



C&I ESS Quick Installation & Commissioning Guide (For Standalone System)

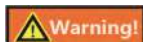
Applicable to KAC20-50DP2/KAC80-125DP2 PCS + BIS60-260E
Series Battery Cabinet

Version 1.0

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Safety Instructions

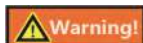


Warning!

WARNING: RISK OF ELECTRIC SHOCK

DO NOT touch the wires, contacts, terminals, or any conductors connected to the grid circuit inside the equipment.

Failure to follow safety instructions could result in severe injury or death from electric shock.



Warning!

WARNING: LETHAL HIGH VOLTAGES exist inside the product.

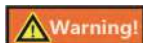
- Note and abide by all warning signs on the product.
- Observe the safety precautions listed in this manual and other related documents.



Warning!

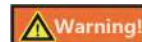
WARNING: Damaged Equipment Hazards

- Damaged equipment or system failure may cause electric shock or fire!
- Perform an initial visual inspection of the equipment for damage or other hazards before operation.
- Check whether other external devices or circuit connections are secure.
- Confirm that this equipment is in a safe state before operating it.



Warning!

WARNING: This equipment must be installed by **licensed electrician** and qualified personnel only. The installation and wiring of this equipment must comply with all applicable national, state/provincial, local electrical codes and standards. Attempting installation by unqualified individuals could result in unsafe operation, code violations, personal injury/loss of life, or damage to the equipment.



Warning!

WARNING: Battery Protection

DC HIGH VOLTAGE! ELECTRIC SHOCK HAZARD!

The battery in the system generates a high voltage when connected. Accidental contact can result in electric shock or life-threatening injuries.



Warning!

WARNING: Ground Fault Protection

- When a ground fault occurs in the integrated PCS, there may be fatal high voltage in parts that are not originally charged. DANGEROUS IF ACCIDENTALLY TOUCHED!
- Before operation, ensure there is no ground fault in the system, and take relevant protective measures.



Warning!

WARNING: Live Line Measurement

- There are high voltages in the equipment in the integrated PCS, and accidental touch may cause fatal electric shock hazards.
- During live measurement, take appropriate protection, such as wearing insulating gloves.
- There must be an accompanying person to ensure personal safety.



Warning!

WARNING: Improper Parameter Settings

- Improper parameter settings may affect the normal function realization of internal devices.
- Only authorized professionals can set the parameters.



Warning!

WARNING: Regulatory Compliance

The installation and various operations of the integrated PCS must comply with the relevant standards and regulations of the country/region where the project is located

Tools

Work Clothes



Safety Robber
Shoes



Helmet



Robber
Gloves



Safety
Clothing



WARNING! Use only insulated and protected tools.

PCS & Battery Cabinet



Torque
wrench with
7mm, 10mm,
17mm, 18mm,
19mm
sockets



Wire
cutter



Crimping
tool



Phillips
screwdriver
ø6 mm,
L= 230 mm



Heat gun



Multimeter



Cable
stripper



Wire stripper



Drill



Flat Head
Screwdriver for
Terminal Block
Screws



Box cutter



Pipe cutter



Flat head
screwdriver



Torque wrench
with M4, M6,
M10, M12
sockets



Adjustable
wrench



Open-end
torque wrench



Ladder

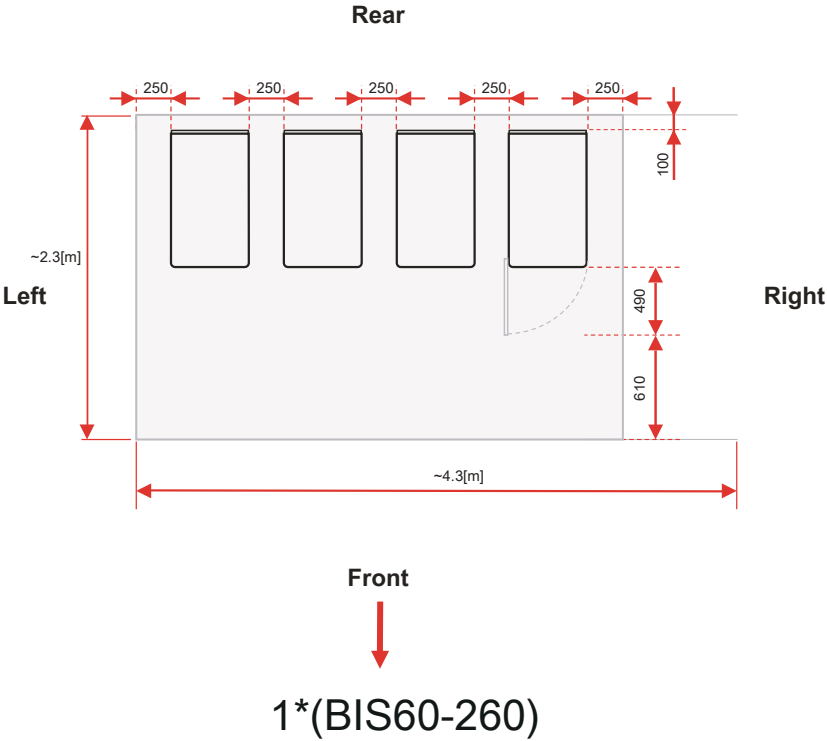


Hammer

Site Layout 1-1

Default Layout & Clearance Distances (Top View)

All dimensions are in [mm]



BIS60-260	
Direction	Distance [mm]
Front	≥ 1100
Rear	≥ 100
Right	≥ 250
Left	≥ 250

NOTE!
Installers are hereby notified that local codes and regulations could extend the required clearances beyond what is specified in this manual. Before proceeding with installation, consult with relevant authorities to ensure compliance with local regulations concerning clearance distances.

Default Layout & Clearance Distances (Top View)

All dimensions are in [mm]

Rear

The diagram illustrates the default layout and clearance distances for a battery cabinet system. The layout is a rectangular array of cabinets, with dimensions and labels as follows:

- Overall Dimensions:**
 - Width: $\sim 10.7[m]$
 - Depth: $\sim 8.5[m]$
- Clearance Distances:**
 - Between cabinets: 250 mm
 - From rear wall: 100 mm
 - From side walls: 100 mm
 - From front wall: 100 mm
 - From floor: 480 mm
- Cabinet Labels:**
 - Top row: B4-B, B5-B, B6-B
 - Second row: B4-A, B5-A, B6-A
 - Third row: B1-B, B2-B, B3-B
 - Bottom row: B1-A, B2-A, B3-A
- Other Labels:**
 - EMS01D (top right)
 - Left (left side)
 - Right (right side)
 - Front (bottom center)

BIS60-260

Direction	Distance [mm]
Front	≥ 1100
Rear	≥ 100
Right	≥ 250
Left	≥ 250

EMS01D

Direction	Distance [mm]
Front	≥ 580
Rear	≥ 100
Right	≥ 250
Left	≥ 250

Note: The maximum cable length between the PCS and the BIS60-260E series battery cabinets is 20 meters. Refer to this layout diagram for the placement of battery cabinets in a parallel system.

NOTE!

Installers are hereby notified that local codes and regulations could extend the required clearances beyond what is specified in this manual. Before proceeding with installation, consult with relevant authorities to ensure compliance with local regulations concerning clearance distances.

12*(BIS60-260)

All dimensions are in [mm]

Right

EMS01D	
Direction	Distance [mm]
Front	≥580
Rear	≥100
Right	≥250
Left	≥250

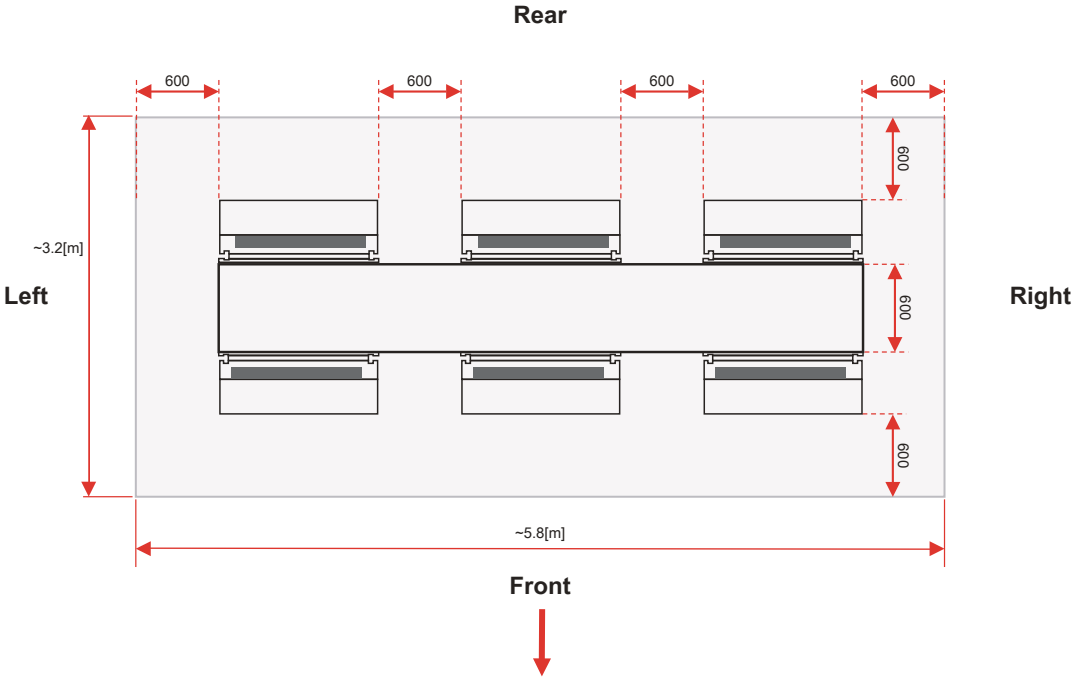
NOTE!

Installers are hereby notified that local codes and regulations could extend the required clearances beyond what is specified in this manual. Before proceeding with installation, consult with relevant authorities to ensure compliance with local regulations concerning clearance distances.

Site Layout 1-3

Default Layout & Clearance Distances (Top View)

All dimensions are in [mm]



6*(KAC125DP)

KAC125DP	
Direction	Distance [mm]
Front	≥ 600
Rear	≥ 600
Right	≥ 600
Left	≥ 600

NOTE!
Installers are hereby notified that local codes and regulations could extend the required clearances beyond what is specified in this manual. Before proceeding with installation, consult with relevant authorities to ensure compliance with local regulations concerning clearance distances.

Environmental Conditions & Requirements



CAUTIONS and Requirements of Installation Environment

- When the equipment is running, do not cover the vents or heat dissipation system to prevent fire due to high temperature.
- The equipment should be installed in an area away from liquids; it is forbidden to install it under water pipes, air outlets and other places that are prone to condensation, or under places that are prone to water leakage, such as air-conditioning outlets, vents, and outlet windows in the machine room, to prevent liquids from entering the inside of the equipment and causing malfunction or short circuit.
- If any liquid enters the equipment, please turn off the power immediately and notify the administrator.
- Do not place the equipment in an environment with flammable or explosive gas or smoke, and do not perform any operations in such environment.
- Check the operation of the equipment and the sand and dust conditions around the equipment every month. If there is a lot of dust on the equipment, it may prevent the equipment from operating normally. Professionals need to refer to the maintenance manual for maintenance.



CAUTION! For indoor installations ventilated room is required



CAUTION! When Installed in indoor locations consider heat dissipation values of all installed devices when choosing appropriate room / space for their installation



Note

NOTE! Battery Cabinet & Battery Inverter max noise is >70 dBA, 1 meter distance



Diagram of Pure On-grid Application Scenarios

Diagram of Pure On-grid Application Scenarios

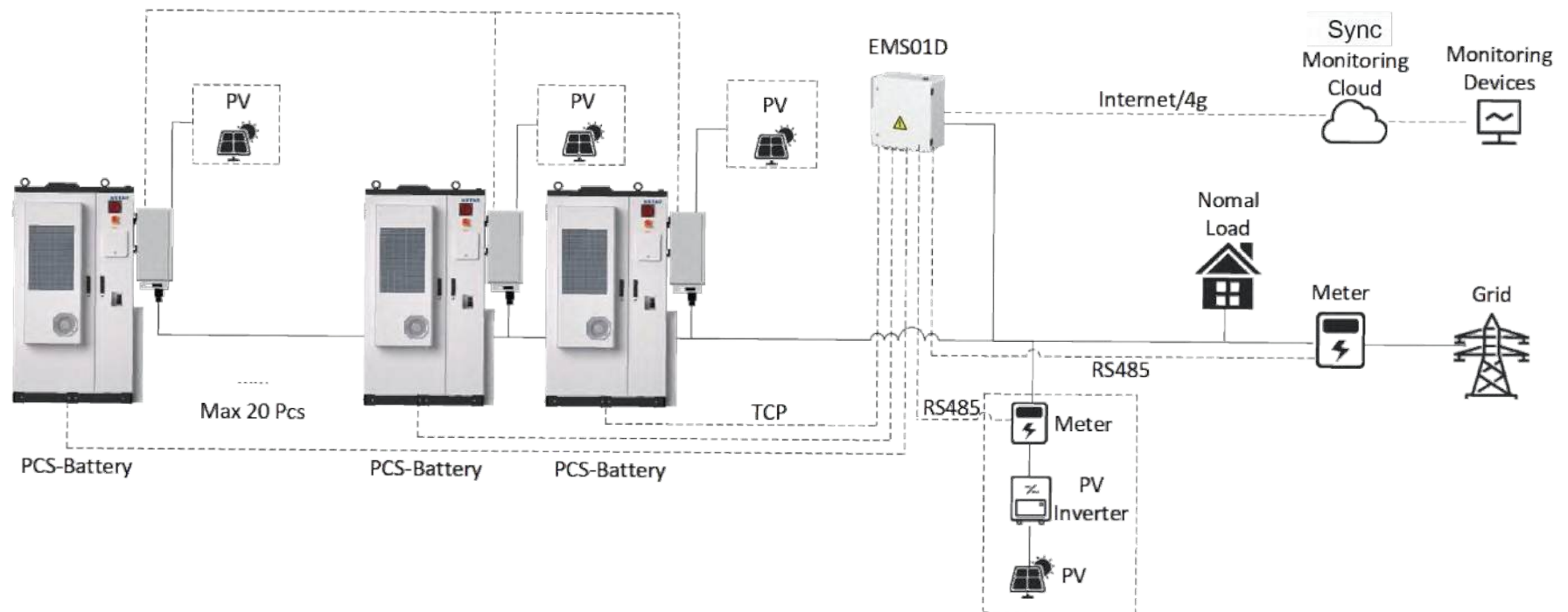
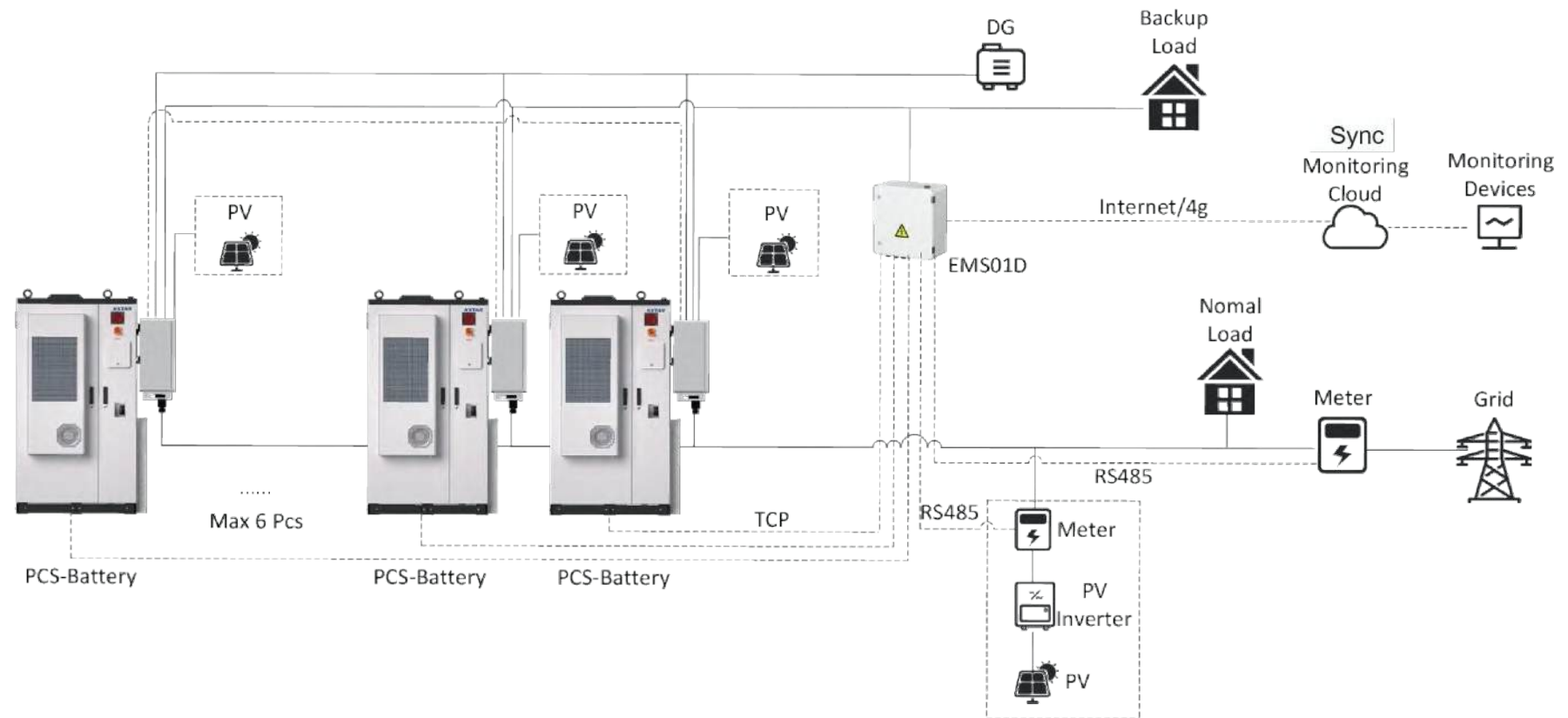


Diagram of On/Off-Grid Application Scenarios

Diagram of On/Off-Grid Application Scenarios



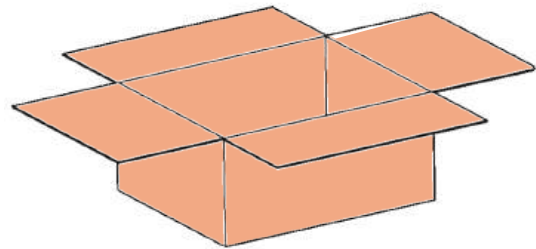
Part Kits Cables 1-1

System Cable Kit

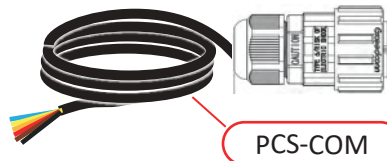
Battery Cabinet (Cluster 1)
to Inverter DC Cables (3.5m) (A)



Battery Cabinet (Cluster 2) to
Inverter DC Cables (3.5m) (B)



Battery Cabinet to
Inverter
CAN Cables (3.5m) (C)



AC Auxiliary Cable (3.5m) (D)



PAY ATTENTION!

All cables are marked with a designation label, the standard cables length of the PCS to the battery cabinet is 3.5m. When the user uses other solutions on site, refer to the following table for wire length;

Cables length classification

NO.	Item	Length Description
1	1*PCS+1*BAT	Standard cables length is 3.5m
2	1*PCS+2*BAT	Slave cabinet cables length is 6m
3	1*PCS+1*BAT	Maximum cables length supports 20m

PCS parallel communication cable (S)



Cable kit for battery cabinet parallel connection (if the configuration is 1PCS+1BAT, these two cables are not included)

Battery Cabinet to Battery Cabinet
Modbus TCP Cable (6 m) (E)



AC Auxiliary Cable (3.5m) (D)



Battery Cabinet Part Kits 1-2

Battery Cabinet Package Contents (Inside Battery Cabinet)

Fire Clay (x2) (H)



PE Cable (0.7m) (F)



Corrugated Plastic
Tube Ø 34.5 mm (I)

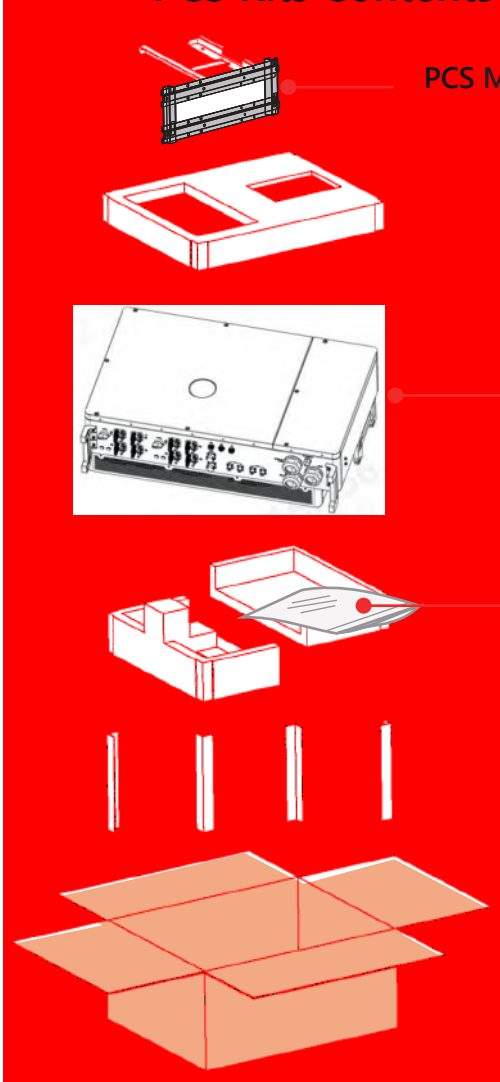


Corrugated Plastic
Tube Ø 21.2mm (J)



PCS Part Kits 1-3

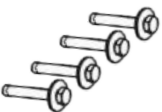
PCS Kits Contents



PCS Mounting Bracket (L)

Inverter

Mounting
Screws (x12) (M)
10mm x 30



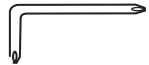
Bracket Lock
Screws (x2) (N)
6 mm x 16



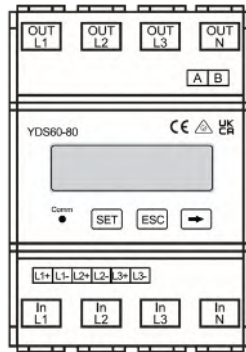
AC Terminal
(x15) (O)



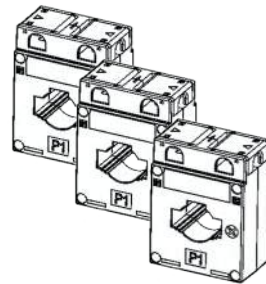
Right-angled
Phillips
Screwdriver (P)



Other Part Kits 1-4



Meter (Q)
Optional



**Current Transformers
for Meter (x3) (R)**
Optional

Meters and CTs are optional accessories. There are two types of CTs:

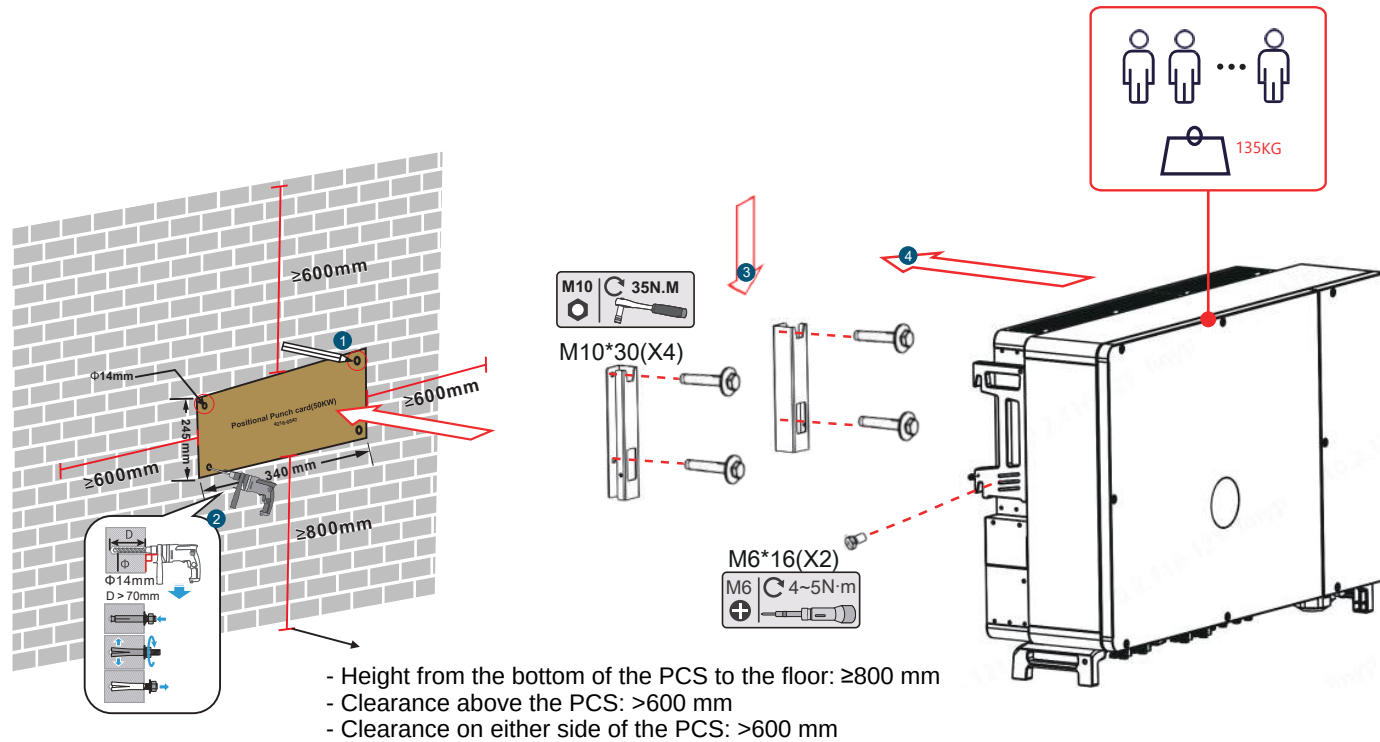
1. For systems with a power rating of 300 kW, use a 500 A:5 A CT (part number 3806-0134) with a accuracy class of 0.2S and a bore diameter of 31mm
2. For systems with a power rating of 300 kW to 1,000 kW, use a 1,500 A:1 A CT, part number 3806-0136.accuracy class 0.2S, with a CT bore diameter of 45 mm

Customers may also purchase their own CTs. It is recommended that the current on the primary side of the CT match the system's rated current, and that the secondary current be selected between 1 A and 5 A to ensure compatibility with the electricity meter:

Note: Pure off-grid systems do not require an electricity meter!

Install the Inverter On the Wall

NOTE: The cable length from the PCS to the battery cabinet is 5 meters and 20 meters.



Reference Notes for System Wiring Electrical Schematics - Supported Site Configurations

Note: If the user's site features a multi-PCS parallel system, installation and wiring must be performed based on the wiring configuration of a single PCS subsystem, in accordance with the on-site application scenario and using the electrical schematic topology diagram for the parallel system. For a pure on-grid system, refer to the electrical schematic topology diagram for a pure on-grid system; for a on/off-grid system, refer to the electrical schematic topology diagram for an on/off-grid system. The electrical schematic diagrams for the PCS pure on-grid system and the 6-unit PCS parallel on-grid and off-grid system are presented below. Users may refer to the corresponding electrical schematics for installation; actual on-site wiring should be based on the electrical schematics provided by the on-site electrical installation personnel, and all electrical wiring requirements must comply with local electrical safety standards and regulations;

MCCB Selection (Technical Specifications): Selection should be based on the actual on-site power rating and the electrical installation professional with qualifications; the electrical schematic diagrams provided by KSTAR are for on-site wiring reference only;

Item	Function Description
QMainGrid	Main circuit breaker for the grid;
QMainDG	Diesel generator main switch;
QNormalLoad	Normal load switch;
QPVInv1	PV inverter switch;
QBackupLoad	Backup port main switch;
QBPGrid	User grid bypass switch;
QBPDG	User-operated generator bypass switch;
GRID BYPASS	Grid bypass branch;
DG BYPASS	Generator bypass branch;
ATS SWITCH 1	ATS unit for utility grid bypass and generator bypass (required when both the utility grid and a generator are available);
ATS SWITCH 2	ATS unit for the output side of the Backup-Load and (utility grid/generator bypass);
RCD1	Grid-side residual current device (RCD); optional depending on local standards;
RCD2	Standard load-side residual current device (RCD); optional depending on local standards;
RCD3	Backup-side residual current device (RCD); optional depending on local standards;

Note: When the QBPGGrid, QBPDG, and QBackupLoad switches are present, only one of them shall be closed at a time;

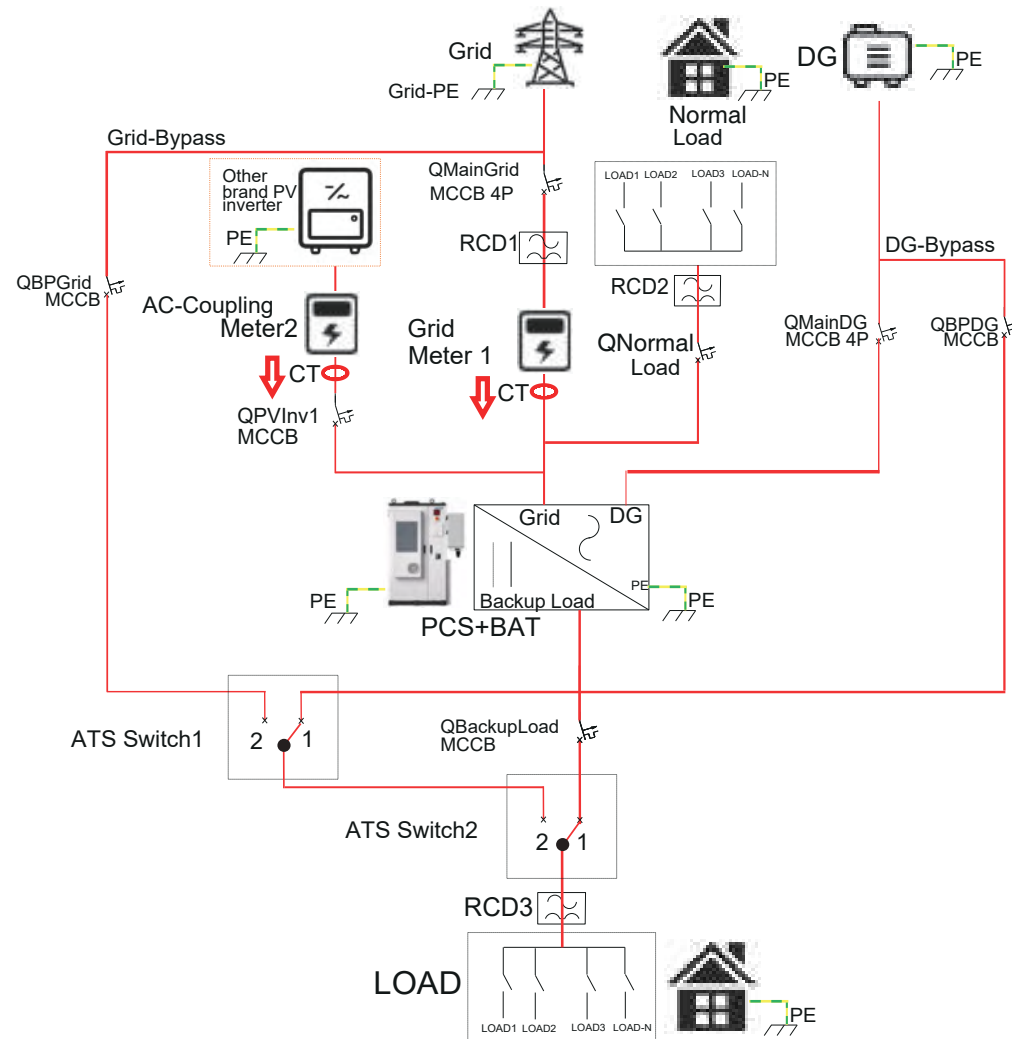
Note: Generators are not permitted to be connected to the PCS-Grid side;

In an off-grid parallel operation scenario, if a load is connected to the Backup-Load side, ensure that the length of the AC power cables between the PCS-Backup-Load and the downstream load's AC distribution box is as consistent as possible, with a length deviation of $\leq 10\%$.

Note: Pure on-grid systems do not have generators or BackupLoad wiring;The EMS01D has a rated voltage of 230V AC. For on-grid systems, use L/N of either phase of grid. For off-grid systems,use the third phase (L3/N) of the PCS-Backup-Load circuit.

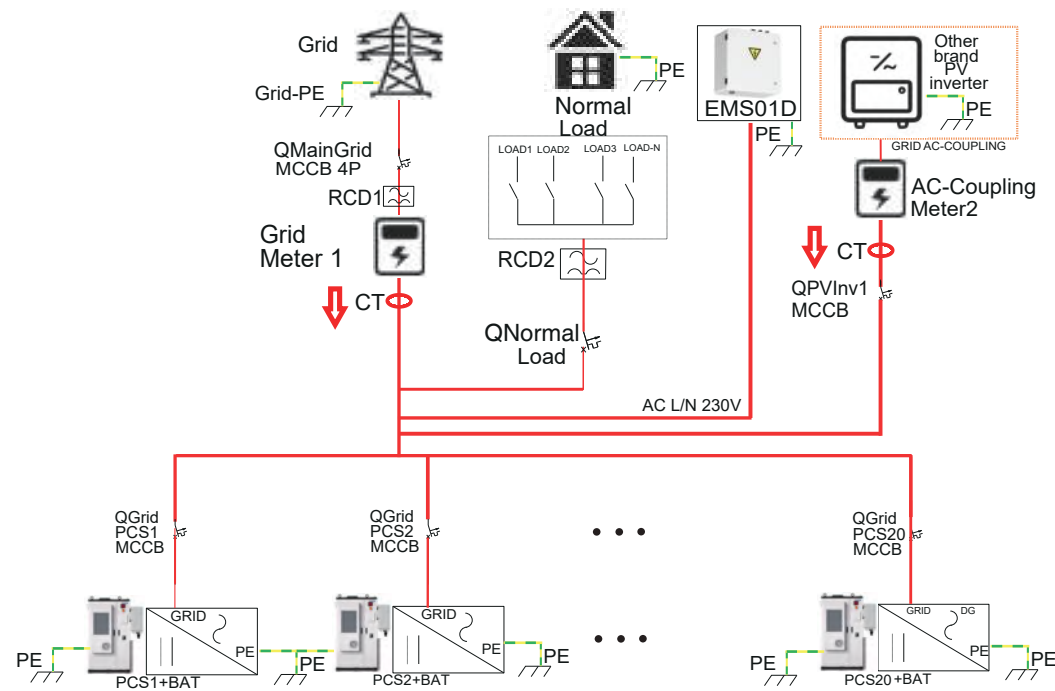
Note: When the system is configured with only the utility grid or a diesel generator, only one ATS unit is required. The ATS unit can be either a manually operated switch or an electrically operated switch;

Reference Electrical Schematic for the 1PCS+1BAT System

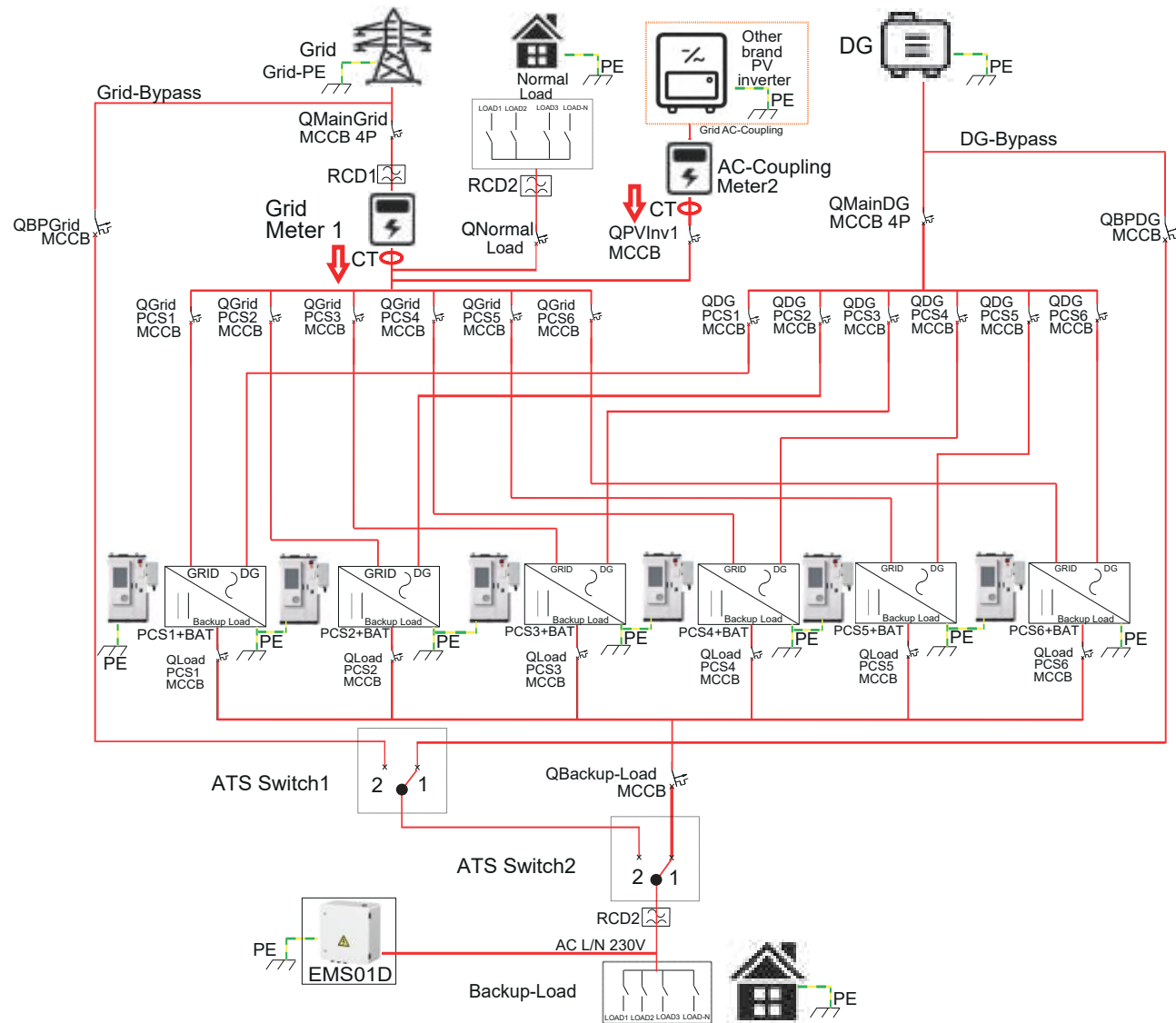


Reference Electrical Schematic for a Pure On-grid System (No Backup Load, No Generator)

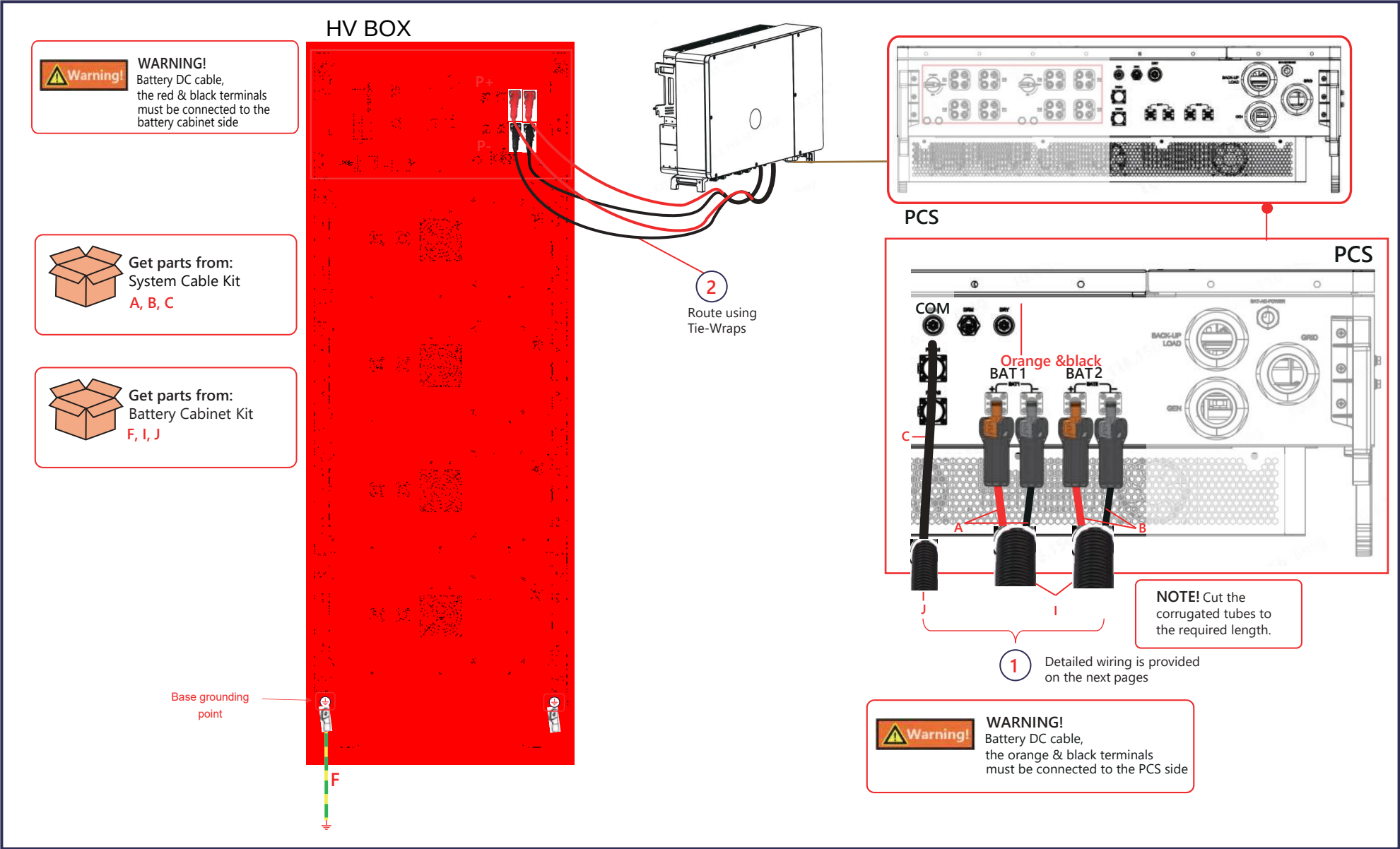
Note: In a pure on-grid system, there is no generator and no Backup-Load wiring; the EMS01D has a rated voltage of 230V AC, and the on-grid system uses either the L or N line of the utility grid.



Reference for the Electrical Principles of On/Off-Grid Systems

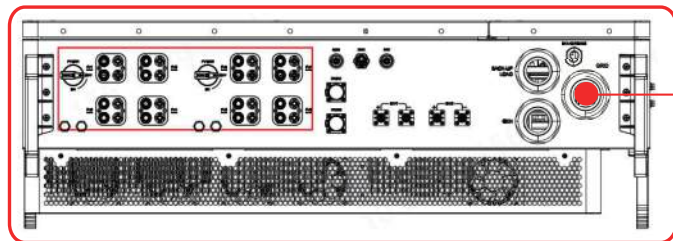


Wiring Diagram for a Single PCS with a Single Cabinet

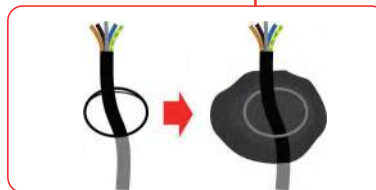
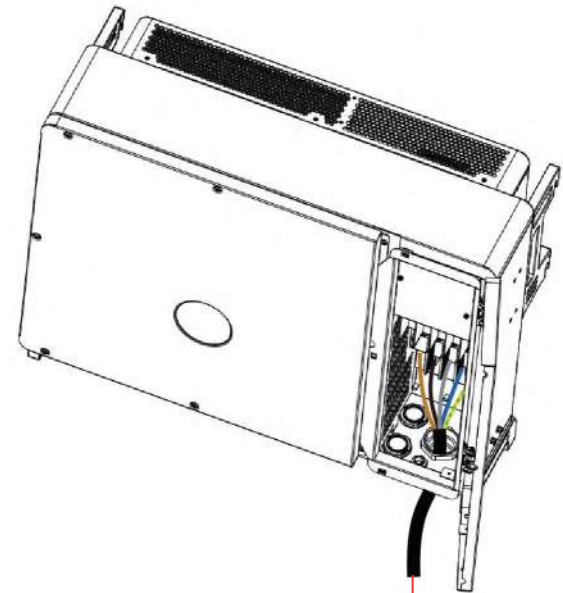
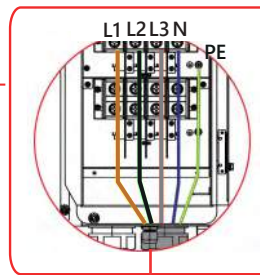


PCS Wiring Compartment Details

When connecting the PCS, be sure to slip a waterproof sleeve over the cable where it enters to prevent moisture from getting inside the PCS unit!



PCS



WARNING!

When wiring the PCS, be sure to thread the cables through the waterproof sleeve and secure the sleeve in place.

KAC50DP2 Cable Specifications

This page provides specifications for the KAC50DP2 cable. The cable specifications indicate whether the cable is supplied by KSTAR or provided by the user for installation. Note: For the KAC125DP2 cable, please refer to the cable specifications on the next page.

Items (KAC50DP2 Cables)	Max Current	Proposed Diameter (mm)	Proposed Diameter (AWG)	Connect	Provided by
PV	DC 24A	4~6mm	9~11 AWG	/	Installer
Battery DC cable	DC 80A	21mm	4AWG	/	KSTAR
Grid	AC 160A	≥ 34 mm	≥ 2 AWG	M8	Installer
Backup-Load	AC 110A	20~35mm	2~4AWG	M6	Installer
GEN	AC 110A	20~35mm	2~4AWG	M6	Installer
AC AUX power	AC 16A	4mm	/	M4	KSTAR
PCS parallel communication	/	/	/	/	KSTAR
PCS-COM cable	/	/	/	/	KSTAR
METER 485 communication	/	/	/	/	Installer
CTs	/	/	/	/	Option
Grounding cable	/	10~16mm	5~7AWG	M6	Installer

The cable specifications recommended in the table above are all for copper-core cables. Specific cable specifications can be adjusted based on the actual power requirements at the user's site.

KAC125DP2 Cable Specifications

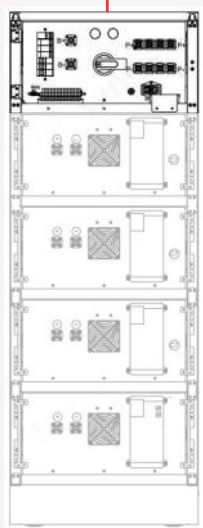
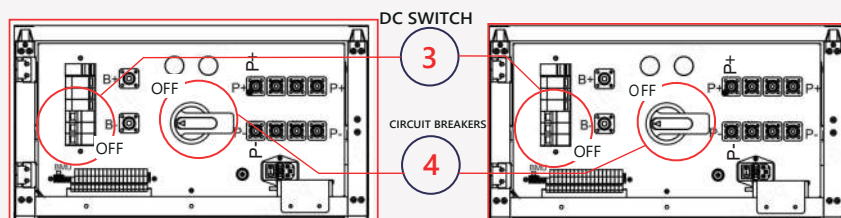
This page provides specifications for the KAC125DP2 cable. The cable specifications indicate whether the cable is supplied by KSTAR or provided by the user for installation.

Items (KAC125DP2 Cables)	Max Current	Proposed Diameter (mm)	Proposed Diameter (AWG)	Connect	Provided by
PV	DC 24A	4~6mm	9~11 AWG	/	Installer
Battery DC cable	DC 80A	21mm	4AWG	/	KSTAR
Grid	AC 218A	≥46mm	≥1AWG	M10	Installer
Backup-Load	AC 218A	≥46mm	≥1AWG	M6	Installer
GEN	AC 218A	≥46mm	≥1AWG	M6	Installer
AC AUX power	AC 16A	4mm	/	M4	KSTAR
PCS parallel communication	/	/	/	/	KSTAR
PCS-COM cable	/	/	/	/	KSTAR
METER 485 communication	/	/	/	/	Installer
CTs	/	/	/	/	Option
Grounding cable	/	10~16mm	5~7AWG	M6	Installer

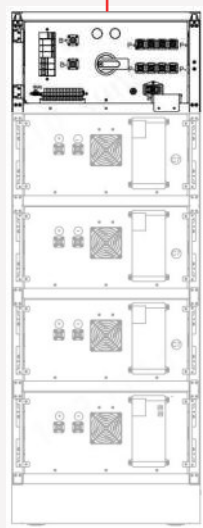
The cable specifications recommended in the table above are all for copper-core cables. Specific cable specifications can be adjusted based on the actual power requirements at the user's site.

Pre-Wiring Inspection

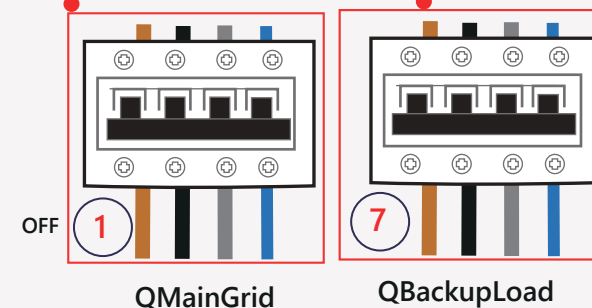
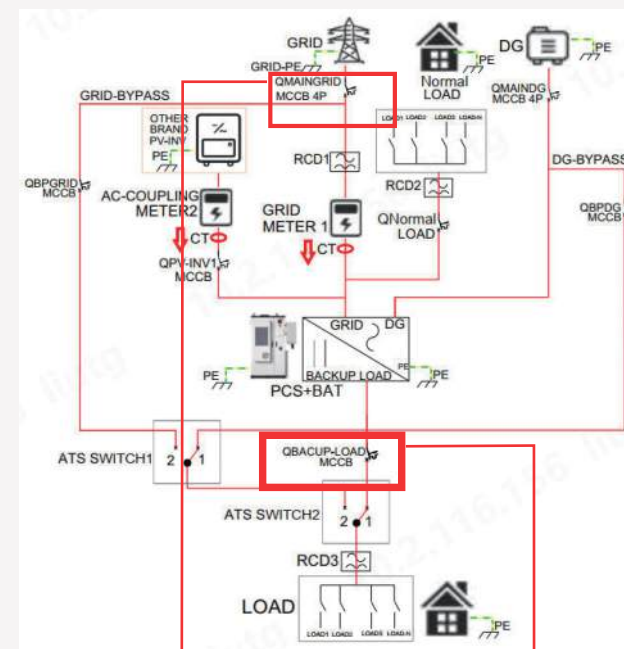
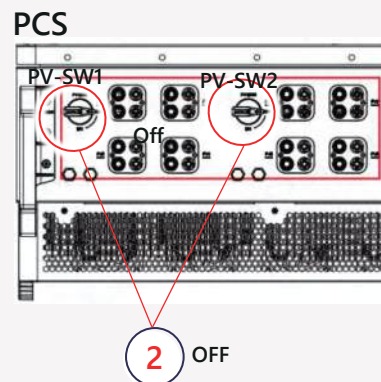
Note: Before connecting the wires, make sure switches 1, 2, 3, 4, and 7 are all in the off position!



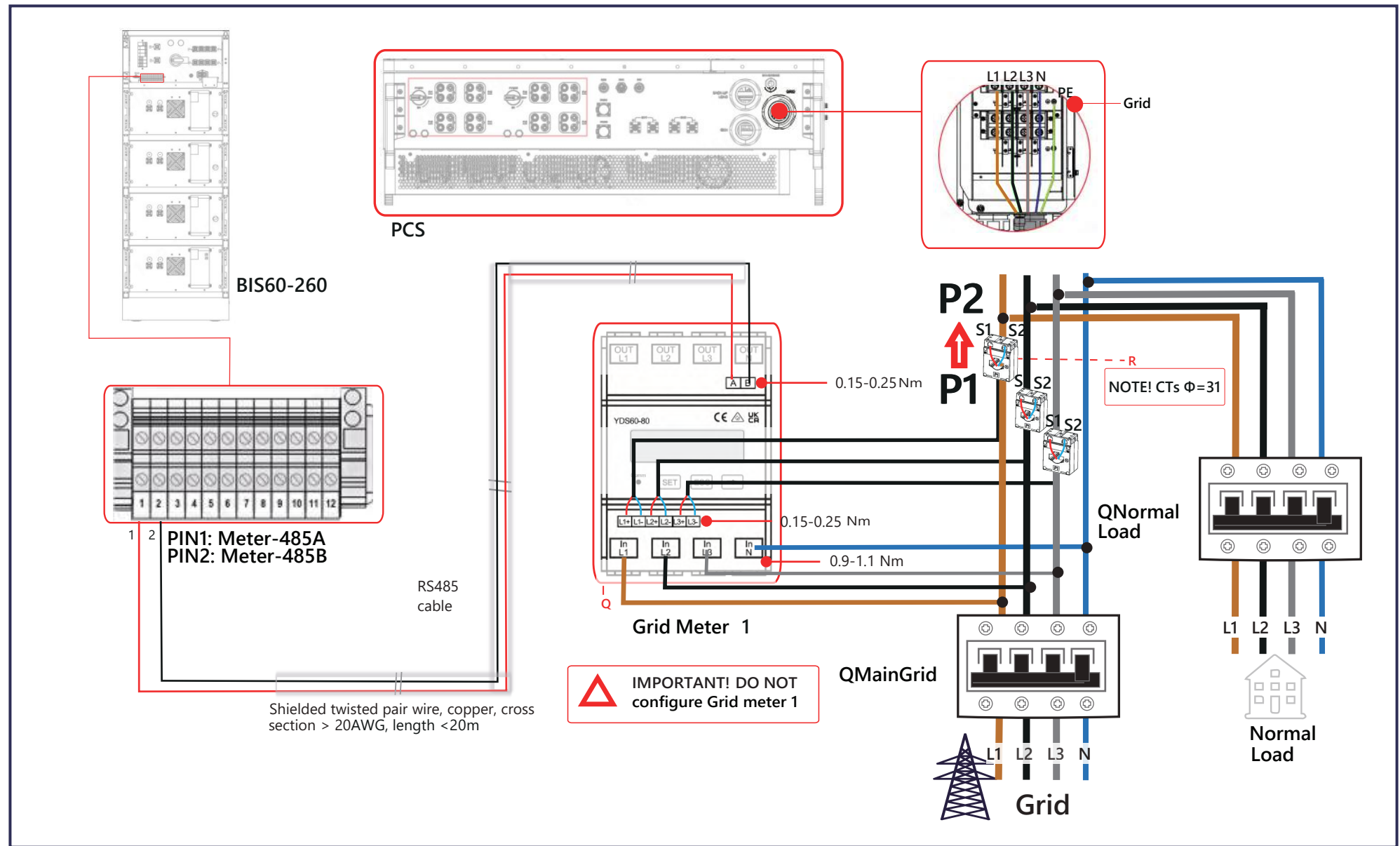
BIS60-260
Slave



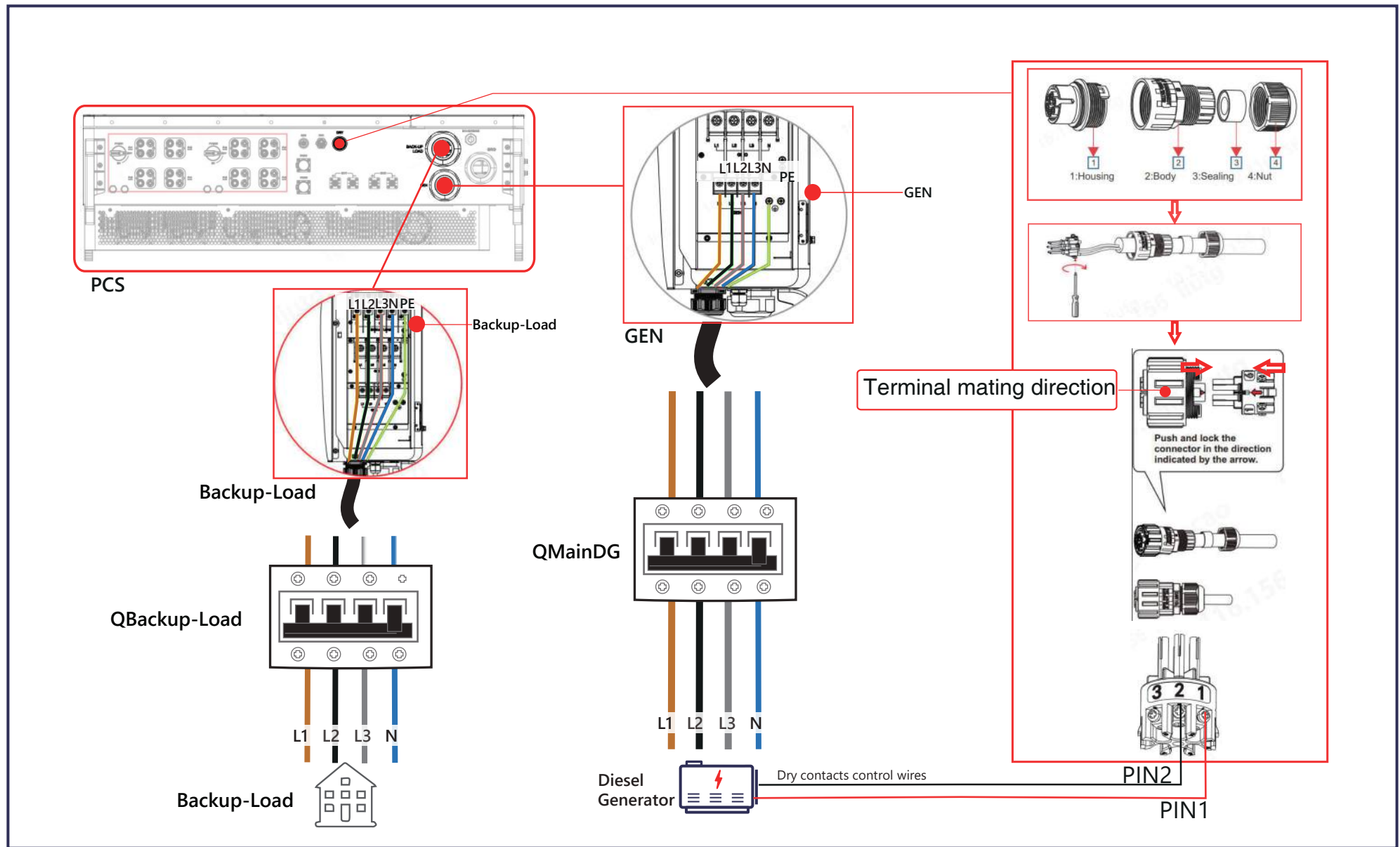
BIS60-260
Master



Grid and Meter Wiring

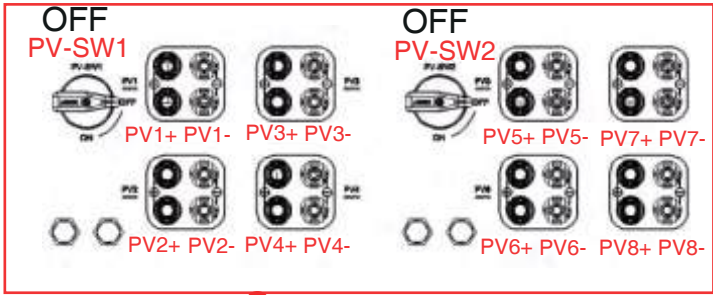


Backup-Load, DG and the Generator's Dry Contacts Wiring

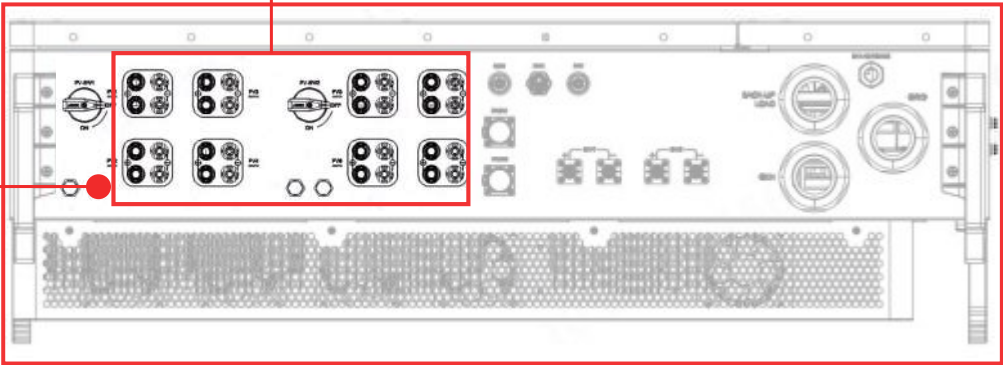


PCS Wiring and PV Parameter Requirements

PV Input Parameter	PCS	
	KAC20-50DP2	KAC80-125DP2
Number of MPPTs	4	8
Maximum input voltage	1000V d.c.	1000V d.c.
MPPT voltage range	250~950V d.c.	250~950V d.c.
Rated voltage	720V d.c.	720V d.c.
Maximum input current of each MPPT	45A	45A
Maximum number of strings for each MPPT	2	2

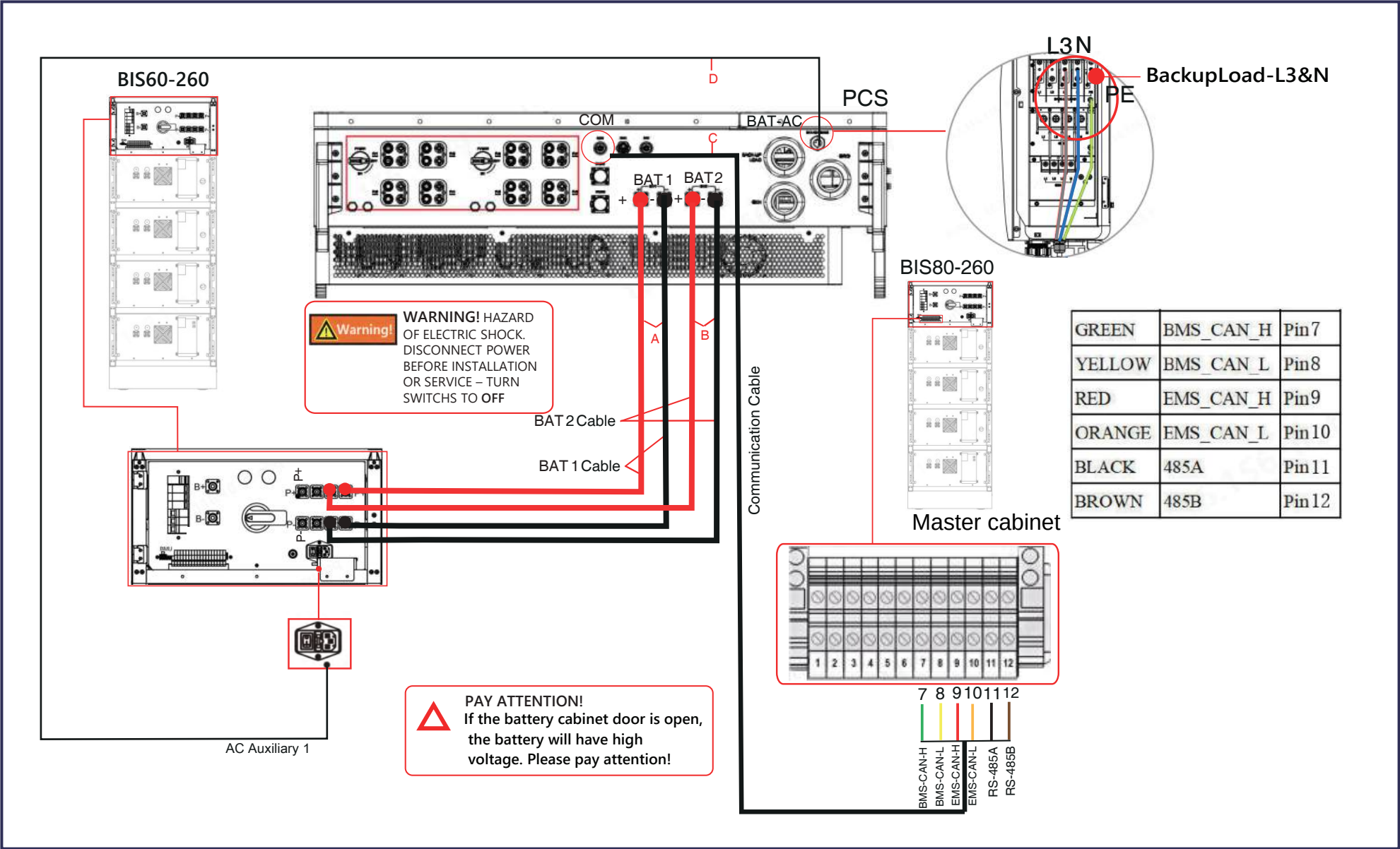


PV

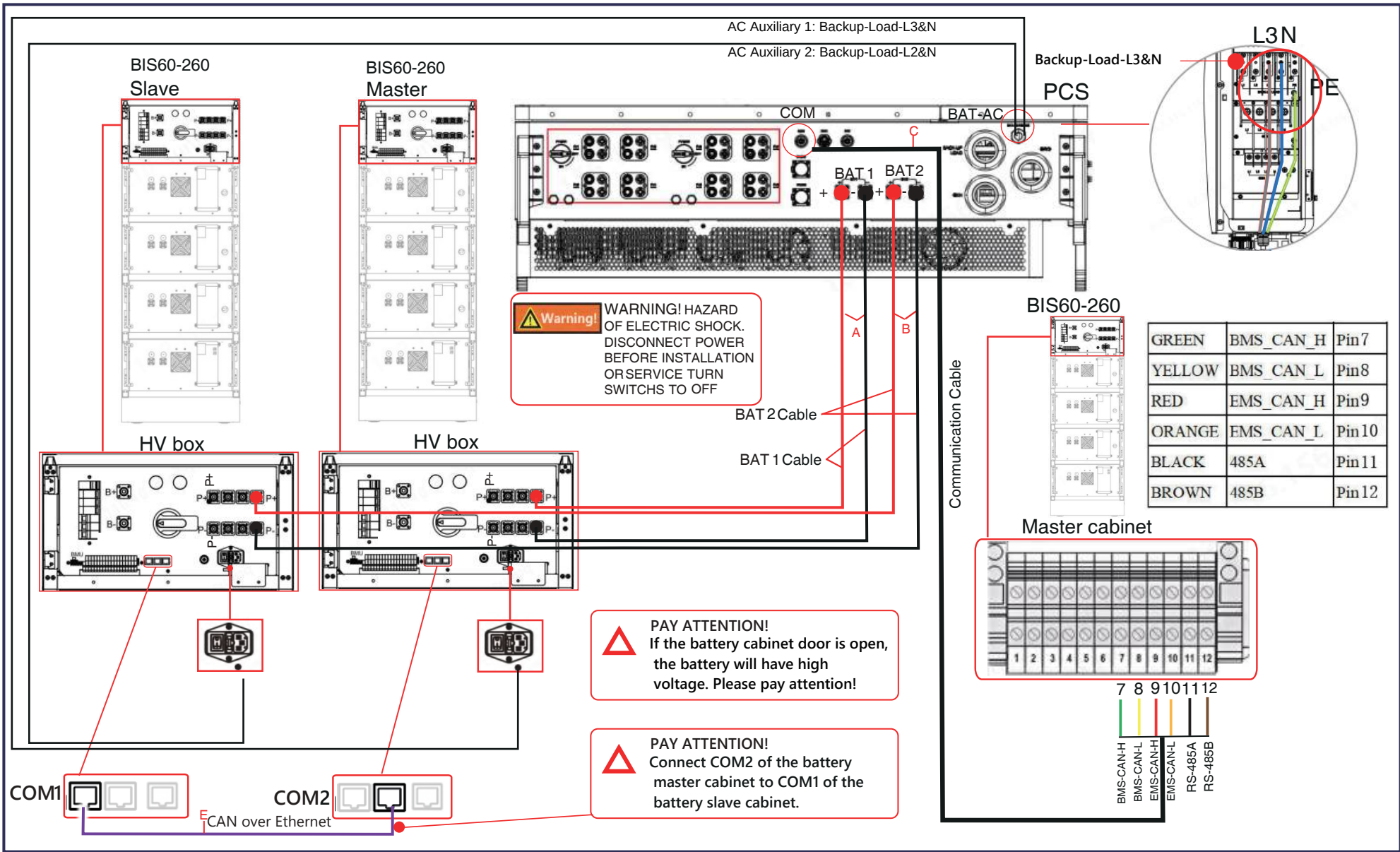


PCS

Single Battery Cabinet with PCS Wiring



PCS with Paralleled Battery Cabinets Wiring



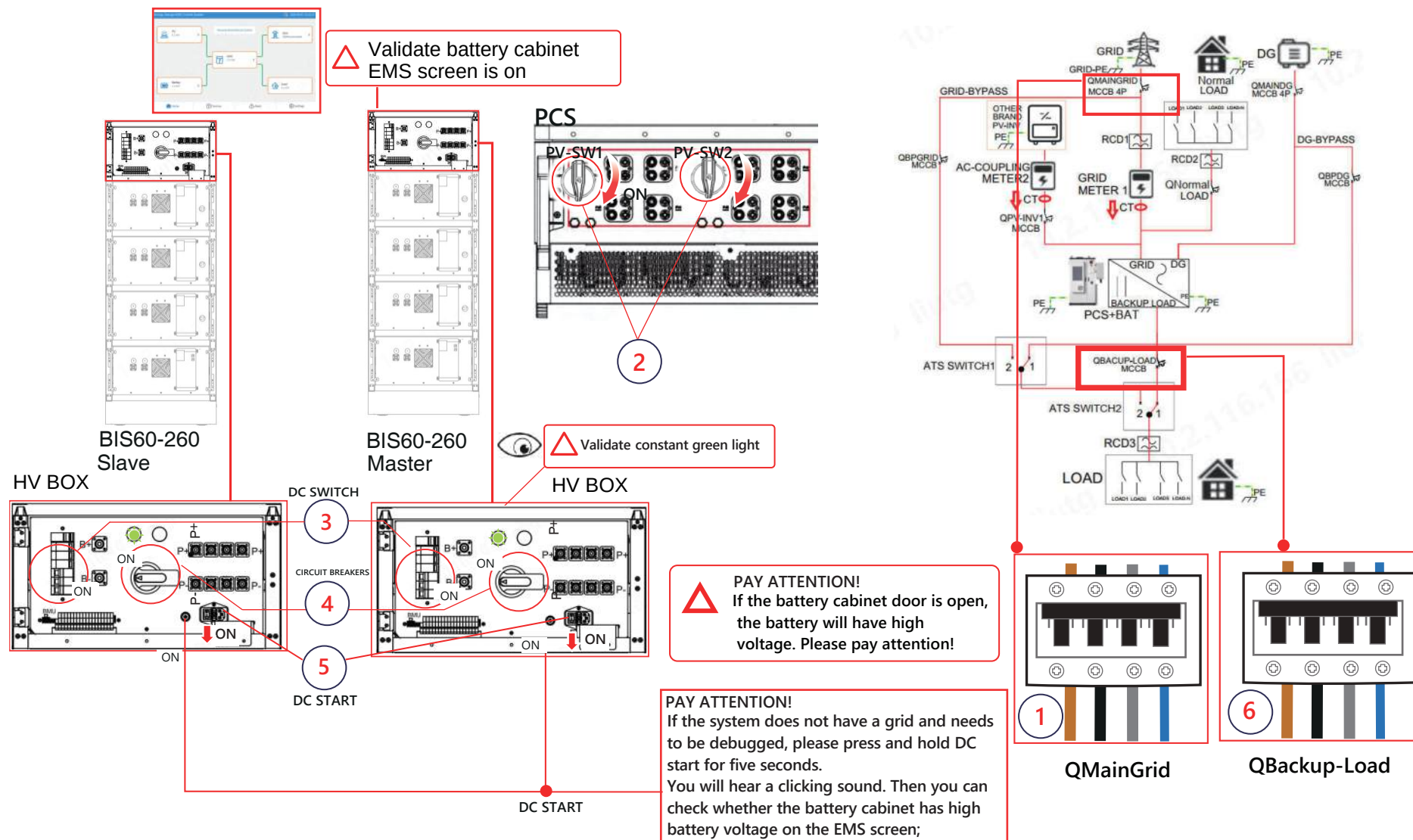
Check the Wiring before Powering On

Before powering on, carefully check that the following cables are connected correctly!

	Check Items
1	Check that the L1/L2/L3/N/PE connections in the power grid are correct (if a grid is present).
2	Check that the L1/L2/L3/N/PE connections on the diesel generator are correct (if there is a diesel generator).
3	Check that the L1/L2/L3/N/PE connections for the Backup-Load are correct (if a Backup-Load is present).
4	Check that the battery DC cables from the PCS to the battery cabinet are connected correctly (BAT1 & BAT2).
5	Check that the AC auxiliary power cables from the PCS to the battery cabinet are connected correctly (Backup-Load-L3/N).
6	Check whether the COM port communication cable between the PCS and the battery cabinet is connected correctly (connection between the PCS COM port and the battery cabinet terminal block).
7	Check that the L1/L2/L3/N terminals on the utility meter, the meter's 485 communication cable, and the CT wiring are connected correctly (if a meter is present).
8	Check that the PV connections are correct (PV+/PV-)
9	Check that the network cables between the main and slave battery cabinets, as well as the AC auxiliary power cables for the slave battery cabinet (if present), are connected correctly.
10	Check whether the PCS enclosure and battery cabinet enclosure are grounded.

System Power-On Sequence

Follow the numbered steps to power up the system

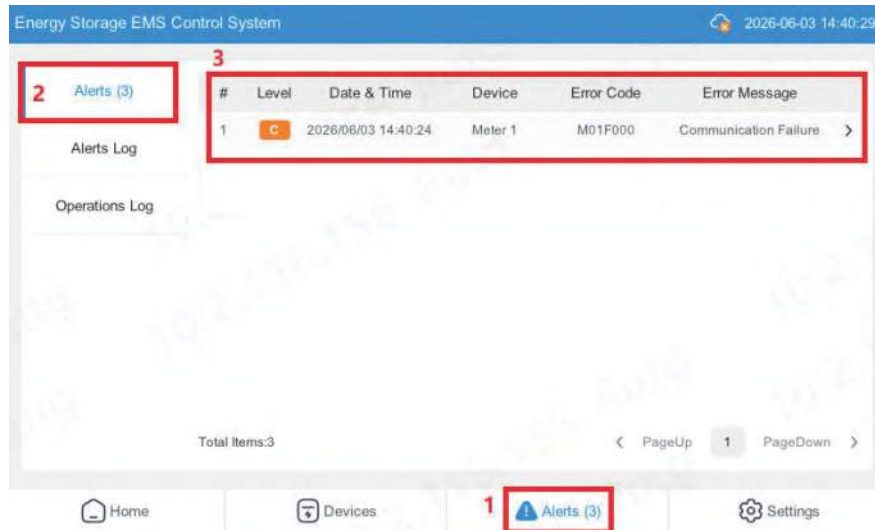


Check After Power-On

1

Post-Power-On Check Procedure:

1. Check the “Alerts” interface for any abnormal real-time alerts, such as communication alerts. If there is a PCS communication alert, first verify that the PCS communication cables are connected correctly. If there are any other abnormal alerts, contact the appropriate KSTAR technical support personnel promptly for analysis and resolution;

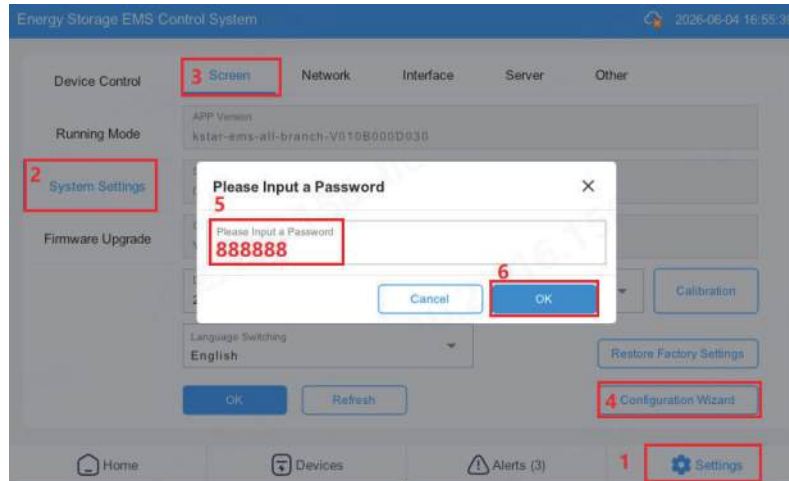


2

2. Once the communication alarm on the EMS screen has cleared, follow the on-screen prompts for the EMS on the battery cabinet screen: follow the prompts for the master battery cabinet if it is the master cabinet, and follow the prompts for the slave battery cabinet if it is the slave cabinet.

Master Battery Cabinet Operation Guide

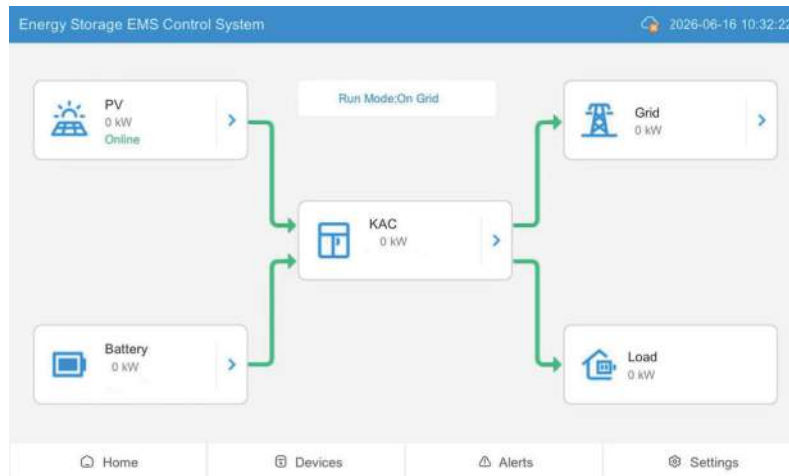
- 1 “1.Settings”- “2.System Settings”-“3.Screen”-“4.Configuration Wizard”-“5.Password:888888”-“6.OK”



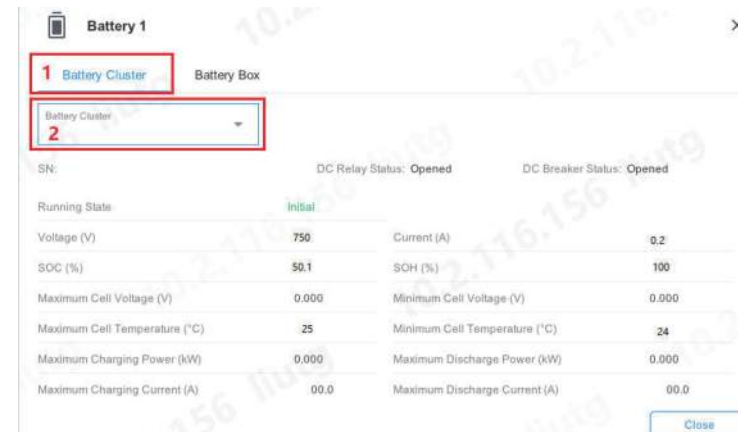
- 2 Follow the on-site equipment configuration guide. Be sure to configure the system according to the actual on-site equipment setup; incorrect configuration may prevent the system from operating properly:

Setup Steps	Master Cabinet
1.Start Using	Start Using
2.Is there “STS”	None
3.EMS in cabinet	Master
4.Battery cabinet type	Whether there is slave cabinet
5.PCS type	PCS type
6.Is there GEN	Is there GEN
7.Is there PV inverter	Is there PV inverter
8.Meter type	Utility Meters & PV-Side Meters
9.Restart now	Restart now

- 3 Battery Master Cabinet Interface After Setup

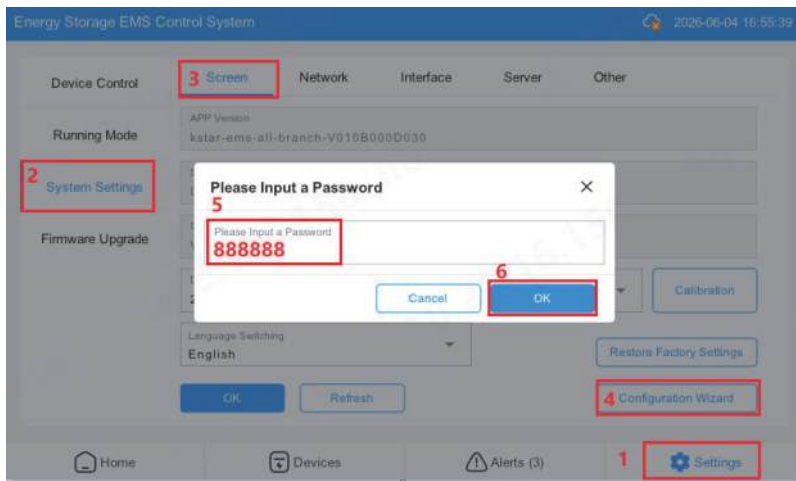


- 4 If there is a slave battery cabinet, and after the slave battery cabinet has been configured and the communication lines between the master and slave battery cabinets are functioning properly, check the voltage information for Cluster 2 on the EMS screen of the master battery cabinet. If Cluster 2 displays battery voltage and other relevant information, this indicates that communication between the master and slave battery cabinets is normal;



Slave Battery Cabinet Operation Guide

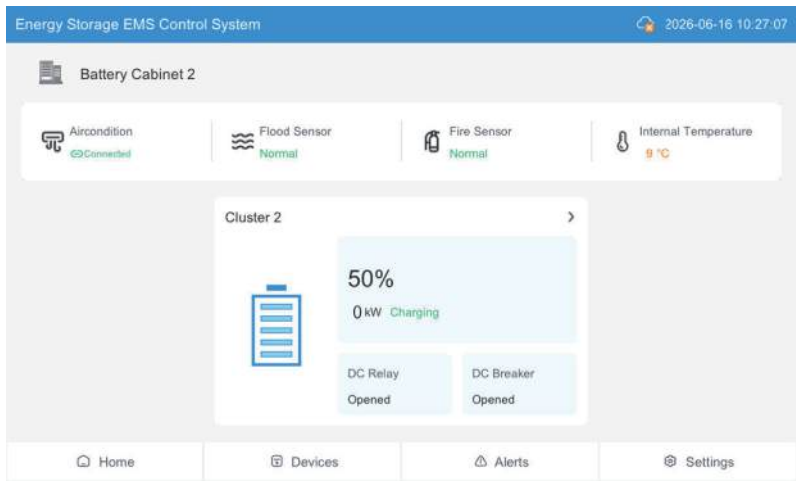
1. “1.Settings”- “2.System Settings”-“3.Screen”-“4.Configuration Wizard”-“5.Password:888888”-“6.OK”



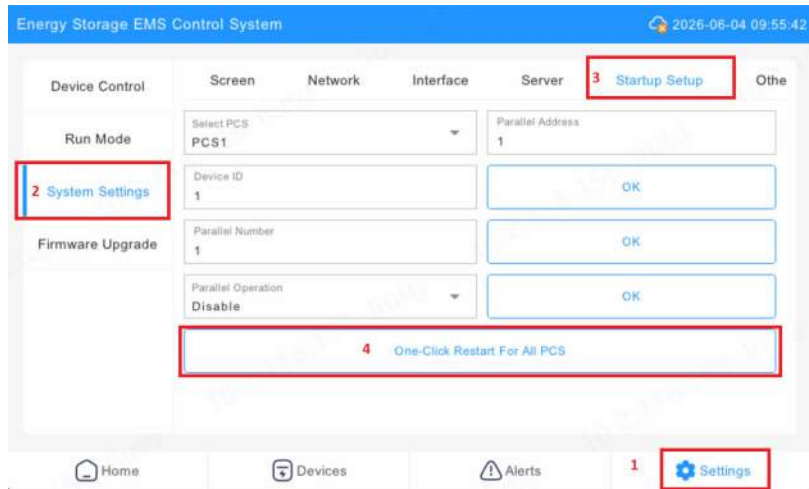
Follow the on-site equipment configuration guide. Be sure to configure the system according to the actual on-site equipment setup. Incorrect configuration may prevent the system from operating properly:

Setup Steps	Slave cabinet
1.Start Using	Start Using
2.Is there “STS”	None
3.EMS in cabinet	Slave
5.Battery cabinet type	Battery cabinet type
6.PCS type	/
7.Is there GEN	/
8.Is there PV inverter	/
9.Meter type	/
10.Restart now	Restart now

3. Slave Battery Cabinet Interface After Setup



Go to Master Cabinet EMS screen “Setting”-“System Settings”-“Startup Setup”-“One-Click Restart For All PCS”



Upgrade Procedure

1 Step1: “1. Alerts” – “2. Firmware Upgrade”: Please contact KSTAR technical support to obtain the latest firmware version. Refer to Appendix 1 for the upgrade procedure;

Energy Storage EMS Control System 2026-06-03 14:56:53

Device Control

Running Mode

System Settings

Firmware Upgrade

Device Type: HMI

Firmware File: Please select firmware file

Start Upgrade

Home Devices **1** Alerts (3) Settings

Device	Firmware Version
HMI	V010B000D030
BMS 1	V000B000D000
PCS 1 (Version 1)	V000B000D000
PCS 1 (Version 2)	V000B000D000
PCS 1 (ARM Version)	V000B000D000

Upgrade sequence	Device	Firmware Version
①	HMI(EMS)	
②	BMS	
③	PCS-DSP1	
④	PCS-DSP2	
⑤	PCS-ARM	

2 Step2: If the PCS program has not been upgraded, Go to “Setting”-“System Settings”-“Startup Setup”-click the “One-Click Restart For All PCS”

Energy Storage EMS Control System 2026-06-04 09:55:42

Device Control Screen Network Interface Server **3** Startup Setup Other

Run Mode

Select PCS: PCS1

Parallel Address: 1

Device ID: 1

Parallel Number: 1

Parallel Operation: Disable

4 One-Click Restart For All PCS

Home Devices Alerts **1** Settings

Basic Settings: Time & Grid Standards

1

“1.Settings”- “2.System Settings”-“3.Screen”-“4.Date&Time”
-“5.Time Zone”-“6.Calibration”-“7.OK”

Energy Storage EMS Control System 2026-05-22 15:04:10

Device Control 3 Screen Network Interface Server Other

Running Mode APP Version: kstar-ems-all-branch-V010B000D030

Serial Number: 00000000000000000000

OS Version: V000B000D000

4 Date & Time: 2026-05-22 15:03:45 5 Time Zone: GMT+0 6 Calibration

Language Switching: English

7 OK Refresh Restore Factory Settings Configuration Wizard

Home Devices Alerts (3) 1 Settings

Note: When selecting the appropriate local grid standard under the “Grid Standard” setting, the PCS must be powered off to modify the grid standard;

2

“1.Settings”- “2.System Settings”-“3.Other”-“4.Grid Standard”-“5.OK”

Energy Storage EMS Control System 2026-05-22 15:54:34

Device Control Screen Network Interface Server 3 Other

Running Mode Local Modbus RTU Address: 1 Interface Protocol Type: Kstar

2 System Settings 4 Grid Standard: EN 50549 Interface Protocol Port: 2000

Firmware Upgrade DI-power control: Disable Power Control Mode: Three-Phase Hybrid

5 OK Refresh Meter Settings

Home Devices Alerts (3) 1 Settings

Note: If the EMS can connect to the Internet, the time can be synchronized with the Internet.

Operating Mode Selection

Note: If multiple ESS units are connected in parallel to the EMS01D, you must configure the mode on the EMS01D “1.Settings”-
“2.Running Mode”-“3.Running Mode select”-“4.OK”

Four running modes: Manual Control, Self Consumption, Peak Shifting, and Time of Use

The screenshot displays the 'Energy Storage EMS Control System' interface. At the top, a blue header bar contains the system name and a timestamp '2026-06-15 16:47:06'. The main content area is divided into several sections. On the left, a sidebar lists 'Device Control', 'System Settings', and 'Firmware Upgrade'. The 'Device Control' section includes a 'Remote Control' dropdown menu set to 'Disable' and an 'Inverter Power (kW)' display showing '0.00'. The 'System Settings' section has two checked options: 'Reverse Power Protection Control' and 'Demand Control', each with a 'Value (kW)' display showing '0.00' and '100.00' respectively. The 'Firmware Upgrade' section is currently empty. The 'Running Mode' section is highlighted with a red box and labeled '2'. It contains a dropdown menu labeled 'Running Mode' with 'Manual Control' selected, indicated by a blue checkmark. Below this, the other three modes are listed: 'Self Consumption', 'Time of Use', and 'Peak Shifting'. The 'Peak Shifting' option is highlighted with a red box and labeled '3 Running Mode select'. At the bottom of the main content area, there are two buttons: 'OK' and 'Refresh'. The 'OK' button is highlighted with a red box and labeled '4'. The bottom navigation bar contains four icons: 'Home', 'Devices', 'Alerts (3)', and 'Settings'. The 'Settings' icon is highlighted with a red box and labeled '1'.

Energy Storage EMS Control System 2026-06-15 16:47:06

Device Control

Remote Control
Disable

Inverter Power (kW)
0.00

System Settings

☒ Reverse Power Protection Control Value (kW)
0.00

Firmware Upgrade

☒ Demand Control Value (kW)
100.00

Running Mode

Manual Control ✓

Self Consumption

Time of Use

Peak Shifting

OK Refresh

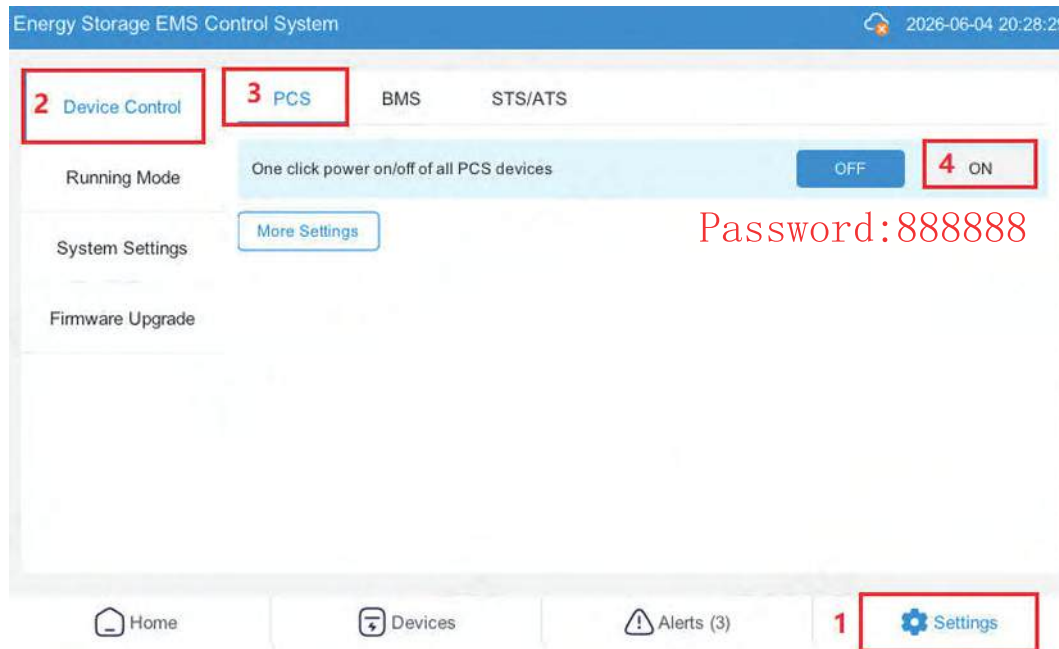
Home Devices Alerts (3) Settings

System Power On

Note: If there are no error alerts displayed on the EMS screen and the system does not consist of multiple PCS units operating in parallel, you may proceed to power on the energy storage system; if the system is configured in parallel, follow the wiring and commissioning procedures for parallel systems.

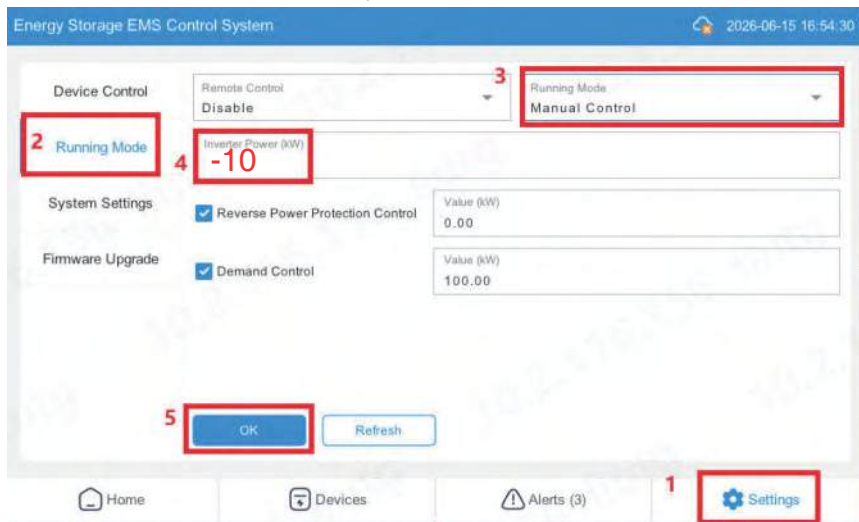
After the PCS is turn on. It's proposed to set the system to “manual control” mode to test charge/discharge.

“1.Settings”- “2.Device Control”-“3.PCS”-“4.ON”,interface.



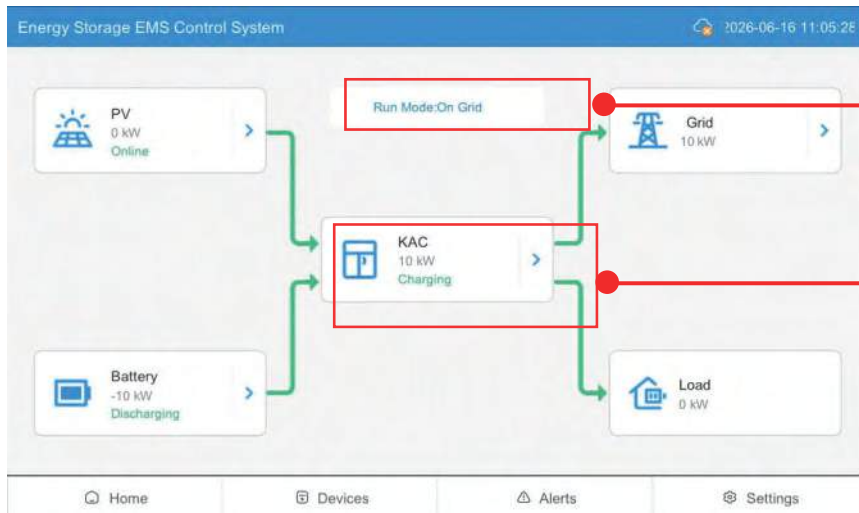
On-Grid Charge Test

1 “1.Settings”- “2.Run Mode”-“3.Run Mode-Manual Control”
-“4.Inverter Power”-“OK”,



Step 1: Set the charging power to 10 kW;
Step 2: Return to the EMS home screen to verify that the PCS status, current mode, and power display are correct.

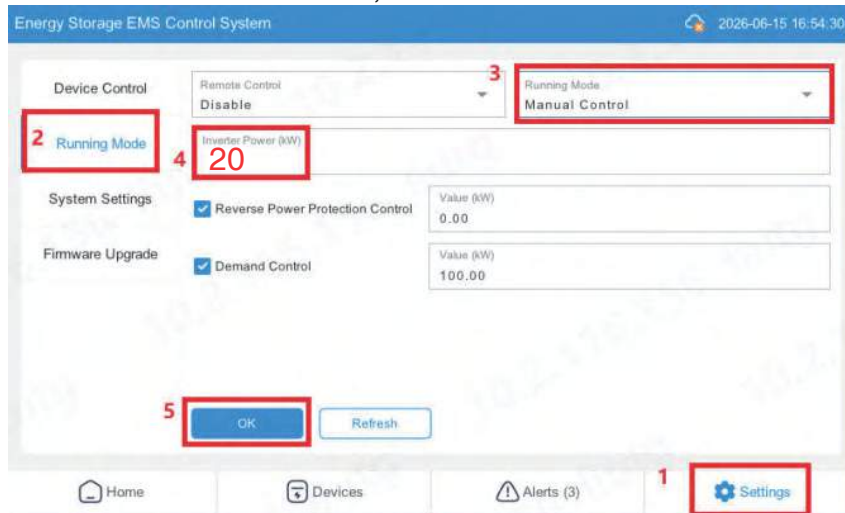
2



Step 3:View Operating Mode: On-Grid
Step 4:View the EMS homepage for 10 kW charging.

On-Grid Discharge Test

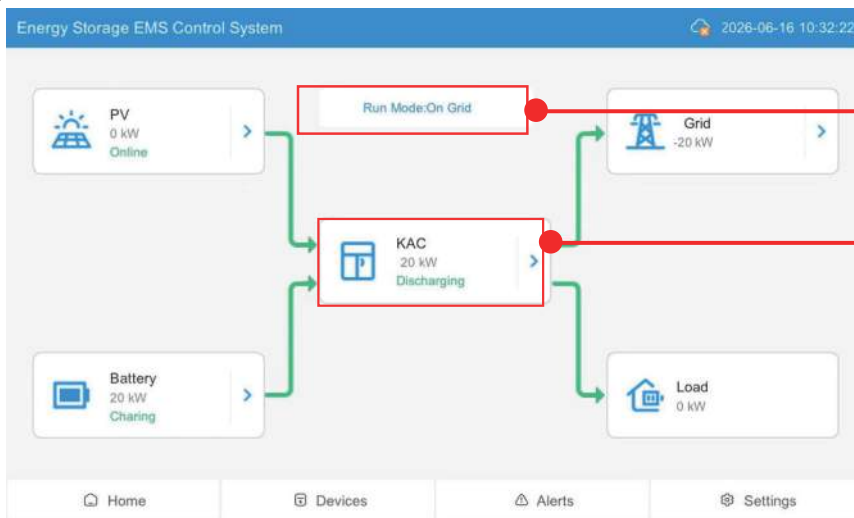
1 "1.Settings"- "2.Run Mode"- "3.Run Mode-Manual Control"
- "4.Inverter Power"- "OK",



Step 1: Set the discharge power to 20 kW;

Step 2: Return to the EMS home screen to verify that the PCS status, current mode, and power display are correct.

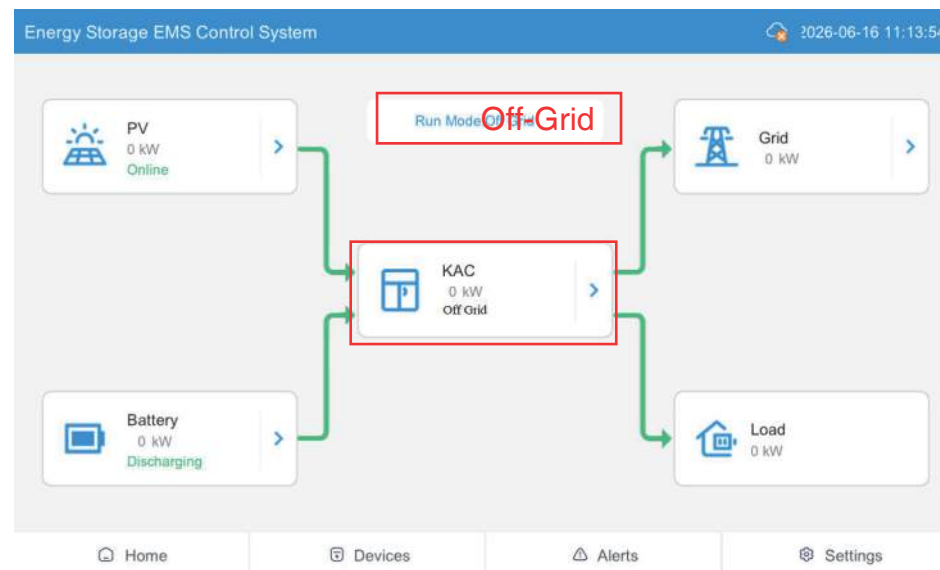
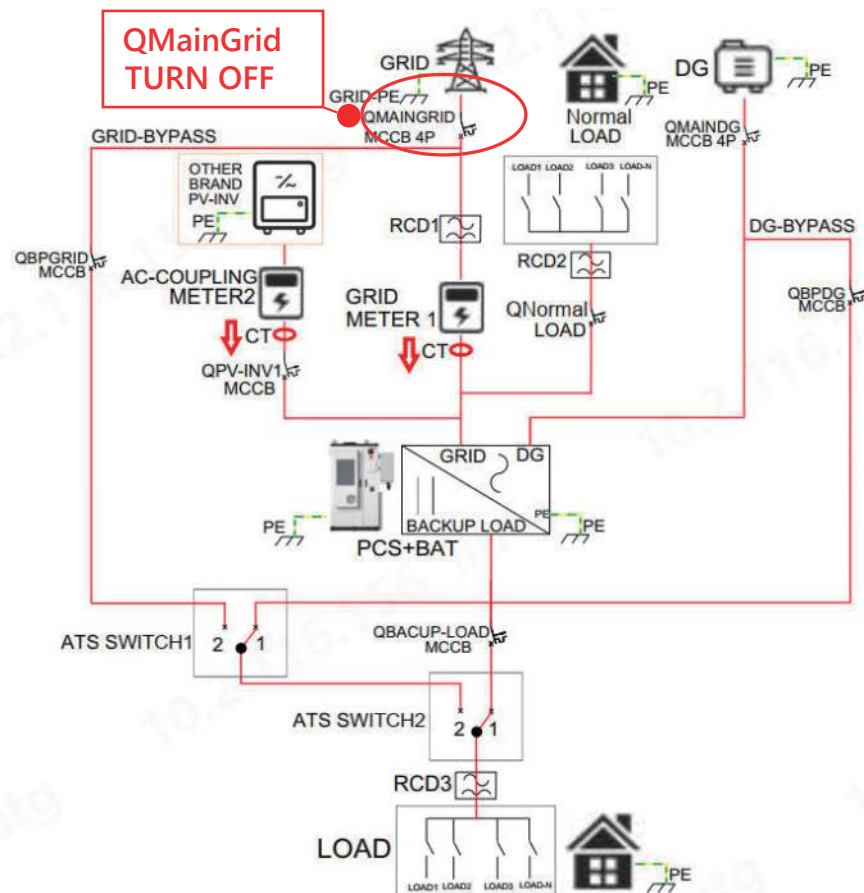
2



Step 3: View Operating Mode: On-Grid

Step 4: View the EMS homepage for 20 kW discharging.

On/Off-Grid Switching Test



Switching from On-grid to Off-grid Test:

- Step 1: With the system connected to the grid, turn off switch QMainGrid;
- Step 2: Return to the home screen and check whether the EMS screen has switched to off-grid mode;
- Step 3: View Operating Mode: Off-Grid
- Step 4: Check the EMS homepage to see if the system is discharging while off-grid.

Switching from Off-grid to On-grid Test:

- Step 1: With the system connected to the grid, close the switch QMainGrid;
- Step 2: Return to the home screen and check whether the EMS screen has switched to on-grid mode;

EMS Generator Settings Interface Guide

Instructions for the Generator

NO.	Item	Function Description
1	Diesel Generator Rated Power (kW)	Set the rated power of the diesel generator;
2	DG Maximum Charging Power Enable	Enables the diesel generator' s maximum charging power. Once enabled, the diesel generator charges the battery at its maximum charging power. Operation is based on the following formula: DG Maximum Charging Power = Diesel Generator Power – (Max Load Power);
3	Max Generator Charging Power (kW)	The diesel generator' s maximum charging power;

Energy Storage EMS Control System

2026-04-27 08:51:12

2 Device Control

PCS

BMS

3 STS/ATS

PV Inverter

Run Mode

STS Power On/Off ☒

System Settings

5 ☒ DG Maximum Charging Power Enable

4 Diesel Generator Power (kW)
100

6 DG Maximum Charging Power (kW)
32

Firmware Upgrade

Note: The generator's maximum available power minus the maximum potential load power.

7 OK

Refresh

Developer Options

Home

Devices

Alerts

1 Settings

Diesel Generator Configuration Rules: $\text{DG Maximum Charging Power} = \text{Diesel Generator Power} - (\text{Max Load Power})$;
The maximum charging power set for the diesel generator must be less than the generator's rated power minus the maximum potential load power; otherwise, if the sum of the load power and the battery charging power exceeds the generator's total power, the generator will be at risk of overload.

DG Test -DG Start Test

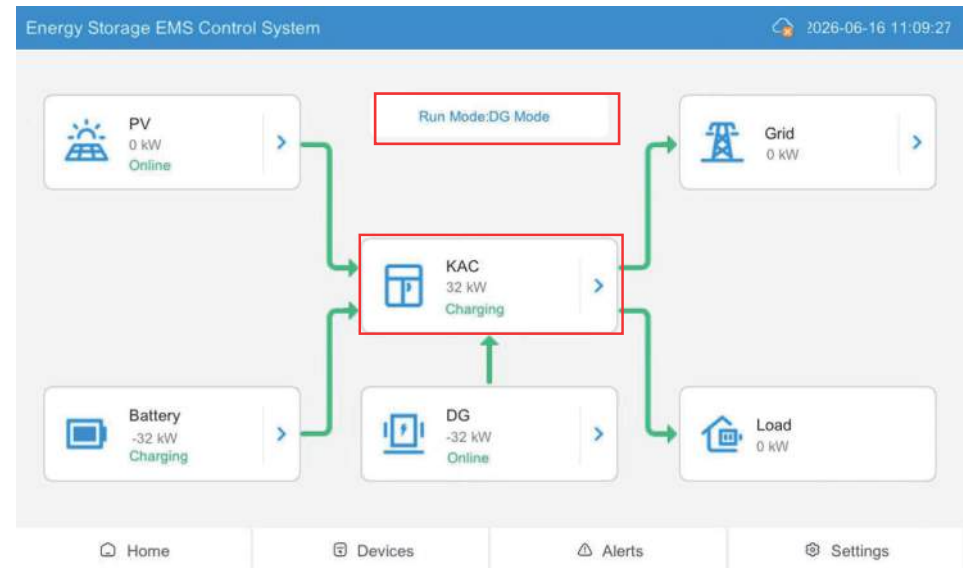
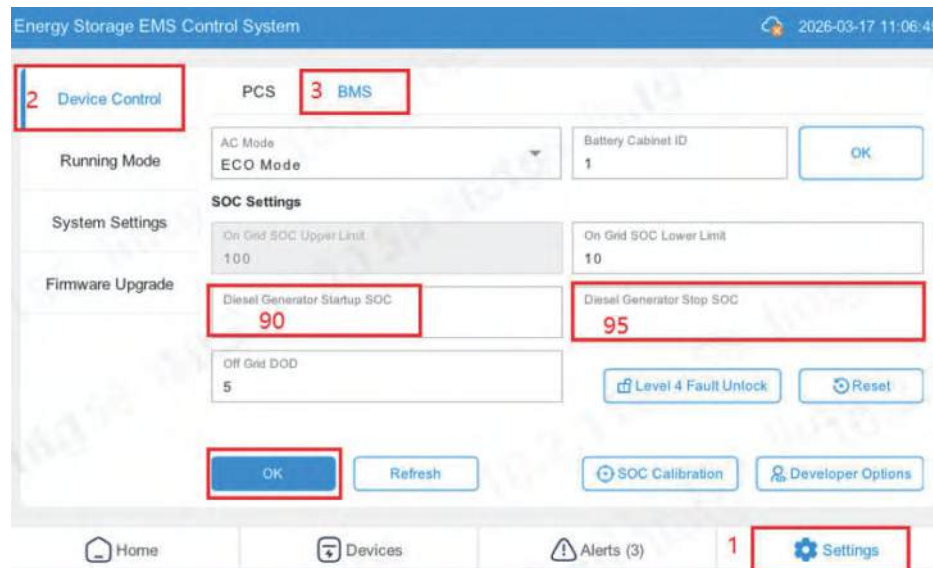
Prerequisites for diesel generator testing: With the PCS powered off, all PCS-PV switches must be open, and disconnect the grid switch (QMainGrid), and the actual battery SOC must be $\leq 88\%$;

For example: actual battery SOC: 88%;

Step 1: Set the diesel generator stop SOC: 95%;

Step 2: Diesel generator start SOC: 90%;

Step 3: Wait about 2 minutes and observe whether the diesel generator starts on the EMS screen homepage, View operating mode is DG-Mode, and Generator charging the battery.



Explanation of Generator Startup Conditions:

Test Conditions for Automatic Generator Startup by PCS: Diesel Generator stop SOC value > Diesel Generator start SOC value > BAT actual SOC value (Diesel Generator stops SOC value $\geq$ the Diesel Generator starts SOC value + 5)
(Diesel Generator starting SOC value $\geq$ BAT actual SOC value + 2)

DG Test -DG Stop Test

Prerequisites for diesel generator testing: With the PCS powered off, all PCS-PV switches must be open, and disconnect the grid switch (QMainGrid), and the actual battery SOC $\leq 88\%$; For example: actual battery SOC: 88%;

Step 1: Set the diesel generator stop SOC: 20%;

Step 2: Diesel generator start SOC: 15%;

Step 3: Wait about 2 minutes and observe whether the diesel generator stops on the EMS screen homepage.

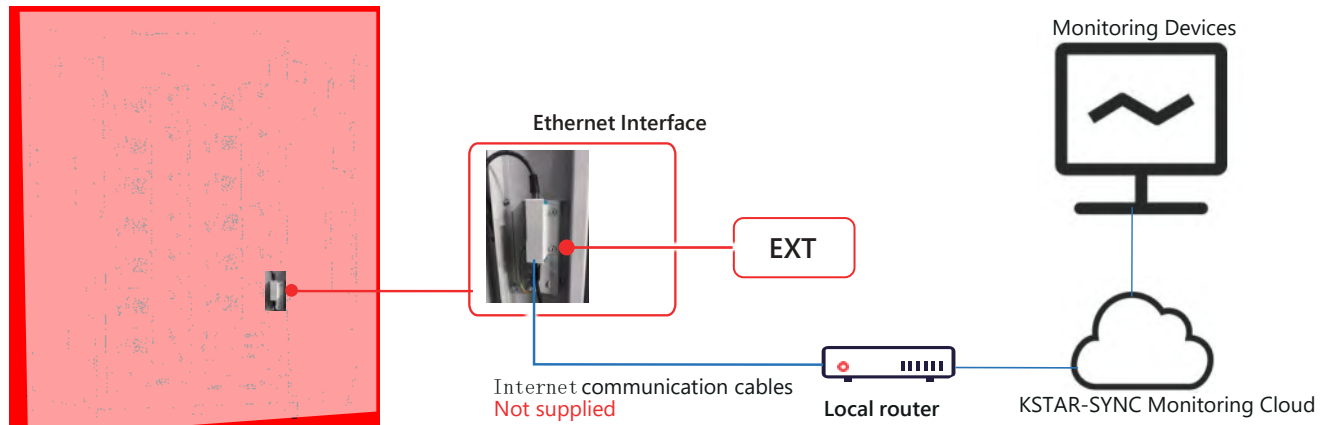
The screenshot displays the 'Energy Storage EMS Control System' interface. At the top, a blue header bar contains the system name and a timestamp '2026-03-17 11:06:49'. Below the header, a navigation bar includes '2 Device Control' (highlighted with a red box), 'PCS', and '3 BMS' (highlighted with a red box). The main content area is divided into sections: 'Running Mode' (set to 'ECO Mode'), 'System Settings', and 'Firmware Upgrade'. Under 'System Settings', there are fields for 'On Grid SOC Upper Limit' (100), 'On Grid SOC Lower Limit' (10), 'Diesel Generator Startup SOC' (15, highlighted with a red box), and 'Diesel Generator Stop SOC' (20, highlighted with a red box). There is also a field for 'Off Grid DOD' (5). At the bottom of the settings section, there are buttons for 'OK' (highlighted with a red box), 'Refresh', 'Level 4 Fault Unlock', 'Reset', 'SOC Calibration', and 'Developer Options'. The bottom navigation bar includes 'Home', 'Devices', 'Alerts (3)', and '1 Settings' (highlighted with a red box).

Explanation of Generator Shutdown Conditions:

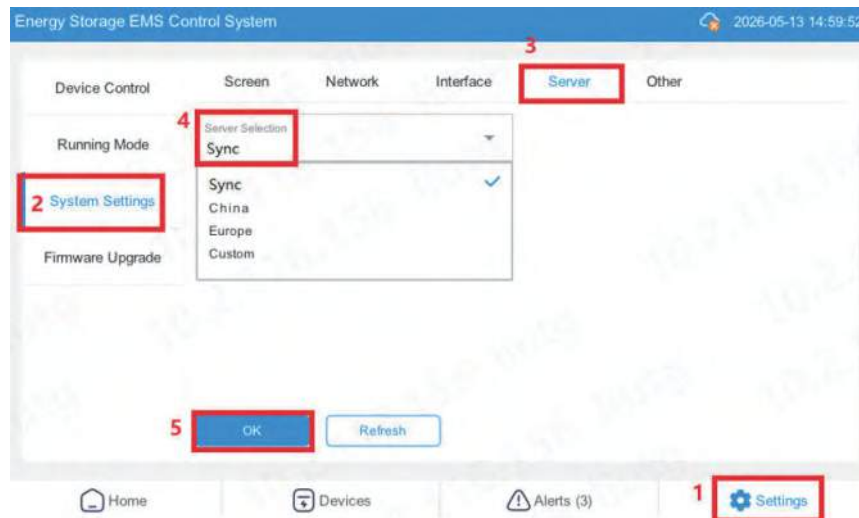
Test Conditions for Automatic Generator Shutdown by PCS: $BAT \text{ actual SOC value} > \text{Diesel Generator stop SOC value} > \text{Diesel Generator start SOC value}$ ($\text{Diesel Generator stops SOC value} \geq \text{the Diesel Generator starts SOC value} + 5$)
($\text{Diesel Generator starting SOC value} \geq \text{BAT actual SOC value} + 2$)

Network Connection & Setup 1-1

Step1:Connect the wires according to the wiring diagram shown.



Step2:select “Sync” for the server. “1.Setting”-“2.System Settings”- “3.Server”-“4.Sync”-“5.OK”



Network Connection & Setup 1-2

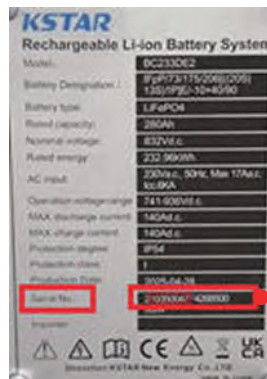
Check whether the Serial Number on the EMS screen matches the S/N on the battery cabinet nameplate. If they match, no action is required; if they do not match, change the S/N on the EMS screen to match the battery cabinet's S/N.

How to Change:

"1.Setting"->"2.System Settings"->"3.Screen", Click this to "Refresh" 10 times to set the SN number, click "OK" at the bottom to save set.

Enter the S/N number listed on the battery cabinet's nameplate on the EMS screen, then click OK to save the settings.

Note: If the S/N number on the EMS screen matches that of the battery cabinet, there is no need to change the S/N. The S/N number must match the battery cabinet's S/N, and you must distinguish between uppercase and lowercase letters:



Energy Storage EMS Control System

2026-06-04 20:13:04

Device Control **3 Screen** Network Interface Server Other

Running Mode

APP Version
kstar-ems-all-branch-V010B000D030

Serial Number
00000000000000000000

Firmware Upgrade

OS Version
V000B000D000

Date & Time
2026-06-04 20:12:20

Time Zone
GMT+0

Language Switching
English

OK Refresh

Calibration

Restore Factory Settings

Configuration Wizard

Energy Storage EMS Control System

2026-06-04 20:13:04

Device Control **3 Screen** Network Interface Server Other

Running Mode

APP Version
kstar-ems-all-branch-V010B000D030

Serial Number
00000000000000000000

Firmware Upgrade

OS Version
V000B000D000

Date & Time
2026-06-04 20:12:20

Time Zone
GMT+0

Language Switching
English

OK Refresh

Calibration

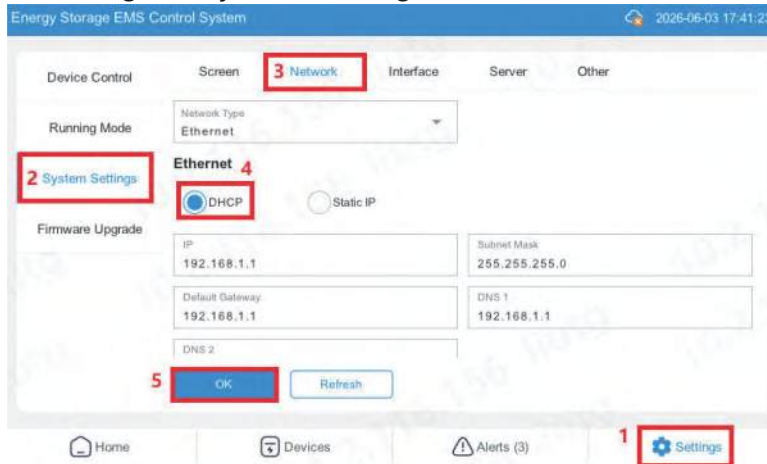
Restore Factory Settings

Configuration Wizard

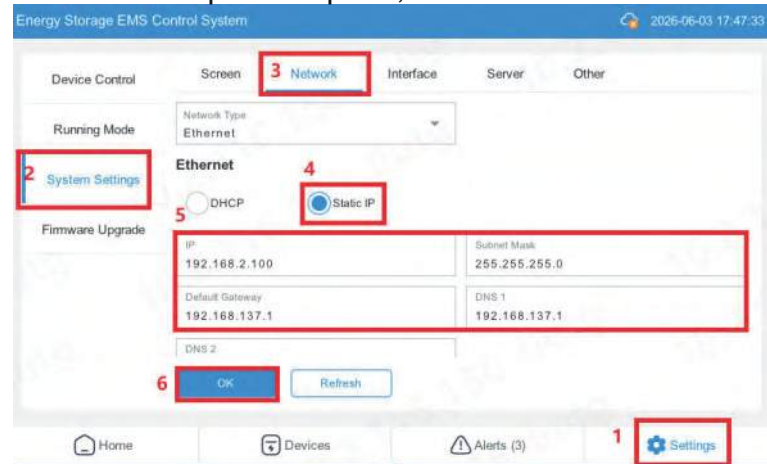
Network Connection & Setup 1-3

DHCP Automatic Network Connection Settings

“1.Setting”-“2.System Settings”-“3.Network”-“4.DHCP”-“5.OK”



“1. Settings” – “2. System Settings” – “3. Network” – “4. Static IP” – “5. OK” Enter the static IP address for the network port. Once the setup is complete, click “OK.”



Note: The device supports Ethernet, DHCP. Please inform the customer to open the following address for the IP port used by the company and allow the firewall to pass through.

51.141.112.234 2800 (Encrypted)
51.141.112.234 2900 (Unencrypted)
111.230.141.84 2800 (Encrypted)
111.230.141.84 2900 (Unencrypted)
20.82.106.247 19636 (Encrypted)
20.82.106.247 9636 (Unencrypted)
193.112.41.194 21
51.141.112.234 2700
159.75.9.163 2700

Unable to access the internet without using the collector.

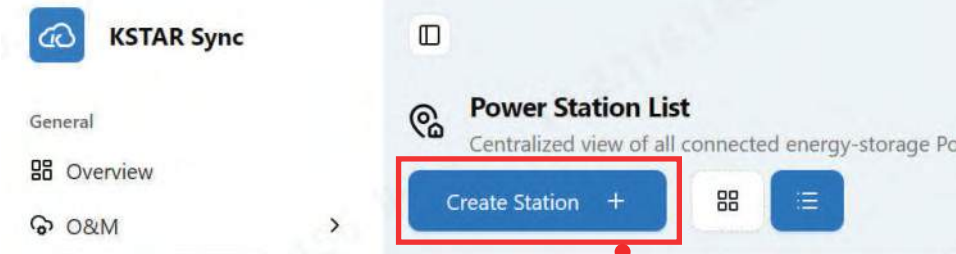
Note: If the user's network does not support automatic DHCP connection, the user must enter a static IP address for the network port being used to establish a connection.

Connecting the Datalogger to the KSTAR Sync Platform 1-1

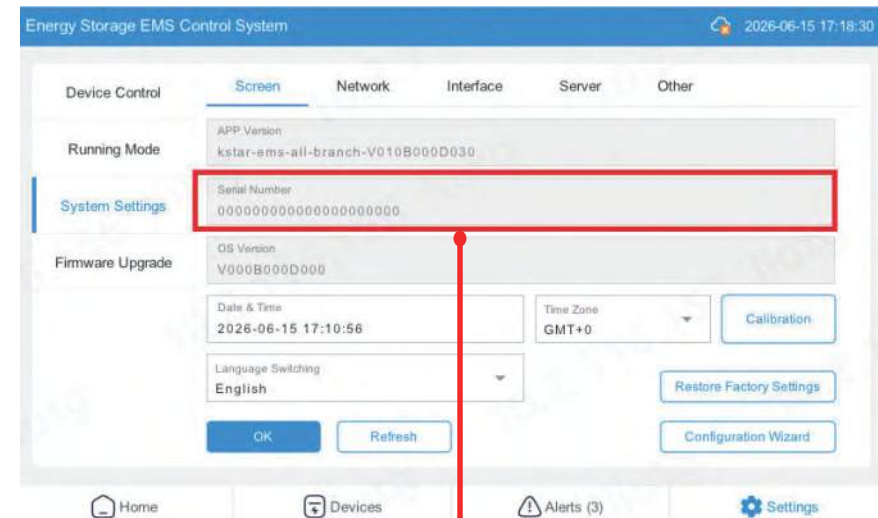
KSTAR-Sync website: <https://sync.ksdatacloud.com/>

Step 1: Register using the KSTAR-Sync website or by downloading the app on your phone;

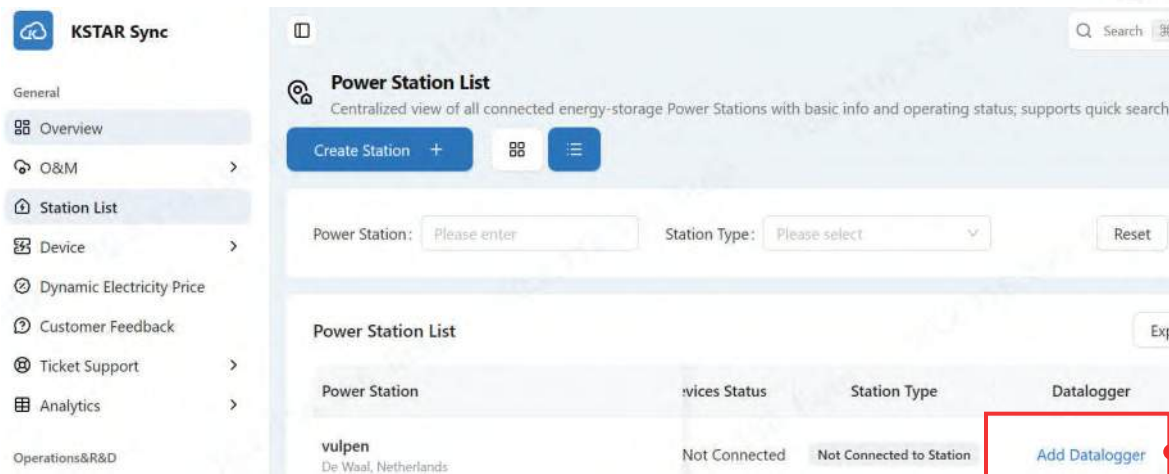
Step 2: Log in to Sync, then add the power plant and datalogger information;



Step3: Create Station



Step 4: Enter the datalogger information and the S/N information displayed on the EMS screen



Connecting the Datalogger to the KSTAR Sync Platform 1-2

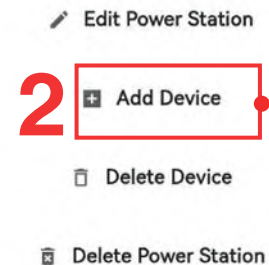
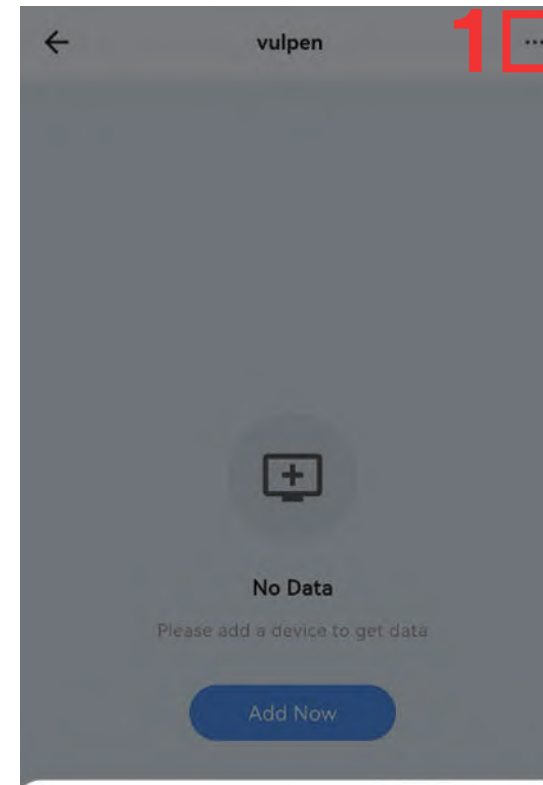
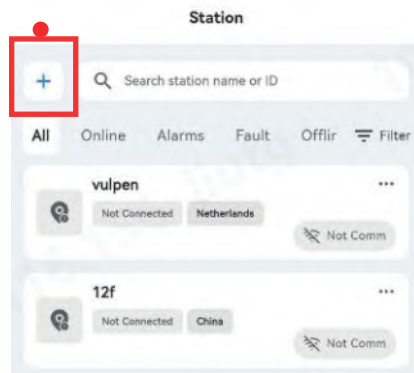
Step 1: Download the KSTAR Sync app on your phone and sign up

1. Android phones: Go to the Google Play Store, search for KSTAR Sync, and download it.
2. iOS phones: Go to the App Store, search for KSTAR Sync, and download it.
3. Scan the QR code with your phone to download KSTAR Sync.



Step 2: Log in to Sync via the mobile app, then add the station and datalogger information

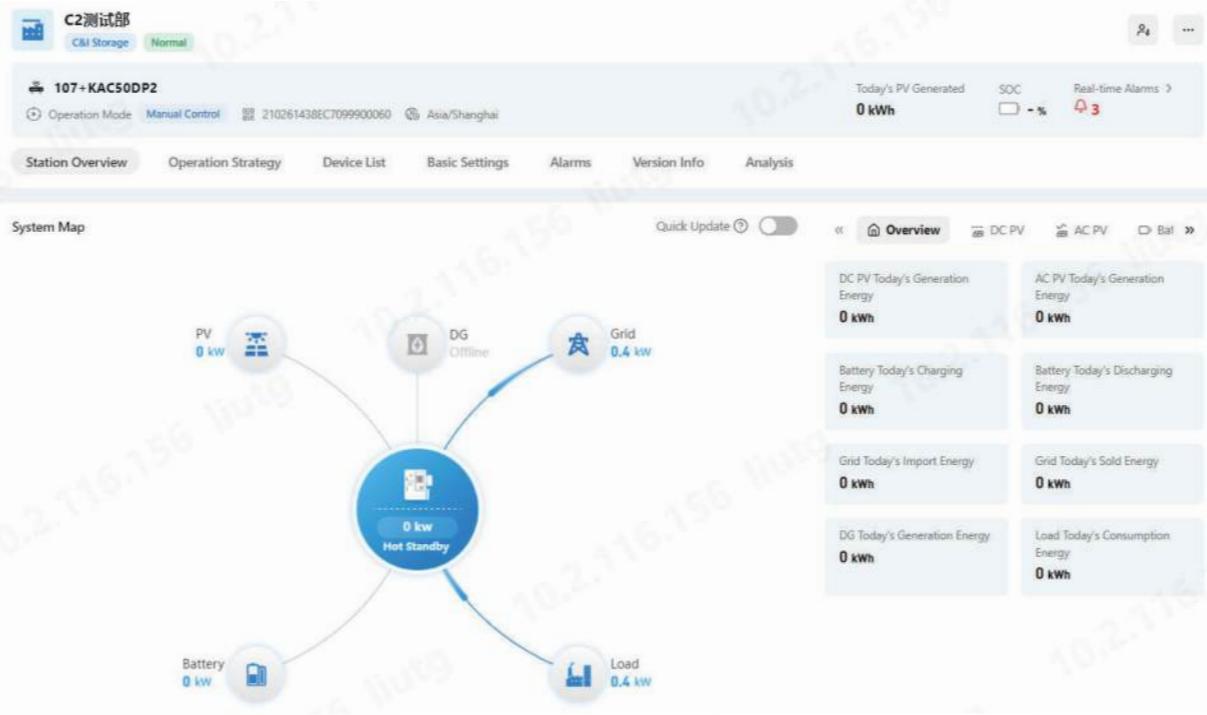
Step 3: After adding a station, click on it, and then add a new datalogger device to the station.



Step 4: Enter the datalogger information, which is the S/N displayed on the EMS screen.

KSTAR Sync Web Version Station Details—Introduction to the Station Overview Interface

The power station overview interface centrally displays the operational data for all equipment within the power station, covering photovoltaic systems, inverters, batteries, the power grid, diesel generators, and loads, providing a comprehensive view of the operational status of each type of equipment. The system offers various visualization formats, including system diagrams, line charts, and bar charts, to clearly present real-time power curves, cumulative power generation, and electricity consumption data for each piece of equipment, helping users efficiently monitor the overall operational status of the power station.



Station Overview

NO.	Item	Function Description
1	System Map	View the power flow diagram while the system is running
2	Energy Analysis	Power Analysis Curve
3	Energy Trends	Energy-Power Trend Curve

KSTAR Sync Web Version Station Details—Introduction to the Operation Strategy Interface

The operation strategy interface serves as the system's intelligent control core. The system offers four operation strategies—Manual Control, Self-consumption, Time-of-Use, and Peak Shaving—to enable automated management of the power station's charging and discharging operations. Users can flexibly select the optimal operation strategy based on actual electricity demand, electricity pricing policies, and grid requirements to achieve the comprehensive goals of enhancing economic efficiency, ensuring electricity safety, and participating in grid dispatch.

C2测试部
C&I Storage Normal

107+KAC50DP2
Operation Mode: Manual Control ID: 210261438EC7099900060 Asia/Shanghai

Today's PV Generated: 0 kWh SOC: --% Real-time Alarms: 3

Station Overview **Operation Strategy** Device List Basic Settings Alarms Version Info Analysis

Operation Strategy Last Updated 2025-11-05 09:55:04

Grid Power Control

Export limit enabled ☒ * Export limit Value: 0 kW

Import limit enabled ☒ * Import limit Power: 100 kW

Power Factor Compensation ☐

Manual Control
Reduce electricity costs by leveraging time-of-use price differences to optimize economics.

Self-consumption
With self-consumption, users can reduce purchases from the public grid and lower electricity costs.

Time-of-Use
Grid prices vary by time, typically peak, flat, and off-peak.

Peak Shaving
Reduce peak-period load, lower electricity costs, and improve grid efficiency.

* PCS Power: 0 kW

Reset Submit

Grid Power Control

NO.	Item	Function Description
1	Export limit enabled	When export limit is enabled, the system operates according to the set export limit value; when export limit is disabled, there is no export limit.
2	Export limit Value	Settings of export limit value
3	Import limit enabled	When it is enabled, the system operates according to the set demand value; when it is disabled, there is no limit.
4	Import limit Power	Settings of limit power
5	Power Factor Compensation	Power factor compensation function

Operation Strategy

NO.	Item	Function Description
1	Manual Control	Users can fully customize the charging and discharging power as well as the operating periods, making it suitable for special operating conditions or temporary scheduling needs.
2	Self-consumption	Prioritize the consumption of solar power; store excess electricity in batteries; and draw power from the batteries when supply is insufficient, thereby maximizing the rate of self-consumption of green electricity.
3	Time-of-Use	Based on the peak-valley electricity pricing mechanism, charging takes place during off-peak hours and discharging during peak hours, taking advantage of the price difference to save on electricity costs.
4	Peak Shaving	Discharge during peak electricity usage hours to reduce grid demand, and charge during off-peak hours to smooth out the electricity consumption curve and lower capacity charges.

Introduction to the KSTAR Sync Device List Interface

The Device List primarily displays information about the equipment at the power station and allows users to view basic parameter information for KACs, battery cabinets, and meters.

The screenshot displays the KSTAR Sync Device List Interface. At the top, there's a header with 'C2测试部' and 'C&I Storage Normal'. Below this, a sub-header shows '107+KAC50DP2' with 'Operation Mode Manual Control', a device ID '210261438EC7099900060', and location 'Asia/Shanghai'. On the right, it shows 'Today's PV Generated 0 kWh', 'SOC' with a battery icon, and 'Real-time Alarms 3'. A navigation bar includes 'Station Overview', 'Operation Strategy', 'Device List' (selected), 'Basic Settings', 'Alarms', 'Version Info', and 'Analysis'. A left sidebar lists 'kac' (selected), 'bms', and 'meter'. The main content area shows 'Unnamed Device' with a device icon, status 'Alarm', type 'KAC', SN '123456789012345678901', and model 'KAC50DP2'. It also shows 'Data updated at 2025-11-05 10:39:16'. Below this are tabs for 'Basic Info', 'Curve Analysis', 'Remote Settings', 'Alarm Logs', and 'Historical Data'. The 'Basic Info' tab is active, showing 'Real-time Data' with a table of metrics: Daily PV Generation(kWh) 0, Monthly PV Generation(kWh) 0, Total PV Generation(kWh) 0.6, Bat Daily Charged Energy(kWh) 0, Bat Monthly Charged Energy(kWh) 0, Bat Total Charging(kWh) 0, Bat Daily Discharged Energy(kWh) 0, Bat Monthly Discharged Energy(kWh) 0, Bat Total Discharging(kWh) 0, Total PV Power(kW) 0, Battery Power(kW) 0, Total Active Power(kW) 0, Internal temperature(°C) 39, and Uploaded Time 2025-11-05 10:39:16. The table has tabs for 'Overview', 'Grid Side', 'Load Side', 'INV Side', and 'DG Side'.

Device List

NO.	Name	Function Description
1	KAC	View the corresponding KAC's basic information, curve analysis, remote control, alarm logs, and historical data.
2	BMS	View the corresponding BMS's basic information, curve analysis, remote control, alarm logs, and historical data.
3	METER	View the basic information and historical data for the corresponding meter.

Introduction to the KSTAR Sync Basic Settings Interface

See the table below for a detailed description of the basic settings:

EMS Settings-Third-party EMS Dispatch		
NO.	Item	Function Description
1	Remote Control	When enabled, control is handled by a third-party control system; when disabled, control follows KSTAR's original design logic.
2	Export limit enabled	When enabled, the ESS controls the power to maintain the configured export limitation.
3	Export limit Value	Settings of export limit value
4	Import limit enabled	Enabled, the ESS controls the power to maintain the configured import limitation.
5	Import limit Power	Settings of import limit power
6	Import & Export Override Protection	When enabled, the ESS enforces the configured import limitation and export limitation, overriding conflicting commands from a third-party EMS
7	Import & Export Power Control Rate	The rate for import and export power control
8	Communication Protocol Type	Select the external communication protocol. Supported protocols include KSTAR, Eniris, and Envitron.
9	TCP Port	Configure the TCP communication port used by external systems.
10	Modbus RTU Address	Modbus RTU address used for RS485 communication. Default baud rate: 19200 bps.
11	Power Control Mode	PCS control mode selection: Three-Phase Hybrid, Three-Phase Independent, Single-phase min active power*3.
12	PCS Rated Power	Sets the maximum charge and discharge power available for each PCS.
13	DI-Power Control	Controls the ESS power according to DI input signals.
14	KAC1-Off-grid Frequency Modulation	KAC1-Off-grid Frequency Modulation.
15	On Grid SOC Upper Limit	Maximum battery SOC in grid-connected mode.
16	On Grid SOC Lower Limit	Minimum battery SOC in grid-connected mode.
17	Off GridDOD	Maximum allowable Depth of Discharge (DOD) when operating in off-grid mode.
18	DG Startup SOC	In off-grid mode, the generator starts automatically via dry contact when the battery SOC falls below the configured value.
19	DG Stop SOC	While the generator is running, it stops automatically when the battery SOC reaches the configured value.
20	DG Rated Power	Rated output power of the DG. It is recommended to reserve sufficient capacity for sudden load changes.
21	DG Charging Power Enable	When enabled, the ESS charges at the configured DG charging power. When disabled, charging power is automatically adjusted according to the remaining capacity of FDG.
22	Grid Standard	Grid standard settings.
23	DG Rated Power	Set the rated power value for the diesel generator
24	SOC Calibration Settings	When enabled, automatic SOC calibration begins according to the set value.

Introduction to the KSTAR Sync Alarm Interface

See the table below for an overview of the alarm interface:

**C2测试部**

C&I StorageNormal

**107+KAC50DP2**

Operation ModeManual Control210261438EC7099900060Asia/Shanghai

Today's PV Generated0 kWhSOC- %Real-time Alarms 3

Station Overview

Operation Strategy

Device List

Basic Settings

Alarms

Version Info

Analysis

Alarm CenterPlease enter

Time RangePlease select → Please select

DevicePlease enter

Reset

Query

Expand

Real-time Alarms

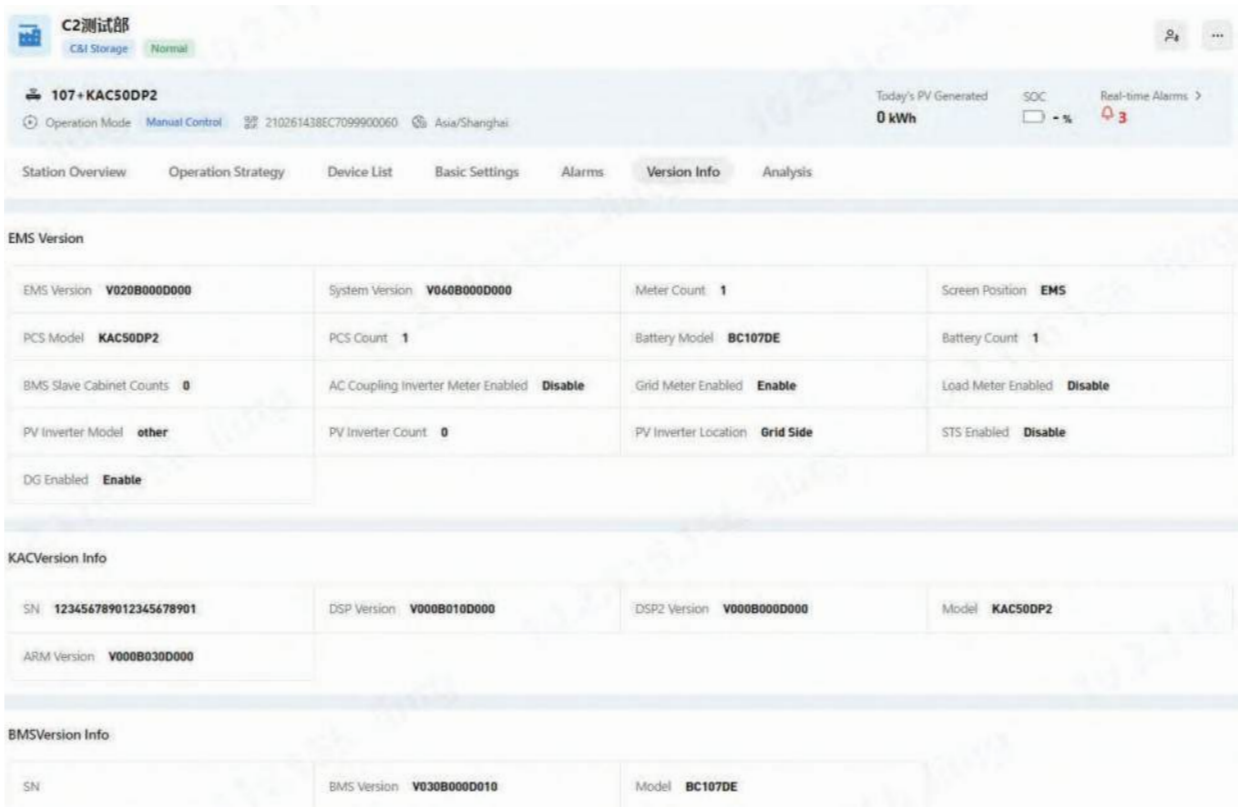
Historical Alarms

C I

Alarms List		
NO.	Name	Function Description
1	Real-time Alarms	View real-time system alarms
2	Historical Alarms	View historical alarms

Introduction to the KSTAR Sync Version Information Interface

Introduction to the version information interface:



Version List		
NO.	Name	Function Description
1	EMS Version	View the EMS firmware version information
2	KAC Version	View the KAC firmware version information
3	BMS Version	View the BMS firmware version information

Introduction to the KSTAR Sync Data Analysis Interface

Introduction to the data analysis interface: Data from KAC, BMS, and METER can be exported into a table format for viewing.

 **C2测试部**

C&I Storage

Normal

 **107+KAC50DP2**

Today's PV Generated
0 kWh

SOC
 - %

Real-time Alarms >
 **3**

Operation Mode **Manual Control**

 210261438EC7099900060

 Asia/Shanghai

Station Overview

Operation Strategy

Device List

Basic Settings

Alarms

Version Info

Analysis

KAC

BMS

METER

Select Device

☐ KAC1



Please select a device first

2026-07-10 → 2026-07-10 

 Save

Reset

Submit

System template:

Cell Temperature

Cell Voltage

Branch Data

Cluster Data

DC Voltage & Current

DC Current

DC Voltage

AC Analysis

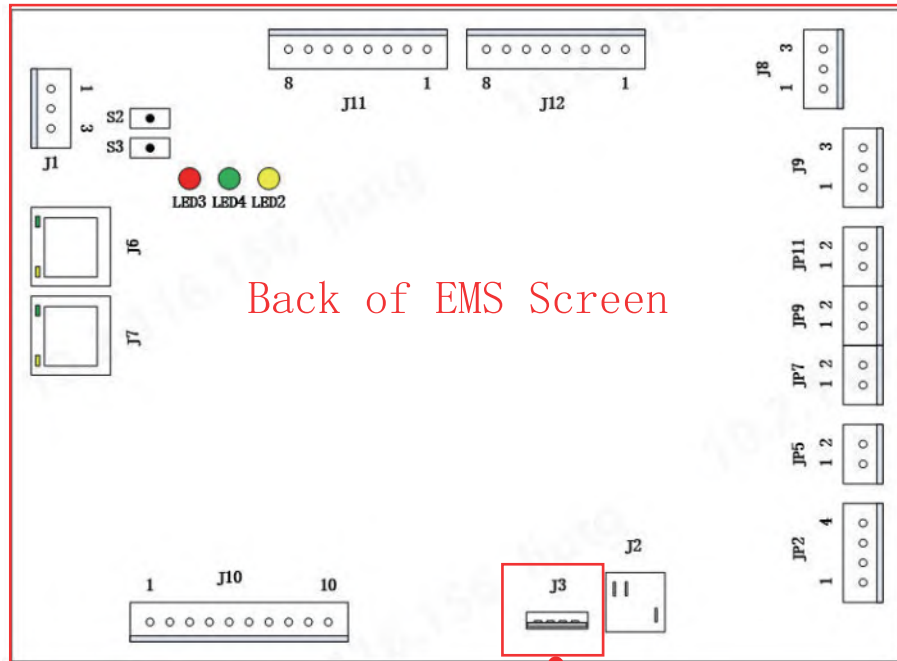
测试

测试2

Appendix 1: Device Firmware Upgrade

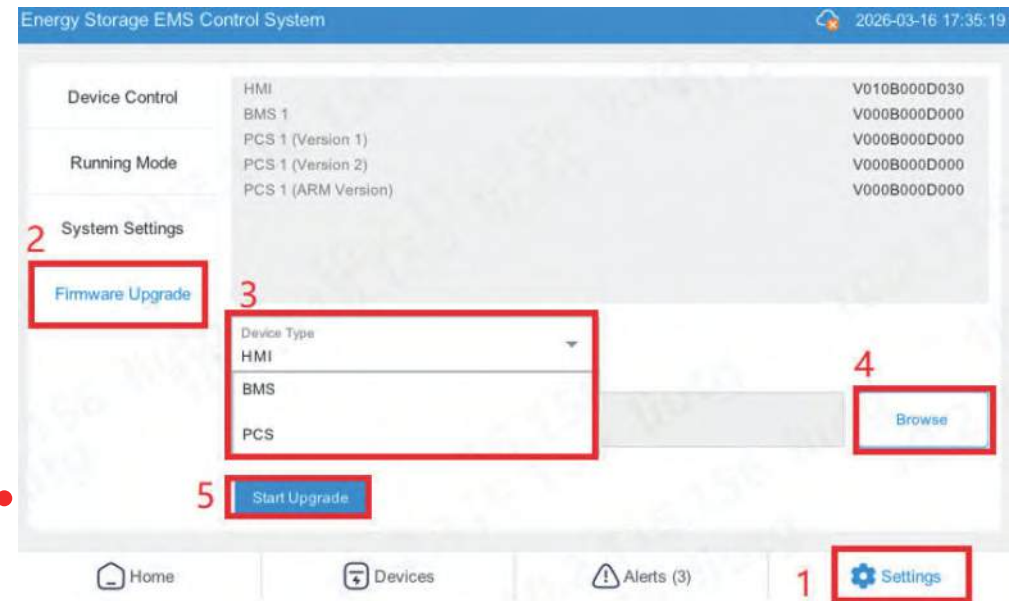
Step 1: Prepare a USB flash drive $\leq 32\text{G}$ and format it as FAT32. Download KSTAR's PCS/BMS/HMI upgrade firmware package to the USB flash drive (HMI corresponds to the EMS upgrade firmware).

Step 2: Go to "Setting"->"Firmware Upgrade", Which device to upgrade, just select the device, type and then select the corresponding file, click to start the upgrade.

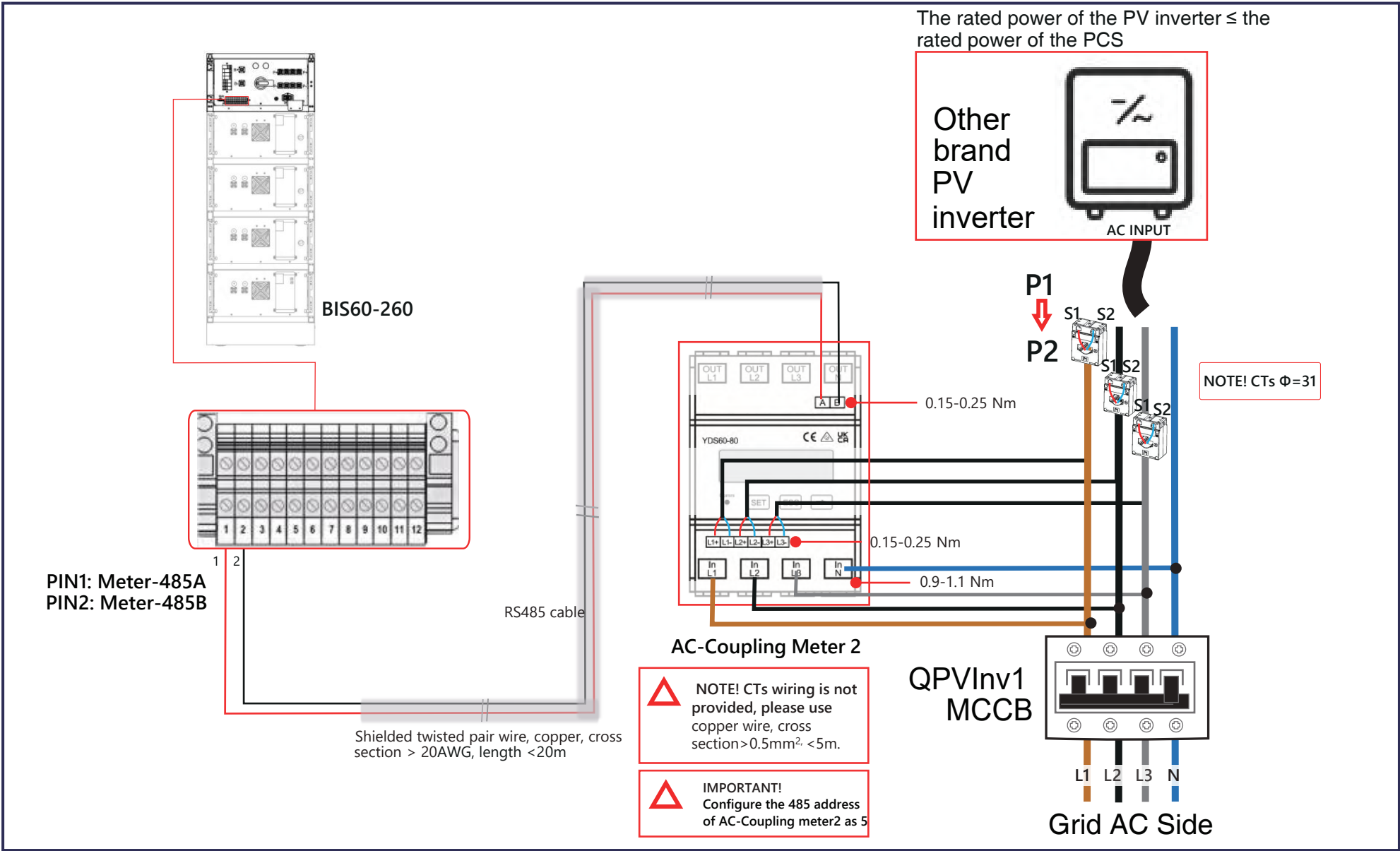


1 USB flash drive

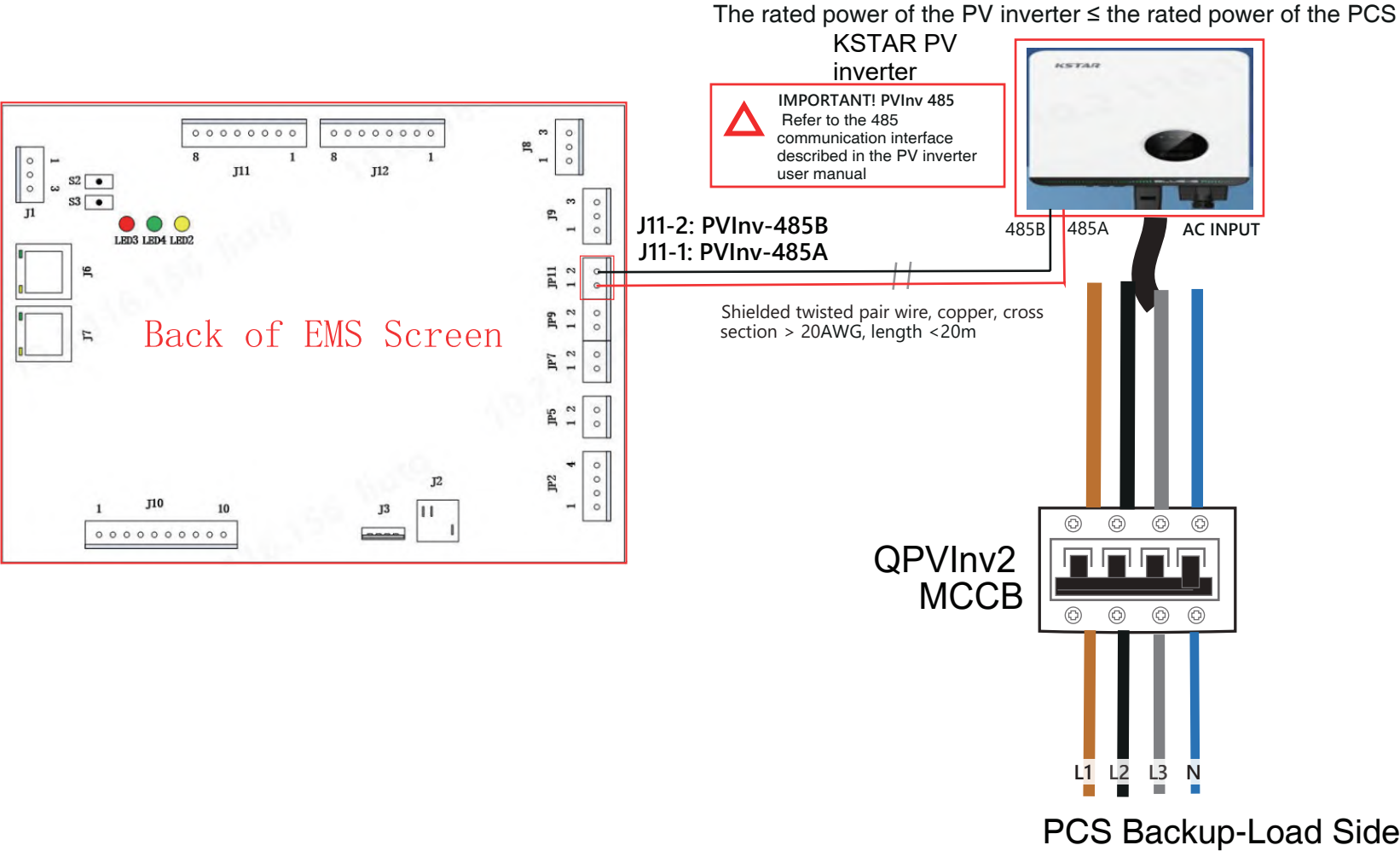
2



Appendix 2: Grid Connection: PV Inverters and AC-Coupled Meters Wiring

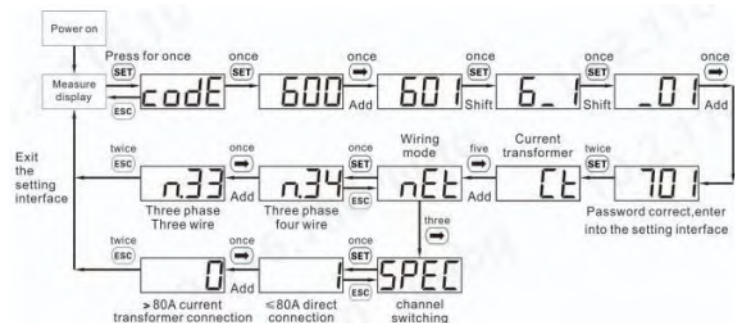


Appendix 3: AC-Coupling of KSTAR-PV Inverter with a Single System on the Backup-Load Side



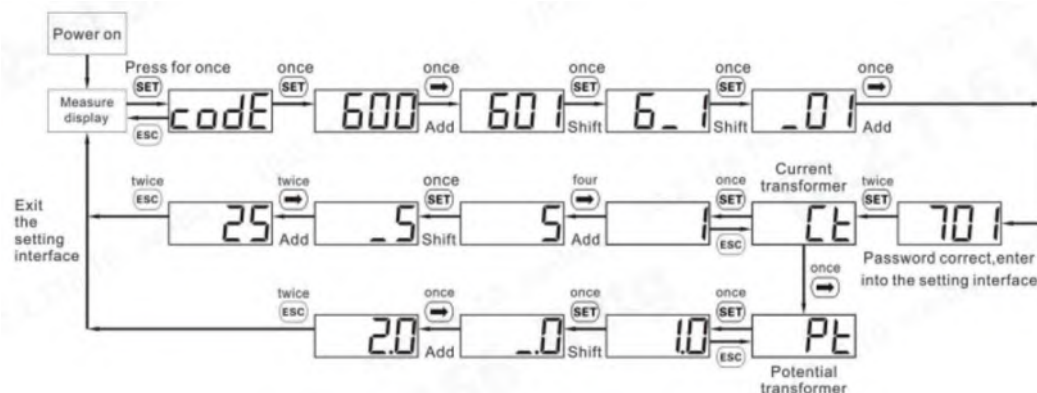
Appendix 4: Meter Settings

Step1: Set wiring mode (three-phase four-wire or three-phase three-wire)and channel switchover (direct connection or current transformer connection)

Set the mode of connection

Set the mode of connection as 3 phases 4 wires: n.34

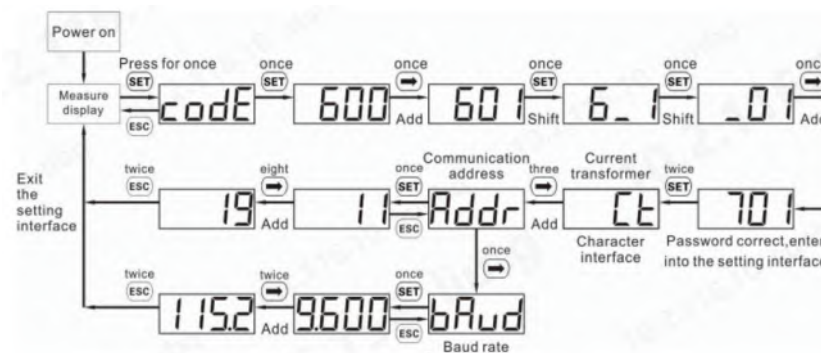
Step2: Set the current transformation ratio or potential transformation ratio:

Set CT ratio

The configuration of our company is 100:1 (optional)

Set this based on the CT ratio at the site:

Step3: Set communication address or baud rate:



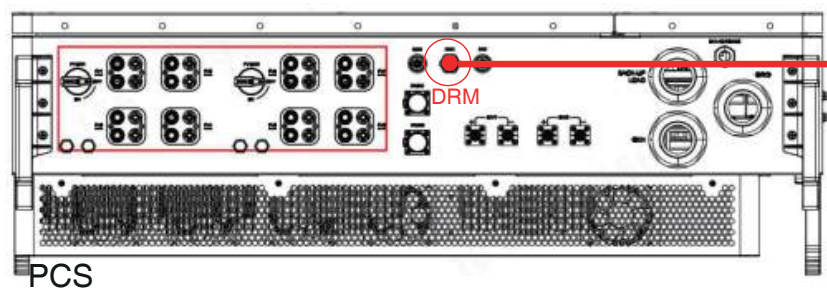
Set the baud rate `bAud` or `Addr`:

Set the baud rate as 19.200

The specific address is selected based on the type of electricity meter on site; Set address: 485 address for the Grid-side meter: 1; 485 address for the PV-side meter: 5

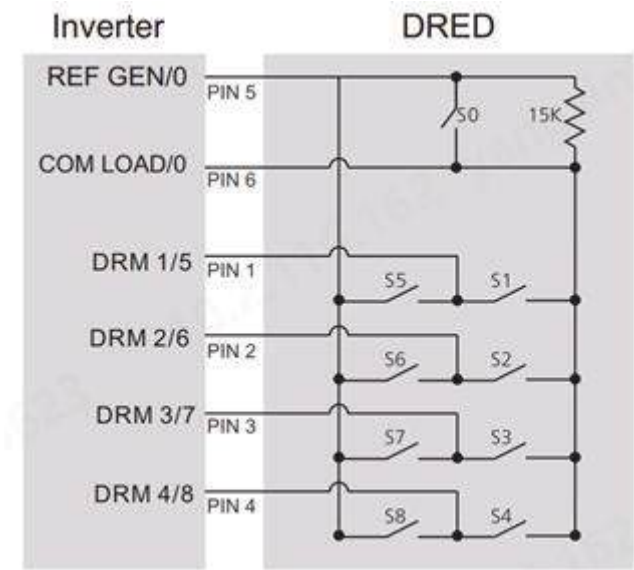
Appendix 5: PCS-DRM Port Wiring & Function Description

The PCS complies with AS/NZS 4777.2:2020 standard. Its DRM port can be connected to a Demand Response Enabling Device (DRED) in Australia or New Zealand or a Radio Ripple Control Receiver (RRCR) in other areas or countries.



PCS-DRM Description

NO.	Network
PIN1	DRM1/5
PIN2	DRM2/6
PIN3	DRM3/7
PIN4	DRM4/8
PIN5	REF GEN/0
PIN6	COM LOAD/0
PIN7	V+
PIN8	V-



Station Overview

Mode	States	Function Description
DRM 0	S0:close	Operate the disconnection device
DRM 1	S1:close	Do not consume power
DRM 2	S2:close	Do not consume at more than 50% of rated power
DRM 3	S3:close	Do not consume at more than 75% of rated power and supply reactive power if capable
DRM 4	S4:close	Increase power consumption (subject to constranins from other active DRMs)
DRM 5	S5:close	Do not generate power
DRM 6	S6:close	Do not generate at more than 50% of rated power
DRM 7	S7:close	Do not generate at more than 75% of rated power and absorb reactive power if capable
DRM 8	S8:close	Increase power generate (subject to constranins from other active DRMs)