

AiO Box IEC Operation Manual



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1. Any damage caused by improper installation, usage, or maintenance that does not follow the instructions in this manual.
2. The product must be used in an environment that complies with the specified design parameters. Failure to adhere to these environmental requirements may result in malfunctions or damage. Any performance issues or component failures arising from non-compliance are not covered under the product warranty.
3. Damage caused by improper handling during transportation, moving, storage, or unpacking.
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5. Warranty has expired.
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7. Corresponding Ground Fault Detection (GFD) equipment is not equipped.
8. Installation or repair performed by unauthorized service providers or

personnel.

9. Use of unauthorized or non-original software, interface devices, parts, or consumables leading to malfunction or damage.
10. Altered or tampered product serial numbers, or failure to provide the product for inspection, testing, or repair.
11. Normal wear and tear or aging, or surface defects, dents, or marks that do not affect product performance.
12. Minor noise or vibration that does not affect product performance.
13. Theft of the product or its components.
14. To avoid internal component damage, please refer to the instruction manual and ensure proper cables are connected to the correct ports. Any damage due to incorrect wiring is not covered under warranty.
15. Damage caused by improper cleaning methods (e.g., using chemical cleaners) is not covered under warranty scope.
16. Damage to fuses or DC/AC surge protectors is not covered under the product warranty scope.
17. The installation height must provide adequate wiring space and account for environmental risks such as flooding or snow accumulation. Any damage caused by failure to meet these requirements is not covered under warranty scope.
18. The company is not liable for consequential, indirect, incidental, or punitive damages arising from disputes related to this disclaimer. The maximum compensation is limited to the actual purchase price of the product.
19. Use in environments not compliant with the product manual (e.g., extreme temperatures, humidity, magnetic fields, static interference, or corrosive gases).
20. Environmental or safety incidents arising from failure to comply with relevant laws or regulations regarding use, recycle or disposal of product.
21. This product is not intended for use in life-support systems, medical equipment, aerospace systems, or other high-risk applications. The company is not responsible for any consequences arising from violation of this provision.
22. This product may contain chemicals identified by local regulations as carcinogenic, teratogenic, or harmful to reproduction. Avoid contact with

internal components. Wash hands if contact occurs.

23. The "DANGER," "WARNING," "CAUTION" and "NOTICE" in this manual are not exhaustive. They serve as a supplement to the complete set of safety instructions that should be followed.
24. Installation, wiring, maintenance, inspection, or replacement of parts must not be carried out by non-qualified personnel. The manufacturer assumes no warranty obligations or legal liability for personal injury or equipment damage arising from failure to comply with these requirements.
25. In case scenario is not addressed in this manual, please contact Delta customer support for guidance.

1 Information on this Document

This manual is an Operation Manual. Please refer to the Installation Manual and Maintenance Manual for installation and maintenance procedures.

1.1 Validity

This document is valid for:

- AIOA279K125L
- AIOB279K125L
- AIOC279K125L

AIOC279K125L represents the top-tier configuration. AIOA279K125L is identical to the AIOC279K125L, except without the PV connection, AIOB279K125L is identical to the AIOC279K125L, except without the PV connection and has no PCS module. The PCS, HV Box, battery modules, liquid cooling unit and connecting wiring within AIOA279K125L are fully factory pre-assembled; The HV Box, battery modules, liquid cooling unit and connecting wiring within AIOB279K125L are fully factory pre-assembled; The PCS, HV Box, battery modules, DD module, liquid cooling unit and connecting wiring within AIOC279K125L are fully factory pre-assembled; AIOA279K125L, AIOB279K125L and AIOC279K125L are abbreviated as AiO Box.

Depending on the functions and selected options, individual sections may be irrelevant for installation and operation. Illustrations in this document are reduced to the essential information and may deviate from the real product. Delta reserves the right to make changes to the product.

1.2 Target Group

This manual is for operators of the power storage plant and qualified technical personnel. The product must and can only be installed by professional technicians who meet the following skills:

- Knowledge of how the product works and is operated.
- Training in the operation and commissioning of electrical devices.
- Knowledge of all applicable laws, standards and directives.
- Training in risk prevention when working with electrical installations.
- Knowledge of and compliance with this document and all safety information.
- Be familiar with local standards and relevant safety regulations of electrical systems.

1.3 Levels of warning messages

To ensure the safety of the users and their properties when they use the product and to make sure that the product is used in an optimal and efficient manner, this manual provides users with the relevant safety information highlighted by the following symbols.

Below is a list of symbols that are used in this manual. Review them carefully to make better use of this manual.

** DANGER**

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

** WARNING**

Indicates a moderately hazardous situation which, if not avoided, will result in death or serious injury.

** CAUTION**

Failure to transport and store the product in accordance with the requirements in this manual may invalidate the warranty.

NOTICE

Failure to transport and store the product in accordance with the requirements in this manual may invalidate the warranty.

1.4 Symbols in the Product

Sings on the product

**Beware of dangerous voltage**

The product operates at high voltages. All work on the product must only be performed as described in the documentation of the product.

**Beware of incorrect operation**

Personals must operate correctly, if not avoided, could result in serious personal injury or device damaged.

**Beware of hot surface**

The product can get hot during operation. Do not touch the product during operation.

**Beware of shock**

Live parts! Do not touch them until 5 minutes after disconnection from the power sources.

**Beware of extrusion**

Don't put hands in the movable and/or rotation parts of product.

**Arc Flash Hazard**

There is an arc flash hazard associated with all electrical equipment. There is an increased risk of arc flash with any equipment modification (e.g., open doors). Serious injuries can occur in arc flash incidents. Appropriate PPE and training as per local codes and regulations is required.

**Fire Hazard**

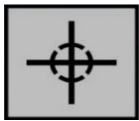
Fire is possible under certain, extreme fault conditions.

**Beware of noise**

The product generates loud noise. When working on the product, wear hearing protection.

**Unlock direction**

Unlock direction labels, which locate on the doors.

**Center of gravity**

Center of gravity label, which is on the enclosure of product.

1.5 Primary risks associated with AiO Box

The primary risks associated with the AiO Box system are:

1.5.1 Hazardous voltage

Hazardous Voltage

- High AC voltage at AiO Box input.
- 1200Vdc at battery side and PV interface side.

Consequence

Electrocution, Fire, Explosion.

Avoidance

- Only qualified and authorized person should only be allowed restricted access.
- Equipment barriers must remain in place.
- PPE must be appropriate for the task and equipment

1.5.2 Arc fault

Arc fault

When insulation breakdown or accidental contact between high voltage conductors, an arc fault will be happened through the air gap between conductors.

Consequence

- Arc fault creates an electrical explosion.
- Light and heat emitted from the explosion is known as arc flash.
- Pressure wave caused by the tremendous temperatures of the arc flash is known as arc blast.

Avoidance

- Only qualified and authorized person should only be allowed restricted access.
- Restricted access.
- Equipment barriers must remain in place.
- PPE must be appropriate for the task and equipment.

1.6 Arc flash hazard boundary

The US National Fire Protection Association (NFPA) has developed specific approach boundaries designed to protect employees while working on or near energized equipment. These boundaries are:

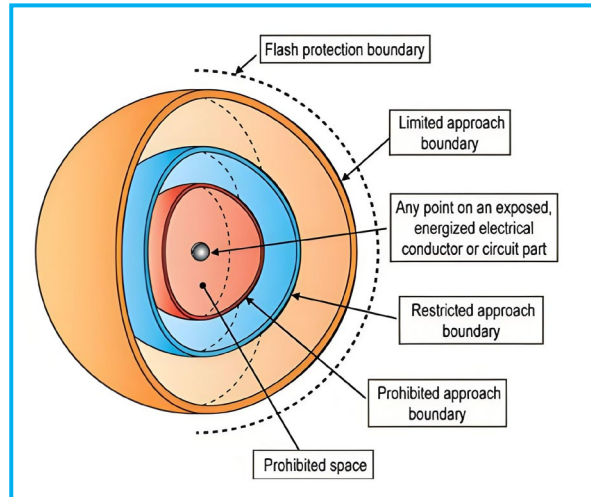


Figure 1-1: Arc flash boundaries (Refer to NFPA 70E)

- Flash Protection boundary (outer boundary) – this is the farthest established boundary from the energy source. If an arc flash occurred, this boundary is where an employee exposed to a curable second-degree burn. The issue here is the heat generated from a flash that results in burn.
- Limited approach – An approach limit at a distance from an exposed live part where a shock hazard exists.
- Restricted approach – An approach limit at a distance from an exposed live part which there is an increased risk of shock.
- Prohibited approach (inner boundary) – A distance from an exposed part which is considered the same as contacting the live part.

1.7 Arc flash label

According to “Maximum Power Method” in NFPA 70E, the estimated DC arc flash incident energy at the maximum power point can be calculated, and then the hazard boundary is defined as following Figure 1-2.

 WARNING			
ARC FLASH AND SHOCK HAZARD PRESENT APPROPRIATE PPE REQUIRED			
ARC FLASH PROTECTION		SHOCK PROTECTION	
Working Distance	455 mm(1 ft 6 in.)	Shock Hazard	System voltage: 1500Vdc(DC), 400V(L-L, Main power), 230V(L-N, Auxiliary power),
Incident Energy	2.07 Cal/cm ²	Limited Approach	1.5 m(5 ft 0 in.)
Arc Flash Hazard Boundary	678.18mm (2 ft 2.7 in)	Restricted Approach	0.5 m(1 ft 8 in.)
		Glove Class	0
Refer to NFPA 70E for PPE requirements			

Figure 1-2: Arc flash label for reference

1.8 Personal protective equipment (PPE)

The PPE is determined by the incident energy which is the temperature produced (in cal/cm²) at a distance (usually eighteen inches) from an arc flash.

PPE requirement for AiO Box system operational precautions is category 1.

PPE CATEGORY 1	PPE CATEGORY 2	PPE CATEGORY 3	PPE CATEGORY 4
Minimum Arc Rating of 4 cal/cm²  Arc Rated Clothing: • AR long-sleeve shirt and pants, or AR coverall • AR face shield, or AR flash suit hood • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Heavy-duty leather gloves • Leather footwear (as needed)	Minimum Arc Rating of 8 cal/cm²  Arc Rated Clothing: • AR long-sleeve shirt and pants, or AR coverall • AR flash suit hood, or AR face shield and AR balaclava • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Heavy-duty leather gloves • Leather footwear	Minimum Arc Rating of 25 cal/cm²  Arc Rated Clothing: • As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants • AR flash suit hood • AR gloves • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Leather footwear (as needed)	Minimum Arc Rating of 40 cal/cm²  Arc Rated Clothing: • As required: AR long-sleeve shirt, AR pants, AR coverall, AR flash suit jacket, and/or AR flash suit pants • AR flash suit hood • AR gloves • AR jacket, parka, rainwear, or hard hat liner (as needed) Protective Equipment: • Hard hat • Safety glasses or safety goggles • Hearing protection (with inserts) • Leather footwear (as needed)

Figure 1-3: PPE category

1.9 LOTO procedure

1. Check the status of PCS and battery racks from EMS, make sure that the circuit breakers/contactors of PCS DC side are all disconnected, and the HV contactors of racks are disconnected.
2. PPE1 is required for operator.
3. Turn off the on-site AC circuit breaker (QA1) which supplies the power of AiO Box. Apply a LOTO adapter and LOTO lock and tag to the circuit breaker handle to prevent it from being turned back on.
4. Switch off the isolation switch of the battery to "OFF" state. Pull out the LOTO ring of

the isolation switch handle and apply LOTO lock and tag to the LOTO ring to prevent it from being turned back on.

5. Turn off the circuit breaker QB4 and QB6, which supplies auxiliary power of AiO Box.
6. After 5 minutes, check, with a multi-meter, that the 220VAC auxiliary power input connection terminal QB6 reads 0V.
7. Check, with a multi-meter, that the 1,200VDC bus bar reads 0V.

1.10 Term & Abbreviations

Term/Abbreviation	Explanation
PCS	Power Conditioning System
MCB	Main Circuit Breaker
MC	Main Contactor
SSC	Soft Start Contactor
HMI	Human Machine Interface
DC	Direct Current
AC	Alternating Current
PC	Computer
CT	Current Transformer
MCU	Main Control Unit
UPS	Uninterruptible Power Supply
PDU	Power Distribution Unit
ACB	Air Circuit Breaker
MPCB	Motor Protection Circuit Breaker
PF	Power Factor
OVP	Over Voltage Protection
UVP	Under Voltage Protection
OCP	Over Current Protection
BMU	Battery Management Unit
BMS	Battery Management System
BESS	Battery Energy Storage System
FSS	Fire Suppression System
MBMU	Master Battery Management Unit
SBMU	Slave Battery Management Unit

MSD	Manual Switch Disconnecter
SOC	State of Charge
SOH	State of Health
TMS	Thermal Management System

2 General safety instruction

Important Safety Instructions

SAVE THESE INSTRUCTION

This manual contains important safety instructions for AiO Box that shall be followed during installation and maintenance of the inverter, if ignored, maybe result in personal injury or device damaged. So before starting installation, operation, commissioning or maintenance of AiO Box, read through the entire manual and note all **DANGER!** **WARNING!** **CAUTION!** and **NOTICE!** statements.

AiO Box is designed and tested to meet all applicable international safety standards. However, like all electrical and electronic equipment, safety precautions must be observed and followed during installation, operation and maintenance of AiO Box to reduce the risk of personal injury and to ensure installing safety.

Only qualified personal who are licensed and/or satisfy state and local jurisdiction can perform installation, commissioning and maintenance work, and must wear suitable safety protective equipment.

All installations must confirm with the local laws, regulations, codes and standards applicable in the jurisdiction of installation, even though it has conflict with this manual.

2.1 General Safety Rules

DANGER

Touching the terminals or contactors connected to the grid may lead to electric shock!

- Do not touch the terminals or conductors connected to the grid.
- Respect all safety instructions on the grid connection.

DANGER

Lethal voltages are present inside the device!

- Pay attention to and follow the warning signs on the device.
- Respect all safety instructions in this manual and other pertinent document.

** DANGER**

Electric shock or fire may occur due to device damage or system fault.

- Visually inspect the AiO Box for device damages or other hazards.
- Check if the external devices and circuit connections are safe.
- Only operate the device when it is safe to do so.

** WARNING**

All installations and operations on the AiO Box must be in full accordance with the national and local regulations and standards.

** WARNING**

Ensure that the installation environment (such as voltage, temperature, humidity, altitude, pollution level, water-proof and dust-proof level) is within the scope of equipment specifications.

** WARNING**

The installation, electrical connection, commissioning, maintenance, and troubleshooting must be carried out by professional electrical technicians conforming to local codes. Before performing operations, operators should have read this manual completely and mastered the safety issues related to the operation.

2.2 Ground Fault Protection

DANGER

If a ground fault occurs in the system, some parts that are supposedly voltage-free may carry lethal voltage. Accidental touch may cause serious damage. Make sure there is no system ground fault before performing operation and take proper protective measures.

2.3 Warning label setting

During on-site transportation, installation, repair, maintenance and other operations of the AiO Box, in order to prevent irrelevant personnel from approaching and mis-operation or accident, shall take the following precautions:

- Perform Lockout-Tagout procedure strictly.
- Set up warning signs or safety warning belts near the site operation area.

2.4 Live Line Measurement

DANGER

Before electrical connection, please ensure that the AiO Box and electrical equipment inside it are intact and hazard-free. All electrical connections must meet electrical standards of local country/region.

⚠ DANGER

High voltages are present inside the device. Death can result from burning and electric shock due to touching the live components of the AiO Box. During live line measurement:

- Use suitable protective equipment (e.g. wear insulated gloves, etc.).
- Accompanied by other persons.

2.5 Measuring Instrument

The instrument for measuring the electrical parameters should meet the following requirements:

⚠ WARNING

- The instrument for measuring the electrical parameters should be a high-quality instrument with sufficient measuring range.
- Make sure the connection and use of the instrument are correct to avoid arc and other dangerous situations.
- Use suitable protective equipment, for example, dielectric gloves during live line measurement.

2.6 Voltage-free Operations

Perform operations on the AiO Box only when all devices inside the AiO Box are completely voltage-free.

- Avoid any inadvertent re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid inadvertent touch.
- Ensure sufficient escape room.
- After the AiO Box stops, wait at least 10 minutes before operating it.
- Ensure that the AiO Box is completely voltage-free.

2.7 ESD Protection

CAUTION

Devices may be damaged irreversibly by electrostatic discharge (ESD).

- Avoid unnecessary touching of the printed circuit board (PCB).
- Observe all the ESD-related safety instructions. Wear proper personal protective equipment (PPE) such as wrist strap.

2.8 General Safety instruction

DANGER

- Pre-Installation & De-Energization
Ensure the AiO Box is fully de-energized before installation.
Maintain adequate safety clearance for operation and maintenance.
- Personal Protective Equipment (PPE)
Always wear appropriate PPE before performing any work.
Ensure PPE complies with local laws, regulations, and safety standards.
- High-Voltage (MV) Equipment Operation When operating MV equipment:
 - Stand on an insulated mat or stool.
 - Wear insulated gloves, shoes, and protective clothing.Direct contact with live parts is strictly prohibited, even when wearing PPE.
- Pre-Energization Testing
Conduct and pass insulation tests and voltage withstand tests before energizing the system.
- Capacitor Discharge Safety
AiO Box contains capacitors; ensure they are fully discharged and residual Voltage is below safety thresholds before handling.
- Weather Precautions
Do not open equipment doors on rainy days to prevent water ingress, which may damage components or cause electric shock.

** DANGER**

- **Equipment Startup Safety**
Never start equipment with doors open; ensure all enclosures are securely closed.
- **Grounding Requirements**
All power cable trays and equipment must be properly grounded to an earth electrode.
Grounding cables must comply with local safety standards.
- **Printed Circuit Board (PCB) Safety**
When the AiO Box is energized, PCBs (especially AC/DC voltage sampling boards) may carry high voltage.
Exercise caution when using test instruments (e.g., oscilloscopes) to avoid electric shock.
- **Fault Condition Safety**
In case of a fault, main and auxiliary circuits may still carry hazardous voltage.
Always measure voltage and ensure it is below safety limits before performing any operation.
- **Lifting & Transportation Safety**
Use proper lifting tools and slings with sufficient capacity to prevent accidents.
Some AiO Box components are extremely heavy; always use mechanical assistance to avoid injury.

WARNING

- The cooling fan may continue rotating after system shutdown. Never touch the blades or rotating components.
- Always wear protective gloves and safety glasses when disassembling AiO Box components to prevent injury from sharp edges.
- Avoid contact with heatsinks or heating surfaces immediately after shutdown due to burn risk. Allow sufficient cooling time before handling.
- Maintenance must be performed with a second person present to ensure personal safety at all times.

**CAUTION**

- Remove all conductive debris from the cabinet during equipment installation to prevent potential damage.
- Install the AiO Box using bolts with the specified strength ratings, in strict compliance with the installation requirements.
- Ensure adequate heat dissipation by confirming that all ventilation pathways remain clear and unobstructed.
- When handling fiber optic cables: Never grasp the fiber body directly; Avoid contact with fiber end faces;
Maintain a minimum bending radius of 35mm at all times.
- Under no circumstances open current transformer (CT) secondary wiring while the AiO Box is energized.
- All live bolted connections must be tightened to the exact torque values specified in this documentation.
- This equipment is designed exclusively for use with IT systems (IEC 60364 standard).
- Prolonged periods of non-operation may adversely affect the system's overall lifespan, particularly battery performance.

NOTICE

- All dimensions in this document are in millimeters (mm), unless otherwise specified.
- Do not remove or damage safety signs. Replace any damaged signs immediately to maintain compliance.

2.9 Daily Operation

Make sure the doors of the AiO Box are closed and locked during daily operation to prevent internal devices from damages caused by rain or rodents.

Regularly check and maintain the AiO Box and internal devices to ensure long-term and reliable operation of the AiO Box.

2.10 Disposal of Waste

When the AiO Box has come to the end of its service life, it cannot be disposed of together with household wastes. Some inside components can be recycled while some components can cause environmental pollution.

Please contact the local authorized collection point.

3 Product introduction

3.1 Product overview

AiO Box mainly include PCS, Y board, battery rack, battery management system (BMS), fire suppression system (FSS), thermal management system (TMS).

Battery rack is the core unit in the energy storage system and acts as the equipment for storing electrical energy. It can be applied to many applications including renewable energy integration, frequency regulation, and voltage regulation of the grid.

This battery rack consists of 1P52S*6S battery modules system, battery management system (BMS).

Table 3-1 Components of AiO Box system

System	Sub Components	Qty.	Remark
PCS	Power conversation unit	1	
Battery Racks	Battery Modules	6	With CSC
HV box	HV box	1	Including SBMU, fuse, isolation switch and so on
TMS	Cooling unit	1	Including compressor, pump, fan, heater and others
FSS	Smoke detector	1	
	Aerosol	1	
	Gas detector	1	

3.1.1 Battery rack

The battery system contains 6 battery modules by series connection, each battery module is composed of 52 battery cells in series connection also, so each rack contains 312 battery cells. Totally, liquid-cooled battery rack's configuration is 1P312S.

3.1.2 Battery module

Total 52 pieces lithium iron cells (280Ah/3.2V) in series connection is used for every battery module. For safety protection, an internal fast-acting DC fuse is included.

3.1.3 HV box

HV box integrate SBMU, HV contactors, pre-charge circuit, high breaking capacity and high-speed DC fuses, which can control battery rack by SBMU and send battery status data to PCS.

Table 3-2 Information of switch

No.	Switch	Name of switch	Function
1	QF1	Circuit Breaker	To switch on and off the DC24V auxiliary power supply of the HV box
2	QS1	Isolation switch	To switch on and off the output of battery system. (Cannot operate with load)

3.1.4 FSS overview

The FSS is composed of smoke detector, gas detector and aerosol, which main function is to prevent fire spread in time when any open flame signal or gas signal appears in the EES and sent out fire signal to PCS. The main components layout is shown as below.



Table 3-3 Key subsystems of FSS system

Component	Quantity	location
Smoke detector	1	On the top of Battery rack
Gas detector	1	On the top of the inner Battery door
Aerosol	1	On the top right of Battery rack

Table 3-4 Instruction of smoke detector, gas detector and aerosol

FSS components	Function
----------------	----------

Smoke detector	Working principle: using a light source and a photosensitive sensor, when smoke particles enter the light path, some of the light is scattered by reflection and refraction onto the sensor.
Gas detector	Working principle: Gas diffuses into the sensor through a capillary or membrane at the top of the sensor; inside the electrolyte within the sensor, the gas undergoes oxidation or reduction reactions at the sensing electrode (working electrode), generating a minute electric current; the magnitude of this current is directly proportional to the gas concentration; the instrument measures this current and converts it into a corresponding gas concentration reading.
Aerosol	Working principle: Aerosol mainly composed of ultra-fine potassium salt particles and inert gas, and ultrafine potassium salt particles can quickly consume OH, H and O radicals and prevent the combustion chain reaction from proceeding.

3.1.5 TMS overview

The TMS is liquid cooling, whose main function is to maintain the operating temperature of the battery system to an allowable range. The chiller is used for providing cooling & heating capacity for each battery rack. Each module has their own outlet and inlet pipes, and controlled by TMS controllers.

Due to adapt high performance TMS, the whole system 312 cells can acquire a high consistency and then can keep a long service time. The main feature of this system included:

1. Suitable for extreme ambient temperature application: $-30^{\circ}\text{C} \dots +55^{\circ}\text{C}$.
2. Single Phase L-N $220\text{V} \pm 10\%$, 50/60Hz power supply are prepared by users through micro breaker. $I \geq 16\text{A}$

3.2 BMS introduction

3.2.1 BMS overview

BMS is used in energy storage system, which can monitor the battery voltage, current, temperature, managing energy absorption and release, thermal management, low voltage power supply, high voltage security monitoring, fault diagnosis and management, external communication with PCS and ensure the stable operation of the energy storage system.

3.2.2 Battery status monitoring

1. BMS monitors the battery's parameters, including cell voltage, module temperature, battery module current and total battery module voltage.
2. BMS detects or calculates the battery status (SOX): such as State of Charge (SOC), State of health (SOH), state of energy (SOE) and state of power (SOP).
3. BMS functions as a safety management system in such cases as under voltage, over discharge, overvoltage, over-temperature, and overcurrent of the battery. In case of failure, the system will give an alarm to the supervisory equipment, limit the charge and discharge current or power, and control the disconnection of all HV relays. This can protect the battery while safeguarding the power systems security.

3.2.3 Charging/Discharging management

1. BMS controls and monitors the high voltage main contactors, auxiliary relays and low voltage coils.
2. BMS has pre-charge control within the parallel connection among racks.
3. BMS works in the management of charge and discharge. It will calculate the charge and discharge power limit according to the existing status of the battery (temperature, SOC) and electrical components and then report to PCS.
4. BMS has the function of balance management to extend the energy efficiency of the battery system.

3.2.4 Thermal management

BMS has the function of sample collecting of battery cell temperature.

3.2.5 High voltage safety monitoring

1. BMS has the function of high voltage sampling (collecting data of the main positive voltage)
2. BMS supports the detection of the status of fuse and switch, as well as the auxiliary contact of the primary loop contactor.

3.3 PCS introduction

Power Conditioning System (PCS) is a bi-directional conversion system that converts power between energy storage and grid, along with energy and grid power quality

management features.

It supports demand charge management by peak shaving, enables load shifting for time-of-use savings, and provides real power and reactive power compensation to improve power quality by power command from site controller or EMS.

With PCS solution you can realize the fullest value of an energy storage system.

3.4 AiO Box specification

3.4.1 Mechanical specification

Item	Specification	Notes
Dimensions (W x D x H)	1400mm*1300mm*2400mm	Excluding package
Net Weight	AIOA279K125L ~3,265±100kg AIOB279K125L ~2,955±100kg AIOC279K125L ~3,325±100kg	
Type of enclosure	Outdoor	
Degree of Protection	Control Box of Liquid Chiller: IP55 Battery modules: IP66 PCS module: IP65	
Transportation vibration	2M4	
Color	RAL7035	

3.4.2 Temperature and environment specification

Parameter	Value	Comments
Operating temperature (Normal rating)	-25~55°C	De-rating >45°C
Storage temperature	-30~60°C	
Relative humidity	0%~95%RH	non-condensing
Corrosion degree	C3-Medium(standard) C5-Medium(optional)	@25°C, full power
Operating elevation	0~4000m	De-rating >2000m

Cooling	Forced air cooling (PCS module) Liquid cooling (battery module)	
---------	--	--

3.4.3 Electrical specification

Item	Specification	Comments
Battery specification		
Type of Battery	LFP(LiFePO4)	
Battery Normal capacity	279.5kwh	
Number of Battery module	6	
Configuration	1P312S	
DC voltage range@ full load	873.6-1123.2Vdc	
Rated DC voltage	998.4Vdc	
Prate	0.5P	
DC Protection Device Configuration	DC Fuse+ DC load breaker	
AC side specification		
Type of power grid	IT/TN system	
Rated Grid Voltage	400VAC, 3P3W/3P4W	
Grid Voltage Range	360Vac~440Vac	-10%~+10% AC power will de-rating as the ac voltage according to the curve
Rated Grid Frequency	50/60Hz	
Grid Frequency Range	45-55/55-65Hz	
Rated AC Power at PF=1	125Kva/125kW@45°C	@Un
Rated AC Current	180.4 Arms@45°C	@Un

Power Factor	0 to 1 leading or lagging,	@Un
Current Harmonics	IEEE 519 Compliant, < 3% THD	Full load@ Grid short circuit Ratio≥2.5
Power accuracy	±1%	@Full load
AC voltage detection tolerance	±1%	
AC current detection tolerance	±1%	
AC utility frequency deviation	≤0.01Hz	
AC utility sampling frequency	≥10Hz	
Charging-discharging transfer time	<100ms	±90% rated power
Power response time	<50ms	0~100% rated power
AC Input SPD	Class II , 20kA	
AC protection Device configuration	AC breaker	SCCR≤50kA
General		
RTE	≥87%	Not including aux power loss
Fire Suppression	Aerosol	
Fire detective device	Smoke detector, flammable gas detector and exhausting system	
Interface specification		
HMI	Power &Run &Fault &LEDs, EPO button	
EMS communication	Yes	For EMS (customer)

4 Hardware component operating

4.1 Switch function description

There are some switches for main circuit and auxiliary circuit to disconnect power supply, the detail information as shown in following pictures.

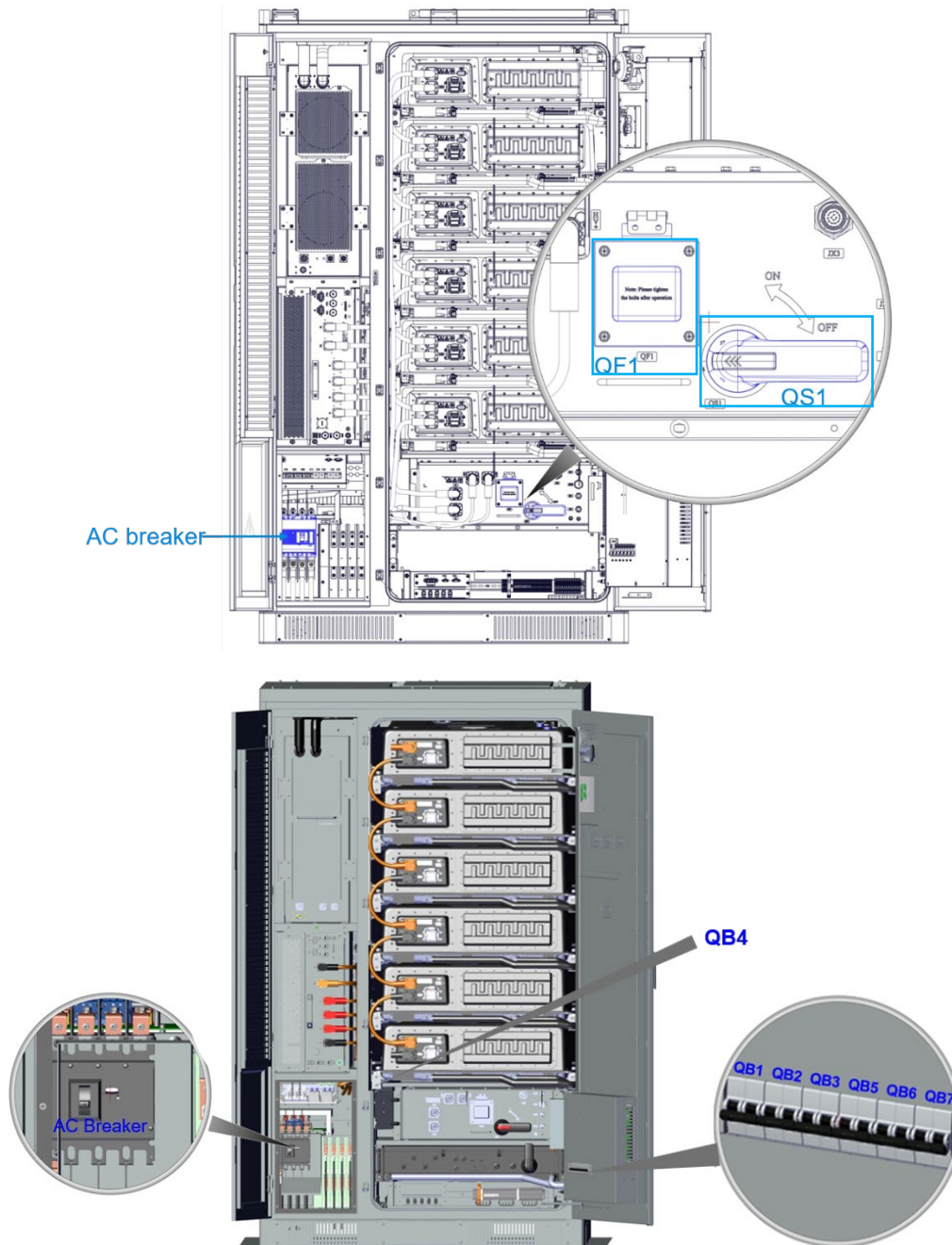


Figure 4-1 Switches in battery cabinet

Position	Name	Description	
1	QB1	Reserved	
2	QB6	Switch for external AUX power	

3	QB2	Switch for SMPS1	
4	QB3	Switch for dehumidifier	
5	QB4	Switch for chiller	
6	QB5	Switch for SMPS2	
7	QB7	Switch for PV combiner box	option

4.2 Insulation test

After completing all cable wiring, need to insulation insulating resistance of AC side prior to energize. Ensure AC breaker and breaker1 are turned off, then measure resistance between each phase cable and ground point with insulation meter, test voltage is 500Vdc and resistance should be not less than 0.6MΩ.

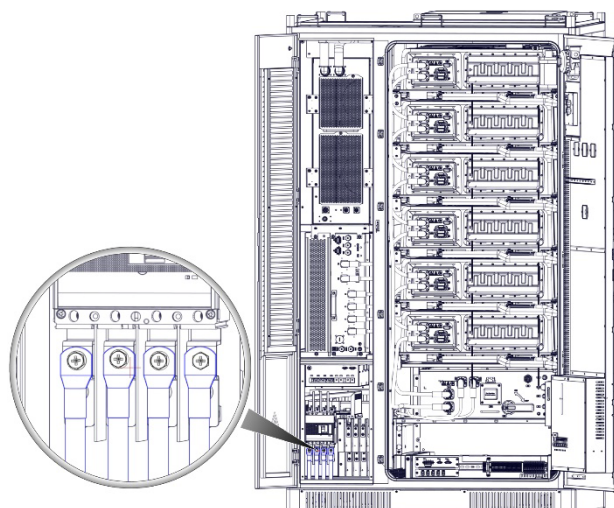


Figure 4-2 AC side insulation test

4.3 Power on main circuit

⚠ WARNING

- Ensure the AiO Box is reliably grounded.
- Press EMERGENCY STOP button at first, ensure AC breaker is open.
- Confirm power cables sequence, make sure no misconnection.
- Power on operation should first obtain approval from grid operator.

Note:1. Please remove the battery charge/discharge time label on the cabinet.

2. QB7 is not used in AIOA279K125L and AIOB279K125L.

1. Open the front door, remove the protective plate.
2. Measure AC input voltage, ensure line voltage is 400Vac±10% and phase voltage is 230Vac±10%, also phase sequence (positive sequence) shall be correct, then

close AC breaker.

3. Measure voltage of QB6:2&4, ensure it's $220\text{Vac} \pm 10\%$, then turn on QB6.
4. Turn on QB2, QB3, QB4, QB5.
5. If QB7 is connected to PV combiner box, shall be turned on.
6. At last, turn on DC isolated switch QS1.

5 Communication interface

5.1 General

This chapter describes how to operate PCS via Human Machine Interface. The following instruction can help user to master it in a short time.

There are two RJ45 port can be connected to PCS, but their IP address is difference, Port3 IP address: 192.168.254.10 and Port4 IP address: 192.168.1.136. The IP address of Port4 can be configured as required.

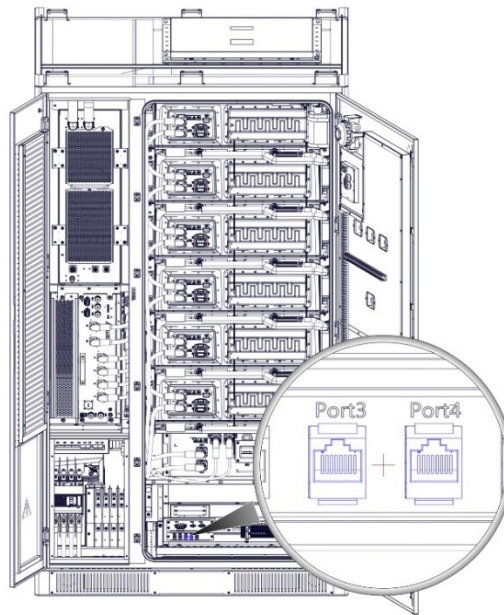


Figure 5-1 RJ45 port for communication

5.1.1 Local computer IP address settings

Before connecting to the HMI, the IP address of the PC should be set through the steps listed below:

- Right click the "Internet access" icon in windows taskbar, then click "Open Network & Internet settings".

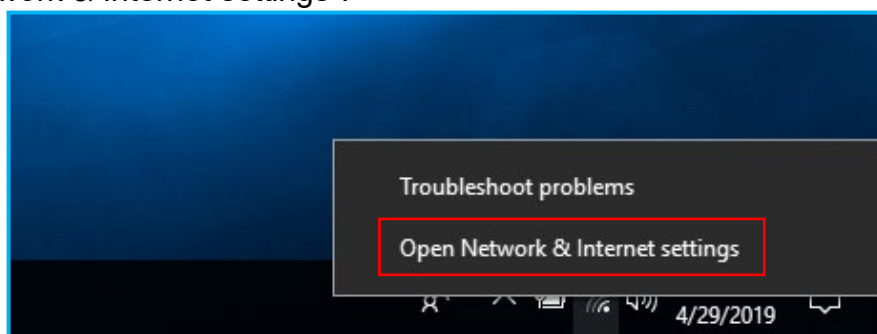


Figure 5-2 Open Network & Internet settings

b) Click “Ethernet” on the left side of the settings in Fig 5-3.

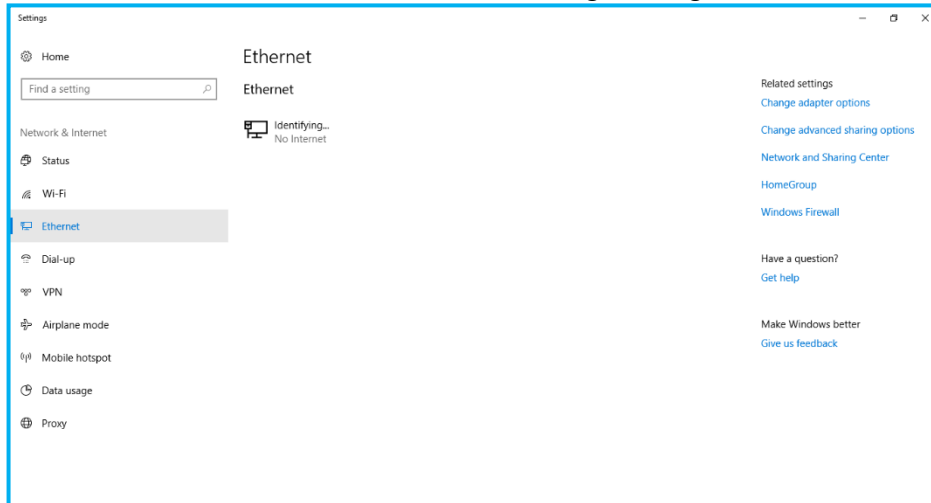


Figure 5-3 Choose “Ethernet” on the left

c) Click the “Network and Sharing Center” on the right side of the settings.

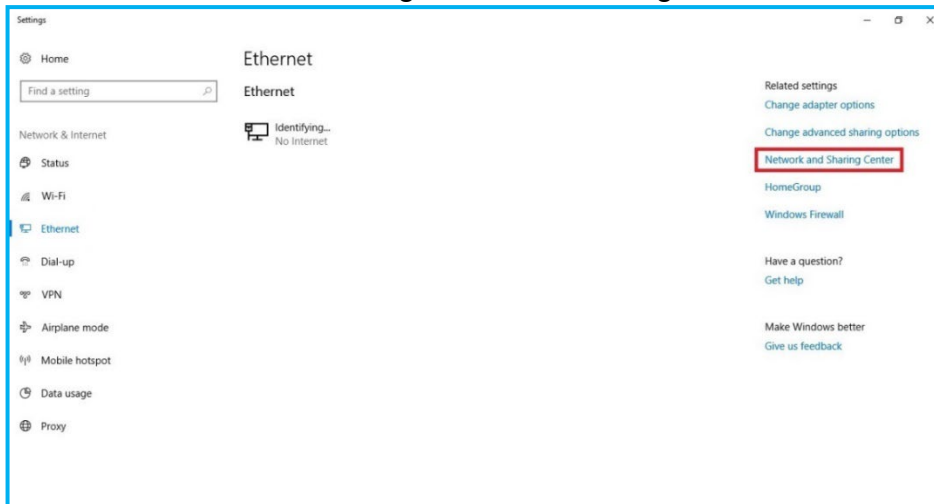


Figure 5-4 Click “Network and Sharing center” on the right in the red box

d) Click the “Ethernet” in Fig 5-5.

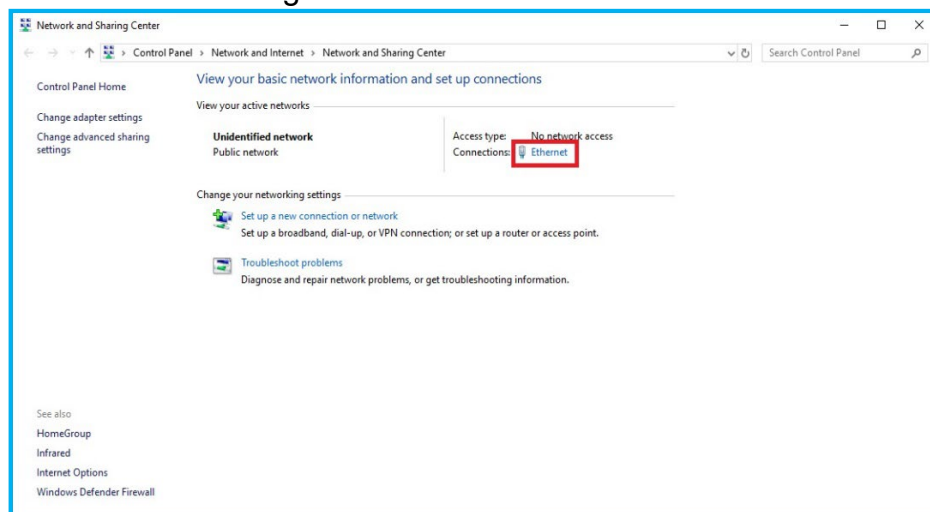


Figure 5-5 Configure “Ethernet”

- e) In the dialog of “Ethernet Status”, click the button “Properties”.

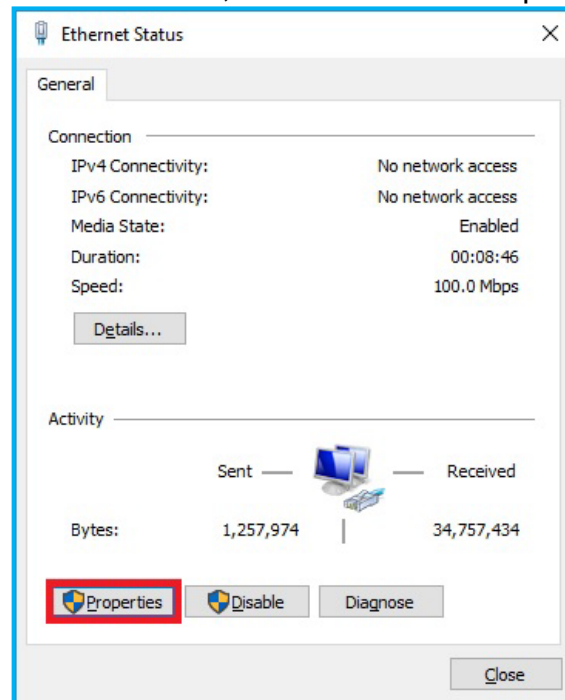


Figure 5-6 Properties

- f) Then double click the “Internet Protocol Version 4(TCP/IPv4)”

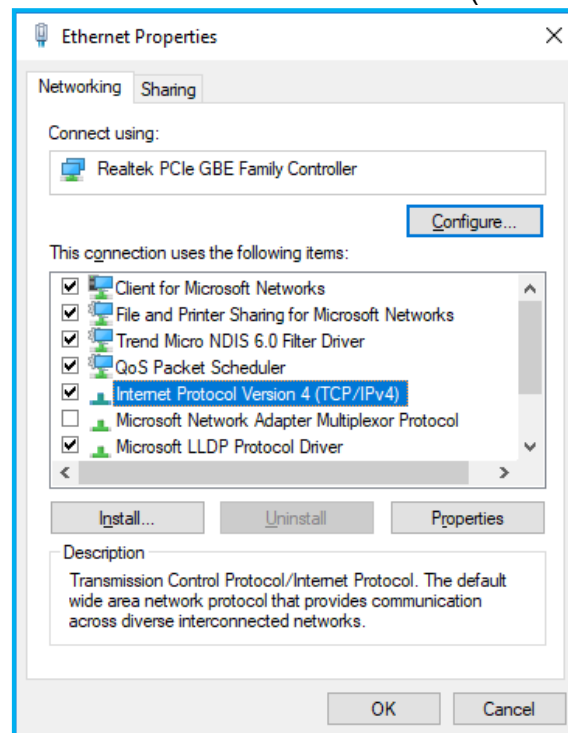


Figure 5-7 “Internet protocol version 4(TCP/IPv4)”

- g) If use Port4 as HMI communication port, shall fill the “IP address”, “Subnet mask” and “Default gateway” according to following picture, click “OK” button to complete the settings. The IP address of the host PC should be in the same segment with the PCS, and the Subnet mask should be the same. (The default

IP address of the PCS is 192.168.1.136, the setting is in following picture.)

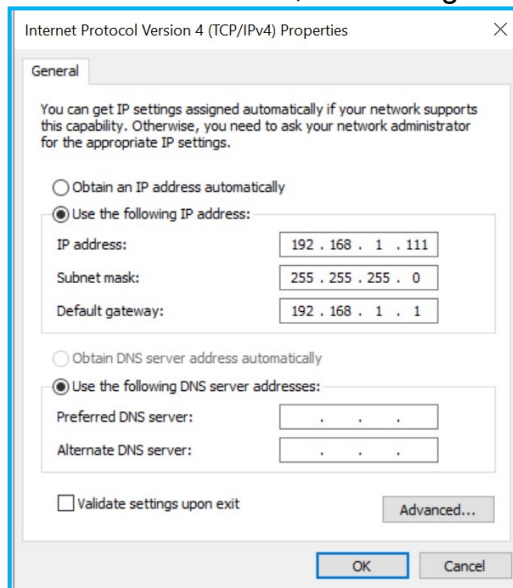


Figure 5-8 Input the “IP address” and “Subnet mask”

- h) If use Port3 as HMI communication port, shall fill the “IP address”, “Subnet mask” and “Default gateway” according to following picture, click “OK” button to complete the settings. The IP address of the host PC should be in the same segment with the PCS, and the Subnet mask should be the same. (The default IP address of the PCS is 192.168.254.10, the setting is in following picture.)

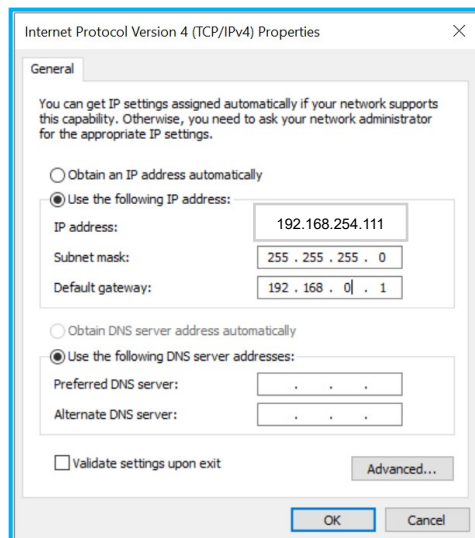


Figure 5-9 Input the “IP address” and “Subnet mask”

5.2 Log in HMI

Double clicks the IE browser icon and enter IP address “192.168.254.10” to open HMI login window. And then enter correct user name and password. Different account with its password means different level operation right. The following content is displayed

with the highest administrator privileges.

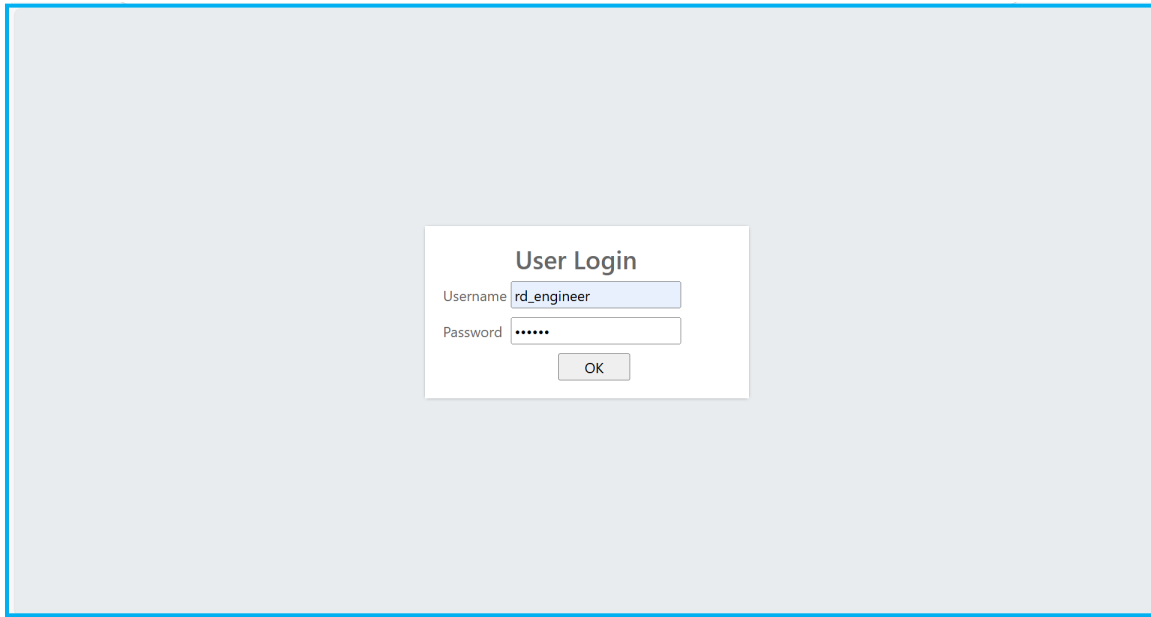


Figure 5-10 Login window

Click “OK” button to enter HMI window as shown in figure 5-10.

If you want to save the username and password on your PC, directly click “Save” button on the dialog box, otherwise you can select “Not now” to give up it. Once you save the username and password, you can login HMI easily in next time, and don’t need to enter them in login window.

Select “Logout” to exit HMI window.

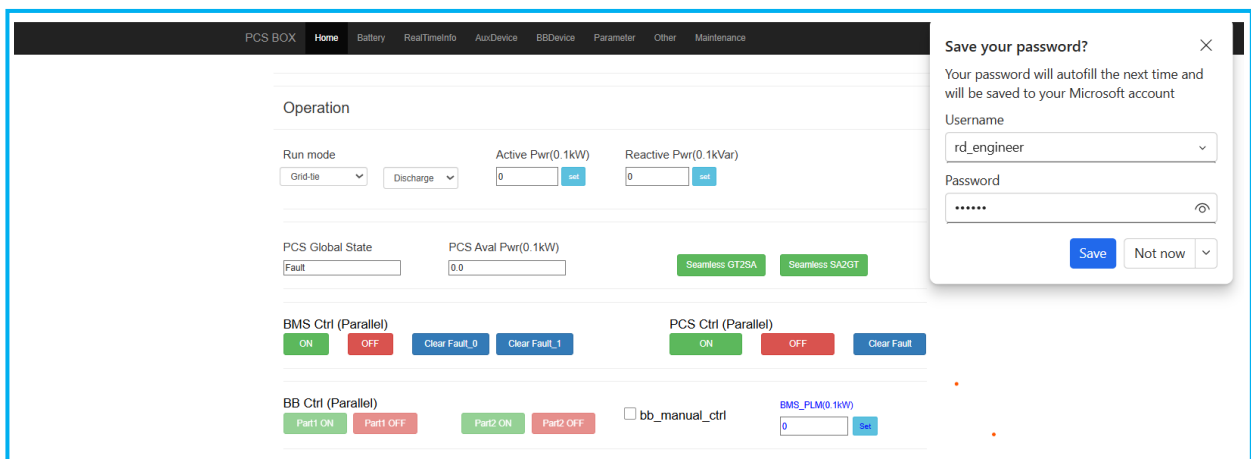


Figure 5-11 HMI window

HMI home page has few functions area, their detail introduction is list in following table.

PCS BOX
Home
RealTimeInfo
AuxDevice
BBDevice
Parameter
Other
Maintenance
logout

Run mode

Grid-off

Discharge

A

Active Pwr(0.1kW)

0

set

Reactive Pwr(0.1kVar)

0

set

B

PCS Global State

Fault

PCS Aval Pwr(0.1kW)

0.0

C

BMS Ctrl (Parallel)

ON

OFF

Clear Fault_0

Clear Fault_1

D

PCS Ctrl (Parallel)

ON

OFF

Clear Fault

E

BB Ctrl (Parallel)

Part1 ON

Part1 OFF

Part2 ON

Part2 OFF

F

BOX Group Index:

☐ 1
☒ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7
☐ 8
☐ 9
☐ 10

BMS Ctrl (Self)

ON

OFF

G

PCS Ctrl (Self)

ON

OFF

H

BB Ctrl (Self)

Part1 ON

Part1 OFF

Part2 ON

Part2 OFF

I

(For BB CP Ctrl Test , Not For Normal)

BB190 USER Mode

BB_PLM(0.1kW)

PORTB_CP

100

Set

J

Firmware Version

A os_version

3.1.24.0.29

A system_version

3.2.24.0.72

A loboard_version

3.3.24.3.0

A module_version

0.0.0.0.0

A fpga_version

0.0.0

K

BOX Status

Standby

PCS Status

Fault

Running Mode

Grid-off

PCS Derating(%)

100.0

L

Running Information

Index	Name	Value	Unit
0	SYS_VOLT_PCS_RS	3.0	V
1	SYS_VOLT_PCS_ST	2.2	V
2	SYS_VOLT_PCS_TR	0.8	V
3	SYS_DC_IN_VOLT	1.3	V
4	DAM_IO_R	0.0	A

Index	Name	Value	Unit
5	DAM_IO_S	0.0	A
6	DAM_IO_T	0.0	A
7	SYS_POWER_ACTIVE_ALL	0.0	kW
8	SYS_POWER_REACTIVE_ALL	0.0	kVar
9	SYS_POWER_APPVA_ALL	0.0	kVA

M

Primary Battery Information

Index	Name	Value	Unit
0	STATUS	NORMAL	N/A
1	SOC	29.4	%
2	SOH	100.0	%
3	IN_VOLT	1027.8	V
4	EX_VOLT	0.1	V
5	CURRENT	0.0	A
6	LMT_CH_CURR	-135.8	A
7	LMT_DISCH_CURR	135.8	A
8	LMT_CH_PWR	-139.6	kW
9	LMT_DISCH_PWR	139.6	kW
10	CH_ENGY	189.3	kWh
11	DISCH_ENGY	68.0	kWh
12	MAX_V	3.296	V
13	MIN_V	3.293	V
14	AVG_V	3.294	V

Index	Name	Value	Unit
15	MAX_T	23	°C
16	MIN_T	22	°C
17	AVG_T	22	°C
18	Fault_Level	0	N/A
19	F_1	0000H	N/A
20	F_2	0000H	N/A
21	F_3	0000H	N/A
22	F_4	0000H	N/A
23	F_5	0000H	N/A
24	F_6	0000H	N/A
25	F_7	0000H	N/A
26	F_8	0000H	N/A
27	F_9	0000H	N/A
28	F_10	0000H	N/A

N

Figure 5-12 Home page

Area	Explanation
A	Run Mode selection. Include Grid-tie, Grid-off, AFE, SVG, operator can select it according to requirement.
B	Active and reactive power setting. PCS operator can enter power value in it, for active power, positive means discharge energy to grid and negative means charge battery. For reactive power, positive means reactive power injection, but negative means reactive power absorption.

C	System status and available power. Indicate PCS current running condition. Include Fault, Initial, Standby, Soft start, Normal run.
D	All BMS operation button, include BMS ON, BMS OFF, Clear Fault function. Suitable for multiple parallel.
E	All PCS operation button, include PCS ON, PCS OFF, Clear Fault function. Suitable for multiple parallel.
F	All BB operation button, include Port1 ON, Port1 OFF, Port2 ON, Port2 OFF. Suitable for multiple parallel. Only applicable to AIOC279K125L.
G	BMS operation button of Single AiO Box, include BMS ON, BMS OFF function.
H	PCS operation button of Single AiO Box, include PCS ON, PCS OFF function.
I	BB operation button of Single AiO Box, include Port1 ON, Port1 OFF, Port2 ON, Port2 OFF function. Only applicable to AIOC279K125L.
J	BB control and power setting of Single AiO Box, only applicable to AIOC279K125L.
K	Firmware version, display OS version, system version, IO board version, module and FPGA firmware version.
L	AiO status information.
M	PCS running information, including AC voltage, current and power information.
N	Battery information, including battery voltage, current, power and fault information.

5.4 HMI real time info

In Real Time Info page, it mainly displays PCS MCU info, Module info and real-time fault info.

PCS BOX Home **RealTimeInfo** AuxDevice BBDevice Parameter Other Maintenance logout

BOX Group Index: ☒ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 A

MCU Info

Index	Name	Value	Unit
0	SYS_FREQ_GRID	0.00	Hz
1	SYS_VOLT_GRID_RS	0.2	V
2	SYS_VOLT_GRID_ST	0.0	V
3	SYS_VOLT_GRID_TR	0.0	V
4	SYS_VOLT_PCS_RS	1.5	V
5	SYS_VOLT_PCS_ST	1.5	V
6	SYS_VOLT_PCS_TR	0.3	V
7	SYS_VOLT_GRID_R	0.0	V
8	SYS_VOLT_GRID_S	0.0	V
9	SYS_VOLT_GRID_T	0.0	V
10	SYS_VOLT_PCS_R	0.5	V
11	SYS_VOLT_PCS_S	1.0	V
12	SYS_VOLT_PCS_T	0.5	V
13	SYS_CURR_GRID_R	0.0	A
14	SYS_CURR_GRID_S	0.0	A
15	SYS_CURR_GRID_T	0.0	A
16	SYS_POWER_ACTIVE_R	0.0	kW
17	SYS_POWER_ACTIVE_S	0.0	kW
18	SYS_POWER_ACTIVE_T	0.0	kW

Index	Name	Value	Unit
20	SYS_POWER_REACTIVE_S	0.0	kVar
21	SYS_POWER_REACTIVE_T	0.0	kVar
22	SYS_POWER_APPA_R	0.0	kVA
23	SYS_POWER_APPA_S	0.0	kVA
24	SYS_POWER_APPA_T	0.0	kVA
25	SYS_POWER_ACTIVE_ALL	0.0	kW
26	SYS_POWER_REACTIVE_ALL	0.0	kVar
27	SYS_POWER_APPA_ALL	0.0	kVA
28	SYS_VOLT_IN	1023.2	V
29	SYS_PCMD_ANALOG	0.0	kW
30	SYS_QCMD_ANALOG	0.0	kVar
31	SYS_TEMP_AMBIENT	42.1	°C
32	SYS_TEMP_INLET	30.3	°C
33	SYS_IMD_ISO	0	kΩ
34	SYS_MAX_POWER_AVAIL	125.0	kVA
35	SYS_SEAMLESS_SS_CTRL_DO1	0	N/A
36	SYS_SEAMLESS_SS_CTRL_DO2	0	N/A
37	SYS_SEAMLESS_SS_FBK	0	N/A
38	SYS_GRID_ACTIVE_POWER	0.0	%

PCS BOX	Home	RealTimeInfo	AuxDevice	BBDevice	Parameter	Other	Maintenance	logout
---------	------	--------------	-----------	----------	-----------	-------	-------------	--------

DSP Info				C			
Index	Name	Value	Unit	Index	Name	Value	Unit
0	DAM_V_GRID_RS	7.5	V	22	DAM_POWER_REACTIVE_R	-0.1	kVar
1	DAM_V_GRID_ST	0.0	V	23	DAM_POWER_REACTIVE_S	-0.1	kVar
2	DAM_V_GRID_TR	7.8	V	24	DAM_POWER_REACTIVE_T	-0.1	kVar
3	DAM_V_CAP_RS	7.5	V	25	DAM_S	0.4	kVA
4	DAM_V_CAP_ST	1.6	V	26	DAM_P	-0.3	kW
5	DAM_V_CAP_TR	9.5	V	27	DAM_Q	-0.3	kVar
6	DAM_V_GRID_R	5.2	V	28	DAM_DC_VIN	1027.1	V
7	DAM_V_GRID_S	2.3	V	29	DAM_DC_IIN	0.0	A
8	DAM_V_GRID_T	2.5	V	30	DAM_DC_BUS	0.0	V
9	DAM_FREQ_GRID	0.00	Hz	31	DAM_DC_BUS_POS	0.0	V
10	DAM_IL1_R	0.0	A	32	DAM_DC_BUS_NEG	0.0	V
11	DAM_IL1_S	0.0	A	33	DAM_DC_BUS_POS_HIGH	0.0	V
12	DAM_IL1_T	0.1	A	34	DAM_DC_BUS_POS_LOW	0.0	V
13	DAM_IO_R	0.0	A	35	DAM_DC_BUS_NEG_HIGH	0.0	V
14	DAM_IO_S	0.0	A	36	DAM_DC_BUS_NEG_LOW	0.0	V
15	DAM_IO_T	0.0	A	37	DAM_TEMP_AMBIENT	33.3	°C
16	DAM_POWER_APPA_R	0.0	kVA	38	DAM_TEMP_R	33.1	°C
17	DAM_POWER_APPA_S	0.0	kVA	39	DAM_TEMP_S	32.0	°C
18	DAM_POWER_APPA_T	0.0	kVA	40	DAM_TEMP_T	32.3	°C
19	DAM_POWER_ACTIVE_R	-0.1	KW	41	DAM_V_CAP_R	5.9	V
20	DAM_POWER_ACTIVE_S	-0.1	KW	42	DAM_V_CAP_S	1.7	V
21	DAM_POWER_ACTIVE_T	-0.1	KW	43	DAM_V_CAP_T	3.7	V

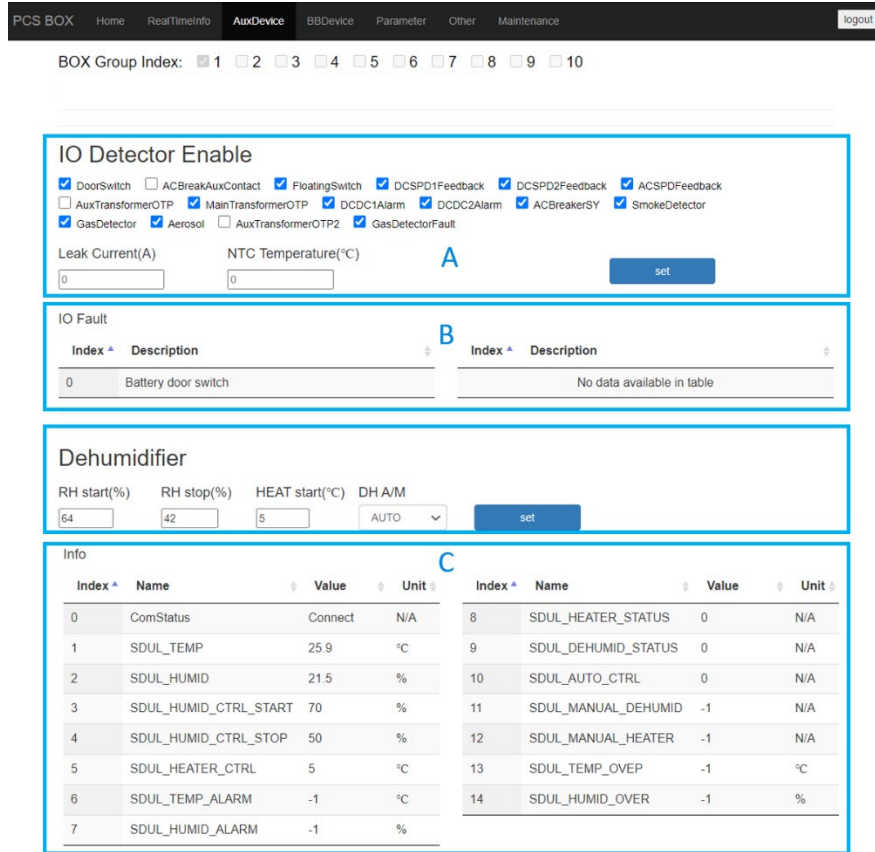
MCU Fault		DSP Fault	
Index	Description	Index	Description
No data available in table		No data available in table	

Figure 5-13 Realtime info window

Area	Explanation
A	BOX group ID index. There are up to ten Box group can parallel connected, and each box group can consist of three cabinets, one Primary cabinet and two Sub cabinet. Sub cabinet don't have PCS, and its battery output will connect to primary cabinet DC connector. Box group info is read individually through can select group ID. Once check the group ID, its PCS info will display in following area.
B	PCS MCU info. It is also called system info, which mainly displays PCS voltage, current, frequency and power parameters. This info is from MCU FW.
C	DSP info. It mainly displays IGBT module voltage, current, frequency and power parameters. This info is from DSP FW.
D	PCS has two kind of fault, MCU and DSP fault, MCU fault is form MCU FW. DSP fault is from DSP FW, Once PCS occurs fault, the fault info will arise here immediately. And PCS can clear them automatically if actual fault is disappeared.

5.5 Aux device

In auxiliary device page, it mainly indicates some auxiliary device info, such as IO board, dehumidifier and cooling system. Also, can set their parameters through this page.



The screenshot shows the 'AuxDevice' page with a navigation bar at the top containing 'PCS BOX', 'Home', 'RealTimeInfo', 'AuxDevice' (selected), 'BBDevice', 'Parameter', 'Other', and 'Maintenance'. A 'logout' button is on the right. Below the navigation bar is a 'BOX Group Index' row with checkboxes for indices 1 through 10. The main content area is divided into four sections:

- IO Detector Enable (Area A):** Contains various status checkboxes (e.g., DoorSwitch, ACBreakAuxContact, FloatingSwitch, DCSPD1Feedback, DCSPD2Feedback, ACSPDFeedback, AuxTransformerOTP, MainTransformerOTP, DCDC1Alarm, DCDC2Alarm, ACBreakerSY, SmokeDetector, GasDetector, Aerosol, AuxTransformerOTP2, GasDetectorFault) and input fields for 'Leak Current(A)' and 'NTC Temperature(°C)' with a 'set' button.
- IO Fault (Area B):** A table with columns 'Index' and 'Description'. It shows one entry: Index 0, Description 'Battery door switch'.
- Dehumidifier:** Contains input fields for 'RH start(%)' (64), 'RH stop(%)' (42), 'HEAT start(°C)' (5), and 'DH A/M' (AUTO), with a 'set' button.
- Info (Area C):** A table with columns 'Index', 'Name', 'Value', and 'Unit'. It lists 15 parameters related to the dehumidifier, including status, temperature, humidity, and control values.

Figure 5-14 Aux device window

Area	Explanation
A	IO signal enables, all IO signal can be bypassed or enable.
B	IO fault info display area, if this fault is caused by IO signal, fault info will indicate here.
C	Dehumidifier info, including all dehumidifier control parameter, such as temp and dehumidify

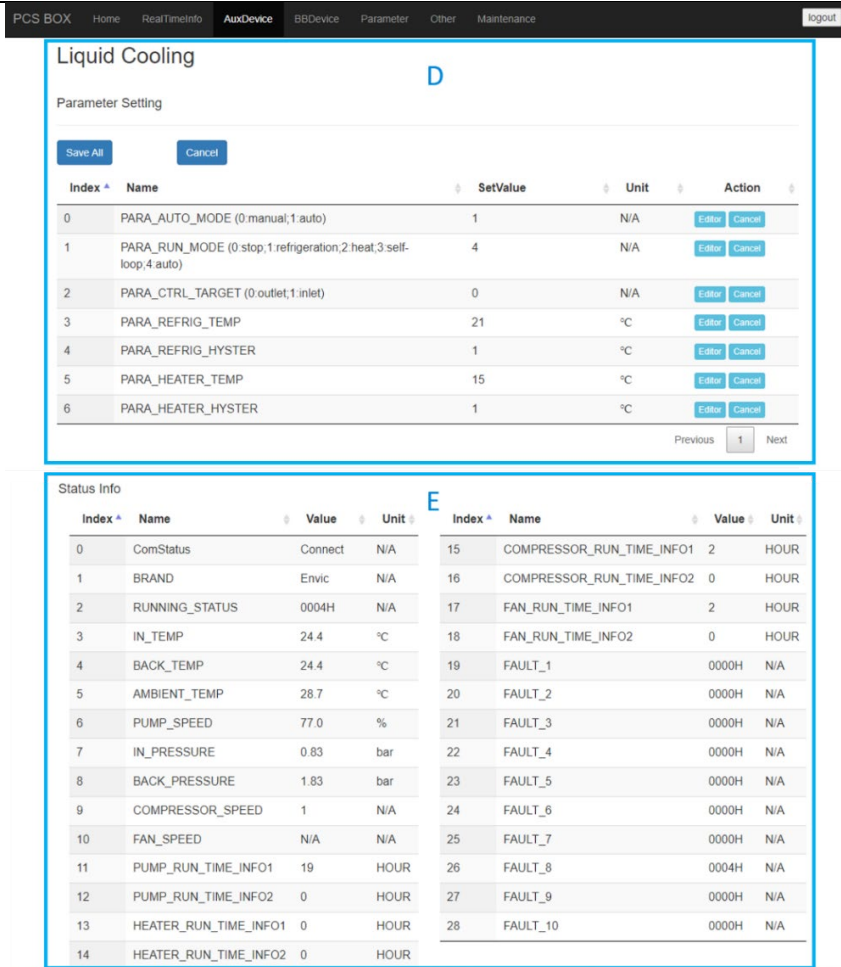


Figure 5-15 Aux device window

Area	Explanation
D	Chiller system control parameter setting, including control mode, run mode and running/stop temp threshold
E	Chiller system running info, including liquid temp, pressure, pump rotation seep and it fault info

5.6 Parameter

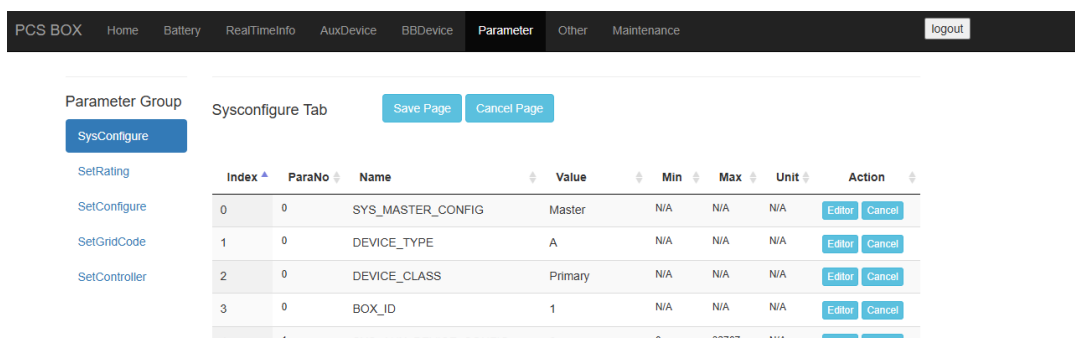
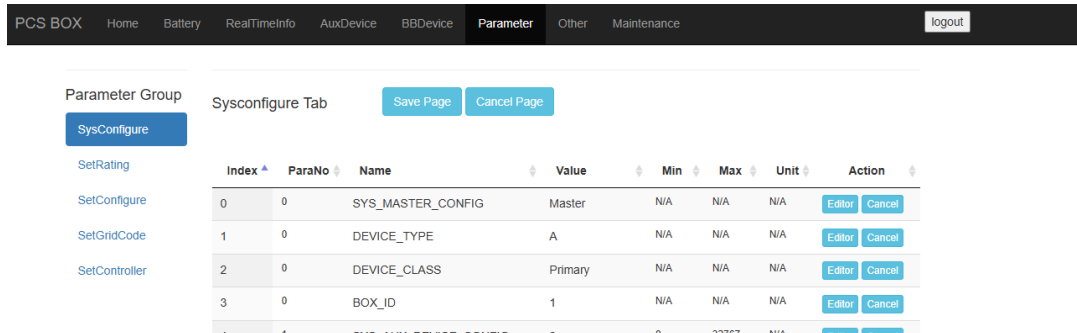


Figure 5-16 Parameter page

On this page, you can configure the required parameters as per your actual application.

5.6.1 AiO Box parallel configuration

Log in to the HMI and navigate to the **Parameter** page.



Index	ParaNo	Name	Value	Min	Max	Unit	Action
0	0	SYS_MASTER_CONFIG	Master	N/A	N/A	N/A	Editor Cancel
1	0	DEVICE_TYPE	A	N/A	N/A	N/A	Editor Cancel
2	0	DEVICE_CLASS	Primary	N/A	N/A	N/A	Editor Cancel
3	0	BOX_ID	1	N/A	N/A	N/A	Editor Cancel

Figure 5-17 Parallel configuration page

AIOA279K125L configuration:

By factory default, AIOA279K125L is in master mode with ID 1; you only need to configure the slave devices.

1. SYS_MASTER_CONFIG: Click the **Editor** button, select *Slave*.
2. BOX_ID: Click the **Editor** button, update the number to n (where $2 \leq n \leq 10$).
3. Then click **Save Page**.

AIOB79K125L configuration:

The AIOB79K125L can only act as a subsystem, and it supports up to two slave devices.

1. SYS_MASTER_CONFIG: Click the **Editor** button, select *Slave*.
2. DEVICE_TYPE: Click the **Editor** button, select *B*.
3. DEVICE_CLASS: Click the **Editor** button, select *Subset1*.
4. BOX_ID: Click the **Editor** button, update the number to n (where $n=1$ or 2).
5. Then click **Save Page**.

AIOC79K125L configuration:

By factory default, AIOC279K125L is in master mode with ID 1; you only need to configure the slave devices.

1. SYS_MASTER_CONFIG: Click the **Editor** button, select *Slave*.
2. BOX_ID: Click the **Editor** button, update the number to n (where $2 \leq n \leq 10$).
3. Then click **Save Page**.

After setting parameters, Power off PCSs and power on them again.

5.7 Others

PCS BOX
Home
RealTimeInfo
AuxDevice
BBDevice
Parameter
Other
Maintenance
logout

ETH0(local) IP Setting

IP Address

192.168.254.10

MAC

B8-94-D9-CB-8C-E3

Mask

255.255.255.0

Gateway

192.168.254.1

A

ETH1 IP Setting

IP Address

192.168.1.136

Port

502

MAC

B8-94-D9-CB-8C-E5

Mask

255.255.255.0

Gateway

192.168.1.1

Set

EMS IP Address

192.168.254.5

Set

B

NTP Server Setting

IP Address

0.0.0.0

Set

Data/Time Setting

TimeZone

Beijing

Set

Date/Time(Localtime)

xxxx/xx/xx xx:xx:xx

Get

Set

NET Monitoring(A-ETH1 / B-ETH0)

Socket Check

Enable

Check Period(sec)

30

Set

Net Restart

Disable

Delay Time(min)

1

Set

BOX Serial Number

XXXX00000000

Set

PCS Serial Number

XXXX00000000

Set

Liquid Cooling Type

TongFei

E

Figure 5-18 Other page

Area	Name	Explanation
A	PCS IP setting	PCS IP address. There are two IP address, ETH0 an ETH1, the former is static IP address, can be changed and it is used to create system internal network, the latter IP can be changed according to site requirement, but shall avoid former IP network domain, because these two IP can't be in same network domain.
B	EMS IP	This IP is used to set EMS IP address.
C	Date/Time	PCS system date/time, select tome zone and click get button to capture PC time, then click set button to synchronize PCS date/time with PC time.
D	BOX and PCS SN	Box and PCS product serial number, it is the same with nameplate SN.
E	Liquid type	According to chiller type based on chiller product.

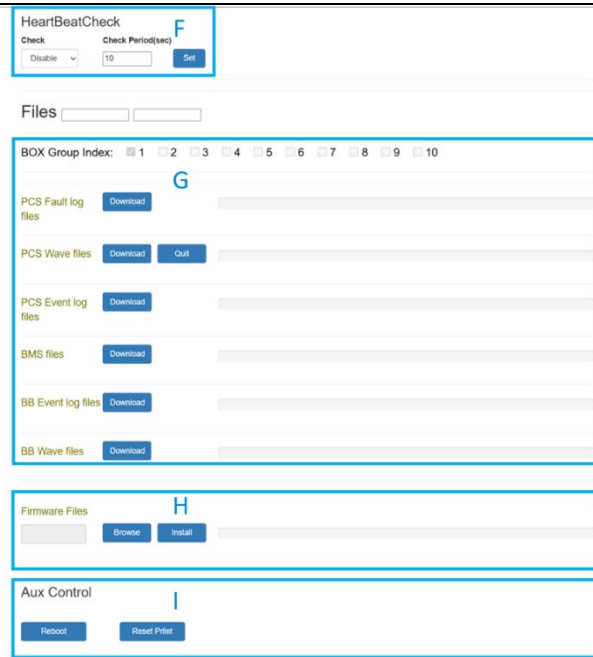
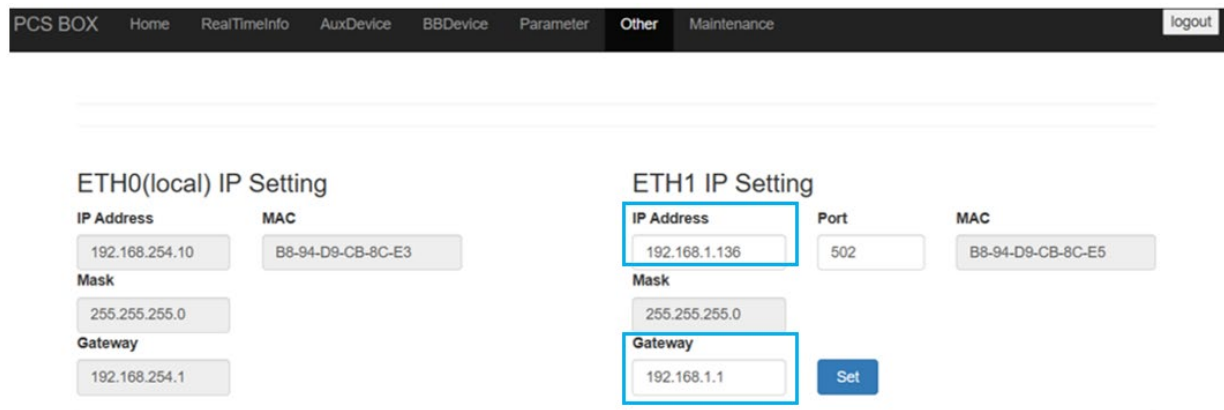


Figure 5-19 Other page

Area	Name	Explanation
F	Heart Beat	Communication heart beat monitoring, which is used to monitor communication status between PCS and HMI.
G	PCS log export	PCS log file export, include PCS, BMS and other device fault info, system log and wave file, these data is used to analyze system fault.
H	FW upgrade	FW upgrade window.
I	Aux control	Reboot all PCS control processor, include MCU and DSP.
E		Reset Par list is used to restore all PCS parameters to default value.

5.7.1 IP Address Settings

Log in to the HMI and navigate to the **Other** page.



Update the IP Address and Gateway as required (e.g., 10.148.40.90 and 10.148.40.1),

then click the **Set** button.

After setting IP address, Power off PCSs and power on them again.

5.7.2 Log file export

Once PCS or other device occur fault, the fault info will be record in memory chip as a log file even though the real time fault is cleared. The log file can be export from memory through HMI tool. Take PCS as example to share how to export files. Click the Download button (A), the progress bar will indicate the file download state, when it is fully filled, means file is save to PC completely. Then HMI window will appear a dialog box (B) to guide the save path, click Open file to open log file directly. Normally, the file includes two txt document, one is Module log and the other one is System log.

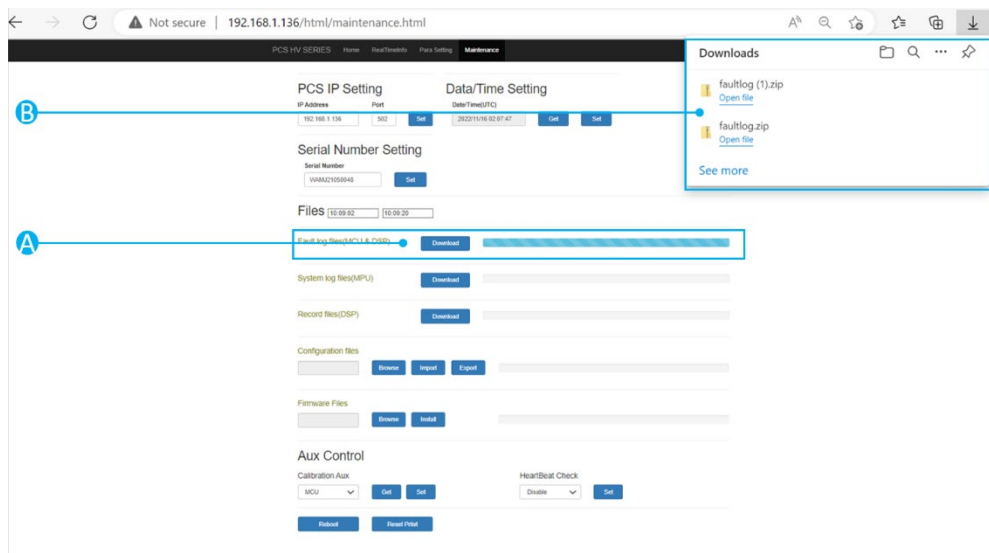


Figure 5-20 Log file download

If the dialog box disappears, the log file can be found in PC downloads fold as shown below picture.

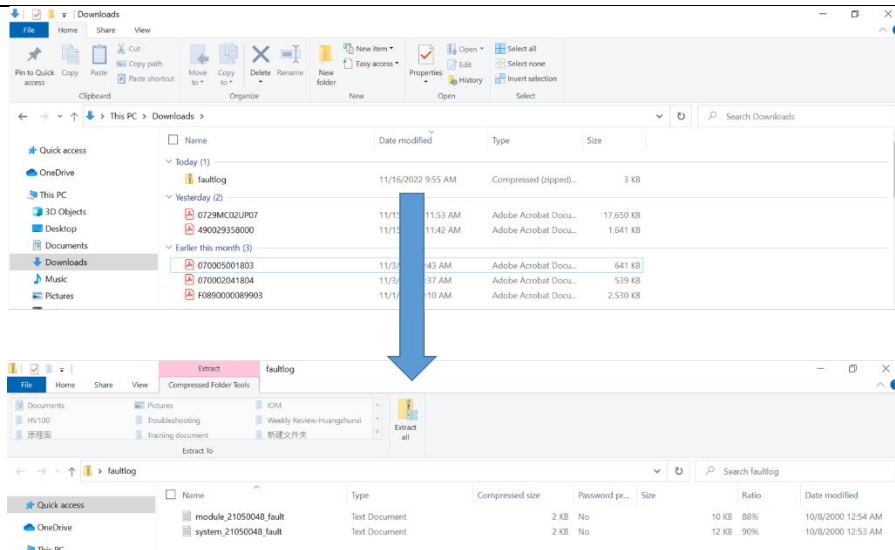


Figure 5-21 Log file save path

5.7.3 FW update

If FW of AiO Box need to be updated/upgraded, which can conduct it through HMI tool. At first, select FW file by clicking browse button, then click install button to import FW file to all device. When multi cabinet consist a parallel system, all device FW can be updated at one time. This operation will last few minutes.

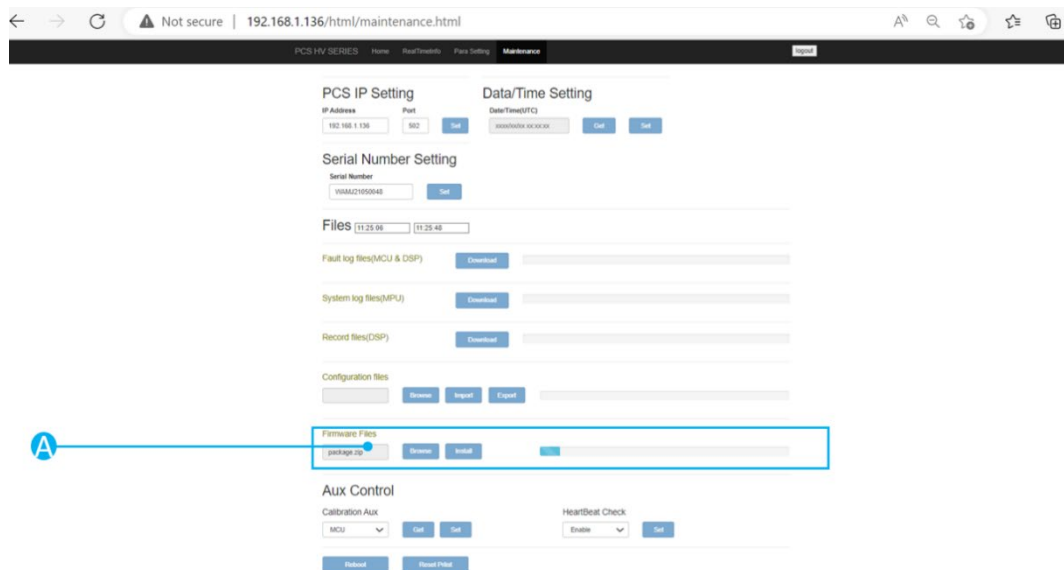


Figure 5-22 FW upgrade

Once FW is installed completely, system will reboot automatically after confirming the dialog box tips.

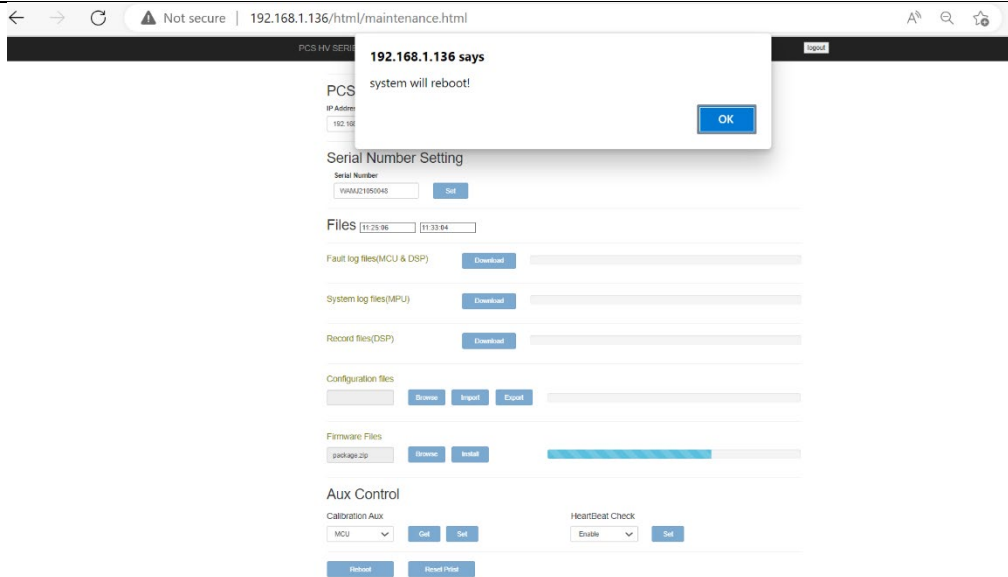


Figure 5-23 System reboot

After completing the firmware upgrade, log in to the HMI interface again and check the updated firmware version on the 'Home' page to confirm whether the version number has been upgraded to the latest one. Shown as the figure 5-24.



Figure 5-24 Check firmware version

6 System configuration

AiO Box should be configured before any other operation. Here the configurations are divided to following groups, Installation configuration, Ratings & Run Mode, Grid Code & Protection, System Clock & Communication, and Battery Info. If no action is done, factory default settings would be applied.

Abbreviations would be referred in following sections:

Table 6-1 Abbreviation table

Abbr.	Definition
[M]	Must
[O]	Optional

6.1 Password management

The web login offers three levels of user permissions and passwords, the password is a combination of numbers, letters and symbols. And the password must be a combination of at least 8 characters. Simple password combinations such as 12345678 are prohibited.

- administrator,
- application engineer
- customer.

After logging in with different user permissions, users can obtain different parameter information and have the corresponding modification rights.

6.2 Parameter configuration

In this part, we mainly pay attention to system configurations linked with installation. For example, how many AiO Boxes are installed, Basic communication parameters like IP address, baud rate etc. Before configuration, please check the system configuration documents.

For these items, a recommended process is as follows:

- [M] Step1. Read value stored in AiO Box;
- [M] Step2. Input correct password level I or level II;
- [O] Step3. Write new value to AiO Box, if change is necessary;
- [O] Step4. Read new value to verify if new setting is applied.

Note:

*If step3 is processed, step4 is a must operation. If step4 failed, try step3 and step4 again.
All these items only could be modified off line, which means they only could be modified in S1 (Standby) and S4 (Fault).*

6.3 Communication configuration [FIRST RUN / WHEN NEED]

Configurations about communication items **SHOULD** be set before others. Which means that, communication configurations should be done first.

Table 6-2 Configuration Table for Ethernet Communication.

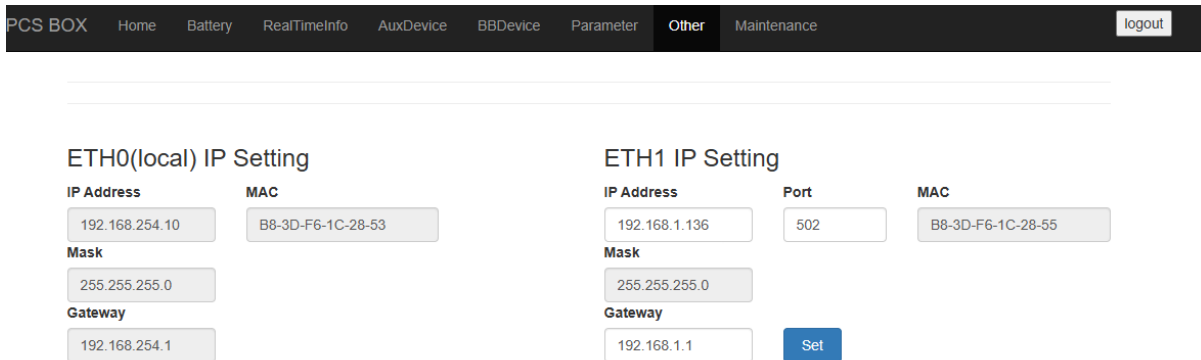
ADDR (HEX)	ADDR (DEC)	TYPE	DEFINITION	DESCRIPTION	Unit	RW	Min	Max	Default	OA
1836	6198	Uint16	EN_PR_OS_CONFIGURE_IP_ADDR1	IP_ADDR1.XXX.XXX.XXX	NA	RW	0	255	192	No
1837	6199	Uint16	EN_PR_OS_CONFIGURE_IP_ADDR2	XXX.IP_ADDR2.XXX.XXX	NA	RW	0	255	168	No
1838	6200	Uint16	EN_PR_OS_CONFIGURE_IP_ADDR3	XXX.XXX.IP_ADDR3.XXX	NA	RW	0	255	1	No
1839	6201	Uint16	EN_PR_OS_CONFIGURE_IP_ADDR4	XXX.XXX.XXX.IP_ADDR4	NA	RW	0	255	136	No
183A	6202	Uint16	EN_PR_OS_CONFIGURE_IP_PORT	IP_PORT	NA	RW	0	32767	502	No

The default IP address is 192.168.1.136 and port is 502, if need to set new IP address, please modify the above registers.

Table 6-3 Configuration Table for Ethernet Communication.

ADDR (HEX)	ADDR (DEC)	TYPE	DEFINITION	DESCRIPTION	Unit	RW	Min	Max	Default	OA
183B	6203	Uint16	EN_PR_OS_GW_IP_ADDR1	IP_ADDR1.XXX.XXX.XXX	NA	RW	0	255	255	No
183C	6204	Uint16	EN_PR_OS_GW_IP_ADDR2	XXX.IP_ADDR2.XXX.XXX	NA	RW	0	255	255	No
183D	6205	Uint16	EN_PR_OS_GW_IP_ADDR3	XXX.XXX.IP_ADDR3.XXX	NA	RW	0	255	255	No
183E	6206	Uint16	EN_PR_OS_GW_IP_ADDR4	XXX.XXX.XXX.IP_ADDR4	NA	RW	0	255	0	No

You can make the settings in the interface based on the parameters shown in the following picture.



The screenshot shows the 'Other' tab in the PCS BOX interface. It displays two sections for Ethernet IP settings:

- ETH0(local) IP Setting:**
 - IP Address: 192.168.254.10
 - Mask: 255.255.255.0
 - Gateway: 192.168.254.1
 - MAC: B8-3D-F6-1C-28-53
- ETH1 IP Setting:**
 - IP Address: 192.168.1.136
 - Mask: 255.255.255.0
 - Gateway: 192.168.1.1
 - Port: 502
 - MAC: B8-3D-F6-1C-28-55
 - A 'Set' button is visible next to the Port field.

Figure 6-1 Parameter settings

Table 6-4 Set new IP address, for example new IP address=10.7.21.40, port=502

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	1836	000A	Set IP_ADDR1 =10	Set new IP address : 10.7.21.40 Port:502	[M]
2	01	06	1837	0007	Set IP_ADDR2 =7		[M]
3	01	06	1839	0015	Set IP_ADDR3 =21		[M]
4	01	06	183A	0028	Set IP_ADDR4 =40		[M]
5	01	06	183B	01F6	Set IP_PORT =502		[M]

6.4 Run mode/Operation mode [FIRST RUN / WHEN NEED]

PCS run mode should be set before run. PCS may run in different run modes according to user's instant requirements.

For example, at 8:00 PCS could run in grid-tie/grid-following mode under an operation mode as '1. Power Set'. And at 9:00, maybe PCS would be changed to run in Standalone/Grid-forming mode with constant voltage and constant frequency. Anyway, one run mode should be set first.

The most important key items are listed in "Table 6-5 Table of Run Mode & Operation Mode".

For these items, a recommended process is as follows,

- [M] Step1. Read value stored in PCS;
- [O] Step2. Write new value to PCS, if change is necessary;
- [O] Step3. Read new value to verify if new setting is applied.

Table 6-5 Table of Run Mode & Operation Mode

ADDR (HEX)	ADDR (DEC)	TYPE	DEFINITION	DESCRIPTION	Unit	RW	Min	Max	Default	OA
1892	6290	Uint16	EN_CMD_PCS_RUN_MODE	0: PCS Run with Grid-Following /Grid-tie mode; 1: PCS Run with Grid-Forming/Off-grid mode;2:AFE mode;3:Open_loop mode;4:VSG mode Default: 0 - Grid-following mode Note: The PCS will be restored to the default value every time it is powered on again.	NA	R/W	0	5	0	No
1870	6256	Uint16	EN_PR_SYS_MASTER_CONFIG	System Master configuration. 0: Master (Default). 1: Slave.	NA	RW	0	1	0	No
1895	6293	Uint16	EN_PR_NUM_OF_PCS_IN_PARA	How many PCS modules are installed in system.	NA	RW	1	10	1	No
18D0	6352	Uint16	EN_PR_GC_Q_MODE_SEL	Reactive Power Mode Selection 0: SPF 1: Power Set (Demand response) 2: PFP 3: Volt-Var 4:Watt-Var(only for 1547) 5:Fixed Q(only for 4110) 6: Volt Restrained(only for DELTA_DEFAULT/JAPAN) Other: NA	NA	RW	0	6	1	Yes
18D1	6353	Uint16	EN_PR_GC_PQ_PRIORITY	Priority of active power / reactive power (GC mode) 0: Reactive first; 1: Active first;	NA	RW	0	1	0	No

Two typical configurations for system application are listed as follows for reference.

Run mode VSG(On-Grid) ▼	SYS_MASTER_CONFIG	Master	N/A	N/A	N/A	Editor	Cancel
	NUM_OF_PCS_IN_PARA	1	1	10	N/A	Editor	Cancel
	Q_MODE_SEL	1	0	6	N/A	Editor	Cancel
	PQ_PRIORITY	0	0	1	N/A	Editor	Cancel

Figure 6-2 Parameter settings

Table 6-6 PCS System mode: Independent mode (Factory default)

M/O	ADDR(Hex)	Definition	Default	PCS#1	Description
M	1892	CMD_PCS_RUN_MODE	0	0	Grid following
M	1870	PR_SYS_MASTER_CONFIG	0	0	Master
M	1895	PR_NUM_OF_PCS_IN_PARA	1	1	Single PCS application
M	18D0	PR_GC_Q_MODE_SEL	1	1	Power demand mode
M/O	18D1	PR_GC_PQ_PRIORITY	0	0	Reactive power priority

If ten PCSs are installed in some storage system applications. Configuration parameters as the table shown below.

Table 6-7 PCS System mode: Parallel mode

M/O	ADDR (Hex)	Definition	Default	PCS#1 (ID=1-10)	Description
M	1892	CMD_PCS_RUN_MODE	0	0	PCS run mode (0: Grid following, 1: Grid-forming)
M	1870	PR_SYS_MASTER_CONFIG	0	0	PCS#1: master PCS#2, #3, #4, #5, #6, #7, #8, #9, #10.: slave
M	1895	PR_NUM_OF_PCS_IN_PARA	1	10	Parallel number is 10
M	18D0	PR_GC_Q_MODE_SEL	1	1	Power demand mode
M/O	18D1	PR_GC_PQ_PRIORITY	0	0	Reactive power priority

Note:

For parallel system mode, only the register [1870] need to be configured one by one. Except the configured PCS can be powered on, the other PCS need to be powered off. For the other registers, the upstream controller or EMS only needs to communicate with the Master for parameter configuration, and the Master will copy these parameters to each slave via broadcast mode.

After setting parameters, Power off PCSs and power on them again.

7 Normal operation

AiO Box should be configured before running. Once AiO Box is configured, core settings are memorized.

Core settings can only be modified when AiO Box's state is 'STANDBY' or 'FAULT'. If you find that the changes could not be applied, please check the AiO Box's state first.

The AC output terminals of ALL-IN-ONE PCS is 3 phase 4 wire, including a neutral line, and ALL-IN-ONE PCS can connect to a TN system with neutral line grounded or to an IT system without neutral line. But the neutral line output of ALL-IN-ONE PCS will not be grounded by PCS itself. In grid-tied mode, the neutral line should be grounded by utility grid. In standalone mode, the neutral line should be grounded by load side distribution cabinet.

7.1 Grid-tie (GT) mode operation

Power On AiO Box

To power on the ALL-IN-ONE PCS in grid-tied mode, see the following requirements:

After the PCS installation is completed, check to ensure that the upstream breaker of AC side is in the closed state before powering on PCS.

And check to make sure the battery system is powered on and battery system output switch is in closed state.

Ethernet communication port (ETH1) of ALL-IN-ONE PCS shall be connected to EMS or upper-level controller or site controller to establish the communication link.

Step 1: open the front door.

Step 2: turn the AC breaker and DC disconnects in the front of the cabinet to ON state. The AiO Box powers on and enters standby mode.(Refer to the DC switch marked as QS1 in Figure 4-1)

Step 3: set the correct IP address (Default:192.168.254.10) and port number (502) and start communicating with ALL-IN-ONE PCS.

Step 4: configure and confirm the right operation mode (Grid-tied mode) and parameters by following the below table via upper-level controller.

Table 7-1 Parameters of GRID TIE Mode

CMD				DESCRIPTION	REMARK	Option
ID(PCS)	Function	Register	Value			
01	06	1892	0000	Set PCS run as GRID TIE mode	0: Grid Tie/Grid-following	[M]
01	06	1893	0000	Set wiring mode	0: 3P3L	[M]
01	06	1870	0000	Set Master	0: Master	[O]
01	06	1895	0001	Set parallel number	1: single PCS	[O]
01	06	18D0	0001	Set Power demand mode	1: Power demand mode	[O]
01	06	18D1	0000	Set Reactive power priority	0: Reactive power	[O]

priority

Step 5: after completing the configuration, check whether ALL-IN-ONE PCS is “Standby” status, if it is, the upper-level controller sends “Power ON” command to ALL-IN-ONE PCS. PCS will synchronize with grid.

Step 6: when ALL-IN-ONE PCS enters the “Normal” status, the upper-level controller sends “Reactive Power” or/and “Active Power” command to ALL-IN-ONE PCS, it will output the corresponding power to the grid. See below table for parameters of power on and power command of ALL-IN-ONE PCS.

Table 7-2 Parameters of power on and power command

CMD				DESCRIPTION	REMARK	Option
ID(PCS)	Function	Register	Value			
01	06	18B0	0001	Command for PCS ON	Please Check if PCS State is in Standby first. After a few seconds (About 8-10s), PCS state would change to “RUN”. Or check register 0x06F4, Or check register 0x0730.	[M]
01	06	800	00C8	Set Active Power Command.	Value in Hex, unit is	[M]

				0.1kW. 0xC8 is 20kW for example.			
01	06	801	00C8	Set	Reactive	Value in	[M]
				Power Command.		Hex, unit is 0.1kVar	

NOTE:

1. When PCS is running, user could change commands for active and reactive power (step 6) when it is necessary.
2. Model ALL-IN-ONE PCS: P-rated is 125kW.

Power Off AiO Box

After ALL-IN-ONE PCS is working in grid-tied mode, one can shut down and power off PCS by following steps.

Step 1: the upper-level controller sets “Reactive Power” or/and “Active Power” command to 0, and PCS out power will become to 0.

Step 2: the upper-level controller sends “Power OFF” command to ALL-IN-ONE PCS, ALL-IN-ONE PCS will stops running and enters the “Standby” status.

Table 7-3 Parameters of power off

CMD				DESCRIPTION	REMARK	Option
ID(PCS)	Function	Register	Value			
01	06	18B0	0002	Command to Stop/Off PCS.	PCS would turn to Standby if there is no any fault.	[M]

NOTE: In emergency status, one can press the “EPO” button on the front door to shut down AiO Box.

Step 3: open the front door.

Step 4: turn the AC breaker and DC disconnects in the front of the cabinet to OFF state. The AiO Box powers off and one can do maintenance to AiO Box. (Refer to the DC

switch marked as QS1 in Figure 4-1)

7.2 Standalone (SA) mode operation

In the off-grid mode, the machine will operate without an electricity grid. If it is connected to the grid without following the instructions in the user manual, it may cause unexpected malfunctions, resulting in the machine being unable to work.

Power On AiO Box

To power on the ALL-IN-ONE PCS in standalone mode, see the following requirements:

1. After the PCS installation is completed, check to ensure that the upstream breaker to utility grid is in the open state, and the breaker to load is in the closed state before powering on PCS.

2. And check to make sure the battery system is powered on and battery system output switch is in closed state.

3. Ethernet communication port (ETH1) of ALL-IN-ONE PCS shall be connected to EMS or upper-level controller or site controller to establish the communication link.

Step 1: open the front door.

Step 2: turn the AC and DC switches/disconnects in the front of the cabinet to ON state. The PCS powers on and enters standby mode.

Step 3: set the correct IP address (Default: 192.168.1.136) and port number (502) and start communicating with ALL-IN-ONE PCS.

Step 4: configure and confirm the right operation mode (Standalone mode) and parameters by following the below table via upper-level controller.

Table 7-4 Parameters in Standalone/Grid-forming Mode

CMD				DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value						
01	06	1892	0001	Set PCS run in SA mode temporarily.	1: SA/Grid-forming mode.	[M]
01	06	1893	0000	Set wiring mode	1: 3P3L	[M]
01	06	18B0	0001	PCS ON	Turn to RUN STATE	[M]
01	06	18B0	0002	PCS OFF	Turn to STANDBY STATE	[M]

NOTE: The value of register [0x1892] will be restored to the default value every time it is powered on again.

Step 5: after completing the configuration, check whether ALL-IN-ONE PCS is “Standby” status, if it is, the upper-level controller sends “Power ON” command to ALL-IN-ONE PCS. PCS will output 3 phase sine wave voltage.

Step 6: when ALL-IN-ONE PCS enters the “Normal” status, the local load connected to PCS output can be powered.

Power Off AiO Box

After ALL-IN-ONE PCS is working in standalone mode, one can shut down and power off PCS by following steps.

Step 1: all the load is open, and PCS out power will become to 0.

Step 2: the upper-level controller sends “Power OFF” command to ALL-IN-ONE PCS, ALL-IN-ONE PCS will stops running and enters the “Standby” status.

NOTE: In emergency status, one can press the “EPO” button on the front door to shut down AiO Box.

Step 3: open the front door.

Step 4: turn the AC breaker and DC disconnects in the front of the cabinet to OFF state. The PCS powers off and one can do maintenance to AiO Box.

According to the above introduction, you can set and operate the machine as shown in the following diagram in either off-grid or grid-connected mode to achieve the purpose of making it run.

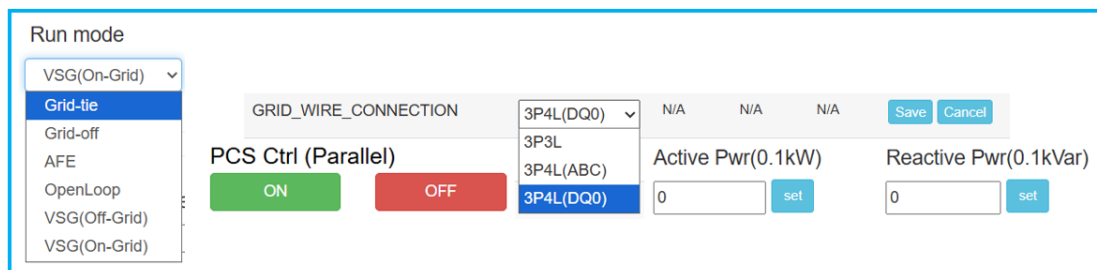


Figure 7-1 Grid-tie/Standalone run mode setting

8 Parameter setting

8.1 Grid code [FIRST RUN / WHEN NEED]

AiO Box should be configured before run. Once AiO Box was configured, core settings are memorized. AiO Box would load default settings if customer do not want to change anything.

Core settings are only could be modified when AiO Box’s state is ‘**STANDBY**’ or ‘**FAULT**’.

If you find that the changes could not be applied, please check the AiO Box's state first.

For these items, a recommended process is as follows:

- [M] Step1. Read value stored in AiO Box;
- [M] Step2. Input correct password level I or level II;
- [O] Step3. Write new value to AiO Box, if change is necessary;
- [O] Step4. Read new value to verify if new setting is applied.

Note:

(a) We recommend user check settings before run PCS each time, to make sure all the settings are the same as you planed.

(b) Please confirm Main breaker / Contactor for **GRID TIE** is close.

(c) This chapter applies to the parameter configuration of grid code for different area in grid-connected mode.

(d) To model ALL-IN-ONE PCS, only need to select different grid code and enable one or more functions, generally don't need to modify any detailed curve point or parameters.

8.2 Set grid code

The register parameters of this chapter will vary depending on the register [0x189E] (Grid code type). When PCS is applied to a certain area, you should first confirm the applicable grid regulations and set the following register. For Australian regulation AS/NZS 4777.2:2020+A1:2021+A2:2024, the user needs to write the value "6" to register [0x189E], the corresponding numbers for specific country codes can refer to the below table for detail. (Note: The following settings are given as an example for Australia. Other regulations may vary. They should be adjusted according to the actual regulations in place. The document mainly provides instructions on how to set them up and cannot cover all regulations.).

Table 8-1 Grid code parameter

Index	Grid Code Type	Description
0	No Set	No grid code application.
1	AS4777.2A	Applicable to Australia Region A grid-connected regulatory certification.
2	NZS4777.2	Applicable to New Zealand grid-connected regulatory certification.

4	AS4777.2B	Applicable to Australia Region B grid-connected regulatory certification.
5	AS4777.2C	Applicable to Australia Region C grid-connected regulatory certification.
11	IEEE1547_400V	Applicable to The United States Region 400V grid-connected regulatory certification
13	IEEE1547_480V	Applicable to The United States Region 480V grid-connected regulatory certification
14	JETGR_50HZ	Applicable to Japan Region 50Hz grid-connected regulatory certification
15	JETGR_60HZ	Applicable to Japan Region 60Hz grid-connected regulatory certification
31	Delta Default	Default configuration, cannot be applied to specific regions, only for test use.

You can select the countries and regions you want to set by choosing from the parameter interface in the following picture.

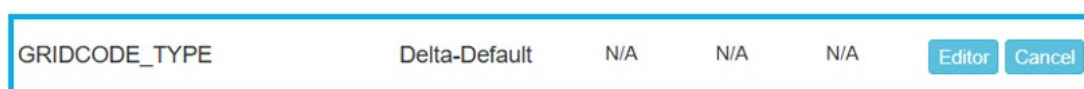


Figure 8-1 Parameter settings

Table 8-2 grid code parameter setting (example)

STEP	CMD	DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value				
1	01 06 189E 0006	Grid code.	Choose and confirm the appropriate code according to the application area. 0: No Set 1: AS4777.2A 2: NZS4777.2 4: AS4777.2B 5: AS4777.2C 11:IEEE1547_400V	[M]

13:IEEE1547_480V
14: JETGR_50HZ
15: JETGR_60HZ
31: Delta Default
Others reserved

8.3 Normal/Soft-start ramp rates setting

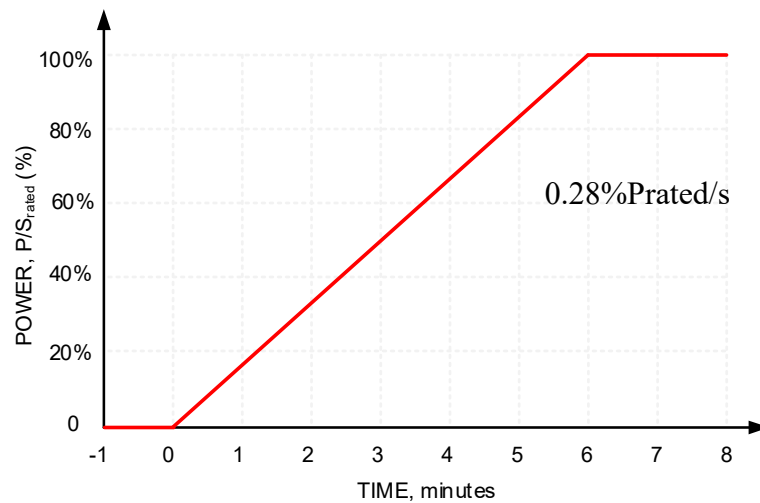


Figure 8-2 Normal/Soft-start ramp rates

Table 8-3 Steps for setting Normal soft start ramp rates [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	18D4	0001	Enable normal soft start ramp rate	1: Enable with 0.01% Scale	[M]
2	01	06	18D5	001C	Set normal soft start ramp rate value	Setting normal soft start ramp rate value = 0.28%	[O]

Table 8-4 Steps for disabling Normal soft start ramp rates

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	18D4	0000	Disable normal soft start ramp rate	0: Disable normal soft start ramp rate	[M]

Note: For Normal ramp rates function configuration, which is suitable for user-defined slope, the configuration steps are the same as above table.

You can enable this function by following the settings shown in the picture below.

NORM_SOFT_RR_EN	1	0	3	N/A	Editor	Cancel
NORM_SOFT_RR_VAL	28	1	10000	N/A	Editor	Cancel

Figure 8-3 Parameter settings

8.4 Anti-Islanding protection function setting

There are three selectable modes in the isolated island mode. The specific setting modes can be referred to in the following table.

ANTI_ISLANDING_EN	0	0	3	N/A	Editor	Cancel
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Figure 8-4 Parameter settings

Table 8-5 Steps for setting anti-islanding protection function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value							
1	01	06	18D9	0001	Enable anti-islanding passive check	0: Disable 1: Active Enable	[M]

Note: The detecting method of active anti-islanding is judging the variation of frequency or voltage by injecting the reactive power to grid.

Table 8-6 Steps for disabling anti-islanding protection function

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	18D9	0000	Disable anti-islanding check	0: Disable	[M]

8.5 High/Low voltage protection function setting

Table 8-7 Passive anti-islanding voltage limit values

Protective function	Protective function limit	Trip delay time	Maximum disconnection time
Undervoltage 2 ($V < <$)	70 V	1 s	2 s
Undervoltage 1 ($V <$)	180 V	10 s	11 s
Overvoltage 1 ($V >$)	265 V	1 s	2 s
Overvoltage 2 ($V > >$)	275 V	—	0.2 s

Table 8-8 Steps for setting high/low voltage protection function [FIRST RUN / WHEN NEED]

STEP	CMD	DESCRIPTION	REMARK	Option
	ID(PCS) Function Register Value			

1	01	06	18DA	001E	Enable high/low voltage protection	bit4 = 1: Over Level 2 enable bit3 = 1: Over Level 1 enable bit2 = 1: Under Level 1 enable bit1 = 1: Under Level 2 enable bit0 = 0: Under Level 3 disable	[M]
2	01	06	18DB	0000	Set over/under voltage time scale	bit4 = 0: Over Level 2 scale 0.01s(10ms) bit3 = 0: Over Level 1 scale 0.01s(10ms) bit2 = 0: Under Level 1 scale 0.01s(10ms) bit1 = 0: Under Level 2 scale 0.01s(10ms) bit0 = 0: Under Level 3 scale 0.01s(10ms)	[O]
3	01	06	18DC- 18E5	/	Threshold Value and time Configuration	The value is different based on different grid code, please refer to ALL-IN- ONE PCS Protocol.	[O]

According to the above description, you can set the parameters on the interface according to the specifications. The values of UVP and OVP are percentages with an accuracy of 0.1%. The units of UVP_TIME and OVP_TIME are seconds and the accuracy is 0.01. You can adjust the " over/under voltage time scale" value to make the

precision of " UVP_TIME and OVP_TIME " to 0.1.

(Note: The parameters are for illustrative purposes only).

AC_VOLT_LEVEL_EN	31	0	287	N/A	Editor	Cancel
AC_VOLT_TIME_SCALE	0	0	31	N/A	Editor	Cancel
AC_OVP_HV2	1125	1000	1300	N/A	Editor	Cancel
AC_OVP_HV1	1125	1000	1300	N/A	Editor	Cancel
AC_UVP_LV1	550	50	1000	N/A	Editor	Cancel
AC_UVP_LV2	750	50	1000	N/A	Editor	Cancel
AC_UVP_LV3	750	50	1000	N/A	Editor	Cancel
AC_OVP_TIME_HV2	20	1	30000	N/A	Editor	Cancel
AC_OVP_TIME_HV1	200	1	30000	N/A	Editor	Cancel
AC_UVP_TIME_LV1	1000	1	30000	N/A	Editor	Cancel
AC_UVP_TIME_LV2	1000	1	30000	N/A	Editor	Cancel
AC_UVP_TIME_LV3	1000	1	30000	N/A	Editor	Cancel

Figure 8-5 Parameter settings

Table 8-9 Steps for disabling high/low voltage protection function

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	18DA	0000	Disable high/low voltage protection	bit4 = 0: Over Level 2 disable bit3 = 0: Over Level 1 disable bit2 = 0: Under Level 1 disable bit1 = 0: Under Level 2 disable bit0 = 0: Under Level 3 disable	[M]

8.6 High/Low frequency protection function setting

Table 8-10 Passive anti-islanding frequency limit values

	Region	Australia A	Australia B	Australia C	New Zealand
Under-frequency 1 ($F <$)	Protective function limit value	47 Hz	47 Hz	45 Hz	45 Hz
	Trip delay time	1 s	1 s	5 s	1 s
	Maximum disconnection time	2 s	2 s	6 s	2 s
Over-frequency 1 ($F >$)	Protective function limit value	52 Hz	52 Hz	55 Hz	55 Hz
	Trip delay time	—	—	—	—
	Maximum disconnection time	0.2 s	0.2 s	0.2 s	0.2 s

Table 8-11 Steps for setting high/low frequency protection function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	18E6	0006	Enable high/low frequency protection	bit3 = 0: Over Level 2 disable bit2 = 1: Over Level 1 enable bit1 = 1: Under Level 1 enable bit0 = 0: Under Level 2 disable	[M]
2	01	06	18E7	0000	Set over/under frequency time scale	bitx = 0: 0.01s(10ms) bit3 = 0: Over Level 2 scale 0.01s(10ms) bit2 = 0: Over Level 1 scale 0.01s(10ms) bit1 = 0: Under Level 1 scale 0.01s(10ms) bit0 = 0: Under Level 2 scale 0.01s(10ms)	[O]
3	01	06	18E8-18EF	/	Protection Value and time Configuration	The value is different based on different grid code, please refer to ALL-IN-	[O]

ONE PCS

Protocol.

According to the above description, you can set the parameters on the interface according to the specifications. The units of UFP and OFP are Hz and the accuracy is 0.01. The units of UFP_TIME and OFP_TIME are seconds and the accuracy is 0.01. You can adjust the " over/under frequency time scale" value to make the precision of " UFP_TIME and OFP_TIME " to 0.1.

(Note: The parameters are for illustrative purposes only).

AC_FREQ_LEVEL_EN	15	0	15	N/A	Editor	Cancel
AC_FREQ_TIME_SCALE	0	0	15	N/A	Editor	Cancel
AC_OFP_HF2	5500	5000	7000	N/A	Editor	Cancel
AC_OFP_HF1	5500	5000	7000	N/A	Editor	Cancel
AC_UFP_LF1	4500	4000	6000	N/A	Editor	Cancel
AC_UFP_LF2	4500	4000	6000	N/A	Editor	Cancel
AC_OFP_TIME_HF2	200	1	30000	N/A	Editor	Cancel
AC_OFP_TIME_HF1	200	1	30000	N/A	Editor	Cancel
AC_UFP_TIME_LF1	200	1	30000	N/A	Editor	Cancel
AC_UFP_TIME_LF2	200	1	30000	N/A	Editor	Cancel

Figure 8-6 Parameter settings

Table 8-12 Steps for disabling high/low frequency protection function

STEP	CMD				DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value							
1	01	06	18E6	0000	Disable high/low voltage protection	bit3 = 0: Over Level 2 disable bit2 = 0: Over Level 1 disable bit1 = 0: Under Level 1 disable bit0 = 0: Under Level 2 disable	[M]

8.7 Reconnection function setting

Table 8-13 Steps for setting Reconnection function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
------	-----	--	--	--	-------------	--------	--------

ID(PCS)		Function	Register	Value			
1	01	06	18F0	0001	Auto reconnection function enable	1: Enable auto reconnection function	[M]
2	01	06	18F1	04EC	Auto reconnection voltage set high Unit: 0.1%	Setting value = 110%, means 110%*Vrated	[O]
3	01	06	18F2	037B	Auto reconnection voltage set low Unit: 0.1%	Setting value = 89.1%, means 89.1%*Vrated	[O]
4	01	06	18F3	1397	Auto reconnection frequency set high Unit: 0.01Hz	Setting value = 50.15, means 50.15Hz	[O]
5	01	06	18F4	128E	Auto reconnection frequency set low Unit: 0.01Hz	Setting value = 47.50, means 47.50Hz	[O]
6	01	06	18F5	003C	Auto reconnection time set delay Unit: s	Setting value = 60, means 60s	[O]

NOTE: Model ALL-IN-ONE PCS: Vrated is 230V, Frated=50Hz

You can refer to the above information and make the following settings on the interface.

AUTO_RECONNECT_EN	1	0	1	N/A	Editor	Cancel
AC_RECONNECT_HV	1100	1000	1300	N/A	Editor	Cancel
AC_RECONNECT_LV	891	800	1000	N/A	Editor	Cancel
AC_RECONNECT_HF	5015	5000	7000	N/A	Editor	Cancel
AC_RECONNECT_LF	4750	4000	6000	N/A	Editor	Cancel
AC_RECONNECT_TIME	60	1	1000	N/A	Editor	Cancel

Figure 8-7 Parameter settings

Table 8-14 Steps for disabling Reconnection function

STEP	CMD		DESCRIPTION		REMARK	Option
ID(PCS)		Function	Register	Value		
1	01	06	18F0	0000	Auto reconnection function disable	0: Disable auto reconnection [M]

8.8 SPF mode setting

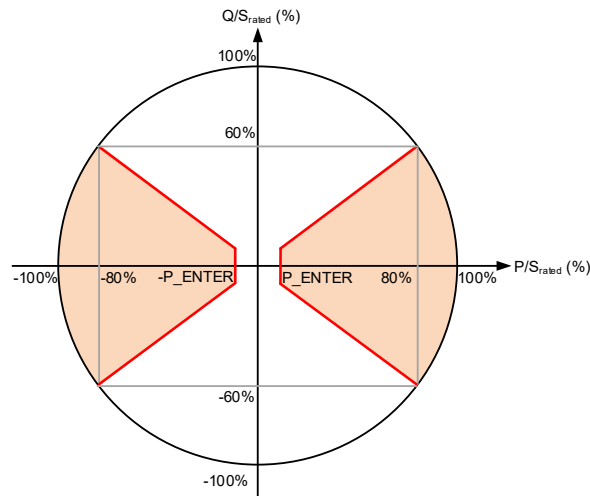


Figure 8-8 SPF control mode limit area

Table 8-15 Steps for setting SPF mode [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	18FB	0001	Enable SPF mode.	1: Enable SPF.	[M]
2	01	06	18FC	03E8	Set target PF	PF = 1.000	[M]
3	01	06	18F9	0064	Enter level for active power in SPF	Setting value = 10%, means 10%*Prated	[O]
4	01	06	18FA	005A	Exit level for active power in SPF	Setting value = 9%, means 99%*Prated	[O]
5	01	06	18F6	0064	Set Q maximum	Set reactive power maximum Default: 100%	[O]
6	01	06	18F7	0000	Set PF minimum	Set PF minimum Default: 0%	[O]
7	01	06	18D0	0000	Set Q mode	0: SPF	[M]

NOTE: Model ALL-IN-ONE PCS: Prated is 125kW

Table 8-16 Steps for disabling SPF mode

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	18FB	0000	Disable SPF mode.	0: Disable SPF.	[M]
2	01	06	18D0	0001	Return to default value	1: Power set (Demand mode)	[M]

If you want to use this function, following the instructions on the interface below to make the settings.

Q_MODE_SEL	0	0	6	N/A	Editor	Cancel
AF_Q_ABS_MAX	1000	0	1000	N/A	Editor	Cancel
AF_PF_ABS_MIN	0	0	1000	N/A	Editor	Cancel
AF_QMODE_ENTRY_P_ABS	100	0	1000	N/A	Editor	Cancel
AF_QMODE_EXIT_P_ABS	90	0	1000	N/A	Editor	Cancel
SPF_MODE_EN	1	0	2	N/A	Editor	Cancel
SPF_TARGET	1000	-1000	1000	N/A	Editor	Cancel

Figure 8-9 Parameter settings

8.9 Volt-Var function setting

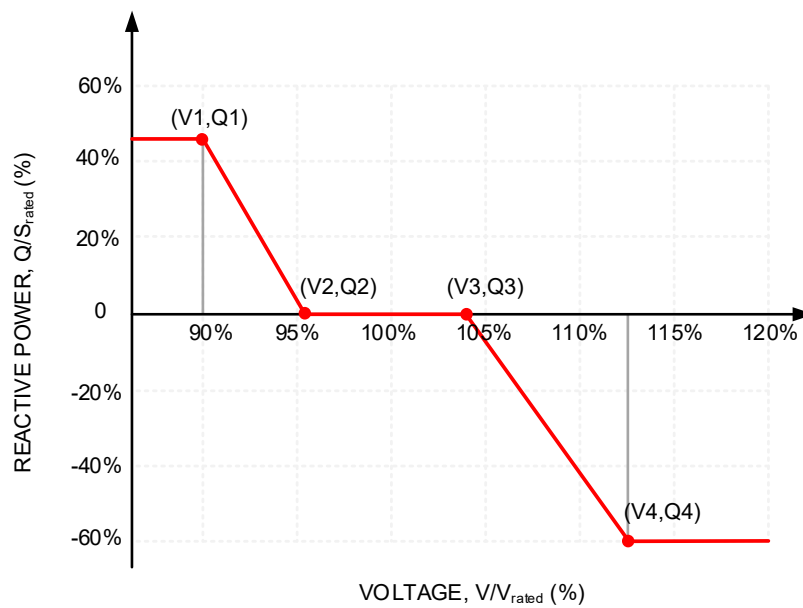


Figure 8-10 Volt-Var control mode curve

Table 8-17 Steps for setting Volt-Var function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	1908	0001	Volt-Var function enable.	1: Enable.	[M]
2	01	06	1909 - 1910	/	Curve points configuration. Q1->[0x100A], V1->[0x1009] Q2->[0x100C], V2->[0x100B] Q3->[0x100E],	The value is different based on different grid code, please refer to ALL-IN-ONE PCS Protocol.	[O]

					V3->[0x100E] Q4->[0x1010], V4->[0x100F]		
3	01	06	18F9	0064	Enter level for active power in Volt-Var	Setting value = 10%, means 10%*Prated	[O]
4	01	06	18FA	005A	Exit level for active power in Volt-Var	Setting value = 9%, means 9%*Prated	[O]
5	01	06	18D0	0003	Reactive Power Mode Selection.	3 = Volt-Var	[M]
6	01	06	18B0	0001	PCS Power ON	Turn to RUN STATE	[M]

NOTE: Model ALL-IN-ONE PCS: Prated is 125kW;

Table 8-18 Steps for disabling Volt-Var function

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	1908	0000	Disable Volt-Var function.	0: Disable.	[M]
2	01	06	18D0	0001	Return to default value	1: Power set (Demand mode)	[M]

If you want to use this function, simply follow the instructions in the interface. For the parameter settings of the curve points, you can refer to the actual volt-var curve.

Q_MODE_SEL	3	0	6	N/A	Editor	Cancel
AF_QMODE_ENTRY_P_ABS	100	0	1000	N/A	Editor	Cancel
AF_QMODE_EXIT_P_ABS	90	0	1000	N/A	Editor	Cancel
VVAR_MODE_EN	1	0	2	N/A	Editor	Cancel
VVAR_V1	900	0	1300	N/A	Editor	Cancel
VVAR_Q1	500	-1000	1000	N/A	Editor	Cancel
VVAR_V2	970	0	1300	N/A	Editor	Cancel
VVAR_Q2	0	-1000	1000	N/A	Editor	Cancel
VVAR_V3	1030	0	1300	N/A	Editor	Cancel
VVAR_Q3	0	-1000	1000	N/A	Editor	Cancel
VVAR_V4	1100	0	1300	N/A	Editor	Cancel
VVAR_Q4	-500	-1000	1000	N/A	Editor	Cancel

Figure 8-11 Parameter settings

8.10 Volt-Watt function setting

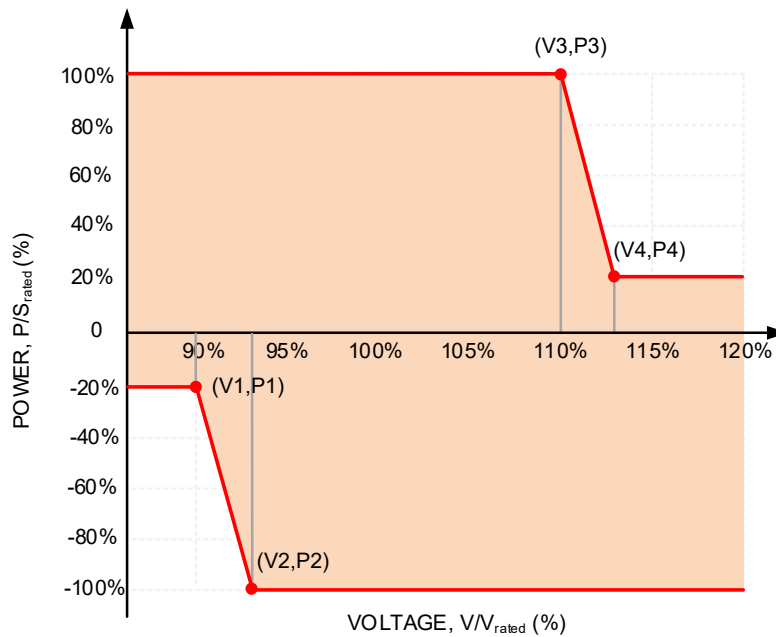


Figure 8-12 Volt-Watt control mode limit area

Table 8-19 Steps for setting Volt-Watt function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
2	01	06	1919	0001	Volt-Watt function enable.	1: Enable.	[M]
3	01	06	191A-1921	/	Curve points configuration. P1->[0x191B], V1->[0x191A] P2->[0x191D], V2->[0x191C] P3->[0x191F], V3->[0x191E] P4->[0x1921], V4->[0x1920]	The value is different based on different grid code, please refer to ALL-IN-ONE PCS Protocol.	[O]
4	01	06	18D0	0001	Reactive Power Mode Selection.	1 = Power Set	[M]

Table 8-20 Steps for disabling Volt-Watt function

STEP	CMD			DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value						

1 01 06 1919 0000 Disable Volt-Watt 0: Disable. [M]
function.

If you want to use this function, simply follow the instructions in the interface. For the parameter settings of the curve points, you can refer to the actual volt-var curve.

Q_MODE_SEL	1	0	6	N/A	Editor	Cancel
VWATT_MODE_EN	1	0	3	N/A	Editor	Cancel
VWATT_V1	900	700	1300	N/A	Editor	Cancel
VWATT_P1	1000	-1000	1000	N/A	Editor	Cancel
VWATT_V2	950	700	1300	N/A	Editor	Cancel
VWATT_P2	1000	-1000	1000	N/A	Editor	Cancel
VWATT_V3	1050	700	1300	N/A	Editor	Cancel
VWATT_P3	1000	-1000	1000	N/A	Editor	Cancel
VWATT_V4	1100	700	1300	N/A	Editor	Cancel
VWATT_P4	200	-1000	1000	N/A	Editor	Cancel

Figure 8-13 Parameter settings

8.11 Freq-Watt function setting

8.11.1 3-Point mode

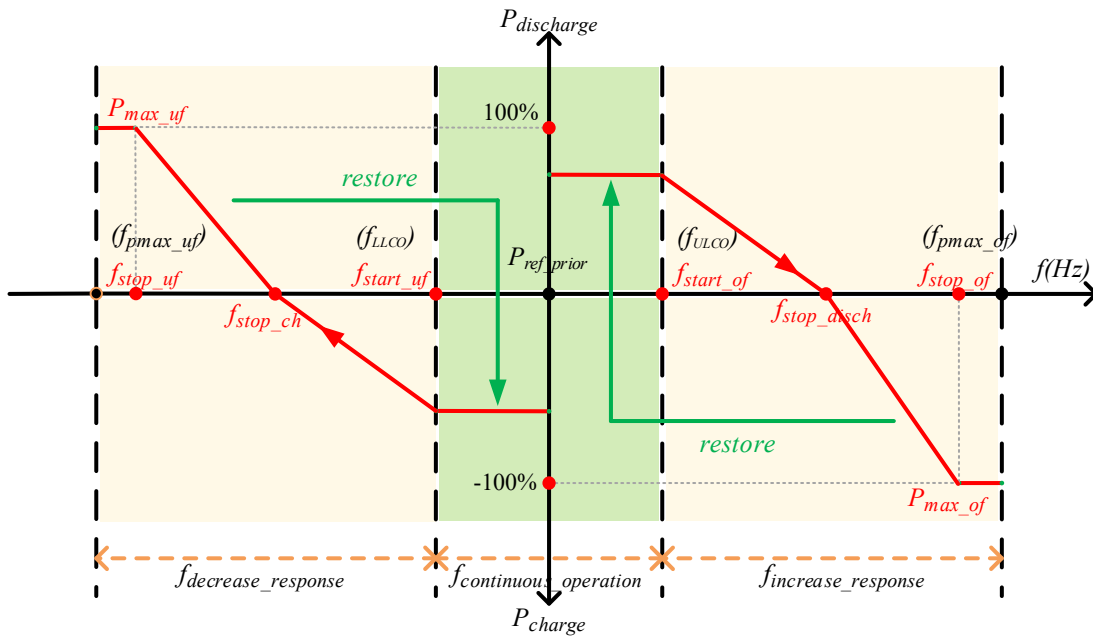


Figure 8-14 Freq-Watt control mode curve (3-point mode)

Table 8-21 Steps for setting Freq-Watt function [FIRST RUN / WHEN NEED]

STEP	CMD	DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value				

1	01	06	1923	0003	Freq-Watt function enable (Over frequency).	3: 3-Point Mode (w/ Register 4291.)	[M]
2	01	06	1929	0003	Freq-Watt function enable (under frequency).	3: 3-Point Mode (w/ Register 4297.)	[M]
3	01	06	1924-1926, 192A-192C	/	Curve points configuration.	The value is different based on different grid code, please refer to ALL-IN-ONE PCS Protocol.	[O]

Table 8-22 Steps for disabling Freq-Watt function

STEP	CMD	ID(PCS)	Function	Register	Value	DESCRIPTION	REMARK	Option
1	01	06	1923	0000	0000	Disable Freq-Watt function (Over frequency).	0: Disable.	[M]
2	01	06	1929	0000	0000	Disable Freq-Watt function (Under frequency).	0: Disable.	[M]

You can set the parameters by referring to the picture below. Enable this function.

FWATT_OF_MODE_EN	3	0	6	N/A	Editor Cancel
FWATT_OF_FSTART	5025	4000	7000	N/A	Editor Cancel
FWATT_OF_FSTOP	5200	0	7000	N/A	Editor Cancel
FWATT_OF_FSTOP_DISCH	5100	0	7000	N/A	Editor Cancel
FWATT_UF_MODE_EN	3	0	6	N/A	Editor Cancel
FWATT_UF_FSTART	4975	4000	7000	N/A	Editor Cancel
FWATT_UF_FSTOP	4700	0	7000	N/A	Editor Cancel
FWATT_UF_FSTOP_CH	4800	0	7000	N/A	Editor Cancel

Figure 8-15 Parameter settings

8.12 Watt-Var function setting

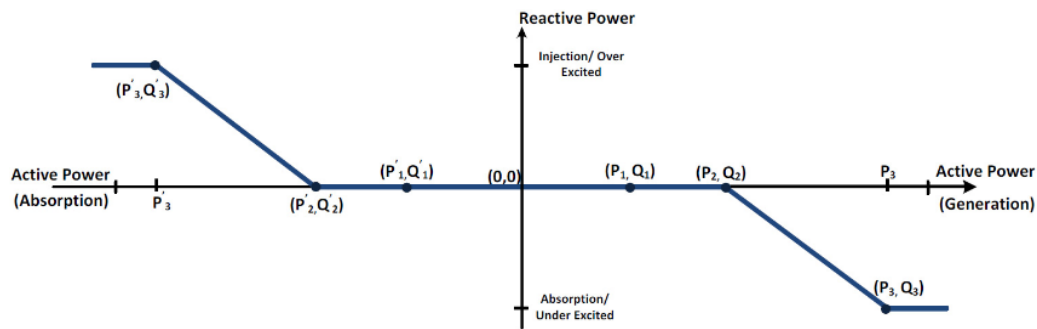


Figure 8-16 Watt-Var control mode limit area

Table 8-23 Steps for setting Watt-Var function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value							
1	01	06	1957	0001	Watt-Var function enable.	1: Enable.	[M]
2	01	06	1958-1963	/	Curve points configuration. P1->[0x1958], Q1->[0x1959] P2->[0x195A], Q2->[0x195B] P3->[0x195C], Q3->[0x195D] P4->[0x195E], Q4->[0x195F] P5->[0x1960], Q5->[0x1961] P6->[0x1962], Q6->[0x1963]	The value is different based on different grid code, please refer to ALL-IN-ONE PCS Protocol.	[O]
3	01	06	18D0	0004	Reactive Power Mode Selection.	4	[M]

Table 8-24 Steps for disabling Watt-Var function

STEP	CMD				DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value							
1	01	06	1957	0000	Disable Watt-Var function.	0: Disable.	[M]

If you want to use this function, simply follow the instructions in the interface. For the

parameter settings of the curve points, you can refer to the actual volt-var curve.

WATTVAR_MODE_EN	1	0	1	N/A	Editor	Cancel
WATTVAR_P1	200	-1000	1000	N/A	Editor	Cancel
WATTVAR_Q1	0	-1000	1000	N/A	Editor	Cancel
WATTVAR_P2	-500	-1000	1000	N/A	Editor	Cancel
WATTVAR_Q2	0	-1000	1000	N/A	Editor	Cancel
WATTVAR_P3	-1000	-1000	1000	N/A	Editor	Cancel
WATTVAR_Q3	440	-1000	1000	N/A	Editor	Cancel
WATTVAR_P4	200	-1000	1000	N/A	Editor	Cancel
WATTVAR_Q4	0	-1000	1000	N/A	Editor	Cancel
WATTVAR_P5	500	-1000	1000	N/A	Editor	Cancel
WATTVAR_Q5	0	-1000	1000	N/A	Editor	Cancel
WATTVAR_P6	1000	-1000	1000	N/A	Editor	Cancel
WATTVAR_Q6	-440	-1000	1000	N/A	Editor	Cancel

Figure 8-17 Parameter settings

8.13 Voltage average protection function setting

Table 8-25 Steps for setting voltage average protection function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value							
1	01	06	1937	0003	Average voltage protection enable	bit 0 = 1: Average under voltage enable bit 1 = 1: Average over voltage enable	[M]
2	01	06	1938	0462	Average voltage OVP voltage value	Setting value = 112.2%, means 112.2%*Vrated	[O]
3	01	06	193A	012C	Average voltage OVP time value	Setting value = 3, means 3s	[O]

NOTE: Model ALL-IN-ONE PCS: V_{rated} is 230V

If you want to use this function, you can refer to the parameter settings shown in the picture below.

AC_OUVP_AVG_EN	3	0	3	N/A	Editor	Cancel
AC_OVP_AVG_HV1	1112	1000	1300	N/A	Editor	Cancel
AC_UVP_AVG_LV1	900	0	1000	N/A	Editor	Cancel
AC_OVP_AVG_TIME_HV1	3000	1	30000	N/A	Editor	Cancel
AC_UVP_AVG_TIME_LV1	3000	1	30000	N/A	Editor	Cancel

Figure 8-18 Parameter settings

Table 8-26 Steps for disabling voltage average protection function

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	1937	0000	Average voltage protection disable	bit 0 = 0: Average under voltage disable bit 1 = 0: Average over voltage disable	[M]

8.14 Demand response mode setting

Table 8-27 Steps for setting demand response mode [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	193A	0001	Demand response mode enable	1: Enable demand response mode	[M]
2	01	06	193B	0000	Reactive power demand of DRM3 and DRM7. (AS/NZS4777.2 only)	Setting value = 0, means reactive power is 0	[O]

NOTE: Model ALL-IN-ONE PCS: Vrated is 230V

If you want to use this function, you can refer to the parameter settings shown in the picture below.

DRM_MODE_EN	1	0	1	N/A	Editor	Cancel
DRM_REACTIVE_P_DEMAND	0	-1000	1000	N/A	Editor	Cancel

Figure 8-19 Parameter settings

Table 8-28 Steps for disabling demand response mode

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	193A	0000	Demand response mode disable	1: disable demand response mode	[M]

8.15 Voltage ride through function setting

Table 8-29 Voltage ride through response

Voltage limits	Inverter response
> 260 V	Cease power generation
180 V to 260 V	Continuous operation
< 180 V	Cease power generation

Table 8-30 Steps for setting Voltage ride through function [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	193E	0001	High Ride through function enable.	1: Enable.	[M]
2	01	06	193F	0001	Low Ride through function enable.	1: Enable.	[M]
3	01	06	1941	046A	Over voltage trip point	Over voltage: 113%	[O]
4	01	06	1942	030E	Under voltage trip point configuration.		[O]

You can enable this function by following the settings shown in the picture below.

AC_OVRT_MODE_EN	1	0	2	N/A	Editor	Cancel
AC_UVRT_MODE_EN	1	0	2	N/A	Editor	Cancel
AC_OVRT_HV1	113	0	1300	N/A	Editor	Cancel
AC_UVRT_LV1	782	0	1000	N/A	Editor	Cancel

Figure 8-20 Parameter settings

Table 8-31 Steps for disabling Voltage ride through function

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	193E	0000	Disable high ride through function.	0: Disable.	[M]
2	01	06	193F	0000	Disable low ride through function.	0: Disable.	[M]

8.16 Soft or hard gen/Exp power limitation

Table 8-32 Steps for Soft or hard gen/Exp power limitation function

ADDR (HEX)	ADDR (DEC)	TYPE	DEFINITION	DESCRIPTION	Unit	RW	Min	Max	Default	OA
0x611	1553	Uint16	PR_SYS_AUX_DEVICE_CONFIG	Generation/export power limit mode enable. b4: Generation soft limit enabled b5: Generation hard limit enabled b6: Export soft limit enabled b7: Export hard limit enabled Only for AS4777.2:2020	NA	RW	0	32767	0	No
0x614	1556	Uint16	PR_SYS_GEN_SOFT_LIMIT	Generation power soft limit. Only for AS4777.2:2020	0.1%	RW	0	1000	1000	No
0x615	1557	Uint16	PR_SYS_GEN_HARD_LIMIT	Generation power hard limit. Only for AS4777.2:2020	0.1%	RW	0	1000	1000	No
0x616	1558	Uint16	PR_SYS_EXP_SOFT_LIMIT	Export power soft limit. Only for AS4777.2:2020	0.1%	RW	0	1000	1000	No
0x617	1559	Uint16	PR_SYS_EXP_HARD_LIMIT	Export power hard limit. Only for AS4777.2:2020	0.1%	RW	0	1000	1000	No

Table 8-33 Steps for setting generation soft limit mode [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	0x614	03E8	Generation power soft limit to 100%Pn	Limit to 100% rated active power	[M]
2	01	06	0x611	0010	Enable generation soft power limit	Setting value = 1	[M]

NOTE: Model ALL-IN-ONE PCS: Vrated is 230V

If you want to use this function, you can refer to the following parameter settings.

SYS_AUX_DEVICE_CONFIG	240	0	32767	N/A	Editor	Cancel
SYS_GEN_SOFT_LIMIT	1000	0	5000	0.1kVA	Editor	Cancel
SYS_GEN_HARD_LIMIT	1000	0	5000	0.1kVA	Editor	Cancel
SYS_EXP_SOFT_LIMIT	1000	0	5000	0.1kVA	Editor	Cancel
SYS_EXP_HARD_LIMIT	1000	0	5000	0.1kVA	Editor	Cancel

Figure 8-21 Parameter settings

Table 8-34 Steps for disabling demand response mode

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	0x611	0000	Generation power soft limit disable	0: disable Generation power soft limit	[M]

8.17 Communication with BMS

8.17.1 Communication configuration [FIRST RUN / WHEN NEED]

Please refer to the chapter 5.1.1

8.17.2 BMS control, protection and recharging

8.17.2.1 Turn on/off BMS

Table 8-35 Steps for Turn on/off BMS Turn on/off BMS

ADDR (HEX)	ADDR (DEC)	TYPE	DEFINITION	DESCRIPTION	Unit	RW	Min	Max	Default	OA
184A	6218	Uint16	EN_PR_OS_CMD_BMS_START	BMS Stop/Start Command 0: NA 1: BMS ON 2: BMS OFF	NA	W	0	2	0	No
184C	6220	Uint16	EN_PR_OS_CMD_BMS_FAULT_CLEAR	BMS Fault Clear 0: NA/No Command 1: Fault Clear Command	NA	W	0	1	0	No

EMS need to write “1” to the register[0x184A] of ALL-IN-ONE PCS local controller, then ALL-IN-ONE PCS will send BMS ON command to the BMS to TURN ON the battery system. And write “2” to TURN OFF the battery system.

Table 8-36 Clear system fault

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	184A	0001	BMS Stop/Start Command 1: BMS ON	Turn on BMS	[M]
2	01	06	184A	0002	BMS Stop/Start Command 2: BMS OFF	Turn off BMS	[M]

NOTE:

1. Only need to set the command to the ALL-IN-ONE PCS master.
2. The “BMS OFF” command is only available when ALL-IN-ONE PCS is “Standby” status.

8.17.2.2 Clear BMS fault

EMS need to write “1” to the register[0x184C] of ALL-IN-ONE PCS local controller when BMS is failure, then ALL-IN-ONE PCS will send reset fault command to the BMS to clear fault through Modbus TCP.

Table 8-37 Clear system fault

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	184C	0001	BMS Fault Clear 1: Fault Clear Command	Clear all faults of BMS	[M]

NOTE: Only need to set the command to the ALL-IN-ONE PCS master.

8.17.2.3 Protection parameters configuration

If the battery system is included in the system, some protection parameters need to be set before using it. The following table shows the setting steps.

Table 8-38 Steps for setting demand response mode [FIRST RUN / WHEN NEED]

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	1878	0C7F	BMS Auxiliary Configuration Enable Registers bitx = 1: Check enable, bitx = 0: Check disable; x=0-15 b0=1: BMS Communication Check Enable. b1=1: BMS Fault Check Enable. b2=1: BMS Warning Check Enable. b3=1: Battery Voltage High Fault Check Enable. b4=1: Battery Voltage Low Warning Check Enable. b5=1: BMS SOC Fault Check Enable (high/low). b6=1: BMS SOC Warning	Enable all related protection of Battery system <i>*Note: Auto recharging function isn't enabled.</i>	[M]

Check Enable (high/low).

b10=1: Battery Cell Volt

High Warn Check Enable.

b11=1: Battery Cell Volt

Low Warn Check Enable.

2	01	06	187B- 187C 187D- 187E	/	Protection threshold setting of SOC, battery DC voltage, cell voltage.	Refer to the chapter "4.3 Battery Parameter" of ALL-IN-ONE PCS Prototocol.pdf for more information.	[O]
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Note: The user can enable or disable one or more protection items by setting bitx of register[0x1878] to "1" or "0".

8.17.2.4 Auto recharging control mode

When the SOC is lower than the set lower limit [0x187F], if the auto-recharging function is enabled through setting the register [0x1878] (**bit8=1, bit9=1**), the ALL-IN-ONE PCS will automatically start recharging according to the power command set by the register [0x1881].

Table 8-39 Steps for Auto recharging control mode

STEP	CMD				DESCRIPTION	REMARK	Option
ID(PCS) Function Register Value							
1	01	06	1878	0FFF	BMS Auxiliary Configuration Enable Registers bitx = 1: Check enable, bitx = 0: Check disable; x=0-15 b8=1: Battery Auto Recharge by SOC Enable. b9=1: Battery Auto Recharge Power by Set Enable.	Enable auto-recharging function of Battery system <i>*Note: All protection functions and power limit function are enabled.</i>	[M]
2	01	06	187F	0019	Start charging when SOC is less than 2.5%.	SOC low limit= 2.5%	[O]
3	01	06	1880	0064	Stop charging when SOC is greater than 10%.	SOC high limit= 10%	[O]
4	01	06	1881	00C8	Power command for auto-charging	Power Command = 20kW	[M]

8.17.2.5 Manual recharging control mode

When the SOC is lower than the set lower limit [0x187F], if the manual-recharging function is enabled through setting the register [0x1878] (**bit8=1, bit9=0**), the ALL-IN-ONE PCS will start recharging according to the power command set by the register [0x800].

Table 8-40 Steps for Manual recharging control mode

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	1878	0DFF	BMS Auxiliary Configuration Enable Registers bitx = 1: Check enable, bitx = 0: Check disable; x=0-15 b8=1: Battery Auto Recharge by SOC Enable. b9=0: Battery Auto Recharge Power by Set Enable.	Enable manual- recharging function of Battery system. <i>*Note: All protection functions are enabled.</i>	[M]
2	01	06	187F	0019	Start charging when SOC is less than 2.5%.	SOC low limit= 2.5%	[O]
3	01	06	1880	0064	Stop charging when SOC is greater than 10%.	SOC high limit= 10%	[O]
4	01	06	800	01F4	Power command for manual-recharging	Power Command = 50kW	[M]

8.17.2.6 Power limit control function

If the “BMS Power Limitation” function is enabled (bit7=1), then the maximum output power of ALL-IN-ONE PCS will be limited by the available charge and discharge power curve from BMS.

Table 8-41 Steps for Power limit control function

STEP	CMD				DESCRIPTION	REMARK	Option
	ID(PCS)	Function	Register	Value			
1	01	06	1878	0080	BMS Auxiliary	Enable power limit	[M]

Configuration Enable	function.
Registers	<i>*Note: All</i>
bitx = 1: Check enable,	<i>protection</i>
bitx = 0: Check disable;	<i>functions and</i>
x=0-15	<i>recharging</i>
b7=1: BMS Power	<i>function are</i>
Limitation Check Enable.	<i>disabled.</i>

9 AiO Box commissioning

Commissioning procedure

If AiO Box installation is completed, the commissioning step can be carried out in accordance with follow flow chart.

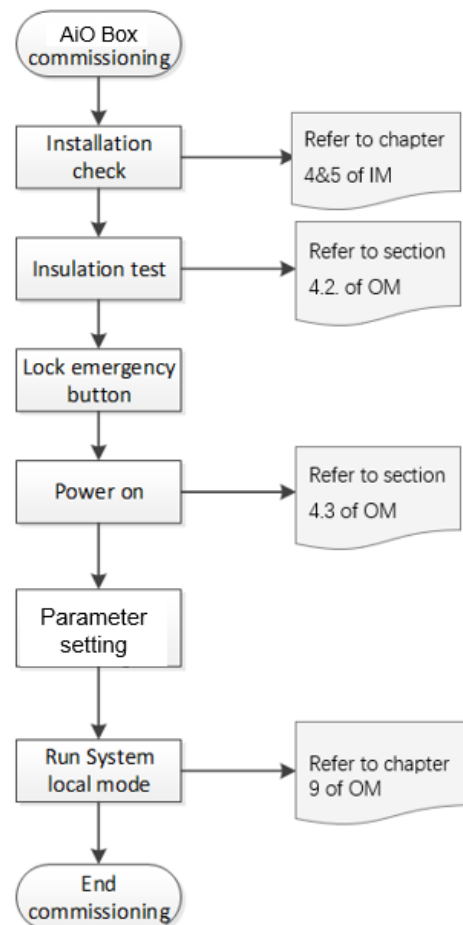


Figure 9-1 Commissioning step

If special parameter configuration is required, please complete the settings prior to powering on the system.

The following describes the procedures for startup, loading and unloading operations via the AiO Box's HMI.

9.1 AIOA279K125L operation

Power On AiO Box

1. Connect PC to AiO Box via network cable.
2. Open google chrome browser and enter IP 192.168.254.10 to open logon window.
3. Enter user name and password into logon window to open HMI homepage

as shown in figure 9-2.

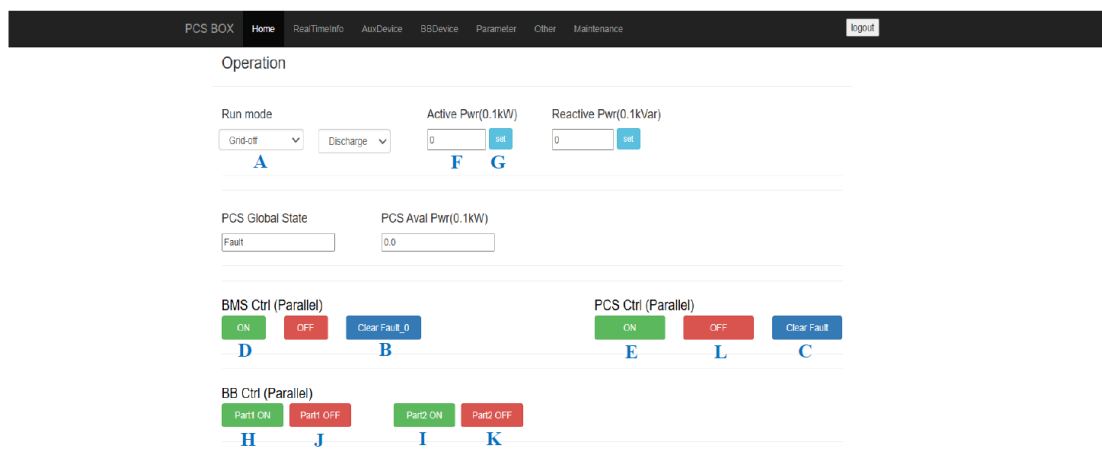


Figure 9-2 AiO Box homepage window

4. Select **“Grid-tie”** run mode (A).
5. Click **“Clean Fault”** button(B) of BMS Ctrl and **“Clean Fault”** button(C) of PCS Ctrl, clear all fault information if no fault existed.
6. Click **“ON”** button (D) of BMS Ctrl, the HV box relays closed; click **“ON”** button (E) of PCS Ctrl, PCS start-up power modules modulation.
7. Adjust active power setting value (F) and click **“Set”** button(G), the power from 0 to 125KW (negative means charge operation, positive means discharge operation) and step is 50KW.
8. Running 5mins at full power, if there is no error appeared, the test is passed. Otherwise, you need to remove the error and test it again.

Power off AiO Box

1. Reduce active power setting to zero.
2. Click **“OFF”** button (L) of PCS Ctrl, stop power module modulation.
3. After you finished the commissioning work, press EMERGENCY STOP button to test its protection function. Normally when EMERGENCY STOP is pressed down, the fault pilot lamp is glowing. Meanwhile, HMI appears EMERGENCY STOP error.

9.2 AIOC279K125L operation

Power On AiO Box

1. Connect PC to AiO Box via network cable.
2. Open google chrome browser and enter IP 192.168.254.10 to open logon window.
3. Enter user name and password into logon window to open HMI homepage as shown in figure 9-3.

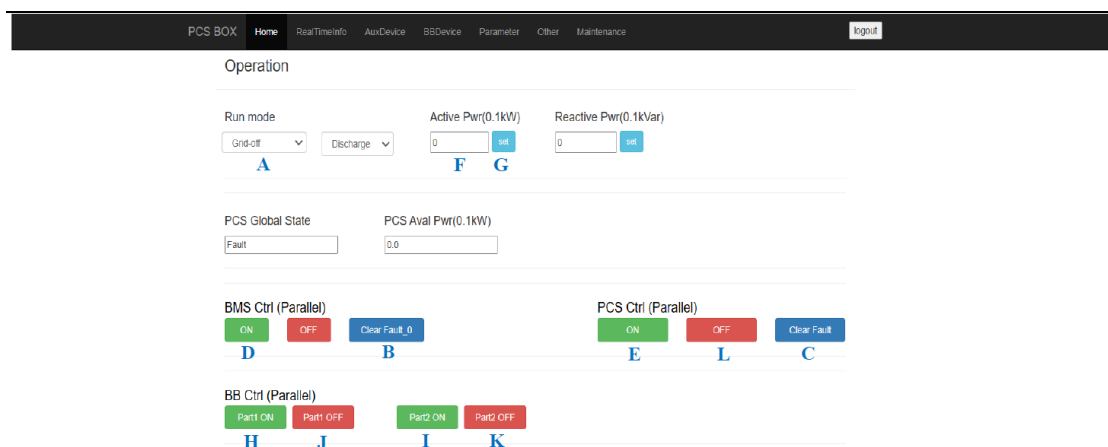


Figure 9-3 AiO Box homepage window

4. Select **“Grid-tie”** run mode (A).
5. Click **“Clean Fault”** button(B) of BMS Ctrl and **“Clean Fault”** button(C) of PCS Ctrl, clear all fault information if no fault existed.
6. Click **“ON”** button (D) of BMS Ctrl, the HV box relays closed; click **“ON”** button (E) of PCS Ctrl, PCS start-up power modules modulation. Then click **“Part1 ON”** button (H) and **“Part2 ON”** button (I) of BB Ctrl, BB power module is running.
7. Adjust active power setting value (F) and click **“Set”** button(G), the power from 0 to 125KW (negative means charge operation, positive means discharge operation) and step is 50KW.
8. Running 5mins at full power, if there is no error appeared, the test is passed. Otherwise, you need to remove the error and test it again.

Power off AiO Box

1. Reduce active power setting to zero.
2. Click **“OFF”** button (L) of PCS Ctrl, stop power module modulation; then click **“Part1 OFF”** button (J) and **“Part2 OFF”** button (K) of BB Ctrl, stop BB power module; then stop PCS.
3. After you finished the commissioning work, press EMERGENCY STOP button to test its protection function. Normally when EMERGENCY STOP is pressed down, the fault pilot lamp is glowing. Meanwhile, HMI appears EMERGENCY STOP error.

Contact

If you have technical problems with our products, please contact the Delta Service. The following data is required in order to provide you with the necessary assistance:

- Company name.
- Product type.
- Serial number of the product.
- Site location of product (Address / Geographic coordinates).
- A description of the requirement or issue faced.
- Current log files If available.