

# *Immortal*

## *LTO Cold-Weather Batteries*

### CONFIGURATION GUIDE FOR 5S LTO (12V SYSTEMS)

This document provides technical guidance for the use of a conventional Lead-Acid or (Lithium) Charge Controller newly equipped with 12V Titan LTO Immortal Cold-Weather Storage Batteries. In case you are not familiar with the behaviour of Lithium Titanate, included are a few explanatory comments. For more information on our batteries, you may refer to the document "Why Choose Titan LTO Immortal Cold-Weather Batteries," and other information available from TitanLTO.ca

**Titan Immortal batteries operate at a voltage range compatible with all configurable 12V Controllers.**

#### CRITICAL CHARGE SETTINGS

1. Bulk/Absorption Voltage: Set to from 13.0V - 14.0V (5 cells in series, maximum 2.8V per cell).
  - LTO does not suffer much "voltage-sag," so when charging is complete, within a minute or so, at room-temperature, your final resting voltage will be ~0.1V below the Bulk Setting.
  - At and between -20C and -40C the resting voltage will drop by a total of 0.5V – 1.2V respectively.
  - The "Gel" Setting Workaround: If your controller lacks a "User" mode, the Gel Setting (14.1V–14.4V) is within BMS Specs and the manufacturers' recommendations for safe use.
2. Float Setting: For maximum life, turn OFF or use a Float Voltage setting of 13.0V – 13.5V.
  - A float is not necessary, as LTO does not suffer from the weaknesses of Lead Acid: There is no sulfation at partial States of Charge (SOC), it is tolerant of high charge rates at up to 100% SOC, and has an extremely low self-discharge rate of less than 1% per month.
3. Equalization: **MUST BE DISABLED.** High-voltage equalization is not necessary, and although the BMS will prevent charging above 14.5V, there is a remote chance frequent operation will damage the BMS and disable your battery.
4. Temperature Compensation: **MUST BE DISABLED** (Set to 0.0mV/°C). Even at -40°C, the internal resistance of an LTO battery is very low.

#### SOC READINGS

All things being equal, a Lithium battery has a higher resting voltage than Lead-Acid, and maintains a higher voltage for the majority of its cycle, then at roughly 20% SOC the voltage will drop quickly. Because the voltage curve is so flat, traditional "bar-style" battery meters or gauges designed for Lead-Acid will be inaccurate. We recommend a shunt-based battery monitor for precise tracking.

#### NOTE:

1. Because other Lithium batteries behave similarly, if you can change the SOC meter to a Lithium Setting without affecting any of the Controller settings, this will be quite accurate.
2. As a temporary measure, it is possible to just watch the gauge until it starts to drop, then you know you are at about 20%.