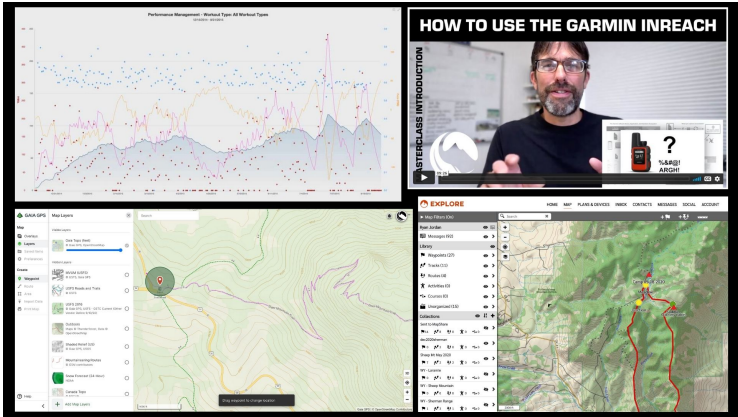










Backcountry electronics require additional time, attention, and different skills.

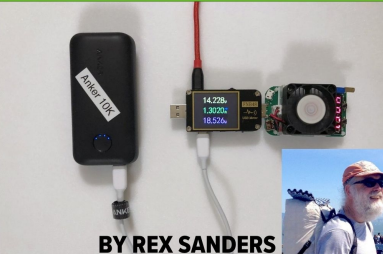
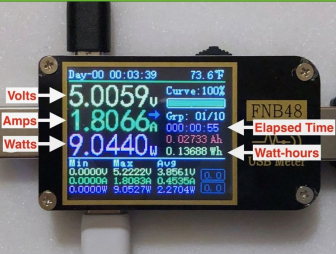


Battery Management
& Portable Battery Chargers



BATTERY BENCH

THE BACKPACKINGLIGHT.COM
ELECTRONIC DEVICE TESTING PROTOCOL



BY REX SANDERS

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"What is the best way to calculate how much battery capacity I need?" - Carrie (email)

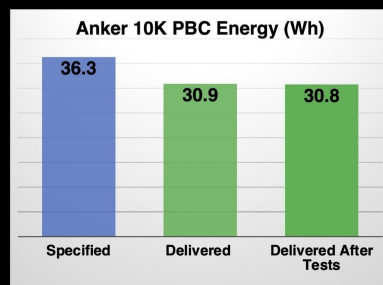
How to calculate portable battery charger capacity needed for a particular trip?

$$\begin{aligned} & \# \text{ recharges} \times \text{battery capacity (Wh) of Device 1} \\ & + \\ & \# \text{ recharges} \times \text{battery capacity (Wh) of Device 2} \\ & + \\ & \# \text{ recharges} \times \text{battery capacity (Wh) of Device 3} \\ & = \\ & \text{specified battery capacity of portable battery charger needed} \end{aligned}$$

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

I know a 10,000 mAh rated external battery pack doesn't provide me with a true 10,000 mAh worth of power. Is there an accurate assumption of how much of the 10,000 mAh we actually get (i.e., 60%, 70%, etc.)?" - Rick (email)

Manufacturer energy specifications vs. reality



Source: "BatteryBench: A Protocol for Testing Portable Battery Chargers and Electronic Devices for Backpacking," by Rex Sanders, *Backpackinglight.com*, December 14, 2021.

How to calculate portable battery charger capacity?

$$\begin{aligned} & \# \text{ recharges} \times \text{battery capacity (Wh) of Device 1} \\ & + \\ & \# \text{ recharges} \times \text{battery capacity (Wh) of Device 2} \\ & + \\ & \# \text{ recharges} \times \text{battery capacity (Wh) of Device 3} \\ & = \\ & \text{delivered (measured) battery capacity of portable battery charger needed} \end{aligned}$$

What about wasted energy in cables, connectors, circuit bleed, environmental conditions, and device battery aging?

CASE STUDY: 8-Day Trek

Petzl Bindi: 680 mAh battery x 1 recharge = 680 mAh
Garmin inReach Mini: 1,250 mAh battery x 1 recharge = 1,250 mAh
Garmin Fenix 5X Plus: 430 mAh battery x 2 recharges = 860 mAh
Sony RX100 m6: 1,240 mAh x 4 recharges = 4,960 mAh
iPhone SE: 1,620 mAh x 3 recharges = 4,860 mAh

12,610 mAh (needed)

*consider a 20-40% energy loss from portable battery pack [specification](#)

16,000 - 20,000 mAh PBC Spec

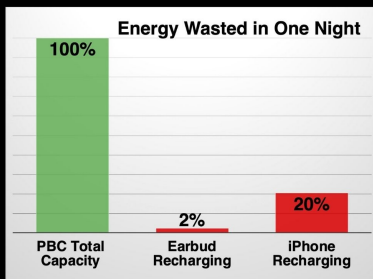
Can I operate my electronic device at cold temperatures?

What if I need to operate it below freezing?

Safe Battery Temperatures			
35° C	95° F	45° C	113° F
0° C	32° F		
		-20° C	-4° F
Operation		Storage	

Source: "BatteryBench: A Protocol for Testing Portable Battery Chargers and Electronic Devices for Backpacking," by Rex Sanders, *Backpackinglight.com*, December 14, 2021.

Energy Wasted in One Night



Should I leave my device plugged into the portable battery charger overnight?

Source: "BatteryBench: A Protocol for Testing Portable Battery Chargers and Electronic Devices for Backpacking," by Rex Sanders, *Backpackinglight.com*, December 14, 2021.



MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Who takes electronic toys backpacking? Get a map. Get a compass." - Michael (email)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Any good solar panel setups for extended ultralight trips?" - elliotwdh (instagram)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Are there any tricks to get a higher % of mAh (i.e., charge the devices from 25% to 75% twice verses charging them from 0% to 100% once, etc.)" - Rick (email)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"How effective are walkie-talkies, particularly in canyons?" - deasy_does_it (instagram)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"For a novice learning backcountry navigation, and in consideration of costs, could you please recommend an easy to use and learn starter package?" - Caroline of Canada (email)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Why won't my phone hold a charge when hiking in the cold?" - bigskysteph (instagram)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"What's the best solar charger for a phone or watch?" - mtcammerer_jds (instagram)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"How do you keep track of the miles you make?" - zumieke (instagram)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Best handheld GPS?" - jeffersonalle (twitter)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Recommended watch with altimeter that's solar powered?" - natenelson84 (instagram)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Is a data/metrics centered watch worth the investment?" - natenelson84 (instagram)

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"Any updated power bank products we should consider?" -
mike.obester (instagram)

"Best battery charger?" - jeffersonalle (twitter)

key performance metrics:

energy density (1,000 to 2,000) • delivered (measured) energy (85%) •
weather sealing (IPX rating/observed) • multi-device charging

MEMBER Q&A - BACKCOUNTRY ELECTRONICS

"I would be curious about your thoughts of battery efficiency with a conventional camera versus a cell phone. I am assuming the cell phone is more efficient per picture than a conventional camera given the intense design focus on cell phone power efficiency. But I have never done measurements to validate that assumption.

For multi day trips, I'm usually part of a group. With someone else navigating. So my primary usage for my phone is taking pictures. I do see a fairly significant impact on phone battery charge if I take a large number of pictures in a given day." - Arthur (Email)