The Ultimate Guide to Powering Your Telescope: Behind the Scenes with Celestron PowerTank and PowerTank Lithium

August 30, 2018

For owners of computerized telescopes, there are now more choices than ever when it comes to portable power supplies. To help you sift through all the options, we sat down with our Product Manager for Astronomy, Lance Lucero, who's responsible for developing our PowerTank Lithium and PowerTank Lithium Pro batteries.

Q: What are my options for powering a Celestron telescope?

A: Of course, you can choose to run your telescope on AC power with an AC adapter. Some telescopes include an adapter, and others accept one that can be purchased separately. This is the most convenient and cost-effective choice for permanently installed telescopes or if your observing site has access to AC power. However, be careful when setting up your telescope that you leave plenty of slack, so you do not trip on the cord in the dark.

Many of our telescopes accept standard batteries, either in a separate battery pouch or a built-in battery compartment. These work, but if you observe with any frequency, you'll quickly get tired of buying new batteries. Unfortunately, rechargeable AA batteries do not put out enough voltage to reliably

power a telescope (1.2 volts instead of 1.5 volts). This is where a dedicated astronomy power supply comes in. Celestron offers four portable batteries at a range of capacities and price points: PowerTank, PowerTank 17, PowerTank Lithium, and our new PowerTank Lithium Pro.

Q: What are the advantages and disadvantages of sealed lead acid batteries like the original PowerTank and PowerTank 17?

A: Most people are familiar with sealed lead acid as the battery technology you'll find in your car. It works well for this application because the battery is constantly recharged as you drive. Lead acid batteries do not perform well when left idle for long periods. (That's why you need to top off your car battery after not driving for a couple of weeks.) If you choose a sealed lead acid battery for astronomy, you'll need to charge and discharge it with some regularity. Every month or so, it's good to go through a full discharge/recharge cycle to keep the battery at optimum performance.A: Sealed lead acid batteries are a bit of a relic, but they're still popular for astronomy and work reliably when well maintained.

Also, like car batteries, sealed lead acid astronomy batteries do not last forever. You can prolong its lifespan with proper maintenance, but after about two years, you'll probably need to replace it.

Sealed lead acid is not a perfect solution (nor the most environmentally friendly), but astronomers have trusted these batteries for decades and they're a cost-effective option for people willing to put in the effort to maintain them. The original PowerTank is a smaller capacity battery, best suited for telescopes like the NexStar SLT and below. The larger PowerTank 17 works well for larger telescopes and longer observing sessions.

Q: What are the advantages and disadvantages of lithium iron phosphate (LiFePO4) batteries?

A: Whether it's the TSA banning certain smartphones or the great "hoverboard" fiasco of 2015, it seems that unsafe lithium batteries are constantly in the news. When we decided to develop our own lithium battery, our primary concern was safety.

We quickly learned that all lithium batteries are not created equal. We spent a little more money to invest in lithium iron phosphate (LiFePO4) technology over the cheaper but less reliable lithium cobalt oxide. Besides its safety advantages, LiFePO4 is more powerful, so it puts out a steady 12V over the life of the battery, unlike its competitors. Finally, LiFePO4 batteries have about 4x more charge cycles compared to lithium cobalt oxide competitors.

The one disadvantage of our PowerTank Lithium and PowerTank Lithium Pro is its higher initial price point. However, at over 2000 charge cycles per battery, compared to just 500 for lithium cobalt and even fewer for sealed lead acid, we think you'll agree that it becomes quite cost effective compared to replacing these cheaper batteries over the years. Plus, LiFePO4 requires no regular maintenance once fully charged, so it can work in your emergency kit as well as your astronomy kit!

Q: Other manufacturers sell "lithium batteries" for astronomy. What makes Celestron's PowerTank Lithium and PowerTank Lithium Pro different?

A: Since the earliest days of computerized telescopes, amateur astronomers have been improvising power solutions. In the 1980s, people 'hacked' old fashioned lead acid car batteries to power their telescopes and the rest is history. In that same vein, many

other power solutions on the market were not designed with astronomy in mind. The small 155 Watt-hour lithium batteries that have cropped up online are actually repurposed power supplies for portable CPAP breathing machines.

CPAP machines differ significantly from telescopes in the way they draw power. Telescopes are more demanding and need to consistently draw at or near 12V to operate optimally. When connected to a telescope, these batteries never deliver a full 12V and lose power quickly, tapering down to 11V in less than 2 hours.

Then there are the form factor differences. To power a telescope with a CPAP-style battery, you'll probably need to use a small 6" cord that adapts the 12 Volt output to a cigarette lighter plug, then plug in a cigarette lighter adapter to the adapter. The cigarette lighter cord that many include is only 3 feet long, so it will not reach the power port on most German equatorial mounts if placed on the ground.

Our team at Celestron designed PowerTank Lithium and PowerTank Lithium Pro *specifically* for astronomy. The high-quality battery keeps a consistent voltage until the last 30 minutes of its life, and the form factor is perfect for telescopes, including straps to attach it to tripod legs. By placing the battery on the tripod leg, you can keep your cords short and out of the way, eliminating trip hazards and cord wrap issues.

Q: Why doesn't PowerTank Lithium Pro include an AC outlet?

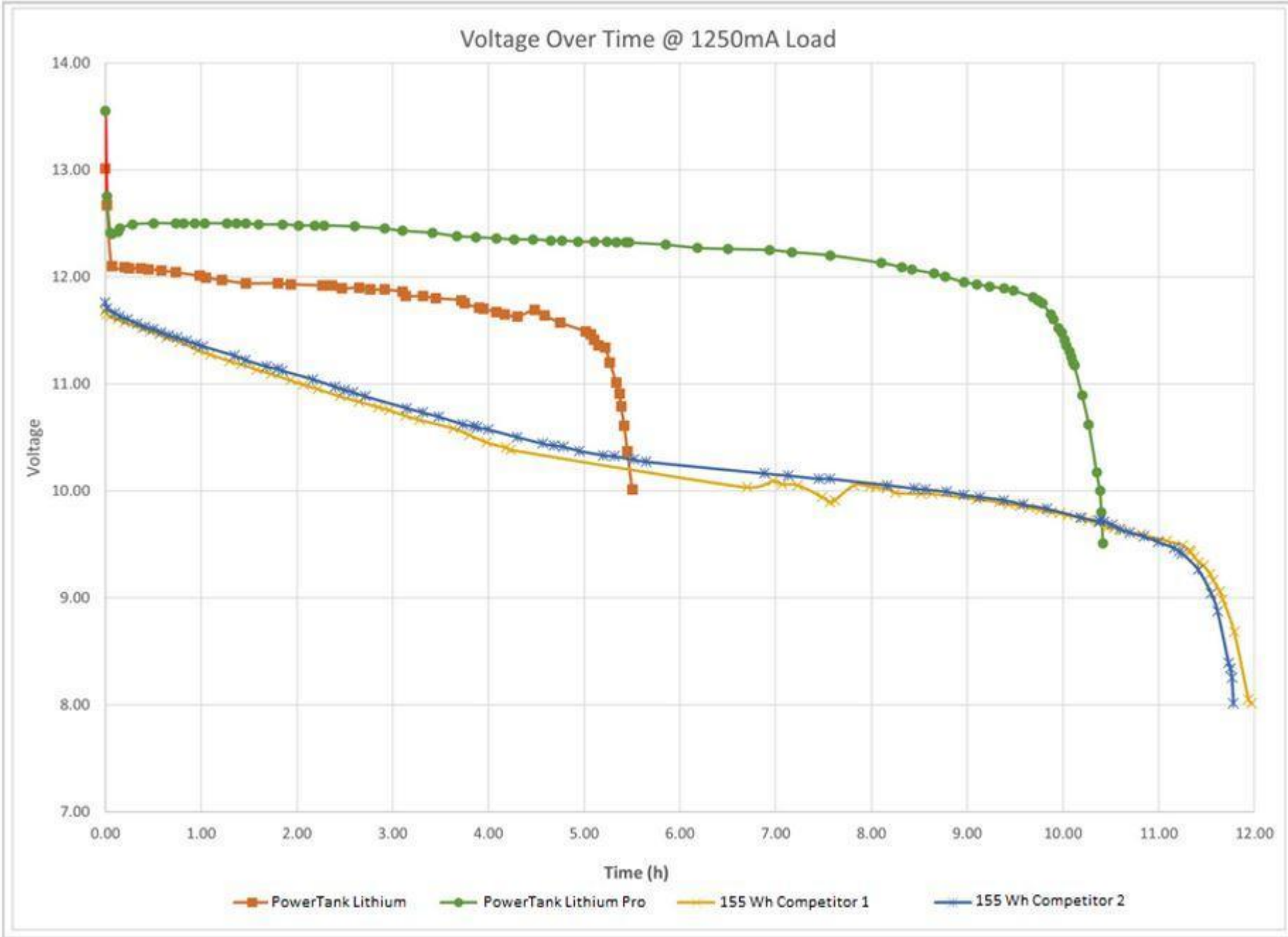
A: We thought about including an AC outlet on PowerTank Lithium Pro, since other batteries on the market offer this feature. However, after testing those batteries, we determined that it does not make sense for a battery of this size to have an AC circuit.

DC to AC converters are notoriously inefficient. What's more, these 155 Wh batteries also require the use of an internal fan to keep the batteries cool when drawing from the AC port. Powering the fan eats up electricity that should be going to your device. All these factors combine to render the battery much less useful than its technical specifications might suggest.

To demonstrate this, we hooked up a competitor's 155 Wh battery to a single 60-watt incandescent lightbulb via the AC port. It drained in 2 hours.

Of course, a lightbulb is the last thing you'd want to power when dark sky observing or imaging. So, we tested it with a laptop. The battery's manual claimed the maximum output was 100 watts. Most laptop chargers need between 70-125 watts. But running autoguiding software and image capturing software at the same time requires more power from the laptop. Unsurprisingly, the draw exceeded 100 watts and the battery shut down after 2 minutes of use.

Rather than add an essentially useless AC outlet to PowerTank Lithium Pro, we decided to include an integrated "cigarette lighter" port, which is compatible with many telescopes and astronomy accessories.



Celestron tested voltage over time for PowerTank Lithium, PowerTank Lithium Pro, and two competitors' batteries.