

Fuel Gauge Recalibration

Recalibration

If the battery is in need of fuel gauge recalibration, the red LED on the CH5000A will flash upon insertion of the battery.

This indicator provides feedback to the user on the accuracy of the fuel gauge and avoids unnecessary battery calibration cycles.

The user has the option to calibrate the fuel gauge and charge the battery, or to only charge the battery.

This option is given because a recalibration cycle is longer than a charge cycle & it may not be convenient to go through the calibration cycle.

To recalibrate the battery, press the calibrate button on the front of the CH5000.

No action is required if only a recharge is required, as the charger will automatically begin to charge the battery.

The blue calibration LED will flash to indicate that the battery is undergoing the recalibration cycle.

There may be a short delay before the calibration begins. During calibration the discharge resistors will heat up and the fan will operate to maintain temperature within acceptable limits. Removing the battery &/ or pressing the calibration button again will re-start the process from the beginning.

At the end of this procedure the blue LED will stay constant indicating a fully charged, fully calibrated battery.

The most common cause of calibration failure is overheating of the pack during discharge. Please keep the charger away from direct sunlight or heat sources.

What is recalibration & why is it needed?

The fuel gauge in the battery uses a highly accurate voltmeter, ammeter and time clock to measure actual charge in & out of the battery pack. In addition there are algorithms to compensate for the effects of discharge rate, discharge temperature, self-discharge and charging efficiency etc.

All this combines to provide a highly accurate fuel gauging system. What is also required is the means to ensure the continued reliability of this system throughout the life of the battery pack.

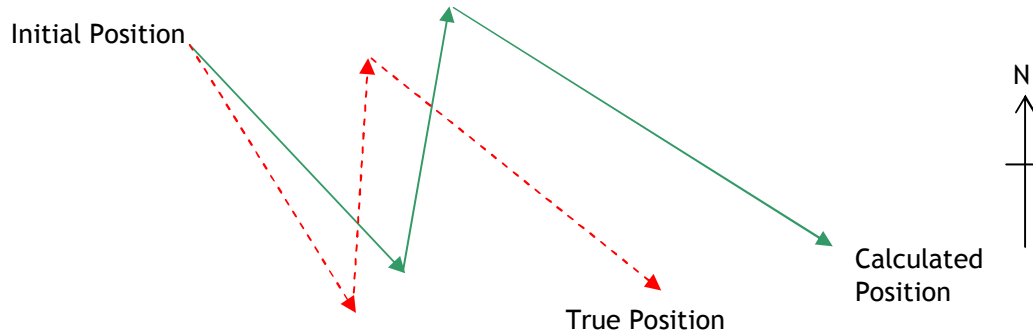
Even with all this technology, the only time at which the battery is absolutely certain of its real capacity is when it is either completely full or completely empty. Anywhere in between is a calculated estimate - albeit a highly accurately calculated one.

Also, as the battery ages, the amount of available capacity shrinks - so each cycle the "full" point gets a little bit lower. Imagine if the fuel tank in your car got smaller as your car got older - you'd need to occasionally recalibrate your car's fuel gauge too.

What's more, if the battery only sees partial charges and discharges during its application, then it may not get the benefit of a "full" or "empty" reference point for some time and must rely more and more on its calculated figure. So the fuel gauging system may be subject to drift during use.

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This is analogous to navigating by dead reckoning - you take compass readings & set off on your heading to your waypoint & then change course etc. After a few changes in course, the minor errors in your execution of the course can become amplified and your true position can drift from your calculated position.



In use, as the fuel gauge mathematically works out the battery's remaining capacity. It will also work out an estimated accuracy figure known as the "Max Error". This keeps track of the overall accuracy of the system. In this way the battery can tell the device not only how much capacity is remaining, but also how reliable this estimate is. When an Inspired Energy battery achieves a Max Error of 10% the recalibration bit is set. This is an electronic Flag which tells the system that the fuel gauge is in or out of calibration.

Some devices use this recalibration bit to trigger a note on the device screen to tell the user to recalibrate their battery. Other systems simply put a note in their instruction manual to recalibrate the battery every so often. The CH5000A uses the recalibration bit to tell the user if recalibration is necessary and flashes the red LED if the battery fuel gauge is becoming inaccurate.

So the recalibration is used to re-set the fuel gauge algorithms, re-establish the full and empty points, and re-calculate the actual capacity in the battery. In this way, even as the battery ages and things change, the accuracy and reliability of the fuel gauge can be retained throughout the life of the battery.

Now in order to carry out a full recalibration the following must occur:

- Fully charge the battery (this establishes the current "Full" point.)
- Fully discharge the battery (This tells the system how much charge is available for discharging, and re-sets the Max Error)

At this point the battery is calibrated, but it is also empty - so it needs a full recharge to return it to use.

This process can be achieved inside the device (Fully charge the battery & then leave the device on until the battery is fully discharged, then recharge it again) but this can be time consuming and inconvenient. Also many electronic devices operate a device shut-down before the battery is fully discharged. These devices will not be capable of recalibrating smart battery packs and an external device such as the CH5000A must be used instead.

A desktop device like the CH5000A, which automatically takes the batteries through this process, is a useful alternative, ensuring accuracy and reliability of the fuel gauge throughout the life of the battery. As the process of recalibration includes the charging process it is most convenient to build in this functionality into a charger and give the user the option of a regular charge or a recalibration with a charge.