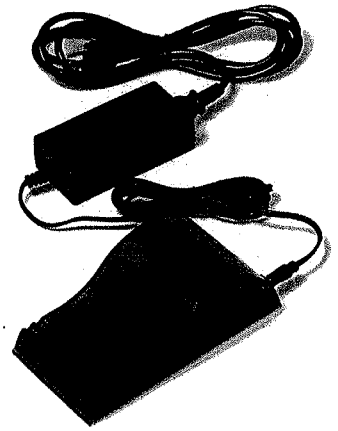
RESPIRONICS®

EverGo™
Portable Oxygen Concentrator

EverGo Smart Charger/Recalibrator

The EverGo Smart Charger/Recalibrator is an external, smart battery charger that can recharge an EverGo battery and recalibrate its fuel gauge. This recalibration enables the battery to calculate a highly accurate estimate of remaining battery life, shown on the battery fuel gauge, even as the battery ages.



Package Contents

The following items are included with your EverGo Smart Charger/Recalibrator. If any of the items shown below are missing, contact your home care provider.

- Evergo Smart Charger/Recalibrator
- DC Power Supply With Input Cable
- AC Power Cord
- This Instruction Guide (not shown)

Cautions

- Do not open the charger or power supply case. There are no user-serviceable parts inside.
- Do not expose the charger or power supply to water or conductive liquids; this is not a sealed case.
- Replace a battery if it fails to charge or if you notice a decrease in capacity.
- Inspect the power cord for signs of damage. Discontinue use and replace if damaged.
- Use only the power supply provided with the charger.

Recharging Time

If the EverGo battery is depleted, it takes approximately 4 1/2 hours to fully charge.

Setting Up Your Charger/Recalibrator

1. Place the charger unit on a flat, level surface away from sources of heat and moisture.
2. Plug the cable from the DC power supply into the back of the charger and connect the power supply to an electrical outlet using the AC power cable that came with your unit.

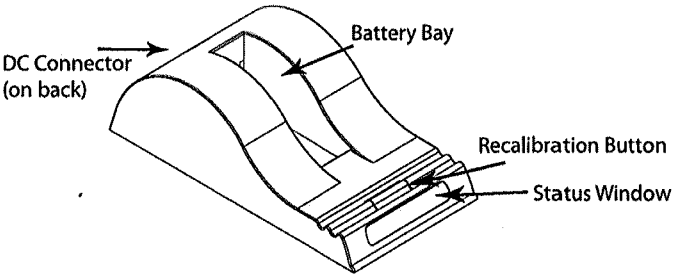


Figure 1. Battery Charger/Recalibrator

Charging a Battery

1. Place the battery into the battery bay making sure that the 5-way connector is fully seated, as shown in Figure 2.
2. In the status window, the FLASHING GREEN LED will light showing that it is charging. When the battery is fully charged, the LED will turn solid green.

Figure 2. Battery Inserted in Battery Charger/Recalibrator

LED Color Indicators

When a battery is inserted in the battery charger, an LED in the status window will tell you the status of the battery.

Flashing Green:	Battery is currently charging.
Solid Green:	Battery is fully charged and may be removed.
Flashing Blue:	Battery is currently in recalibration mode.
Solid Blue:	Battery fuel gauge has finished recalibration and is fully charged.
Flashing Red:	Battery fuel gauge is in need of recalibration.
Solid Red:	Error -- battery cannot be charged. Please call your home care provider.

Checking the Battery Fuel Gauge

The EverGo battery uses four lights as a fuel gauge. The fuel gauge accuracy in normal use is typically ±1.5%. To check the fuel gauge, press the PUSH button on the battery (not the button on the battery charger).

4 Lights:	75% full to 100% full
3 Lights:	50% to 75% full
2 Lights:	25% to 50% full
1 Light:	10% to 25% full
Light Blinks:	Less than 10% full -- recharge battery.

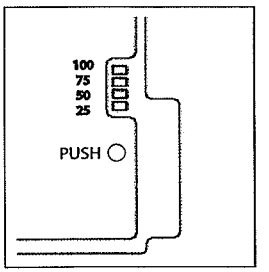


Figure 3. Battery Fuel Gauge

What is Recalibration? Why is it Needed?

The battery's fuel gauge is a highly accurate estimate of the life remaining in the battery. To calculate this estimate, the system must know the battery's full point and empty point. This is not as easy as it sounds because as a battery ages, the amount of available capacity shrinks. So every time you charge it, the full point gets slightly lower. Likewise, the empty point changes as well. Recalibration resets the fuel gauge as the battery gets older, resulting in the best possible estimate of remaining life.

If your battery needs to be recalibrated, you will see a FLASHING RED LED in the charger's status window when you put it in the battery bay for recharging. The time required to recalibrate the EverGo battery ranges from 14 to 20 hours. For this reason, you may want to keep a spare battery on hand.

Additional EverGo batteries (PN 900-102) are available for purchase. For more information, contact your home care provider.

Note: Recalibration takes less time if the battery is fully charged.

Caution: During recalibration, the Battery Charger/Recalibrator heats up and the fan runs to cool the unit. The most common cause of recalibration failure is overheating. Please do not use the charger in direct sunlight or near heat sources.

How to Recalibrate your Battery

If the battery fuel gauge needs recalibration, when you insert the battery in the charger, a FLASHING RED LED will appear. If the LED does not flash red when you put the battery in the charger, it does not need to be recalibrated and it will recharge automatically.

If the FLASHING RED LED appears, you have two options: to only charge the battery (and postpone recalibration), or to recalibrate the fuel gauge and charge the battery. *The recalibration cycle is much longer than a charge cycle, so if you need the battery soon, you may want to postpone recalibration for a later time.*

- To recharge the battery and postpone recalibration, take no further action because the charger will automatically begin to charge the battery. The FLASHING GREEN LED will light up to indicate that the battery is charging.
- To recalibrate the battery while charging it, press the Recalibration Button on the front of the charger (shown in Figure 1). This will cause the FLASHING BLUE LED to appear, indicating that the battery is undergoing the recalibration cycle. There may be a short delay before recalibration begins. When the battery is fully calibrated and fully charged, the SOLID BLUE LED will light up.

Note: Recalibration is initiated each time the button is pressed, so do not press the recalibration button part way through the recalibration cycle, because this would cause recalibration to begin again.

Specifications - Charger/Recalibrator

Weight:	8 oz. (235 g)
Dimensions:	2.25 in. x 7 in. x 3.5 in. (58 mm x 180 mm x 92 mm)
Mating Connector:	5-blade standard battery connector
Communications Compliances:	System Management Bus Rev 1.0, Smart Battery Data Specification rev 1.0, and Smart Battery Charger Specification Rev 1.0 compliant

Specifications - Power Supply

Weight:	17.6 oz. (500 g)
Dimensions:	4.6 in. x 1.5 in. x 2.4 in. (119 mm x 38 mm x 60 mm)
Input:	90 to 260 VAC, 50/60 Hz
Output:	24 V, 2.5 A

Disposal

Dispose of the device in accordance with local regulations.

How to Contact Respironics

For additional information about your EverGo system, call the Respironics Customer Service department at 1-800-345-6443 (US and Canada only) or 1-724-387-4000. Visit Respironics web site at www.respironics.com

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Fuel Gauge Recalibration

If fuel gauge recalibration is needed, the red LED on a calibrating charger will flash upon insertion of the battery.
This provides feedback on the accuracy of the fuel gauge and avoids unnecessary calibration cycles.

The user can either calibrate the fuel gauge and charge the battery, or just charge the battery.
Calibration takes longer than charging & it may not be convenient to go through the calibration cycle.

To recalibrate the fuel gauge, press the button on the front of the charger.
The charger will automatically begin to charge the battery if the button is not pressed.

The blue LED will flash to indicate that the battery is undergoing the recalibration cycle.
During calibration the discharge resistors will be cooled by the fan. 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 calibrated fuel gauge.
Warm environments can cause calibration failure - keep the charger away from direct sunlight or heat sources.

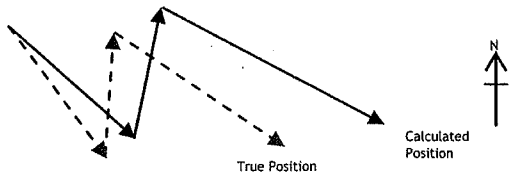
How Does the Battery Fuel Gauge Work?

We have two types of fuel gauge, ***Coulomb-Counters*** found in older batteries & ***Impedance Trackers*** in newer ones.

Coulomb-Counter Fuel Gauges use a voltmeter, ammeter and time clock inside the battery to measure the energy 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.

If a battery with a coulomb-counter fuel gauge only sees partial charges and discharges, then it may not get the benefit of a "full" or "empty" reference point for some time and must rely increasingly on its calculated figure. So its accuracy may drift during use.

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



Impedance Tracking Fuel Gauges estimate the remaining capacity by monitoring the internal impedance of the cells and comparing this to a table of values. As with coulomb-counters, the effects of discharge rate, discharge temperature, self-discharge and charging are all included in the assessment. Impedance measurement is more accurate when the battery is at rest & as a result, impedance trackers use periods of inactivity to self-recalibrate. This reduces the need for fuel gauge recalibration.

What is Recalibration & why is it needed?

As the battery ages and is used, its available capacity shrinks - so with each cycle, your device's runtime gets a little bit less. *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.*

A good rule of thumb is that Li Ion batteries lose 5% capacity per 100 cycles & 5% per year.

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Fuel Gauge Recalibration

The fuel gauge not only provides the battery's remaining capacity, it also gives 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. Our calibrating chargers use the recalibration-bit to flash the red LED & tell the user that recalibration is advisable.

How Is Recalibration Accomplished?

Impedance tracking fuel gauges retain accuracy longer than coulomb-counters & can even self-recalibrate in use as long as there are periods of inactivity in the cycle so that the impedance measurement can be made more accurately. If no periods of rest are present in the cycle then the Impedance tracking fuel gauge will accumulate the Max-Error at a rate of 1% every 20 cycles. (This is rare in most real-life applications, but is common in laboratory cycling tests).

Impedance-Tracking fuel gauge recalibration is achieved by charging the battery, allowing it to rest, discharging it & allowing it to rest again as shown below:

- Charge the battery to full charge & allow it to rest for at least 5¼ hrs.
- Discharge the battery to empty & allow it to rest for 5¼ hrs.
- At this point the fuel gauge is calibrated, but the battery is partially discharged & will require a recharge.

Coulomb-Counters use a different profile:

- Fully charge the battery
- Carry out a controlled discharge until the battery is fully discharged
- At this point the fuel gauge is calibrated, but the battery is fully discharged & will require a recharge.

In both cases the temperature during the process must remain between 10°C & 40°C.

As you can see, impedance tracking fuel gauges are more likely to encounter suitable conditions for self-recalibration in their everyday operation whereas a continuous uninterrupted discharge from full to empty is much less likely & hence coulomb-counters require more frequent fuel gauge calibration using external methods such as the Inspired Energy calibrating chargers.

So recalibration is used to re-set the fuel gauge to match 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. The latest impedance tracking fuel gauges need fewer recalibrations because they have the capability to self-calibrate however, depending on your application, the need for recalibration may not be completely eliminated. The latest Inspired Energy calibrating chargers have the capability to maintain fuel gauge accuracy on all types of fuel gauge used in the full range of "N"-Series Inspired Energy smart SMBus battery packs. For more details on smart charging and recalibration go to:

www.inspiredenergy.com

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