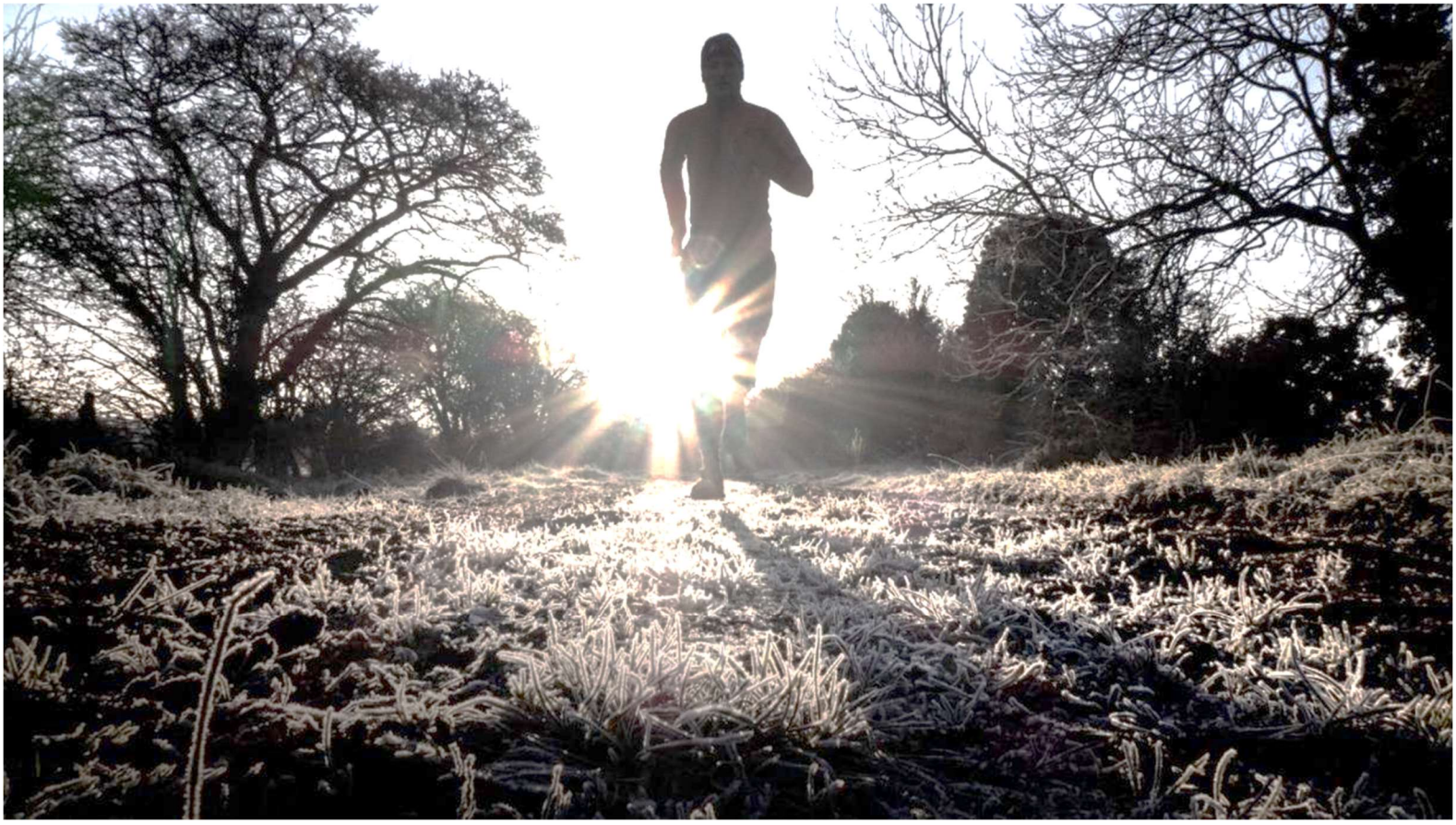
ENEFRAME

Next Generation Lithium Iron Phosphate Battery Systems



Quick User Quick Guide March 2021

Please read this entire guide as it contains important information that will ensure the safety and longevity of your batteries.

Congratulations on owning an EneFrame Lithium Iron Phosphate Battery Systems, crafted with care, tested individually, and hand assembled from A-grade Lithium-Ion-Phosphate battery cells.

Lithium-Ion-Phosphate is a leading energy storage technology, that allows high energy density, very efficient storage of electricity and exceptional longevity. The information in this short guide will provide you with the necessary information that will allow you to safely use and care for your batteries. If properly cared for, your battery should reliably operate for 15 years (or more).

Your EneFrame battery incorporates the following key capabilities:

- An advanced wireless management system that communicates and shares data between your batteries.
- A touchscreen interface to view and control your batteries.
- Intelligent battery balancing and regulation components to make sure that your batteries are optimally balanced and in good health.
- Over charge and under discharge cut-off.
- Alarms and controls to warn you of any important information or issues.
- Publishing key data to the EneFrame online monitoring website for your consumption, and our remote monitoring service to warn you of any detected issues.

Most Important Information and Warnings

- Warning: Electric shock can kill, and wrong connections will damage your equipment. Ask a professional to install and configure your batteries if you are not familiar with doing so.
- Register your battery at www.EneFrame.co.za immediately after installation. This will allow remote monitoring, support and automatic software updates. This will activate your 8-year battery guarantee. (Please refer to additional detail sections.)
- Connect your battery to your home WiFi. Make sure to connect your batteries to a Wi-Fi access point through its touchscreen interface. Your batteries will not be monitored and will not function optimally if not connected to a WiFi access point. It is critical for the longevity of your system.
- Do not short-circuit your battery. Although each battery comes equipped with a 250 amp fuse that can be replaced, a short-circuit may also damage the internal control components and require parts to be replaced.

- Do not rapidly discharge or charge your battery. Maximum discharge and charge rate is 0.5 C (half amp-hour capacity). For example, our 270 Amp-hour battery system must not be discharged or charged above 130 amps.
- Update your inverter / charger settings. Your battery needs to be charged at the correct voltage, and cut-off at the correct levels. (Please refer to additional detail sections.)
- Do not overcharge your battery, as this will result in premature failure and possibly fire. Recommended charge voltage per 12-volt (individual) battery is 14.2 volt maximum. At this voltage, the battery is 100% charged and higher voltages must be prevented. (Please refer to additional detail sections.)
- Keep your battery at a controlled temperature and away from water. Store your batteries inside in a protected area. Do not charge your battery below 0 (zero) degree Celsius at any time, as this will rapidly damage the battery. Do not charge, discharge, or store your battery above 40 degrees Celsius, as it will shorten its lifespan.
- Do not store your battery for prolonged periods in a completely discharged or charged state. The ideal state of charge when not using your battery is 40%-80%. A voltage of approximately 12.8 volt for a 12 volt battery is the correct storage voltage. Your battery can be stored safely for up to 6 months without any charging, but check periodically that voltage remains above 12 volt for a single battery. Completely switch off your battery and the control board when doing long-term storage and the battery is not being used. (Please refer to additional detail sections.)
- Try to not often discharge your batteries to absolutely zero capacity (fully discharged). Your batteries will last longer if there is 5%-10% left (about 12.2v) when you charge them up again.
- Do not connect in series batteries that are on very different levels of charge states. The batteries you connect to form a larger voltage battery that needs to be in balance, and individual batteries must not be used separately and then connected back to form a bank. If the batteries are very out of balance, more balancing may be required than what the balancing circuit can provide. If this happens, it is recommended to first charge the batteries up individually with a battery charger before connecting them, if you know that they are on different levels of charge.

Additional Detail – Charging and Voltages

You can safely connect multiple 12 volt batteries in series and parallel to achieve a larger battery. Connecting batteries in series increase the total voltage of the system.

Depending on the number of batteries you connect in series, your system will typically be configured to be either 12, 24, 36 or 48 volt nominal. Please refer to the table below for your specific charge configuration. Make sure to change your inverter / charger settings to these specifications.

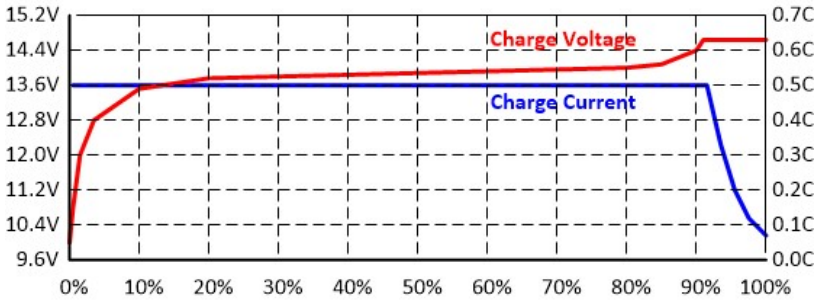
	12 Volt System	24 Volt System	36 Volt System	48 Volt System
Charger profile setting	Set your charger to a custom charge profile and select the bulk, absorption, and float charge as per below.			
Recommended bulk charge voltage setting (Maximum voltage)	14.1 -14.2 volt	28.2 - 28.4 volt	42.3 - 42.6 volt	56.4 - 56.8 volt
Recommended absorption time setting	<= 1 hour	<= 1 hour	<= 1 hour	<= 1 hour
Recommended charger float voltage setting	13.4 volt to 13.5 volt	26.8 volt to 27.0 volt	40.2 volt to 40.5 volt	53.6 volt to 54 volt
Minimum voltage (hard cut-off voltage, 99% discharged)	11.8 volt	23.6 volt	35.2 volt	47.2 volt

* Notes:

- Be sure to set the above settings in your inverter and charger. You typically need to select a “custom” battery profile, which will allow you to enter these values. It is critical that you do not exceed these

charge voltages, or completely drain your batteries past the minimum voltage. Over-charging could cause permanent damage and will shorten the life of your battery.

- Take caution that inverter voltage settings are often not accurate. When your battery has reached absorption full voltage and also when your batteries are in float, validate the accuracy of your voltage settings by viewing the true battery voltage readings on the battery touch screen interface.
- At the minimum cut off voltage (11.8 volt), the battery is already fully drained (0% state of charge). For longevity, you do not often want to discharge your battery past 5% state of charge as this puts stress on the battery and reduced its lifespan. So ideally, cut off the battery at a higher voltage (12.1 volt suggested.)
- Lithium-Ion-Phosphate batteries have a very consistent voltage at any given stage of charge. Only when the battery is either more than 90% charged the voltage starts to rapidly increase, or when it is below 10% discharged the voltage starts to rapidly drop. The voltage vs. state of charge profile is as per below.



Additional Detail – Connecting your batteries

It is important that batteries are connected correctly and safely. Wrong connections could damage your batteries and your other electronic equipment. Please follow these steps carefully. If you are not qualified to perform electric connections, please consult the help of a professional.

1. Ensure all your batteries are in the “off” position before connecting or disconnecting any cables.

2. Ensure all battery cables are disconnected from all the batteries.
3. Inverter connection first:
    a. Ensure your inverter is switched off.
    b. Connect the battery master positive lead to the positive terminal of your inverter, and the master negative, to the negative of your inverter.
4. Connect all battery terminal plugs to all batteries.
    a. Note! Make sure you are connecting batteries correctly depending on whether you are connecting batteries in series or in parallel. You need to use differently wired battery cables for different configurations.
    b. Note! Your total connected battery voltage must be compatible with your inverter.
5. On the master battery press the “pre-charge” button down and hold it pressed down for about 5 seconds (for a 48-volt system), and then switch on the master “on” switch while you are still

pressing the pre-charge button. About 2 seconds after turning on the master “on” switch, you can release the pre-charge button. For a 12- or 24-volt system, hold the pre-charge button for about 10-15 seconds before turning on the master on switch.

6. Turn on the master “on” switch on all the other batteries. The LED EneFrame lights should turn on for all the batteries.
7. Allow the batteries about 60 seconds to boot up and perform a self-test.
8. On the master battery touchscreen, go into “edit” mode and make sure to specify the battery ID obtained from the EneFrame management website. (Refer to the “remote monitoring” detailed section for these last steps.)
9. Add all the other batteries to the same bank.
10. Exit “edit mode”. All batteries should now be visible and displayed in blue on the main screen.

Additional Detail – Remote monitoring

The remote monitoring website allows you to see the history of your batteries, and any possible system warnings or issues. It stores key statistics about your battery, which is important to view from time to time to ensure your batteries are functioning optimally. You can access the remote monitoring website login link from the main EneFrame website at www.EneFrame.co.za

It is important to register your battery bank on the monitoring website immediately after installation. When you register and create your battery location, you get a unique battery ID code, which you must enter on your battery control screen in order for it to post data and receive software updates automatically.

Registering your batteries allows our free remote monitoring service to advice you of any potential issues with your batteries, and automatically activates your battery guarantee. If your batteries are not loaded onto the online platform and if they are not connected to Wi-Fi to submit data, then your warrantee is void.

The remote monitoring website shows you the history of the following battery values:

- Temperature per battery
- Daily min and max statistics
- All system messages and alerts
- Voltages per cell in each battery
- Cell balancing counters

It also allows you to download the full history of your batteries in an Excel file, which you can analyse and use as desired.

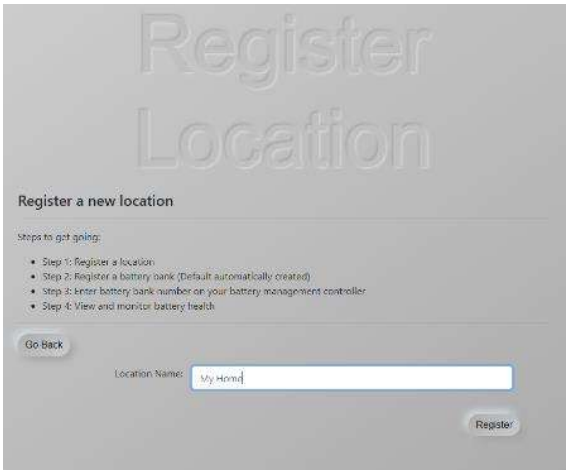
Please follow these steps to register your batteries online:

1. Go to https://eneframe.bluequark.co.za
2. Click on register and provide your details:

3. Look for the confirmation email that is sent you’re the email address you provided and click on the registration link.

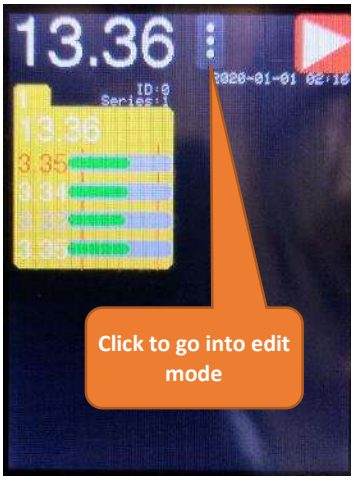
4. Login using your new account:

5. Register a new location. (You can have more than 1 location):

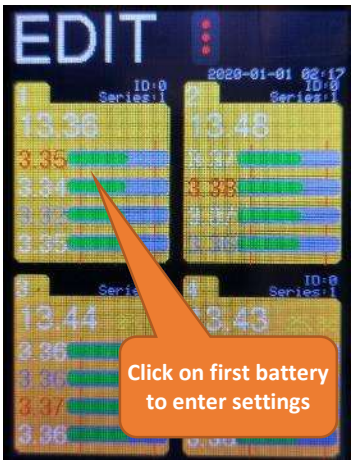


6. Observe your default battery created. You can edit its name. Observe the unique 5-digit code:

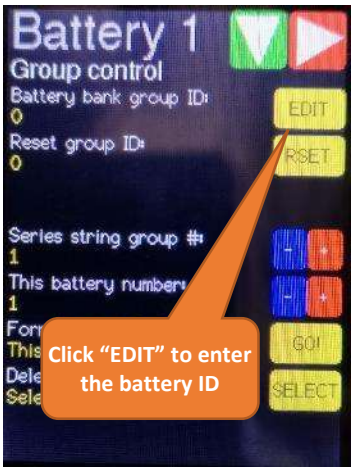
7. Go to your master battery and on the touch screen interface go into “edit mode” by clicking on the three dots at the top of the screen.

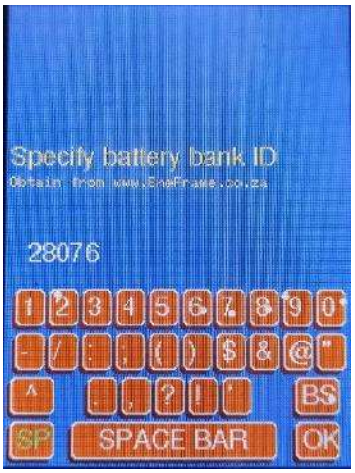


8. Click on your master battery (the first one listed on the screen).

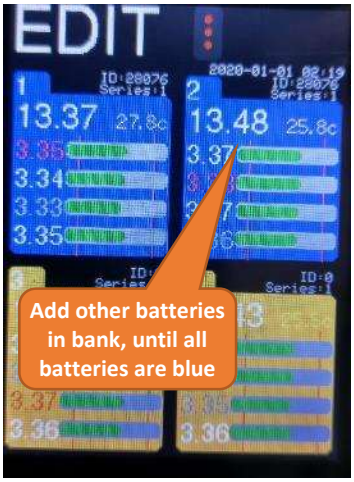


9. Enter this unique code by clicking on “EDIT”.





10. Go to each of your other batteries (displayed in yellow as it does not have a code entered), and click on “get ID” to copy from the main battery. You can also change your battery number, so that each battery is numbered from 1 to 4 (for example if you have 4 batteries in this bank).



11. When you are done, again click on the three dots at the top to exit “edit mode”.
12. Go to the general settings on your battery touch screen by clicking the right arrow on the top right of the screen twice. Set your primary (and optionally secondary) Wi-Fi access point and enter the password of each.
13. Click on “test internet” to ensure connectivity.
14. Your batteries should now start to publish data to the online website every 20 minutes, which you will be able to view by going to the online web portal.

Additional Detail – Other information

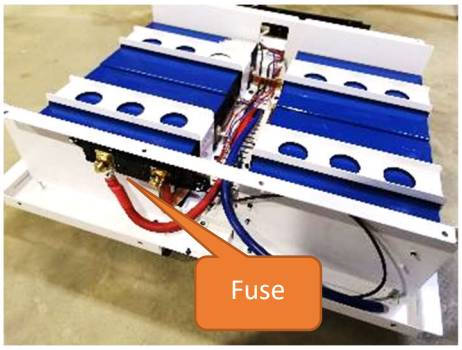
Please note the below other relevant information

Pre-charge surge protection circuit:

- The master battery (the one with the touch screen), also comes with a pre-charge button that limits inrush current when connecting your batteries to equipment (i.e. the inverter).
- This protects your inverter, as it prevents the sudden rush of current that creates a massive spike in electric flow into your inverter.
- When ever possible, make sure to press the pre-charge button and hold for about 5-10 seconds before turning on the final master switch on your batteries. final connection to the positive terminal of your master battery.
- Warning: Always ensure your inverter and equipment is off before connecting to or removing from the batteries.

Fuses:

- Each battery comes equip with a 250 amp fuse that is on the positive battery terminal. This protects the battery in case of accidental short-circuit. If it is blown, it must be replaced with one of similar capacity.



Battery balancing and resistor heat:

- As your battery is balancing cells, it will burn of excess energy through its control circuit and resistors.
- This will generate heat, which is normal. If doing substantial balancing, the aluminium plates that are attached to the resistors may got very hot to touch and may pose a burn risk when pressed against skin.
- Also for this reason, do not place any items or materials that are susceptible to heat damage close to the batteries.

Additional Detail – Control System Interface and settings

In the previous section we explained how to do the basic setup of your battery bank so that it publishes data to the online monitoring website. In this section we will go through some of the other main screens and settings on your battery touch screen interface.

(Document in progress. To be specified.)