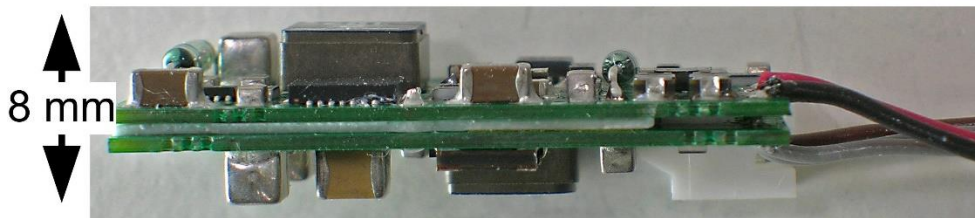
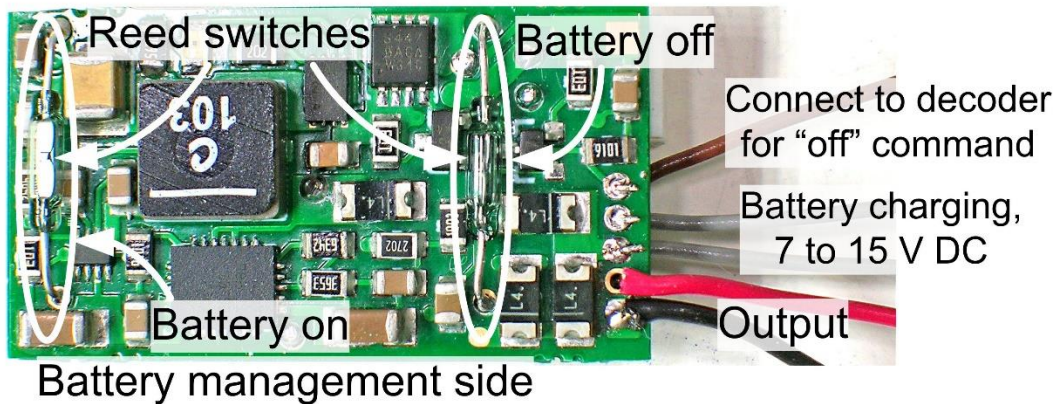
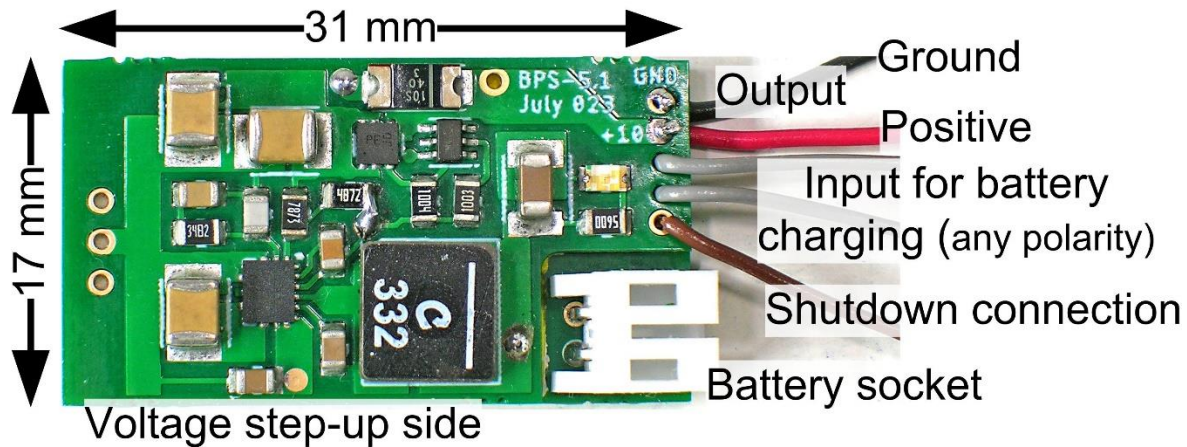


# BPS-v5 User Guide

S-CAB 10 volt, 1 amp battery power supply

This fifth generation BPS battery power supply is intended for applications requiring up to 1 amp from a small package. It replaces BPS-v4. Energy is provided by one, or two lithium polymer (LiPo) cells connected in parallel, and higher voltage output is produced electronically using a step-up converter. The functions of battery charging, battery protection and switching are included within the design.



For diesel loco installation, best to allow 10 mm headroom

## Comparison with Version 4

BPS-v4 was made obsolete by electronic supply problems and improvements of new components. BPS-v5 includes several improvements over V4:

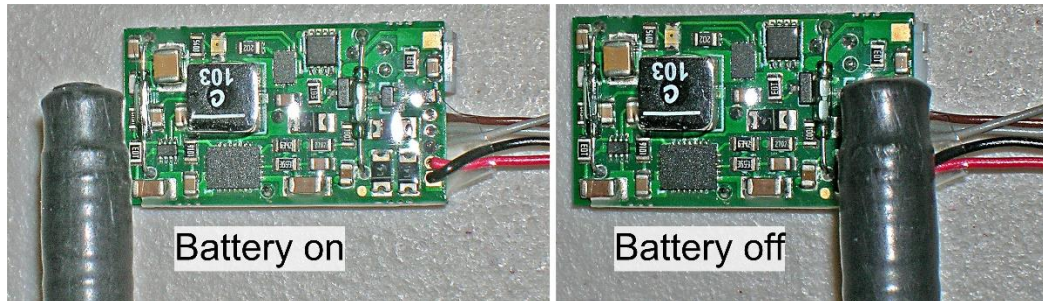
- Improved efficiency and increased output. With sufficient battery capacity, BPS-v5 can sustain continuous output of 1.2 amps at 10 volts.
- Length reduced from 34 to 31 mm. This allows crosswise mounting in most HO scale steam loco tenders.

- Automatic turn-on is more reliable.
- Improved modularity.

## Battery Power Switching

**Manual on/off:** When there is no track power, the pencil with a magnet instead of an eraser comes in handy. Let's call it a magnet wand, or simply; a "wand". Its job is to activate magnetic reed switches, of which there are two; one for "on", the other for "off".

For best sensitivity, align magnet parallel to reed switch as shown in figure.



Looking at the figure, since reed switches are relatively close together, it's usually easier to swipe the magnetic wand from right to left to turn on and reverse the motion for off.

**Automatic On:** BPS turns on when track or input voltage is detected. BPS-v5 has under-voltage lock-out at 6.5 volts and over-voltage shutdown at 20 volts. Automatic turn-on occurs at approximately 6.7 volts. This is also the point at which battery charging begins.

At 20 volts, input turns off (battery charging ceases) but battery power remains on. Battery charging restarts when input voltage drops below 18 volts. If battery power turns off during over-voltage shutdown, it will turn back on at 18 volt threshold.

**Decoder off-command:** By default, S-CAB installations with SoundTraxx or NCE decoders are set up to use a decoder 'F5' command to shut down battery power. This requires connection of the BPS shut-down wire (brown) to the appropriate decoder function output. For SoundTraxx, this is a brown wire (output FX4); for NCE decoder, the wire color is purple/violet.

*Be careful to turn off battery power when finished operation. Otherwise, the battery may be discharged next time operation is attempted.*

**Battery power indication:** BPS v5 includes a blue LED to indicate battery power on/off status. If the LED is off, the battery is not supplying power to BPS output. This maximizes battery charging by disconnecting the step-up converter while charging continues.

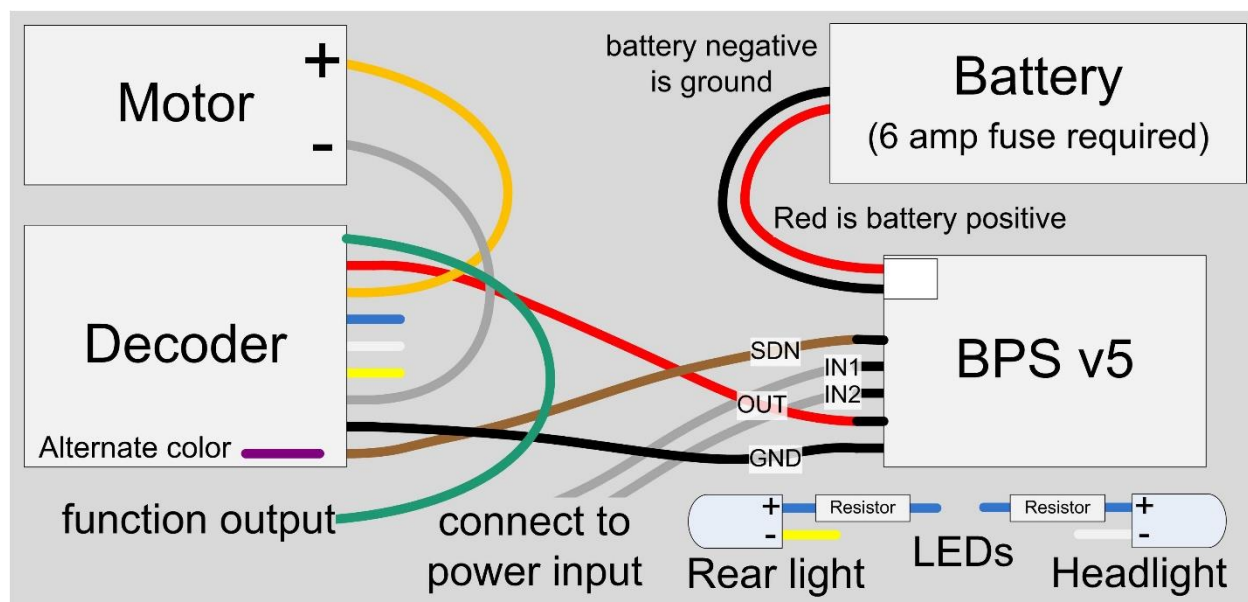
**A second benefit of turning off battery power during charging:** Everything turns off automatically when BPS power input is terminated deliberately or accidentally.

**Battery power is off, but decoder still has power:** Since BPS v5 includes battery bypass, input power flows to BPS output irrespective of whether battery power is on or off. This is true even if the battery is unplugged. Consequently, a connected decoder will be powered while BPS input voltage is between 6.5 and 18 volts. If sound is not desired while battery charging, SoundTraxx decoders allow either loco shutdown or sound muting while a decoder remains operational.

## Wiring

Previous wire colors are retained:

- SDN (brown)
- IN1 and IN2 (gray),
- OUT (red),
- GND (black).



In most deliveries, BPS power output (OUT red and GND black) and SDN (brown) are already connected to a decoder.

For a push-button shutdown, a momentary contact switch can be connected between SDN and GND.

## BPS Location

Since the magnet wand's maximum activation range is 3/4", the BPS circuit board must be mounted close to an accessible surface (roof of diesel, or side of a tender, for example). When this is not possible, one option is to connect a second reed switch, or a momentary contact device mounted somewhere conveniently in the model.

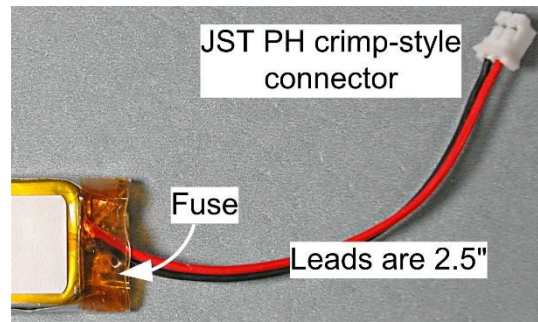
## Battery Selection

A battery used with BPS v5 requires a 6 amp fuse as well as leads and connector capable of carrying up to 5 amps battery current.

BPS warranty requires use of BPS batteries. No liability is assumed for use of 3<sup>rd</sup> party batteries.

Any battery used with BPS must satisfy the following criteria:

1. Battery must safely deliver 6 amps.
2. Fuse protection should be 6 amps.
3. Use a JST PH connector with crimp-type plug and 24 AWG leads. This eliminates use of insulation displacement connectors.
4. Connector must be wired with correct polarity.



## Battery Charging

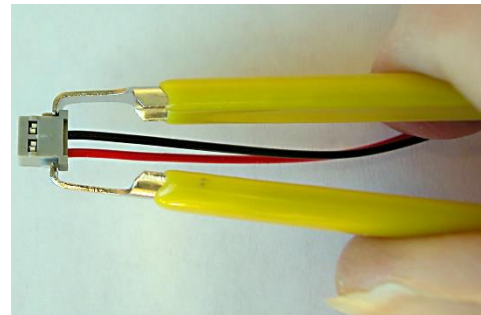
Power for battery charging is typically from track to wheels. It's desirable that charging voltage be well-regulated DC, or DCC from a quality supplier. Set track voltage between 12 and 13 volts for best operation and do not exceed 16 volts.

*It's best to avoid hobby-market DC train controllers for battery charging.*

*Version 5 input voltage protection can tolerate voltage peaks up to 30 volts. However, the warning remains relevant since hobby controllers are often unregulated with peak voltages that can damage electronic components.*

## Battery Leads

Battery plug and socket are tight by design and not intended for frequent disconnection. Please avoid unplugging by pulling the leads. Eventually, a wire will pull out of the connector. An IC Extraction Tool is a simple way to avoid this problem.



## Battery Fuse

BPS batteries are protected by a fuse within the battery package and cannot be replaced by user. A blown fuse requires return to factory repair or purchase of a new battery.

The most common cause of a blown fuse is an attempt to measure battery voltage at the BPS battery socket. There is high risk that multi-meter probes will momentarily short-circuit battery output and blow the fuse, clearing the short instantaneously (there won't even be a spark).

Another cause is failure to properly insulate the BPS circuit board during bench testing or installation. The heat-shrink wrapper minimizes this risk and should not be removed.

The most embarrassing mistake is an attempt to shorten battery leads while forgetting to cut each lead separately. Cutting leads simultaneously short-circuits the battery and blows the fuse.

## Battery Bypass

BPS-v5 battery supply is nominally 10 volts. Depending on component tolerances, measured values will be between 10.1 and 10.4 volts. Rectified track voltage connects to BPS output through an output diode. Since accumulated diode voltage drop is 1.2 to 1.5 volts, track voltage of 12 volts input produces approximately 10.5

volts output which begins to supplement battery output. If track voltage exceeds 12.5 volts, battery no longer contributes to output and battery energy is conserved while simultaneously recharging.

There is no benefit of track voltage greater than 13 volts. If BPS output derived from track input (call this "bypass voltage") is significantly greater than BPS voltage, loco speed variations will be noticeable as output switches between bypass voltage and battery step-up voltage.

## DC Power Supply

A commercial-grade DC power supply is recommended for use with battery power. 30 volt, 5 amp supplies can be purchased on-line for \$60. Both voltage and current limit is adjustable. Set the voltage to 12.7 volts for track power. Overload protection is included, and a lower threshold can be set to limit current.

The power supply current measurement is particularly helpful when battery charging. BPS-v5 has a 500 mA charge rate for batteries. When charging at this rate with power supply voltage of 12.5 volts, power supply current measurement is approximately 200 mA. As battery reaches full charge, current will drop to a few mA; or zero if no load is connected to the BPS.

