SUN SYNK

HYBRID PARITY (SUPER) INVERTER

INSTALLING THE SUNSYNK HYBRID INVERTER WITH A GENERATOR

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v.2 (02/21/22)

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1. INTRODUCTION

This manual presents instructions to installing the Sunsynk Hybrid Inverter with a generator. All the procedures described in this manual should be followed carefully. If you have questions or concerns about the operation and maintenance of this product, please contact our customer support.

All personnel involved in the installation, setup, operation, maintenance, and repair of this machine should read and understand this manual, mainly its safety instructions. Substandard performance and longevity, property damage, and personal injury may result from not knowing and following these instructions.

2. SAFETY

2.1. General Safety

- Use this device only in accordance with this instruction manual, as well as all applicable local and national laws and regulations. Only allow this device to be installed, operated, maintained, repaired, etc. by others who have also read and understood the user manual. Ensure that this manual is included with this device if it is ever given or sold to a third party.
- **DO NOT** allow minors, untrained personnel, or personnel suffering from physical or mental impairment that would affect their ability to follow this manual to install, operate, maintain, or repair this device.
- Any untrained personnel who might be near the device while it is in operation **MUST** be informed that it is dangerous and fully instructed on how to avoid injury during its use.

2.2. Symbols

⚠ WARNING	This symbol indicates information that if ignored, could result in personal injury or even death due to incorrect handling.
⚠ CAUTION	This symbol indicates information that if ignored, could result in personal injury or physical damage due to incorrect handling.
NOTICE	Indicates information that is considered important, but not hazard-related.

2.3. Safety Instructions

⚠ WARNING

HIGH LIFE RISK DUE TO FIRE OR ELECTROCUTION.

The Sunsynk Single-Phase Hybrid Inverter can only be installed by a qualified licensed electrical contractor. This is not a DIY product.

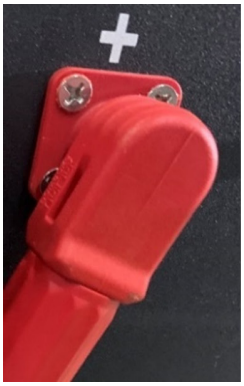
- Be sure to read this manual thoroughly before installation.
- Do not attempt to install the inverter by yourself. Installation work must be performed following national wiring standards by authorised personnel only. Do not turn on the power until all installation work is complete.
- Do not disassemble the inverter. If you need repair or maintenance, contact a professional service centre.
- Always use an individual power supply line protected by a circuit breaker and operating on all wires with a distance between contacts of at least 3mm for this unit.
- The unit must be correctly grounded and the supply line must be equipped with a suitable breaker and RCD to protect people.
- Disconnect all wires before performing any maintenace or clearning to reduce the risk of electric shock.
- The unit is not explosion-proof, so it should not be installed in an explosive atmosphere.
- Never touch electrical components immediately after the power supply has been turned off since the system can still have residual energy, so electric shock may occur. Therefore, after turning off the power, always wait 5 minutes before touching electrical components.
- This unit contains no user-serviceable parts. Always consult an authorised contractor for repairs.

3. COMMISSIONING

3.1. Connecting the Batteries

When connecting a Lithium battery, follow the connection steps below and check 'Setting up a Lithium Battery' to connect with an inverter.

1. Connect the correct diameter of cable in accordance with the battery manufacture specifications along with recommended safety devices.
2. Connect a communication cable from the batteries to the inverter in compliance with the battery manufacturer guidelines. The cables have two ends, one to be specifically connected to the BMS and another to be connected to the inverter, do not connect them incorrectly.
3. Connect the power and communication cables to the inverter correctly.

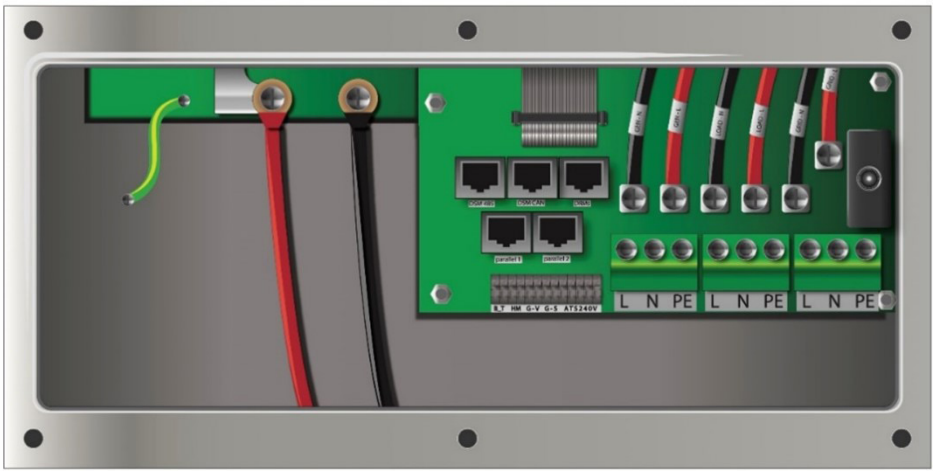


NOTICE

When connecting more than one battery, ensure they are set in the configuration of 'master and slave'.

- **Battery connection of the 3.6kW/5.5kW model**

- **Battery connection of the 8kW model**



For safe operation and compliance, an individual DC overcurrent protector or disconnection device is required for the connection of the battery and the inverter. Users are recommended to utilise a suitable fuse and DC isolator. In some applications, switching devices may not be required, but overcurrent protectors must be used.

3.2. Connecting the Load

Connect the load to the “Load” port in the inverter utilizing appropriate protection devices.

3.3. Connecting the Generator

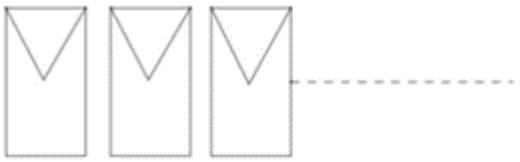
Connect the generator to the “Gen” port.

- **Bottom view of the 3.6kW/5.5kW model**

- **Bottom view of the 8kW model**

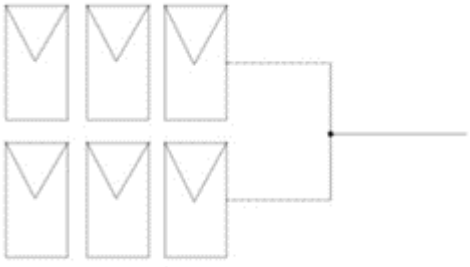
3.4. Connecting the PV

The 3.6kW and 5.5kW Inverters are fitted with only one MPPT Controller with a maximum current of 9Amps.



Single String

The 8.8kW Inverter has two built-in MPPT controllers (MPPT1 and MPPT2).That means two individual arrays can be connected to each MPPT for better performance. The maximum current of the array connected to each MPPT is 18Amps.



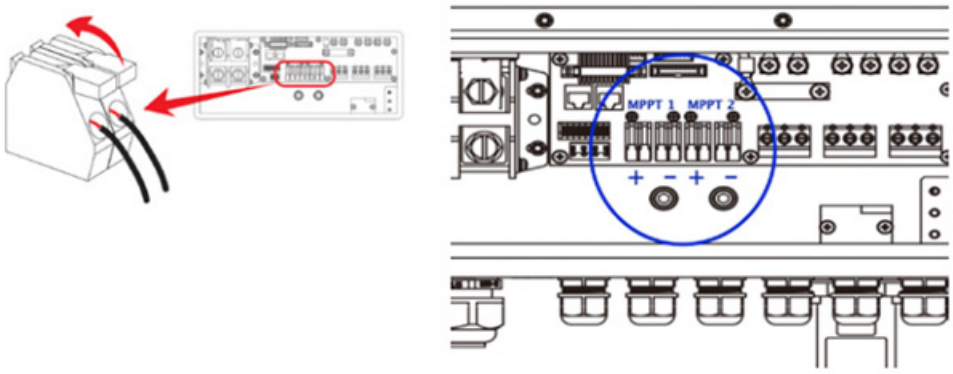
Two Strings in
Parallel per MPPT

Before connecting to PV panels, install a separate DC circuit breaker between the inverter and PV modules. In addition, we request users install PV junction box with surge protection to protect the system from lightning strike.

To avoid any malfunction, do not connect any PV modules with possible current leakage to the inverter. For example, grounded PV modules will cause current leakage to the inverter.

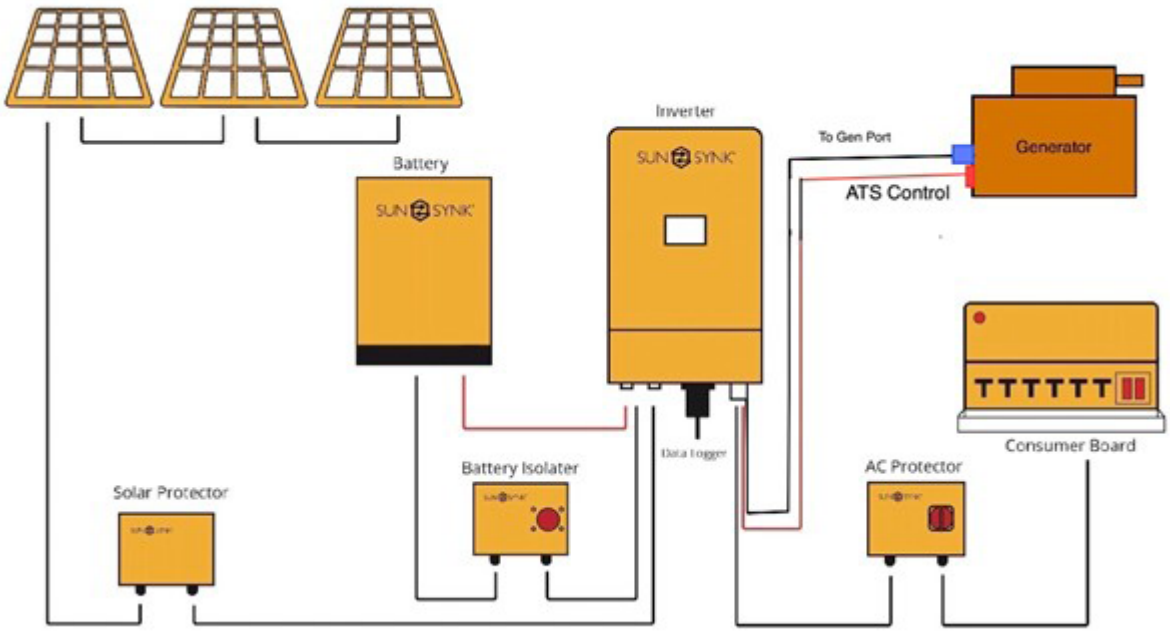
The open-circuit voltage (Voc) of the PV array should be higher than minimum start voltage and lower than the maximum PV input voltage.

8.8kW PV Connection



5.5kW PV panels are connected via the MC4 connectors located at the bottom of the inverter

3.5. System Diagram



> **⚠ WARNING**
>
> **Ensure you have used appropriate safety devices in accordance with local wiring regulations.**

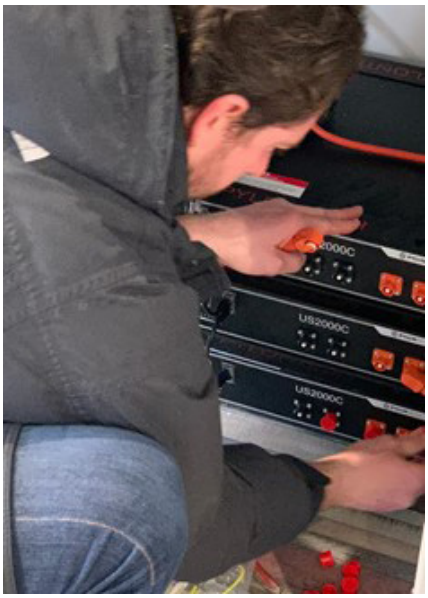
3.6. Power Up

1. Switch on the inverter by pressing the green start button.
2. Switch on the Battery Isolator.
3. Switch on the Solar Isolator if solar is used.
4. The system should now start running.

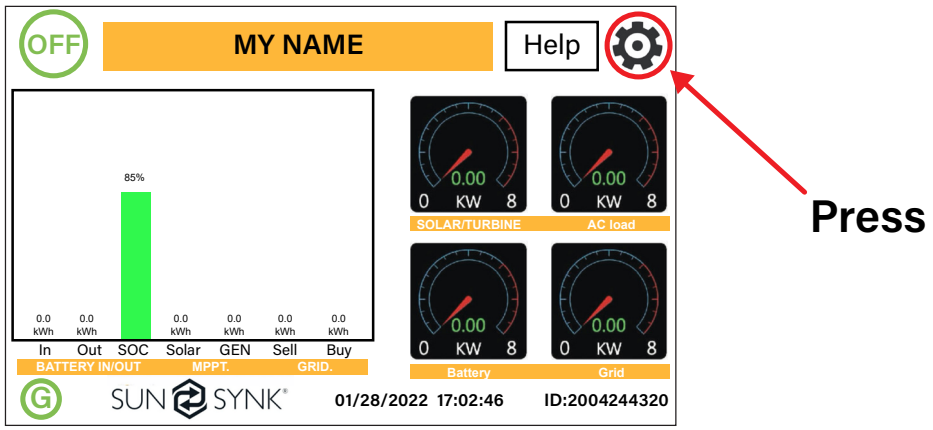
> **⚠ WARNING**
>
> **The start-up should be performed by a qualified engineer since there is a high risk of electruction while the covers are off.**

3.7. Setting Up a Lithium Battery

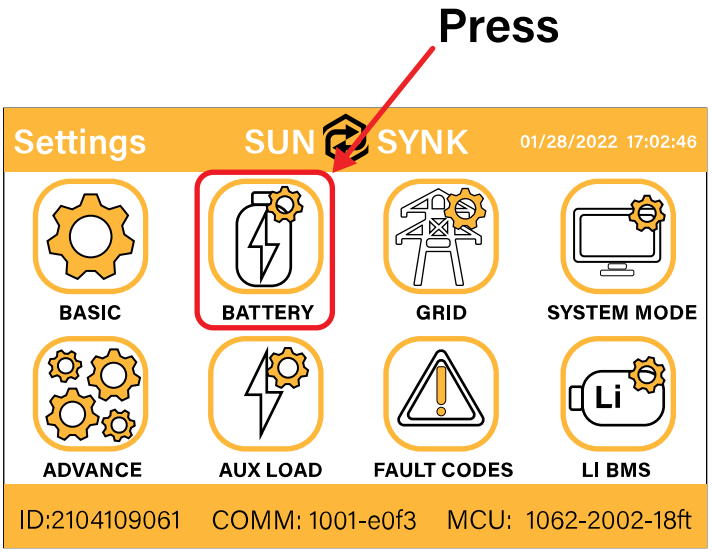
The first step to take after the system powers-up is to check that the lithium battery is communicating correctly with the inverter. If it is not communicating with the inverter, you need to set-up the battery via the Battery Setup screen before continuing with the commissioning process.



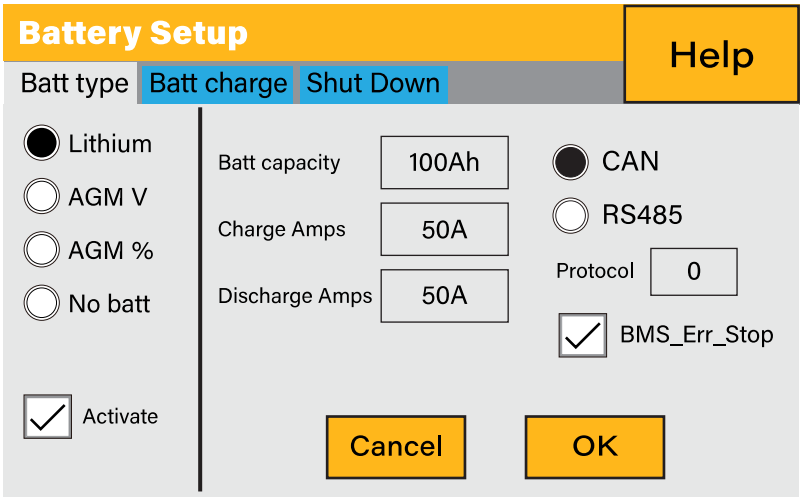
1. On the Home page, press the gear icon on the top-right corner.



2. Click on the Battery icon.



3. On the Battery Setup screen:



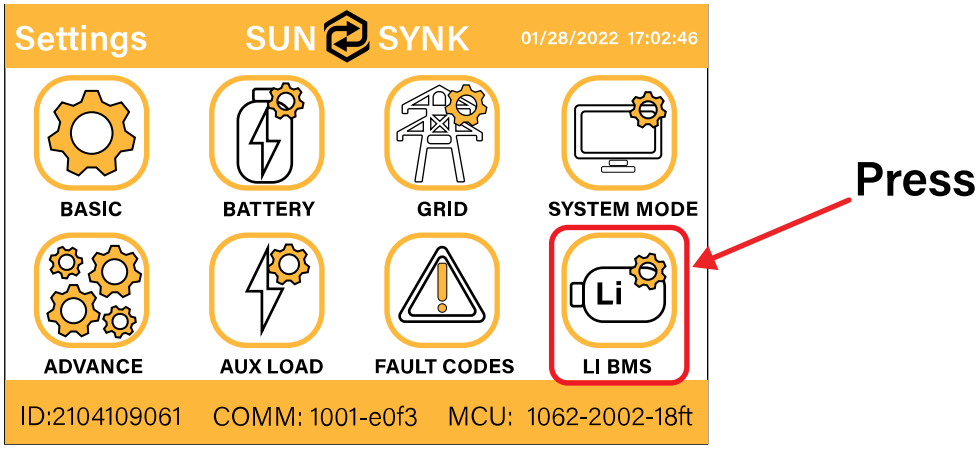
a. Select 'Lithium';
b. Select the communication protocol specified by the manufacturer guide or select from the list below;
c. Press 'OK'.

Brand	Model	48V Storage Inverter	RS485 or CAN	Inverter Setup	Notes
PYLON	US2000B	✓	CAN	0	
			RS485	12	
	US3000		CAN	0	
			RS485	12	
	US2000C		CAN	0	
			RS485	12	
	US3000C		CAN	0	
			RS485	12	
	UP5000		CAN	0	
			RS485	12	
	US5000		CAN	0	
			RS485	12	
	Force L1		CAN	0	
			RS485	12	
	Force L2		CAN	0	
			RS485	12	
DYNESS	B4850	✓	CAN	0	
	POWERBOXF			0	

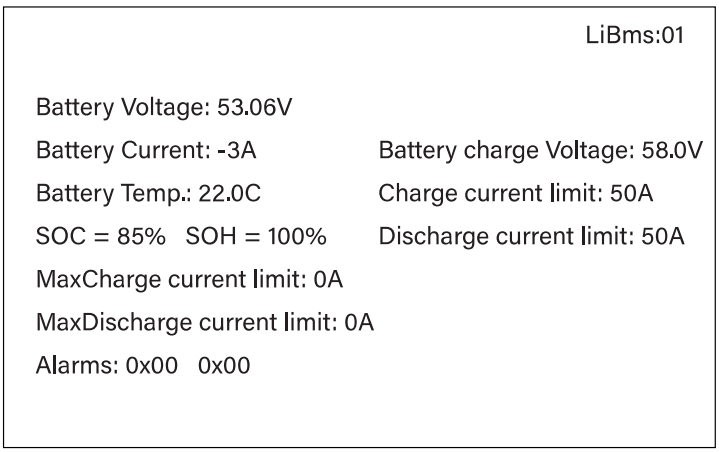
Brand	Model	48V Storage Inverter	RS485 or CAN	Inverter Setup	Notes
SolarMD	SS4074	✓	CAN	0	To be used with V2 Logger http://solarmd.co.za/inverter-compatibility-solarmd/ sunsynk-and-solar-md/
	SS4037			0	
	SS202			0	
SHOTO	SDC10-Box 5	✓	CAN	0	
HUBBLE	AM-2 5.5KW	✓	CAN	0	
SACRED SUN	SSIF2P15S48100C	✓	RS485	1	Cut Line 3, 6, 8
	FCIFP48100A		RS485	1	
	SSIFP48100A		RS485	1	
UZ ENERGY	UZ-EB51.2-100ALL	✓	CAN	0	
GenixGreen	ESS-5120	✓	RS485	6	
	ESS-10240		RS485	6	
	ESS-BOX2		RS485	6	
	ESS-BOX3		RS485	6	
	ESS-BOX4		RS485	6	
Sunwoda	H4850M	✓	RS485	7	
VISION Group	V-LFP51.2V100Ah-5KW	✓	CAN	13	
	VLFP51.2V200Ah-5KW		CAN	13	
Alpha Ess	M4856-P	✓	CAN	0	
	SMILE BAT		CAN	0	
GSL ENERGY	GSL051100A-B-GBP2	✓	CAN	0	
	GSL051200A-B-GBP2		CAN	0	
	GSL051280A-B-GBP2		CAN	0	
	ZnP48100ESA1		CAN	0	
	GSL-51-100		CAN	0	
	GSL-51-200		CAN	0	
TOPBAND	TB51100F-T110	✓	CAN	0	
	TB51120-T110		CAN	0	
Weco	4K4 LV	✓	CAN	0	
	5K3 LV		CAN	0	
DOWELL	IPACK	✓	CAN	0	
	C3.3/IPACK		CAN	0	
	C6.5/IPACK C10		CAN	0	
Giter	G2500-48V	✓	CAN	0	
	G5040-48V		CAN	0	
CF Energy	CFE2400	✓	CAN	0	
	CFE5100		CAN	0	
	CFE5100S		CAN	0	

Brand	Model	48V Storage Inverter	RS485 or CAN	Inverter Setup	Notes
Batterich/ Greenrich	UP3686		CAN	0	
Narada	48NPFC80		RS485	16	RJ45 Pin 1: GND RJ45 Pin 2: RS485_A RJ45 Pin 3: RS485_B RJ45 Pins 4, 5, 6, 7, 8: No Connection Single-phase Hybrid Inverter Comm version is E41E Single-phase Hybrid Inverter Comm version is 1001 - E016
	48NPFC100		RS485	16	
	48NPFC150		RS485	16	
	48NPFC200		RS485	16	
BYD	BYD Battery-Box LV Flex Lite		CAN	0	
Deye	SUNB-5.0-C01-48-PC		CAN	0	
	SUNB-5.0-E01-48-PC		CAN	0	
	SUNB-5.0-G01-48-PC		CAN	0	
AOBOET	Uhome-LFP 5000		CAN	0	
	Uhome-LFP 2400		CAN	0	
Wattsonic	Li-LV battery series	✓	CAN	14	
KODAK	FL5.2	✓	CAN	0	
Fox ess	LD-48100P	✓	RS485	1	
PYTES Energy	E-BOX 48100R		CAN	0	
BST	MD48-100		CAN	0	
	MD48-50		CAN	0	
Highstart	HSD4870		CAN	0	
Rosen Solar Energy	LFP48V200AH		CAN	0	
ZRGP	ZR-FC48100-1630J1		CAN	0	
	ZR-FS4850-16OSJ1		CAN	0	
	ZR-FS48100-16OSJ1		CAN	0	
	ZR-PBX1		CAN	0	
BALANCELL	P26		CAN	0	
	P27		CAN	0	
Shanghai Green Tech Co.,Ltd.	GTEM-48V2500		RS485	12	
Unipower	UPI.FP4845		RS485	15	
LD	LD-100P210J		RS485	17	

4. Go back to the Settings page and click on 'LI BMS':



5. You should see a screen with the LI BMS information, like the figure below:



If some information is not displayed correctly on the screen a communication error has occurred and the following remedial steps should be taken:

a. Check your data cable is the correct type.

b. Check the cables are plugged into the correct sockets. Usually, RS485 connection is employed. However, some battery manufacturers use other types.

NOTICE

With some types of lithium batteries, the BMS cannot be controlled by the Sunsynk Inverter. In these cases, treat the battery as a Lead-Acid type and set the charging and discharging protocol by following the battery manufacturer specification.

3.8. Testing the Generator

After setting up the battery, follow the steps below to test the generator:

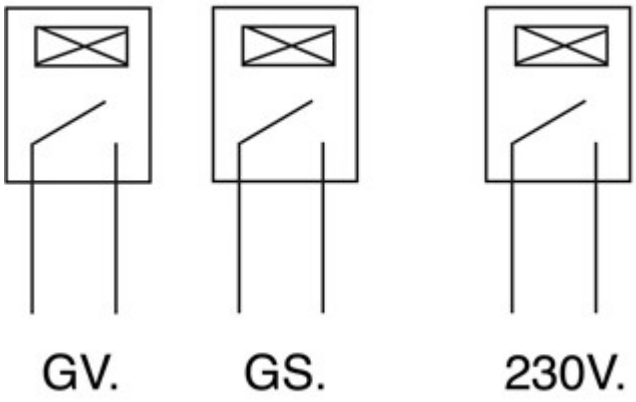
1. Fit a switch directly to the A/T/S leads.
2. Switch on the generator to automatic.
3. Plug the generator into the inverter.
4. Switch all isolators on.
5. Close the switch.
6. The generator should start up automatically.
7. Open the switch. The generator should stop.

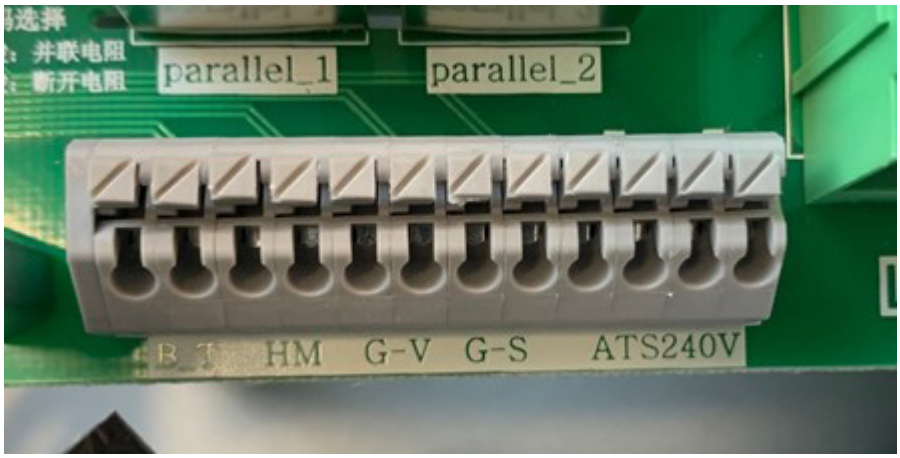
NOTICE

It is important to check if your generator comes with this simple automatic function because if it doesn't, the generator will not be able to run automatically from the inverter.

3.9. Connecting the ATS to the Inverter

The inverter has three relays. Depending upon the function that is needed, these relays will operate differently.

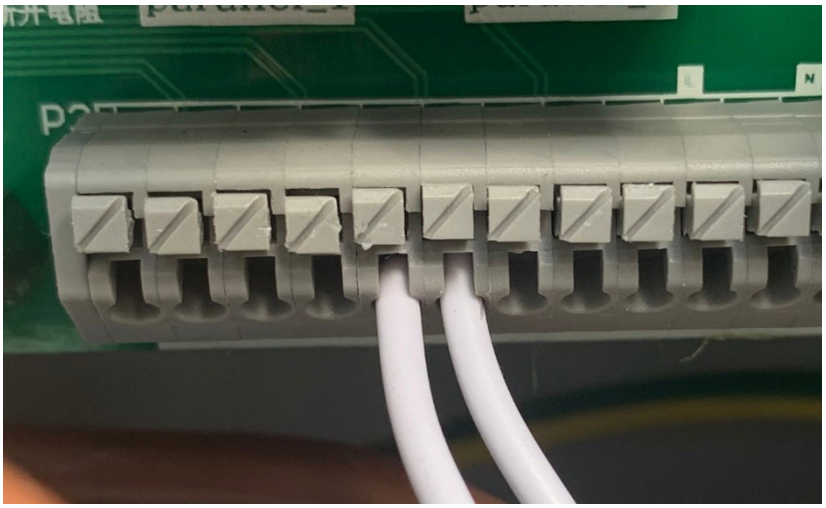




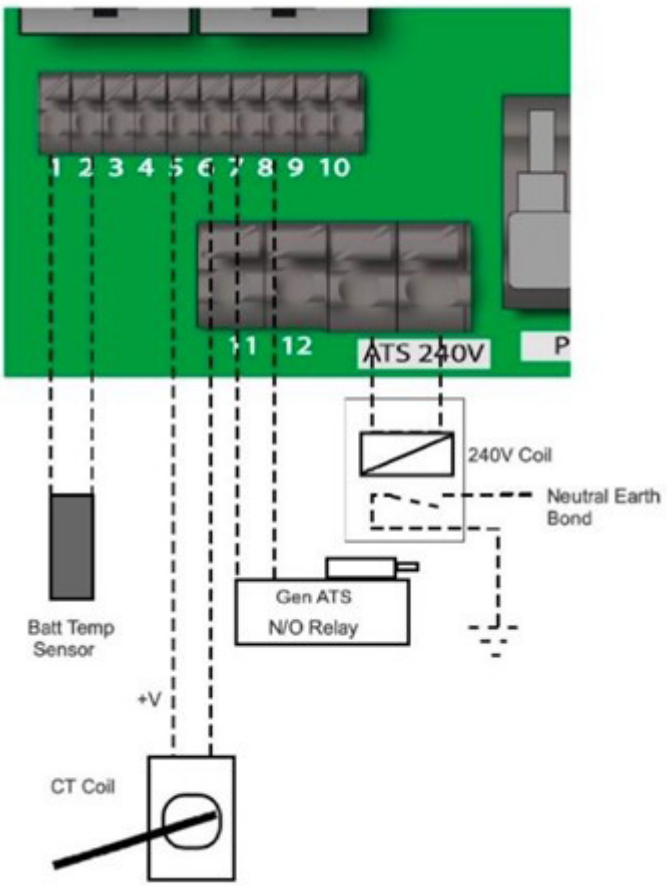
Both GV and GS can start the generator, but this depends upon the setting you select. GV and GS are both dry contacts N/O (normally open).

> *NOTICE*
>
> **If you are using the Earth bond feature, then GS will start the generator. But, if you are not using the earth bond feature, then GV will start the generator.**

For general operation, we will use the GV Terminal.



If you are using the 8.8kW inverter, then this connection would be terminals 7+8.



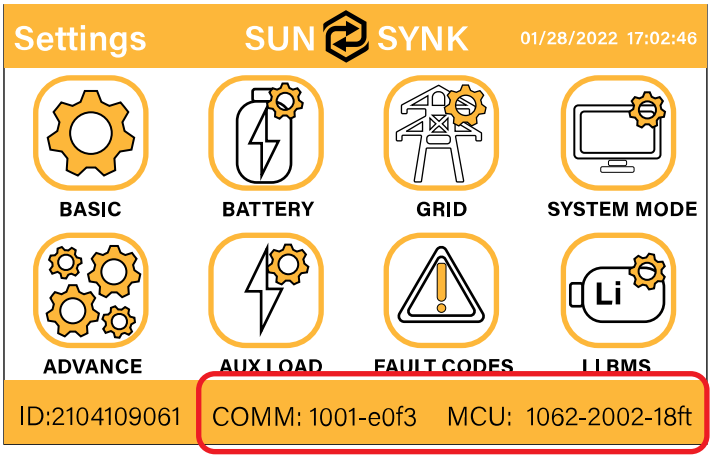
3.10. Software Update

Check if you need to update the software running the inverter. For this manual, the appropriate updates are:

- MCU 2159 - 3.6K
- MCU 3160 - 5.5K
- MCU 3878 - 8.8K

- UI Version E417

The software version is shown on the navigation page:



Before going on site, check if your software is already up-to-date. If not, we recommend you update it. This can be done in three ways:

1. Wi-Fi data logger.
2. GSM data logger.
3. Hand held programmer.

The easiest method is to use a GSM data logger, which is simply plugged into the bottom of the unit, and there is no need to carry out any setup. The only drawback with the GSM data logger is that the updating time is long and can typically take up to 2 hours.
The Wi-Fi data logger relies on a good Wi-Fi signal and needs to be set up. Please refer to the data logger setup procedure.
If an update is required, then please contact one of the Sunsynk Service Centres with the data logger number, and the update can be done remotely. When carrying out an update, please be patient as it can take some time.

NOTICE

Appropriately qualified engineers can conduct an update using a handheld programmer. However, extra care should be exercised when using this instrument so as not to damage the inverter.

4. PROGRAMMING THE INVERTER TO WORK WITH A GENERATOR

Before programming the inverter, ensure that:

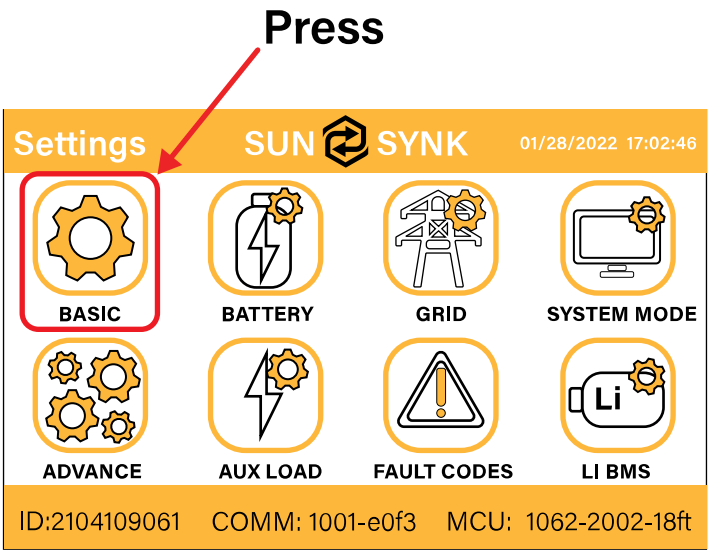
1. The battery is communicating properly.
2. The inverter starts up correctly.
3. The generator A/T/S is functioning correctly.
4. The inverter's software is updated.

Now that you have performed all the connections and all of the peripherals are working well, it is time to program the inverter. The following sections will describe how to do that.

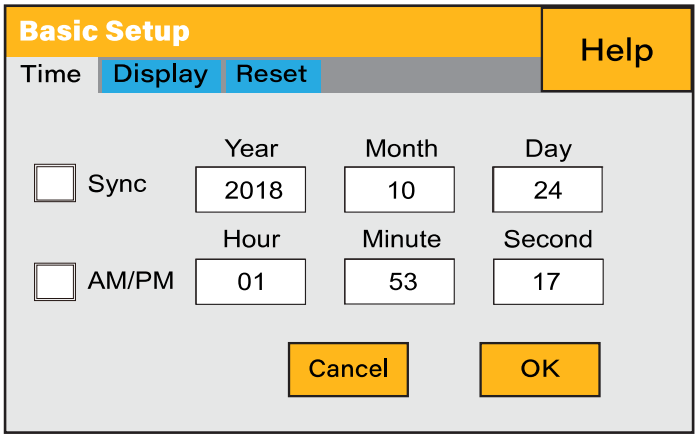
4.1. Setting Up Time and Date

In order to ensure efficient power generation, the Date and Time must be set correctly. The below diagrams explain the correct step:

1. On the Settings page, press the BASIC icon.



2. The Basic Setup page will appear on the screen.

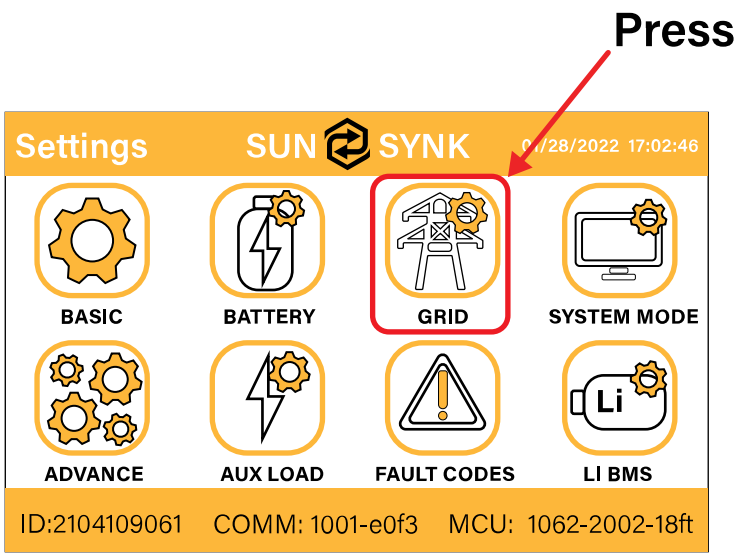


3. Touch the screen on the variable that you wish to adjust.
4. Increase or decrease the numbers by pressing the UP and DOWN buttons.
5. Press 'OK' to set the changes.

We suggest that you do not use the 'Sync' button as this function can set the inverter to the wrong time zone.

4.2. Setting Up the Grid

On the navigation page, click on the GRID icon to set up the grid.

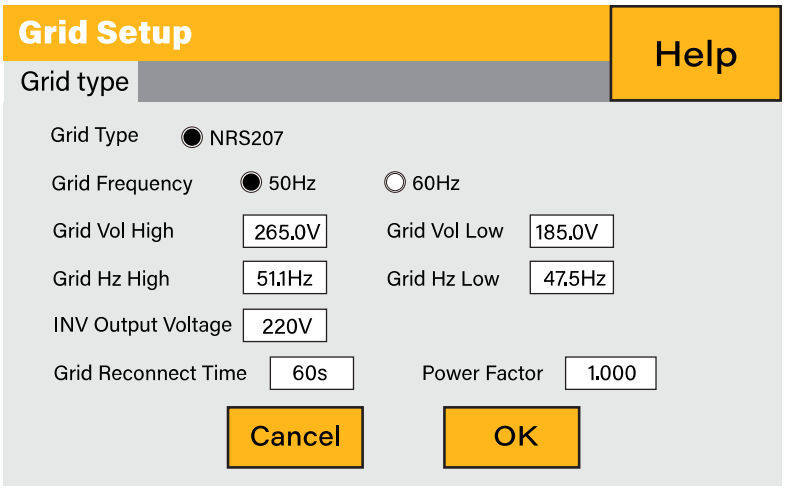


Generators operate with wide tolerance, so we suggest you to select:

a. Higher frequency limit: frequency 51.5 Hz or higher
b. Lower frequency limit: 47.5 Hz or Lower
c. Lower voltage limit: 185V
d. Higher voltage limit: 265V

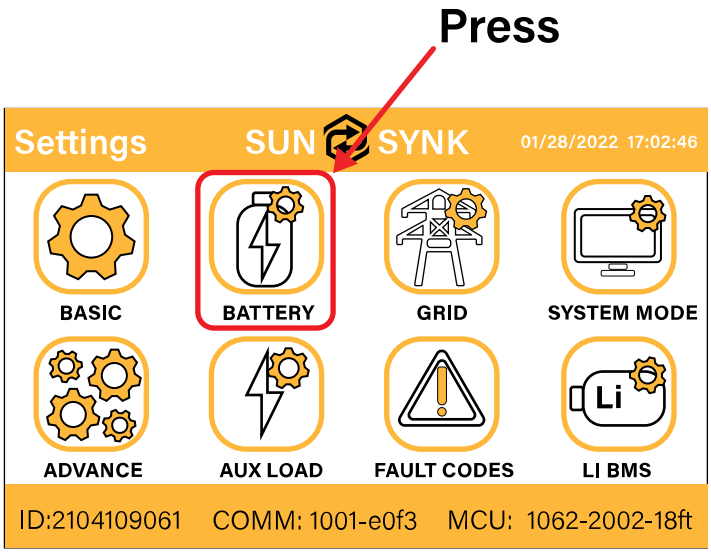
The inverter will then lock into the generator. If the generator frequency or voltages are outside of your recommended settings the system will not work.

Please note that the generator needs to provide enough power for the load and charge the batteries at the same time. Therefore, the user should ensure they have a generator powerful enough for both.



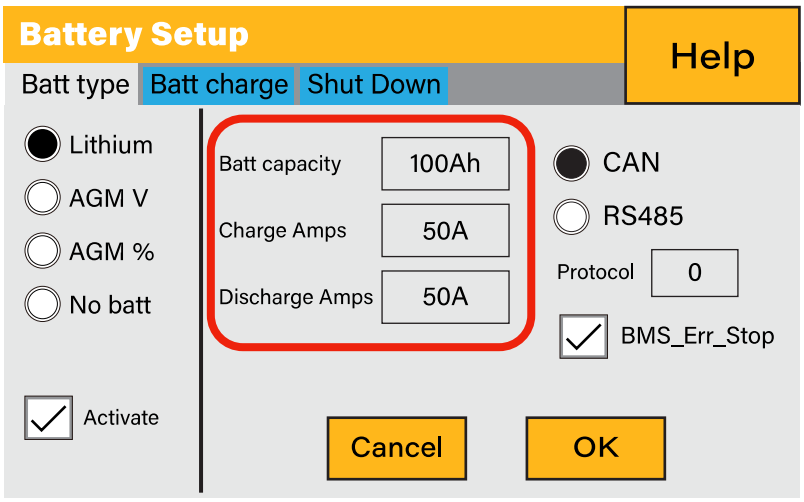
4.3. Setting Up the Batteries

To set up your batteries, click on the BATTERY icon on the Settings page.

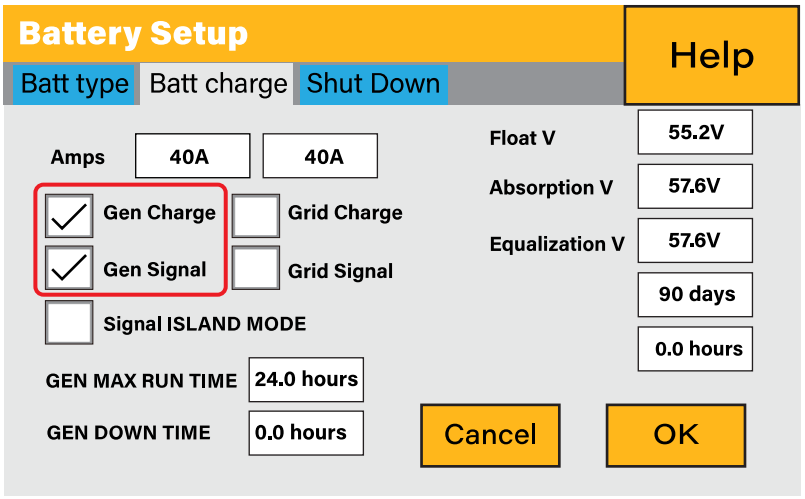


On the Battery Setup page you can configure many settings:

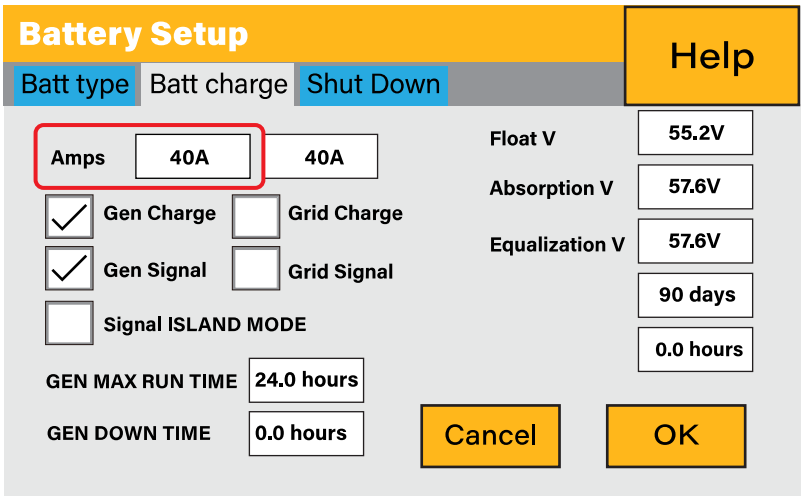
a. Select battery size (if not auto-set) and the maximum charge and discharge of the batteries:



b. On the 'Batt Charge' sub-page, select 'Gen Charge' and 'Gen Signal':



c. Set up the battery charging current.



NOTICE

The battery charging current cannot exceed the maximum power of the inverter, otherwise it will shut down. You also need to be aware of the following settings:

a. C-rating of the battery (charge and discharge).

b. Battery cables (normally 100Ah per stack).

How to calculate the maximum charge or discharge of the battery:

$$Max.charge/discharge = \frac{C\ Rating * Battery\ Power}{Battery\ Voltage}$$

Example:

2 sets of batteries of 5 kWh / 48V:

$$Max.charge/discharge = \frac{0.5\ (Lithium) * (2 * 5{,}000)}{48} \approx 100A$$

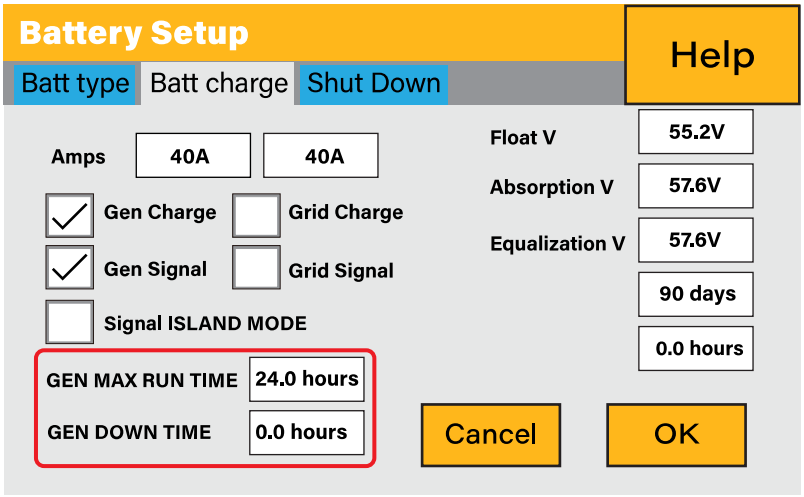
If you are using AGM then the C-Rating may only be 0.1 or lower.

The second step is to check if the inverter can withstand these values:

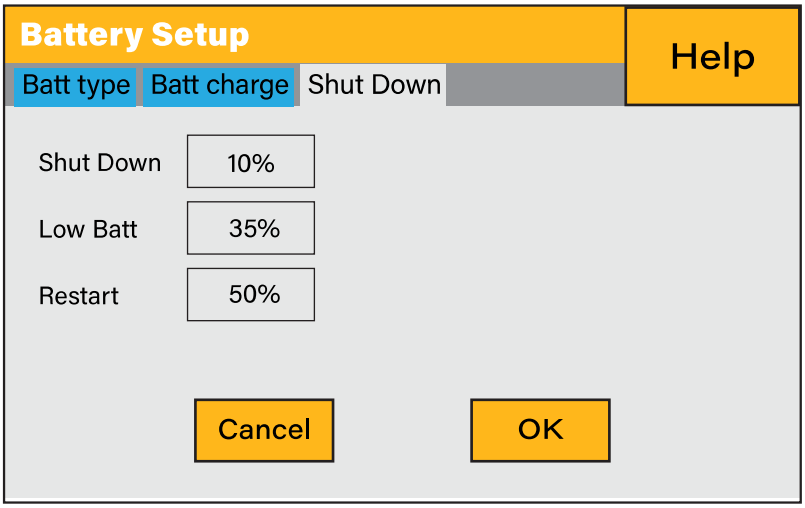
- 3 kW Max 50 Amp.
- 5.5 kW Max 80 Amp.
- 8.8 kW max 100 Amp.

d. Set up generator run time and cool-down time:

Some generators, especially in enclosed areas, can only run for a maximum time, otherwise they may overheat. This can be set as follows:



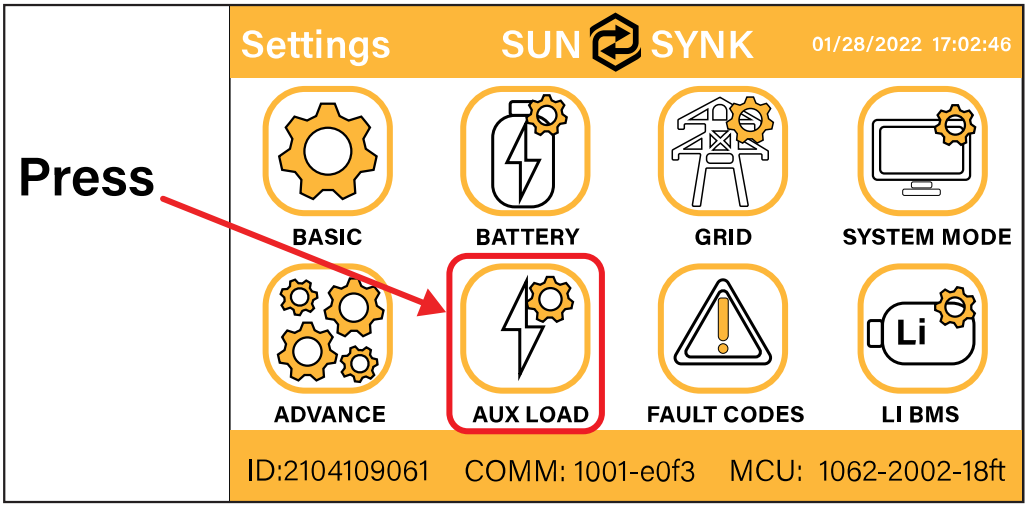
e. Select the battery shutdown voltage / percentage:



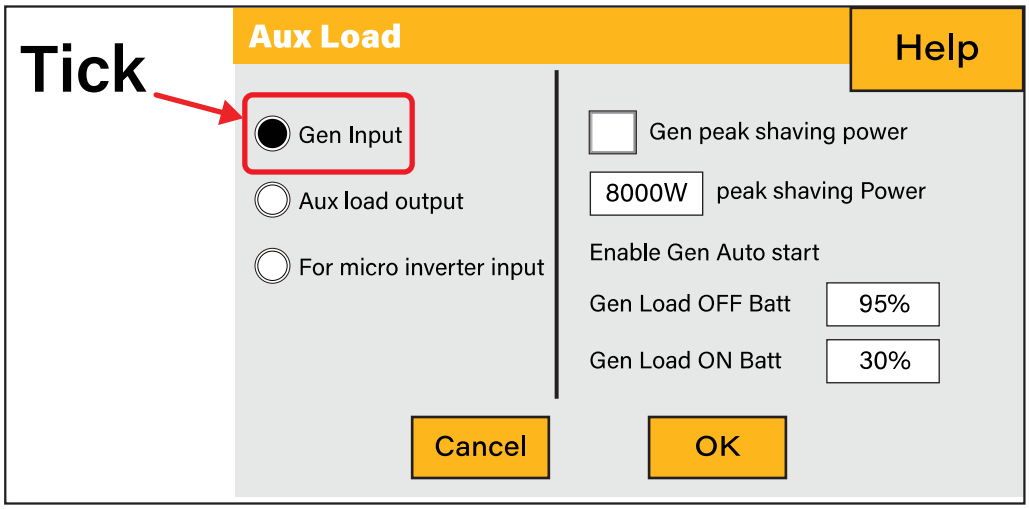
- 'Shut Down' refers to the battery 'Sate of Charge' (SOC) which is expressed as a %. This setting will cause the inverter to switch-off the Grid but not shut down completely.
- 'Low Batt' is the setting at which the low battery level warning sound will activate.
- 'Restart' is the battery level the battery needs to reach before the battery will re-start the inverter again.

4.4. Select System Mode

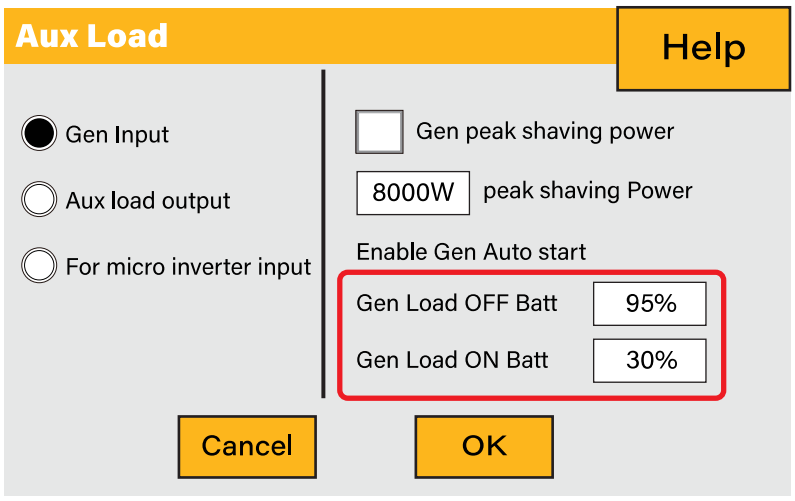
On the navigation page, press the "Aux Load" icon.



a. On this page, you need to program the Aux port as a generator port, as in the figure below:



b. Then, select the start/stop value for the generator (we suggest Start at 35% and Stop at 95%).



4.5. Select System Mode

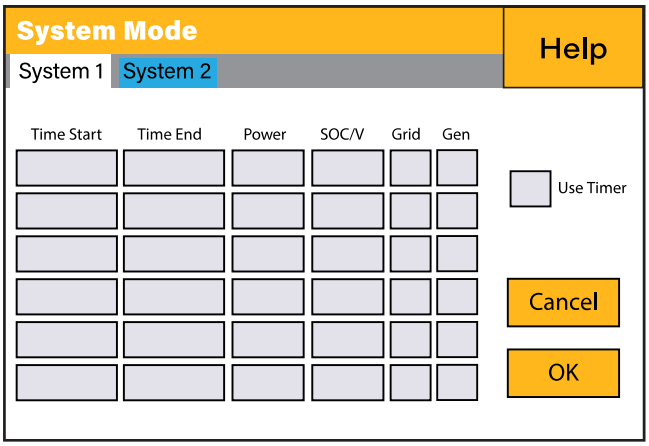
On the navigation page press ‘System Mode’. This is the heart of the Sunsynk Inverter.

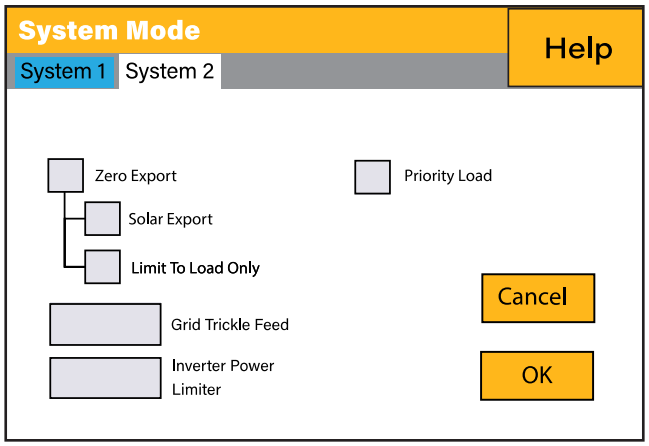
What this page displays:

- A setting to prevent the inverter exporting power to the grid - ‘Zero Export’.
- The ability to limit power supply to only the household loads - ‘Solar Export’.
- Set the power limits to supply only the loads connected to the LOAD port - ‘Priority to Load Only’.

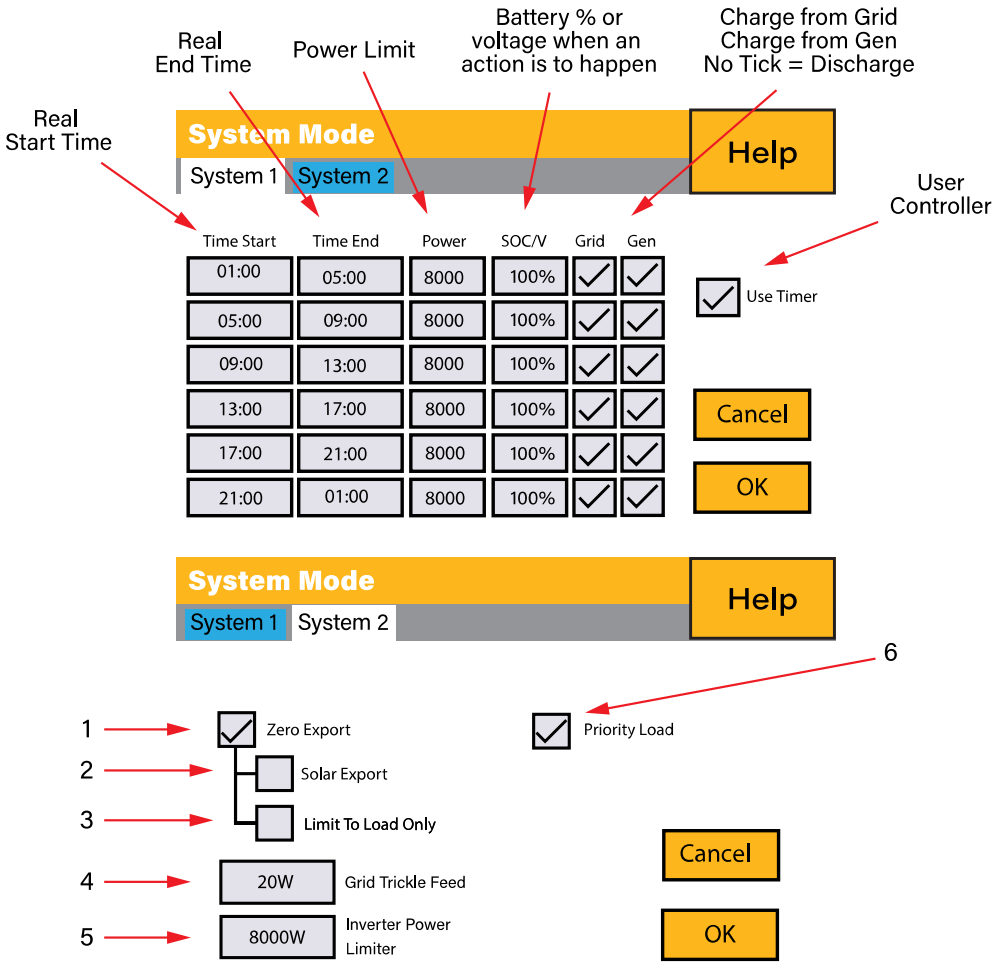
What you can do from this page:

- Set a real time to charge or discharge the battery.
- Choose to charge the battery from the grid or generator.
- Limit export power to the grid.
- Set the unit to charge the battery from the grid or generator ticking ‘Grid’ or ‘Gen’ and set what times this needs to occur.
- Set the time to discharge the unit to the load or export to the grid by unticking ‘Grid’ and ‘Gen’.





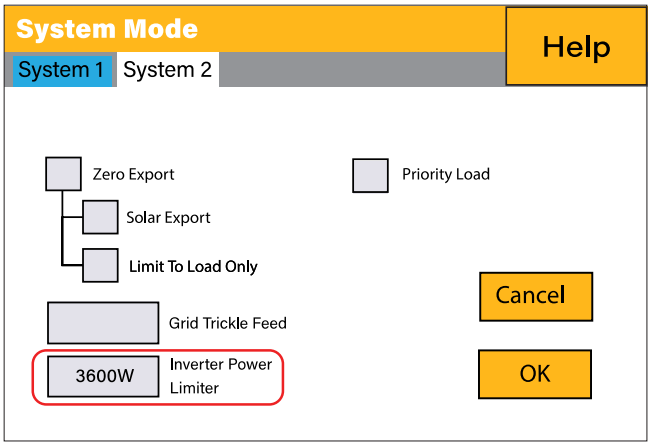
The description of each field is presented below.



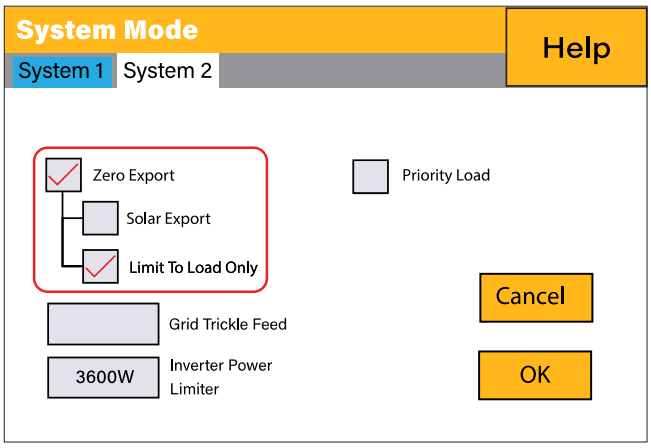
Concerning the detailed figures above:

1. Tick this box to do not export power back to the grid (the CT coil will detect power flowing back to the grid and will reduce the power of the inverter only to supply the local load).
2. Tick this box if you wish to export your solar power back to the grid.
3. Tick this box if you only want to supply power to the load side of the inverter.
4. 'Zero Export Power' is the amount of power flowing from the Grid to the Inverter. Set this value to '20 - 100W' to instruct the inverter to always take the prescribed amount of power from the Grid to minimise the tripping of sensitive pre-paid electricity meters if 'Reverse Power Detection' occurs.
5. This controls the maximum overall power, both to the 'Load' and 'Grid' ports combined. It is set to Low if an 'over-current' fault occurs
6. Tick this box if you wish to set the solar panels give power to the 'Load'. If you un-tick this box the solar will send power to charge the batteries.

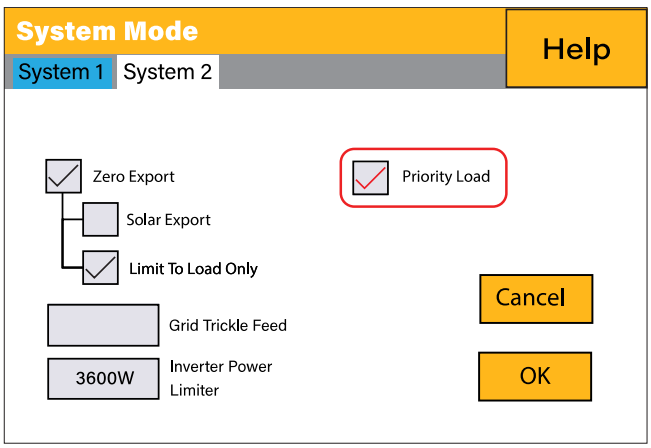
1. Select the maxiumum power of the inverter.
   - 3.6kW inverter maximum power: 3.6kW.
   - 5.5kW inverter maximum power: 6kW.
   - 8.8kW inverter maximum power: 9kW.



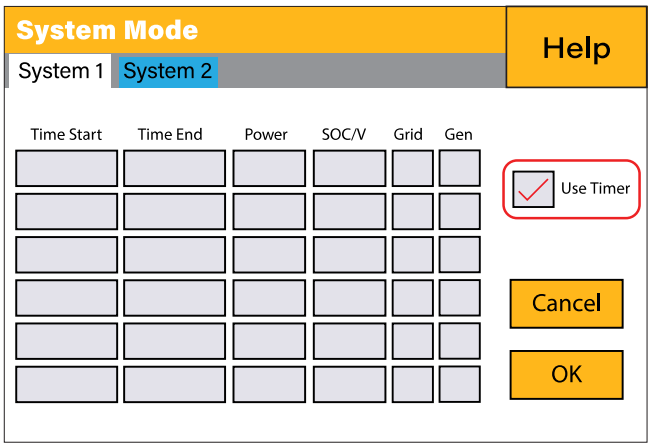
2. Select ‘Zero Export’ and ‘Limit to Load Only.



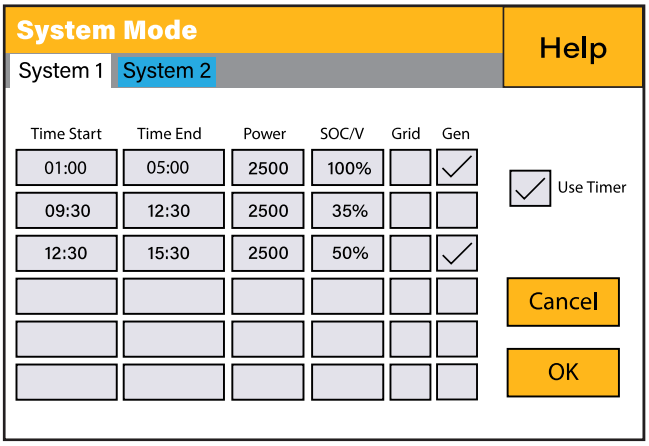
3. Select what to do with solar power.
   - If you are working Off-grid, then you should prioritise the battery.
   - If you are On-grid and the generator is just a backup, then prioritise the load.

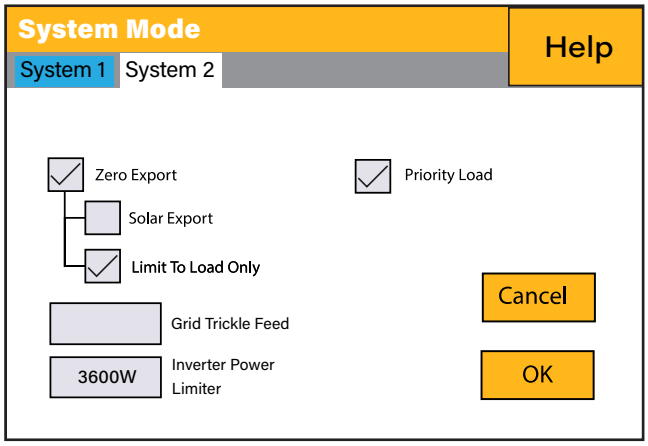


4. Select ‘Use Timer’. This is the real time in which the inverter will charge or discharge from the generator.



Example of setting:



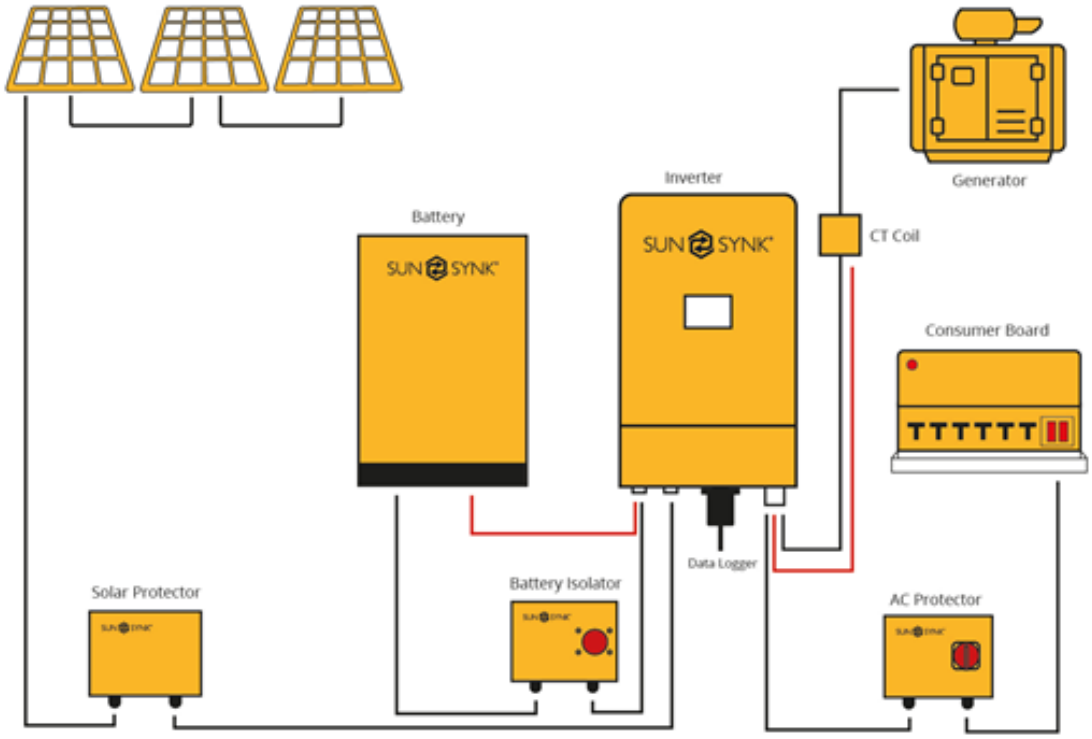


Time Start: This is the real time in which the function will be activated.
Time End: This is the real time in which the function will be deactivate.
Power: This is the maximum power this function will control.
SOC: This is the SOC the battery must reach.
Grid: The charge from the grid.
Gen: Makes the generator to charge the batteries.
(Tick the Gen box or Grid box to either charge or if discharge required, do not tick.)

4.6. Using the Grid Port

A few things to keep in mind while using the Grid Port:

- You may choose to connect the generator to the Grid Port. In our experience, this choice is okay, but not all generators are compatible, and the system will not work.
- Remember that if you connect the generator to the Grid Port, you must fit a CT coil and set the Zero Export feature to around 150W. This action will prevent the inverter from exporting power back to the generator.



NOTICE

If using Grid port, remember you will need to make all settings to charge from Grid and Grid Signal rather than generator.

5. FINAL CONSIDERATIONS

Once you are happy that everything is fully functional or connections are made correct and secure:

1. Shut the inverter Down:
    a. Switch off the Solar isolator.
    b. Switch off the Inverter.
    c. Switch off the Battery Isolator.
2. Ensure that:
    a. All cable glands are tightened.
    b. The inverter cooling system is not obstructed.
    c. You have completed all mandatory cable tests (do not carry out any earth leakage or bond tests with the wires as it will damage the inverter).
    d. All cables are secure.
3. Replace waterproof covers and fix mandatory warning labels.
4. Tidy up the site.

5. Reboot the inverter:
    a. Switch on the Solar Isolator.
    b. Switch on the Inverter.
    c. Switch on the Battery Isolator.

If you have followed this simple guide, the system will be set-up and running normally.

Key Points:

1. The generator-set must be powerful enough to power the load and charge the battery at the same time. Typical sizes of generator are as follows (Normally Generators are twice the size of an inverter):
   a. 3.6kW inverter = 7 KVA Gen Set.
   b. 5.5kW Inverter = 10 KVA Gen Set.
   c. 8.8kW Inverter = 15 KVA Gen set.

If you are using two inverters in parallel, then you will need to double the requirement. However, there is an exception to the rule if using two or more inverters in parallel, then one of the inverters can be used as a charger and another as a discharger.

To discharge the inverter that is used as a charger, it cannot be connected to the parallel circuit. This will simply charge the battery when required and the second inverter will constantly discharge from the battery.

2. Always be aware of the C rating of the battery and the battery cabling. This is the maximum charge and discharge you can use. As a rule of thumb, AGM batteries are much lower than lithium.
3. Always test each part of the circuit individually before completing the whole system.
4. Always check if your inverter requires an update before you go on-site. A good Internet connection will help when seeking an update.
5. Always keep your wires neat and tidy.
6. If using multiple batteries ensure all the battery cables of the same length.

You can watch the video for this manual in the link below:
https://www.youtube.com/watch?v=aYw2-9z0lPM

For more information, training videos, software upgrades, help line, forum please refer to http://www.sunsynk.com - Tech Support (Do not forget to register first on the website).

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