SUN ⇄ SYNK

Installing the Sunsynk Hybrid Inverter with a Generator

INDEX

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

■ 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.

2.1. Symbols

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

2.2. Safety Instructions

> ⚠ **WARNING**
>
> **HIGH LIFE RISK DUE TO FIRE OR ELECTROCUTION.**
> **The Sunsynk 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 bellow and then check section 3.7 "Setting Up a Lithium Battery" to set it up in the inverter:

1) Connect a properly power cable following the battery manufacturer specification and recommend safety devices.

2) Connect communication cable from the batteries to the inverter, properly following the battery manufacturer specifications. The cables have two ends, one to be specifically connected to the BMS and the another one to be connected to the inverter, do not mix them up.

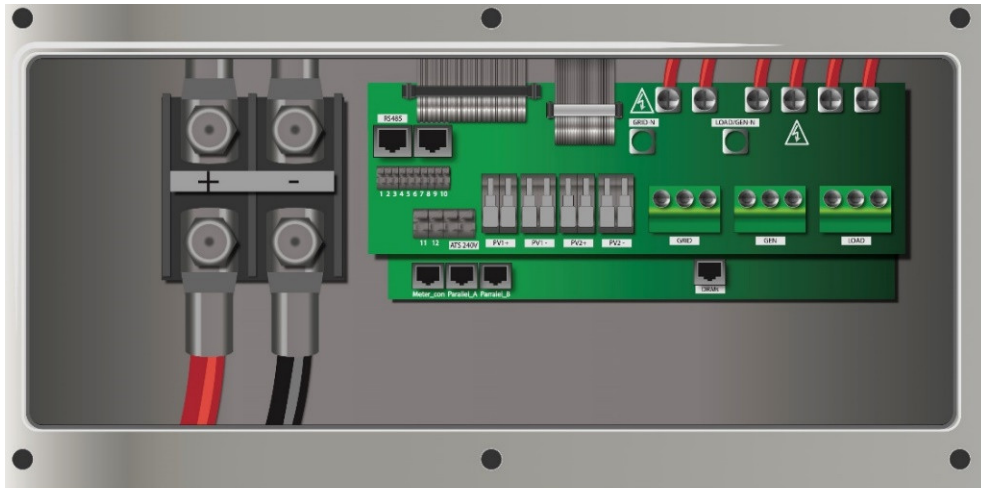3) Connect the power and communication cables to the inverter correctly.
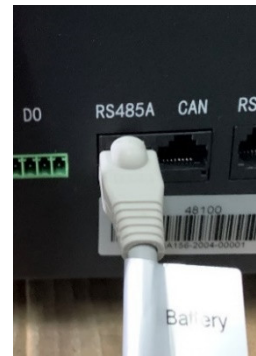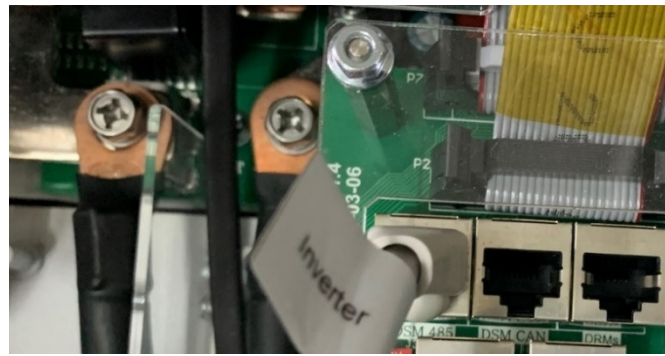
> **NOTICE**
>
> When connecting more batteries, ensure the they are set in the correct configuration master and slave.

■ **Battery connection of the 3.6kW/5.5kW model**
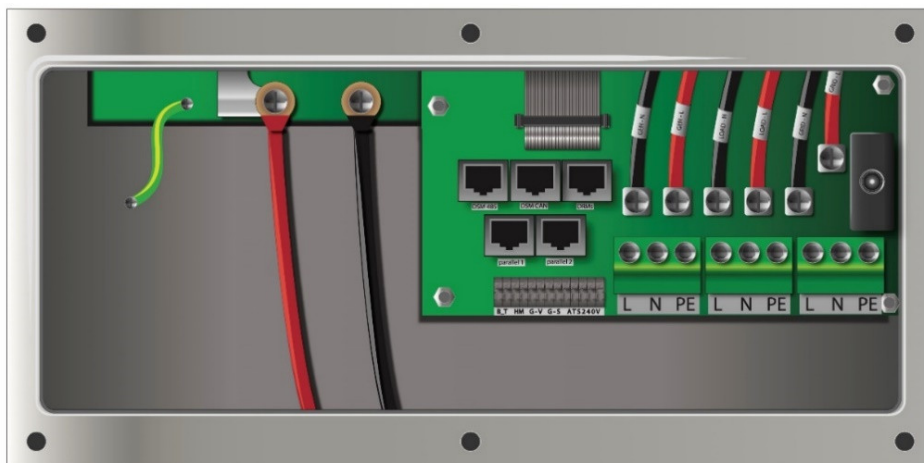
■ **Battery connection of the 8kW model**

For safe operation and compliance, an individual DC overcurrent protector or disconnection device is required for the connection of the battery and the inverter. It is recommended to utilize a suitable fuse and DC isolator (see next page). In some applications, switching devices may not be required but overcurrent protectors are still required.

3.2. Connecting the Load

Connect the load to the "Load" port in the inverter utilizing appropriate protection devices.
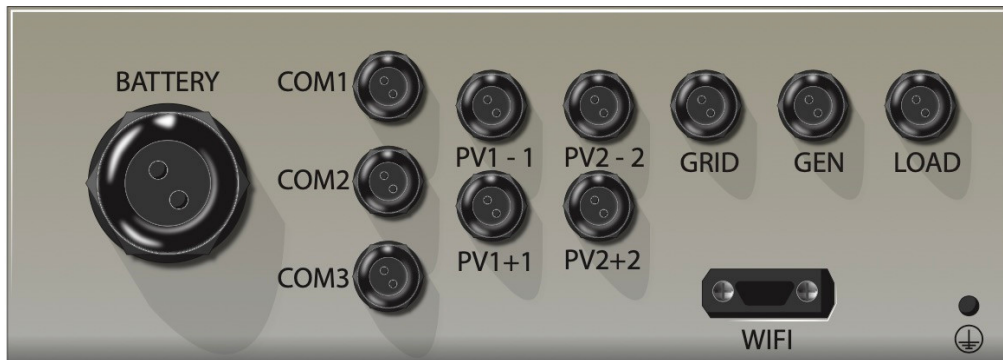
3.3. Connecting the Generator

Connect the generator to the "Gen" port.
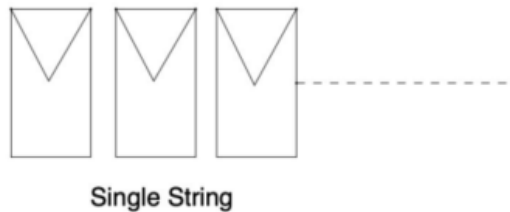
■ **Bottom view of the 3.6kW/5.5kW model**

■ **Bottom view of the 8kW model**

3.4. Connecting the PV

The 3.6kW and 5.5kW models have only one MPPT controller with a maximum input current of 9Amp.


Single String

The 8.8kW inverter has two built-in MPPT controllers, MPPT 1 and MPPT 2. Therefore, two individual arrays can be connected to each MPPT for better performance. The maximum current of the array connected to each MPPT is 18Amp.
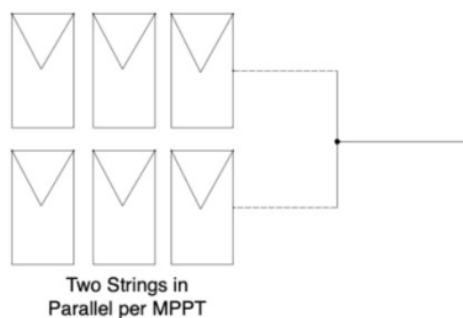
Two Strings in
Parallel per MPPT

■ Before connecting to PV modules, install a separate DC circuit breaker between the inverter and PV modules.

■ 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. Open-circuit voltage (Voc) of PV modules does not exceed max. PV array open-circuit voltage open-circuit voltage (Voc) of PV modules should be higher than min. start voltage.

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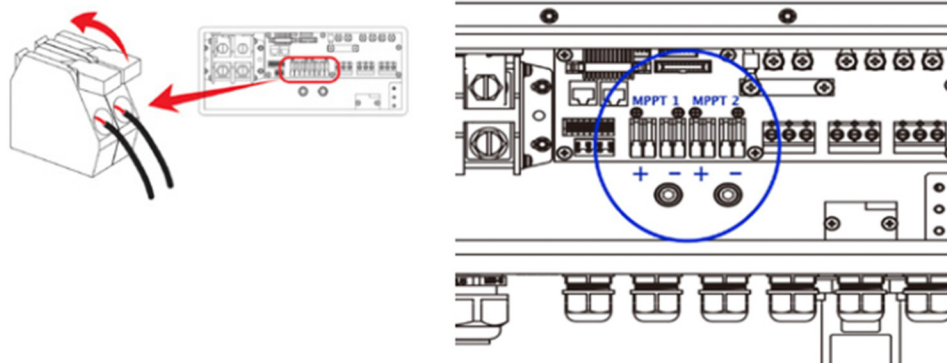
5.5kW PV panels are connected via the MC4 connectors located at the bottom of the inverter

■ Before connecting to PV modules, install a separate DC circuit breaker between the inverter and PV modules.

■ 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. Open-circuit voltage (Voc) of PV modules does not exceed max. PV array open-circuit voltage open-circuit voltage (Voc) of PV modules should be higher than min. start voltage.

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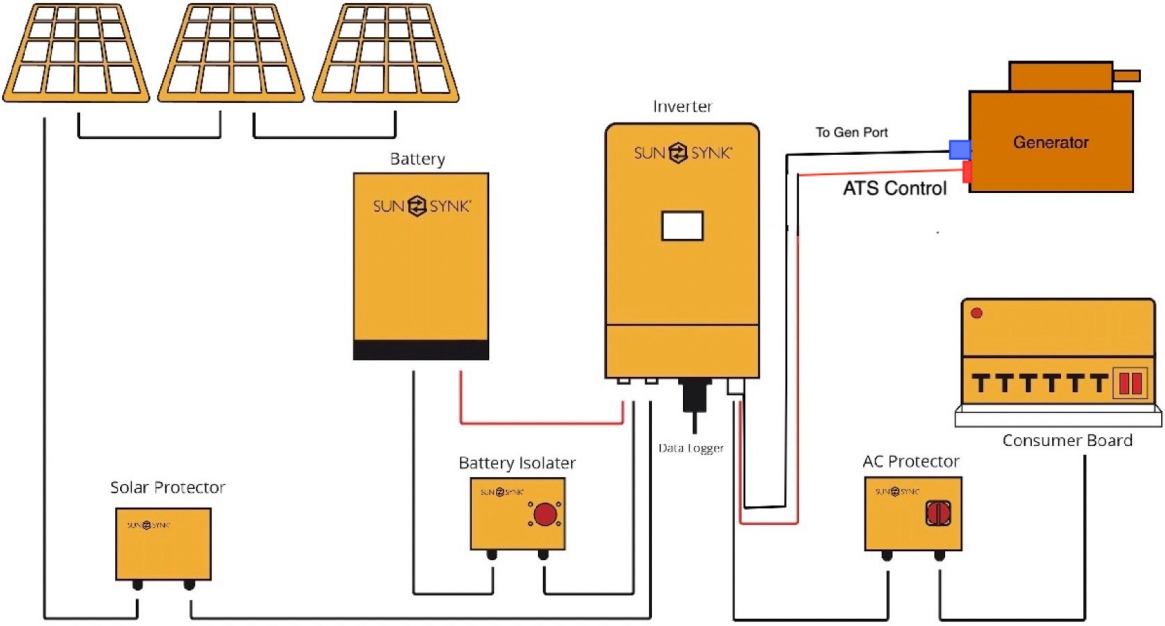
> ⚠️ **WARNING**
>
> **Ensure you have used appropriate safety devices in accordance with local wiring regulations.**

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 startup 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 thing to do after the system power-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 on the Battery Setup screen before moving forward with the commissioning.
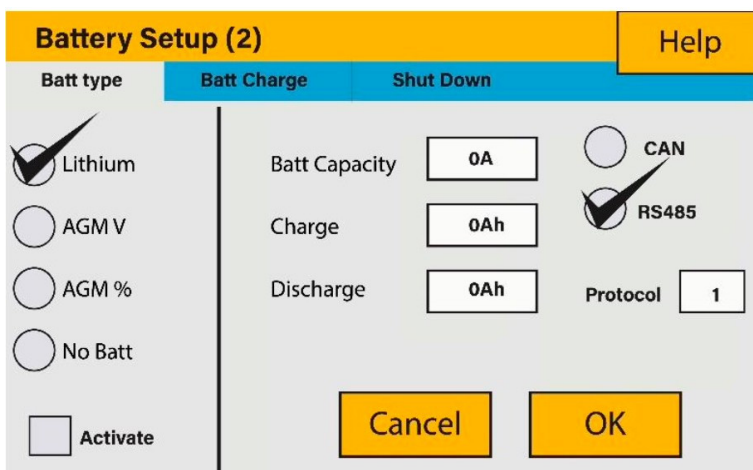
1) On the Home Page, press the gear icon on the top-right corner.
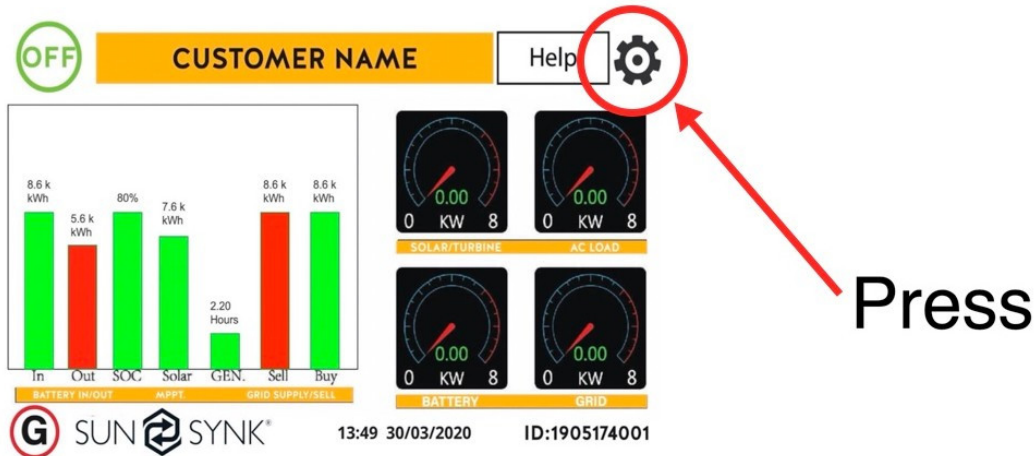
Press

2) Click on the Battery icon.
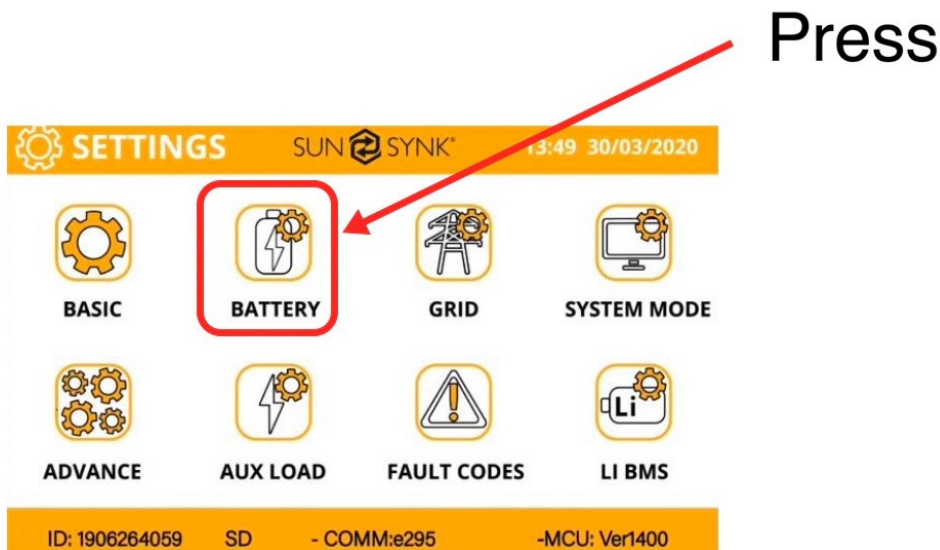
Press

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 or Equivalent	US2000	✓	CAN	0	
			RS485	5	
	US20000-PLUS	✓	CAN	0	
			RS485	5	
DYNESS	B4850	✓	CAN	0	
	B48100	✓	CAN	0	Short Lione 6&7 at inverter side
	POWERBOX F	✓	CAN	0	
	POWERBOX 9.6	✓	CAN	0	
SolarMD	SS4037	✓	CAN		To be used with V2 Logger http://solarmd.co.za/inverter-compatibility-solarmd/sunsynk-and-solar-md/
	SS4074	✓	CAN		
	SS202	✓	CAN		
Freedomwon	Freedom Lite Commercial 52V and HV Models	✓	CAN		www.freedomwon.co.za/storage/2019/09/freedom-lite-commercial-installation-manual-rev-2-september-2019.pdf
REVOV	1st and 2nd life	✓	RS485		PINS 1&2 must be Swopped at Battery side.
SHOTO			No		Voltage Base Charge settings must be used.
HUBBLE			No		Voltage Base Charge settings must be used.
CCGX	48Vxxxx	✓	CAN	0	Need confirm CAN_H CAN_L
SACRED SUN	48Vxxxx	✓	RS485	1	Cut Line 3, 6, 8
SOLAX	48Vxxxx	✓	CAN	0	
KOK	48Vxxxx	✓	RS485	2	
UZ ENERGY	UZ-EB51.2-100-A11	✓	CAN	0	
Topakpower	48Vxxxx	✓	RS485	4	

Hai Ying	HY48050	✓	CAN	0	
Re-Power	LS4850	✓	CAN	0	
Herewin Technology	HY48050	✓	CAN	0	
GenixGreen		✓	RS485	6	
Sunwoda	H4850M	✓	RS485	7	
X-ratong	48Vxxxx	✓	RS485	8	
Enershare Technology	BMS48150	✓	RS485	9	
PYLON 3.0		✓	RS485	12	
Murata		✓	RS485	11	
GS10000		✓	RS485	3	
BPE		✓	CAN	0	
ABOET		✓	CAN	0	
VISION Group		✓	CAN	13	
Alpha		✓	CAN	0	
Backbone	B-LFP51.2V 100Ah and B-LFP51.2V 125Ah	✓	CAN	0	• Float voltage 54.5V • Absorption V 55.00V • Disable equalisation 0 Days • Shutdown 20% • Low Batt 35% • Restart 50%

4) Go back to the Settings Page and click on "LI BMS":

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

Li BMS	Help ?
Sum Data	Details Data

Mean Voltage:50.34V	Charging Voltage :53.2V
Total Current:55.00A	Discharging Voltage :47.0V
Mean Temp :23.5C	Charging current :50A
Total SOC :38%	Discharging current :25A
Dump Energy:57Ah	

If some information is not displayed correctly on the screen, there is a communication error. Thus, stop and fix this problem. Follow the steps below:

a) Check if your data cable is the correct type.

b) Check if you are plugging the cable into the correct sockets. Usually, RS 485 is employed, but some battery manufacturers use others.

> **NOTICE**
>
> Some types of lithium battery the BMS cannot be controlled by Sunsynk inverter. In this case, treat the battery as a lead-acid type and set the charging and discharging protocol 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.

GV.   GS.   230V.
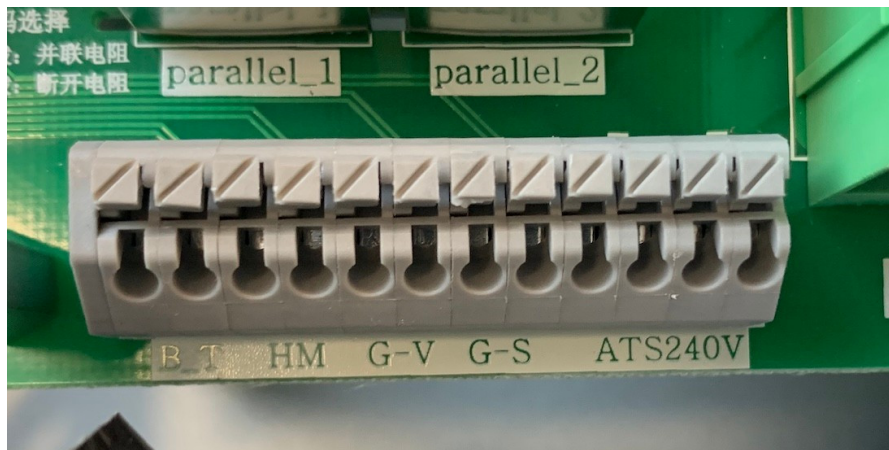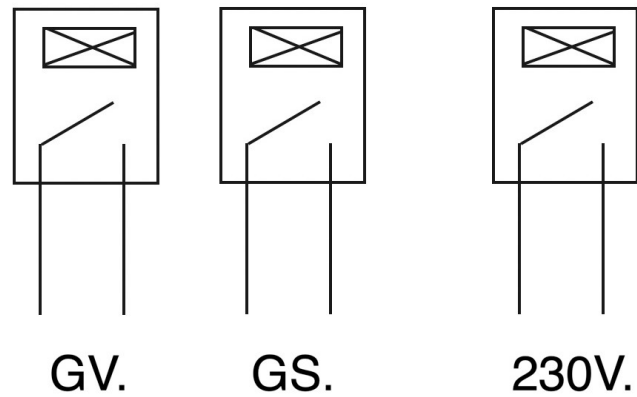
Both GV and GS can start the generator, but this depends upon the setting you select. GV and GS are both dry contacts N/ O (normally open).

> **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.
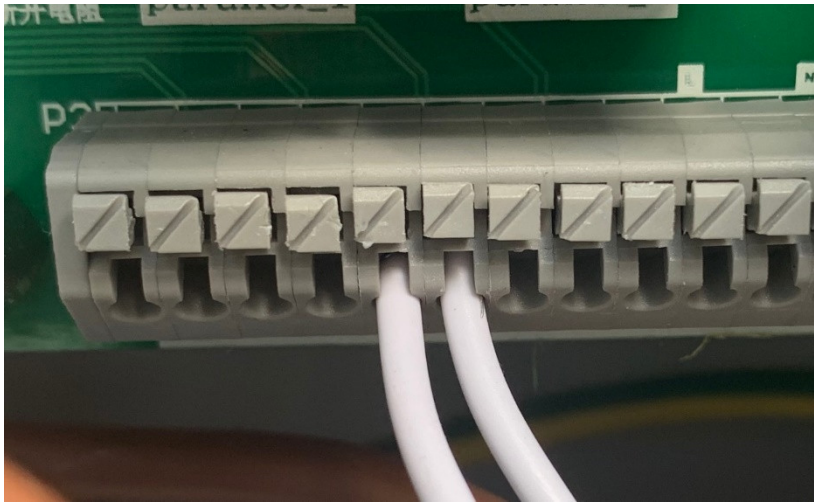
If you are using the 8.8kW inverter, then this connection would be terminals 7+8.
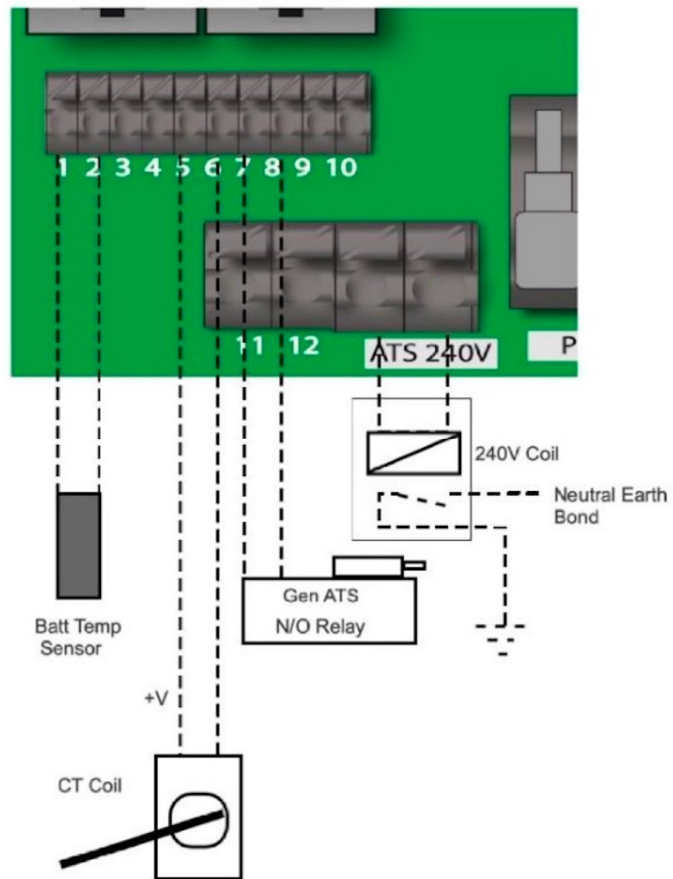
3.10. Software Update

Check if you need to update the software running in the inverter. For this manual it refers to:

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

UI Version E417

The software version is show on the navigation page:
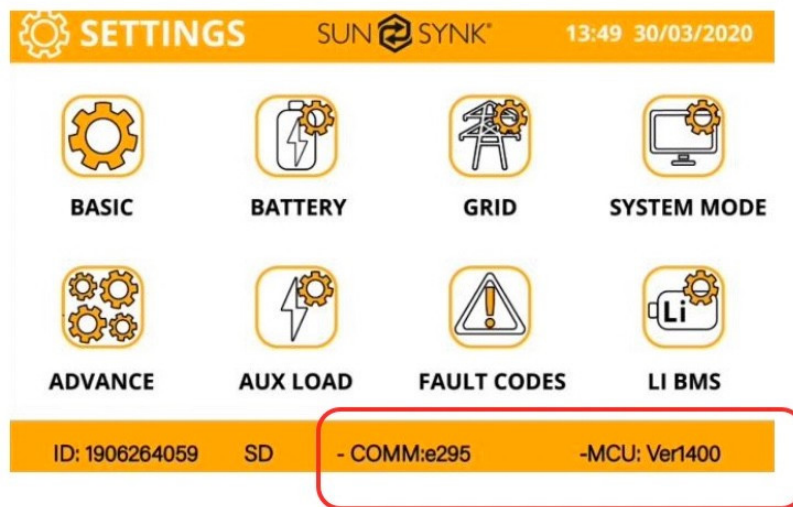
Before going on site, check if your software is updated. We strongly recommend you have it updated.

You can update the software 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 engineers 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.

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.
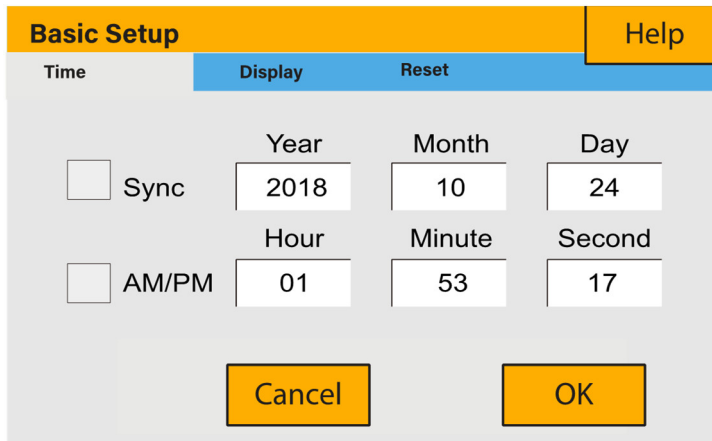
4.1. Setting Up Time and Date

If you do not set the time and date correctly, then it cannot work properly. Therefore, follow the steps below to set time and date.

1) On the Settings Page, press the "Basic" icon.
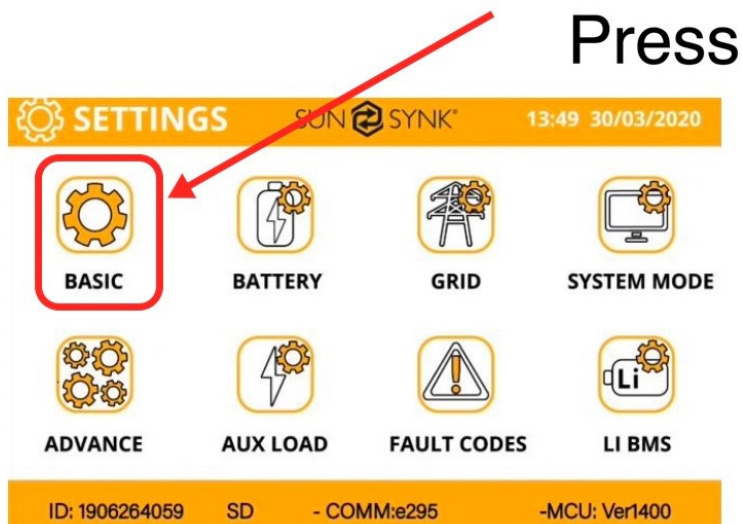
2) The Basic Setup page will show up on the screen.

3) Touch the screen on the variable that you want to change.

4) Change the number up and down using the Up and Down buttons.

5) Press "OK" to set the changes.

We suggest not selecting Sync because this can set to the wrong time zone sometimes.

4.2. Setting Up the Grid

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

Generators operate with quite big 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 lock into the generator. If the generator frequency or voltages are out of specification, then it will not work.

Note the generator needs to provide enough power for the load and charge the batteries at the same time. Thus, ensure you have a generator big enough for both.
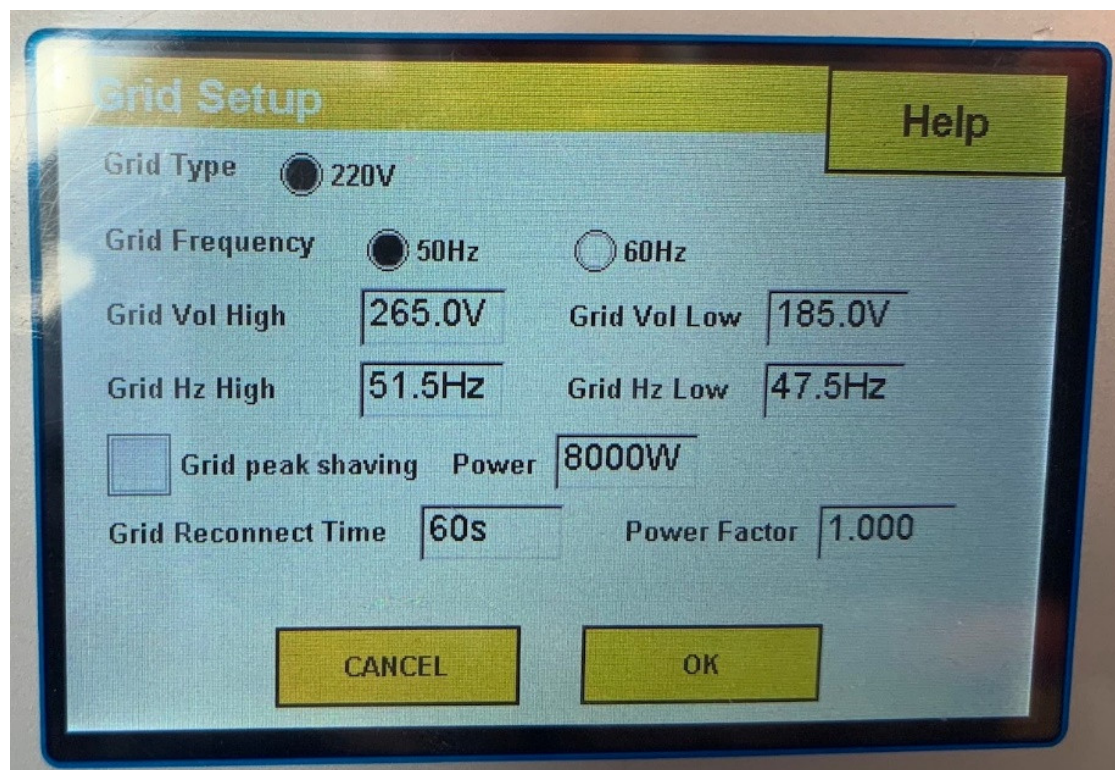
4.3. Setting Up the Batteries

To set up your batteries, click on the "Battery" icon on the settings page.
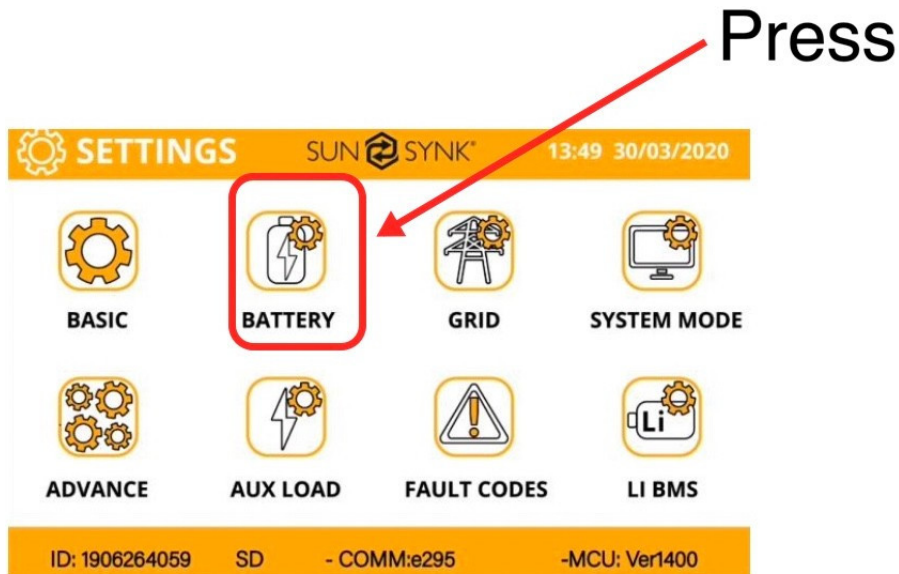
From here you can configure many settings:

a) Select battery size (if not auto set)
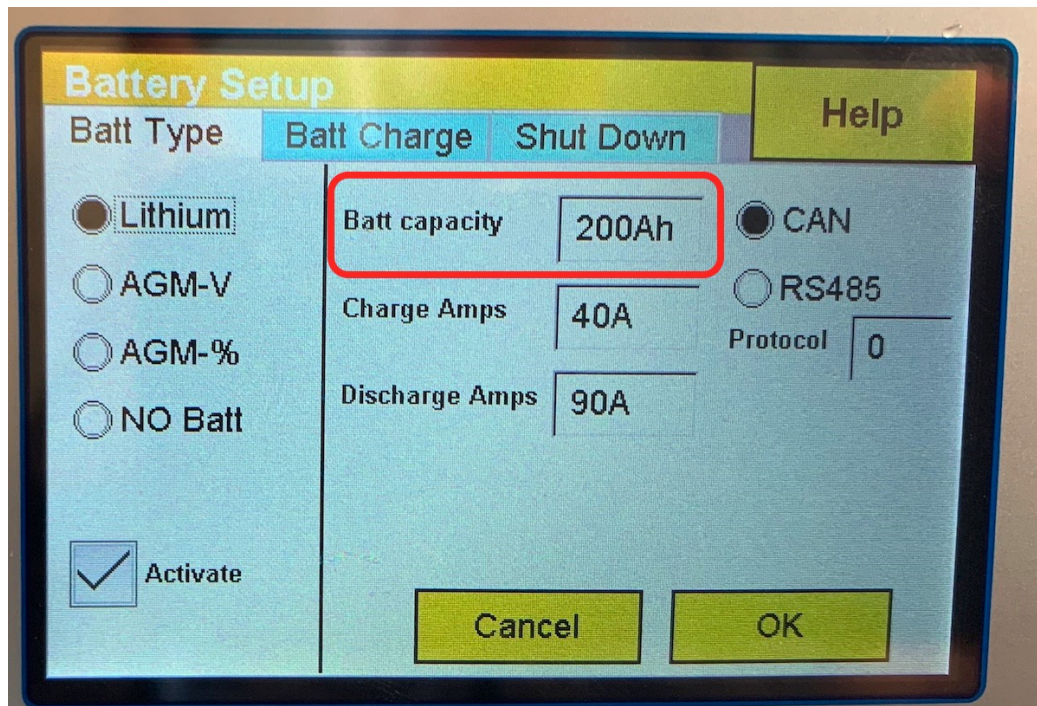
b) Max. charge and discharge of the batteries
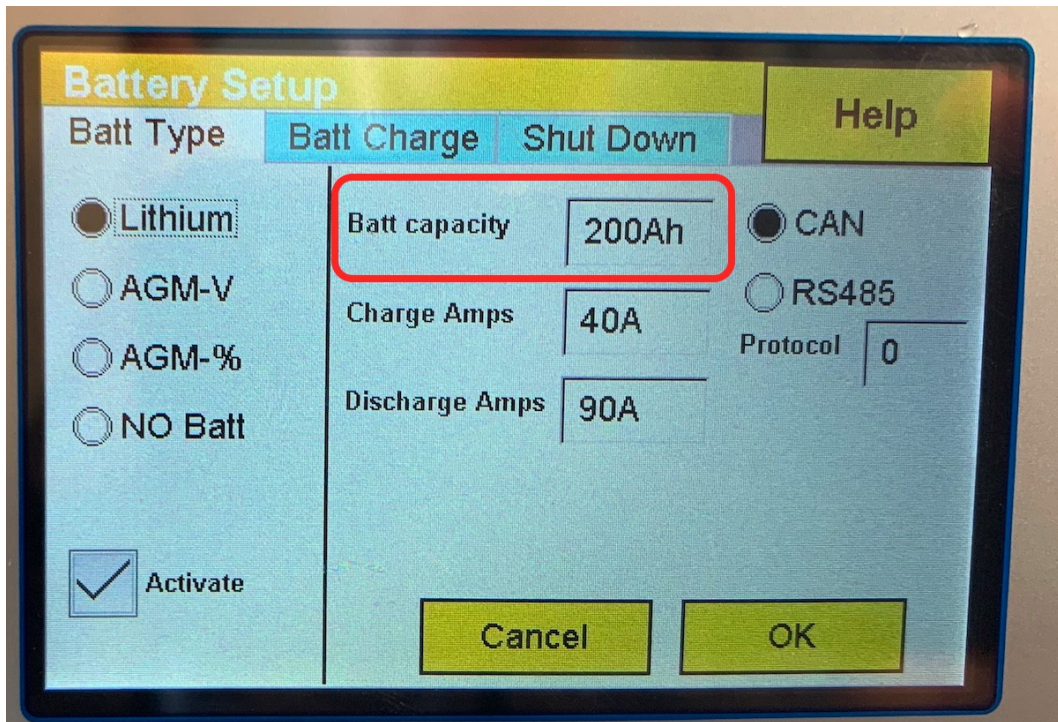
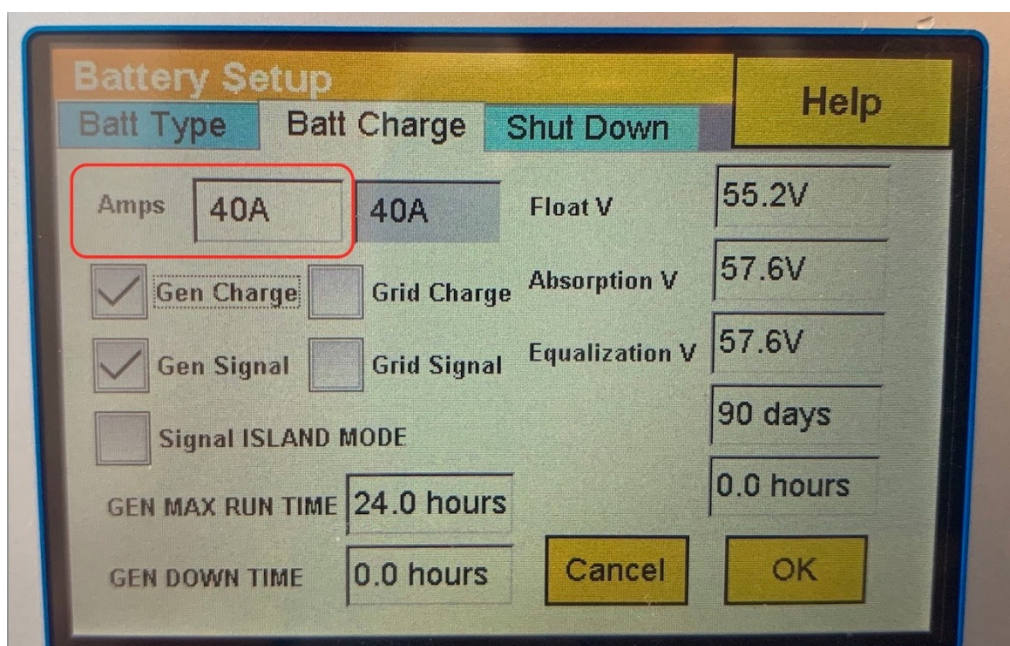c) On the Batt Charge sub-page, select "Gen Charge" and "Gen Signal".
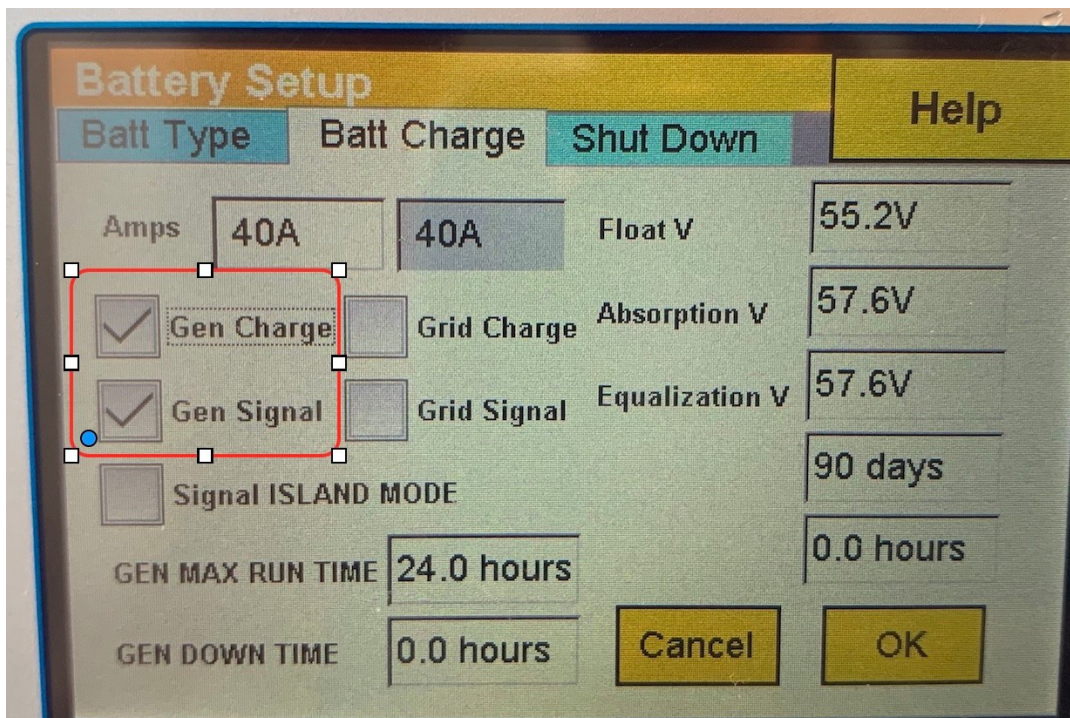
d) Set up the battery charging current.
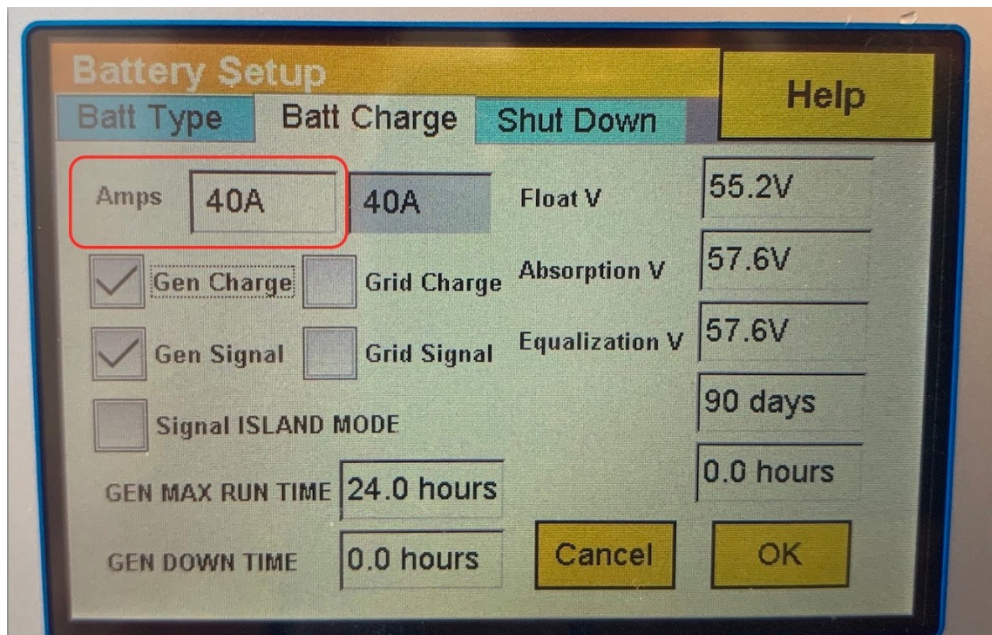
> ### NOTICE
>
> This cannot exceed the maximum power of the inverter, otherwise it will shut down. Also, you need to be aware of:
>
> a) C rating of the battery (charge and discharge).
> b) Battery cables (normally 100Ah per stack).

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 much lower.

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

a) 3 kW Max 50 Amp
b) 5.5 kW Max 80 Amp
c) 8.8 kW max 100 Amp

e) Set up generator run time and cool-down time:

Some generators, especially in enclosed areas, can only run for a max time, otherwise they may overheat. This setting can be done as below:
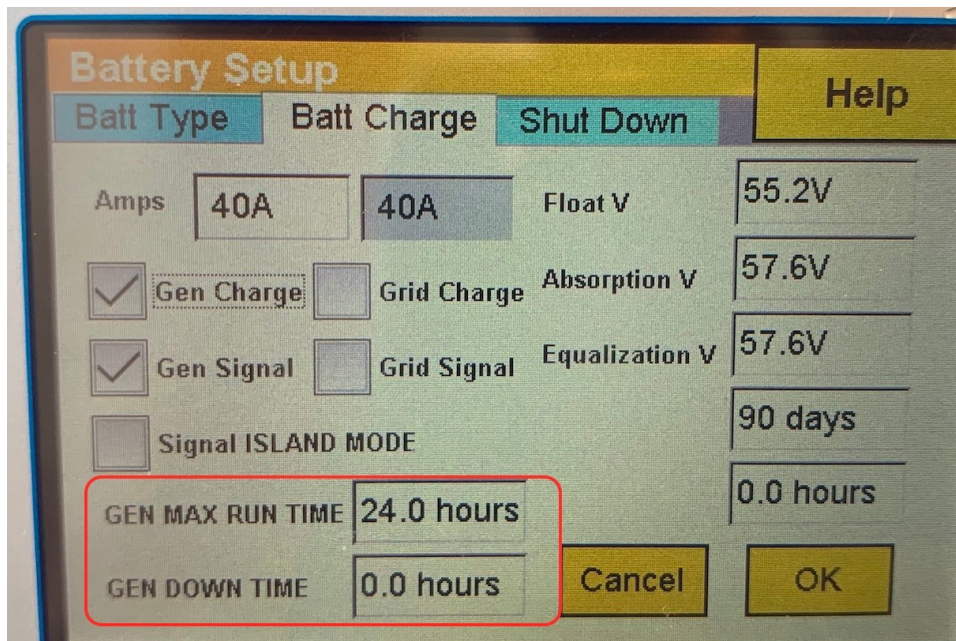
f) Select the battery shutdown voltage / percentage:
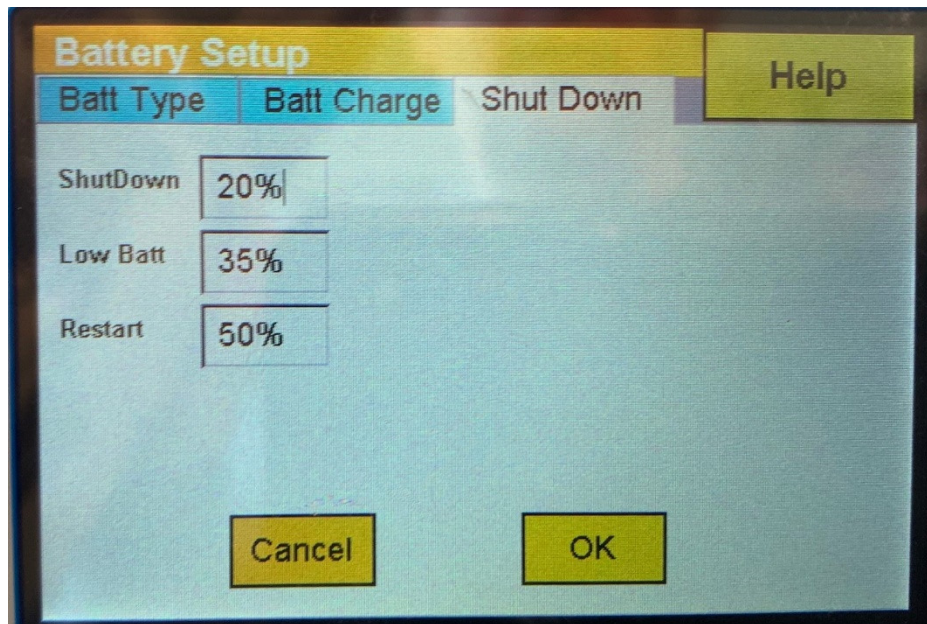
a) Shutdown is the battery SOC % that will cause the inverter will switch off the grid but not shut down completely.

b) Low Battery is battery warning beep.

c) Reset is the battery level the battery needs to reach before the battery will start the inverter again.
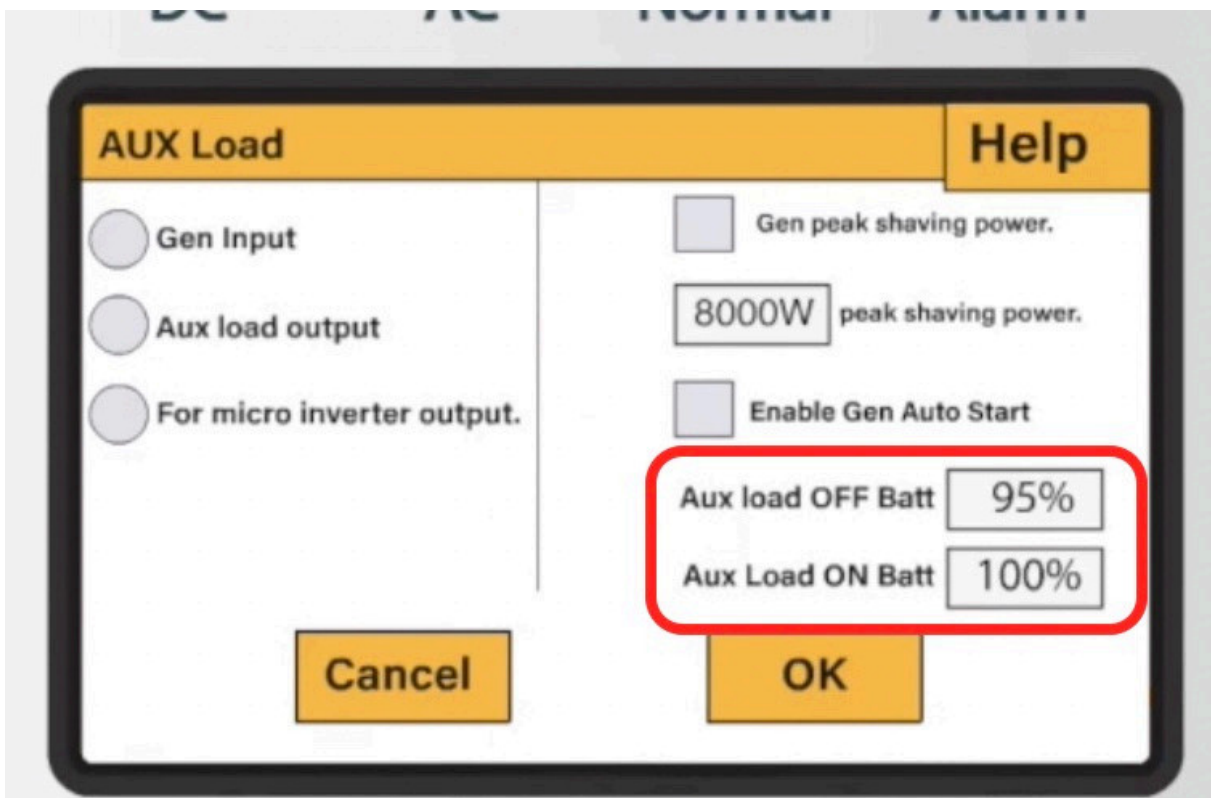
4.4. Selecting the Aux Port

On the navigation page, press the "Aux Load" icon.
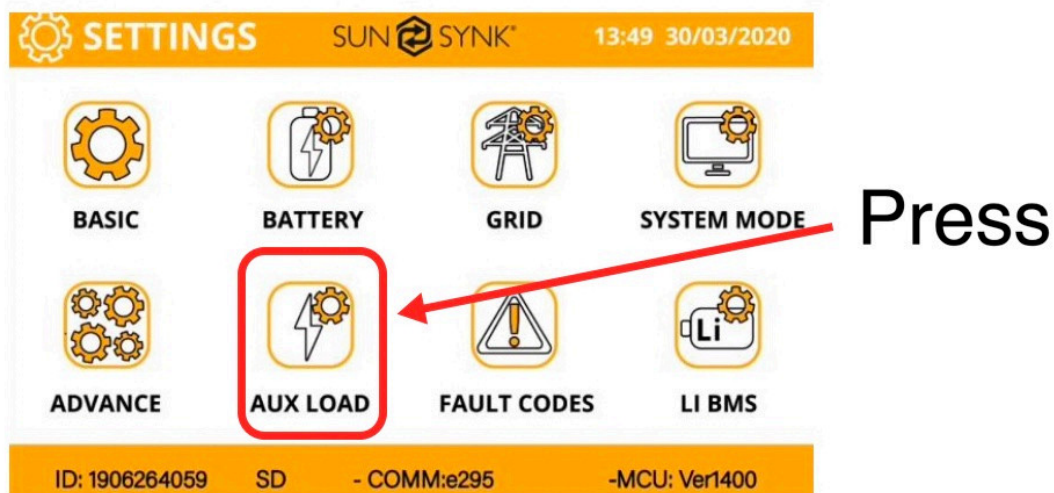
1) On this page, you need to program the Aux port as a generator port, as in the figure below:
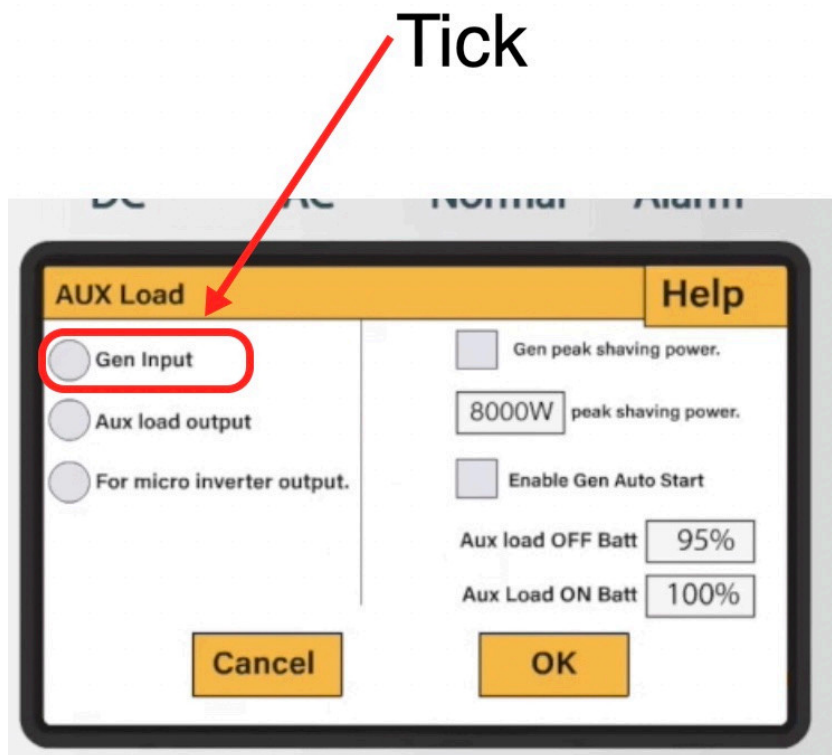
2) Then, select the start/stop value for the generator (we suggest Start at 35% and Stop at 95%).

4.5. Select System Mode

On the navigation page, press "System Mode". This is the heart of the Sunsynk inverter.

What this page displays:
- Prevent export power to the grid with "Zero Export".
- Limit power to supply to only all the house loads with "Solar Export".
- Limit power to supply only the loads connected to LOAD port with "Limit to Load only".

What you can do from this page:
- Define 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.
- Define to charge the battery from the grid or generator ticking Grid or Gen and define when it needs to occur.
- Define the time to discharge to the load or export to the grid by unticking Grid and Gen.

1) Select the maxiumum power of the inverter.

a) 3.6kW inverter maximum power: 3.6kW

b) 5.5kW inverter maximum power: 6kW

c) 8.8kW inverter maximum power: 9kW

2) Select "Zero Export" and "Limit to Load Only".

3) Select what to do with the solar power.

    a) If you are working off-grid, then you should prioritise the battery.
    b) If you are on-grid and the generator is just a backup, then prioritise the load.

SYSTEM MODE

Time   Power   SOC/V   Grid Gen

[X] Zero Export
    [ ] Solar Export
    [X] Limit to Load Only
[ ] Zero Export Power
3500 Max Sell Power

[ ] Use Timer   [X] Priority Load   Cancel   OK

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

SYSTEM MODE

Time   Power   SOC/V   Grid Gen

[X] Zero Export
    [ ] Solar Export
    [X] Limit to Load Only
[ ] Zero Export Power
3500 Max Sell Power

[X] Use Timer   [ ] Priority Load   Cancel   OK

Example of setting:

Time: this is the real time in which the function will be activated.
Power: this is the maximum power this function will control.
SOC: this is the SOC the battery must reach.
Grid: charge from the grid.
Gen: charge the batteries from the generator.

Tick the Gen box or Grid box to charge or do not tick to discharge.

4.6. Using the Grid Port

It looks a little complex, but it is quite simple. A few things to keep in mind:

You may choose to connect the generator to the grid port. This is okay from my personal experience, but not all generators are compatible, and the system will simply not work.

Remember that if you are connecting the generator to the Grid port, you must fit a CT coil and set the Zero Export feature to around 150W. This will prevent the inverter exporting power back to the generator.
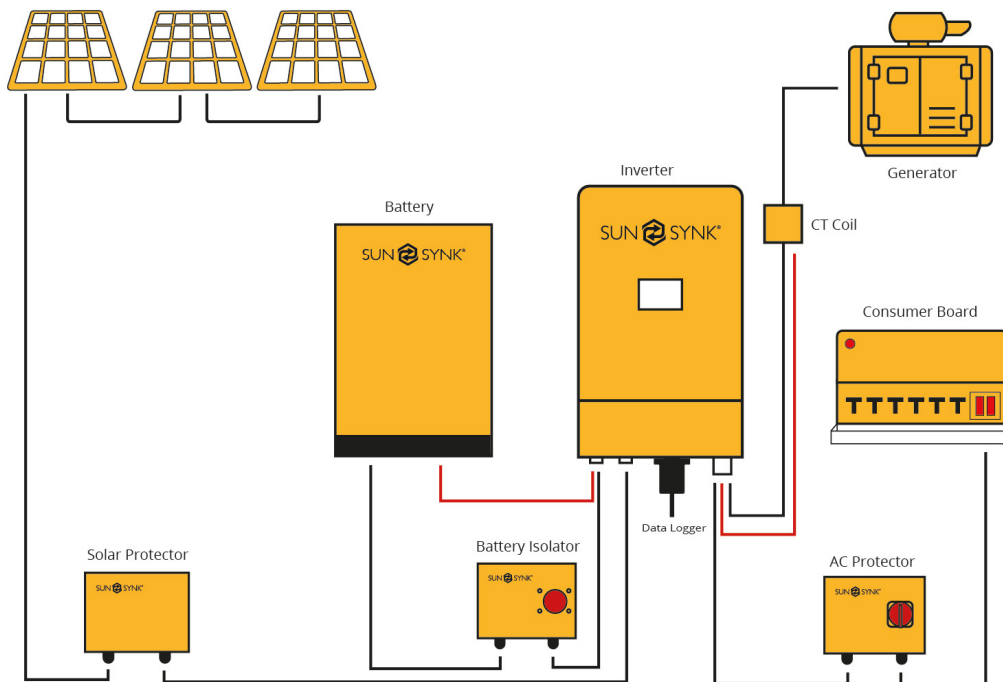
NOTICE

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 correctly and tight:

1) Shut the inverter Down

    a) Switch off Solar isolator.

    b) Switch off inverter.

    c) Switch off battery isolator.

2) Ensure that:

    a) all cable glands are tightened.

    b) the inverter cooling system is not obscured.

    c) you have completed all mandatory cable tests (do not carry out any earth leakage or each bond tests with the wires in the inverter; this many cause damage).

    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 partly enough to power the load and charge the battery at the same time typical sizes are. As a simple rule of thumb, the generator should be double the size of the 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. I there is a poor signal, this can take up most of your day waiting for the 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

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