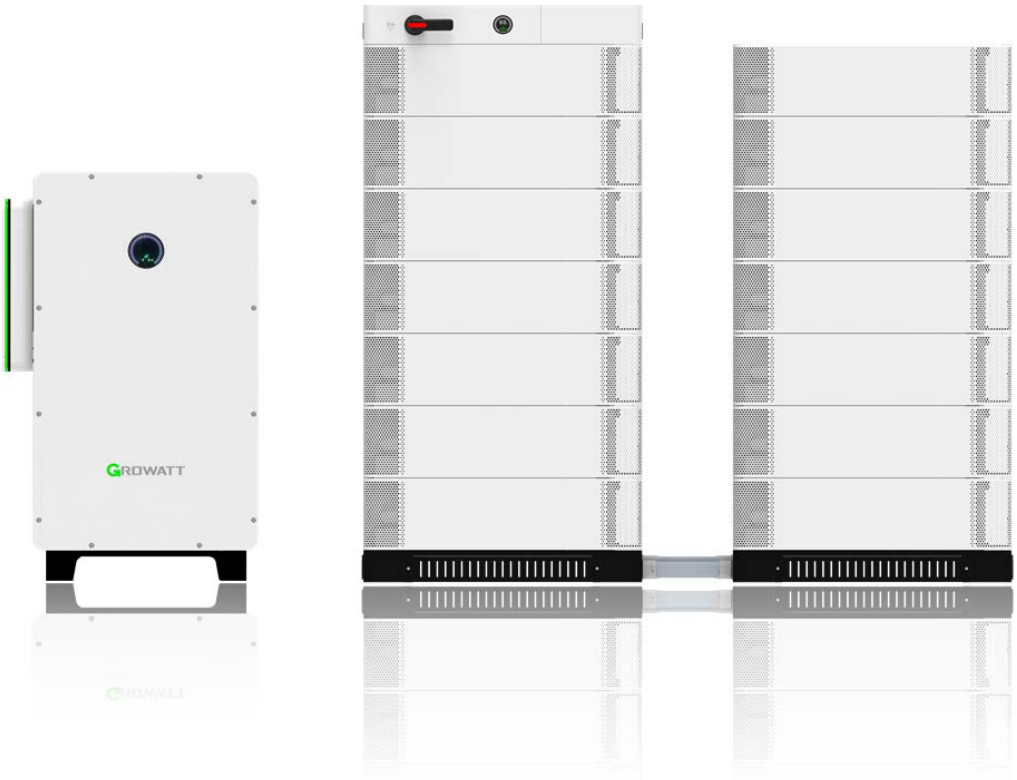

WIT+APX PV-ESS-DG System Solution

User Manual

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1. Introduction

1.1 Overview

This manual is intended to provide product information and installation instructions for users of WIT+APX PV-ESS-DG System Solution (PV + Energy Storage System + Diesel generator) purchased from Shenzhen Growatt New Energy Co., Ltd. (hereinafter referred to as Growatt). Please read this manual carefully before performing any operations. Store the documents in a convenient place and ensure that they are available at all times for installation, operation and maintenance personnel. For possible changes in this manual, Growatt accepts no responsibilities to inform users.

Note:

1. The WIT 50-100K-HU-US Series Inverter is hereinafter called WIT.
2. The APX 129.0-200.7H-S1-US Battery System is hereinafter called APX.
3. This manual is prepared mainly based on the HU model.

1.2 Target Group

Only qualified electrical technicians are allowed to install the PV-ESS-DG System. Installers should read through this manual prior to installing, commissioning and troubleshooting the system.

If questions arise during installation, you can visit us.growatt.com to leave a message or contact Growatt customer services at 400-931-3122.

1.3 Symbol Conventions

The following safety symbols may occur when handling the system. Familiarize yourself with the symbols and their meaning before installing or operating the equipment.

Table 1.1 Safety Symbols

Symbol	Meaning
	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury
	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

	NOTICE indicates a situation which, if not avoided, can result in property damage.
	Information that you must read and know to ensure optimal system operation.

Table 1.2 Safety labels

Symbol	Designation	Meaning
	High voltage	High voltages are present when the system is in operation. All work on the system must be performed by well-trained electrical technicians.
	Burn warning	Do not touch the equipment in operation because it generates high temperature on the enclosure.
	Protective grounding	Connect the ground point of each component of the system to the grounding bar for protective grounding.
	Delayed discharge	Residual voltage exists after the system is powered off, and it takes 5 minutes for the equipment to discharge to the safe voltage.
	Refer to the manual	Reminds the operator to refer to the manual before operating or installing the system.
	DC	Direct current
	AC	Alternating current

2.Safety Precautions

Before operation, please read the precautions and operating instructions in this manual carefully to avoid accidents. The "DANGER", "WARNING" and "CAUTION" statements in this manual do not represent all safety matters to be observed, and are intended to supplement various operational safety precautions.

2.1 General Safety

1) Please read this manual carefully before installation. Damages caused by failure to follow the instructions in the manual are beyond the warranty scope.
2) Only qualified and trained electrical technicians are allowed to perform operations and cable connections on the system.
3) During installation, please do not touch other parts inside the equipment other than the wiring terminals.
4) Ensure that all electrical connections comply with local electrical standards.
5) If maintenance is required, please contact the authorized local system installation and maintenance personnel.
6) Before operating the equipment in the on-grid mode, ensure that you have obtained any permission needed from the local grid operator.

2.2 Safety Instructions

Transportation:

 WARNING	● As the equipment of this system is heavy, use extreme caution when moving it to avoid injury due to accidental falls.

Installation:

 NOTICE	● Please read this manual carefully before installation. Damages caused by failure to follow instructions specified in the manual are beyond the warranty scope.
 DANGER	● Ensure that there is no electrical connection on all equipment of the system before installation.
 WARNING	● Please observe the installation instructions specified in this manual, including the installation environment and clearance requirements. ● Install the equipment of the system in a dry and well-ventilated location; otherwise, performance de-rate may be initiated due to excessive heat. ● Please read the installation instructions and safety precautions carefully before installation.

Electrical Connections:

 DANGER	● Before electrical connections, make sure that the DC switches on the inverter and the battery are in the "OFF" position. ● Turn off the AC breaker; otherwise high voltages on the grid side may cause lethal injuries. ● All operations must be performed by trained and professional electricians. Comply with all safety information specified in this manual and local regulations. ● Do not touch the equipment in operation as high voltages might lead to lethal injuries. ● Do not place flammable or explosive materials around the system equipment.
 WARNING	● Each inverter must be equipped with a separate AC circuit breaker. Multiple inverters cannot connect to the same AC circuit breaker. ● If the cable is thick, do not wiggle it after tightening the cable terminals. Otherwise, loose connection may cause overheating and device damage. Ensure that the terminals are properly connected before powering on the system. ● Ensure the correct polarity before connecting the battery to the inverter.

Maintenance and Replacement:

 DANGER	● All operations must be performed by trained and professional electricians, and all instructions specified in this manual should be observed. ● Wait at least 5 minutes after turning off the DC switch and AC breaker to avoid dangers. Do not perform any operation with power on. ● If the inverter reports “PV Isolation low”, do not touch the enclosure as a ground fault might have occurred. ● Beware of high voltages which can cause electric shocks.
 WARNING	● Do not use air pump to clean the fans as it may damage the fans.

Other:

	● Upon delivery, check if the package of the inverter is intact. If you notice any damage, please contact your supplier. ● For better heat dissipation, please clean the fan regularly.

 WARNING	● The maximum PV input voltage should not exceed 1100V, and the battery input voltage should not exceed 1000 V. ● For the equipment that will not be put into operation in the future, you should properly dispose of it in accordance with locally applicable regulations.

3. System Introduction

3.1 System Overview

The Growatt **WIT+APX PV-ESS-DG System** consists of the WIT inverter, the APX commercial battery system, the smart meter and others. This system can be applied to C&I (Commercial & Industrial), micro-grid and other application scenarios. Diverse operating modes are available, including on-grid mode, off-grid mode and on/off-grid transfer. The PV-ESS-DG system comes with a variety of features, such as self-consumption, peak shaving and valley filling, TOU (Time of Use), emergency power backup and power expansion. The system also supports parallel operation of multiple devices, enabling power and battery capacity expansion.

3.1.1 System Description

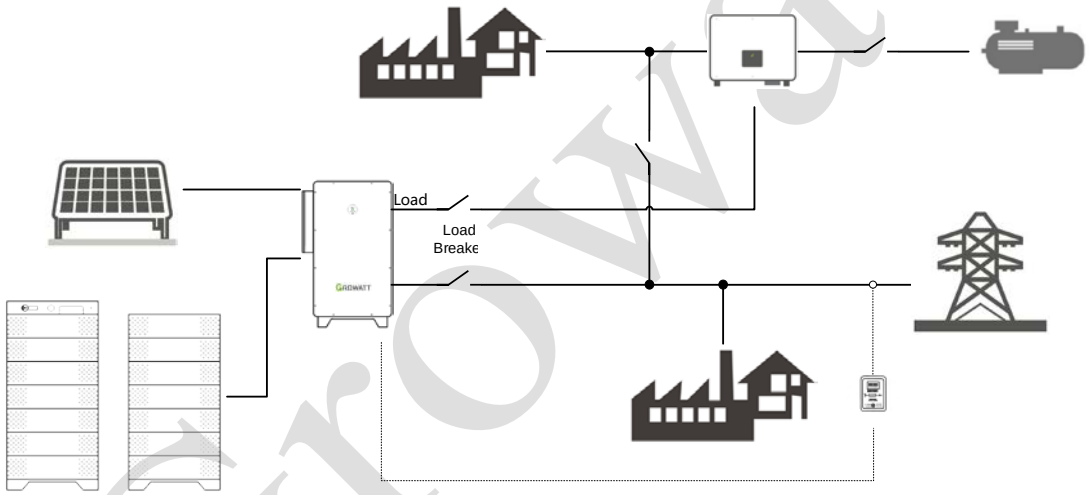


Fig 3.1 On/off-grid PV-ESS-DG system with a single WIT Inverter

Components:

Table 3.1 Components of the on/off-grid PV-ESS-DG system

Icon	Component	Description	Responsible party
PV	PV panels	Prepared by users	Supplier
PCS	Hybrid inverter	Model: WIT 50/63/75/100K-HU-US (This manual is prepared mainly based on the HU model)	Growatt
BAT	Battery	Model: APX 129.0-200.7H-S1-US	Growatt
ATS	Dual power transfer switch	Prepared by users (Eaton meter is recommended)	Supplier
Meter	Smart meter	Model: TPM-CT-E-US	Growatt

GEN	Diesel generator	Prepared by users (requires external dry contact to activate)	Supplier
BREAKER	Circuit breaker	Prepared by users	Supplier

3.1.2 System Highlights

1. Feature diverse application scenarios, including self-consumption, peak shaving, power backup, and microgrid.
2. Equipped with on-grid, off-grid and on/off grid switching capabilities.
3. Support multiple systems to be connected in parallel, enabling battery and power expansion.
4. The battery is self-contained with integrated optimizer, allowing dynamic voltage adjustment and flexible combination of battery capacity; mixing old and new battery modules is supported to make the most of the battery capacity.
5. Support PV+ESS and PV+ESS+DG applications.
6. Support local and remote monitoring to facilitate intelligent O&M (operation and maintenance).

3.1.3 System Operating Principles

7. The WIT inverter comes with the PV terminals. With connection to the solar modules, the inverter converts the solar power that goes through the MPPT circuits and inverter circuits into AC power, which is then fed to the grid and sent to support loads.
8. The WIT inverter comes with the battery terminals. With connection to the batteries, the inverter can charge the battery with both PV and grid power for energy storage, and the battery power can be discharged to export power to the grid and supply power to loads.
9. The WIT inverter is integrated with the on/off-grid switch module, supporting automatic transfer between on-grid and off-grid operation and manual transfer with a transfer time less than 16.7 ms.
10. The APX battery system can be configured flexibly, allowing connection of 9 to 14 modules.
11. The APX battery system features the DC-DC function, which can adjust battery voltage according to the voltage at the grid port and the PV port of the inverter, fulfilling voltage requirements in different application scenarios.
12. The APX battery system features the DC-DC function, which enables battery SOC balancing by adjusting voltage and output power.
13. The meter can collect the voltage and current at the grid-connection port and measure the charging/discharging power to enable the inverter export limitation.

3.1.4 WIT Inverter Operating Mode

Load first:

The solar power and the battery power are prioritized towards powering the loads. If the export limitation is disabled, the surplus solar power will be fed to the grid while the battery power cannot be sold to the grid. If the export limitation is enabled, neither the solar power nor the battery power would be sent to the grid.

Priority of power sources supplying to the loads:

1.Solar panels;

2.Bateries;

3.Grid.

NOTE: In Load first mode, a meter is required.

Battery first:

The solar power is directed towards charging the battery first, ensuring that the battery SOC has reached the preset upper threshold. Then the excess solar power will be sent to support the loads. The further surplus solar power can be exported to the grid (with Export Limitation disabled). In case that the solar power is insufficient, it can draw energy from the grid to charge and battery and support the loads.

Priority of power sources charging the battery:

1.Solar panels;

2.Grid.

Grid first:

The solar power is prioritized towards powering the loads, and the surplus solar power will be fed to the grid. The further surplus solar power (if any) can be sent to charge the battery. If the solar power is insufficient to support the loads, the battery will discharge to power the loads and the excess battery energy can be sold to the grid.

Priority of power sources supplying to the loads:

1.Solar panels;

2.Bateries;

3.Grid.

From the “Control” page, select “Mode Selection and Time Setting”, where you can configure the six time windows. As shown in the figure, you are allowed to set the operating mode for each period based on power consumption and electricity tariffs. You can set “Enable” or “Disable” to determine whether to run the device in the preset mode during the specific time period. This way, you are allowed to configure different operating modes for different application scenarios.

3.1.5 System Application Modes

Self-consumption: Maximize self-consumption, and the surplus power is fed to the grid. The system prioritizes supplying power to loads, and the excess power is fed to the grid to generate revenue.

Peaking shaving: Set the power threshold that the WIT+APX PV+ESS+DG system can draw from the grid. When the power drawn from the grid exceeds the threshold, the battery will discharge to reduce the power drawn from the grid until it is below the threshold or until the battery reaches its maximum discharge capability. When the power drawn from the grid is below the threshold, the system will determine whether to charge the battery based on the current operating mode and the battery SOC.

Time-of-use (TOU) Control: Configure the system to work in the preset mode during different time segments, especially suitable for areas with peak-valley electricity pricing.

Power expansion: When the distributed power is insufficient to support the short-term peak loads, the PV-ESS-DG system outputs power and draws power from the grid to support the loads, thus enhancing its power supply capacity.

Microgrid: A microgrid is a stand-alone system that consists of distributed energy sources. The PV-ESS-DG system can form a microgrid to ensure power supply to loads, or connect to the utility grid for enhanced energy independence of the user's power supply system.

Backup power: When the grid fails, the PV-ESS-DG system can supply power to critical loads to ensure its uninterrupted operation.

Energy quality: The device can output reactive power to regulate the grid power quality.

3.2 Description of components within the scope of delivery

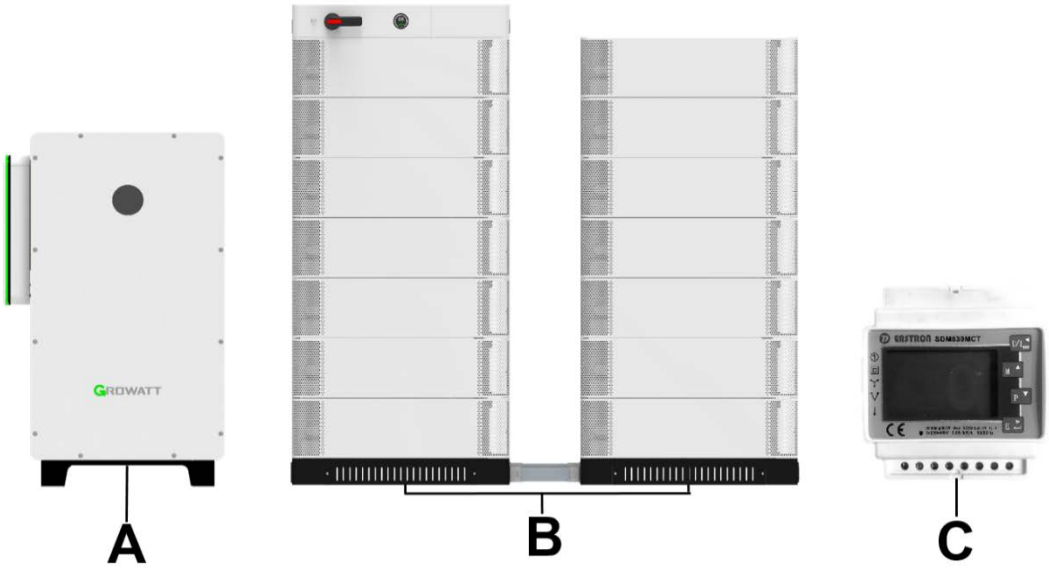


Fig 3.2 Components of the on/off-grid PV-ESS-DG system within the scope of delivery

Detailed description:

Table 3.2 Equipment description of the PV-ESS-DG system

Device	Model	Description
A. WIT inverter	WIT 50/63/75/100K-A-US	● The -HU Hybrid Inverter models come with the transfer module, enabling seamless transition between on-grid and off-grid operation; equipped with the grid port and the load port; support connection to the PV and battery modules at the same time. ● The –H Hybrid Inverter models have one AC port; support connection to the PV and battery modules at the same time. ● The –AU Storage Inverter models have the transfer module, enabling seamless transition
	WIT 50/63/75/100K-H-US	
	WIT 50/63/75/100K-AU-US	
	WIT 50/63/75/100K-HU-US	

		between on-grid and off-grid operation; only supports the connection of batteries. ● The –A Storage Inverter models have one AC port, only supporting the connection of batteries.
B. Battery	APX 129.0-200.7H-S1-US	● 14.33kWh per battery pack; 9-14 unit can be connected in series with the minimum capacity of 129.0 kWh and the maximum capacity of 200.7 kWh.
C. Smart meter	TPM-CT-E-US	● Collect grid-side charging/discharging data in real time and upload to the inverter, enabling export limitation.

3.3 Reference Documents

Table 3.3 Manuals of components of the PV-ESS-DG System

Device	Model	Access documents
Hybrid Inverter	WIT-HU User Manual	
Hybrid Inverter	WIT-HU Quick Guide	
Battery	APX User Manual	

Battery	APX Quick Guide	
TPM-CT-E-US	TPM-CT-E-US Quick Guide	

4. System Installation

4.1 System Layout

4.1.1 Basic Installation Requirements

A. Ensure that the installation surface is solid enough to support the weight of the system for a long time.

B. Ensure that the installation position comply with the layout clearance requirements, which are specified in this section.

C. Do not install the system in areas with flammable or heat-intolerant materials.

D. Components of the system are protected to IP66 and can be installed indoors or outdoors.

E. Do not expose the system to direct sunlight. Otherwise, the excessive heat may lead to power reduction. You are recommended to install a sun shelter.

F. Keep the humidity at 0% to 95% RH.

G. Keep the ambient temperature at -10℃ to +45℃; the recommended ambient temperature for installing the APX battery is below 30℃.

H. Keep dust and dirt in the environment to a minimum level.

I. Do not install the battery in highly humid areas such as bathrooms.

J. Products of the system should only be installed on a flat floor or vertical wall, refer to Figure 4.1 below:

Fig 4.1

Reserve enough clearance around each component to ensure the proper operation of the equipment and facilitate ease of operation. Please observe all clearance requirements mentioned in this section. To promote the stable operation of the system, reserve a clearance of at least 11.81 inches between the back of the WIT inverter and the wall, and keep the back of the APX battery system at least 23.62 inches from the wall.

Fig 4.2（The units in the figure are:mm）

1. Keep the system far from strong magnetic signal.
2. Ensure that the system is out of the reach children.

4.1.2 System Layout

Set up the PV-ESS-DG system according to the system layout, observing clearance requirements. Do not build or run the system in a narrow space.

Upon delivery and determining the installation position, move the equipment to the installation site with the recommended transportation method provided in the corresponding Quick Guide, then position each component in accordance with the system layout. Observe recommended clearances which are illustrated in the figure below. Install the meter, ATS, WIT and APX in a sequence from left to right. The meter is wall-mounted, with a distance of 47.42 inches above the ground. The horizontal clearance requirements are: 23.63 inches between the meter and ATS; 31.5 inches between ATS and WIT; 31.5~39.37 inches between WIT and APX; 9.84~13.78 inches between two battery clusters. Install the WIT and APX close to the wall, while leaving a clearance of 11.81 inches between the WIT inverter rear side and the wall and 23.62 inches between the APX battery rear side and the wall. If the APX battery is next to the wall on the right side, maintain a clearance of 15.75 inches. Please refer to the figure below:

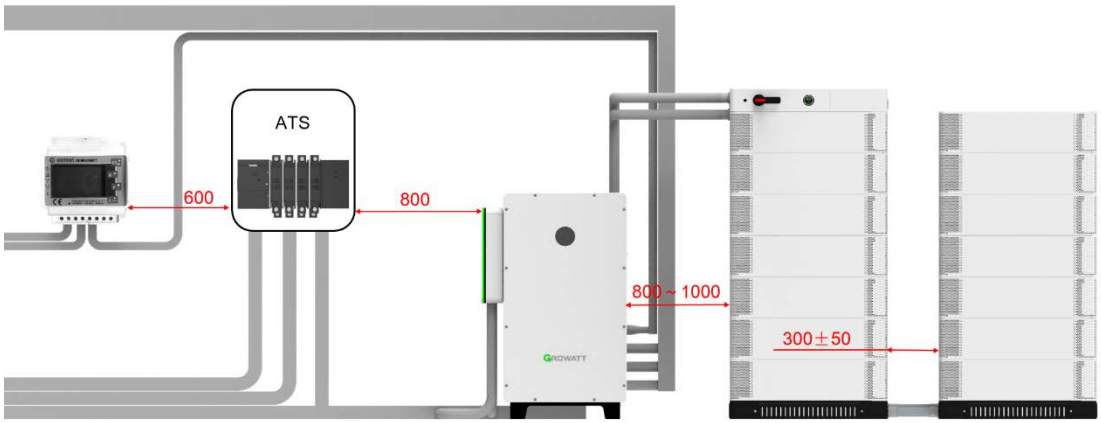


Fig 4.3 System layout（The units in the figure are:mm）

To extend the service life of the system and avoid power de-rating due to excessive temperature, you are advised to install a sun shelter when the system is installed outdoors to shield it from direct sunlight and rain. As shown in the figure below, please leave a clearance of 39.37 inches on the front side and 59.06 inches on both sides.

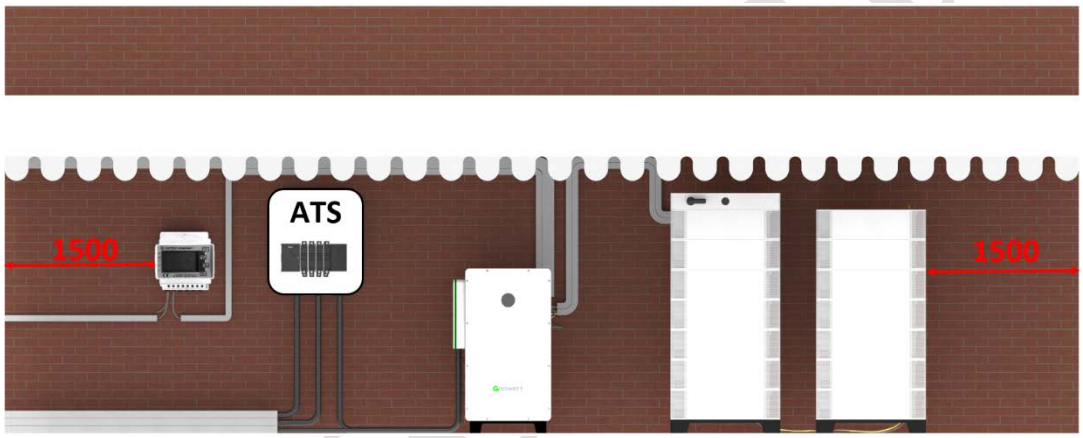


Fig 4.4 Front view of the sun shelter（The units in the figure are:mm）

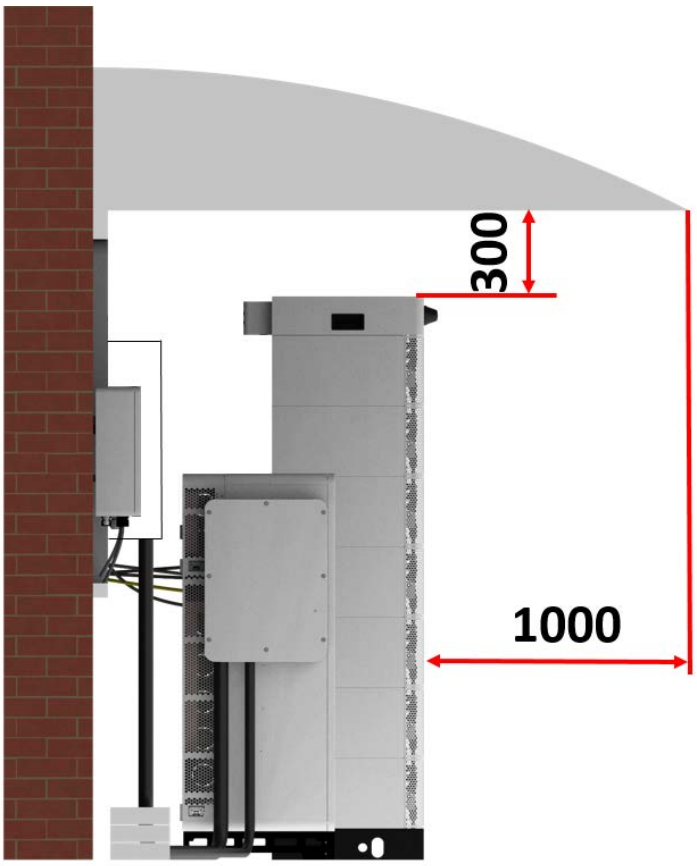


Fig 4.5 Side view of the sun shelter（The units in the figure are:mm）

4.1.3 Install System Components

Please refer to the User Manual of each component mentioned in Chapter 3.

4.2 Cable Connections

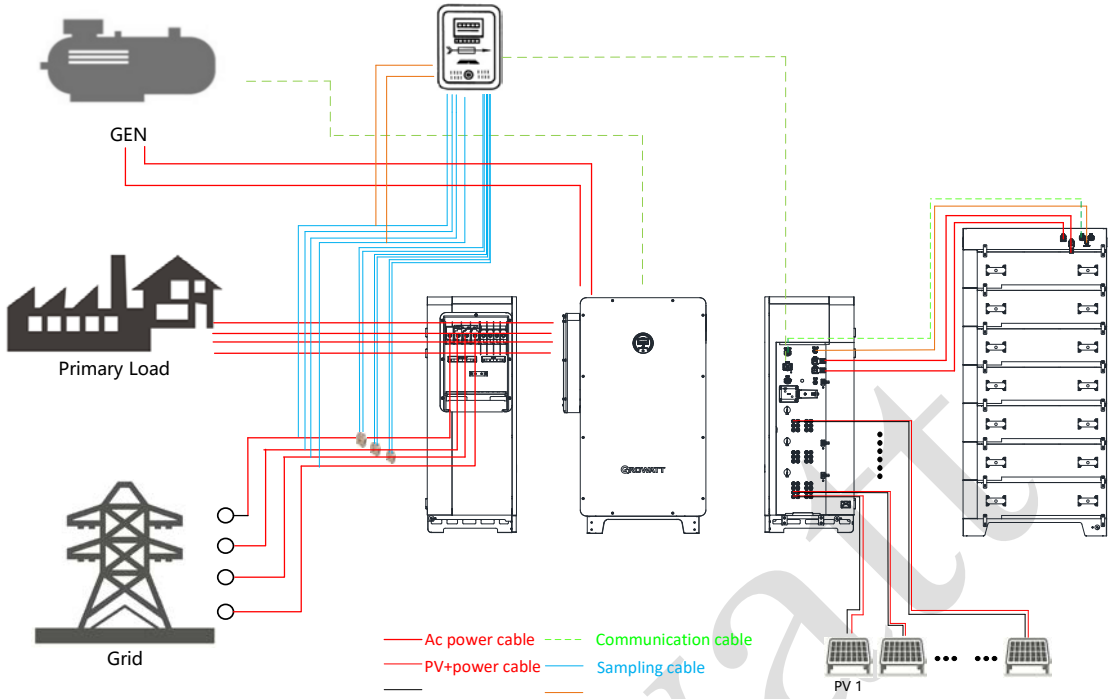


Fig 4.6 PV+ESS+DG system electrical connections

4.2.1 Connect the PE Cables

危险	● Connect the PE cables of the PV-ESS-DG system before connecting any other cables. Ensure that all components are properly grounded to prevent personal injury and device damage.
	● All non-current carrying metal parts and device enclosures of the PV-ESS-DG system should be grounded, such as the mounting bracket and the enclosures of the PCS, battery, ATS and distribution cabinet.
	● Enclosures of all components of the PV-ESS-DG system should be connected to the same grounding bar for equipotential bonding.

The ground point of each component is shown in the figure below:

Fig 4.7 System ground point positions

Note:

Connect the PE cable of each component to the grounding bar, using the shortest wiring route whenever possible.

4.2.2 System Wiring Safety Precautions

DANGER	● Before electrical connections, make sure that the DC switches of all components are in the "OFF" position, especially the one of the battery system. Disconnect the AC breaker on the grid side. Otherwise high voltages present in the PV-ESS-DG system may cause lethal injuries. ● All operations must be performed by trained and professional electricians. Comply with all safety information specified in this manual and local regulations. ● Do not touch the equipment in operation unless necessary as high voltages are dangerous. ● Do not place flammable or explosive materials around the system.
WARNING	● Each WIT inverter must be equipped with a separate AC circuit breaker. Multiple inverters cannot connect to the same AC circuit breaker (not applicable to off-grid application). ● Ensure that the battery terminals are audibly snapped into place. ● If the cable is thick, do not wiggle it after tightening the cable terminals. Ensure that the terminals are properly connected; otherwise, loose connection may cause overheating and device damage. ● The battery wiring terminals are shielded with the protective cover. Upon completion of cable connection on the battery side, re-install the protective cover to prevent accidental touch.

4.2.3 System Wiring Instructions

Upon completion of the after-installation check, verify if all cables required for system wiring are complete and intact, and check if the cables that should be prepared separately meet the recommended specifications.

Table 4.1 Cable list for system wiring

No.	Cable usage	Connection	Remark
W00/W01	APX-WIT power cable	WIT (BAT+) ~ APX (PCS+) WIT (BAT-) ~ APX (PCS-)	Provided by Growatt
W02	APX-WIT AC power supply cable	WIT (BMS AC) ~ APX (AC INPUT)	Provided by Growatt
W03	APX-WIT communication cable	WIT (BMS COM) ~ APX (PCS)	Provided by Growatt
W16/W17/W18/W19	WIT-Grid power cable	WIT (GRID R) ~ Distribution cabinet (R) WIT (GRID S) ~ Distribution cabinet (S) WIT (GRID T) ~ Distribution cabinet (T) WIT (GRID N) ~ Distribution cabinet (N)	Prepared by user (Growatt provides the terminals)
W20--W59	WIT-PV power cable	WIT PV1-10 (+) ~ PV panel (+) WIT PV1-10 (-) ~ PV panel (-)	Prepared by user (Growatt provides the terminals)
W60--W63	Meter to Grid voltage sampling cable	Distribution cabinet (R) ~ Meter (L1) Distribution cabinet (S) ~ Meter (L2) Distribution cabinet (T) ~ Meter (L3) Distribution cabinet (N) ~ Meter (N)	Prepared by user
W64--W66	Meter to Grid current sampling cable	CT1 (SI, S2) -- Meter (Ia1, Ia2) CT2 (SI, S2) -- Meter (Ib1, Ib2) CT3 (SI, S2) -- Meter (Ic1, Ic2)	Prepared by user
W67	Meter to WIT communication cable	WIT COM1 (6, 7/8, 9) -- Meter (485-1-A, 485-1-B)	Prepared by user

Recommended specifications of cables that should be prepared by users:

1. Inverter's PV-side power cables (W20~W59):

Table 4.2 WIT inverter – Max. current per MPPT& Recommended cable specification

Inverter model	Max. current per MPPT	Recommended cable specification
WIT 50-100K-H/HU-US	16A*2	12AWG

2. Inverter's AC-side power cables (W04~W07, W16~W19):

Table 4.3 WIT inverter – Recommended AC power cable specification

Inverter model	Recommended cable specification
WIT 50/63K-A/-H-US	1 AWG
WIT 75/100K-A/-H-US	2/0 AWG

Table 4.4 WIT inverter – Recommended AC power cable specification

Inverter model	Grid-side recommended cable specification	Load-side recommended cable specification
WIT 50/63K/-AU/-HU-US	4/0AWG	1AWG
WIT 75K/-AU/-HU-US	300kcmil	2/0AWG
WIT 100K/-AU/-HU-US	300kcmil	2/0AWG

Recommended circuit breaker (CB) specifications:

For the WIT 50-100K-A-US and WIT 50-100K-H-US models

Inverter model	Rated voltage of CB	Rated current of CB
WIT 50/63K-A/-H-US	480V	150A
WIT 75/100K-A/-H-US	480V	250A

For the WIT 50-100K-AU-US and WIT 50-100K-HU-US models

Inverter model	Rated voltage of CB	Rated voltage of CB on the load side	Rated voltage of CB on the grid side
WIT 50/63K-AU/-HU-US	480V	300A	150A
WIT 75/100K /-AU /-HU-US	480V	400A	200A

4.2.3.1 Wiring of the Battery System

After positioning all components following the system layout, move the battery modules as specified in the Quick Guide of the battery system, then secure the battery system to the designated location. For detailed battery system wiring instructions, please refer to the Quick Guide.

Fig 4.8 Wiring of the APX battery system

After the cable connection is complete, check the following items:

Table 4.5 Battery system cable connection checklist

General item	Position	Checking item
PE cable	Between modules	1. Check the yellow-green PE cable and screws supplied with each component. 2. Screws are tightened. 3. Each module is connected with the PE cable, including the BM, CM and base.
	Battery enclosure	1. Check the yellow-green PE cable and screws supplied with the battery package. 2. Screws are tightened. 3. Connect the PE cable reliably, using the shortest wiring route whenever possible
Power cable	Between CM and BM	1. Check the battery terminals. 2. Cables are securely connected. 3. The power terminal B+ of CM is connected with the power terminal B+ of the first BM; the power terminal B- of CM is connected with the power terminal B- of the last BM in the second column (the bottommost one).

	Between two BMs in the same column	1. Check the battery terminals. 2. Cables are securely connected. 3. Check the cable connecting two BMs in the same column, with a black connector on one end and an orange connector on the other end.
	Between two BMs in different columns	1. Check the battery terminals. 2. Cables are securely connected. 3. Connect the B- terminal of the bottommost BM in the first column to the B+ terminal of the uppermost BM in the second column using the long power cable with a black connector on one end and an orange connector on the other end.
	The last BM to CM	1. Check the battery terminals. 2. Cables are securely connected. 3. Connect the B- terminal of the last BM to the B- terminal of CM using the long power cable with one black connector on each end.
Communication cable	CM-BM	1. RJ45 connector 2. Cables are securely connected.
	Between two BMs in the same column	1. RJ45 connector 2. Cables are securely connected. 3. Cable connecting two BMs in the same column
	Between two BMs in different columns	1. RJ45 connector 2. Cables are securely connected. 3. Connect the IN and OUT ports of the bottommost BM in the first column to the IN and OUT ports of the uppermost BM in the second column respectively.
	OUT port of the last BM	1. RJ45 connector 2. Cables are securely connected. 3. For the bottommost BM in the second column, cover the IN port of the with a dustproof cap, and install the short-circuit cap onto the OUT port.

After verifying that all cable connections of the battery system are correct, install the external cover of the fan.

Note:

- The recommended battery voltage ranges from 750 V to 1000 V. Users need to determine the number of battery modules considering the actual voltage and power on site.
- The battery column with the CM is defined as the first column, and the other one is the second column.

4.2.3.2 Wiring between the Battery and the Inverter

 DANGER	● Before electrical connections, make sure that the DC switches on the WIT inverter are in the "OFF" position, and disconnect the DC breaker on the battery side and the AC breaker on the grid side. Otherwise high voltages present in the inverter

	may cause lethal injuries. ● All operations must be performed by trained and professional electricians. Comply with all safety information specified in this manual and local regulations. ● Do not touch the equipment in operation unless necessary as high voltages are dangerous. ● Do not place flammable or explosive materials around the WIT inverter.
WARNING	● If the cable is thick, do not wiggle it after tightening the cable terminals. Ensure that the terminals are properly connected; otherwise, loose connection may cause overheating and device damage. ● The battery wiring terminals are shielded with the protective cover. Upon completion of cable connection on the battery side, re-install the protective cover to prevent accidental touch.

1. Pipe position

Pipes ① and ② route four cables: W00, W01, W02 and W03, which are supplied with the battery package.

2. Cable connection

W00 and W01: power cables between the battery and the WIT inverter, fed through Pipe ②, connecting the PCS+ and PCS- terminals on the battery to the BAT+ and BAT- terminals on the WIT respectively;

W02: power cable between the battery and WIT, fed through Pipe ②, connecting the AC INPUT port on the battery to the BMS AC port on the WIT;

W03: power cable between the battery and WIT, fed through Pipe ①, connecting the PCS port on the battery to the BMS COM port on the WIT.

Please refer to the figure below for wring between the battery and the WIT:

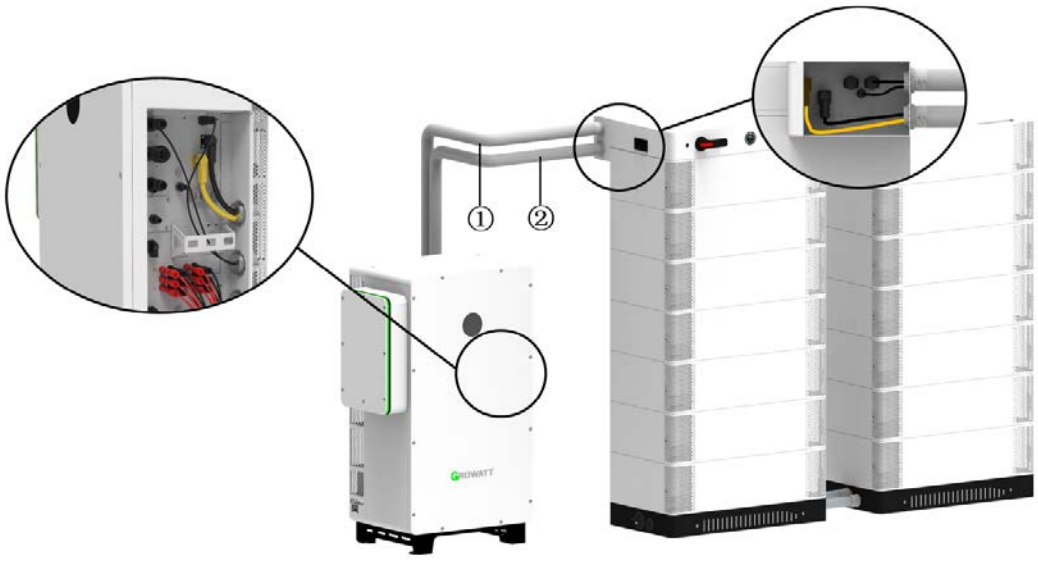


Fig 4.9 Wiring between the APX battery and the WIT inverter

4.2.3.3 Wiring of Power Cables on Inverter's PV Side

注意	Operations in this section only apply to the WIT 50-100K-H-US and WIT 50-100K-HU-US models.
危险	● Before electrical connections, make sure that the DC switches on the WIT inverter are in the "OFF" position, and disconnect the DC breaker on the battery side and the AC breaker on the grid side. Otherwise high voltages present in the inverter may cause lethal injuries. ● All operations must be performed by trained and professional electricians. Comply with all safety information specified in this manual and local regulations. ● Ensure the correct polarity before connecting the PV modules to the inverter. ● Do not touch the equipment in operation unless necessary as high voltages are dangerous. ● Do not place flammable or explosive materials around the inverter.
警告	● The maximum open-circuit voltage per PV string should not exceed 1100V. ● Ensure that all requirements are fulfilled to prevent fire or damage to the WIT inverter, which is beyond the scope of warranty, and Growatt shall not be liable for any consequential damages.

1. Pipe position

Pipe ③ routes forty cables: PV+: W20-W39, PV-: W40-W59, which should be prepared by users separately according to the recommended specifications. The wiring terminals are provided by Growatt.

2. Cable connection

W20-W59: power cables between PV panels and the WIT, fed through Pipe ③, connecting the PV panels to the PV(1-10)+ and PV(1-10)- terminals on WIT correspondingly, as shown below:

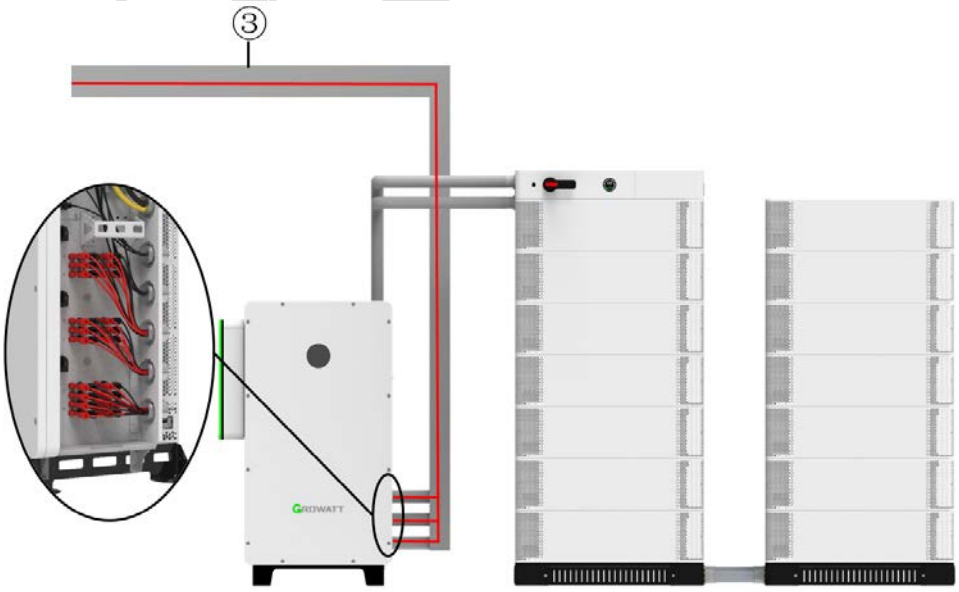


Fig 4.10 Wiring on the WIT inverter's PV side

Note:

1. Hazardous voltages are present on the PV panels connected in series when exposed to solar irradiance, which might cause lethal hazards. Cover the PV panels with dark material prior to connecting the DC input cables and ensure that the DC switch is in the OFF position, otherwise the high voltages of the WIT inverter might lead to lethal hazards.
2. The PV modules of the same string connected in series should be of the same model.
3. The max. short-circuit current per string must not exceed 40 A under any circumstance.
4. For optimal system configuration, it is recommended to connect a same number of PV modules each string.

4.2.3.4 Wiring of Power Cables between the Inverter and the Grid

1. Pipe position and dimensions

Pipe ⑦ routes four cables: W16, W17, W18 and W19, which should be prepared by users separately according to the recommended specifications. The wiring terminals are provided by Growatt.

2. Cable connection

W16, W17, W18 and W19: power cables between WIT and grid, fed through Pipe ⑦, connecting grid port (R/S/T/N) on the WIT to the grid (R/S/T/N) as shown below:

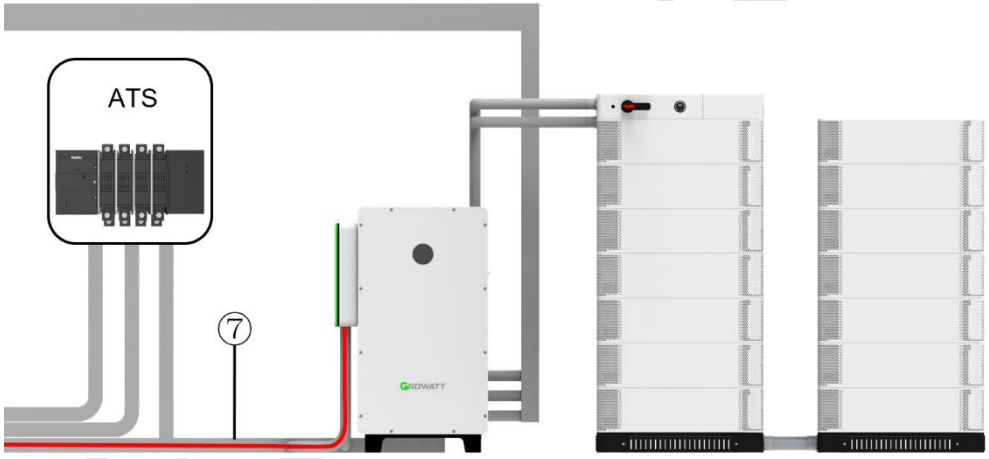


Fig 4.11 Wiring on the WIT inverter's grid side

Select the suitable circuit breaker and cables according to the recommended specifications. Run cables through the pipe, then connect the grid port of the WIT inverter to the grid over the circuit breaker.

4.2.3.8 Wiring of the Smart Meter and the Sampling Cable

1. Pipe position and dimensions Pipe ⑧ routes one cable: W67, prepared by users.

Pipe ⑨ routes four cables: W60, W61, W62 and W63, prepared by users.

Pipe ⑩ routes three cables: W64, W65 and W66, prepared by users.

2. Cable connection

Meter wiring:

W67: communication cable between the smart meter and WIT, fed through Pipe ⑧, connecting COM1 (Pin 6, 7) of WIT to RS485-1of the meter (Pin A, B).

W60, W61, W62 and W63: power supply and sampling cables between the smart meter and the grid, fed through Pipe ⑨, connecting the voltage sampling port (L1/L2/L3/N) on the Meter to the grid-side circuit breaker (R/S/T/N).

W64, W65 and W66: cables between the smart meter and the grid-side current sampling CT, fed through Pipe ⑩,

connecting the three-phase current sampling port of the smart meter to CT 1/2/3 (S1 and S2), as shown below:

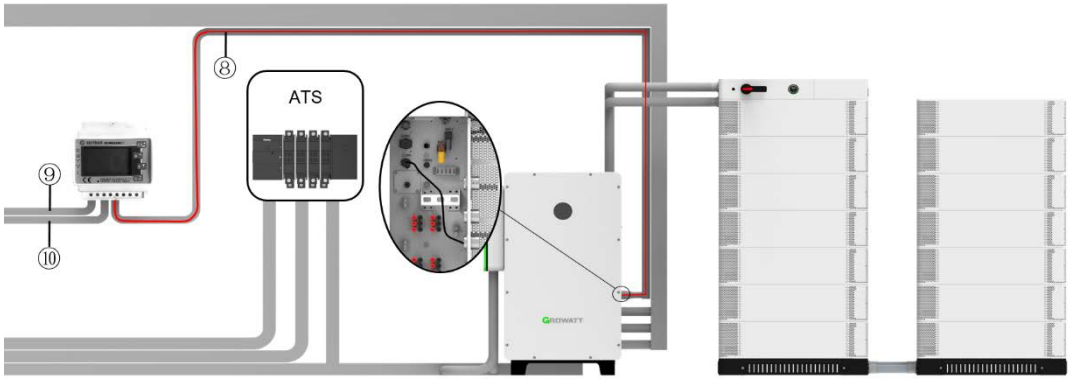


Fig 4.12 Wiring of communication cables between WIT and the Smart Meter

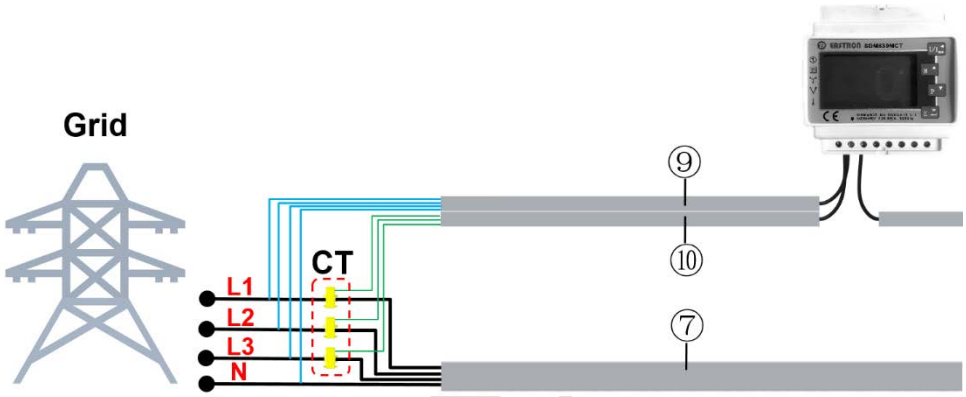


Fig 4.13 Wiring of meter's communication and sampling cables

4.3 Checklist

Upon completion of cable connections, please check all cable connections referring to the checklist below:

Table 4.16 System electrical connection checklist

General item	Specific item	Inspection
PE cable	WIT inverter enclosure PE cable	1. Check the yellow-green PE cable and cable specifications. Check if the cable is securely connected to the nearby grounding bar. 2. Protect the wiring terminals from rain.
	APX battery enclosure PE cable	1. Check the yellow-green PE cable and cable specifications. Check if the cable is securely connected to the nearby grounding bar. 2. Protect the wiring terminals from rain.
	PE cable of the secondary side of the CT connecting to the meter	1. Check the yellow-green PE cable and cable specifications. Check if the cable is securely connected to the nearby grounding bar.

		2. Protect the wiring terminals from rain.
Power cable	Power cables between the APX battery and WIY inverter	1. The battery terminals (orange and black) are correctly installed. 2. Cables are securely connected. 3. Prevent cables from being cut by the edges of the cable sleeve.
	The AC power supply cable between the APX battery and the WIT inverter	1. Ensure correct and secure cable connection. 2. Prevent cables from being cut by the edges of the cable sleeve.
	PV cables between the WIT inverter and the PV array	1. Verify that the polarity of the DC connectors is correct and the cables are securely connected. 2. Prevent cables from being cut by the edges of the cable sleeve.
	Power cables between the WIT inverter and the grid	1. Check the cable specifications and check if the cables are securely connected. 2. Prevent cables from being cut by the edges of the cable sleeve. 3. Avoid over-bending in cable routing or damaging cables. 4. Apply fireproof mud to the terminals.
	Power cables between the WIT inverter and the loads	1. Check the cable specifications and check if the cables are securely connected. 2. Prevent cables from being cut by the edges of the cable sleeve. 3. Avoid over-bending in cable routing or damaging cables. 4. Apply fireproof mud to the terminals.
Communication cable and sampling cable	Communication cable connecting the APX battery to the WIT inverter	Ensure no loose connection and no gaps in sealing rings.
	Communication cable connecting the WIT inverter to the Smart Meter	Ensure no loose connection and no gaps in sealing rings.
	Voltage sampling cable connecting the grid and the Smart Meter	Ensure no loose connection and no gaps in sealing rings.
	Current sampling cable connecting the grid-side CT to the Smart Meter	Ensure no loose connection and no gaps in sealing rings.
	Datalogger network configuration	Ensure no loose connection and no gaps in sealing rings.
	DRMS	Ensure no loose connection and no gaps in sealing rings.

5. System Commissioning

5.1 Power on the System

1. Turn on all DC-Switches on the right side of the WIT inverter.

Note: If there is no disconnecting device such as a combiner box between the PV array and the WIT, terminals of the PV panel will be energized. In this case, turn on the PV-side switch connector at nighttime without solar irradiance, or cover the panels with opaque material before operations.

2. Turn on the switch disconnector on the APX battery. After the WIT inverter is powered on, the WIT will send a command to wake up the battery when connected to the grid or PV power, so that it will be powered on automatically. In case that the battery system is to be operated in off-grid mode, you need to press the button to power on the battery.

3. Turn on the WIT inverter's grid-side upstream circuit breaker.

Note:

The WIT inverter will power on automatically once the requirements of each connection port are met, then the APX battery will start up automatically. Do not touch the equipment after it is powered on unless necessary.

5.2 Configuration and Commissioning

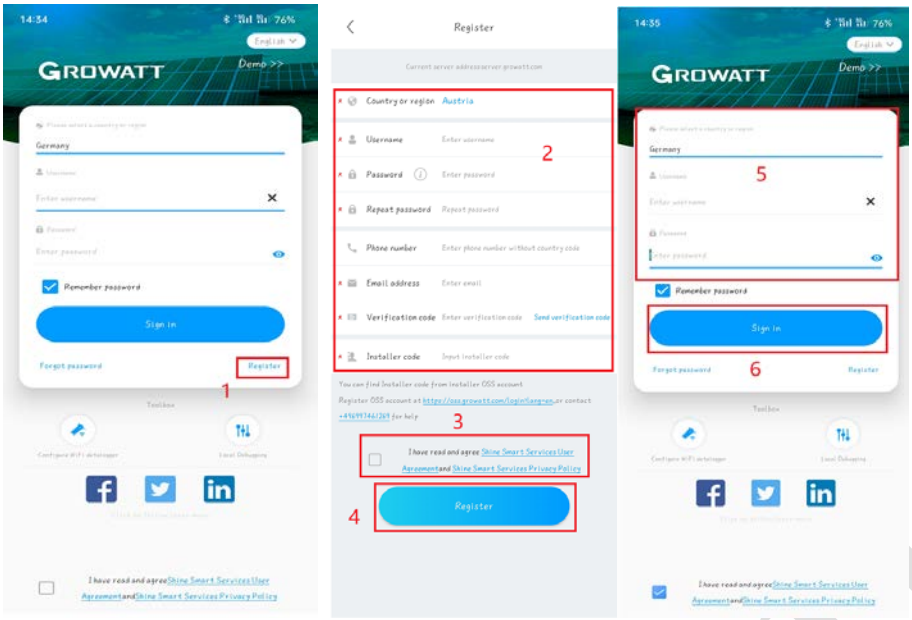
	The WIT inverter might display the wrong time and date if it has been stored for over one month. You need to set the correct time and date before connecting the inverter to the grid.

5.2.1 Register an Account

Note: Ensure a consistent connection to the Internet to perform the following operations.

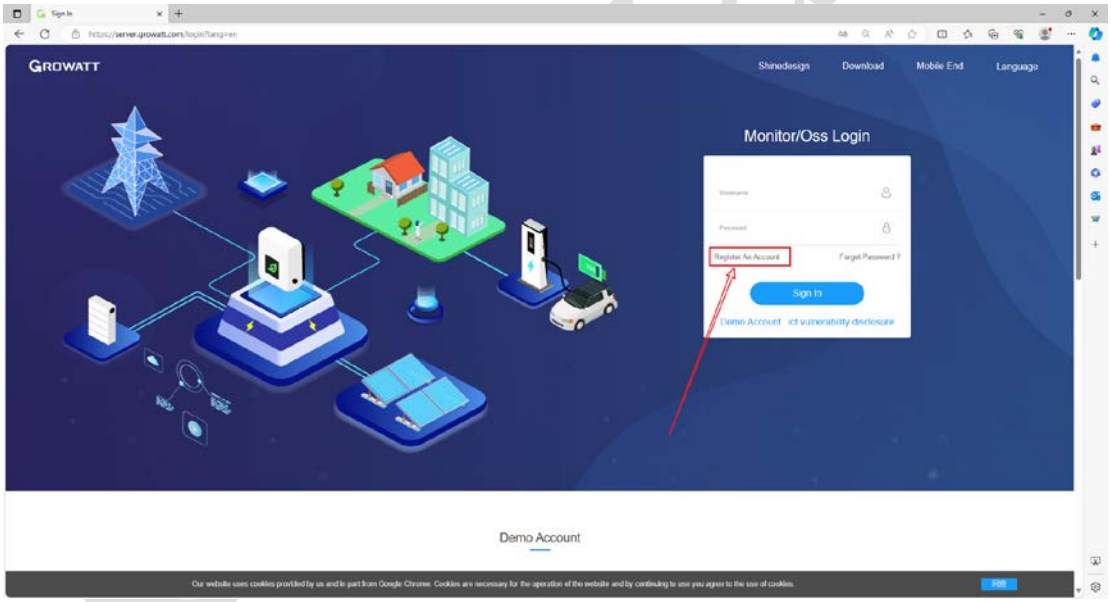
The datalogger can upload data to the server platform, enabling remote monitoring or control via the APP or server webpage. Upon initial usage, you need to configure the datalogger after powering on the system.

1. Register an account with the APP

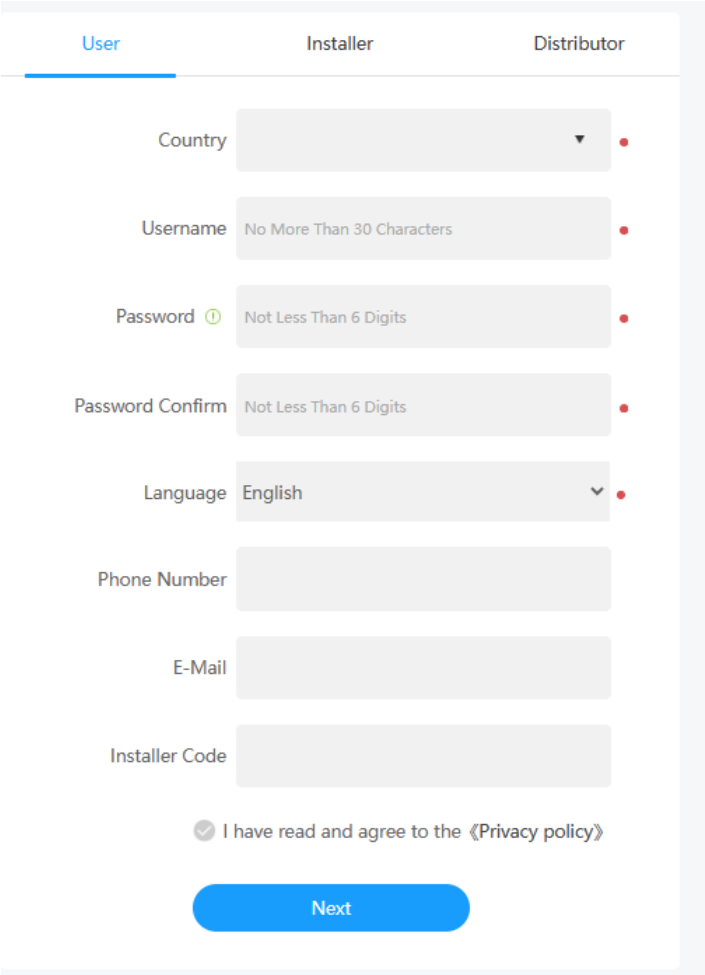


2. Register an account on the website

Open the browser, then enter http://server-us.growatt.com in the address box to access the login page. Click “Register an Account”.



On the Registration Page, fill in the information as prompted and click to agree to the Privacy Policy. Fields marked with the “·” icon are mandatory. Click next, and it will bring you to the “Add Plant” page. Skip this step during account registration to return to the login page.

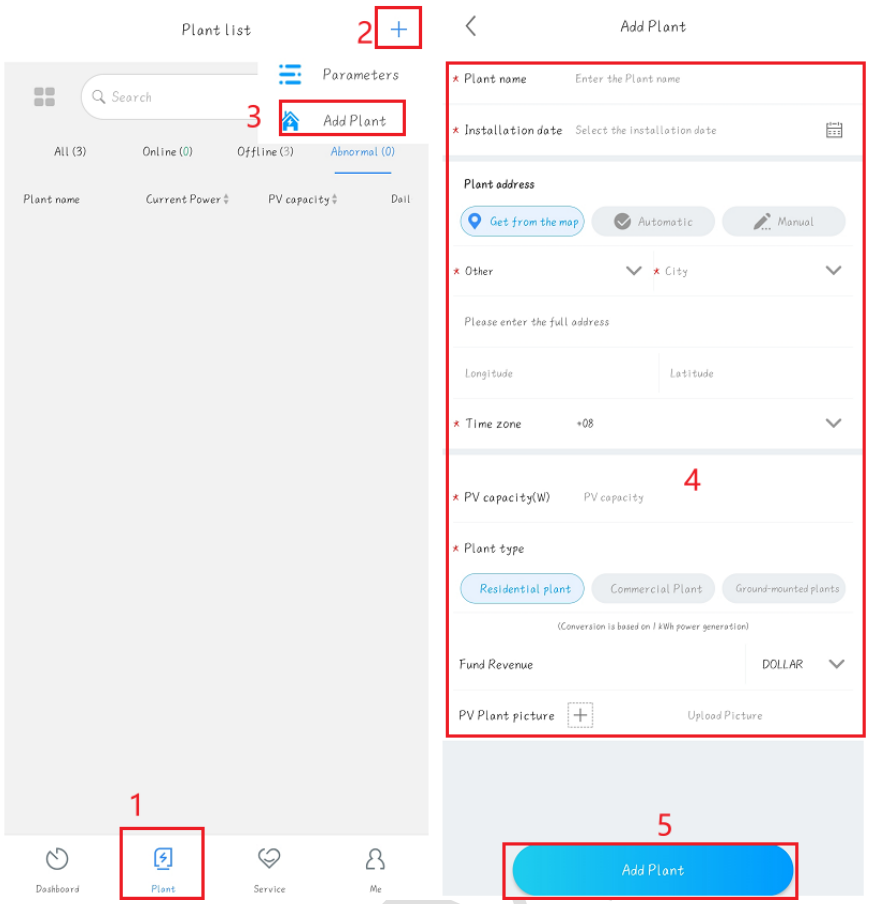


5.2.2 Create a Plant

Note: Ensure a consistent connection to the Internet to perform the following operations.

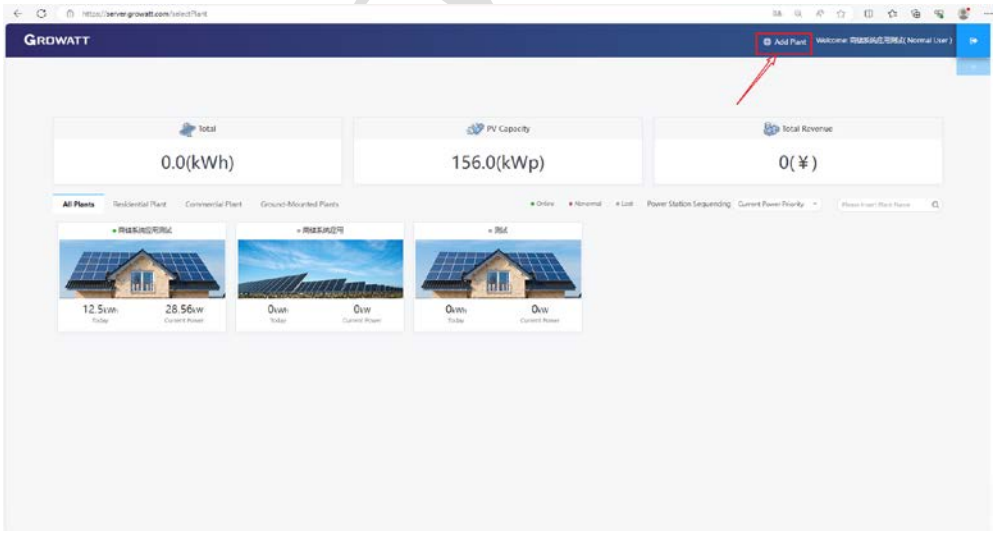
1. Create a plant with the APP

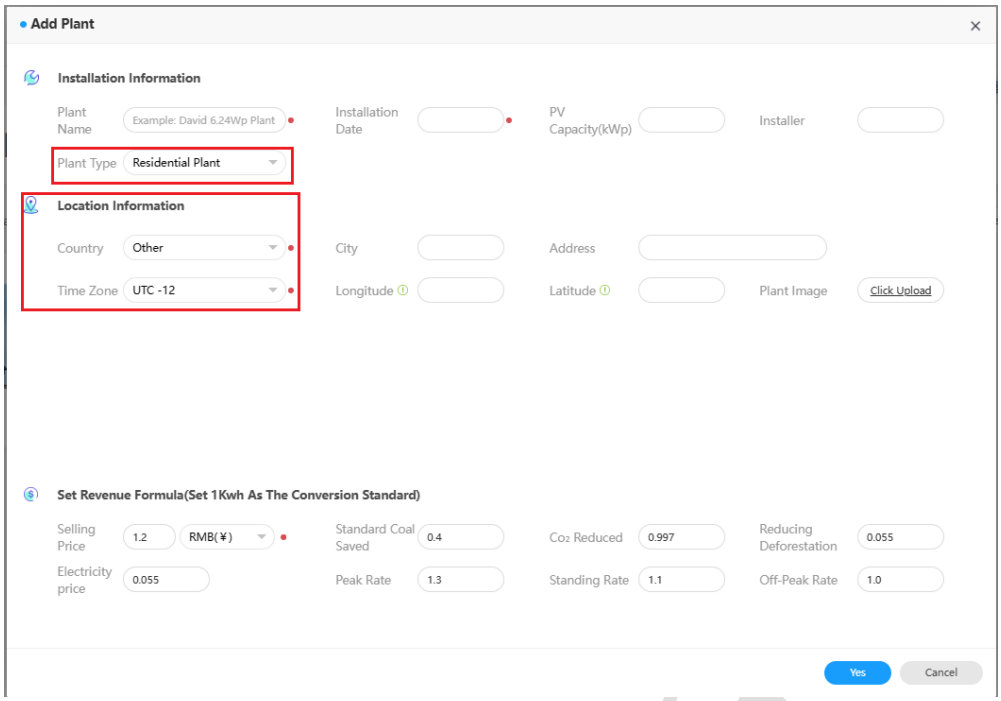
Tap “Plant” > the “+” icon on the upper right corner > “Add Plant”. Fill in the information, then tap “Add Plant”.



2. Create a plant on the website

Click “All Plants” > “Add Plant” on the upper right corner. Fill in the information, then click “Yes”.

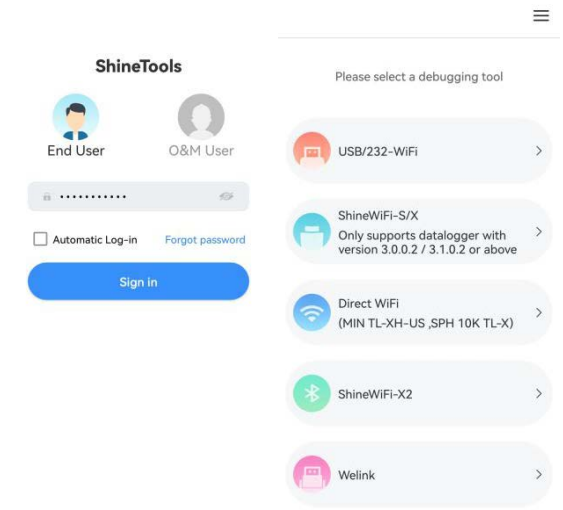




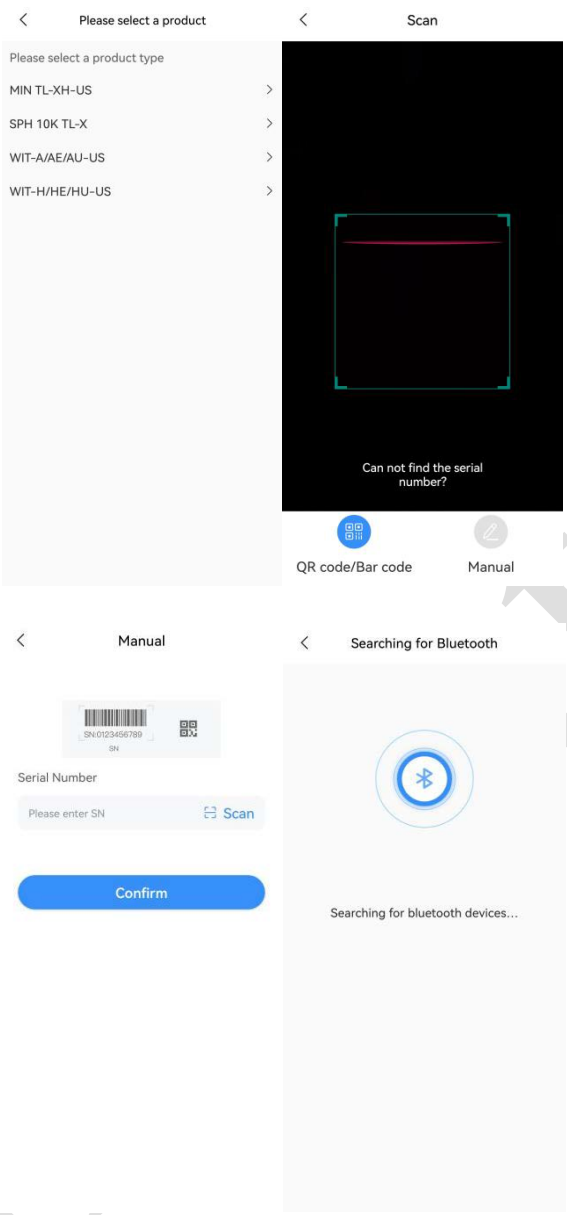
5.2.3 Network Configuration with ShineTools

1. Connect the WIT inverter to the Internet on ShineTools

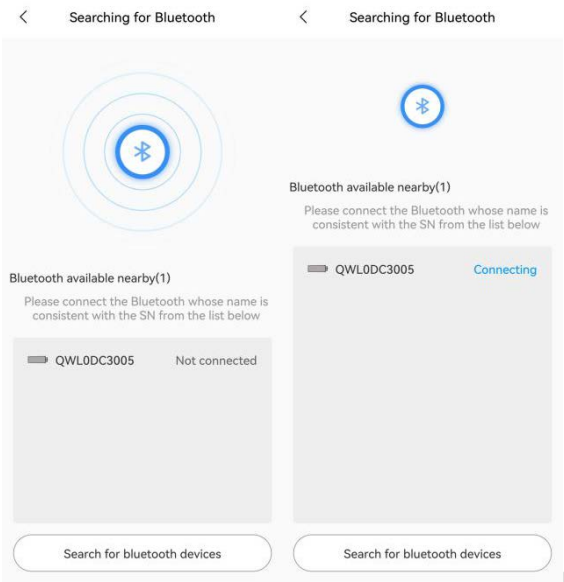
Open ShineTools APP. On the login page, click "End User" and enter the password. The password format is "oss + current date". E.g. oss20230925. Then click "Sign in".



2. Select "Direct WiFi" > "WIT-A/AU-US" or "WIT-H/HE/HU-US". For the SN (serial number), you can scan the SN barcode on the chassis or enter it manually. Then click "Confirm" and it will start searching for Bluetooth devices.



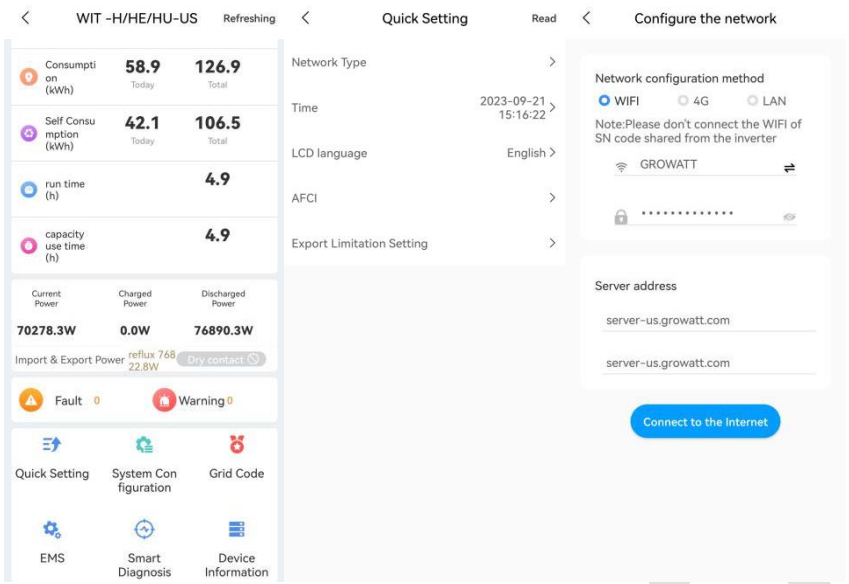
Click "Connect" after the target Bluetooth device is displayed.



After the device is successfully connected, it will display the following page. Make sure that the communication between the WIT inverter and the mobile phone has been established over Bluetooth.

"Then connect the WIT inverter to the WiFi network.

Click ""Quick Settings"" > ""Network Type"" > ""WiFi"". Enter the WiFi name and password, click ""Connect to Internet"" to configure the inverter to the server over the network."



5.2.4 Smart Meter Configuration

Ensure the correct wiring of the Smart Meter, including the grid-side voltage sampling cable, the current sampling cable wiring to the CT, the communication cable and the PE cable as instructed in Chapter 4. Then set parameters following instructions below:

Smart Meter configuration

Connect the voltage sampling cable, the current sampling cable wiring to the CT, the communication cable between the meter and inverter in according to the Quick Guide of the meter mentioned in Section 4. The screen would light up after the system is powered up. Access the configuration page, then set the CT ratio (e.g. set 120 for the CT ratio 600:5), and check if other parameters are correctly configured.

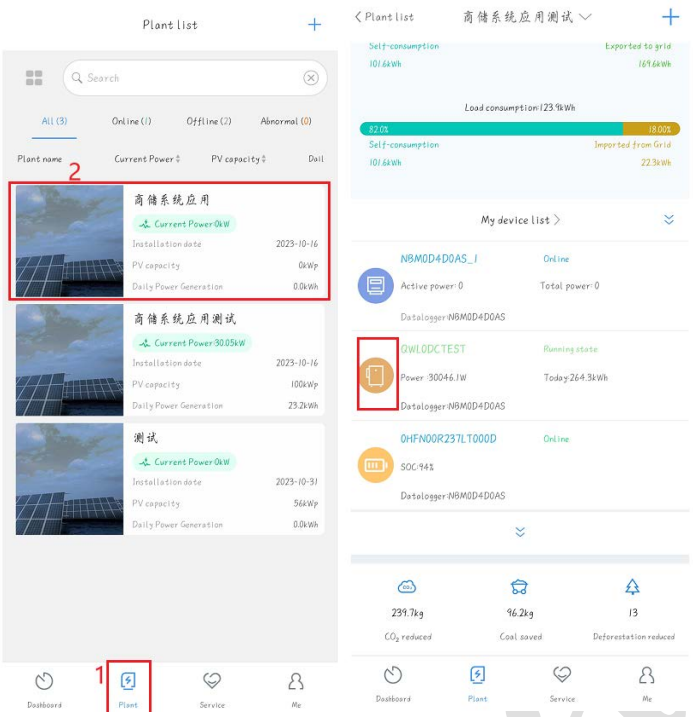
5.2.5 Online Commissioning

5.2.5.1 Online Commissioning with the APP

After completing the above steps, wait until the APP network configuration succeeds, then you can add devices to the power plant to check system information and set parameters.

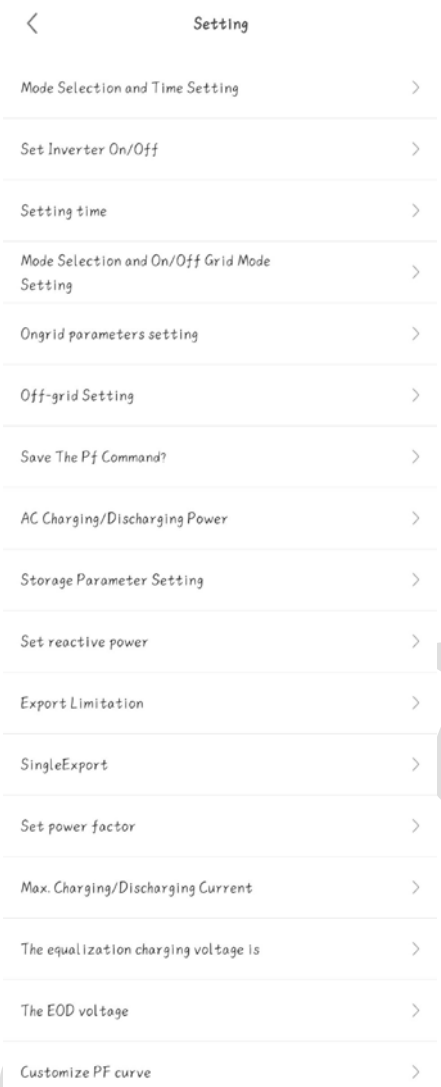
1. Interface description

Sign in with your account and access the page below:



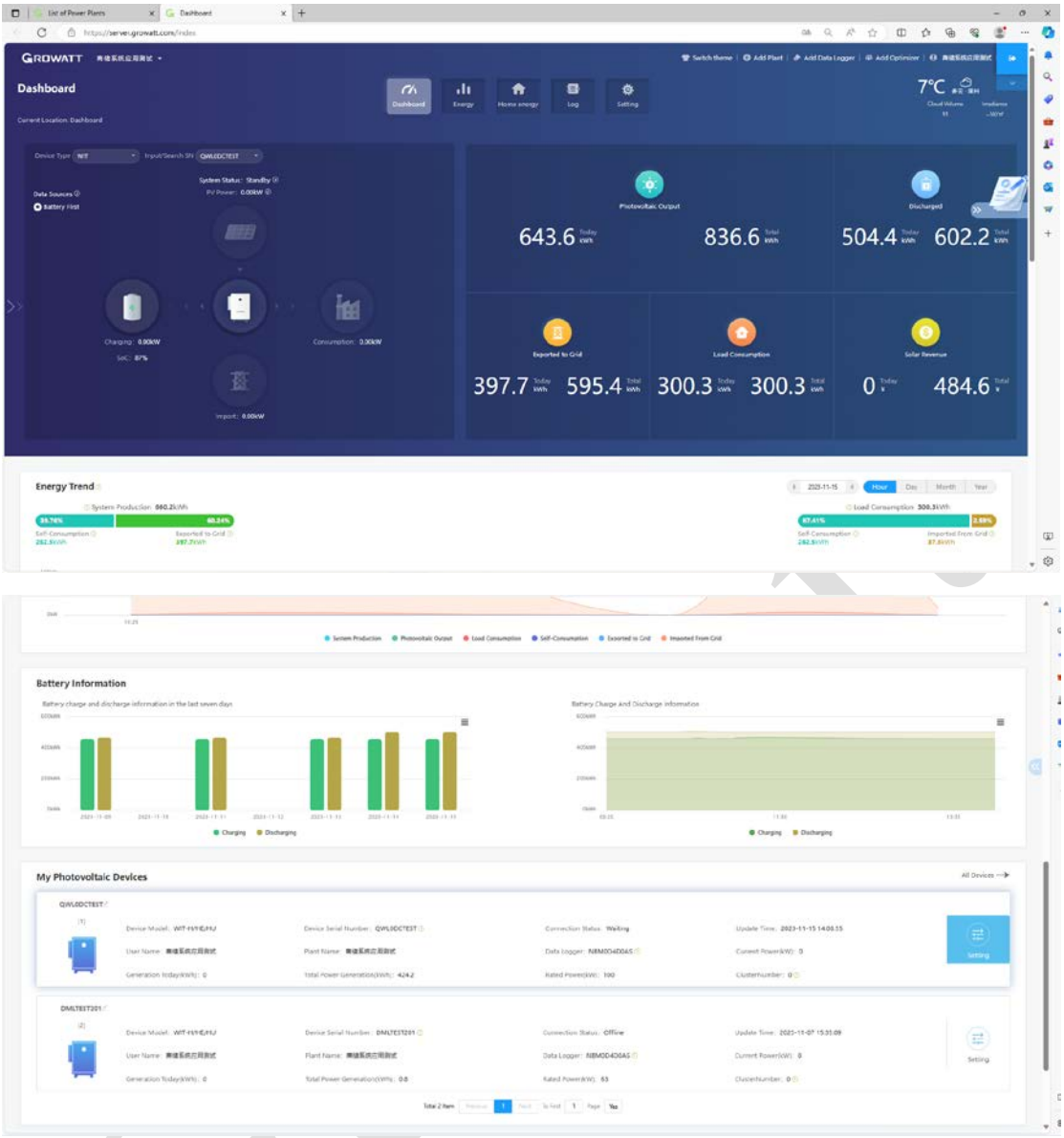
Tap “Plant”, then select the target plant from the plant list.

Find the WIT inverter from “My device list” for parameter settings, which requires password: Growatt+the current date. For instance, if the date is November 1, 2023, the password is growatt20231101.

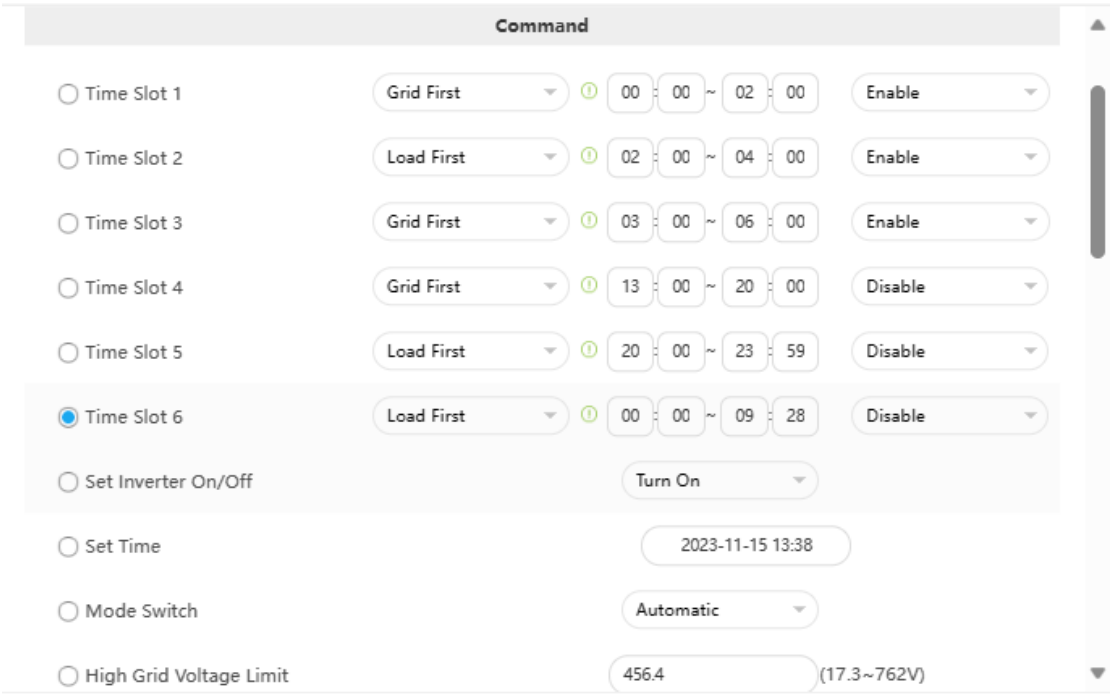


5.2.5.2 Online Commissioning on the Webpage

Web commissioning is the same as the APP commissioning. Sign in with your account and select your target plant to access the page below:



Select the target WIT inverter from the device list for parameter settings. You need to enter the password: the current date, e.g. 20231113.

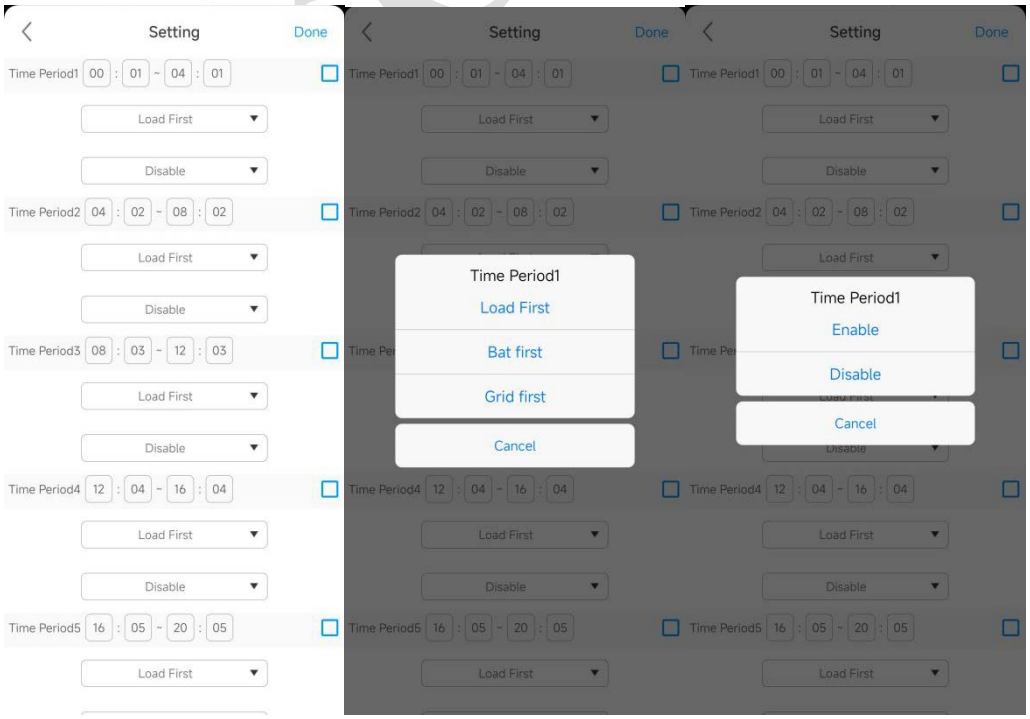


Set all the above parameters the same as parameter settings with the APP.

5.2.5.3 Parameter Settings

Parameter settings with the ShinePhone APP is the same as that on the website. This section takes settings with APP as an example.

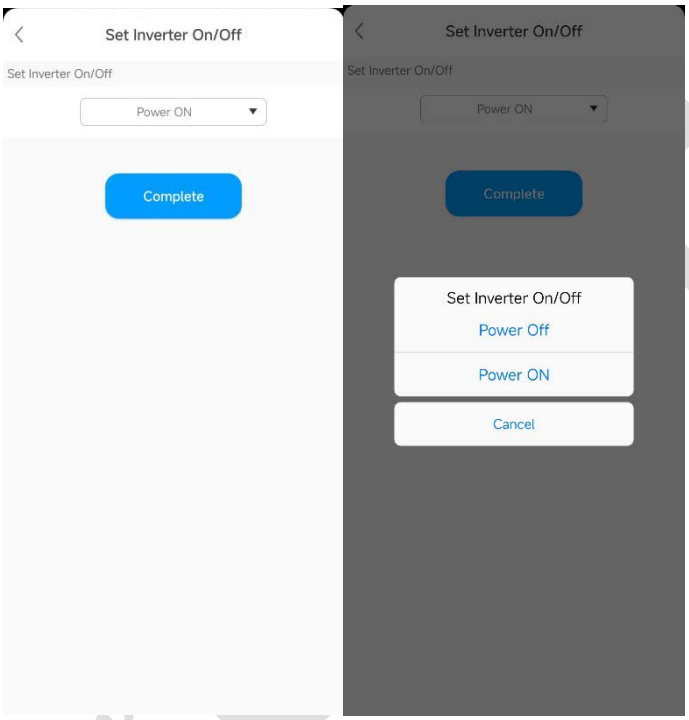
Mode Selection and Time Setting: configure parameters based on actual use. You can set the inverter to operate in three modes: Load First, Grid First or Battery First during different time segments. For detailed operating mode description, please refer to Section 3.1.4. Please note that overlapping time period settings are not allowed. For instance, if the first time segment is set to 02:00~04:00, the other time range can only start from 04:01.



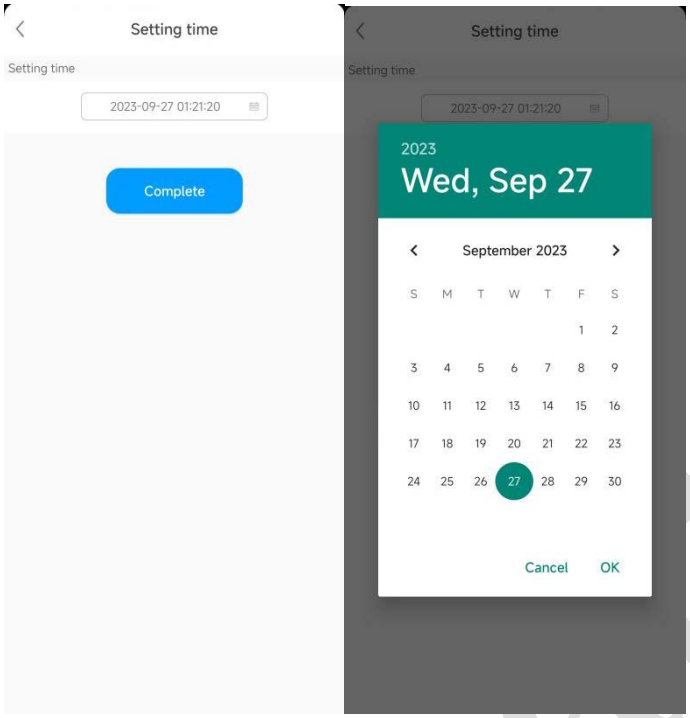
Note:

1. You are advised to set the Battery First mode during off-peak hours, and Grid first mode during peak hours, contributing to cost savings.
2. The operating modes mentioned above apply to the on-grid system. For the off-grid system, it will not response to the priority settings, but gives priority to ensuring the AC output voltage.

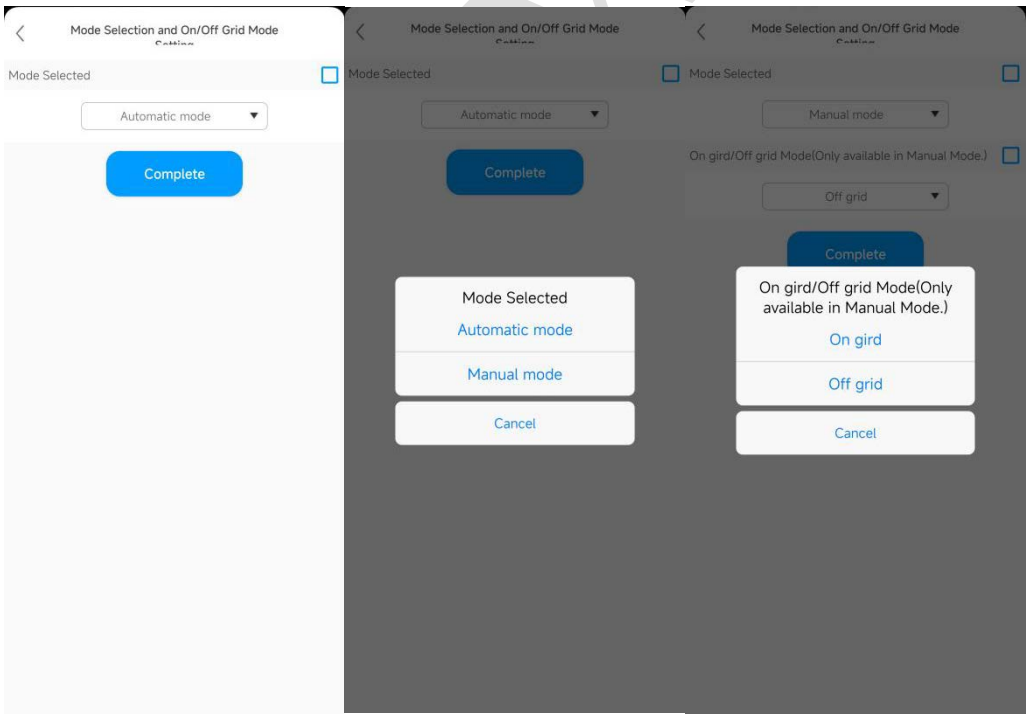
Set Inverter on/off: you can set to power on/off the WIT inverter.



Set the Time: you can set the time of the WIT inverter. With connection to the datalogger, the time will be calibrated automatically.



Setting On/Off-grid Switching Mode: includes automatic mode and manual mode; when set to the automatic mode, the WIT inverter will switch between on/off-grid mode automatically based on the output of AC grid port; when set to the manual mode, you need to set the on/off-grid operating mode manually.

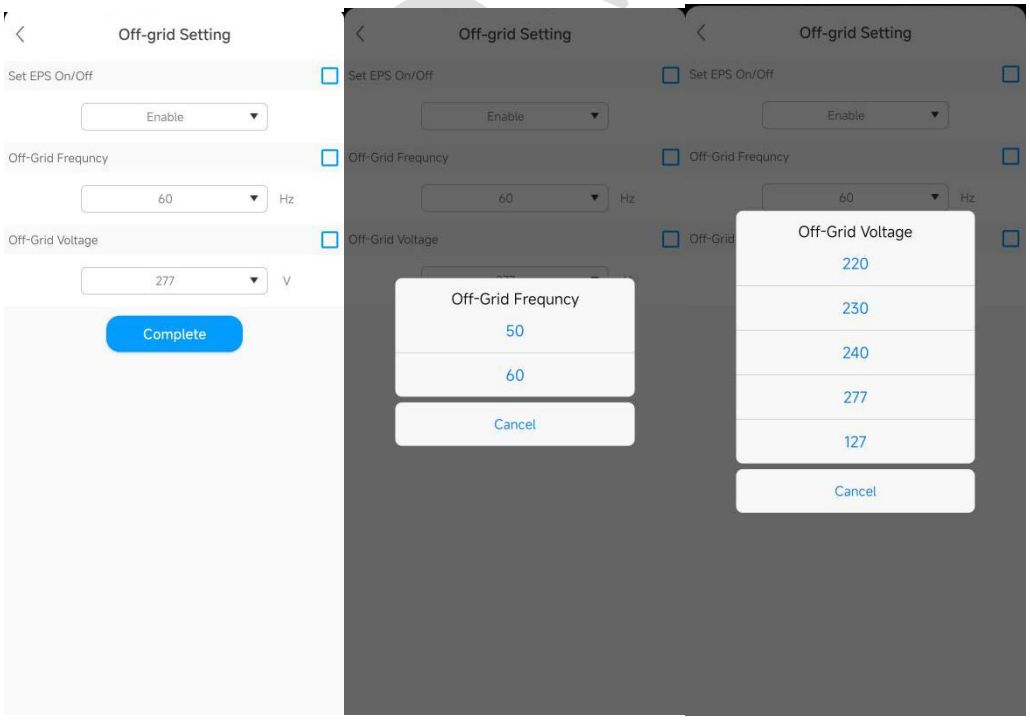


Note:

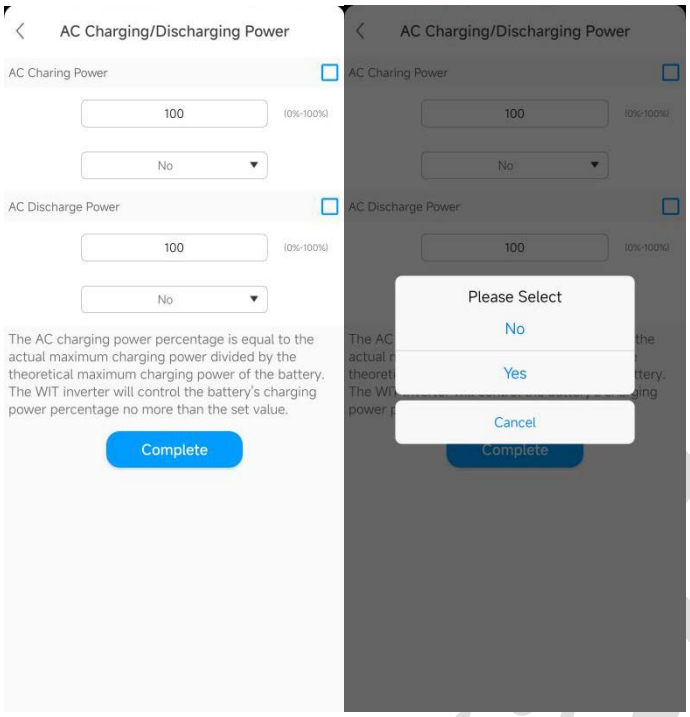
The -H/-A models do not support the automatic mode.

Gird Connection Parameter Settings: set the grid connection thresholds. If the actual voltage/frequency exceeds or falls below the threshold, the inverter cannot be connected to the grid.

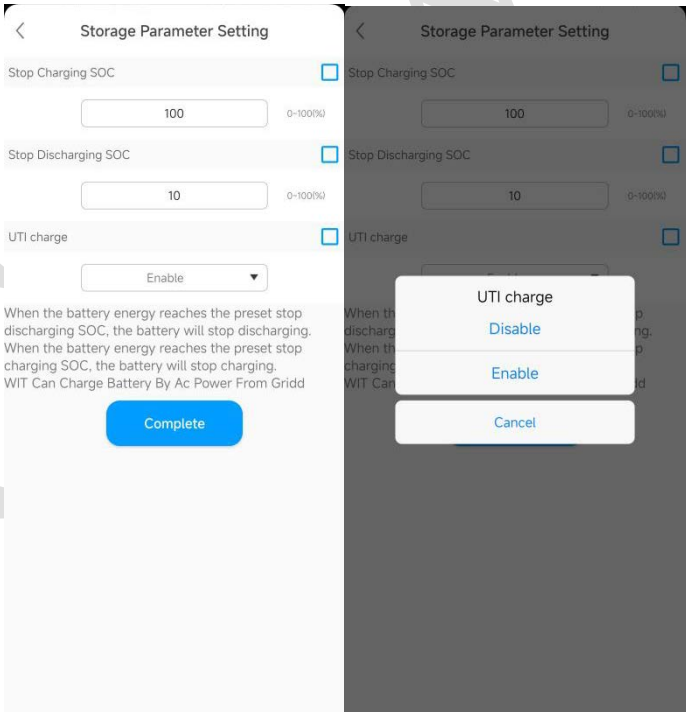
Off-grid Parameter Settings: Set the off-grid parameter range. Off-grid Enable allows you to choose whether to permit the WIT inverter to operate in the off-grid mode. Set the Off-grid Frequency and Voltage in line with the grid power; setting other grid voltage level is prohibited. Growatt shall not be liable for damage caused by failure to follow instructions on setting the voltage level.



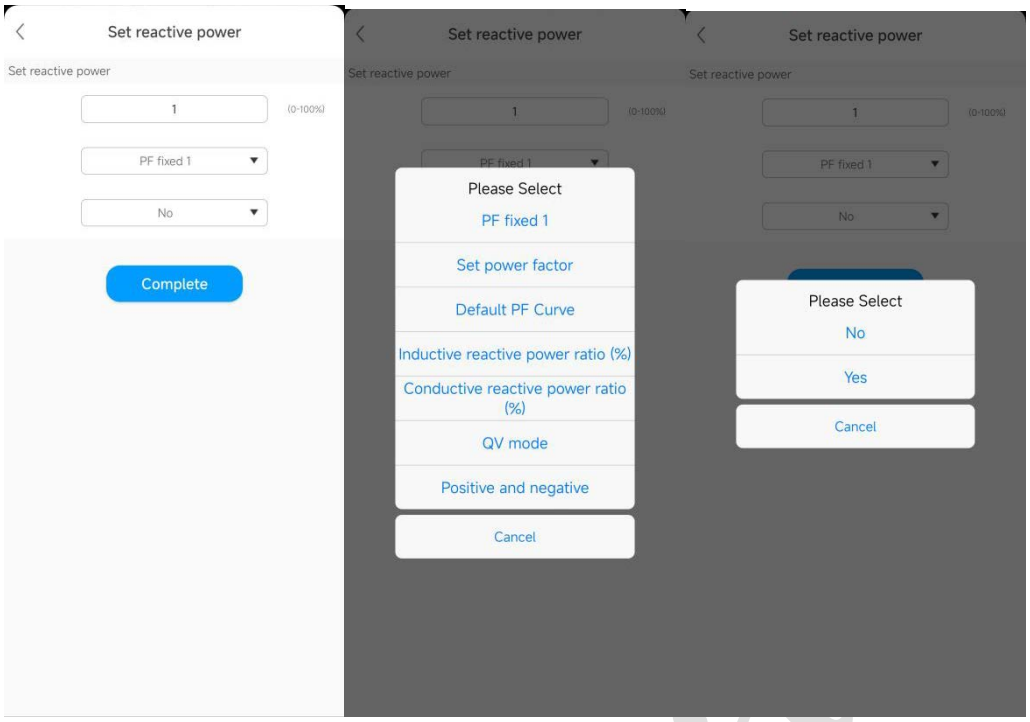
AC Charging & Discharging Power: AC Charging Power is set to limit the maximum power drawn from the grid that charges the battery; AC Discharging Power is set to limit the maximum power of the WIT inverter's AC output terminal. Set the percentage value between 0 and 100.



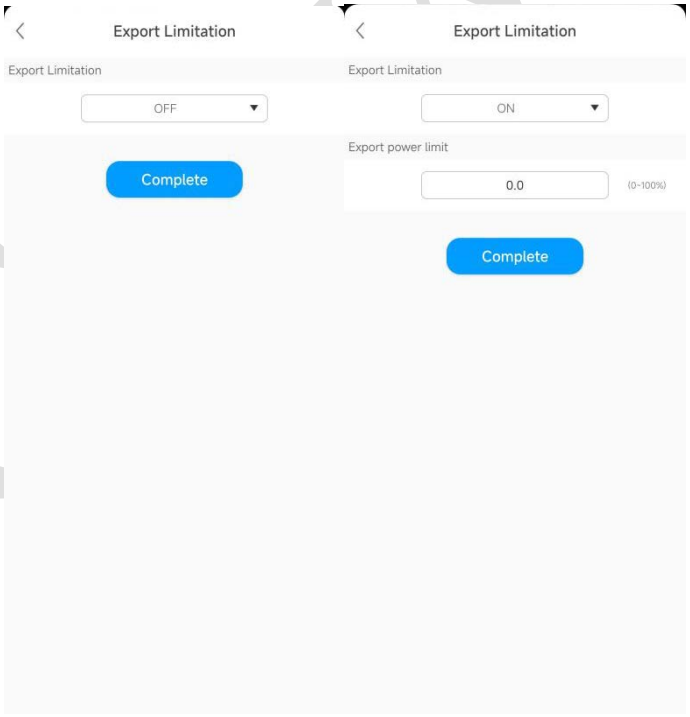
Battery Parameter Settings: you can set the battery charging/discharging cutoff SOC (in percentage, ranging from 0 to 100), and enable/disable the AC charging function.



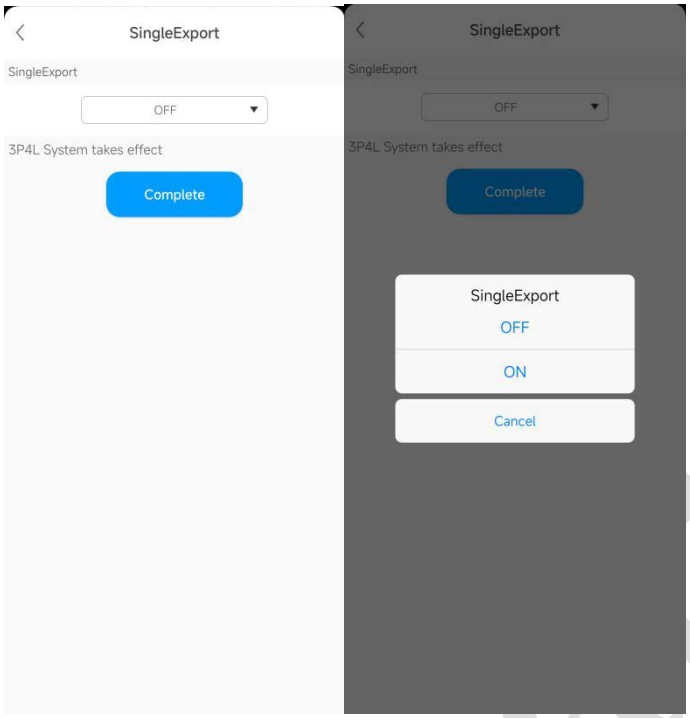
Set Reactive Power: eight modes are available: PF fixed to 1, Set PF, Default PF Curve, Inductive Reactive Power, Capacitive Reactive Power, QV Mode and Positive & Negative Reactive Power Value Adjustment. For PF fixed to 1, Default PF Curve and QV Mode, reactive power value is not configurable. For the other five modes, you can set the reactive power percentage.



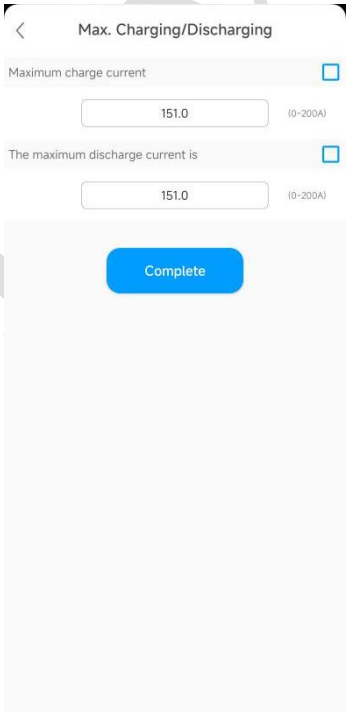
Export Limitation: you can enable or disable this function based on the actual use. Power imported from the grid to the system is forward flow, while power exported from the system to the grid is reverse flow. You can limit the power exported to the grid by setting the export limitation power percentage, ranging from 0 to 100.



Per-phase Export Limitation: enable this function if the local regulations have restrictions on the power exported to the grid per phase. With this function enabled, it can limit the power of each phase that is fed to the grid even with unbalanced loads.

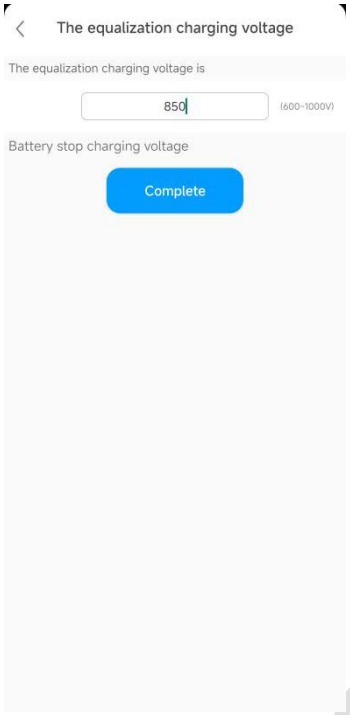


Max. Charging and Discharging Current: limit the maximum charging and discharging current of the battery terminals. This configuration only applies when the battery is directly connected to the inverter, and does not apply to the battery with the DC-DC converter.

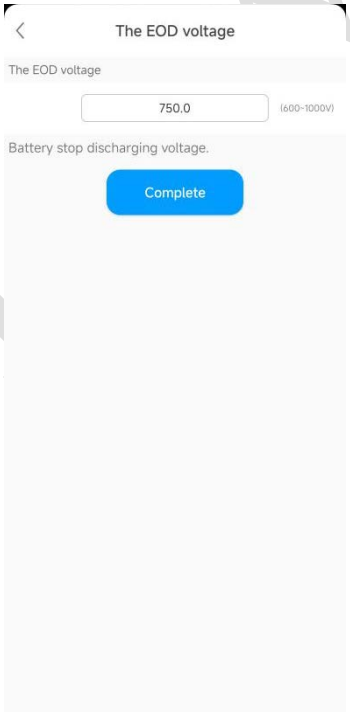


Balancing Charging: limits the battery maximum charging voltage. The battery will stop charging when the actual voltage is greater than the value. This configuration only applies when the battery is directly connected to the inverter, and does not apply to the battery with the DC-DC converter.

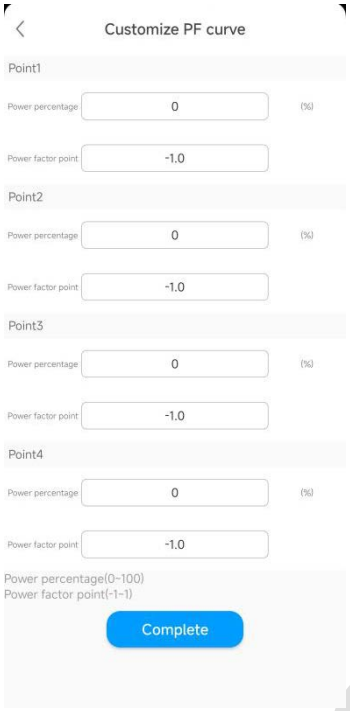
◦



EOD Voltage: battery discharge cutoff voltage. The battery will stop discharging when the actual voltage is lower than the value. This configuration only applies when the battery is directly connected to the inverter, and does not apply to the battery with the DC-DC converter.



Customized PF Curve: you can configure 4 points, setting the PF value and the reactive power. The inverter will operate according to the configuration.

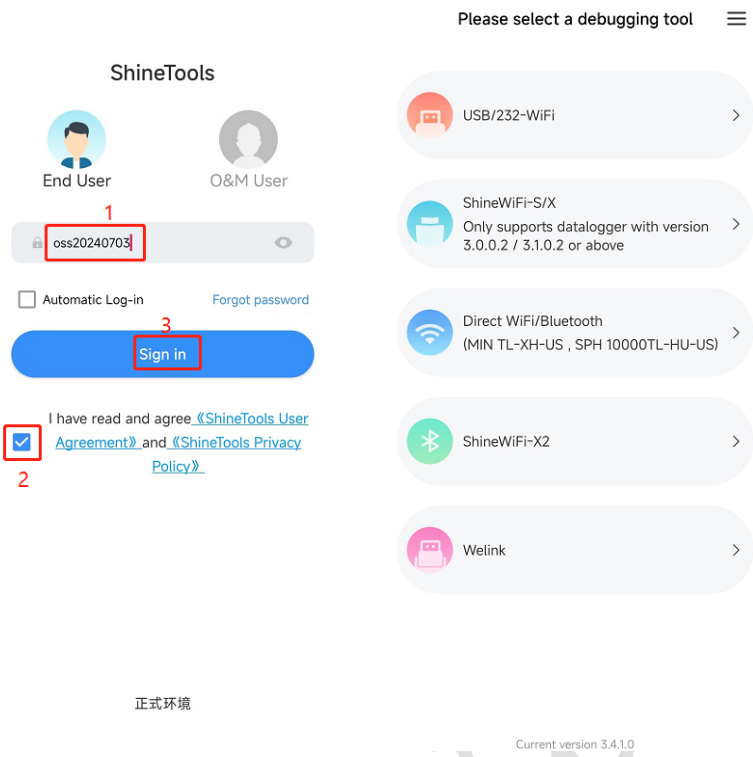


5.2.6 Local Commissioning

If no WiFi connection is available in the commissioning area, you can connect to the datalogger within a short distance over the ShineTools APP to connect to the server, enabling you to view and set system parameters through the APP without configuring the datalogger.

Operation instructions:

1. Download and install ShineTools.
2. Enter the login page, select “End user”, and enter the password, which is oss+the current data, e.g. “oss20231227”.
3. ShineTools supports commissioning with various tools, and users need to select the corresponding tool to proceed.



4. Connect to the datalogger Bluetooth or WIFI hotspot to establish communication between the phone and the datalogger. Select the model to enter the commissioning page.
5. Select the setting items below based on your needs:

A. Quick setting items

Inverter Time: set the time of the WIT inverter. With connection to the datalogger, the time will be calibrated automatically.

Language: set the display language of the WIT inverter.

Export Limitation: set this function complying with the applicable grid standards. Enable export limitation if no power is allowed to be exported to the grid.

AFCI: you can enable the AFCI function and check the current DC arc data.

B. System configuration

Power on/off the Inverter: you can set to power on or off the WIT inverter.

Active Power in Percentage: set the AC port output power of the WIT inverter in percentage, then the WIT inverter will operate within the user-defined limit.

Enable Off-grid Mode: you can enable the off-grid mode when the grid power goes down to support the loads with the PV and battery power.

Enable N-PE Detection: you can enable the function to check the N-PE voltage to ensure safe operation.

Anti-PID working mode (auto/continuous/nighttime): select the Anti-PID working mode according to the on-site situation.

Anti-PID on/off: you can enable/disable the Anti-PID function, which can mitigate the PID effect.

Anti-PID Working Voltage (300~500): select the Anti-PID working voltage level.

On/Off-grid Switching Mode: includes automatic mode and manual mode; when set to the automatic mode, the WIT inverter will switch between on/off grid mode automatically based on the output of AC grid port; when set to the manual mode, you need to set the on/off grid operating mode manually.

Enable Off-grid Output Soft Start: you can enable the soft start function to increase the voltage output gradually,

thus improving safety during startup.

Off-grid Soft Start Time: set the startup time with the soft start function enabled.

C. Grid Code Settings

Note: Users are not authorized to modify parameters of this section as it might affect the normal operation and protection logic.

D. Charge/Discharge Management

Set the Charge and Discharge Priority Time Period: you can set the inverter to operate in the Load First, Grid First or Battery First mode during different time segments according to the actual use. For details, please refer to Section 3.1.1. Please note that overlapping time period settings are not allowed. For instance, if the first time segment is set to 02:00~04:00, the other time range can only start from 04:01.

Enable AC Charging: you can enable this function to draw power from the grid to charge the battery, or disable the function if you do not want to charge the battery with grid power.

AC Charging Power (%): you can limit the grid-side power that charges the battery with the AC Charging function enabled.

Discharge Cutoff SOC: range from 0~100, the battery will stop charging when the SOC exceeds the preset value. You can set an appropriate value to reserve battery energy as backup power.

Max Battery Charging Current: you can limit the battery charging current to not exceed the value you set. This configuration only applies when the battery is directly connected to the inverter, and does not apply to the battery with the DC-DC converter.

Max Battery Discharging Current: you can limit the battery discharging current to not exceed the value you set. This configuration only applies when the battery is directly connected to the inverter, and does not apply to the battery with the DC-DC converter.

Battery Balanced Charging Voltage: you can limit the battery charging voltage to not exceed the value you set. This configuration only applies when the battery is directly connected to the inverter, and does not apply to the battery with the DC-DC converter.

Battery EOD Point: when the battery voltage is less than this value, the battery will raise the under-voltage alarm. This configuration only applies when the battery is directly connected to the inverter, and does not apply to the battery with the DC-DC converter.

E. Device information

PV Voltage and Current: you can check the PV current and voltage of each string;

AC Voltage/Frequency/Current/Power: you can check the voltage, current, frequency and power of the AC port of the WIT inverter;

Battery Parameters: you can tap “Battery” to enter the battery details page, checking the battery hardware and software version and other information;

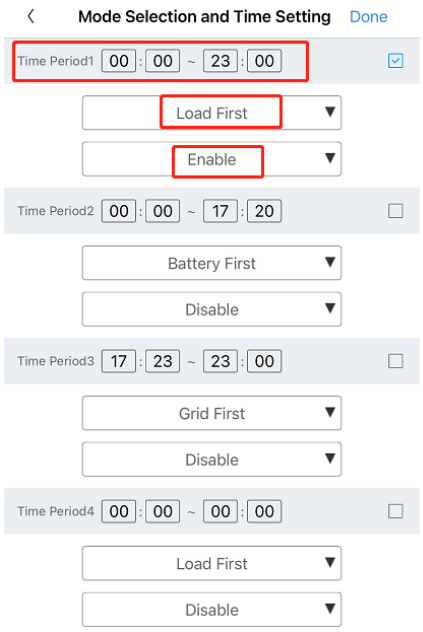
Internal Parameters: you can check key information of the device in operation;

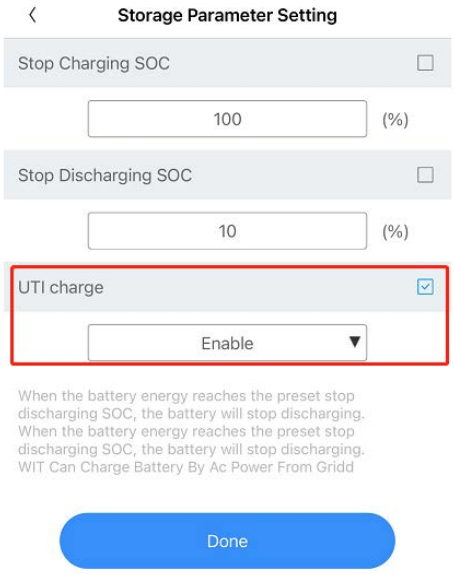
About Device: you can view the hardware and software versions and specifications of the system.

5.3 Application Scenario Configuration

Self-consumption: Maximize self-consumption, and the surplus power is fed to the grid. The system prioritizes supplying power to loads, and the excess power is fed to the grid to generate revenue.

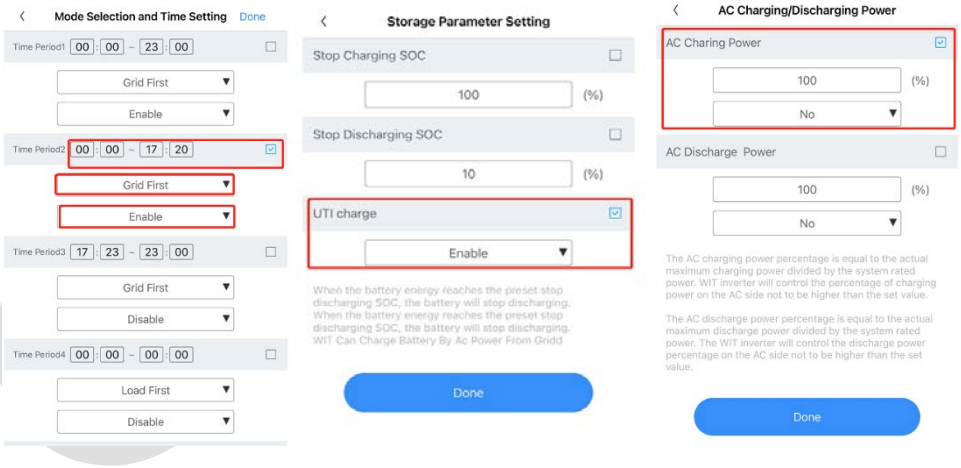
Set to the Load First mode and enable the AC Charging function if you want to charge the battery for backup power.



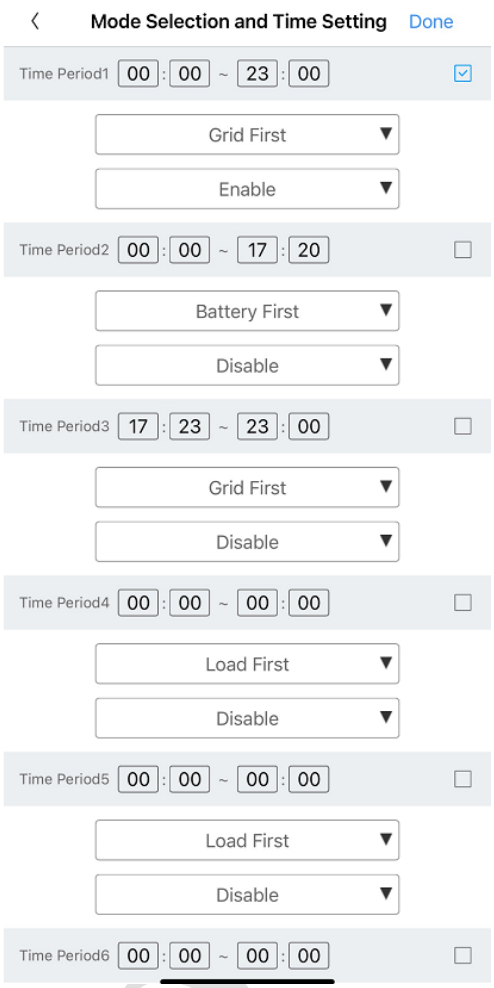


Peaking shaving: Manage customers' energy usage reasonably and systematically according to their electricity consumption patterns, to shave the peaks and fill up the valleys. Minimize the load peak-valley difference to balance power generation and consumption.

Figure out the peak and valley demand period. During the peak demand period, set Grid First mode and disable the AC Charging function; during the valley demand period, set Battery First mode, enable the AC Charging function and set the charging power threshold.

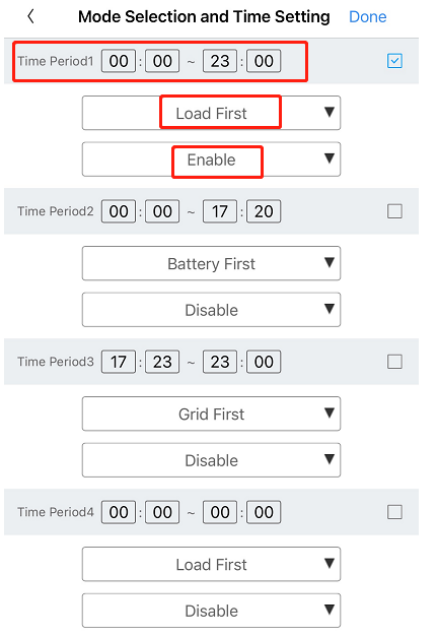


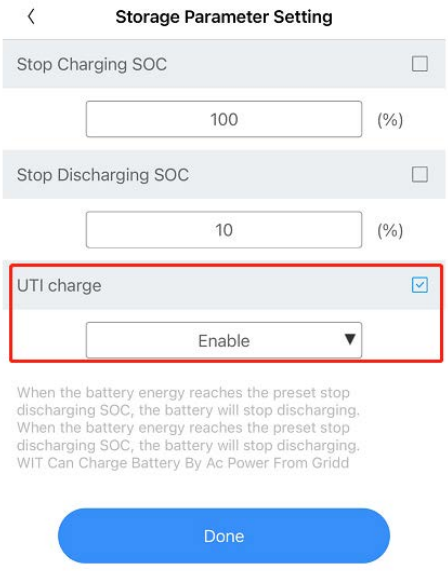
Time-of-use (TOU) Control: Configure the system to work in the preset mode during different time segments. There are six configurable time windows. For each time window, you can set one of the three working modes: Load First, Battery First, or Grid first.



Power expansion: to enhance the power supply capacity.

Set the Load First mode and enable the AC Charging function if you need to charge the battery with the grid power.

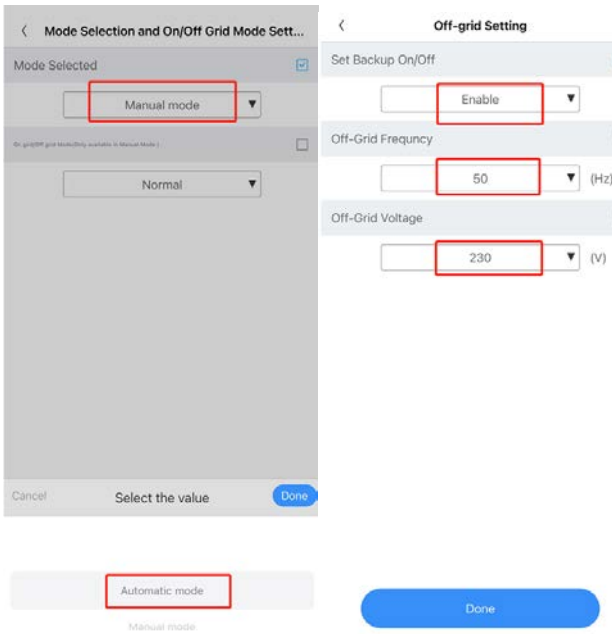




Microgrid: A microgrid is a stand-alone system that consists of distributed energy sources, generally connected to the larger grid with power cables.

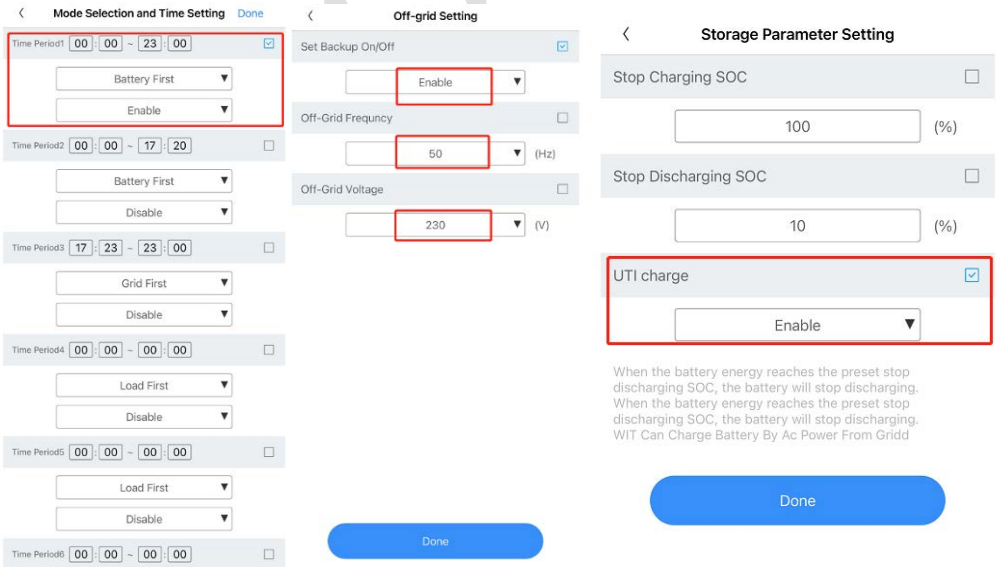
The microgrid can function independently or in cooperation with the primary utility grid.

Set on/off-grid switching mode to automatic mode, enable the off-grid mode and select the off-grid frequency and off-grid voltage.



Backup power: When the grid fails, the PV-ESS-DG system can supply power to critical loads to ensure its uninterrupted operation.

Set to the Battery First mode, enable the off-grid mode and the AC-charging function



Energy quality: The device can operate to output reactive power. Various options are available, including inductive reactive power, capacitive reactive power and customized PF curve to adjust the grid power quality.

5.4 System Operating Modes

After configuring system parameters, power on the WIT inverter and check if the system is operating properly with the APP or on the website.

The intelligent control system of the WIT inverter and the APX battery constantly monitors and adjusts the operating status of the system. Once the WIT inverter or the APX battery detects an alarm, the corresponding LED indicator will turn red and the OLED screen will display the error message. Once a fault is detected, the system indicator and the corresponding indicator will turn red and the OLED screen will display the error message. The indicators will turn green after the alarm or fault is cleared.

Caution:

For more information about the alarm/fault description and troubleshooting suggestions, see Section 6.2.

5.4.1 Waiting Mode

When the PV voltage is greater than 180 V, the WIT inverter will be powered on and enter the “Waiting” state. In this mode, the inverter will check the system parameters. If no abnormality is detected and the PV voltage is greater than or equal to 195 V, the inverter will start to connect to the grid.

5.4.2 Operating Mode

Standby mode: The WIT Inverter enters the standby mode when the operating requirements are not met.

Charging mode: Charge the battery with power drawn from the grid (AC Charging function should be enabled).
This mode should be set manually. You can set the charging period and charging power.
Discharging mode: The battery discharges power to the AC side.
This mode should be set manually. You can set discharging period and discharging power.
When Export Limitation is enabled, the battery only discharges power to support the loads. When Export Limitation is disabled, it can also export power to the grid.
Note:

1. You are advised to set the charging mode during off-peak hours, and discharging mode during the peak hours, contributing to cost savings.
2. The operating modes mentioned above apply to the on-grid system. For the off-grid system, it will only convert the battery power to supply power to the loads.

Load first:

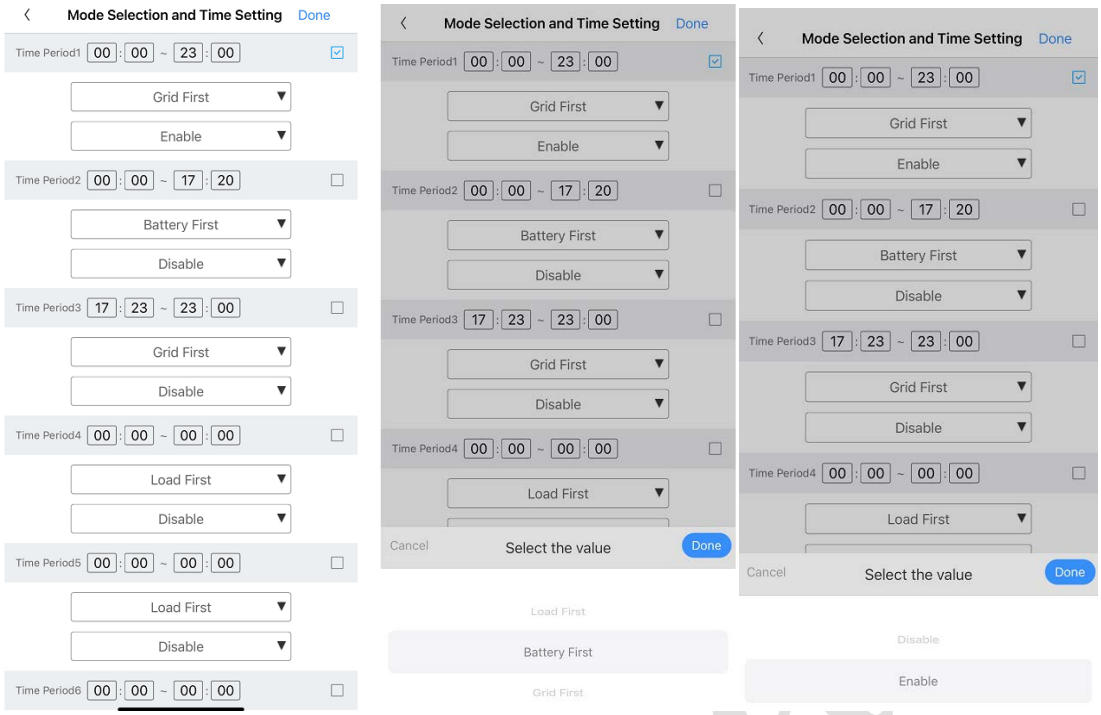
The solar power and the battery power are prioritized towards powering the loads. If the export limitation is disabled, the surplus solar power will be fed to the grid while the battery power cannot be sold to the grid. If the export limitation is enabled, neither the solar power nor the battery power would be sent to the grid.
Priority of power sources supplying to the loads:
1.Solar panels;
2.Bateries;
3.Grid;
NOTE: In Load first mode, a meter is required.

Battery first:

The solar power is directed towards charging the battery first, ensuring that the battery SOC has reached the preset upper threshold. Then the excess solar power will be sent to support the loads. The further surplus solar power can be exported to the grid (with Export Limitation disabled). In case that the solar power is insufficient, it can draw energy from the grid to charge and battery and support the loads.
Priority of power sources charging the battery:
1.Solar panels;
2.Grid;

Grid first:

The solar power is prioritized towards powering the loads, and the surplus solar power will be fed to the grid. The further surplus solar power (if any) can be sent to charge the battery. If the solar power is insufficient to support the loads, the battery will discharge to power the loads and the excess battery energy can be sold to the grid,
Priority of power sources supplying to the loads:
1.Solar panels;
2.Bateries;
3.Grid;
From the “Control” page, select “Mode Selection and Time Setting”, where you can configure the six time windows. As shown in the figure, you are allowed to set the operating mode for each period based on power consumption and electricity tariffs. You can set “Enable” or “Disable” to determine whether to run the device in the preset mode during the specific time period.
You are allowed to configure different operating modes for different application scenarios.



Note:

1. You are advised to set the Battery First mode during off-peak hours, and Grid first mode during peak hours, contributing to cost savings.
2. The operating modes mentioned above apply to the on-grid system. For the off-grid system, it will not response to the priority settings, but gives priority to converting the battery energy to power the loads.

5.4.3 Fault Mode

The intelligent control system of the WIT Inverter monitors and adjusts the system status in real time. When the WIT Inverter detects an alarm, the corresponding status light will turn red and the OLED will display the alarm. When the WIT Inverter detects a fault, the system status indicator and the corresponding status light will turn red and the OLED will display the fault. After the fault or alarm is cleared, the system recovers and all status indicators will be steady green.

NOTE: For detailed description of faults and alarms, please see Section 6.2.

5.4.4 Shutdown Mode

For the on-grid system with Export Limitation enabled and the off-grid system, when the battery SOC is lower than the discharge cutoff SOC and the PV string output does not meet the requirements for grid-tied power generation, the WIT Inverter will automatically shut down. In shutdown mode, the inverter consumes a small amount of energy (PV>Grid>Battery) to wait to start up again when the operating requirements are met.

NOTE: When the DC input voltage is less than or equal to 150Vdc or the battery voltage is lower than 600V, the WIT Inverter enters the shutdown mode automatically.

6. System Maintenance

6.1 Routine Maintenance

6.1.1 Clean the Enclosure

DANGER	● Wait 5 minutes after disconnecting the AC breaker or the DC upstream breaker/switch until the capacitor is fully discharged. ● If the product gets dusty, clean its enclosure with a wet cloth 5 minutes after the system is powered off.

1. Check the humidity and dust in the environment around the system and clean the equipment if necessary;
2. Observe whether the air inlet and outlet of the WIT inverter and the APX battery is normal. If necessary, clean the inlet and outlet vents, or clean the fan.

6.1.2 Maintain the Fan

DANGER	●All operations must be performed by trained and professional electricians, and all instructions specified in this manual should be observed. ●Wait 5 minutes after disconnecting the AC breaker or the DC upstream breaker/switch until the capacitor is fully discharged.
WARNING	●Do not use an air pump to clean the fan as it might damage the fan.

When the WIT inverter or the APX battery is operating in high-temperature environment, proper heat dissipation and ventilation is essential to avoid power de-rating. The WIT inverter and the APX battery come with built-in fans. When the internal temperature gets excessively high, the fans will work to lower the temperature. For de-ratings caused by over-high temperature, possible causes and measures are listed below:

1. Fan is blocked or the heat sink gathers too much dust. You need to clean the fan, the fan guard or the heat sink.
2. Fan is damaged. You need to replace the fan.
3. Poor ventilation condition in the installation location of the WIT inverter and the APX battery. You need to select the appropriate installation location according to the basic installation requirements.

Procedure to clean or replace the fan of the WIT inverter or the APX battery:

1. Before cleaning or replacing the fan, ensure that the WIT inverter is completely disconnected from all power sources. Power off the battery and wait 5 minutes before performing any work.
2. Remove the fan fixing plate on the top of the WIT inverter using a cross-head screwdriver as shown below.
3. Loosen the screws securing the fan slide rail. Disconnect the fan wiring cables, then you can remove the fan

from the WIT inverter, as Fig 6.1 shows:

4. Loosen the screws on both sides of the battery fan cover with the Allen key, then remove the fan cover as shown in Fig 6.2.

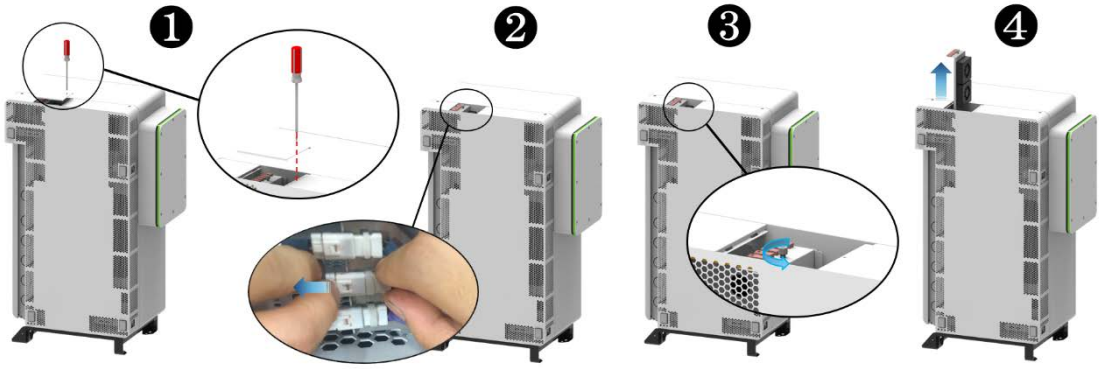


Fig 6.1 Remove fans from the WIT inverter

5. Disconnect the fan connector, unscrew the fan fixing plate, then remove the fan as shown below:

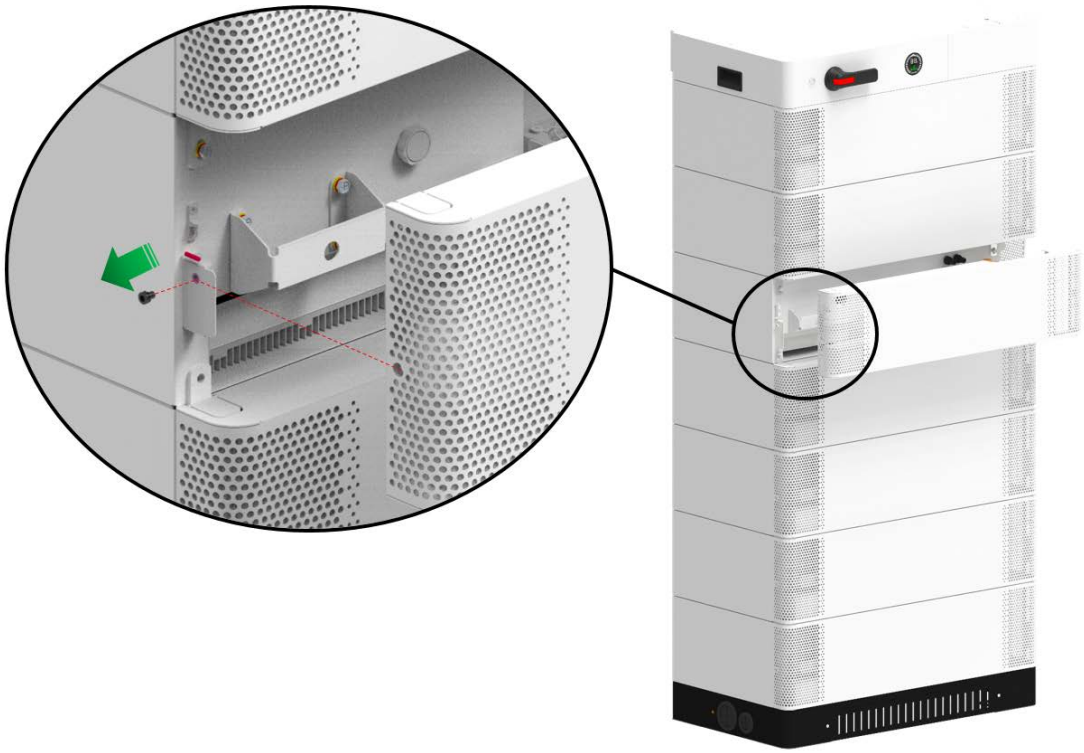


Fig 6.2 Remove fans from the APX battery

Note:

① The WIT 50-100K-A-US and the WIT 50-100K-H-US models are equipped with 5 external fans.

② The WIT 50-100K-AU-US and WIT 50-100K-HU-US models are equipped with 7 external fans.

③ Each battery module of the APX battery system has one fan.

Procedure to clean the fan, fan guard and heat sink, or replace the fan:

① Clean the heat sink with an air pump; clean the fan and fan guard with a brush or cloth moistened with water.

② If necessary, you can remove all fans and clean each fan separately.

③ Remove the fan to be replaced using a cross-head screwdriver, and install the new fan.

④ Bind the cables properly and fix them with a cable tie.

⑤ Re-install the fan, the fan fixing plate and the WIT inverter.

6.2 Troubleshooting

DANGER	● All operations must be performed by trained and professional electricians, and all instructions specified in this manual should be observed. ● If the inverter reports “PV Isolation low”, do not touch the enclosure as a ground fault might have occurred. ● Beware of high voltages which can cause electric shocks.

6.2.1 WIT Inverter Warnings

Warnings indicate the current status of the WIT 50-100K inverter, different from the faults and generally has no effect on the normal operation of the WIT inverter. You can clear a warning by restarting the device, resetting or performing self-corrective measures. The warning codes are shown below:

Table 6.1 WIT inverter warning code list

LCD display	Fault Description	English Suggestion
String Fault	PV string fault	1. Check if the PV panels are normal after shutdown. 2. If the error message persists, contact Growatt support.
Warning 201	PV string/PID quick-connect terminals abnormal	1. Check the wiring of the string terminals after shutdown. 2. If the error message persists, contact Growatt support.
DC SPD warning	DC SPD function abnormal	1. Check the DC SPD after shutdown. 2. If the error message persists, contact Growatt support.
PV Circuit short	PV1 or PV2 short circuited	1. Check if PV1 or PV2 is short circuited. 2. If the error message persists, contact Growatt support.
Warning204	Dry contact function abnormal	1. Check the wiring of the dry contact after shutdown. 2. If the error message persists, contact Growatt support.
Warning205	PV Boost driver abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
AC SPD warning	AC SPD function abnormal	1. Check the AC SPD after shutdown. 2. If the error message persists, contact Growatt support.
USB OCP	USB flash drive overload protection	1. Unplug the USB flash drive. 2. Plug in the USB flash drive again after shutdown. 3. If the error message persists, contact Growatt support.
DC Fuse Open	DC fuse blown	1. Check the fuse after shutdown. 2. If the error message persists, contact Growatt support.

PV Voltage High	DC input voltage exceeds the upper threshold	1. Turn off the DC switch immediately and check the DC voltage. 2. If the DC voltage is within the specified range and the error message persists, contact Growatt support.
PV Reversed	PV wiring abnormal	1. Check the polarity of the PV terminals. 2. If the error message persists, contact Growatt support.
BDC Abnormal	BDC abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
BDC Bus DisConnect	BDC Bus disconnected	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
PID warning	PID function abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning 220	PV string disconnected	1. Check if the PV string is properly connected. 2. If the error message persists, contact Growatt support.
Warning 221	PV string current unbalanced	1. Check if the PV panels of the corresponding string are normal. 2. If the error message persists, contact Growatt support.
No AC Connection	No utility grid connected or utility grid power failure	1. Check if the grid is down. 2. If the error message persists, contact Growatt support.
AC V Outrange	Grid voltage is beyond the permissible range	1. Check if the grid voltage is within the specified range. 2. If the error message persists, contact Growatt support.
AC F Outrange	Grid frequency is beyond the permissible range	1. Check if the grid frequency is within the specified range. 2. If the error message persists, contact Growatt support.
Over Load	Off-grid mode, overload	1. Please reduce the load connected to the off-grid output terminal. 2. If the error message persists, contact Growatt support.
CT Open	CT disconnected	1. Check if the CT is properly connected. 2. If the error message persists, contact Growatt support.
CT Reversed	CT is reversely connected	1. Check if the CT is reversely connected. 2. If the error message persists, contact Growatt support.
CT COM Fault	The inverter failed to communicate with the CT	1. Check if the communication cable is properly connected. 2. If the error message persists, contact Growatt support.
PairingTimeOut	CT pairing timed out	1. Check if the communication cable is properly connected. 2. If the error message persists, contact Growatt support.

Meter Open	Meter disconnected	1. Check if the meter is properly connected. 2. If the error message persists, contact Growatt support.
Meter Reversed	Meter wiring abnormal	1. Check if the L line and the N line of the meter are reversely connected. 2. If the error message persists, contact Growatt support.
NE abnormal N-PE Volt Abnormal	The voltage difference between the N line and the PE cable is abnormal	1. Check if the PE cable is reliably connected after shutdown. 2. If the error message persists, contact Growatt support.
Sequence Err	Phase sequence error in three-phase system	No operation is required. The PCS will automatically adjust the phase sequence.
Fan warning XXXX	Fan failure	1. Check if the fan is properly connected after shutdown. 2. If the error message persists, contact Growatt support.
Warning401	Meter abnormal	1. Check if the meter is turned on. 2. If the meter is correctly connected to the inverter.
Warning402	Communication between the optimizer and the inverter is abnormal	1. Check if the optimizer is turned on. 2. If the optimizer is correctly connected to the inverter.
Warning403	PV string communication failure	1. Check if the wiring of the PV string after shutdown. 2. If the error message persists, contact Growatt support.
Warning404	EEPROM abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning405	DSP and COM firmware version mismatch	1.Check the firmware version. 2. If the error message persists, contact Growatt support.
Warning406	Boost circuit malfunction	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning407	Over-temperature	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning408	NTC temperature sensor is broken	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning409	Reactive power scheduling communication failure	1. Check if ShineMaster is turned on. 2. If the error message persists, contact Growatt support.

Warning410	Abnormal operation of the chip	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning411	Sync signal abnormal	1. Check if the sync cable is abnormal. 2. If the error message persists, contact Growatt support.
Warning412	Startup requirements for grid connection are not met	1. Check if the grid voltage is within the specified range and check if the grid-connection startup voltage configuration is correct. 2. Check if the PV voltage is within the specified range. 3. Restart the inverter. If the error message persists, contact Growatt support.
BMS COM Warning	The inverter failed to communicate with the battery	1. Check if the battery is turned on. 2. Check if the battery is correctly and securely connected to the inverter.
Battery Open	Battery disconnected	1. Check if the battery is properly connected. 2. If the error message persists, contact Growatt support.
Warning：Bat V High	Battery voltage too high	1. Check if the battery voltage is within the permissible range. 2. Check if the battery is correctly connected. 3. If the error message persists, contact Growatt support.
Warning：Bat V Low	Battery voltage too low	1. Check if the battery voltage is within the permissible range. 2. Check if the battery is correctly connected. 3. If the error message persists, contact Growatt support.
Battery reversed	Battery terminals are reversely connected	1. Check if the positive and negative terminals of the battery are reversely connected. 2. If the error message persists, contact Growatt support.
BAT NTC Open	Temperature sensor of the lead-acid battery is disconnected	1. Check if the temperature sensor of the lead-acid battery is installed or not. 2. Check if the temperature sensor is well-connected. 3. If the error message persists, contact Growatt support.
Bat temp outrange	Battery temperature is out of range	1. Check if the ambient temperature of the battery is within the specified range. 2. If the error message persists, contact Growatt support.
BMS Error	BMS reported a fault; unable to charge/discharge	1. Figure out the cause according to the BMS error code. 2. If the error message persists, contact Growatt support.

Li-BAT Overload	Lithium battery overload protection	1. Check if the power of the load exceeds the BAT rated discharge power. 2. If the error message persists, contact Growatt support.
BMS Warning :XXX	BMS communication abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
BAT SPD warning	BAT SPD function abnormal	1. Check the BAT SPD after powering off the device. 2. If the error message persists, contact Growatt support.
Output High DCI	DC component excessively high in output current	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Output High DCV	DC component excessively high in output voltage	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
EPS Volt Low	Off-grid output voltage too low	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning 603	Off-grid output voltage too high	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning 604	Off-grid output overcurrent	1. Check if the load power exceeds the specification limit. 2. Restart the inverter. If the error message persists, contact Growatt support.
Warning 605	Off-grid bus voltage too low	1. Check if the load power exceeds the specification limit. 2. Restart the inverter. If the error message persists, contact Growatt support.
Warning 606	Off-grid output overloaded	1. Check if the load power exceeds the specification limit. 2. Restart the inverter. If the error message persists, contact Growatt support.
Warning 607	Communication with the backup box is abnormal	1. Check the communication wiring of the backup box after powering off the device. 2. If the error message persists, contact Growatt support.
Warning 608	Backup box is abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning 609	Balanced circuit abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Warning 700	Fan of the backup box is faulty	1. Check the wiring of the fan after powering off the device. 2. If the error message persists, contact Growatt support.
Warning 701	Generator failed to start	1. Check the generator and its wiring after powering off the device. 2. If the error message persists, contact Growatt support.

6.2.2 WIT Inverter Errors

Error codes denote a possible equipment failure, fault or incorrect inverter setting or configuration. Any or all attempts to correct or clear a fault must be performed by qualified personnel. The error code would disappear once the fault is cleared. For the irreparable faults, please contact Growatt support.

Table 6.2 WIT inverter error code list

LCD display	Fault Description	Troubleshooting
AFCI Fault	DC arc fault has been detected	1. After shutdown, check the connection of the PV string. 2. Restart the inverter. 3. If the error message persists, please contact Growatt support.
Residual I High	An excessively high leakage current has been detected	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
PV Voltage High	PV input voltage exceeds the upper threshold	1. Disconnect the DC switch immediately and check the voltage. 2. If the PV input voltage is within the permissible range and the error message persists, please contact Growatt support.
PV Isolation Low	PV panels have low insulation resistance	1. Check if the PV strings are properly grounded. 2. If the error message persists, please contact Growatt support.
PV Reversed	PV string reversely connected	1. After shutdown, check if the PV string is reversely connected to the inverter. 2. Restart the inverter. 3. If the error message persists, please contact Growatt support.
AC V Outrange	Grid voltage is beyond the permissible range	1. Check the grid voltage. 2. If the grid voltage is within the permissible range and the error message persists, please contact Growatt support.
AC reversed	AC terminals reversed	1. Check the connection of the AC output terminals. 2. If the error message persists, please contact Growatt support.
No AC Connection	No utility grid connected or utility grid power failure	1. After shutdown, check the AC wiring. 2. If the error message persists, please contact Growatt support.
NE abnormal	The voltage difference between the N line and	1. After shutdown, check if the ground cable is reliably connected.

	the PE cable is abnormal	2. If the error message persists, please contact Growatt support.
AC F Outrange	Grid frequency is beyond the permissible range	1. Check the grid frequency and restart the inverter. 2. If the error message persists, please contact Growatt support.
Over Load	Overload	1. Check if the load exceeds the output power upper limit; if so, please reduce the load. 2. If the error message persists, please contact Growatt support.
CT LN Reversed	CT LN Reversed	1. Check if the CT is reversely connected. 2. If the error message persists, contact Growatt support.
CT COM Fault	CT communication failure	1. Check if the communication cable is properly connected. 2. If the error message persists, contact Growatt support.
CT COM Overtime	CT and inverter pairing timed out	1. Re-pair the inverter and the CT. 2. If the error message persists, contact Growatt support.
ROCOF Fault	ROCOF abnormal	1. Check the grid frequency and restart the inverter. 2. If the error message persists, please contact Growatt support.
NE Fault	PV negative grounding, protection for low Neutral-to-Ground (N-G) voltage	1. Check whether the N line on the inverter side with PV negative grounding is short-circuited with the ground cable and whether the output side is isolated with a transformer. 2. If the error message persists, please contact Growatt support.
BackflowFail	Export limitation fail-safe	1. After shutdown, check the connection of the CT and the meter. 2. If the error message persists, please contact Growatt support.
Error 400	DCI bias abnormal	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Error 401	High DC component in output voltage	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Output High DCI	High DC component in output current	1. Restart the inverter. 2. If the error message persists, contact Growatt support.
Error 403	Output current unbalanced	1. Check if the output current is balanced after shutdown. 2. If the error message persists, contact Growatt support.
Error 404	Bus voltage sampling abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.

Error 405	Relay failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 406	Initialization mode abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 407	Auto-test failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 408	Over-temperature	1. After shutdown, check the temperature of the inverter and restart the inverter after the temperature is within the acceptable range. 2. If the error message persists, please contact Growatt support.
Error 409	Bus voltage abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 410	Abnormal voltage across the flying capacitor	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 411	Internal communication failure	1. Check the wiring of the communication board after shutdown. 2. If the error message persists, please contact Growatt support.
Error 412	Temperature sensor disconnected	1. Check if the temperature sensor module is properly connected. 2. If the error message persists, please contact Growatt support.
Error 413	IGBT drive fault	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 414	EEPROM error	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 415	Auxiliary power supply abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.

Error 416	DC/AC overcurrent protection	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 417	Communication protocol mismatch	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 418	DSP and COM firmware version mismatch	1. Check the firmware version. 2. If the error message persists, please contact Growatt support.
Error 419	DSP software and hardware version mismatch	1. Check the firmware version. 2. If the error message persists, please contact Growatt support.
Error 420	GFCI module abnormal	1. Check the GFCI module after shutdown. 2. If the error message persists, please contact Growatt support.
Error 421	CPLD abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 422	Redundancy sampling inconsistent	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 423	PWM pass-through signal failure	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 424	INV current waveform abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 425	AFCI self-test failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 426	PV current sampling abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 427	AC current sampling abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.

Error 428	BOOST short-circuited	Please contact Growatt support.
Error 429	BUS soft start failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 430	EPO fault	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 431	Monitoring chip BOOT verification failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Error 432	Incompatible battery model	1. Replace the battery model. 2. If the error message persists, please contact Growatt support.
Error 433	Incompatible battery software	1. Upgrade the battery software. 2. If the error message persists, please contact Growatt support.
BMS COM Fault	BMS failed to communicate with the inverter	1. Check the connection of the RS485 cable between the inverter and the battery. 2. Check if the battery is in the sleep mode. 3. If the error message persists, please contact Growatt support.
BMS Error	BMS reported a fault; unable to charge/discharge	1. Figure out the fault based on the BMS error code. 2. If the error message persists, please contact Growatt support.
Bat voltage Low	Battery voltage is below the lower threshold	1. Check the battery voltage. 2. If the error message persists, please contact Growatt support.
Bat voltage High	Battery voltage exceeds the upper threshold	1. Check the battery voltage. If it is within the permissible range, please restart the inverter. If not, please replace the battery. 2. If the error message persists, please contact Growatt support.
Bat Over Temp	Battery temperature is beyond the range for charging/discharging	1. Check the temperature of the battery. 2. If the error message persists, please contact Growatt support.
Bat Reversed	Battery terminals reversed	1. Check if the battery terminals are reversely connected. 2. If the error message persists, please contact Growatt support.

Battery Open	Battery disconnected	1. Check the wiring of the battery terminals. 2. If the error message persists, please contact Growatt support.
BAT Over Load	Lithium battery overload protection	1. Check if the power of the load exceeds the battery rated discharge power. 2. If the error message persists, please contact Growatt support.
BUS2 Volt Abnormal	BUS2 Volt Abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Bat Charge OCP	BAT Charge OCP (Overcurrent Protection)	1. Check if the PV voltage is oversized. 2. If the error message persists, please contact Growatt support.
Bat Discharge OCP	BAT Discharge OCP (Overcurrent Protection)	1. Check if the battery discharge current configuration is proper. 2. If the error message persists, please contact Growatt support.
BatSoftStartFault	BAT soft start failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
BatUncontrolledRectification	Battery uncontrolled rectification fault	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
EPS OP Short	Off-grid output short-circuited	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Bus voltage abnormal	Off-grid Bus Volt Low	1. Check if the battery is working properly or the battery experiences capacity loss. 2. If the error message persists, please contact Growatt support.
AC port volt Abnormal	Abnormal Volt at the off-grid terminal	1. Check if a voltage is present at the AC port. 2. If the error message persists, please contact Growatt support.
Soft Start Fail	Soft start failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
EPS Volt Abnormal	Off-grid output voltage abnormal	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
Balance Circuit fault	Balanced circuit self-test failed	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.

Output High DCV	High DC component in output voltage	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
EPS Abnormal	Off-grid output overload	1. Restart the inverter. 2. If the error message persists, please contact Growatt support.
OfflineSignError	Off-grid parallel signal abnormal	1. Check if the communication cables are properly connected. 2. If the error message persists, please contact Growatt support.
Error 609	Backup box is not detected	1. After shutdown, check the signal wiring for identifying the backup box. 2. If the error message persists, please contact Growatt support.
Error 610	Off-grid split-phase voltage abnormal	1. Power off the system and check if the backup box split-phase transformer and the control relay are abnormal. 2. Restart the system. 3. If the error message persists, please contact Growatt support.
Warning 608	Abnormal communication between the backup box and the inverter	1. Check if the communication cable between the inverter and the backup box is properly connected. 2. If the error message persists, please contact Growatt support.
Warning 608	Backup box grid-side relay failure	1. Restart the backup box. 2. If the error message persists, please contact Growatt support.
Warning 608	Backup box generator relay connection failure	1. Restart the backup box. 2. If the error message persists, please contact Growatt support.
Warning 608	Backup box on-grid overload	1. Restart the backup box. 2. If the error message persists, please contact Growatt support.
Warning 608	Backup box off-grid split-phase overload	1. Reduce the load. 2. If the error message persists, please contact Growatt support.
Warning 608	Overheat inside the backup box	1. Restart the backup box. 2. If the error message persists, please contact Growatt support.

6.2.3 APX Battery Faults

Fault codes denote a possible equipment failure or incorrect setting or configuration. Any or all attempts to correct or clear a fault must be performed by qualified personnel. The fault code would disappear once the fault is cleared. For the irreparable faults, please contact Growatt support.

Table 6.3 APX battery system – CM fault code list 1

Error code	Description	Troubleshooting
PROTECT 203	Insulation protection	Power off the system, then check whether the power cable and the communication cable are loosely connected. If not, please contact Growatt technical support.
WARN 219	Insulation alarm	Power off the system, then check whether the power cable and the communication cable are loosely connected. If not, please contact Growatt technical support.
FAULT 404	EEPROM calibration parameter failure (including BM & CM)	Power off and restart to check whether the fault is cleared. If the problem persists, please contact Growatt technical support for replacement.
FAULT 404	EEPROM failure protection (including BM & CM)	Power off and restart to check whether the fault is cleared. If the problem persists, please contact Growatt technical support for replacement.
FAULT 405	Negative side relay stuck	Power off and restart to check whether the fault is cleared. If the problem persists, please contact Growatt technical support for replacement.
FAULT 405	Positive side relay stuck	Power off and restart to check whether the fault is cleared. If the problem persists, please contact Growatt technical support for replacement.
FAULT 405	Negative side relay failed to close	Power off and restart to check whether the fault is cleared. If the problem persists, please contact Growatt technical support for replacement.
FAULT 405	Positive side relay failed to close	Power off and restart to check whether the fault is cleared. If the problem persists, please contact Growatt technical support for replacement.
FAULT 405	Precharge relay failed to close	Power off and restart to check whether the fault is cleared. If the problem persists, please contact Growatt technical support for replacement.
WARN 408	Ambient temperature over-temperature alarm	Check if the equipment operating temperature exceeds the specified range. If not, please contact Growatt technical support.
WARN 408	Copper bar over-temperature warning	Check if the equipment operating temperature exceeds the specified range. If not, please contact Growatt technical support.
PROTECT 408	Ambient temperature	Check if the equipment operating temperature exceeds

	over-temperature protection	the specified range. If not, please contact Growatt technical support.
PROTECT 408	Copper bar over-temperature protection	Check if the equipment operating temperature exceeds the specified range. If not, please contact Growatt technical support.
PROTECT 409	Total voltage over-voltage protection	Please contact Growatt technical support
WARN 410	Main control crystal oscillator operation alarm	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 411	Communication timeout between CM and BM (detected by CM side)	Check whether the communication cable between BM and CM is connected normally. If it is properly connected, please contact Growatt technical support.
FAULT 411	Communication failure between CM_M3 and CM_BCU	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 411	Communication timeout with PCS	Check whether the communication cable between CM and PCS is connected normally. If it is properly connected, please contact Growatt technical support.
FAULT 426	Current sampling failure	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 506	Busbar open-circuited	Please contact Growatt technical support
FAULT 506	FUSE fault	Please contact Growatt technical support
FAULT 603	Precharge overcurrent	Please check if the power cables between CM and inverter are properly connected. If they are properly connected, please contact Growatt technical support.
FAULT 603	Precharge timeout (failed)	Please check if the power cables between CM and inverter are properly connected. If they are properly connected, please contact Growatt technical support.
FAULT 700	Battery cell high temperature failure error	Please contact Growatt technical support
WARN 707	Discharge overcurrent alarm	Check if the load exceeds the system specifications. If not, please contact Growatt technical support.
WARN 707	Charging overcurrent alarm	Please contact Growatt technical support
PROTECT 707	Discharge overcurrent protection	Check if the load exceeds the system specifications. If not, please contact Growatt technical support.
PROTECT 707	Charging overcurrent protection	Please contact Growatt technical support
PROTECT 803	Charging current limiting nonresponse	Please contact Growatt technical support
PROTECT 803	Discharge current limiting nonresponse	Please contact Growatt technical support
PROTECT 1009	Protection for over-low input voltage	Please check if the number of the connected BMs matches with the inverter. If so, please contact Growatt technical support.

FAULT 1030	Cell went offline	Please contact Growatt technical support
FAULT 1035	Front-end chip failure	Please contact Growatt technical support
FAULT 1042	Total voltage sampling failure	Please contact Growatt technical support
FAULT 1048	Hardware detected overvoltage protection	Please contact Growatt technical support
FAULT 1049	Hardware detected charging overcurrent protection	Please contact Growatt technical support
FAULT 1053	Hardware discharge overcurrent	Check if the load exceeds the system specifications. If not, please contact Growatt technical support.
PROTECT 1062	Single cell overvoltage rapid protection	Please contact Growatt technical support
PROTECT 1099	Low temperature charging overvoltage protection	Please check if the ambient temperature exceeds the specified range. If not, please contact Growatt technical support.
FAULT 1111	Precharge relay drive failure	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 1112	Positive side relay drive failure	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 1113	Negative side relay drive failure	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 1128	CM BOOT sector flash is damaged	Please contact Growatt technical support
FAULT 1147	BM fault	Please contact Growatt technical support
FAULT 1148	BM serial communication timeout protection	Please contact Growatt technical support
FAULT 1149	System voltage level does not match	Please check if the number of the connected BMs matches with the inverter. If so, please contact Growatt technical support.
FAULT 1150	The isolation switch is abnormally disconnected	Please contact Growatt technical support
FAULT 1151	MCU ADC sampling abnormality	Please contact Growatt technical support

Table 6.4 APX battery system – CM fault code list 2

Error code	Description	Troubleshooting
FAULT 411	Communication with INV is abnormal	Power off the system, then check if the communication cable between CM and PCS is properly connected. If so, please contact Growatt technical support.
FAULT 411	Abnormal serial communication with Main Control Chip 1	Power off the system, then restart to check if the fault is cleared. If the problem persists, please contact Growatt technical support.
FAULT 411	Communication with BM is	Power off the system, then check if the communication

	abnormal	cable between CM and BM is properly connected. If so, please contact Growatt technical support.
FAULT 411	Parallel operation with multi-master failed	Power off the system, then restart to check if the fault is cleared. If the problem persists, please contact Growatt technical support.
FAULT 419	Software and hardware versions are inconsistent	Power off the system, then restart to check if the fault is cleared. If the problem persists, please contact Growatt technical support.
WARN 410	Crystal oscillator is abnormal	Power off the system, then restart to check if the fault is cleared. If the problem persists, please contact Growatt technical support.
WARN 410	USB communication is abnormal	Power off the system, then restart to check if the fault is cleared. If the problem persists, please contact Growatt technical support.
FAULT 417	Version mismatched	Power off the system, then restart to check if the fault is cleared. If the problem persists, please contact Growatt technical support.
FAULT 431	BOOT abnormal	Power off the system, then restart to check if the fault is cleared. If the problem persists, please contact Growatt technical support.

Table 6.5 APX battery system – BM fault code list 1

Code	Description	Troubleshooting
FAULT 416	TZ failure	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 416	Battery transient overcurrent	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 503	Battery transient overvoltage	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 409	BUS transient overvoltage	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 416	Inductor transient overcurrent	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 500	CAN communication abnormal	Check if the communication cable between BM and BM is connected properly. If it is properly connected, please contact Growatt technical support.
FAULT 501	Lithium battery failure	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 411	Communication with the inverter failed	Check if the communication cable between CM and PCS is connected properly. If it is properly connected, please contact Growatt technical support.
FAULT 707	Overload	Check if the load exceeds the system specifications. If not, please contact Growatt technical support.
FAULT 416	BUS transient overcurrent	Restart the system. If the problem persists, please contact

		Growatt technical support.
FAULT 603	BUS soft start failed	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 500	CAN parallel failed	Check whether the communication cable of the system is connected properly. If it is properly connected, please contact Growatt technical support.
FAULT 417	Hardware sampling failed	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 416	Module current sampling failed	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 800	Protocol version incorrect	Update to the latest software version. If the problem persists, please contact Growatt technical support.
FAULT 801	BM bypass failed	Please contact Growatt technical support
FAULT 802	Auxiliary power supply failure	Please contact Growatt technical support
FAULT 410	Crystal oscillator is abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 417	Hardware version inconsistent	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 802	IOBUS failure	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 802	Other module failure	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 702	Forced charge required	Please connect to grid power or use PV power to charge the battery.
WARNING 701	Battery can only be charged	Please connect to grid power or use PV power to charge the battery.
WARNING 703	Fully charged	The system will transfer to bypass/idle mode automatically, and no action is required.
WARNING 707	Overload alarm	Check if the load exceeds the system specifications. If not, please contact Growatt technical support.
WARNING 404	EEPROM read & write abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 412	HVC (high voltage auxiliary power supply) detection abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 412	The IO status of IO Bus is abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 410	Crystal oscillator is abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 502	Battery voltage is low	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 408	Over-temperature	Check if the equipment operating temperature exceeds the specified range. If not, please contact Growatt

		technical support.
WARNING 408	Ambient temperature over-high	Check if the equipment operating temperature exceeds the specified range. If not, please contact Growatt technical support.
WARNING 700	NTC open-circuited	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 411	Serial communication is abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
WARNING 503	Battery voltage high	Restart the system. If the problem persists, please contact Growatt technical support.

Table 6.6 APX battery system – BM fault code list 2

Code	Description	Troubleshooting
FAULT 411	Abnormal communication with Main Control Chip 1	Restart the system. If the fault cannot be eliminated, please contact Growatt technical support.
FAULT 411	Abnormal communication with PM	Check if the communication cable between CM and INV is connected properly. If it is properly connected, please contact Growatt technical support.
FAULT 411	Parallel failure	Check if the system wiring is normal. If normal, please contact Growatt technical support.
FAULT 411	Multi-master parallel failure	Check if the system wiring is normal. If normal, please contact Growatt technical support.
FAULT 411	The short-circuit connector is not installed on the last BM	Check if the short-circuit connector on the last BM is properly installed. If so, please contact Growatt technical support.
WARN 500	Message from slave device is repetitive	Check if the BM system wiring is normal. If the problem persists after restart, please contact Growatt technical support.
FAULT 419	Software and hardware versions are inconsistent	Check if the PM matches the system. If so, please contact Growatt technical support.
WARN 410	Crystal oscillator is abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
WARN 410	USB communication is abnormal	Restart the system. If the problem persists, please contact Growatt technical support.
FAULT 431	BOOT is abnormal	Restart the system. If the problem persists, please contact Growatt technical support.

7. Decommissioning

If the PV-ESS-DG system will not be put into use in the future, handle all components properly.

1. Disconnect the external AC circuit breaker and prevent accidental reconnection.
2. Set the DC-SWITCH to the "OFF" position.
3. Wait at least 5 minutes until the internal capacitor is fully discharged.
4. Remove cables on the AC side.
5. Remove cables on the DC side.
6. Remove the WIT inverter from the installation location.
7. Remove cables between the battery clusters.

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