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ATESS PCS250S/350S

Bidirectional battery inverter with built-in STS User Manual

Contents

1 Introduction

1.1 Contents

This manual will provide detailed product information and installation instructions for users of the ATESS PCS series energy storage integrated inverter (hereinafter referred to as inverter) of Shenzhen ATESS power Technology Co., Ltd. (hereinafter referred to as ATESS). Please read this manual carefully before using the product and store it in a place convenient for installation, operation and maintenance. Users will not be informed of any modification of this manual by ATESS. The contents of the manual will be updated and revised constantly, and it is inevitable that there is a slight discrepancy or error between the manual and the real product, Please refer to the actual products that you have purchased. Users should contact their local distributors or log in to our website: www.atesspower.com to download and obtain the latest version of the manual.

1.2 Target readers

Qualification:

- Only professional electricians certified by relevant departments can install this product.
- The operator should be fully familiar with the structure and working principle of the entire energy storage system.
- The operator should be fully familiar with this manual.

The operator should be fully familiar with the local standards of the project.

1.3 Symbols

In order to ensure the personal and property safety of the user during installation, or optimally efficient use of this product, symbols are used highlight the information. The following symbols may be used in this manual, please read carefully, in order to make better use of this manual.

	**DANGER** DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates there is potential risk, if not avoided, could result in equipment malfunction and property damage.
	**Caution,risk of electric shock** When battery bank connecting point are exposed, there will be DC voltage in the equipment DC side; and when output breaker is on, there is a potential risk of electric shock.
	**Caution, risk of fire hazard** Suitable for mounting on concrete or other non-combustible surface only.
	**Protective conductor terminal** The inverter has to be firmly grounded to ensure the safety of personnel.
	Risk of electric shock, Energy storage timed discharge Electrical shock danger exists in the capacitor; the cover shall be moved at least 5 minutes later after all powers are disconnected.

2 Safety Instructions

2.1 Notice for use

Inverter installation and service personnel must be trained and familiar with the general safety requirement when working on electrical equipment. Installation and service personnel should also be familiar with the local laws and regulations and safety requirements.

- Read this manual carefully before operation. The equipment will not be under warranty if failing to operate according to this manual.
- Operation on the inverter must be for qualified electrical technician only.
- When inverter operating, don't touch any electrical parts except for the touch-screen.
- All electrical operation must comply with local electrical operation standards.
- Permission from the local utility company is required before installing the energy storage system and only professional personnel are qualified for the operation.

2.2 Installation

Proper installation requires following all the instructions in the user manual involving transportation, mounting, wiring and commissioning. ATESS does not cover warranty for the inverter damage due to failing to use it properly.

The protection level of the inverter is IP20, which is designed for indoor installation.

Please refer to chapter 5 for installation instruction.

Other notice for using the inverter:

> Pay attention to the safety instructions listed here and below

> Pay attention to the user manual of energy storage controller

> Technical data related to equipment shall be considered.

2.3 Important note

Item 1: Static electricity can cause damage to the inverter electrostatic discharge may cause unrecoverable damage to inverter internal components!

When operating the inverter, operator must comply with anti-static protection norms!

Item 2: Restriction

The inverter cannot be directly used to connect the life support equipment and medical equipment!

Item 3: Precautions

Make sure installation tools or other unnecessary items are not left inside the inverter before starting up.

Item 4: Maintenance notice

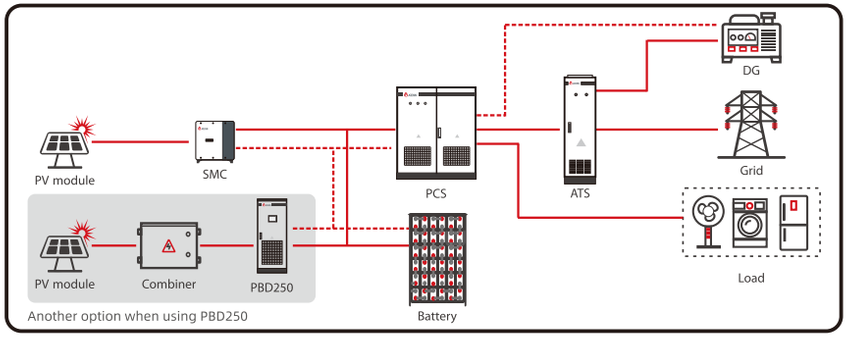
Maintenance can only be carried out after the inverter totally discharged.

Product Description 3

3.1 Bi-directional energy storage inverter

1. PCS series energy storage controller produced by ATESS is a bidirectional battery inverter. Its main function is to store the energy of power grid / oil engine to the battery, or release the stored energy to the power grid or supply load.

2. The energy storage controller can realize seamless switching off the grid and ensure uninterrupted load supply. At the same time, it can be combined with SMC(Smart MPPT Controller) or PBD (photovoltaic DC converter) to charge photovoltaic energy into the battery or output it through inverter of energy storage controller.

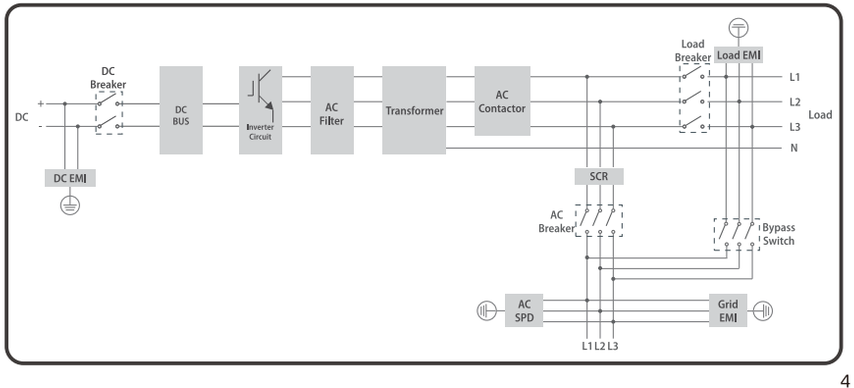


SMC/PBD+PCS system diagram

System Description:

The system stabilizes the power output from the solar panels through a solar charging controller (PBD250 or SMC), and connects to the PCS to convert DC to AC for powering the load or feeding into the grid. It can also charge the battery. If both the utility grid and a diesel generator are connected to the system, an ATS (Automatic Transfer Switch) is required for switching

3.2 Circuit diagram of the inverter



3.3 The layout of the main components

3.3.1 External components

The main external components of the energy storage controller include: LED indicator, LCD touch screen, off-on knob, emergency stop button and other parts.

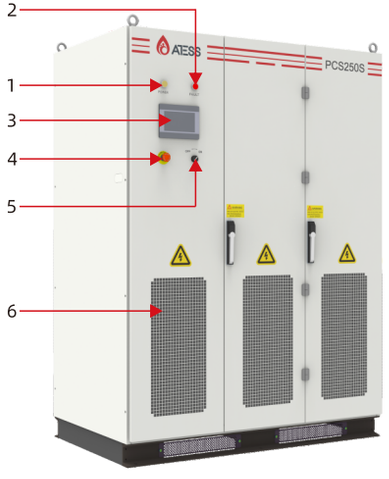


Figure 3-3-1-1 Inverter appearance

No.	Name	Descripition
1	Power indicator	When power supply is normal, the indicator displays yellow.
2	Inverter malfunction indicator	When inverter is faulty, the indicator displays red.
3	touch Screen LCD	Operation information display, receive control command and parameters setting
4	Emergency STOP	Shut down the inverter when pressed down
5	Off-on knob	only control the grid-side switch, and does not control the DC-side switch
6	Dust screen	prevent dust from entering into the inverter

Figure 3-3-1 Part description

Indicator

There are two LED indicators on the inverter which is used to display the current status of the inverter.

Figure 3-3-1-2 LED indicators

Emergency STOP

> The emergency stop button is only used in case of emergency, such as: serious failure in the grid, fire, etc.

Figure 3-3-1-3 Emergency STOP

The emergency stop button immediately disconnects the inverter from both grid and battery, which ensure the safety of the inverter. By pressing the emergency stop button, the device will be locked in the "off" position. Only release the emergency stop button by rotating it clockwise and closing AC, DC breaker, can the inverter resume working normally.

Off-on knob

It is used to start or stop the inverter.

Figure 3-3-1-4 Off-on knob

Touch screen

It displays the inverter's operating parameters, power generation, and faulty information record. Please refer to Section 6, for details.

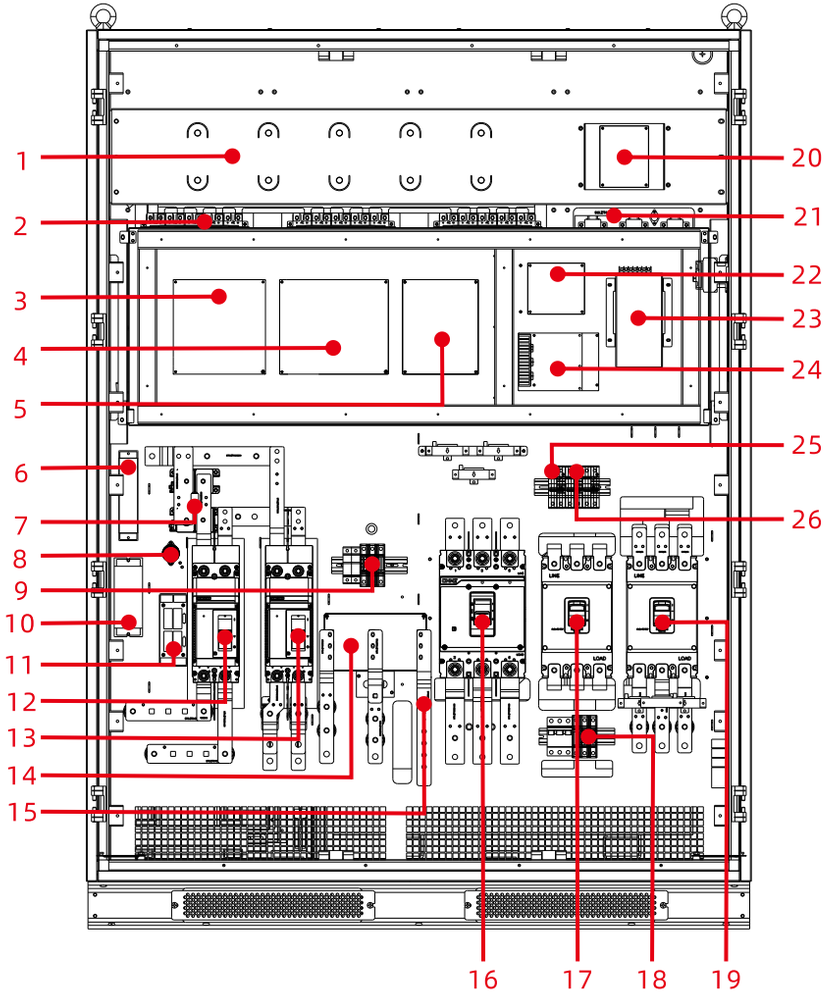
3.3.2 Components at the front

The main components of PCB and AC power supply circuit breaker include lightning protection switch, AC power supply circuit breaker, etc. The layout of different models is different, not all of them can be displayed here, which does not mean that there is no such part.

3.3.2.1 PCS250S and PCS350S main parts overview

NO	Name	Description
1	Capacitance	DC bus capacitance
2	IGBT	Inverter IGBT
3	Sampling board	PCB that samples voltage, current and temperature
4	Control board	Control board
5	Connect Board	Connect Board
6	Aluminum shell resistance 1	DC bus discharge resistance
7	DC main relay	DC main relay
8	DC auxiliary relay	DC auxiliary relay
9	DC lightning protection and lightning protection switch	DC lightning protection and lightning protection switch
10	DC soft-start resistor	Bus voltage soft-start current-limiting resistor
11	DC filter board	Battery voltage filtering
12	Battery circuit breaker	Control the connection of battery and PCS
13	PV input circuit breaker	SMC or PBD access switch
14	N-PE Relay Board	Control of the N line for both grid-connected and off-grid operations
15	PE terminal	Grounding copper bar
16	Gird circuit breaker	Control Gird connection with PCS
17	Bypass circuit breaker	Bypass maintenance switch
18	AC lightning protection and lightning protection switch	Bypass maintenance switch
19	Load circuit breaker	Control Load connection with PCS
20	SCR Driver Board	Control on/off SCR switch
21	SCR	Control on/off grid switch
22	Rectifying board	DC power supply and AC/DC power supply PCB
23	Mingwei power	Power supply module
24	BUCK board	DC Power supply PCB
25	DG dry contact	Control running of DG
26	AC power supply microbreaker	AC power supply microbreaker

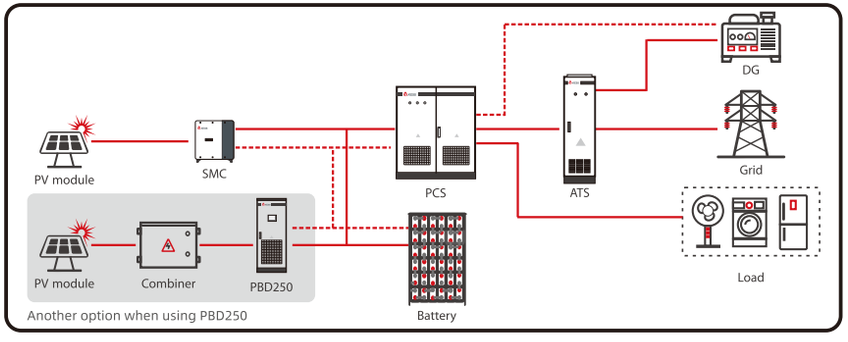
Table-PCS250S and PCS350S main parts overview



PCS250S and PCS350S main parts overview

3.4. Operation mode

1.Please read chapter 7.2.4 for the setting method of operation mode, and set the operation mode on the screen.



System diagram

3.4.1 ON-grid charge and discharge mode

Functions optional in on-grid modes

Anti-reflux (default enable is 0)

When set to 1, enable the anti countercurrent function;

When set to 0, the anti-reflux function is disabled.

1. In case of reverse current prevention, it is forbidden to feed power to the power grid.

2. When the reflux is not prevented, the residual power can feed to the power grid.

3. In DG mode, the anti-reflux function is turned on by default and cannot be closed.

Simultaneous charging enable (default enable is 1)

1. When set to 1, the grid or DG can charge the battery at the same time as the PV.

2. When it is set to 0, the PV will charge the battery first, and the grid or DG will not charge the battery. Power grid or DG can be allowed to supply power when there is no PV battery charging.

Please read chapter 7.2.4 for setting method.

3.4.1.1 Load priority mode

1. When the PV energy is sufficient, PV will supply the load first, and the remaining electricity will be charged to the battery.

2. When the PV power cannot fulfill the load, the battery will discharge automatically. If the battery discharges to the stop discharge set point, the battery will stop discharging and the load will be powered by PV and the grid. In order to protect the battery, the battery will be charged with a small current. When the battery is charged to a recoverable discharge state, the discharge will be resumed.

Stop discharging set point: discharge cut-off voltage, discharge cut-off SOC, see Chapter 7.2.4 for details

Recover discharging set point: Battery saturation and recovery discharge SOC. See Chapter 7.2.4 for details

3.4.1.2 Battery priority mode

1. When the PV energy is sufficient, charge battery first and supply the remaining power to the load;

2. When the PV energy is insufficient, the PV charge the battery first, the load is supplied by the power grid, and the power grid charges the battery at the same time;

3. If the battery is not discharged in the battery priority mode or switched to other modes, in order to maintain the electrochemical activity of the battery, it will enter the battery discharge state after one week of current limiting charging, and the battery discharge power will be calculated according to the battery specification. (it will not discharge to the power grid when anti-reflux).

3.4.1.3 Economic mode

The period of economic mode is divided into peak period, fair period and valley period. Please refer to section 7.2.4 for the setting details.

1. Valley period: working logic is the same to the battery priority mode's.

2. Fair period:

A) When PV energy is sufficient, PV is preferentially used for load, and the residual energy to charge the battery;

B) When PV energy is insufficient, PV and power grid jointly supply load without charging the battery;

C) The battery supply the load without discharging.

3. Peak period:

A) The grid does not charge the battery;

B) When PV energy is sufficient, PV shall supply the load first and the battery shall be charged.

C) When PV energy is insufficient, there are two cases:

(1) If the battery state does not reach the stop discharging set point, PV and battery supply for load.

(2) When the battery state reaches the stop discharging set point, the battery does not discharge, PV and power grid jointly supply the load without charging the battery.

3.4.1.4 Time shifting mode

1. Peak period: There are five time periods on the screen, and the corresponding discharge power value (KW) can be set for each time period. When reaches the set time, it will discharge automatically based on the set value.

2. Fair period: the screen can be set for 5 time periods, and the battery will not be charged or discharged during the set time period.

3. Valley period: the screen can be set for 5 periods, and the corresponding charging power value (KW) can be set for each period. When reaches the set time, it will discharge automatically based on the set value.

4. Time segments cannot overlap or be omitted.

5. For details about how to set a time range, see 7.2.4.

3.4.1.5 EMS MODE

Description:

1. In EMS mode, the PCS is controlled by EMS management system and has no operation logic itself, and the power is controlled by EMS command;

2. The power transmitted under EMS mode is still limited by the screen setting value;

3. It needs to be used with EMS;

3.4.2 Off-grid mode

1. When there is no power grid or the DG is connected, the PCS will automatically switch to off grid mode.

2. In off grid mode, when the PV energy is sufficient, the PV will power the load first and charge the battery.

3. In off grid mode, when PV energy is insufficient, the battery will automatically discharge and supply the load.

4. When the power grid or DG is restored, the inverter will automatically switch to on-grid mode or DG mode.

3.4.3 DG mode

1. In off grid mode, if the inverter is connected to the DG and the DG enable is set to 1, when the battery discharges to the stop discharge setting point, the inverter sends a dry contact signal to start the DG. After the DG is successfully connected, it enters DG mode. Now the DG supplies power to the load; Meanwhile, the inverter stops supplying power to the load and only charges the battery.

2. When the battery reaches the preset point of stopping DG, the inverter will stop the dry contact signal, the DG will be switched off and inverter will switch to off-grid mode.

● Start the DG set point: SOC lower limit, discharge cut-off voltage, see Chapter 7.2.4 for details

● Turn off the DG set point: SOC upper limit, floating charge current limit point settings. See Chapter 7.2.4 for details.

3.4.5 PV charge

1. In off-grid mode and PBD or SMC or SMC is connected to the system, when the battery discharges to the stop discharging set point and no power grid or DG is connected, the battery continues to discharge to the undervoltage alarm point and enters the PV charge mode.

2. In PV charge mode, the PCS stops AC output and only keeps the PBD or SMC charging the battery.

3. In PV charge mode, the PBD or SMC continues to charge, and the battery state returns to the setting point of "PV charge to off-grid", and automatically switches to off-grid mode.

4. In PV charge mode, when the power grid/DG is connected, immediately exit the PV charge mode and enter the grid-connected/DG mode.

3.4.6 Fault mode

When the inverter fails, the contactor on AC and DC sides will immediately disconnect and shut down the inverter, so as to ensure the system safety. At this time, the inverter will continuously monitor whether the fault is eliminated, If not, it will maintain the fault state; after eliminated, it will restart automatically.

3.4.7 Permanent failure mode

When the inverter has a serious fault, the contactor on AC and DC sides will immediately disconnect and enter a permanent fault state to ensure safety of the system. When permanent fault is detected three times in a row, all switches will be disconnected. For example, the IGBT module of the inverter is faulty. When inverter enters this permanent failure mode, please do not repair it without permission. You should contact the personnel of the local dealer or call ATESS for help.

3.5 Dimensions and weight

Model	PCS250S	PCS350S
Dimension (W*H*Dmm)	1400/1900/850	
Weight(KG)	1460	1524

Figure--Net Demensions and weight of PCS

3.7 Packing information

NO	Name	Unit	Qty.	Note
1	PCS	unit	1	Key included
2	User manual	pcs	1	
3	Certificate	pcs	1	
4	Factory test report	pcs	1	
5	Accessories	pcs	1	Communication lines etc.

Figure--Packing information

Transportation and Storage 4

4.1 Transportation

Transportation should follow the transportation methods described in the user manual. The inverter's weight and center of gravity should be taken into account

Caution, risk of danger

During transportation, lifting equipment and personnel must be qualified. The inverter should be placed vertically and the inclination cannot be more than 10 degrees. It is not allowed to place the inverter upside down or transport in a horizontal position.Incorrect lifting and transportation can lead to serious injury, property loss and damage to the inverter.

4.2 Inspection and storage

The inverter should be carefully checked before signing the document from the transportation company. Check the received items against delivery note, and if there is any defect or damage, immediately notify the transportation company. If necessary, you can seek help from ATESS Customer Service department.

Caution

ATESS PCS can only be stored when it is stopped and all the doors are closed in a dry room to protect the internal circuits against dust and moisture.

5 Installation

5.1 Installation condition requirements

To ensure normal operation of the machine, the installation environment is required as follows:

- The ingress protection of inverter is IP20. Moreover, as this product is an electronic equipment, it shall not be placed in humid environment.
- Install indoors and avoid sunlight and rain.
- Ventilation of the room shall be good.
- The installation environment shall be clean.
- As some noise will be produced in operation, this equipment shall be installed far from residential quarters.
- The installation ground shall be even enough, and firm enough to support the weight of inverter.
- The installation position shall be convenient for maintenance.
- Ambient temperature range: -25°C~55°C.
- Appropriate space shall be reserved for the machine to ensure ventilation and cooling.

We suggest inverter is installed in the distribution room. The floor, wall clearance, Ventilation equipment and precaution should be designed by professional personnel and satisfy the following requirements.

● Foundation requirement

Inverter is required to install on even ground with fire-retardant material as the

surface or channel steel support structure, and sag or tilt ground is prohibited. The foundation shall be solid, safe and reliable. The foundation shall be capable of bearing the load of the inverter. Its load bearing ability shall be concerned throughout the installation place selection.

● Clearance space

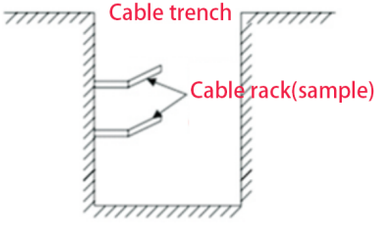
During installation of the inverter, appropriate space shall be left to the wall or other

equipment, in order to satisfy the requirements on narrowest maintenance channel, emergency access and ventilation.

In front of the installation place of inverter, a space of 0.8m or more shall be ensured, the back 0.8m or more, the top 0.8m or more to ensure easy installation, cooling and maintenance.

● Cable trench

The cable connection of inverter adopts bottom inlet and bottom outlet. Cable trenches are recommended to ensure easy installation and maintenance.



The cable trenches are often designed and constructed by the construction side based on relevant standards, with the equipment weight and dimensions required to be considered. Good electrical connection is needed between different cable trenches and GND terminals.

● Wiring specification

Cables in the inverter can be classified into either power cables or data cables. In cabling, the power cable shall be kept far away from, and the cable shall be kept in right angle at cross. The cable shall be as short as possible, and an appropriate distance shall be kept to the power cable. It is recommended that the insulation impedance of BT + and BT - at DC end to ground to be higher than 1m.

The power cable and data access shall be placed in different cable trenches respectively to avoid lengthy routing between the power cable and other cables, so as to reduce the electromagnetic interruption caused by sudden change of the output voltage. The distance among the power cable and data access shall be more than 0.2m. When the cables are crossed, the cross angle shall be 90 degrees, while the distance can be reduced appropriately.

● Ventilation requirement

In operation, inverter will produce a lot of heat. When ambient temperature is too high, the electrical property of the equipment may be affected, the equipment may even be damaged. Therefore, the heat release shall be fully considered in designing the control room to ensure operation of the equipment in high efficiency.

● Ventilation environment

To satisfy the ventilation requirement of inverter, its installation environment shall meet the following conditions:

※ Inverter shall be prevented from being installed in the place of poor ventilation

condition and insufficient air flow;

※ The air inlet shall have enough air supplementation.

● Ventilation equipment

To ensure safe and reliable operation of the equipment, the ambient temperature must be within the permission range -25°C~ 55°C, therefore, appropriate ventilation devices must be equipped with to release the heat generated by the equipment.

1. There must be ventilation equipment inside the distribution room to ensure release of the waste heat generated by the inverter from the equipment, and allow for maximum ambient environment temperature. This can be realized from installation of exhaust devices;

2. Another fan can be added at the air duct outlet to exhaust the air out and ensure balanced pressure;

3. The direction of the air outlet shall be selected according to the local actual wind direction;

4. Pay attention to the dustproof measures and waterproof design at the air inlet and outlet;

5. If more air ducts are required, its dimensions shall be designed by the professionals according to the air output amount.

● Other protections

With IP20 of protection level, inverter is appropriate to be installed in dry and clean environment. Meanwhile, water leakage of the house shall be prevented, as it may damage the inverter. According to EMC requirement and noise level, the inverter shall be installed in industrial environment.

5.2 Tools and spare parts required for whole machine installation

Tools and spare parts required for installation is as follows:

Hoisting crane, forklift or fork lift truck (with the capacity for bearing the weight of the inverter)

- Torque wrench
- Screwdriver
- Wire stripper
- Terminal crimping machine
- Heat dryer
- Megger and multimeter

5.3 Mechanical installation

5.3.1 Transportation of packaged whole machine

This inverter is transported as an integrated unit, and the user can hoist it from the bottom with a forklift, or move it with a hoisting crane or crane.

Note 1: The inverter is integrated and cannot be dissembled either in transportation or installation. Any fault attributed to modification unauthorized by the ATESS is beyond the quality assurance.

Note 2: In movement, tilt, violent shake or sudden force upon the inverter shall be prevented, such as sudden down of lifting.

Note 3: Please read carefully the labeled parameters to select an appropriate transportation means and storage place.

We suggest the user make use of forklift to move the inverter if possible.

Before the inverter is moved to the designated place, we suggest to lay the DC input cable and AC main power supply cable. As these cables are relatively thick, they are hard to be cabled after the inverter is installed.

To keep the equipment in a better protective status, please adopt transportation with package as much as possible, and comply with the labels printed on the package in transportation:

Sign	Indication
	The gravity centre
	Lifting logo
	Face up to prohibit the inverter horizontally, tilted or upside down
	Handle with care, to avoid the transport environment too intense collision friction damage to the inverter
	Keep away from moisture

Inverters whose packages are not demolished can be moved with forklift, hoisting crane or crane. In moving, attention shall be paid to the weight painted on the package to ensure enough load capacity of the devices. As the gravity center of the equipment locates at the lower place symmetrical in front and back and left and right, the support point or hoisting point shall be arranged reasonably in transportation.

The forklift transportation is the standard one. The gravity center of the cabinet in transportation should locate between two forks of the forklift. The big-size inverter may block driver's sight, and it shall be treated with cooperation of the aid personnel.

5.3.2 Movement and installation of bare machine

● Demolish the package of inverter

Please demolish the packaged cabinet of the equipment according to the following procedures:

Procedure 1: Demolish the wood side and roof of the packaged cabinet

Procedure 2: Demolish the out-set package material on the machine

Procedure 3: Demolish the fastening screws between the machine and the pallet

① Demolish the front and back cover lids of the pedestal.

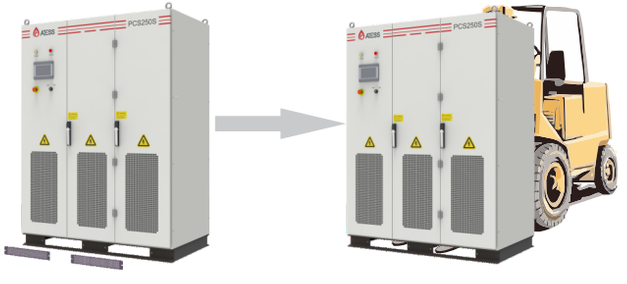
② Screw off the hold-down nuts at the bottom of the wood pallet.

③ Remove the screws, and the inverter will depart from the wood pallet.

● Movement and installation of bear machine

The inverter with demolished package can be moved with forklift, hoisting crane, slide rail or crane. If the package demolished place is far from the final installation place, it can be transported with forklift containing wood pallet.

If the wooden pallet at the bottom of the machine has been removed, when using the forklift, the front and rear cover plates of the base need to be removed first, and the center of gravity should be placed in the middle of the two forklifts, and then start lifting and transporting, as shown in the following figure:



Caution, risk of danger

We must act slowly and gently when transporting the inverter with forklift to avoid violent vibration of the inverter or collision with other objects.

If lifting method is used for moving, please pay attention to the lifting position, ensure that the lifting angle is 70°, and be cautious of the center of gravity position of the inverter.

NOTE:

- It is necessary to always pay attention to the position of the center of gravity of inverter.
- Take necessary auxiliary measures to ensure the safety of transportation personnel
- Take necessary auxiliary measures to ensure that the equipment is delivered to the final installation site.

5.4 Electrical installation

5.4.1 Input and output requirements

Caution, risk of danger

- There is a danger of electrical shock of high voltage in inverter's operation; only electricians of professional skills can operate.
- All connections with this equipment shall be done under non-voltage state.
- The inverter may be damaged if input or output terminal is incorrectly plugged. Failure of acting upon this information may cause serious personnel injury or significant property loss even to death.

● Battery

The PCS250S and PCS350S battery operating voltage is 600V- 900V. The battery voltage sould be not lower than 600V and not higher than 900V.

● PV module

Using SMC: The maximum MPPT working voltage of PV module should not be more than 1300V and the open circuit voltage should not exceed 1500V, otherwise the equipment will be in over-voltage protection state and cannot work normally. The MPPT voltage range of should be within 900V~1300V, which means the minimum PV working voltage shall not be lower than 900V. And unde the rated power, maximum working voltage shall not be higher than 1300V.

The maximum MPPT working voltage of PV module should not be more than 820V and the open circuit voltage should not exceed 1000V, otherwise the equipment will be in over-voltage protection state and cannot work normally. The MPPT voltage range of should be within 480V-800V, which means the minimum PV working voltage shall not be lower than 480V. And under the rated power, maximum working voltage shall not be higher than 800V.

● PV and battery configuration

The MPPT voltage shall be greater than the maximum voltage of the battery, otherwise, the battery cannot be fully charged by PV power. However, it is suggested that the voltage difference not be too large, or it will speed up the machine wearing and the reduce efficiency. The best configuration is that the voltage of MPPT is 100V higher than the maximum battery voltage.

● Three phase grid connection

The inverter will constantly detect whether the power grid meets the grid connection conditions. The grid connection requirements of various countries may be different. The protection parameters of the inverter can be set. For details, please refer to the local grid connection regulations. The power grid is a three-phase power grid. Plus, the installation shall be approved by the local power department.

Model	PCS250S/PCS350S
Grid voltage limit	360V-440V
Grid frequency limit	45Hz-55Hz/55Hz-65Hz

● Cable requirements

1. Please select the corresponding withstand voltage cable according to the voltage level.

2. Because different voltage will lead to change of current, please calculate the corresponding cable diameter according to the actual voltage range. The following table only provides the cable requirements of the lowest working voltage and rated power. In actual application, it should be calculated according to the actual voltage, please inquire the after-sales staff of ATESS if you need more details.

The cables should be calculated according to the actual voltage, or you could contact ATESS.

Cable	Requirements for bus diameter	
Model	PCS250S	PCS350S
Battery	70mm²*2	120mm²*2
AC output	70mm²*2	120mm²*2
N line	70mm²*2	120mm²*2
Ground line	The diameter of the ground cable should not be less than half of the cross-sectional area of the AC output cable	
Communication line	Shielding wire: ≥0.75mm²	

5.4.2 DC side wiring

Caution, risk of danger

The positive and negative of the battery shall not be connected in reverse. A multimeter shall be used to determine the polarity first, and then connect into the corresponding input ends of the battery.

Specific procedures are as follows:

1) Cut off the distribution circuit breaker at the DC side, and ensure that no voltage on the wire at DC side.

2) Use a multimeter to measure the open circuit voltage of the battery to ensure that it is within the allowed range.

3) Determine the positive and negative pole of the battery with a multimeter.

4) Strip off the insulation skin at the end of the cable.

5) Crimp the wiring copper nose.

1. Put the stripped copper core into the crimping hole of the copper nose.

2. Connect the copper nose at both ends of the wiring firmly to the "battery input +" end of the inverter and the positive pole of the battery.

3. Tighten the bolts with a screwdriver or wrench.

8)Connect the "battery input -" end of the inverter to the negative pole of the battery by cable according to the method of step 7.

9) Please be sure that all wiring are fastened.

5.4.3 AC side wiring

Caution, risk of danger

When connecting the AC grid, cut off the circuit breaker at the AC side to ensure that the AC wire connecting to terminals has no electricity.

1) Cut off the circuit breaker at AC side, to ensure that the AC wire connecting to terminals has no electricity. Confirm it with a multimeter.

2)Ensure that the wiring phase sequence at AC side is in consistent with the phase sequence at grid side.

3)Strip the insulation skin off at the end of the cable

4)Crimping copper nose

1. Put the exposed copper core of the stripped wire head into the crimping hole of the copper nose.

2. Use the terminal crimper to compress the copper nose of the wiring, and the number of crimping shall be more than two.

5)Install the shrink fit sleeve.

1. Select the heat shrinkable sleeve which is more consistent with the cable size, length is about 5cm.

2. The heat shrinkable sleeve shall be sleeved on the copper nose of the wiring to completely cover the wire pressing hole of the copper nose.

3. Use a heat blower to tighten the heat shrink sleeve.

6)Connect "L1" cable to "L1" terminal on grid breaker. Select the bolts that match the copper nose.

7) Connect the AC output "L2" to the power grid switch "L2" as described in Step 6. Connect "L3" of AC output to power grid switch "L3"; Connect N wire to the N bar on PCS.

5.4.4 Earthing

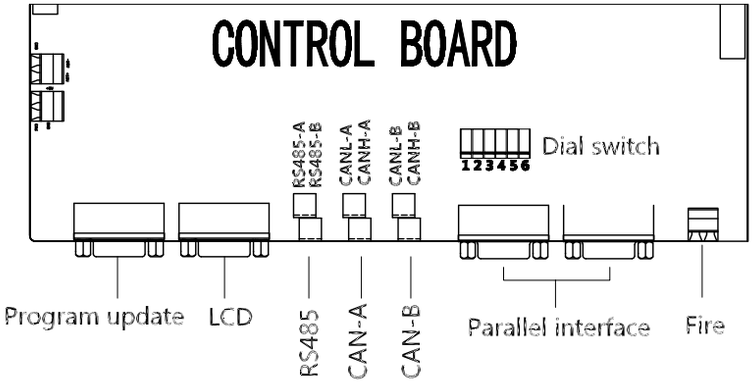
Inverter must be earthing well for safety; Please make sure of the connection between PE in power distribution cabinet and PE copper in the inverter good; and make sure the earthing cable more than half of load cable, and earthing resistance is not lower than 4Ω.

All wiring into the channel at the bottom of the inverter to be all the wiring is completed, the connection port must be sealed with dust cotton, to prevent dust from entering the inside of the inverter.

Connect several connecting wires on the PE copper bar as some parts inside the energy storage controller need to be grounded, please do not change them without permission, so as to avoid electric shock

5.5 Communication

The PCS adopts various communication modes. The figure below is the diagram of the communication port of the control board.



Description of dial switch:

The dial switch is a connection control switch with communication matching resistance (120 Ω). "On" indicates connection resistance and "off" indicates no connection with the resistance.

No.	Name	Description
1	485	485 matching resistance
2	CANA	CAN matching resistance
3	CANB	CAN matching resistance
4	M-S	Parallel matching resistance
5	ON-OFF	
6	MMS	

1. RS485 communication

Multiple inverters communicate with each other through RS485 line, and finally transmitted to the monitoring server through the Shinemaster / EnerLog via Ethernet, which can remotely moniter the operation status and data of single / multiple inverter(s) in real time. Both ends of the RS485 communication line are connected with terminals, and the terminals at both ends are connected in parallel. The length of the line shall not exceed 1000m. It is recommended to use a special shielded communication line.

The RS485 interface of the inverter is located on the internal control board of the machine. Please distinguish "A" and "B". The wrong connection will lead to communication failure.

1. RS485 communication

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● The RS485 interface of the inverter is located on the internal control board of the machine. Please distinguish "A" and "B". The wrong connection will lead to communication failure.

● If Shinemaster / Enerlog is not used for monitoring, the user's own monitoring equipment needs to be compatible with the RS485 communication protocol of ATESS.

● For the same 485 bus, only 120Ω matching resistance needs to be connected from end to end. Please set the dial switch according to the field installation.

2. BMS-CAN communication

● When the PCS works with battery with BMS management system, it needs to communicate with BMS through CAN communication. The CAN communication interface of BMS is connected to CAN-A interface of the PCS, communication can be realized after docking the communication protocol.

● Terminals are used at both ends of the CAN communication line. The terminals at both ends are connected in parallel to make the can communication line. It is recommended to use a special shielded communication line to reduce communication interference and improve the operation stability of the system.

● The CAN-A interface is on the internal control board of the inverter. Please distinguish between "L" and "H". Incorrect connection will lead to communication failure.

● If the user does not use the BMS battery system produced by ATESS, the user's own BMS battery system needs to be compatible with the BMS communication protocol of ATESS.

● For the same CAN bus, just connect 120Ω matching resistance from end to end. Please set the dial switch according to the field installation.

3. PBD or SMC - CAN communication

● PCS is used with PBD or SMC and needs to communicate with it, and the CAN-B communication interface of PBD or SMC is connected to can-B of the PCS.

● PBD or SMC is in the same position as the communication interface of the PCS. Please distinguish "L" and "H". Incorrect connection leads to failure of normal communication.

● For the same CAN bus, 120Ω matching resistance needs to be connected from end to end. Configure the dial switch according to the site installation.

Parallel communication (parallel customized)

● When the same PCS models connect in parallel, the parallel communication line should be connected, which is supplied along with each PCS. The parallel ports of the two PCS are connected using the parallel communication line.

The control board has two parallel ports, either one can be connected, the two ports are exactly the same.

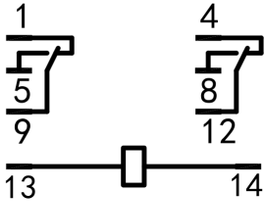
● The dial switch 4, 5 and 6 should be switched to "ON" for the first and the last PCS in the parallel system .

● When no other device is connected to the CAN-B bus in the system, the dial switch 3 of first and the last PCS in the parallel system must also be switched to "ON". If the bus is equipped with other devices, ensure that there are resistors at each end of the bus. Set the dial switch based on the site condition.

As Parallel function is a special customized function, please use it under the guidance of ATESS staff.

5.6 Diesel generator dry contact wiring

The inverter has a passive dry contact contactor to control the diesel generator, and the following is the dry contact structure diagram (initial state).



Wiring instructions:

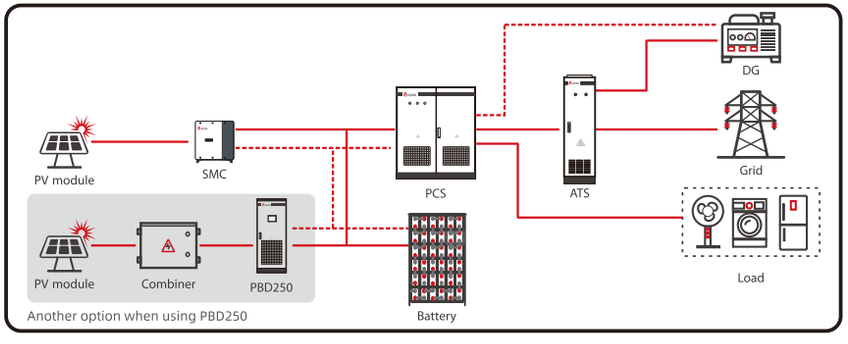
1. "13" and "14" are the dry contact contactor power supply, which has been connected before delivery.

2. There are two groups of dry contacts: 1, 5, and 9 are a group, and 4, 8, and 12 are a group. The two groups work simultaneously.

3. The initial state is that when the PCS does not send the command to start the DG, the state between "1" and "9" is closed, and the state between "5" and "9" is open. When the PCS sends the command to start the DG, "1" and "9" are converted from closed to open, and "5" and "9" are converted from open to closed. "4" and "8" and "12" are the same.

4. When the current needs to pass through the dry contact, the AC voltage does not exceed 240V, the DC voltage does not exceed 28V, and the current does not exceed 5A.

5.7 Energy storage system wiring and communication wiring



5.7.2 Wire connection of parallel system and CAN communication wire

● **Parallel system:**

1. The same PCS model is connected in parallel with the AC output suppling load at the same time, running in the same mode.

2. Parallel means when off-grid parallel, in which multiple PCS maintain the same AC frequency, amplitude and phase.

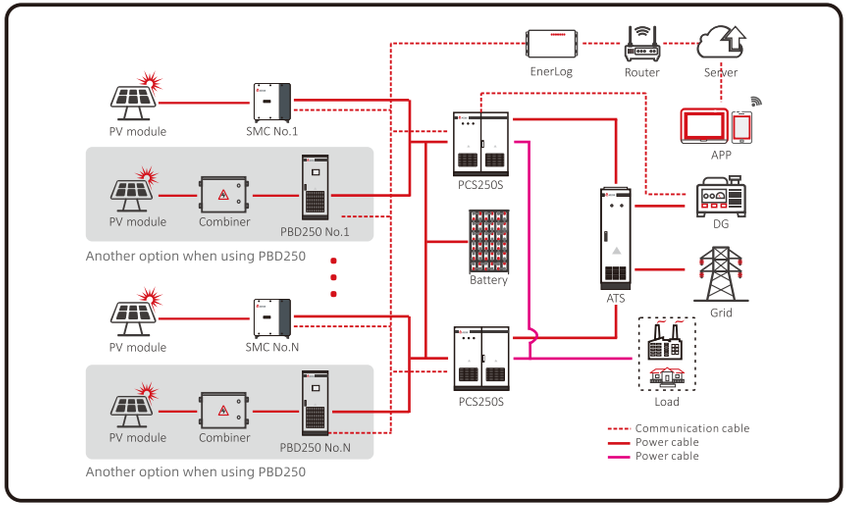
● **System requirements:**

1. The PCS must be of the same model.

2. To ensure the stable running of the system, ensure that the configurations of each machine are consistent.

3. The parallel system needs to communicate, so all devices must be installed in adjacent positions.

For example, the wiring diagram of the system with two parallel PCSs and four PBD or SMCs is as follows:



● **Wiring instructions:**

1. To reduce circulation loss, it is recommended to share batteries. If the shared battery is selected and the battery is equipped with BMS, all devices (PCS and PBD or SMC) need to communicate with the battery.

2. Multiple devices share power grid and DG. When automatic switching function of power grid /DG is required, it needs to be used with bypass cabinet.

3. The parallel system is equipped with dedicated communication ports and cables to connect the communication ports of parallel devices.

4. To ensure the communication quality, the devices must be installed in the same position to reduce the communication distance. The length of the communication cable we supply is 5 meters.

5. The length of the AC cable to the convergence point on each machine must be the same; otherwise, power distribution may be unbalanced.

● **Working mode:**

The working mode of the parallel system is the same as that of the single system, but the working mode of each device must be set to the same.

Redundancy is optional for parallel systems.

Description of redundancy function selection:

Redundancy can be selected only when one device fails and the other devices can still drive all the loads. Otherwise, the device will be overloaded.

Note: Parallel machine is a special function, standard machine may not be equipped with this function, please contact ATESS staff in advance if you need this function.

Installation requirements for parallel systems are high. Before installation, contact ATESS for installation and testing to ensure the correct operation of parallel systems.

6 Commissioning

6.1 Inspection before operation

Before the inverter is put into operation, its installation shall be inspected. At least two staff do the inspection according to the items listed below to ensure the correctness of the installation.

Inspection items for installation

- There is no deformation or damage to the inverter.
- Bottom of the inverter is fixed securely, the foundation support is stable and reliable.
- There is enough space around the inverter.
- The temperature, humidity and ventilation conditions of the environment where the inverter is located meet the requirements.
- There is enough cooling air for ventilation.
- Cabinet sealing protection is complete and reliable

Electrical inspection

- Inverter is grounded completely and firmly.
- The grid voltage matches the rated output voltage of the inverter.
- The phase sequence of grid connection is correct, and the tightening torque meets the requirements.
- The positive and negative poles of DC input connection are correct, and the tightening torque meets the requirements.
- Communication wiring shall be correct and keep a certain distance from other cables.
- Cable number is marked correctly and clearly.
- The insulation protection cover is complete and reliable, and the danger warning label is clear and firm.

Other inspection

- All useless conductive parts shall be tied with insulating ties.
- There are no tools, parts, conductive dust or other foreign matters left inside the cabinet.
- There is no condensation of moisture or ice in the cabinet

6.2 Power on steps

Energy storage controller adopts the integrated AC and DC power supply method, and LCD can be lit when there is AC or DC alone.

- **Battery power supply**

The battery can be used for the first time power-on. When the battery breaker is closed, the LCD should be on.

- **AC power supply**

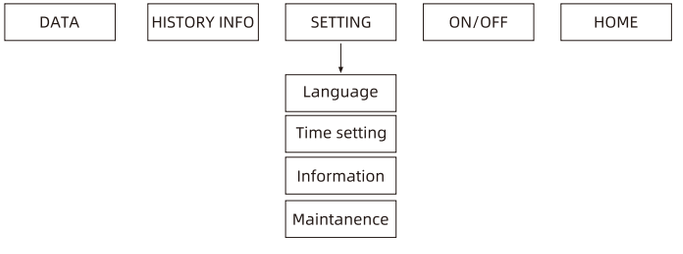
AC power supply can be used for the first time power-on. Turn on AC input switch, bypass switch, AC output switch and the micro breaks, LCD should be on. When the energy storage controller is powered by AC, as long as the battery voltage is detected to be abnormal for more than 10 minutes, all circuit breakers except bypass will be switched off, and inverter won't be able to start and operate when powered by AC source alone. After LCD is lighten by AC power supply, the bypass switch must be off before the machine turns on.

It is recommended to use batteries to light up the screen. After power on, please do not switch the power-on knob immediately. Please check the historical information page and check whether the operation setting is in line with the actual situation. Please refer to Chapter 7 for details.

GUI Instruction 7

7.1 LCD display screen introduction

User can view the information of the PCS operation on the LCD touch screen, as well as setting the operating parameters. In order to facilitate the operation, a menu is provided below.



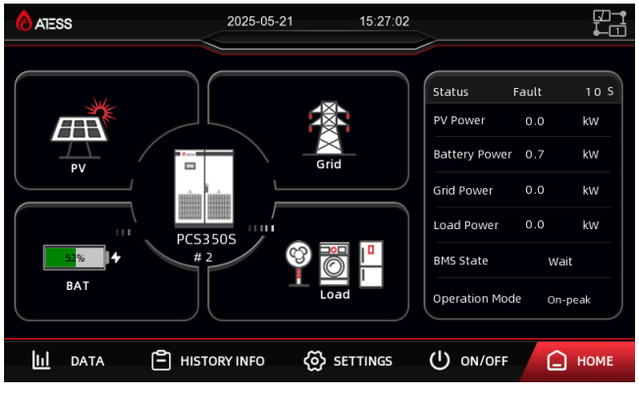
PCS LCD Menu logical structure

7.2 LCD operation

7.2.1 Home page

When powered or clicking “Home” button in any interface will enter into the Home page.

The operating status of the inverter output power, safety standard, model, input and output voltage,current information can be viewed in the page. Pressing the following key can switch to other pages.



Operation status	Description
Fault	Not started or failed to start
Wait	Start initialization
Check	System self checking
Permanent fault	Serious failure occurred
Off grid mode	Off grid mode with load
On grid mode	Successfully connected to grid
PV charge	PV only charging mode
Parallel to off-grid	Parallel system waiting to enter off-grid mode
Parallel to on-grid	Parallel system waiting to enter on-grid mode

Communication station number: the number represents the current station number, which is 485 communication station number. The "√ " above the number indicates that the LCD and the control board communicate normally, and when the display is "×", it indicates that the communication is lost.

On-Grid mode: when the operation state of PCS is on-grid, the current On-Grid mode will be displayed: load priority, battery priority, economic mode, EMS mode and diesel generator mode.

BMS status: when it works with lithium battery with BMS, the current BMS status is displayed here. "Wait" is displayed when there is no BMS communication.

7.2.2 ON/OFF interface

Clicking “ON/OFF” button in any interface will enter into this interface.

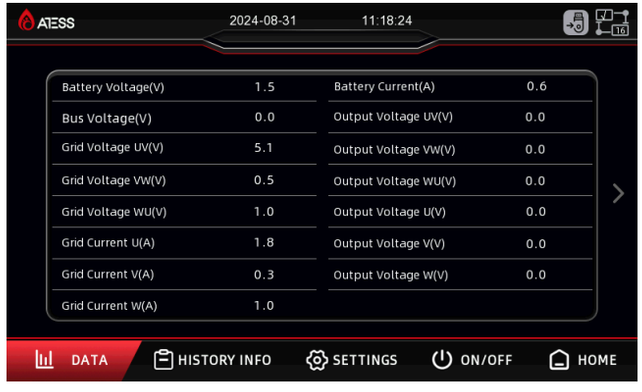
There are “ON” and “OFF” button which is used to turn on and turn off PCS.

Turn on: turn the start knob to on and click "on" to start up successfully.

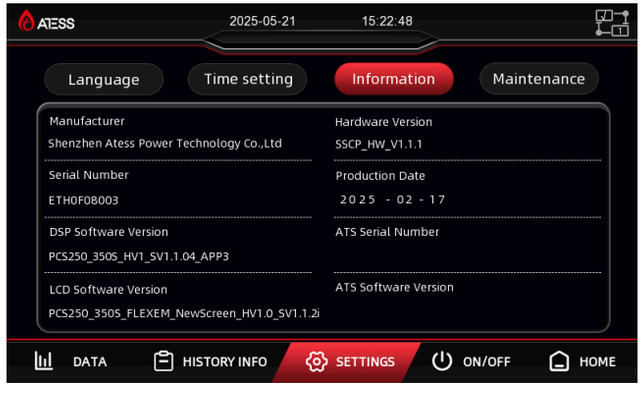
Turn off: shut down by clicking "off", or turn the start / stop knob to off directly.

If PCS will be turned off for a long time, use the off-on knob to shut it down.

Operation data: display the current parameters and real-time data of energy storage power generation, including grid voltage, grid frequency, grid current, DC input voltage, DC input current, temperature in the case and total generation time (real-time update).



Product Information: This page shows the manufacturer, PCS serial number, hardware and software version information, and the date of manufacturing.

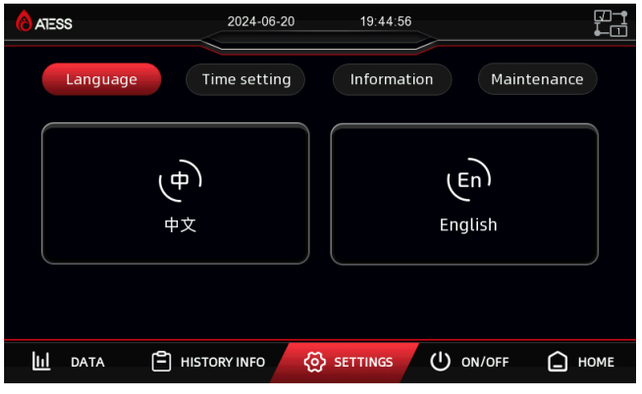


7.2.3 System setting

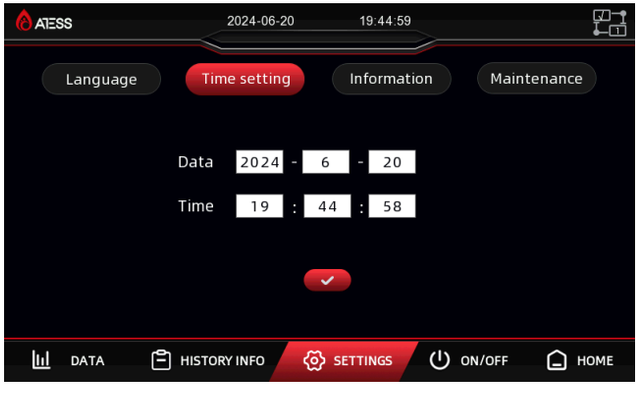
Clicking “Setting” button in any interface will enter into this interface.

Submenu: language , time settings, information, maintenance. Pressing the left button can enter into the corresponding submenu interface. The default one is language setting interface.

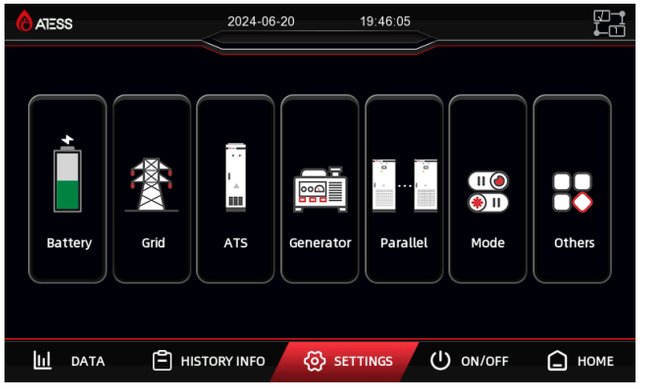
Language Settings: Select language, currently it only supports Chinese, English.



Time setting: system time setting (if the date and time displayed on LCD is not inconsistent with the actual date and time, they can be modified here).



1. Maintenance:



Battery: battery's setting and parameter

Grid: grid's setting and parameter

ATS: ATS's setting

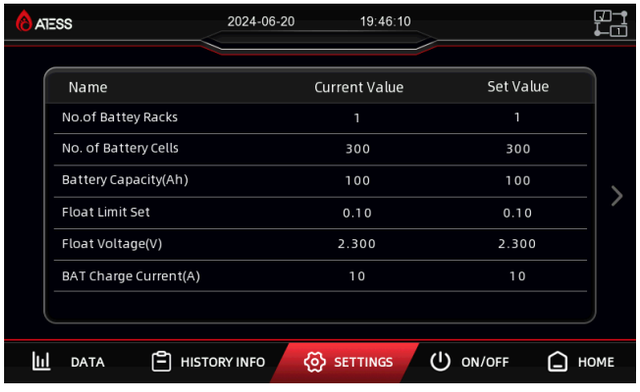
Generator: GEN's setting and parameter

Parallel: PCS parallel's setting

Mode: working modes

Others: Other setting and parameter

Battery



This page is the battery parameter setting page. As battery is an important part of the energy storage system, the battery parameters need to be carefully confirmed whether they are consistent with the actual situation.

No. of Battery Racks: Number of Battery Racks

No. of Battery Cells: Number of Battery Cells

Battery Capacity(Ah): Battery Capacity

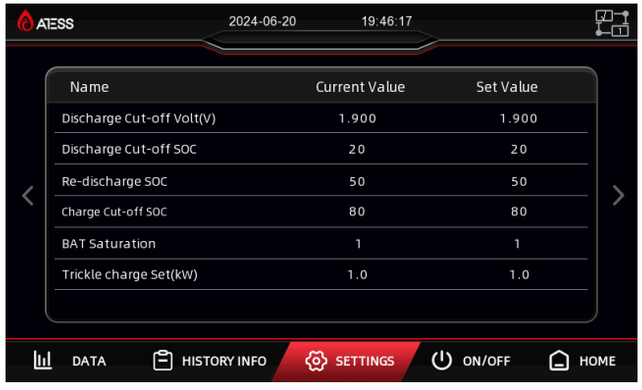
Float Limit Set: When the battery with BMS, the charging current setting value will be based on the smaller one of the maximum charging current limit value sent by the BMS and the charging current setting value set on the screen. The battery real-time cell voltage will be calculated based on the maximum cell voltage sent by the BMS. When the battery without BMS, it will be floating limit in the DG mode and sends a signal to shut-off DG.

$$\text{Target charging current} = \frac{\text{floating cell voltage - current unit voltage}}{\text{floating charge current limiting point value}} \times \text{battery charging current set value}$$

Float Voltage(V): The voltage value of the float charging of the battery cell. When the voltage of the battery cell reaches this set value, the charging current approaches 0A.

When with BMS, calculate the maximum cell voltage sent by the BMS, otherwise calculate the average voltage.

BAT Charge Current(A): This value modify the charging current of the battery. Please set it according to the actual parameters of the battery to avoid significant losses caused by overcharging. When the battery with BMS, the BMS will send a maximum charging current limit and compare it with the charging current set on the screen, taking the smaller value for charging.



Discharge Cut-off Volt(V): When the voltage of the battery cell reaches the discharge cut-off voltage, the battery stops discharging (Switch-on DG in Off-Grid mode or continue discharging until the undervolt activity then switches to PV-only mode).

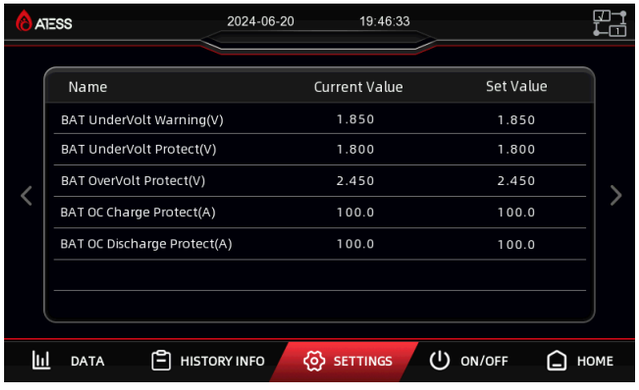
Discharge Cut-off SOC: When the battery with BMS and the SOC reaches the set value, PCS will stop discharging. This only works in On-Grid mode; It does not works when the battery without BMS, and the discharge cut-off voltage is used for judgment.

Re-discharge SOC: When the battery with BMS, after triggers the discharge cut-off SOC and stops discharging. Only continue discharge when the SOC returns to the set value, and only works in On-Grid mode; It does not works when the battery without BMS, and BAT saturation is used as a judgment.

Charge Cut-off SOC: When the battery with BMS, the SOC reaches the set value and stops charging. It does not works when the battery without BMS; When this setting value activity simultaneously with the float charging voltage, whichever is reached first takes effect.

BAT Saturation: Only works in On-Grid mode, when the battery stops discharging and switches to charging due to undervoltage or discharge cut-off, the discharge can only be restored when the battery unit voltage reaches the set value.

Trickle charge Set(kW): When reaching the discharge cut-off voltage or discharge cut-off SOC, charge battery with this power to prevent the battery voltage from being too low.



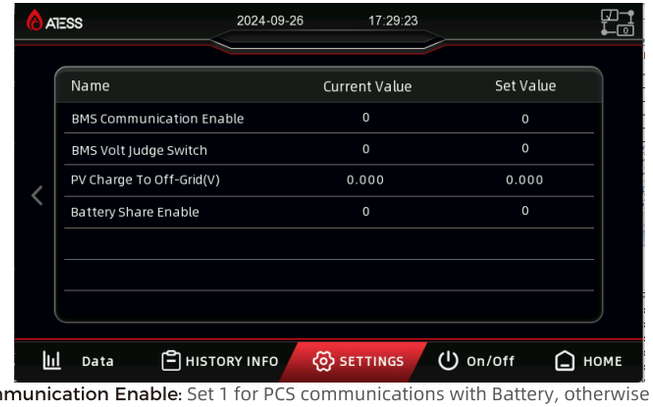
BAT UnderVolt Warning(V): The cell voltage value during battery undervoltage fault. When battery with BMS, use the minimum cell voltage sent by the BMS to calculate, otherwise calculate based on the average voltage.

BAT UnderVolt Protect(V): The cell voltage value during battery undervoltage protection. When the battery voltage reaches this set value, PCS will shut down for protection. When battery with BMS, use the minimum cell voltage sent by the BMS to calculate, otherwise calculate based on the average voltage.

BAT OverVolt Protect(V): The cell voltage value during battery overvoltage protection. When the battery voltage reaches this set value, PCS will shut down for protection. When battery with BMS, use the maximum cell voltage sent by the BMS to calculate, otherwise calculate based on the average voltage

BAT OC Charge Protect(A): The protection value of total battery charging current.

BAT OC Discharge Protect(A): The protection value of total battery discharging current.



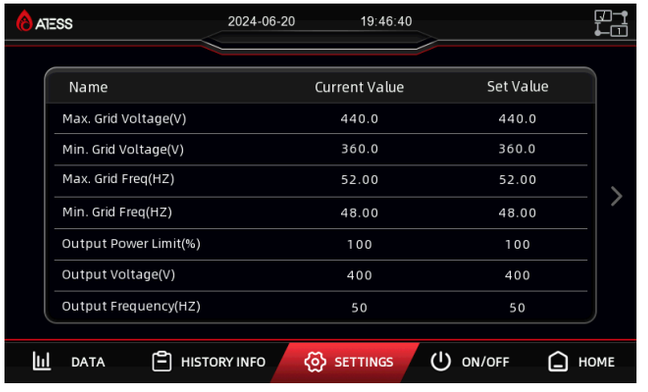
BMS Communication Enable: Set 1 for PCS communications with Battery, otherwise set 0.

BMS Volt Judge Switch: When the poor SOC calculation accuracy of BMS affecting system operation, require to use cell voltage for judgment, it is set to 1; otherwise, it is set to 0.

PV Charge TO Off-Grid(V): In PV only mode, if the battery cell voltage reaches the set value, it will automatically switch to Off-Grid mode.

Battery Share Enable: One PCS does not take effect. Parallel PCS takes effect: a. Battery connecting separately to PCS is set to 0 b. Battery connecting as a whole to PCS is set to 1.

Grid



Max. Grid Voltage(V): The maximum Grid voltage. Switch to Off-Grid mode when over this value. The default setting is 110%.

Min. Grid Voltage(v): The minimum Grid voltage. Switch to Off-Grid mode when under this value. The default setting is 90%.

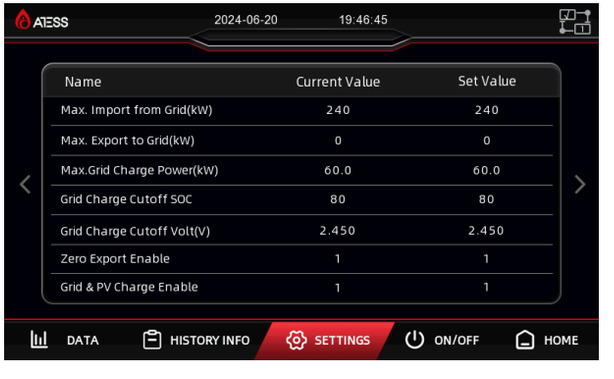
Max. Grid Freq(HZ): The maximum Grid frequency. Switch to Off-Grid mode when over this value. The default setting is +2.

Min. Grid Freq(HZ): The minimum Grid frequency. Switch to Off-Grid mode when under this value. The default setting is -2.

Output Power Limit(%): AC output power percentage. Set from 1%-120%,the default setting is 100%,and recommend do not over 110%.

Output Voltage(V): Set for Off-Grid output voltage 380V or 400V. It may change based on site, restart PCS to change setting.

Output Frequency(HZ): Set for AC output frequency 50 or 60. It may change based on site, restart PCS to change setting.



Max. Import from Grid(KW): Maximum import power from Grid value.

Max. Export to Grid(KW): Maximum export power to Grid value, include PV. Available to set limit value.

Max. Grid charge power (kW): Maximum charging power from Grid, available to set limit value.

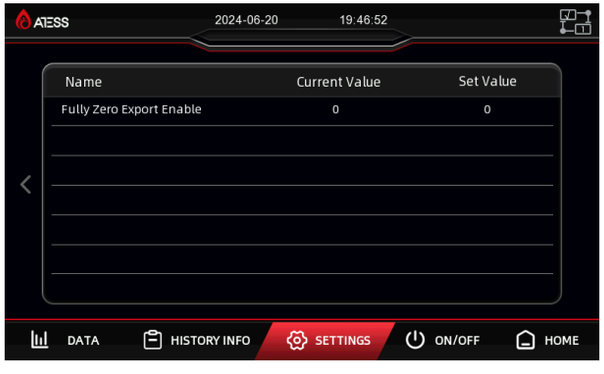
Grid Charge Cutoff SOC: BMS communication enable 1 and BMS voltage judgment enable 0 are activated. When Grid power is sufficient and Grid charging is allowed, charging can be up to the Grid charging cut-off SOC and Grid charging cut-off voltage during Battery first mode, Economic mode - Off peak, and Time schedule - Off peak. When Grid charging cut-off SOC or Grid charging cut-off voltage is reached, only the PV or CP charging is available, Grid does not charge the battery.

Grid Charge Cutoff Volt(V): Without BMS, BMS communication enable 1 and BMS voltage judgment enable 0 are activated. When Grid power is sufficient and Grid charging is allowed, charging can be up to the minimum of BMS cell voltage or battery cell voltage during Battery first mode, Economic mode - Off peak, and Time schedule - Off peak. When Grid charging cut-off SOC or Grid charging cut-off voltage is reached, only the PV or CP charging is available, Grid does not charge the battery.

Zero Export Enable: Set 1 for PCS not allow export power to Grid. Set 0 for PCS allow export power to Grid.

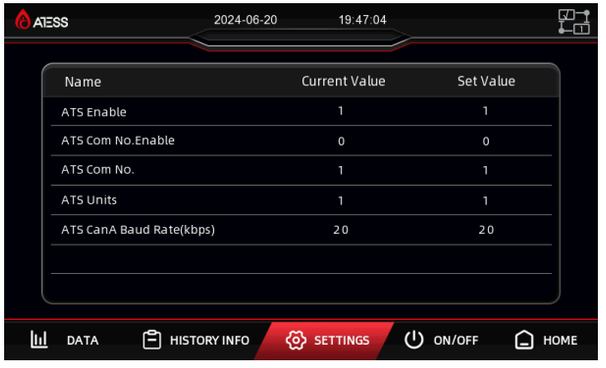
Grid & PV charge Enable: When set 1, Grid or GEN available to charge battery with PV simultaneously. PV will charge battery priority, and shortage will supply by Grid or GEN.

When set 0, Grid or GEN are not available to charge battery with PV simultaneously. PV will charge battery priority, Grid or GEN can charge battery when there is none of PV.



Fully Zero Export Enable: Set 1, during load first mode, phase unbalance, load power will be the minimum phase power * 3. PCS will output this minimum power, and excess power will import from Grid.

ATS



ATS Enable: When ATS from ATESS, set to 1. When ATS not from ATESS, set to 2.Distinguish between Grid and DG by dry contact signal.

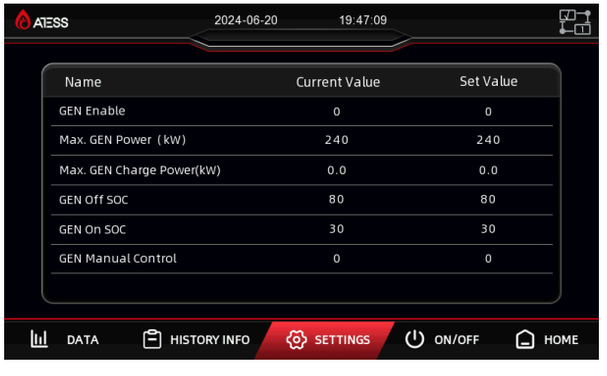
ATS Com No.Enable: when you need to set the communication station number, first set the enable to 1, and then modify the station number. After modification, you must set enable to 0.Only corresponding Inverter and ATS should be turn on .The power should be turn off after setting is completed, so as to avoid repetition.

ATS Com No.: Do not set this for single unit. There are two scenarios for PCS parallel: 1,Each PCS works with one ATS,the same 485 address. 2, All PCS use one ATS, do not set.

ATS Units: Number of ATS.

ATS CanA Baud Rate(kbps): When PCS works with ATS, the CanA Baud Rate of ATS as same as the CanB of PCS. Set ATS comm.station to 1. The default setting is 20kbps.

GEN



GEN Enable: When GEN connects to the Grid input of PCS, set Gen enable to 1,otherwise set to 0. Set 1 when works with ATS too.

Max GEN Power(KW): The maximum import power from Gen (Load+Charge).

Note: Gen power cannot less than the full load power.(Peak load)

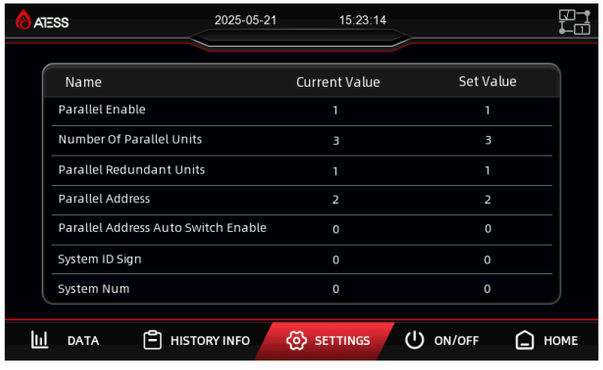
Max GEN Charge Power(KW): The maximum charging power from GEN.

GEN Off SOC: DG mode and BMS enable is 1, when recent SOC is larger than GEN switch-off SOC, PCS sends dry contact signal to switch-off Gen.

GEN On SOC: It only takes effect when DG is enable and battery has BMS. In the off grid mode, when current soc is less than gen on soc, PCS sends dry contact signal to switch-on the generator.

GEN Manual Control: Gen manual switch. Set 1 for PCS sends dry contact signal to switch-on Gen, and set 0 for switch-off.

Parallel



Parallel Enable: Set 1 for activity parallel function, all device needs set to 1.

Number Of Parallel Units: Number of parallel units, 2 units set 2, 3 units set 3.

Parallel Redundant Units: The maximum number of faults that can occur in a parallel system can only be set to 0 or 1. When set to 0, when any units in the parallel system fails, all units will switch to failure; Set to 1, when the number of faults is not greater than 1, other units will still operate normally (maximum supported number of faults is 1).

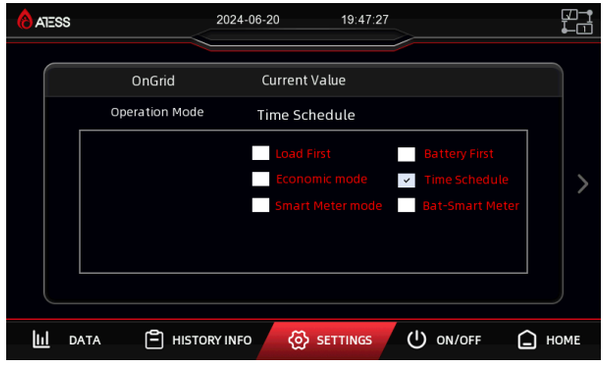
Parallel Address: Address for parallel system, do not repeat. Address must set from 1,and continuous digits, number 1 for master.

Parallel Address Auto Switch Enable: Set 1 to prevent conflicting parallel addresses from being set within the system after enabling it.

System ID sign: Monitoring distinguishes platform whether the devices are the same system and uses it to collect data. Setting the same non-zero number for devices in the same system here.

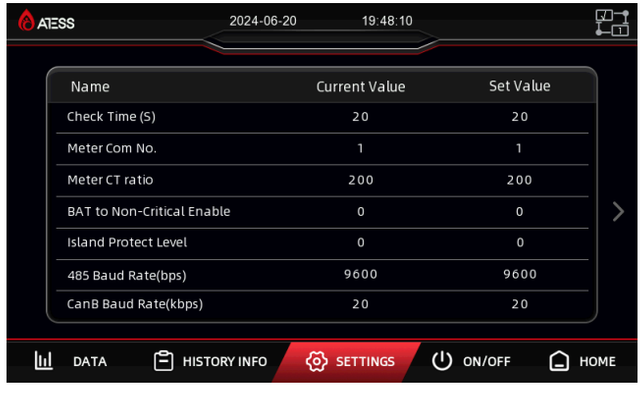
System Num: When the batteries are separated, the background monitoring distinguishes whether devices belong to the same battery system and counts data accordingly. Devices in the same battery system are set with the same non-zero number here.

Mode



Operation Mode: Working mode (Load first; Battery first; Ecomonic mode; Time schedule; Smart meter mode; Bat-smart meter mode).

Other



Check Time(S): Power-on self testing time

Meter Com No.: Communication address of meter

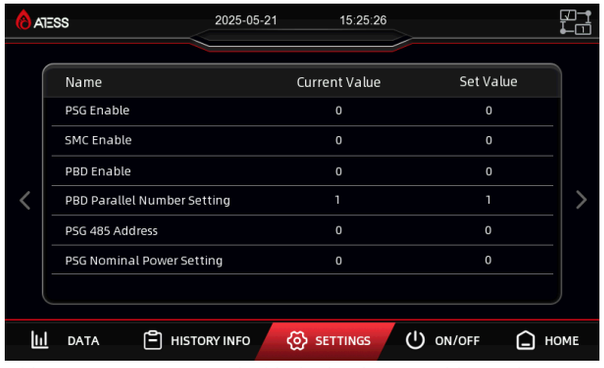
Meter CT ratio: Meter CT ratio

BAT to Non-Critical Enable: Set 1 for battery supply non-critical load

Island Protect Level: The protection function of preventing the PCS switch to Off-grid mode uncorrectly when grid unusual. Input range from 0-9, 0 indicates off, 1-9 indicates levels, it is recommended not set it too high

485 Baud Rate(bps): 485 baud rate of PCS, default setting is 9600

CanB Baud Rate(kbps): CanB baud rate of PCS, default setting is 20



PSG Enable: With PV Inverter connected with the load,PSG Enable can be set to 1. Without PV Inverter connected with the load,PSG Enable can be set to 0. 232 convert 485 communication is set to 1, 3rd party controller read the register address 229: (PSG Limit Power) from modbus protocol. 485 communication is set to 2, 3rd party controller read the register address 229: (PSG Limit Power) from modbus protocol. CANB communication is set to 3， PCS send the percentage of PSG rated power to 3rd party controller.

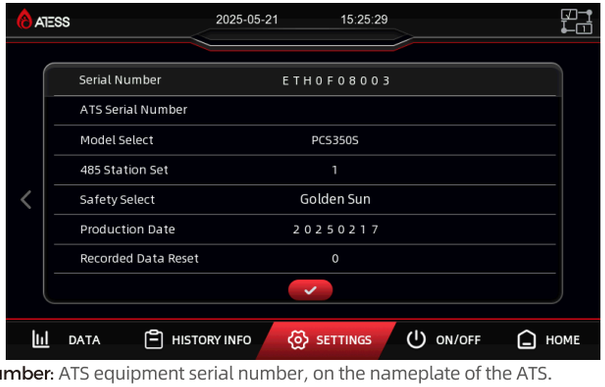
SMC Enable: Set it to 1 when there is a SMC in the system, and set it to 0 when there is no SMC.

PBD Enable: Set it to 1 when there is a PBD in the system, and set it to 0 when there is no PBD.

PBD Parallel Number Setting: The number of PBD in the system

PSG 485 Address: When the machine actively communicates with the PSG, the 485 address of the PSG receiving data (currently, the standard program only supports passive communication).

PSG Nominal Power Setting: The rated power of PV Inverter.



ATS Serial Number: ATS equipment serial number, on the nameplate of the ATS.

Model Select: select the model of PCS according to the actual model, and do not modify it. Due to the slight difference in the design of different models, the wrong model will lead to the failure to start and clear the parameter settings, resulting in unnecessary losses. If it needs to be modified for special reasons, please modify it under the guidance of ATESS after-sales team. After modifying the model, restart it to take effect.

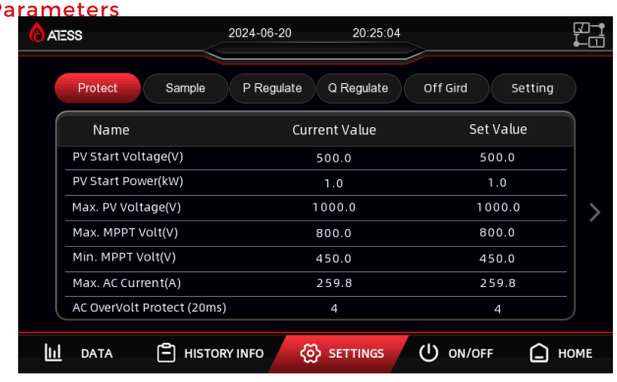
485 Station Set: RS485 communication address setting. If it is a parallel system, must set it from 1.

Safety Select: safety Settings, default parameters, can not be modified.

Production Date: Set the factory production date.

Recorded Data Reset: The accumulated energy of Data is cleared to zero.

Protect Parameters



PV Start Voltage(V): MPPT tracks the PV starting voltage. Default setting is 900V.

PV Start Power(KW): MPPT tracks the maximum power if PV power is larger than PV starting power.

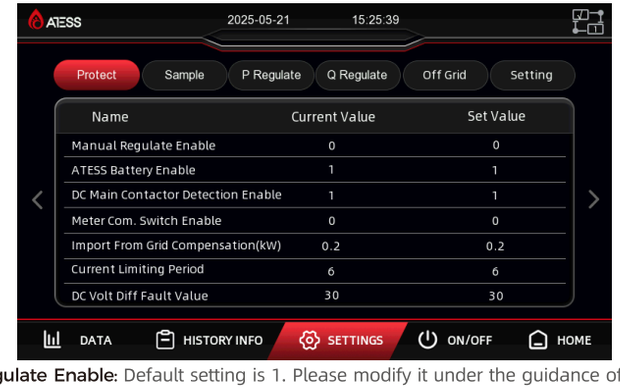
Max. PV Voltage(V): PV maximum voltage. PCS will report PV overVoltage fault and shutdown for protection if PV voltage is higher than PV maximum voltage.

Max. MPPT Voltage(V): PV maximum voltage for MPPT tracks the PV power.

Min. MPPT voltage(V): PV minimum voltage for MPPT tracks the PV power.

Max. AC Current(A): Maximum AC current. PCS will report Grid overCurrent fault and shutdown for protection when grid current more than 1.1 times.

AC OverVolt Protect (20ms): In Off-Grid mode, PCS triggers delay protection of AC overVoltage. Please do not modify it, to avoid affecting system operation normally.



Manual Regulate Enable: Default setting is 1. Please modify it under the guidance of ATESS after-sales service team.

ATESS Battery Enable: Default setting is 0. Please modify to 1 when use with ATESS battery.

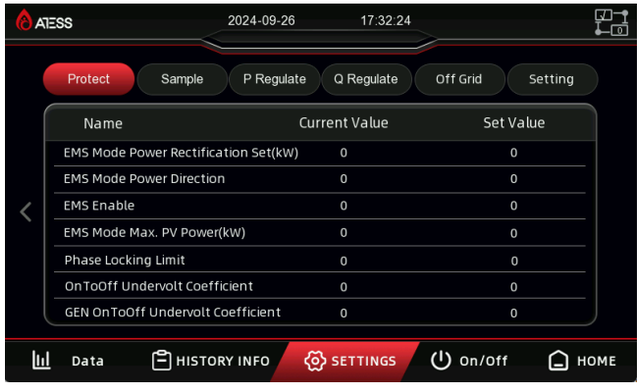
DC Main Contactor Detection Enable: Default setting is 1. Do not modify personally.

Meter Com. Switch Enable: Modify 1 for PCS communication with smart meter, and modify 0 for the third part EMS or controller communication with smart meter.

Import from Grid Compensation(KW): Force to import power from grid, and maximum is 10kW.

Current Limiting Period: Token bucket algorithm.

DC Volt Diff Fault Value: The maximum allowable voltage difference for DC soft start. If the voltage difference between the BUS voltage and the battery voltage exceeds this value, a DC soft start fault will be reported.



EMS Mode Power Rectification Set(kW): During EMS mode, the power of AC-DC or DC-AC.

EMS Mode Power Direction: During EMS mode, 0 is the direction of DC-AC, and 1 is the direction of AC-DC.

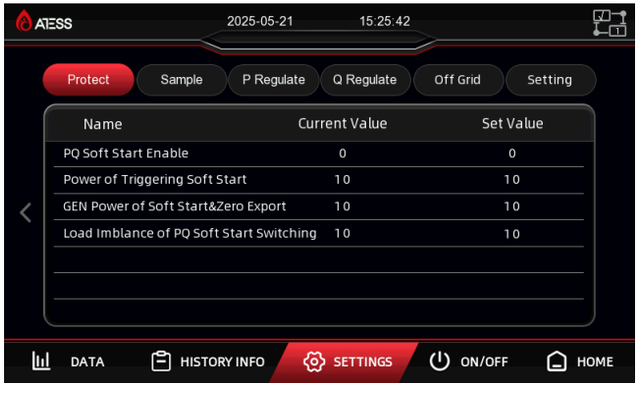
EMS Enable: Set 1 for run EMS mode, set 0 for quit EMS mode.

EMS Mode Max. PV Power(kW): During EMS mode, set for the maximum PV power.

Phase Locking Limit: During Off-Grid switching to On-Grid, the reaction speed of phase locking.

OnToOff Undervolt Coefficient: The coefficient of switching from grid mode to off grid mode is uses to adjust the condition(on to off grid).The default value is 100.

GEN OnToOff Undervolt Coefficient: The coefficient of switching from DG mode to off grid mode is uses to adjust the condition (DG on to off grid).The default value is 100.



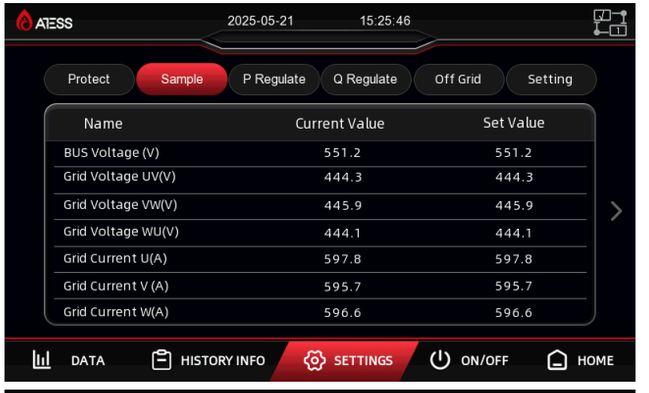
PQ Soft Start Enable: The setting values are 0: Disable soft start, 1:Generator soft start, 2: Grid-connected soft start

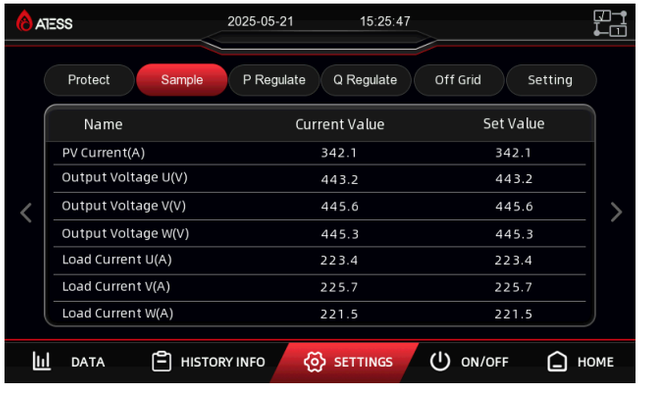
Power of Triggering Soft Start: The soft start function is enabled when the load power exceeds this value.

GEN Power of Soft Start &Zero Export: Set the load power of the generator for off-grid-to-generator mode or generator-to-off-grid mode to prevent backflow

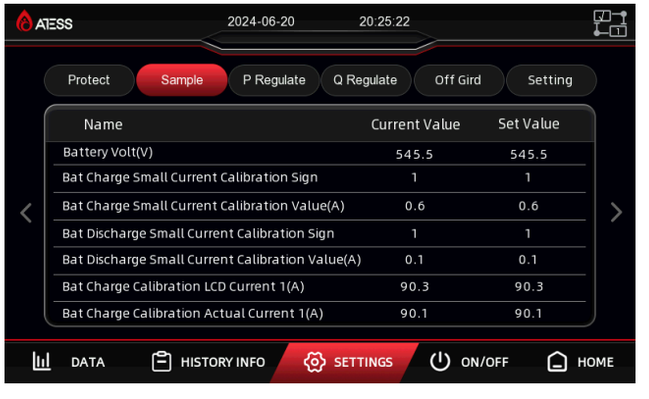
Load Imbalance of PQ Soft Start Switching: When the load unbalance degree exceeds this value, the soft start will switch to another control logic.

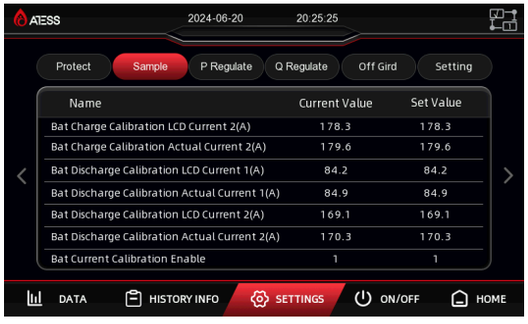
Calibration Parameters





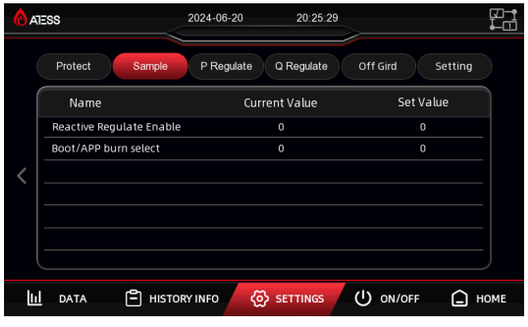
The settings are very important in this page, only modify it under the guidance of ATESS after-sales service team.





Battery Current calibration parameters. Important setting, only modify it under the guidance of ATESS after-sales service team.

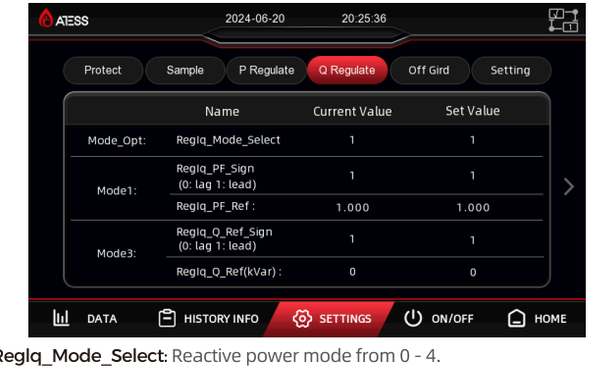
Battery Current Calibration Enable: Keep enable to 0 when calibrating battery current. Set enable to 1 after changing it.



Reactive Regulate Enable: Set 1 for switch-on Reactive Power. Set 0 for switch-off.

Boot/APP burn select: Set 1 for burn from BOOT. Set 0 for burn from APP. The default setting is 0.

Reactive Power



Mode_Opt: Reglq_Mode_Select: Reactive power mode from 0 - 4.

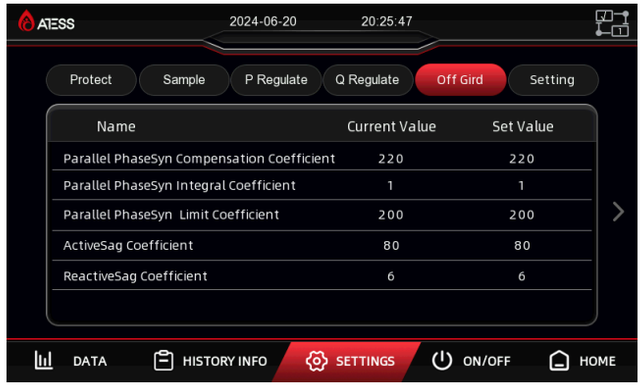
Mode1: Reglq PF Sign(0:lagging 1:leading): Reactive power direction, 0 is lagging, 1 is leading.

Mode1:Reglq PF Ref: Reactive power compensation.

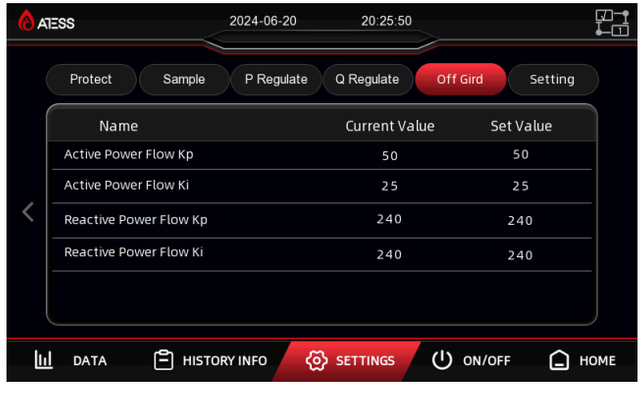
Mode3:Reglq Q Sign(0:lagging 1:leading): Reactive power direction, 0 is lagging, 1 is leading.

Mode3:Reglq Q Ref(kVar): Reference value of reactive power from Grid.

Grid Management

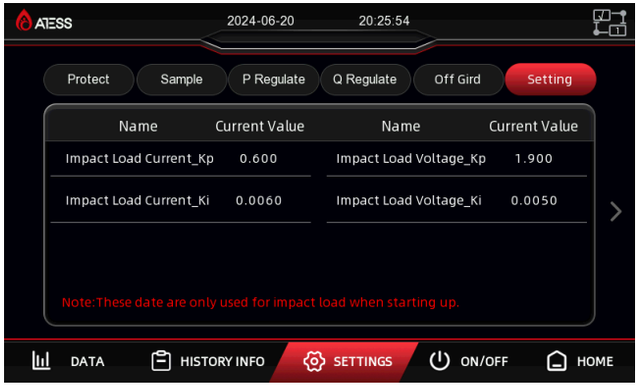


Important setting, only modify it under the guidance of ATESS after-sales service team.

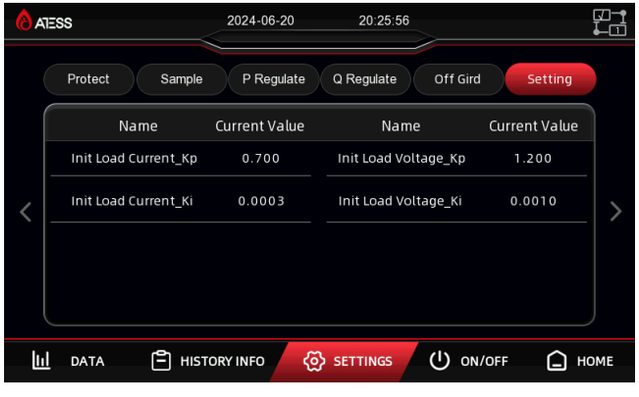


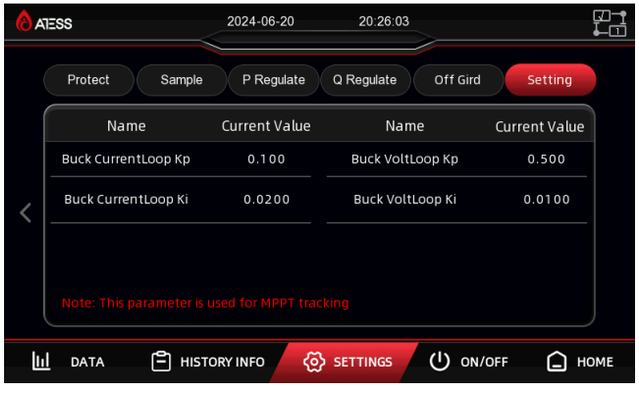
Off-Grid current sharing value. Important setting, only modify it under the guidance of ATESS after-sales service team.

Protection Setting



Important setting, only modify it under the guidance of ATESS after-sales service team.





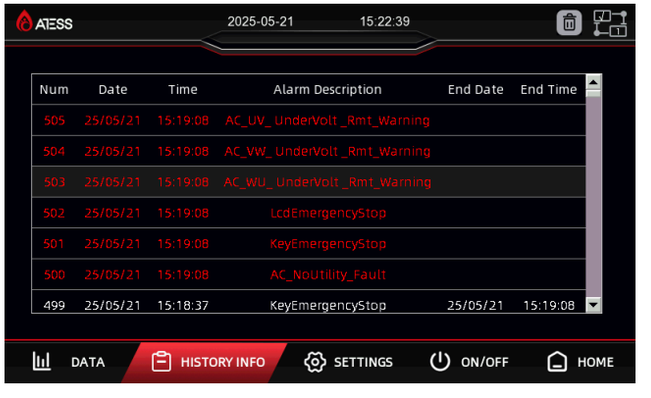
The page without instructions is the factory preset parameter, please do not modif.

If the subsequent scheme changes, please modify the parameters under the guidance of ATESS.

7. 2. 5 Historical information

Clicking “historical information” can enter into the sub-menu of the "historical information".

The submenu includes: Common historical failure, serious historical failure. Via the left button you can enter the corresponding submenu interface. The "common historical faults"is the default interface.



History of failure: all the common history of failure details can be found by flipping the page up and down.

The common fault information, see table 7.3.

7.3 LCD display information schedule

General history failure table

No	Information	
	English	Chinese
1	IGBT_Failure	IGBT永久故障
2	IEEPROM_Write_Failure	EEPROM写永久故障
3	IEEPROM_Read_Failure	EEPROM读永久故障
4	IAC_MainContactor_Failure	主接触器永久故障
5	IAC_SlaveContactor_Failure	辅接触器永久故障
6	Bypass_Communication_Fault	旁路柜通信故障
7	BMS_Communication_Fault	BMS通信故障
8	BMS_Fault	BMS故障
9	Smoke_alarm_Fault	烟雾报警故障
10	AC_NoUtility_Fault	交流无市电故障
11	AC_GridPhaseSeque_Fault	交流电网相序反故障
12	AC_PLL_Fault	交流锁相故障
13	AC_Volt_Unbalance_Fault	交流电压不平衡故障
14	AC_Curr_Unbalance_Fault	交流电流不平衡故障
15	AC_Wu_OverVolt_Fault	交流WU过压故障
16	AC_Wu_UnderVolt_Fault	交流WU欠压故障
17	AC_VW_OverVolt_Fault	交流VW过压故障
18	AC_VW_UnderVolt_Fault	交流VW欠压故障
19	AC_UV_UnderVolt_Fault	交流UV过压故障
20	AC_UV_UnderVolt_Fault	交流UV欠压故障
21	AC_OverFreq_Fault	交流过频故障
22	AC_UnderFreq_Fault	交流欠频故障
23	AC_GridCurr_DcHigh_Fault	电网直流量高故障
24	GridCurr_High_Fault	电网电流高故障
25	AC_Overload_Fault	过载故障
26	AC_Lightload_Fault	轻载故障
27	LVRT_Fault	低压穿越故障
28	Converter_Module_OverTemp_Fault	变流器模块过温故障
29	Converter_L_OverTemp_Fault	变流器电感过温故障
30	Transformer_OverTemp_Fault	变压器过温故障
31	LowTemp_Fault	低温故障
32	EPO_Stop	紧急停机
33	KeyEmergencyStop	手动关机
34	LcdEmergencyStop	LCD关机
35	AC_MainContactor_Fault	交流主接触器故障
36	DC_MainContactor_Fault	直流主接触器故障
37	PBD350_Communication_Fault	PBD350通讯故障
38	AC_SlaveContactor_Fault	交流辅接触器故障
39	AC_Thunder_Fault	交流防雷器故障
40	DC_SoftStart_Fault	DC软启故障
41	INV_SoftStart_Fault	交流软启故障
42	Batt_OverVolt_Fault	电池过压故障
43	Batt_UnderVolt_Fault	电池欠压故障
44	Batt_OverCurr_Fault	电池过流故障
45	Batt_OverCharge_Fault	电池过充故障
46	Fault_Feedback_Warnning	故障反馈告警
47	Temp_Derating_Warnning	过温减载告警
48	Bstt_UnderVlt_Warnning	电池欠压告警
49	PBD250_Communication_Fault	PBD250通讯故障

7.4 General troubleshooting

If there is a fault during the operation, please click the LCD "history information" page to view the fault information. The following are the common fault analysis and solutions of PCS:

1. Manual shutdown: turn PCS panel knob to "off"

solution: the knob is shut down normally, no need to handle.

2. LCD emergency stop: click "off" on PCS screen

Processing steps: the screen is shut down normally, no need to handle.

3. Emergency stop: emergency stop button pressed.

Handling steps: release the emergency stop button in case of no other abnormalities.

4. Batt_UnderVolt_Fault:

Possible reasons:

a. The battery voltage sampled on the screen reaches the under-voltage protection condition and triggers it.

b. The switch of battery on battery side or the on the energy storage controller is not turned on.

c. If this fault occurs during operation, the battery voltage may be pulled down due to high-power output, or the battery itself may be defective.

d. If it is a battery with BMS, this fault will also occur if the lowest cell voltage of the battery unit transmitted by the BMS to the energy storage controller reaches the protection condition.

Processing steps:

a. First, check the battery connection, screen sampling error, and battery parameter settings.

b. If it is a battery with BMS, check whether the BMS data meets the protection conditions.

c. If there is no problem with the above, please contact ATESS for assistance.

5. Batt_OverVolt_Fault:

Possible reasons:

a. The battery voltage sampled on the screen reaches the overvoltage protection trigger condition.

b. If it is a battery with BMS, this fault will also occur if the highest cell voltage of the battery unit transmitted by the BMS to the energy storage controller reaches the trigger protection condition.

7. Batt_OverCurr_Fault: the battery discharge current is higher than the maximum discharge current

Processing steps: check whether the maximum discharge current value of the battery is reasonable, multiply the maximum discharge current by the battery voltage, calculate the maximum discharge power of the battery, see whether it is less than the load power, if yes, reduce the load power.

8. BMS_Fault: secondary or tertiary battery failure

Processing steps:

A. check the specific faults reported by BMS

B. contact the battery manufacturer to solve the problem

C. restart after troubleshooting

9. BMS_Communication_Fault: the energy storage inverter did not receive CAN data sent by battery BMS

Processing steps:

A. check whether the CAN line of ATS is connected to the CAN-A port of the inverter's control board.

B. check if the L and H CAN line are connected reversely.

C. check whether the CAN line is interfered. Suggest to use sampling shielded communication line.

D. use the CAN box to check whether there is data sent by the BMS on the bus.

E. if the communication still fails, contact ATESS.

10. Bypass_Communication_Fault: the energy storage inverter did not receive can data sent by bypass cabinet

Processing steps:

A. check whether the CAN line of ATS is connected to the CAN-B port of the inverter's control board.

B. check whether the L and H CAN line is connected reversely

C. check whether the CAN line is interfered. Suggest to use sampling shielded communication line.

D. use CAN box to check if there is data sent by ATS on the bus.

E. if communication still fails, contact ATESS.

11. AC_NoUtility_Fault: no AC voltage.

Processing steps: generally, this fault will not fade out because there is no output due to other reasons.

12. AC_OverFreq_Fault: the power grid frequency exceeds the upper limit, and the energy storage inverter enters off grid state.

Processing steps: check whether the upper limit of power grid frequency is reasonable. If yes, wait until it returns to normal, the inverter will automatically enter into grid connection state.

13. AC_UnderFreq_Fault: the power grid frequency is lower than the lower limit, and he energy storage inverter enters the off grid state.

Processing steps: check whether the lower limit of power grid frequency is reasonable. If yes, wait until the power grid frequency returns to normal, PCS will automatically enter into grid connection state.

14. AC_UV_OverVolt_Rmt_Warning: when the utility grid voltage is higher than the upper limit, he energy storage inverter enters off grid state.

Processing steps: check whether the upper limit setting of power grid voltage is reasonable. If yes, wait until the power grid voltage returns to normal, and PCS will automatically enter into grid connection state.

15. AC_VW_OverVolt_Rmt_Warning: when the grid voltage is higher than the upper limit, PCS enters off grid state.

Processing steps: check whether the upper limit setting of power grid voltage is reasonable. If yes, wait until the power grid voltage returns to normal, and PCS will automatically enter into grid connection state.

16. AC_WU_OverVolt_Rmt_Warnin: when the grid voltage is higher than the upper limit, PCS enters off grid state.

Processing steps: check whether the upper limit setting of power grid voltage is reasonable. If yes, wait until the power grid voltage returns to normal, and PCS will automatically enter into grid connection state.

17. AC_UV_UnderVolt_Rmt_Warning: when the grid voltage is lower than the lower limit, PCS enters off grid state.

Processing steps: check whether the lower limit setting of power grid voltage is reasonable. If yes, wait for the power grid voltage to return to normal, and PCS will automatically enter into grid connection state.

18. AC_VW_UnderVolt_Rmt_Warning: when the grid voltage is lower than the upper limit voltage, PCS enters off grid mode.

Processing steps: check whether the lower limit setting of power grid voltage is reasonable. If yes, wait for the power grid voltage to return to normal, and PCS will automatically enter into grid connection state.

19. AC_WU_UnderVolt_Rmt_Warning: when the grid voltage is lower than the upper limit voltage, PCS enters off grid state.

Processing steps: check whether the lower limit setting of power grid voltage is reasonable. If yes, wait for the power grid voltage to return to normal, and PCS will automatically enter into grid connection state.

20. AC_GridPhaseSeque_Fault: reverse phase sequence connection of power grid

Processing steps: check the three lines of phase sequence U V W of the utility grid, which are corresponding to A B C connected to the AC input terminal of inverter.

21. OverTemp_Fault: the temperature inside of the machine is too high.

Processing steps:

A. check whether the power supply micro break of the inverter is turned on. If not, turn it on.

B. check whether PCS air inlet and outlet are blocked, and clean dust regularly.

C. wait for the machine to cool down, the fault is eliminated and inverter restart normally, and observe whether the fan works when the temperature reaches 60 ℃. If not, please contact ATESS.

Regarding other faults, please contact relevant professionals of ATESS.

Operation 8

8.1 Power on steps

After installation and system settings are inspected, inverter can be started for operation.

● **First run**

The first operation steps are as follows:

1. Turn on the PV, battery, AC input and power supply micro breaks.

2. Check whether the screen sampling data is abnormal and consistent with the actual situation;

3. After checking, turn the knob to "on", click "on" on the LCD" on / off "page, and wait for the machine to enter" grid connection "; if the site is off grid, it will enter" off grid mode "after starting;

4. During operation, observe whether the data displayed on the screen is normal and whether there is fault information reported, and whether the machine has abnormal noise and smell; if any abnormal situation occurs, please stop the machine immediately for inspection.

Warning!

The bypass switch is only used for maintenance. Please do not turn it on during normal operation.

Manual shutdown

1. After clicking the LCD shutdown button to shut down the machine manually, it must be turned on manually through the start button (on) on the LCD; if the machine is turned off by turning the knob to "off", turn the PCS knob to "on" first, and then click the "on" button on the LCD "switch on" page to start the machine, otherwise inverter cannot start automatically.

Warning!

The machine is still with electricity after manual shutdown.

8.2 Pilot operation completion

The following procedures shall be carried out after the inverter is normally in operation.

Procedure 1: Inspect whether abnormity exists in the inverter, such as excessive noise, excessive heat, abnormal smell or smoke.

Procedure 2: Measure whether inverter voltage, current and THD are stable.

Procedure 3: Operate LCD control panel and inspect whether it displays normally

and accurately.

Procedure 4: Test whether it conforms to the preset operation logic.

By now, the pilot operation of inverter is fully completed, and we can enter the daily operational maintenance.

8.3 Power off steps

CAUTION!

After the inverter is completely powered off, the general DC switch at battery side and the Grid switch at grid side still maintain voltage. If operations are needed, please be sure to cut off the outer power completely, and wait for not less than 5 minutes.

1. Turn the knob switch to "OFF" to shut down
2. Disconnect the AC general input switch
3. Disconnect the DC output switch

It is normal that the PCS generates an alarm during the power-off. You can continue to perform the power-off steps.

Routine Maintenance 9

9.1 Regular maintenance

Due to the influence of environment temperature, humidity, dust and vibration, the devices inside the inverter will be aged and worn, which will lead to potential failure inside the machine. Therefore, it is necessary to carry out daily and regular maintenance to ensure its normal operation and service life. All measures and methods to help the inverter in good working condition belong to the scope of maintenance work.

9.1.1 Safety precautions

(1) Only qualified and authorized personnel can maintain the inverter.

(2) When carrying out maintenance work, do not leave the screws, washers and other metal parts in the inverter, otherwise the equipment may be damaged.

(3) If only the circuit breaker is opened, the cable connection terminal inside the inverter is still electrified.

(4) Before opening the cabinet door and starting the formal maintenance work, it is necessary to not only disconnect the circuit breaker, but also disconnect the front and rear level circuit breakers of the inverter.

(5) After the inverter stops operation, please wait at least 5 minutes before operating.

(6) Disconnect all external connections of the inverter and the internal power supply of the equipment.

(7) Ensure that the inverter is not inadvertently recharged.

(8) Use a multimeter to ensure that the inverter is completely electrically neutral inside.

(9) Make necessary grounding and short circuit connections.

(10) Use insulating material cloth to cover the parts near the operation part that may be electrified.

9.1.2 System Maintenance

Tools to be used during mainteanance

	Cell phone that can take photos
	Multimeter
	Thermometer
	Pen and paper
	Spanner, screwdriver etc
	Thermal imager

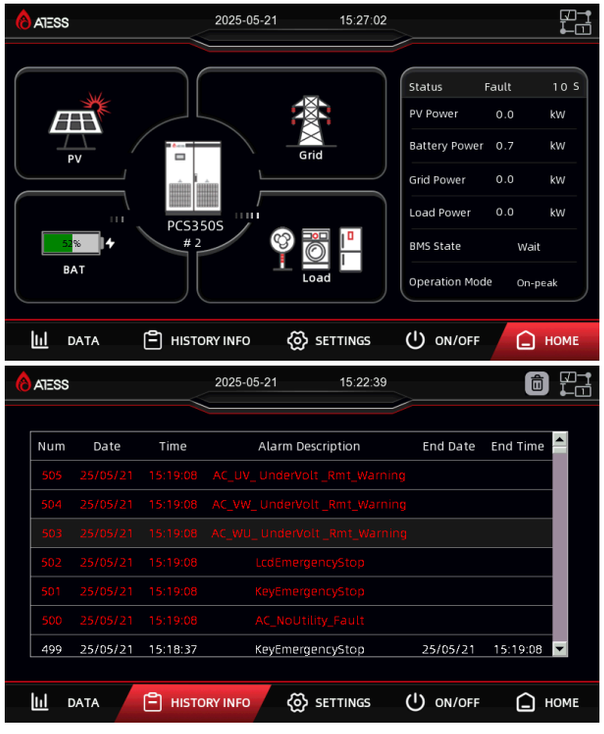
When doing maintaining inspection records, you need to perform inspection one by one according to the table and describe the faulty items.

2.1 Maintenance and inspection checklist for running system

When recording inspection and maintenance, inspection shall be carried out one by one following the table sequence, and the faulty items shall be described accordingly.

Please refer to Capture 10.3 Maintenance and inspection checklist for non-shutdown system.

After the inspection record is completed, photos of the operation status in home page and historical information page shall be taken for record, as shown in the following figures:



2.2 Maintenance and inspection checklist for shutdown system

Please refer to Capture 10.4 Maintenance and inspection checklist for shutdown system.

9.1.3 Relative operations

CAUTION!

All maintenance operations must be carried out in the condition that DC side and AC side of the inverter, PV module and AC distribution cabinet switch are all disconnected. Maintenance must be proceeded only after AC and DC disconnected for at least 5 minutes, in order to avoid electric shock!

Only professional technicians familiar with the system operation can perform such operation.

Disconnect the circuit breaker

Operate the DC switch of PV input and battery input to disconnect PCS from the PV and battery. And operate AC input and AC output switches to disconnect PCS from AC sources. Make sure that PCS won't switch on accidentally. Test with a multimeter to make sure the device is disconnected and with zero voltage. Even if PCS has been disconnected from the grid / main power supply, battery and PV, some of the internal components (such as capacitors) still have residual voltage and discharge slowly, so please wait at least 5 minutes after the circuit breaker is disconnected and use the multimeter to measure and confirm the safety before continuing operation.

Maintain and modify

Only ATESS authorized personnel can maintain and modify the equipment. For personal safety, use only the original accessories provided by the manufacturer. If you use non-original parts, you cannot ensure compliance with relevant certification standards in terms of electrical safety and EMC.

How to use bypass switch

If the PCS fails and cannot continue to operate, it needs to be shut down for maintenance, while the load connected to the PCS needs to continue working, the bypass switch can be used to keep the load work uninterruptedly under the power supply of power grid or generator, and the maintenance personnel can carry out maintenance work safely.

Step 1: turn on the bypass switch in case of machine failure.

Step 2: turn off the switches of "AC input", "AC output", "PV input" and "battery input".At this time, the AC and DC power are disconnected from PCS, and the load is all supplied by the power grid, after the residual power is discharged, maintenance work can be carried out.

Note:

1. After power off, wait for 5 minutes to confirm safety before carrying out maintenance work.
2. Use the multimeter to ensure safety before disassembling and other work.

Function and safety parameters

Do not change parameters of PCS without the authorization of the local power supply company and the instruction of ATESS. Unauthorized change of functional safety parameters may cause injury to personnel or inverter damage, in this case, ATESS will not provide warranty services.

Replace the dust screen

During the use of PCS, the dust on the top shall be cleaned regularly, and the dust screen at the air inlet shall be cleaned or replaced. During the cleaning, PCS needs to be power-off.

Replacement method of dust screen: the dust filter cotton on the door panel can be directly pulled up for cleaning and replacement.

To ensure the normal operation of the machine, clean the air filter regularly. Not cleaning for a long time may affect the intake air volume and cause overheat.

9.2 Waste disposal

The inverter will not cause environmental pollution, since the all the components meet the requirements of environmental protection. According to environmental protection requirements, user shall dispose the inverter in accordance with the relevant laws and regulations.

10 Appendix

10.1 Specification

Model	PCS250S	PCS350S
Battery parameter		
Battery operating voltage	600-900V	
Max. battery charging/ discharging current	458A	642A
Max. battery charging/ discharging power	275kW	385kW
AC parameter		
Rated voltage	400Vac	
Rated current	361A	505A
Rated power	250kW	350kW
Max. AC input power	375kVA	525kVA
Rated frequency	50/60Hz	
Frequency Range	45-55Hz/55-65Hz	
Power factor	0.8lagging—0.8leading	
THDI	<3%(Full load)	
THDU	≤2%	
Overload capacity	110%-10 mins,120%-1 min	
Other parameter		
Ingress Protection	IP20(Outdoors)	
Protective class	Class I	
Mains over voltage category	ClassIII	
Demand response mode	DRM0-8(optional)	
Inverter toplogy	Isolated	
Noise emission	< 65dB(A)@1m	
Cooling	Intelligent air cooling	
Humidity	0-95% non-condensing	
Maximum altitude	6000(derate over 3000m)	
Build-in transformer	Yes	
Operating temperature	-25℃-+55℃	
Active anti-islanding method	In the absence of a reference, the energy storage controller output frequency is disturbed	
Communication		
LCD display	Touch screen LCD	
Communication interface	RS485/CAN	

10.2 ATESS Factory warranty

● **Warranty period**

The warranty period of this product is one year. If otherwise specified in the contract, the contract shall prevail.

During the warranty period, the customer shall show the invoice and date of purchase to the service personnel of ATESS. At the same time, the nameplate mark on the product shall be clear and visible, otherwise, ATESS has the right not to provide warranty service.

● **Warranty conditions**

In the event of failure during the warranty period, ATESS will repair or replace the product free of charge; The customer shall Set aside some time to repair the faulty machine.

● **Liability exemption**

In case of the following circumstances, ATESS has the right not to conduct warranty:

1. Products without logo of ATESS Power Technology logo.

2. The product or component that has exceeded the valid warranty period of ATESS.

3. Failure or damage (such as high temperature, low temperature, too wet or dry, high altitude, unstable voltage or current, etc.) caused by working in beyond-specified environment or wrong installation, storage or use that violates the instructions.

4. Failure or damage caused by unauthorized installation, repair, modification or disassembly. except for those authorized by ATESS.

5. Failure or damage caused by using components that not supplied by ATESS;

6. Failure, damage or transportation damage caused by accident or human factors (operation error, scratching, carrying, bumping, improper voltage connection etc.).

7. Failure or damage caused by force majeure (such as earthquake, lightning, fire etc.).

8. Failures or damages caused by other factors rather than quality problems of the supplied product itself(including components).

10.3 Maintenance and inspection checklist for running system

No.	Category	Check item	Check method	Standard	Result	Problem description	Check frequency
1	System operation status check	Whether the LCD display of the machine is in normal operation	Visual inspection	Operation status display is not "fault" or "serious fault"	☐ Normal ☐ Abnormal		Once a month
2		Whether there is error recorded in history that caused shutdown	Visual inspection	No error caused shutdown	☐ Normal ☐ Abnormal		
3		Whether the data transmission of monitoring device is normal	Monitoring web page / APP	Monitoring connection and data transmission are normal	☐ Normal ☐ Abnormal		
4		Whether the fan rotates normally and the air outlet is normal (first check whether the temperature collected by the equipment reaches the fan opening condition, which normally is 60 ℃)	Visual inspection Thermal imager	Normal rotation, normal air output	☐ Normal ☐ Abnormal		
5		Whether the equipment has abnormal smell or sound	Smell, listen	No abnormal sound or smell	☐ Normal ☐ Abnormal		
6		Emergency stop button(when the system is in standby mode)	Manual	The circuit breaker trips after pressing the emergency stop button	☐ Normal ☐ Abnormal		

10.4 Maintenance and inspection checklist for shutdown system

No.	Category	Check item	Check method	Standard	Result	Problem description	Check frequency
1	System cleaning	Whether there is water leakage or other foreign matters in the room or container	Visual inspection	No water leakage or foreign matter	☐ Normal ☐ Abnormal		Once a month
2		Whether there are rodents and insects such as rats, geckos, cockroaches and ants in the cabinet	Visual inspection	No animals or insects	☐ Normal ☐ Abnormal		
3	System cable connection (power- off inspection)	Whether the power cable connection is loose	Manual /Wrench	No looseness	☐ Normal ☐ Abnormal		Once a month
4		Whether the communication cable connection is loose	Manual bolt driver	No looseness	☐ Normal ☐ Abnormal		
5		Check equipment ground connection	Visual inspection/ Multimeter	<=4Ω	☐ Normal ☐ Abnormal		
6		whether the external connection of the equipment is damaged	Visual inspection	No damage	☐ Normal ☐ Abnormal		
7	Internal cleaning	whether there is moisture or condensation inside the cabinet	Visual inspection	No condensation no moisture	☐ Normal ☐ Abnormal		Once a month
8		Whether there is obvious dust inside the cabinet	Visual inspection	No obvious dust	☐ Normal ☐ Abnormal		
9		Whether the front and rear dust screens has blockage	Visual inspection	No blockage	☐ Normal ☐ Abnormal		
10		Whether there is obvious damage inside the equipment	Visual inspection	No damage	☐ Normal ☐ Abnormal		
11		whether there is obvious rust inside the cabinet	Visual inspection	No rust	☐ Normal ☐ Abnormal		
12		Safety signs	Visual inspection	Safety signs are not shed	☐ Normal ☐ Abnormal		

Note: the table only indicates the recommended maintenance frequency of the product. The actual frequency shall be determined according to the specific installation environment. The scale of power station, location and site environment will affect the maintenance frequency. If the operation environment is windy and dusty, it is necessary to shorten the period and increase the frequency.