

ALTIMETER TWO

SCIENTIFIC PAYLOAD FOR MODEL ROCKETS

Complete Rocket Flight Analysis

Top Speed

Peak Altitude

Peak & Average Acceleration

Engine Burn Time

Coast to Apogee Time

Apogee to Ejection Time

Ejection Altitude

Descent Speed

Total Flight Duration



“How high did it go?” and “How fast was it going?”

A fantastic gift for any rocket flyer.
The start of a great science project.

jolly logic

Visual Tour

Attachment Point

Here is where you fasten your altimeter to your rocket.

Be careful not to block the pressure port opening underneath the attachment point.



After clearing, the animated zero indicates "ready for launch."

Display

Alternates between showing peak altitude and then top speed after each flight. If the speed is rapidly blinking, you have exceeded the g-limit of the AltimeterTwo, and the speed and acceleration readings may be low.

Altitudes higher than 9,999 feet are shown in *thousands of feet*, and are indicated with a decimal point in the display.

1234^{FT}
1234 feet

12.34^{FT}
12340 feet

1234^M
1234 meters

567^{MPH}
567 MPH

912^{KPH}
912 KPH

Push Button

- Quick press for ON/OFF
- Or hold the button to see more options. Release the button when you see the option you want:

data

Display flight data (see *Flight Data* page)

0000

Clear all data and reset for next flight

un it

Switch between displaying feet or meters

boot

Reboot and restart

- Special rarely-seen displays and what they mean

L1 Ft

Launch detected. Use the button to reset for flight.

FAIL

System failure (probably due to damage). Try the boot option, above.

Recharging Connector

Plugs into standard USB ports to recharge. (Does not upload data.)

1234^{FT}

Low Battery Indicator
(Less than one hour left)



Basic Operation



After clearing, the animated zero indicates "ready for launch."

The Button

Although the button looks quite small, you do not need a sharp object to press it. Just place your finger over the center of it and press until you feel a "click."

Powering ON/OFF

Press the button and release it quickly to turn the altimeter on or off. It will also turn itself off if there are no new peak altitudes after one hour.

Clear Before Each Flight

You need to clear the previous altitude and speed before each flight. Press and hold the button until you see "0000," then release. The display will show an animated "0" to indicate that it is ready for launch.

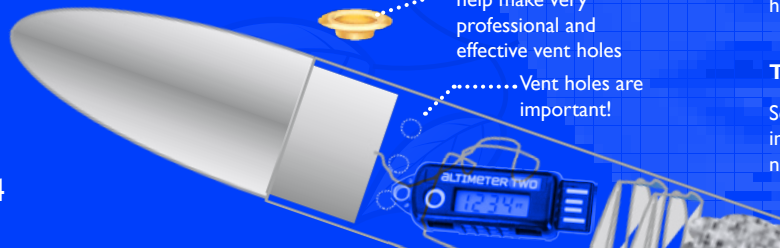
Installation Tips

You can mount the AltimeterTwo in a payload bay, or clip it to your parachute line in the fuselage. We've included a handy clip to make attachment as easy as possible. The AltimeterTwo does not need to face in any particular direction to measure both altitude and speed correctly, though it helps to protect it against sharp jarring impacts during liftoff that may somewhat affect the accuracy of the speed reading.

The altimeter needs to sense outside atmospheric pressure at all times. Drill at least three 1/16" to 1/8" diameter holes evenly spaced around the payload bay or the fuselage in such a way that they will not be blocked once the rocket is assembled for launch.

Metal fabric eyelets help make very professional and effective vent holes

Vent holes are important!



Recharging



Low Battery Indicator

Your altimeter has an advanced Lithium Polymer battery, the same type of battery used in the latest laptops and cell phones (only much, much smaller).

The AltimeterOne will display a small battery icon (see above) when there is one hour or less of battery charge remaining.

It can be recharged in any standard USB port, including those on computers, printers, and other devices.

Recharging Directions

1. If the four silver contacts are dirty, wipe them clean with a damp cloth
2. Insert the altimeter into a USB port
3. A light will glow red or green near the display if inserted properly
4. If unit does not glow when inserted:
 - a. Make sure computer is turned on
 - b. Flip the altimeter over and try again
 - c. Try another computer, or use a "Type A USB Extension" cable

Red:
Charging



Green:
Fully Charged

Fully charging the altimeter usually takes about two hours if the battery is completely discharged. It does not hurt the battery to leave it in the charger, and it's fine to "top it off" whenever you can.

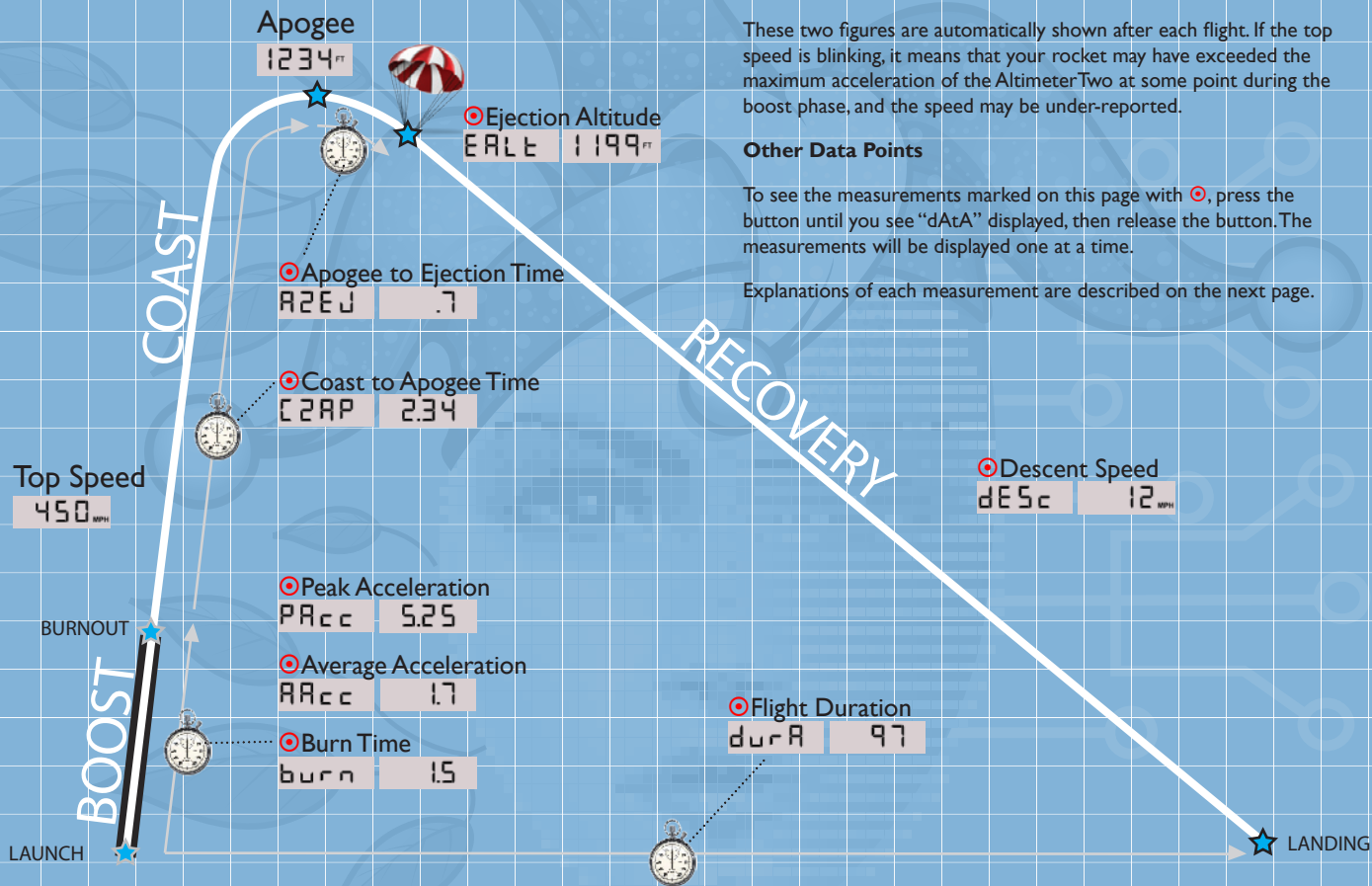
The battery holds enough charge to power the altimeter for about 12 hours of continuous use.

Troubleshooting

Seeing a **RED GLOW** and a **GREEN GLOW** at the same time would indicate that the battery is disconnected or damaged. Hopefully, that will never happen to you.

Flight Data


For explanations of each measurement, see page 8.



Apogee and Top Speed

These two figures are automatically shown after each flight. If the top speed is blinking, it means that your rocket may have exceeded the maximum acceleration of the AltimeterTwo at some point during the boost phase, and the speed may be under-reported.

Other Data Points

To see the measurements marked on this page with , press the button until you see "dAtA" displayed, then release the button. The measurements will be displayed one at a time.

Explanations of each measurement are described on the next page.

Flight Data

Ten Performance Measurements for Every Flight

The AltimeterTwo displays the peak altitude (apogee) and top speed after each flight. If you press the button and hold it until you see the “dAtA” option displayed and then release it, you will be shown eight(8) additional flight measurements

Here is an explanation of each flight measurement.

The first two measurements are shown automatically after each flight.

1 Peak Altitude

Measured from the launch pad using barometric pressure. Can be displayed in either feet (FT) or meters (M) using the “unit” menu.

2 Top Speed

Measured from launch until just after boost ends. Will continue to measure top speed for multistage rockets if the time between burns is limited to about one second. Can be displayed in miles per hour (MPH) or kilometers per hour (KPH).

If the display blinks rapidly while showing Top Speed, it means that at some point the altimeter detected an acceleration that was close to or exceeding its maximum 24G (772 feet/sec²) acceleration rating in at least one of its three measuring directions, including 1G due to gravity. See *Logic and Limits* for tips to enhance this to 40G.

Use the “dAtA” option to see the following:

dAtA

3 Burn Time

burn

The time (in seconds, such as “1.5”) that the motor produces enough thrust to accelerate the rocket.

4 Peak Acceleration during Boost

PAcc

The highest acceleration detected from launch until the rocket coasts. Always displayed in Gs, where one G is 32.2 f/sec² or 9.81 m/sec².

5 Average Acceleration during Boost

AAcc

The average acceleration in Gs measured from launch until the rocket coasts. Average acceleration is useful for comparing the average thrust of two rocket motors, or to compare the weight and aerodynamic performance of two different rockets during launch.

6 Coast to Apogee Time

CTAP

Time in seconds from the end of motor burn until the highest altitude is recorded (either before or after ejection).

7 Apogee to Ejection Time

AEJ

Time in seconds between the highest altitude recorded and the time that ejection (a 3G shock or greater) is detected. Can be negative if ejection occurs before the rocket reaches its top altitude. If no ejection is detected, this will be zero.

8 Ejection Altitude

EAlt

Altitude above the launch pad at ejection measured using barometric pressure. Can be shown in feet (FT) or meters (M). If no ejection is detected, this will be the same as apogee.

9 Descent Rate

dESc

The average vertical speed (in MPH or KPH) from ejection to landing.

10 Flight Duration

durA

Time in seconds from liftoff to landing.

Useful Conversion Factors and Equations

- » One MPH = 22/15 feet/sec (exactly) or 1.47 feet/sec
- » One KPH = 5/18 meters/sec (exactly) or 0.278 meters/sec
- » One G = 9.8055 meters/second² or 32.174 feet/second²
- » One G-sec = 21.9 MPH or 35.3 KPH
- » Top Speed = Average Acceleration X Burn Time X 21.9 MPH/G-sec
- » Top Speed = Average Acceleration X Burn Time X 35.3 KPH/G-sec

Logic and Limits



About the Flight Logic

When you turn on or clear the AltimeterTwo for its next flight, it begins sampling the local air pressure 30 times/second to determine the local pressure at ground level prior to launch. Acceleration is sampled 244 times/second to determine its current orientation, calibrate its at-rest acceleration due to gravity and to detect launch—while also trying to ignore normal handling and shaking. When it detects a strong, sustained acceleration in one direction, the screen changes to “Lift” to indicate liftoff. It calculates velocity until the rocket is definitely decelerating, then it concentrates on capturing peak altitude. If for some reason your rocket dips briefly and re-ascends, it will still reliably capture the top peak.

How Fast and How High Can It Go?

The speed range of the AltimeterTwo is only limited by its ability to measure accelerations. The AltimeterTwo is equipped with a 3-axis accelerometer that can measure up to 24Gs of acceleration in each direction. Objects in the grip of Earth's gravity experience a downward force equivalent to an upward acceleration of 1G. So for typical upward launches, the AltimeterTwo can detect an additional 23Gs (assuming one of the axes is pointed exactly vertical) that it integrates continuously to estimate speed. At 23Gs, it takes about 1.5 seconds to reach the speed of sound.

If you mount the altimeter so that none its flat sides are pointed in the direction of flight (a sort of “one corner highest” orientation), you can measure just over 40Gs (in addition to gravity) without any of the individual axes registering over 24Gs. At 40Gs, it takes about 0.87 seconds to reach the speed of sound.

The AltimeterTwo can measure altitudes up to 29,500 feet (9000 meters) above sea level.

Frequently Asked Questions

“Will a rocket ejection charge damage the AltimeterTwo?”

With proper ejection wadding and air venting, the AltimeterTwo works great clipped to your parachute. If you want to keep it looking like new, you can wrap it in padding if you keep the air vent on the end clear, but that's optional.

Do I have to mount the AltimeterTwo in any particular direction?

No, since it has a full 3-axis accelerometer and can sense linear acceleration in any direction. If you want to maximize the range, see the facing page.

“Can I download flight data to my PC?”

No. The USB connector is just for recharging.

“If the battery dies, will my last flight altitude be saved?”

Yes, readings are saved in non-volatile flash memory.

“Why does the speed sometimes flash rapidly when it's displayed?”

If an acceleration in any direction is at (or very close to) the AltimeterTwo's peak capability (24g), it flashes the display to warn you that the speed calculation may be in error. The result is an UNDER-reporting of speed.

“When I recharge, I see a red and green light together. Why?”

Your battery has become disconnected, or is damaged, and needs repair.

“What repairs are possible if I crash the AltimeterTwo?”

Jolly Logic does not offer a repair service. But spare cases and batteries are available. In general, reattaching the battery and replacing the case are the only repair operations you should attempt. Check our website for instructions if you do.

For More Support

More info is available at www.jollylogic.com. Have questions or suggestions? Contact us at support@jollylogic.com. We'd love to hear from you, including your experiences with the AltimeterTwo.

Altimeter Two Specifications

Mission	For rockets only. Uses an atmospheric pressure sensor and a 3-axis accelerometer to detect peak altitude, top speed, motor burn time, peak and average boost acceleration, coast to apogee time, apogee to ejection time, descent speed, and flight duration.
Useful Range	Altitude to 29,500 ft (9000 m) above sea level. Capable of supersonic speed measurements. Maximum acceleration is from 23G (any orientation) up to 40g (with careful orientation).
Display Precision	Altitude: nearest 1 foot below 10,000 feet and nearest 10 feet at or above 10,000 feet (Nearest meter in metric, all altitudes) Speed: nearest 1 MPH (1 KPH) Acceleration: nearest 0.1G
Sensor Precision	Pressure sampled 31 times/second using 18 bits of precision. Acceleration sampled simultaneously in all three directions at 244 times/second using 15 bits of precision each. Data is NOT downloadable.
Size & Weight	0.47 x 0.64 x 1.93 inches (12 x 16.3 x 49 mm) 0.24 ounces (6.7 grams)
Battery	Included rechargeable Lithium Polymer battery (not user-replaceable) recharges in about 2 hours from most USB ports.

ATTENZIONE!

AVERTISSEMENT!

WARNING!

AVVERTENCIA!

Rischio di soffocamento! Contiene piccole parti. Non adatto a bambini di età inferiore a 3 anni.
Risque de suffocation! Petite pièces. Ne convient pas à un enfant de moins de 3 ans.
Erstickenungsgefahr! Verschluckbare Kleinteile. Nicht geeignet für Kinder unter 3 Jahren.
Choking Hazard! Small parts. Not for children under 3 years.
Peligro de asfixia! Contiene partes pequeñas. Inadecuado para niños menores de 3 años.

14+

**A PARTIRE DAI 14 ANNI
14 ANS ET PLUS
AB 14 JAHREN
FOR AGES 14 UP
A PARTIR DE 14 AÑOS**



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ALTIMETER TWO



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