

# How High SP™

## Self-Powered Altimeter



Figure 1. Full size: front and back

The *How High SP* combines a *How High* Altimeter and a Battery Board accessory to create a completely self-contained, self-powered instrument. The *How High* is permanently mounted to the Battery Board – eliminating wires and connectors. This tiny, light-weight unit is perfect for free-flight airplane models, model rockets, falconry, and other applications where battery power is not normally available. It is also the ideal solution for R/C pilots looking for a fully portable system to move from model to model.

The *How High SP* altimeter provides peak altitude readings when they are most useful – at the field, right after a flight. A single light-emitting diode (LED) reports altitude data through a series of flashes. It does not require the use of a computer, ground-based receiver, or any additional equipment.

Like the altimeter in a full-scale aircraft, the *How High SP* altimeter determines altitude by sensing tiny changes in atmospheric air pressure. It uses a state-of-the-art pressure sensor and proprietary calculation techniques to provide a level of accuracy previously unavailable in such a low cost instrument.

### OPERATION

Understanding how the *How High SP* operates will help you decide where to install the unit – so, we will cover this topic first.

Using the *How High SP* is easy:

- 1) Turn the unit on
- 2) Make your flight
- 3) Read the peak altitude

### 1) Power Up

Simply turn on the built-in power

switch. The LED will light up for about 3 seconds indicating the feet/meters setting. A flickering LED indicates ‘meters’ mode; a steady LED indicates ‘feet’ mode.

The unit will then report the peak altitude of your last flight using a series of flashes. For example, an altitude of 423 feet (or meters) will report as 4 flashes followed by a pause, 2 flashes, another pause, then 3 flashes.

**flash-flash-flash-flash  
flash-flash  
flash-flash-flash**

Each group of flashes represents one digit. Leading zeros are suppressed, so 89 will report as 8 flashes, pause, 9 flashes. Altitudes as high as 7000 feet (2150 meters) can be reported. A zero is represented by a quick double flash (you will know it when you see it). After the last flash of the altitude report, the LED will remain off for 4 to 6 seconds so you will know the report is complete. New units will initially display a factory test value between 1000 and 1100.

### Battery Replacement

The *How High SP* uses two CR2016 Lithium Coin Cell (non-rechargeable) batteries. They are commonly used in watches and calculators and are available at grocery, drug, and hardware stores. Always replace both batteries at the same time.



1. Use a toothpick, or other non-conductive probe, to push the old batteries out of the holder.
2. Stack the two new batteries with the “+” symbol facing up.
3. Slide the stacked batteries, with the “+” symbol up, into the holder.



### WARRANTY

We want you to be happy with your purchase. If you are not satisfied with any product purchased directly from us, return it within 30 days for a full refund of your purchase price. We also provide a one-year replacement warranty on any device that stops working properly - regardless of cause (even crash damage).

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## How High SP™

### Self-Powered Altimeter

#### SPECIFICATIONS

- Output Method:**  
Grouped light flashes
- Output Activation:**  
Power cycle or finger wave
- Peak Altitude Range:**  
50 to 7000 ft. (15 to 2150 m) AGL
- Internal Resolution:**  
0.46 ft. (0.14 m) @ sea level
- Report Resolution:**  
1 ft. (1 m) Above Ground Level
- Batteries (included):**  
CR2016 (2X) 6V, 75mAh
- Battery Life:**  
60 hours (min), 5+ year shelf life
- Size (Excluding LED):**  
.8 x 1.3 x .5 in. (20 x 33 x 12 mm)
- Weight:**  
0.25 oz. (7.2 g) with batteries

[www.WingedShadow.com](http://www.WingedShadow.com)

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## How High SP™

### Self-Powered Altimeter

- Reports Peak Altitude
- 1 ft. (1 m) Resolution
- Integrated Battery Holder and Power Switch
- Perfect for Rockets and Free-Flight models
- Works on its own or with the *See How™* display

## 2) Your Flight

After the altitude report, the *How High SP* will enter measurement mode and the LED will output a brief flash every 2 seconds. This “heartbeat” lets you know the unit is on and all is well. Throughout the flight the *How High SP* is making high-resolution measurements of the atmospheric pressure and temperature every second.

## 3) Reporting Peak Altitude

After landing, you can view the maximum altitude of your flight using any of three different methods:

**A. Cycle the power.** Simply turn the power switch off, and then turn it back on. The unit will perform the power-up sequence described previously; blinking the LED to report peak altitude. It does not matter how long you have the power off (one second or one year).

**B. Wave your finger.** With the LED pointing toward the sun, or the brightest part of the sky if its cloudy, wave your finger back and forth across the LED. (See the “Finger Wave Technique” box on the next page.) When the unit recognizes your wave, the LED will come on for 4 seconds. At this point, stop waving and start counting! The unit will report the peak altitude by flashing the LED just like at power up. You do not have to cycle the power -- after the altitude report, the *How High SP* is ready for your next flight.

**C. Use the See How Display.** Hold the *See How Display* (sold separately) up to the LED and your flight data is transferred and displayed digitally. This optional accessory features an LCD display and a 10-flight memory.

## Notes on Operation

The altitude information is saved in non-volatile memory, so you can view it as often as you like. Simply cycle the power or wave your finger over the LED.

When your next flight reaches an altitude of about 50 feet (15 meters) above the ground, the *How High SP* will allow the old flight data to be overwritten by new flight data.

The *How High SP* always reports altitude above ground level (AGL). The ground-level (zero) reference is taken after the flight when the altitude report is activated or when power is removed.

The installed batteries will power the *How High SP* for 60 to 80 hours. For most modelers, this represents over a year of use -- provided that you turn off the switch after each flight. Instructions for replacing the batteries are on the back of this sheet.

## INSTALLATION

The light mass and rugged construction of the *How High SP* makes it easy to mount. Sticky-back Velcro® or double-sided foam tape can be used to mount the device. Alternatively, it can be simply wrapped in foam and wedged, rubber banded, or strapped into any handy location. The LED has flexible leads that can be bent to aim the light output. Bend the leads slowly to prevent damage.

Figure 2 shows the *How High SP* mounted on the inside surface of a model

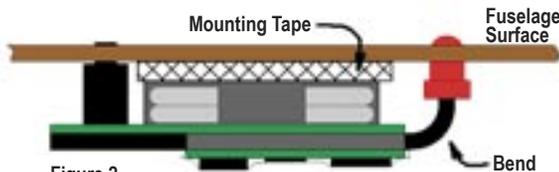


Figure 2.

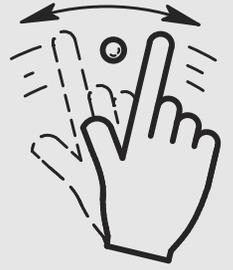
### Selecting Feet or Meters

To change the units used when displaying altitudes:

1. Turn the power on. The LED will come on steady (feet) or flicker (meters) for about three seconds.
2. As soon as the LED turns off, switch off the power (within 1/2 second).
3. Repeat steps 1 & 2 **four** times in a row. The mode will switch from feet to meters (or vice versa). The change will take effect on your next flight. The last flight in memory will not change.

### Finger Wave Technique

- Make sure the LED is pointed directly at the sun, the brightest area of a cloudy sky, or other light source – and not blocked by your shadow.
- Briskly wave your finger back and forth in front of the LED.
- Come very close to the LED as your finger passes over.
- Move your finger completely past the LED on each side by two or three inches (50-75 mm).
- Don't go too slow. About two “round trip” cycles per second is good.
- Flexing your hand at the wrist works better than just moving your finger.
- Usually, only 2 or 3 passes are needed. If it is not working, try re-aiming the LED toward the light.



with the switch and LED accessible from the outside. In this example, foam mounting tape (or Velcro®) is used and the LED leads are bent 90 degrees.

The altimeter can be mounted in any orientation (with the LED pointing up, down, or sideways). Although you need to see the LED to view the altitude data after your flight, it does not need to be exposed during the flight. If desired, you can mount the entire unit inside your model and open a hatch, or even remove the unit, after your flight.

### Model Airplanes

The best place to mount your *How High SP* altimeter is inside your model's fuselage. On most planes, the air pressure inside the fuselage is equal to the pressure of the surrounding air -- which is exactly what we want to measure. When this is not possible, the *How High SP* can be mounted externally. Be aware that air flowing over a surface creates a localized area of low pressure. To reduce errors, choose a location where surface airflow is minimized. For example, mounting the unit on the fuselage side behind the wing can often give acceptable results, while mounting it on the airfoil surface on top of the wing will produce large errors (after all, airplanes fly by producing low pressure above the wing).

### Model Rockets

Use the *How High SP* only in rockets with a separate payload section. It is important that the unit is not exposed to the hot gasses of the rocket engine's ejection charge. It will easily fit in 1” (25mm) and larger tubes. You can wrap foam rubber (or recovery wadding) around the unit so it is not loose in the tube. For a cleaner look, make centering disks out of balsa, cardboard, or foam to center the altimeter in the tube (as shown in Figure 3).

Since the *How High SP* measures air pressure to determine altitude, make sure that the payload section is not air tight. Two or three small holes in the side of the tube are all that is needed. The hole size is not critical – about 1/16-inch (1.5mm) is

adequate to insure that the pressure, at apogee, equalizes to that of the surrounding air. Large holes, or air scoops, can cause pressure or suction effects that will affect accuracy.

You can open the payload section after a flight to access the LED and power switch, or, with careful hole placement, you can access the power switch using a toothpick or similar probe.

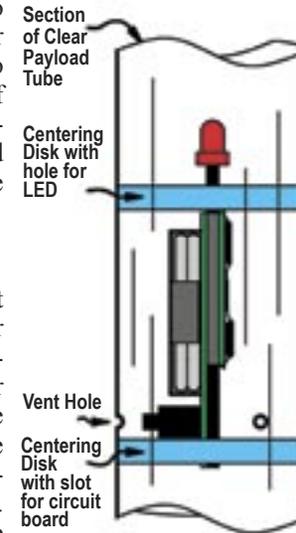


Figure 3.