LT30 Power Consumption Notes

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To test the power consumption of the LT30, I built a battery replacement adapter:

Which snaps into the LT30 battery space, but can be powered by a desktop programmable power supply:

This allows me to measure the consumed power:

With an accuracy of 1 ma (0.001 Amp).

The LT30 battery nominally supplies 3,000 mA hours (three amps for 1 hour) at 3.7 volts. I believe this to be a 'Best Case' power output scenario and am going to quote times in this document assuming a 'not brand new, not optimal best case' 2,000 mA hour battery life.

The LT30, with the [Backlight OFF, WiFi OFF, Bluetooth OFF] and while sitting in idle mode draws 48 mA. So nominally if the backlight never turns on and no programs are running it will run for {41.7 hours} (1.7 days).

Note: throughout this document, I am going to write the expected life under the stated circumstances in {curly brackets} to make it easier to compare battery life.

I have observed that LT30's left on accidentally on Friday night, will sometimes still be running on Monday morning. So this seems to be a reasonable maximum battery life expectation on a full charge.

The question remains how long we should expect the data collector to run while connected to an RTK head. We have verbally claimed about 20 hour battery life when making sales presentations.

I have found that there are several main contributors to battery life:

1. Bluetooth

Turning on Bluetooth, but with no active connection to a device results no measureable change in idle current. Enabling Bluetooth does not change the power consumption.

2. Backlight

Every test mode (Bluetooth ON/OFF, Wi-Fi ON/OFF, Carlson Running or not …) has a characteristic current draw with the backlight ON or OFF.

We have long claimed that the backlight is the single largest contributor to battery life reduction. I have found that this is generally not true, however the backlight does greatly change the consumed power. In general:

Backlight OFF	48 mA	{41.6 Hours}
Backlight ON	163 mA	{12.3 Hours}

A 20 hour run time with the backlight on 100% of the time would be great. Setting the backlight to turn off after 1-minute of inactivity will result in various effective duty cycles depending on the work at hand.

If the operator is collecting Topo shots continuously, the backlight will be on 100% of the time. If the operator is storing boundary corners, the backlight may have a 5% duty cycle.

However, in the worst case, it probably is very possible to achieve 20 hours of run time with a 30-second backlight timeout.

3. Bluetooth + Carlson SurvCE + UHF Connection

Starting Carlson SurvCE, connecting to an X9x+ RTK Head receiving corrections by UHF radio, sitting on the 'Monitor Skyplot' screen uses more power than just sitting in Idle at the Windows Mobile screen.

Backlight Off	60 mA	{40 Hours}
Backlight On	170 mA	{11.7 Hours}

However, there is not a huge difference in power consumption by adding an active Bluetooth connection, having Carlson running and having an active 'Monitor Skyplot' screen displayed.

The data collector will run almost as long running Carlson with an active RTK connection as it would sitting at the main screen running no programs with Bluetooth turned off.

4. Wi-Fi

Turning on Wi-Fi with an active (or inactive) connection to a NTRIP or DIP correction source turns out to be the biggest user of power on the LT30.

Backlight Off	260 mA	{7.7 Hours}
Backlight On	370 mA	{5.4 Hours}

I tested 6 LT30 receivers for this test (screen on and screen off) and they all used the same power.

I tested various Wi-Fi encryption modes and found the difference to be insignificant (all tests with backlight off):

Wi-Fi Turned Off	48 mA	{41.7 Hours}
OPEN (no Wi-Fi security)	221 mA	{9.0 Hours}
WPA-PSK (TKIP) 54 MBS Max	224 mA	{8.9 Hours}
WPA-PSK (AES) 300 MBS Max	246 mA	{8.1 Hours}

5. LT30 Internal GSM Cell Phone Radio

The internal cell phone when idle draws slightly more power:

Backlight Off	56 mA	{35.7 Hours}

In the idle state, there is not an active cellular data connection.

When the data collector is connected to an NTRIP source via the cellular connection in SurvCE, the power usage varies from 150 to 290 mA over a two second period. A typical usages is probably ~ 230 mA (it changes depending on how the data collector is held in your hand). So with the cellular connection:

Backlight Off	230 mA	{8.7 Hours}
Backlight On	350 mA	{5.7 Hours}

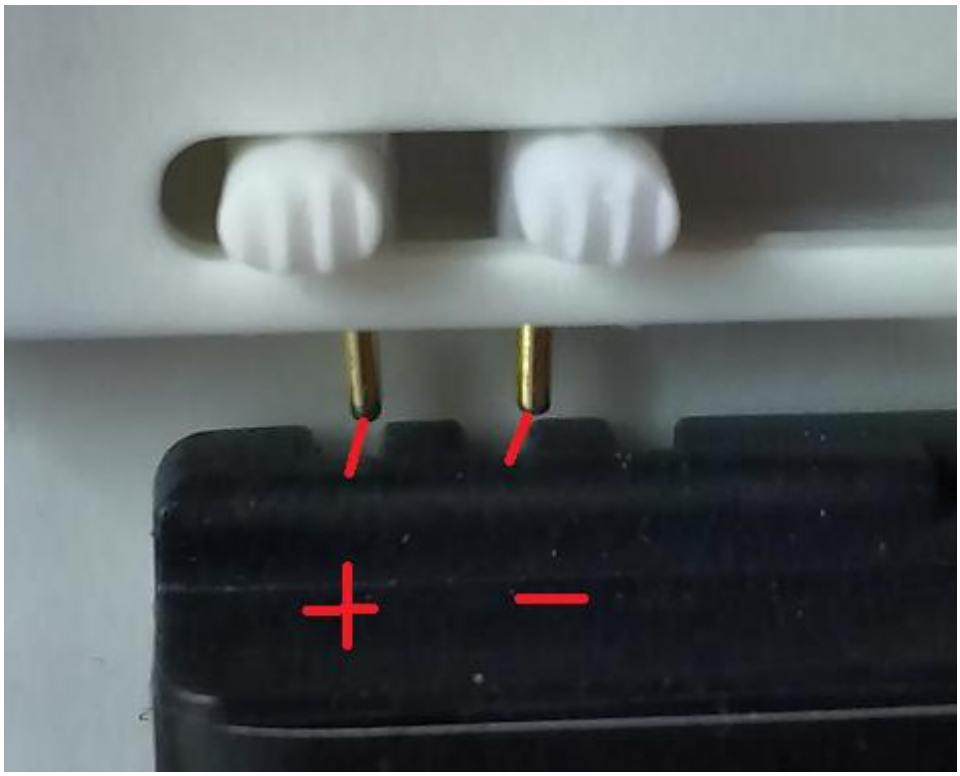
There is only a very slight advantage to using the internal cell phone over an external Mi-Fi. (Of course, Mi-Fi devices are typically able to operate in areas where the internal modem won't connect.)

External Chargers

I have successfully used this device:

http://www.amazon.com/gp/product/B00B2NEOV0?psc=1&redirect=true&ref_=oh_aui_detailpage_o03_s00

to externally charge LT30 batteries. A rubber band is required to keep the battery from jumping off of the tray. Here is a close-up of the pin configuration:



Conclusions

1. Using UHF radio source for corrections will allow the data collector to operate for 4.3 times longer than with a Wi-Fi connection.

2. It is possible to charge the LT30 battery with an inexpensive external charger.

3. With a UHF connection the LT30 will run from 12 to 40 hours, depending on how much backlight is used.