

LITHIUM FAQs

PSL, PSL-BT, PSL-SC and PSL-SH

SHIPPING

Do lithium batteries ship Class 8 or Class 9?

Lithium batteries are classified as Class 9 in two instances.

1. When shipping by air (note that all lithium batteries are required to have a 30% state of charge or less if shipped by air).
2. Lithium batteries that have a capacity greater than 300 Wh, or between 100 and 299 Wh and weigh more than 29.9 kg, are considered Class 9 when shipping by ground.

Batteries with lower capacity and weight can ship at a less restrictive class. For more information on shipping Lithium Batteries, please see your carrier's requirements.

Can I ship lithium batteries with sealed lead acid batteries in the same pallet or container?

Yes, but if the lithium batteries qualify for Class 9 shipping, the entire pallet or container ships Class 9.

Are the lithium batteries UN38.3 certified?

All Power Sonic lithium batteries are UN 38.3 tested for hazardous goods. Only batteries with a capacity greater than 300 Wh, or between 100 and 300 Wh and weigh more than 29.9 kg are shipment restricted.

CHARGING

What chargers can I use?

We recommend that the charger you use should be designed for charging Lithium batteries. SLA chargers can be used but can potentially damage or under charge the battery. The lithium charger should employ a constant current (CC) and constant voltage (CV) charge. The constant current is dependent on the capacity (amperes hour rating) of the Lithium battery and is typically 1C (0.2C to 0.5C is recommended) or less, e.g. a 9 Ah battery should be charged at 9 A or less. The constant voltage should be a minimum of 14.6 V.

Alternatively, A standard constant voltage lead acid battery charger can be used to charge the PSL Lithium Batteries, as long as they meet the following standards:

- Charger must not contain an equalization setting
- Maximum charge voltage of 14.6V
- Recommended float charge voltage of 13.8V
- A charger with Lithium Iron Phosphate setting is recommended
- Some smart or multi-stage lead acid battery chargers have a feature that detects OCV, so it would refuse to charge the over-discharged lithium battery

SERIES/PARALLEL

How many batteries can I use in parallel? Can I install batteries in parallel and series?

All Power Sonic PSL-BT and PSL-SC batteries can be used in parallel. All models support using 4 batteries in parallel without additional engineering required. Up to six batteries can be installed in parallel if the total current of the circuit is below the 1C rating of a single battery, e.g. six PSL-BTC-1290 batteries can be installed in parallel if the circuit is design for less than 9 A. The PSL-SHC batteries cannot be used in parallel. Power-Sonic provides an installation guide for parallel installations. Power Sonic lithium Batteries cannot be installed in parallel and series.

How many batteries can I use in series? Can I install batteries in parallel and series?

Only Power Sonic batteries beginning with PSL-SC or PSL-SH can be used in series. The limit is four batteries in series on the PSL-SC line and two in series on the PSL-SH line. Power-Sonic provides an installation guide for installing batteries in series. Power Sonic lithium batteries cannot be installed in parallel and series.

Can I use more than 4 in series or in parallel?

As mentioned previously, up to six PSL-BT and PSL-SC batteries can be used in parallel if the circuit current is below the 1 C rating of the batteries. Installing more than 4 batteries in series or parallel requires the use of an external battery management unit to manage all batteries on the string. This is currently not supported by Power Sonic.

Do batteries used in series or parallel need to be matched?

Yes. Power Sonic provides specific guidelines for string matching of batteries installed in series or parallel.

What limits the number of Lithium batteries that can be installed in series or parallel?

Unlike sealed lead acid batteries, Lithium batteries have a battery management system which provides current and voltage protection. These protective circuits can interfere with the charging of the batteries when long strings are employed without an external battery management unit. Strings longer than 4-6 are more likely to experience issues and are not supported. This will vary, so please check the battery specifications to ensure strings do not exceed their max.

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BLUETOOTH

What is the range on the Lithium Bluetooth batteries?

The Bluetooth function works within 5 meters of the battery. The range can be influenced by obstructions such as wall, windows, etc. and should be checked during battery installation.

What are the limitations of the Lithium Bluetooth battery communications if enclosed?

The Lithium Bluetooth battery may have some communication limitations if enclosed in a thick or metal enclosure.

How do the events get stored and logged on the PSL-BT line? Where can I check for stored events?

Currently, the event history is not stored. Only active events are displayed.

What types of events are tracked on the app for the PSL-BT line?

- Short circuit
- Short circuit clear
- Hi-Temp when charging
- Hi-Temp when discharging
- Low-Temp when charging
- Low-Temp when discharging
- Over current when discharging
- Over current when charging
- Low voltage
- High voltage
- Temp returned to normal
- Current returned to normal
- Voltage returned to normal

Is information written to the battery from my phone?

The only information that is written from your phone to the battery is the name of the battery when changed.

Can the battery be password protected to prohibit information writing to my phone?

It is currently protected with a generic password. Use "1234" to check series voltage and "5678" to rename the battery.

Can I go back to factory defaults? Is there a reset?

At this time, there is not a reset of the battery to factory defaults. The factory default name of the battery is the serial number which is labeled on the battery.

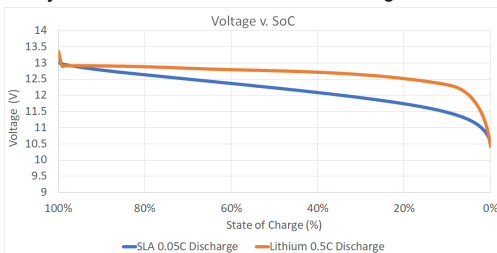
Is anything stored on the app in memory from the battery?

The Bluetooth application only reads information broadcasted by the battery, it does not store information. Changes made by the application to the battery, e.g. changing the batteries name, are sent to the battery and stored in the battery memory.

GENERAL

What is the open circuit voltage (OCV) versus the state of charge (SOC)?

The voltage of a lithium battery is relatively flat during discharge when compared to an SLA as can be seen in the graph below. The OCV is also relatively flat with SOC and should only be used as a reference when estimating the state of charge. The table is representative of the OCV with the SOC for a lithium battery.



SOC	OCV
100%	13.46
80%	13.31
60%	13.17
40%	13.15
20%	12.94

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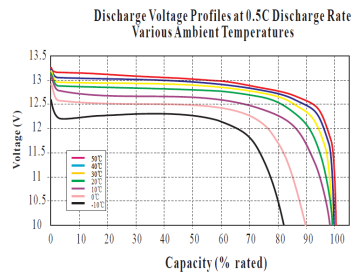
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GENERAL

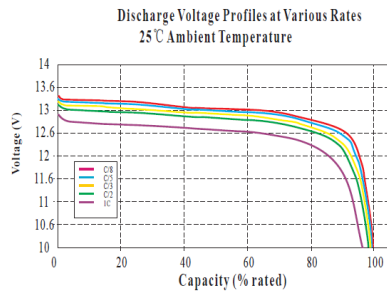
What is the performance of the battery of a variety of temperatures?



Lithium batteries are like lead acid batteries in that the capacity of the battery is higher with warmer temperatures. The graph above shows a typical voltage versus capacity curve for Lithium at a discharge rate of 0.5C. For temperatures above 0° C the capacity is only slightly impacted by temperature. Temperatures below 0° C have lower capacity that decreases with decreasing temperature.

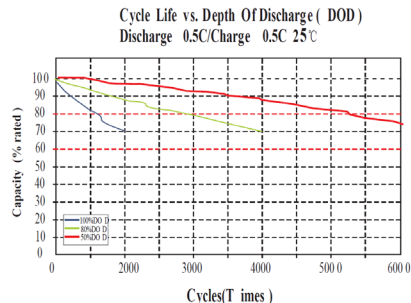
One thing to note is that self-heating of the battery during discharge can mitigate the loss in capacity. This is the voltage rise between 5% capacity and 50% capacity when discharged at 0.5C at a temperature -10° C.

Does the voltage and capacity of a lithium battery vary with discharge rate?



In general, the voltage drops with increasing discharge rate as does the capacity. The Capacity is nearly independent of discharge rate for discharge rates between C/2 and C/8, and only decreases slightly at 1C as can be seen when voltage reached 10 V in the graph above. Lower discharge rate will slightly increase capacity.

What is the impact depth of discharge (DOD) on cycle life?



Lithium batteries are designed to be cycled and have excellent life even when cycled at 100% depth of discharge. The chart above shows the expect cycle life for batteries with DOD from 50% to 100%.

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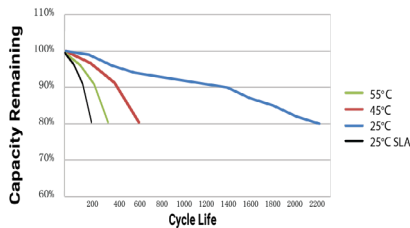
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GENERAL

What is the impact of temperature on the cycle life of a lithium battery?

CYCLE LIFE vs. VARIOUS TEMPERATURE
0.2C CHARGE/0.5C DISCHARGE @ 100% DOD



Like all batteries, high temperatures will lower the life expectancy of the lithium battery. However, although at very high temperatures the cycle life can be reduced by a factor of ten the cycle life at high temperatures is still above the lead acid equivalent. The life cycle performance at different temperatures are compared a lead acid battery in the chart above.

Can I use a lithium battery as a drop-in replacement for an SLA battery in a float charge scenario?

In SLA float applications, the voltage of the charger is 13.65-13.8. When a lithium battery is dropped in as an SLA replacement on a float charge at 13.8V, the lithium battery may not be fully charged, but it can be used.

After a lithium battery is deeply discharged, how do I rejuvenate the BMS?

Power-Sonic lithium batteries recover from a deep discharge when connected to a charger with a voltage of 14.6.

Do you have field-use white papers for these batteries?

Our team is continuously researching and testing our batteries in a variety of applications. Check back soon for the latest white papers, blogs, and articles.

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