
Regulator Programming for LiFePO₄ Batteries (24V)

January 2019

Introduction

Balmar **MC-624** regulators produced after September 2017 contain a standard program for charging lithium (LiFePO₄) batteries. Consult the **Regulator Operation Manuals** available on the Balmar website (www.balmar.net/operation-manuals/) to select the LiFePO₄ standard charge profile ("LFP") for current production Max Charge regulators. If you purchased a Balmar regulator prior to September 2017, you can still set up your regulator to charge LiFePO₄ batteries by using the **Advanced Programming Mode** available in every Max Charge Regulator.

This guide is intended for **MC-624** regulators manufactured prior to September 2017 that did not come pre-programmed with the LFP battery program. This guide will walk you through re-creating the LFP program using the Advanced Programming menu (see pg 11-12 in your regulator manual for more information on **Advanced Programming Mode**). This program is a generalized version of the recommendations provided by several battery manufacturers. For best performance and compatibility, contact your battery manufacturer and use their recommended values in place of ours. LFP batteries are more sensitive to abuse than traditional chemistry batteries. It is **HIGHLY** recommended that this work, in addition to evaluating or installing your charging system (as a whole) be performed by a qualified marine electrical installer that has experience with Balmar charging system products and LFP batteries.

Instructions

The closest starting point is the UFP program, if your **MC-624's** battery program is set to a different chemistry, change to UFP and allow the regulator to save (display shows "SAV") before following the step-by-step guide. See page 9 of the manual for step-by-step instructions for changing the battery program. If you have previously made changes to the UFP program in the advance programming menu and you do not wish to keep them, you can erase the changes by changing to a different battery program (like Fdc), allowing the regulator to save, changing the program back to UFP, and finally allowing the regulator to save again. The battery voltage must be 25.0 volts or higher in order to save the program changes. The regulator will scroll through the program mode three times to give you the opportunity to make the changes. Make use of this opportunity to double check that the values you entered are correct.

1. Turn power to the regulator on
2. Once the regulator is running place the magnet on the Red Dot. The display will acknowledge that it sees the magnet by showing a red dot near the top of the display, between the 2nd and 3rd digits (above the decimal point).
3. When the display shows "PRO" remove the magnet

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4. The display will then show "PRA" to indicate that the regulator has entered Advanced Programming
5. When "CL" is displayed place magnet down
6. When the display shows "29.6" pick the magnet up
7. When "CL" is displayed again place magnet down
8. Continue to hold the magnet down. The display will show "29.6", and begin counting down.
9. When the display shows "28.7" pick magnet up
10. When "bv" is displayed place magnet down.
11. Continue to hold the magnet down. The display will show "28.2" and begin counting up.
12. When the display shows "28.6" pick magnet up.
13. When "B1c" is displayed place magnet down
14. Continue to hold the magnet down. When the display shows "00.5" pick magnet up.
15. When "B1c" is displayed again place magnet down
16. Continue to hold the magnet down. The display will show "00.3" and begin counting down.
17. When the displayed value shows "00.2" pick the magnet up.
18. When "Av" is displayed place magnet down.
19. When the display shows "27.6" pick magnet up
20. When "Av" is displayed place magnet down.
21. Continue to hold the magnet down. The display will show "27.8", and begin counting down.
22. When the display shows "27.2" pick magnet up
23. When "AL1" is displayed place magnet down
24. Continue to hold the magnet down. The display will show "107" or "100" (depending on revision), and begin counting down.
25. When the displayed value shows "030" pick the magnet up. Note: setting "AL1" to the minimum value of "030" enters the regulator into the Battery Temperature Menu. The regulator will automatically return to the Advanced Programming Menu after the "SLP" option. We change "AL1" to the correct value on the last few steps.
26. When "B1L" is displayed place magnet down

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27. Continue to hold the magnet down. The display will show "052" and begin counting down.
28. When the displayed value shows "044" pick the magnet up.
29. When "B2L" is displayed place magnet down
30. Continue to hold the magnet down. The display will show "052" and begin counting down.
31. When the displayed value shows "044" pick the magnet up.
32. When "SLP" is displayed place magnet down
33. Continue to hold the magnet down, the display will show "06.0" and begin counting down.
34. When the displayed value shows "02.8" pick the magnet up.
35. The display will scroll through all the options again. When "AL1" is displayed place magnet down.
36. When the display shows "030" pick the magnet up.
37. When "AL1" is displayed again place magnet down.
38. Continue to hold the magnet down. The display will show "030", and begin counting up.
39. When the displayed value shows "090" pick the magnet up.
40. Let the regulator run through the menu system until the display shows "SAV", goes blank, and then begins running normally.

Additional Notes

- If the "Ev" or "Elc" values are accidentally adjusted the regulator could enter equalize mode. If accidental adjustment occurs, shut down the regulator immediately and start over.
- Many LiFePo₄ batteries have a Battery Management System (BMS) that may disconnect the battery from the alternator when charging is complete. The regulator needs to be shut down before the battery is disconnected as running an alternator without some type of load will damage the alternator. This is doubly true if the battery can be disconnected during high current charging, causing a load dump. The load dump can easily cause a high voltage spike which will destroy the alternator's rectifier, at minimum. ***This is not a warrantable failure.*** To reiterate: THE ALTERNATOR MUST BE SHUT DOWN BEFORE DISCONNECTING THE BATTERY. THE ONLY SAFE WAY TO SHUT DOWN THE ALTERNATOR IS TO TURN OFF THE REGULATOR. The preferred method is to disconnect the regulator's ignition wire, but

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if used as an EMERGENCY ONLY shutdown, disconnecting the regulator's power input wire in addition to the ignition wire has a very, very low chance of damaging the regulator or alternator.

- Applying too much charge current to a LFP battery will, at the very least, permanently damage the battery's capacity. It is **CRITICAL** to ensure that the alternator is not capable of exceeding the maximum continuous charge current rating of your battery (or batteries). As always, check with your battery manufacturer for specifics. If your alternator is capable of outputting more current (at any time or condition) than the battery (or batteries) can handle, you may use the **Amp Manager** feature on the **MC-624** to lower the maximum field drive output, and thereby lower the maximum alternator output current. See page 10 of your regulator manual for details and instructions. Be aware that it is not an exact 1:1 correlation between field output and alternator output, so start with more reduction (lower output) than you think you need and adjust accordingly. The **Amp Manager** setting can be adjusted under the **Advanced Programming** menu with the menu heading "AP".
- It is strongly recommended that an alternator temperature sensor (**MC-TS-A**) be used when charging LFP batteries. Given the extremely high charge acceptance rate of LFP batteries, the alternator will be driven to full output for almost all of the charge cycle. This can cause alternator overheating which will significantly shorten the lifespan of your alternator. When equipped with the **MC-TS-A** temperature sensor, the **MC-624** will help you protect your investment by limiting the field current applied to the alternator to 50% maximum when over the "AL1" temperature threshold. If you cannot use an **MC-TS-A** in your application, you should monitor the alternator's temperature (measure as close to the loop ends of the stator as possible) and discontinue charging if the alternator temperature rises above the maximum recommended level. You may also use the **Amp Manager** feature on your **MC-624** to reduce maximum output. Reduce the output until a tolerable alternator temperature is maintained under all conditions.
- Most LFP battery manufacturers specify minimum and maximum charging temperatures to be from freezing (32°F, 0°C) to around 111°F (44°C). Again, consult with your battery manufacturer for specifics. When equipped with a **MC-TS-B** the **MC-624** can disable charging if the battery temperature exceeds the "B1L" or "B2L" temperature threshold and re-enable charging when the temperature drops below the threshold. This feature is meant to supplement, not replace, your BMS's temperature protection features. "B1L" and "B2L" should be adjusted to be slightly less than BMS's temperature threshold. If a **MC-TS-B** is installed, install it **ONLY** to the "Battery #2 Temperature Sensor" pins (see page 5 in the **MC-624** manual). This is because the "Battery #1 Temperature Sensor" is used for Battery Temperature Voltage Compensation which cannot be completely disabled on the **MC-624** revisions

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in question. The #2 Sensor is used only for display and detecting over-temperature conditions.

Balmar Technical Support is available from 8:30 am – 7:30 pm EST Monday through Friday. Please call on us at +1-360-435-6100 x3 should you have any questions about Balmar products.