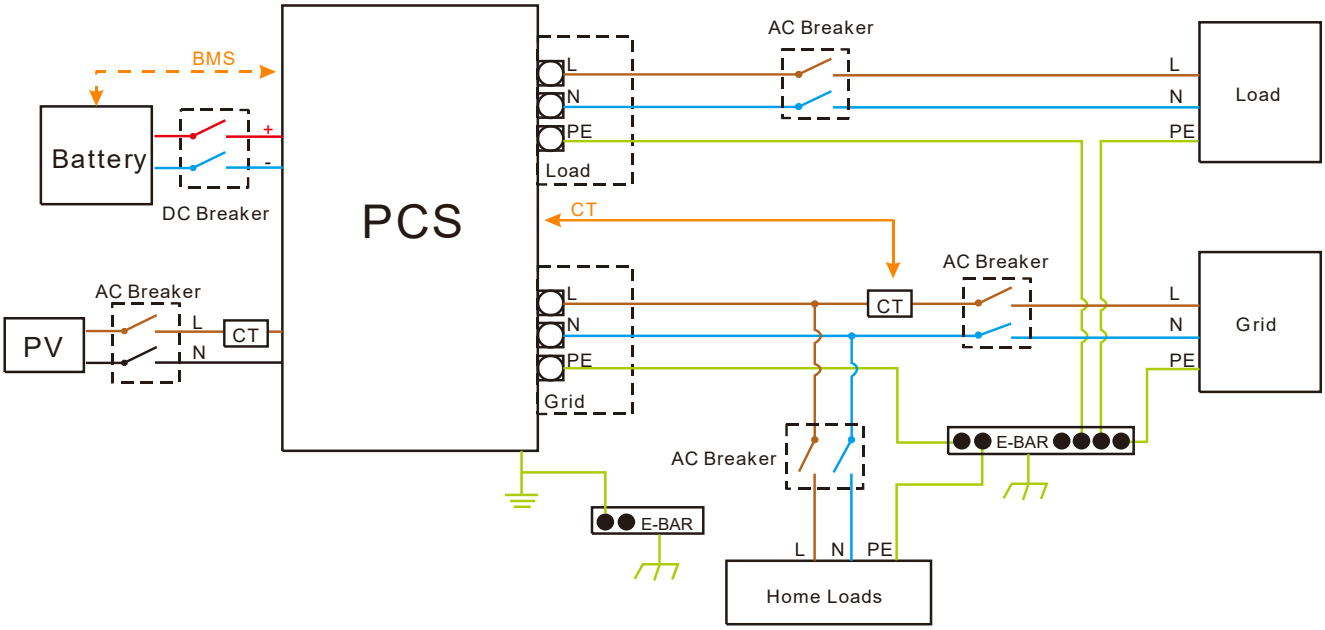
N-Blue

NOTE: This interface is based on the mandatory requirements of certain countries or regions. Users should choose whether to use it according to local regulations.

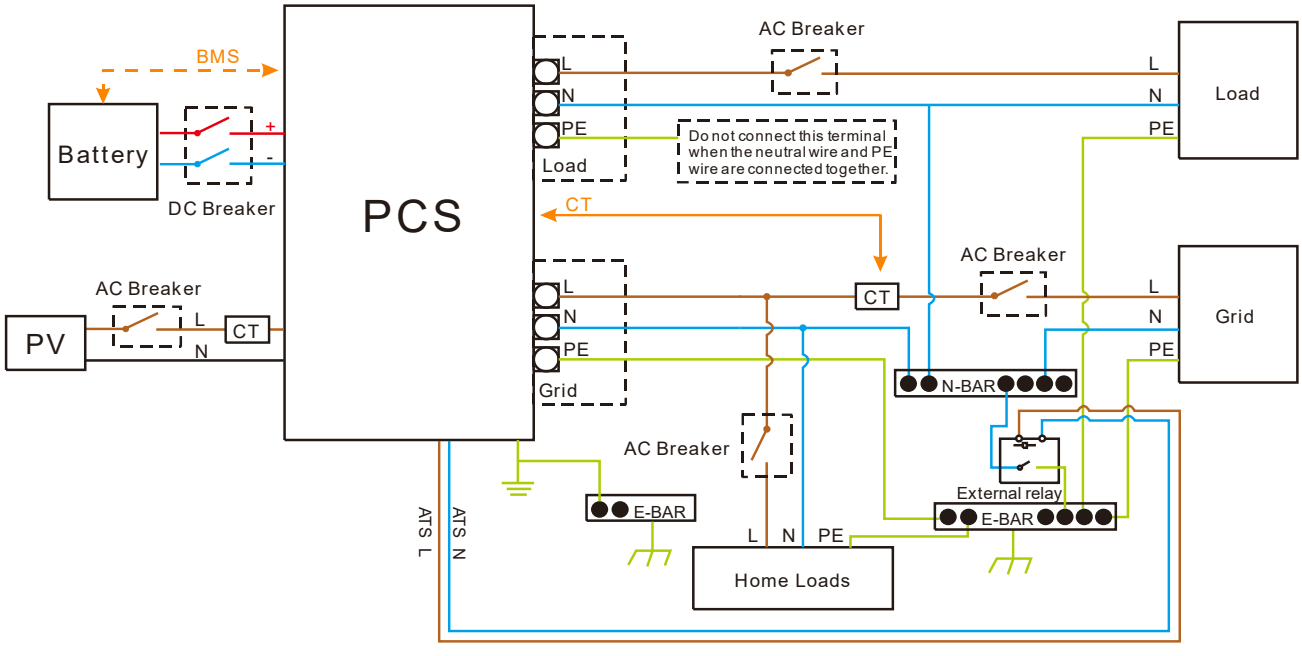
3. Installation

Wiring System for PCS

This diagram is an example for grid systems without special requirement on electrical wiring connection.
NOTE: The back-up PE line and earthing bar must be grounded properly and effectively. Otherwise the back-up function may be abnormal when the grid fails.



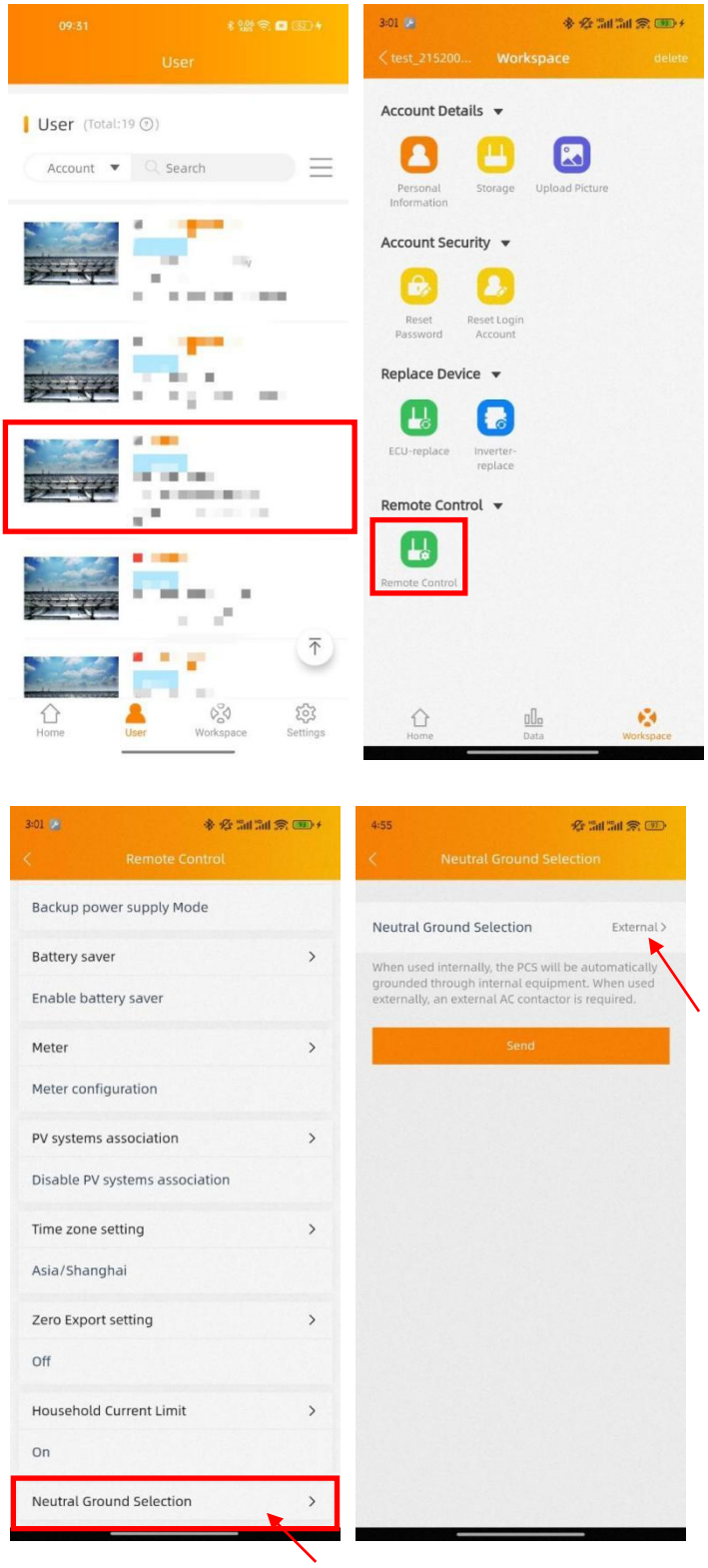
This diagram is an example for application that Neutral connects together with PE in distribution box.
Such as: Australia, etc. (Please follow local wiring regulations!)



3. Installation

Neutral Ground Selection

1. Open the EMA Manager and log in with the installer account.
2. Select the end-user account, click on “Workspace”, and enter “Remote Control”.
3. Click on “Neutral Ground Selection” and choose “Internal” or “ External".

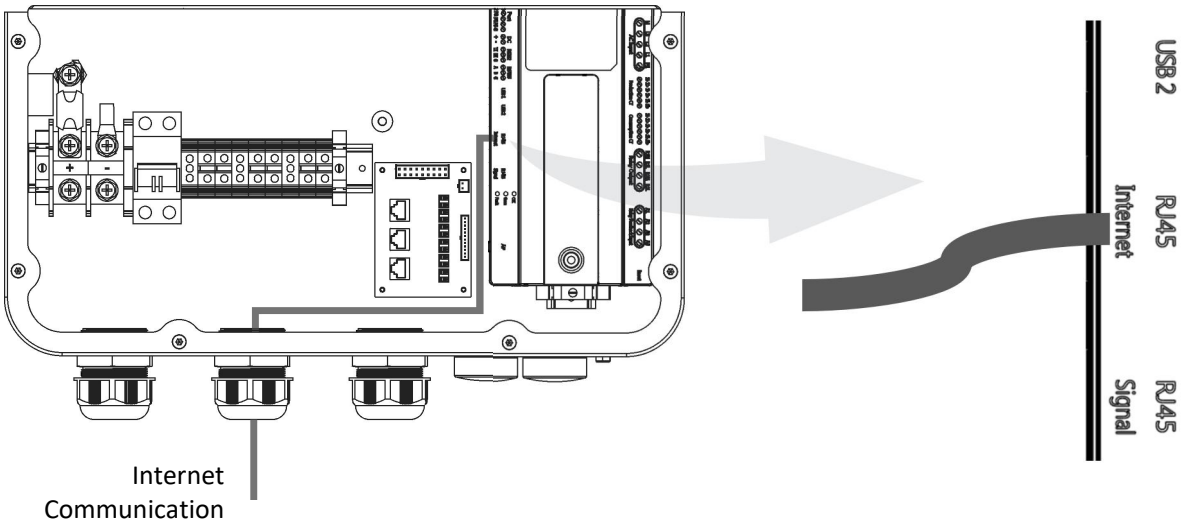


3. Installation

3.4.3 Communication Wiring

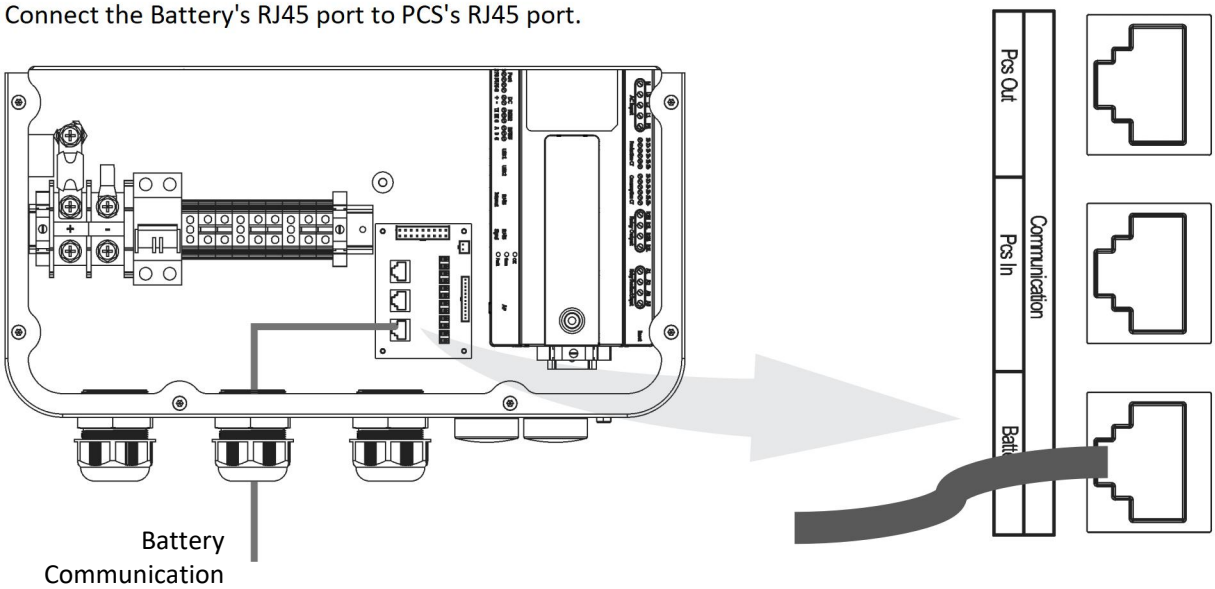
3.4.3.1 Internet Communication

Using the Internet cable, connect the Internet port into the router. The PCS also can be connected to the router via Wi-Fi, please refer to the chapter 5.3.3.1.



3.4.3.2 Battery Communication

Connect the Battery's RJ45 port to PCS's RJ45 port.

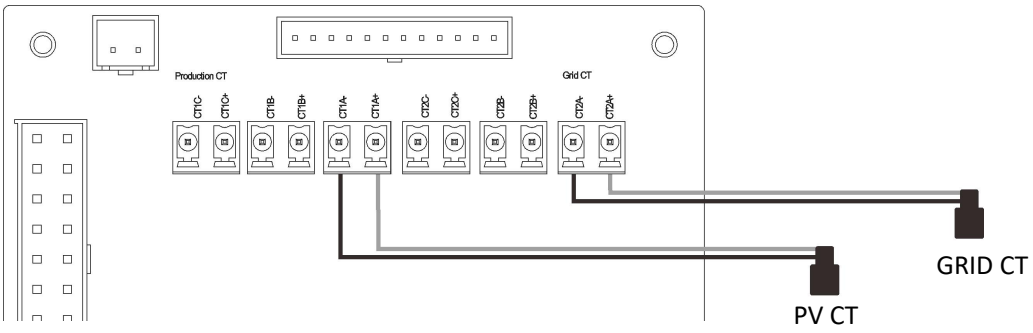


RJ45-PIN	1	2	3	4	5	6	7	8
Battery	NC	NC	NC	CAN-H	CAN-L	NC	485-B	485-A

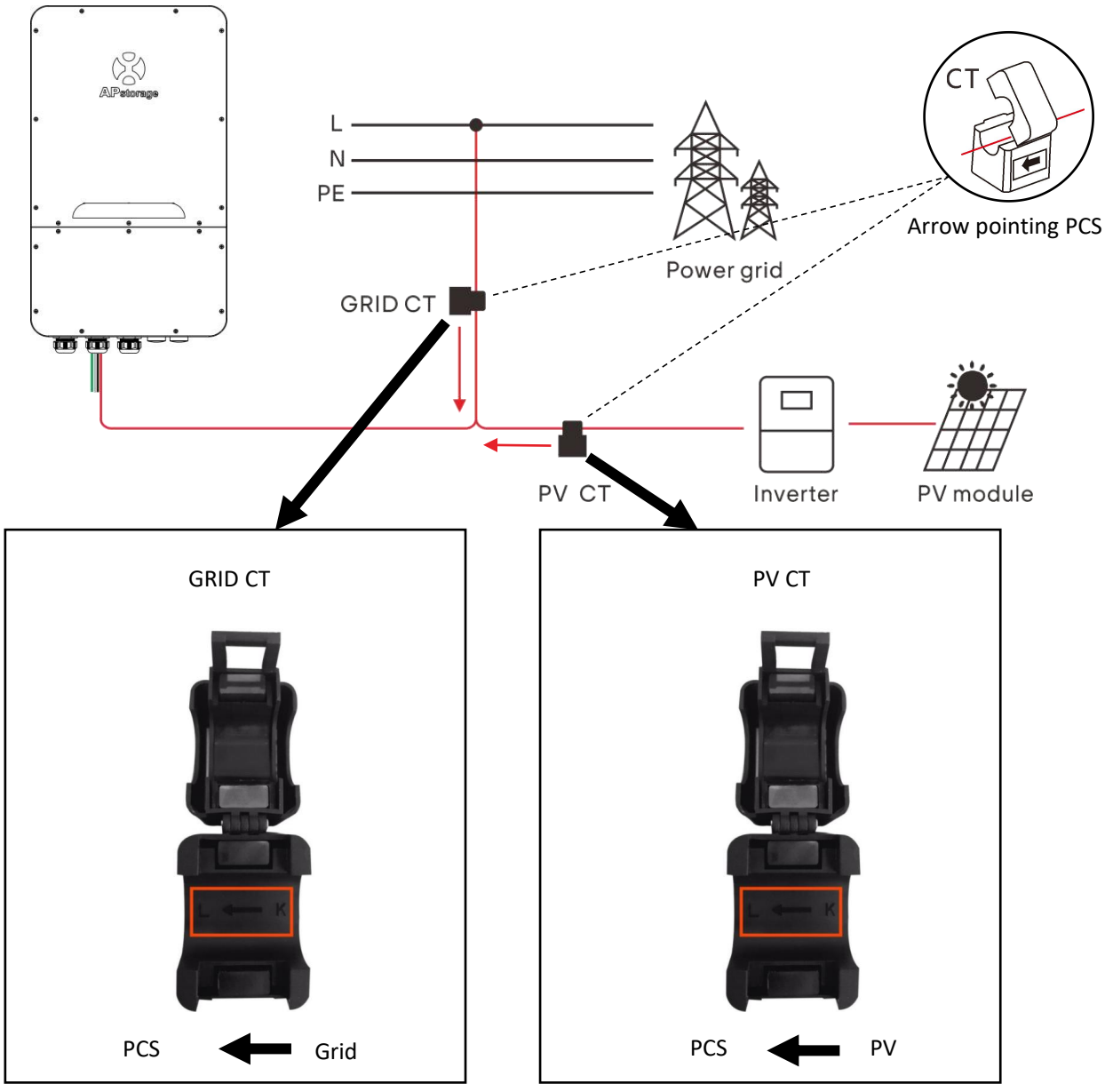
3. Installation

3.4.4 CT Wiring

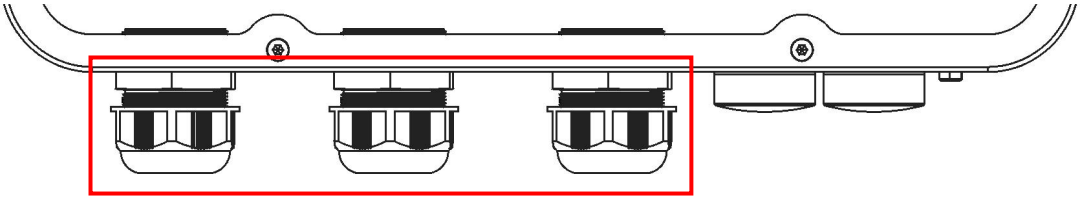
Connect the PV CT cable to the PV CT port of the PCS. Connect the GRID CT cable to the GRID CT port of the PCS.



The direction of CTs: The arrows on the GRID CT should point from grid to PCS and the arrows on the PV CT from PV to PCS.



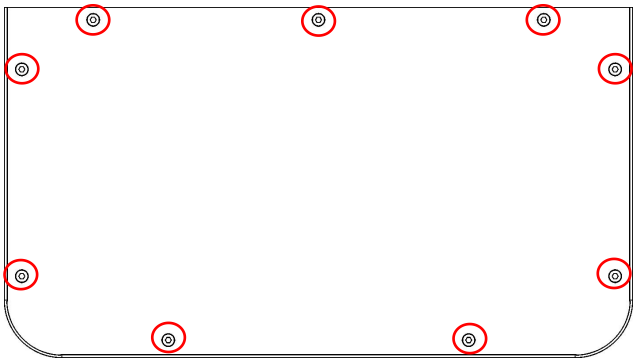
3. Installation



NOTE: After having completed the wiring, the nuts of the cable gland must be tightened.

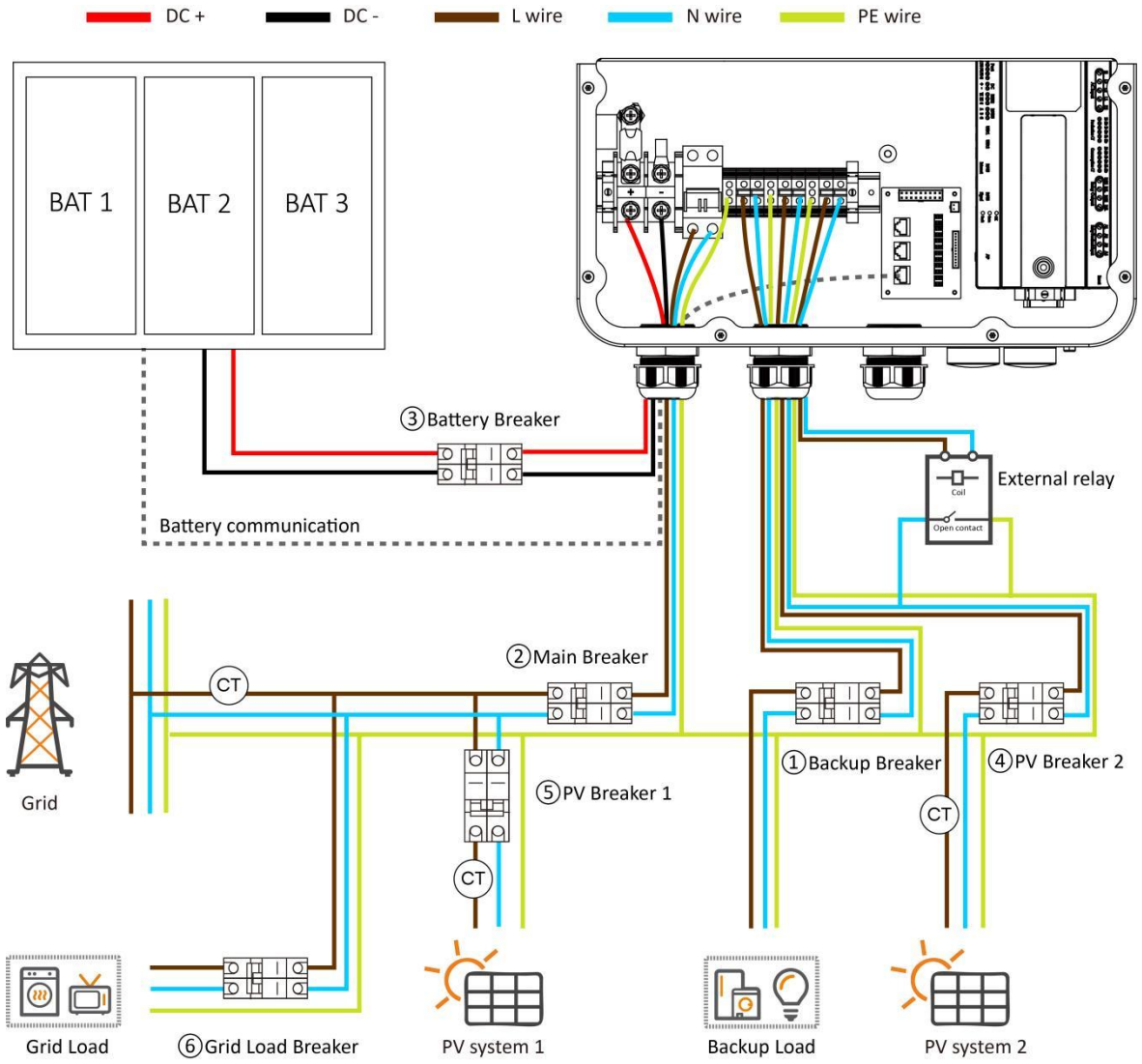
3.5 Install the Lower Cover

As shown, screw the 9 screws back.



3. Installation

3.6 Wiring Diagram



PV system option 2 (see chap 2.2)

PV system option 1 (see chap 2.2)

ELS-5K：

① Backup Breaker: 32A AC Breaker
② Main Breaker : 63A AC Breaker
③ Battery Breaker: 125A DC Breaker
④ PV Breaker 2: 32A AC Breaker

ELS-3K：

① Backup Breaker: 25A AC Breaker
② Main Breaker : 50A AC Breaker
③ Battery Breaker: 100A DC Breaker
④ PV Breaker 2: 25A AC Breaker

⑤ PV Breaker 1: Depends on PV system 1
⑥ Grid Load Breaker: Depends on Grid Load

3. Installation

3.7 Start-up sequence

3.7.1 Power ON

Once the unit has been properly installed and the batteries are connected well, turn on the batteries, then turn on the Battery Breaker, Grid Breaker, Backup Breaker and Main breaker to power the system.

3.7.2 Check the system

Please refer to EMA APP user manual to check the system.

3.7.3 Power Off

Turn off the Battery Breaker, Grid Breaker, Backup Breaker and Main breaker to power the system,then turn off the batteries.

WARNING: Installation must be performed with care.
Before making the final DC connection or closing DC breaker/disconnect, be sure positive(+) must be connect to positive(+) and negative(-) must be connected to negative(-). Reverse polarity connection on battery will damage the inverter.

WARNING: The installer is responsible for providing overcurrent protection.To reduce the risk of fire, install a circuit breaker or overcurrent device on both positive(+) and negative(-) conductors to protect the system.

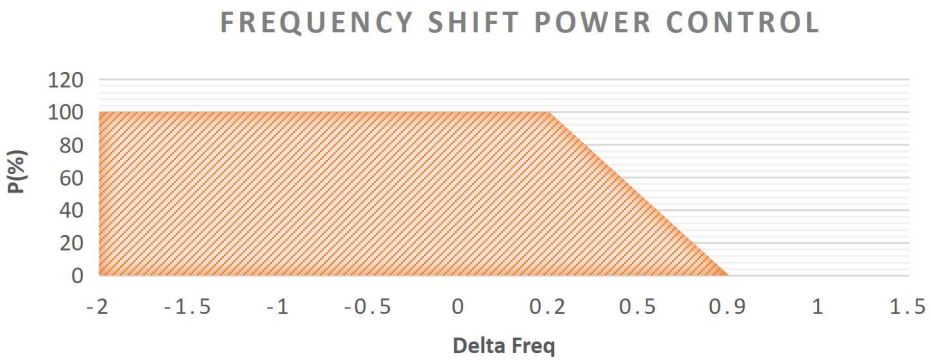
4. Off-Grid AC Coupling Installation

4.1 Frequency Shift Power Control

Functional Overview

If the PV inverter is connected to the off-grid side of the PCS in the system, the PCS must be able to limit its output power. This limitation is necessary when the battery of the PCS is fully charged and the available power of the photovoltaic system exceeds the power demand of the connected load. In order to prevent the battery from overcharging, the PCS uses the measured the photovoltaic power and the requested charging power from battery to adjust the frequency of the microgrid, and the photovoltaic inverter adjusts the output power by detecting the change of the frequency of the microgrid.

The Frequency shift power control is enabled by default on PCS. At the same time, it is necessary to ensure that the PV System 2 is correctly connected to the Production CTs, the overfrequency load reduction function is enabled in PV system2, and is set according to the APstorage over-frequency load reduction parameter setting table.



Example PV Inverter Function showing Power vs Delta Frequency

In the graph above, the horizontal axis is variation of the frequency, 0 is the rated frequency. The vertical axis represents the percentage of the current power to the rated power. The photovoltaic power changes with the microgrid frequency controlled by the PCS.

NOTE: The frequency change curve shown in above figure is only for display purposes. The specific parameters of the photovoltaic inverter and PCS are set according to the local certification standards and APstorage over-frequency load reduction parameter setting table.

4. Off-Grid AC Coupling Installation

4.2 PV System Switch

Functional Overview

If the PV inverter cannot effectively adjust the output Power through Frequency Shift Power Control, we propose the PV System Switch solution. Through the PV System Switch, we can disable the photovoltaic inverter to prevent the battery from being fully charged and the photovoltaic Situations where power cannot be stopped. We can replace the PV System 2 Breaker with an externally controllable PV contactor , together with the backup relay inside the PCS, controls the off-grid energy storage PV system:

A) Backup relay inside the PCS: when the Battery SOC is lower than the lower limit of Backup SOC protection, the PCS stops supplying power to the load to ensure that the battery does not enter a state of power loss. When there is enough solar power to meet the starting conditions of PV System 2, PV System 2 charges the battery through the PCS.

B) When the battery SOC is greater than Backup SOC limit, Backup Loads can be enabled.

C) PV contactor: when the battery SOC is greater than the upper limit of off-grid charging SOC, PCS will disconnect the photovoltaic inverter to prevent battery overcharging and ensure the normal operation of Backup Load.

D) When the battery SOC is lower than the upper limit of off-grid charging SOC recovery, PCS will wake up PV System 2 which will supply power to the energy storage system.

4.3 PV System to APstorage Pairing

1. Determine the maximum single load power rating (kW) to be backed up and select the absolute minimum number of PCS units required to meet the requirements of 2017 NEC 690.10->710.15(A).

2. Calculate the required energy storage capacity (kWh) based on the backup load estimate for the user-defined time period, capacity and the minimum number of batteries required.

3. Calculate the maximum power (PV module 2) of the photovoltaic system connected to the PCS in Table 1. Note the number is different if the PV inverter has Frequency Curtailment and/or not.

If the total power of the photovoltaic system is greater than the maximum power, the excess power (PV System1) is connected to the grid side.

4. Off-Grid AC Coupling Installation

Table 1: The maximum power of the photovoltaic system for storage system backup

Model	Solar Inverters Used	# of APbattery-48V/5.76kWh	Maximum Offgrid Output Power kWac	Maximum Offgrid PV Size kWac
ELS-3K	DS3&DS3D Series	1	2.5	3.12
ELS-3K	DS3&DS3D Series	2	3.68	4.6
ELS-3K	Other	1	2.5	2.5
ELS-3K	Other	2	3.68	3.68

Model	Solar Inverters Used	# of APbattery-48V/5.76kWh	Maximum Offgrid Output Power kWac	Maximum Offgrid PV Size kWac
ELS-5K	DS3&DS3D Series	1	2.5	3.12
ELS-5K	DS3&DS3D Series	2	5	6.25
ELS-5K	Other	1	2.5	2.5
ELS-5K	Other	2	5	5

Two calculation examples are given below for reference:

Step 1: Figure out Battery Max Charge Power.

Step 2: Figure out PCS Charge Power

Step 3: Take the smaller number

Step 4: Multiply by 1.25 (If using Frequency Power Control)

Table 2: Examples Calculation of Off-grid Solar

Examples Calculation of Off-grid Solar	
1 ELS-5K+1 APbattery-48V/5.76kWh 1. Battery Power = 2.5kW 2. PCS Power =5kW 3. Battery Power is smaller than PCS Power 4. Off-grid PV power is 2.5kW 2.5kW*1.25= 3.125kW of Off-grid PV	1 ELS-5K+3 APbattery-48V/5.76kWh 1. Battery Power = 7.5kW 2. PCS Power =5kW 3. PCS power is smaller than Battery Power 4. Off-grid PVpower is 5kW 5kW*1.25= 6.25kW of Off-grid PV

5. APstorage User Interface

Professional and certified Installer can commission, monitor and maintain the APstorage solution and performance via the EMA Manager APP. Please search for the APP in APP Store or Google Play, or use mobile browser to scan the QR codes to download the APP. (EMA App is for end-users, EMA Manager is for installers).

Please scan the QR for EMA APP

NOTE: For Connection and monitoring operation mode, please refer to the EMA APP User Manual.
NOTE: If the PCS has not undergone energy storage initialization testing, please refer to the ELS-5K Quick Installation Guide. Please Scan the QR to download and install the EMA Manager app.

Please scan the QR for EMA Manager APP

6. Technical Data

Model	ELS-5K	ELS-3K
Region	**EMEA**	
General Specifications		
Dimensions W/H/D	847mm × 502mm × 197mm	
Weight	29kg	28.7kg
Maximum Efficiency	96.5%	
Temperature Range	-25°C-65°C (-13°F-149°F)	
Ingress Protection	IP65	
Protective Class	Class Ⅰ	
Over Voltage Category	Ⅲ(MAINS), Ⅱ(Battery)	
Relative Humidity	10%-90%	
Ventilation	Natural convection	
Communication Ports	Ethernet/WIFI/RS485/CAN	
Zigbee Frequency Range	2405MHz - 2480MHz	
Zigbee Maximum Power	8.94 dBm	
Wi-Fi Frequency Range	2412MHz - 2472MHz	
Wi-Fi Maximum Power	16.97 dBm	
Grid Regulation	VDE-AR-N 4105; TOR Erzeuger; OVE-Richtlinie R 25; XP C15-712-3; VFR; CEI 0-21; G98; G99; UNE 217002; NTS; RD647; PN-EN 50549-1; EN 50549-1; EN 50549-10; NF EN50549-1; NF EN50549-10	
Safety	IEC/EN 62477-1	
EMC	EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4	
Warranty	10 years	
Battery Input /Output Data		
DC Battery Input Voltage	40-60VDC	
Charging Strategy for Li-Ion Battery	Self-adaption to BMS	
Max Continuous Charge Current	100A/96A(DE)(1)	77A
Max Continuous Discharge Current	100A/96A(DE)(1)	77A
AC Output Data (On-grid)		
Max. Continuous Output Power	5000VA/4600VA(DE)(1)	3680VA
Max. Continuous Output Current	21.7A/20A(DE)(1)	16A
Max. AC Current From Utility Grid	43.4A(2)/40A(DE)(1)	32A
Nominal Output Voltage	230V	
Adjustable Output Voltage Range	184-253V(3)	
EPS Switch Time	10ms	
Nominal Output Frequency/Range	50Hz/47.5-51.5Hz(3)	
Output Power Factor	>0.99(Adjustable from 0.8 leading to 0.8 lagging)	
THD	<3%	
Grid Connection	Single-phase	
AC Output Data (Backup)		
Max. Output Apparent Power	5000VA/4600VA(DE)(1)	3680VA
Peak Output Apparent Power	7500VA/6900VA(DE)(1) (10s)	5520VA(10s)
Max. Output Current	21.7A/20A(DE)(1)	16A
Nominal Output Voltage	230V	
Nominal Output Frequency	50Hz	

(1) The value is for VDE-AR-N 4105.
(2) The current is limit to 32A when select EN50549 as the grid profile.
(3) Voltage/frequency range can be adjusted if required by local utility.

Specifications subject to change without notice please ensure you are using the most recent update found at web : emea.APsystems.com

7. Contact Information

European offices

APsystems

Karspeldreef 8, 1101 CJ, Amsterdam, The Netherlands
Email: info.emea@APsystems.com
Web: emea.APsystems.com

APsystems

22 Avenue Lionel Terray 69330 Jonage, France
Mail: info.emea@APsystems.com
Web: emea.APsystems.com