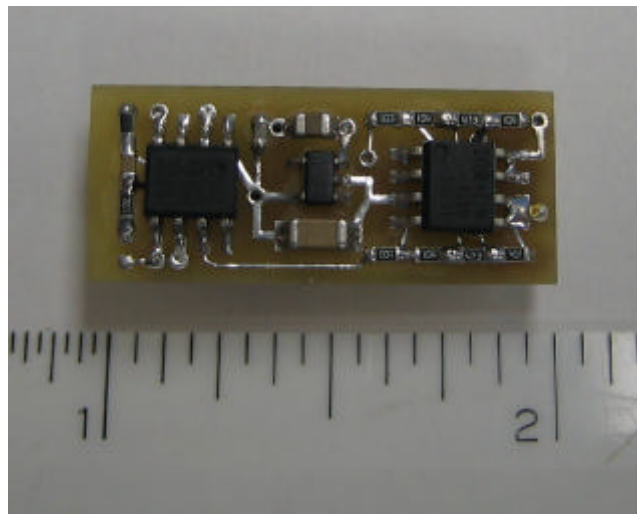


PICO

Altimeter



Congratulations on your purchase of one of rocketry's smallest altimeters.

This altimeter can be used to trigger an event at apogee of a rockets flight.

It will also trigger an event when the rocket reaches a preset altitude after apogee.

This altitude is set at 700feet.

This unit also stores the minimum pressure reached and reports this value so you can determine the peak altitude reached.

This unit is to be used by a rocketeer experienced in the use of electronics.

Contents:

- 1) Pico alt unit
- 2) This manual

Power Source:

It is very important that you adhere to the power requirements. This unit does not come with a firing capacitor onboard. This allows the end user to customize it to their requirements. Some power sources have too much internal resistance so they are unable to supply the momentary current spike that is required to fire some initiators. And some sources, such as 12V A23(N size) batteries, are temperature sensitive so under warm conditions such as on your test bench they work fine but when the ambient temp drops they are unable to supply the current required. There are also situations where your charge initiator requires higher current and you need to use a dual battery setup. If your power source requires a capacitor then install a 1000uF capacitor so that it is used to supply the current required.

Battery combinations:

- 1) 12V A23 battery with capacitor
- 2) 9V battery without capacitor
- 3) 5 to 10 cell NiCd or NiMH rechargeable pack without capacitor
- 4) dual 9V batteries

Please test your setup under conditions similar to the expected field conditions.

Remember you are responsible for your own setup, design and test it well. The suggestions here are merely suggestions.

Installing in rocket:

This unit is a barometric reading unit. As such it requires a vent hole in the electronics bay so that it can read atmospheric pressure. The size of these holes is dependant upon your bay size.

This bay must also be sealed from the ejection gasses that occur during motor ejection charge firing. The altimeter must be protected from these gasses as they are corrosive and can damage the unit.

Mounting of the unit is going to be dependent upon your electronics bay design.

Any design that allows the unit to measure the pressure changes as the rocket changes altitude will be fine.

If you have decided to use a harness board and connector then you will need to ensure the altimeter stays firmly attached to this board.

Operation:

Upon power up the unit will give a single power on flash.
It then waits a second before testing continuity of both pyro channels.
It tests Drogue continuity first and if it has continuity it will flash two times.
It tests Main continuity next and if it has continuity it will flash three times.
If either continuity tests fail then the unit will output the peak altitude from the last launch. But if you had continuity on both channels then you are probably loaded on the pad and have no need for the apogee of the last launch and so it is not reported.
After the continuity test and the optional altitude report the unit will wait a second then sample the ground altitude reading and wait for launch.
This sequence is illustrated in fig 1.

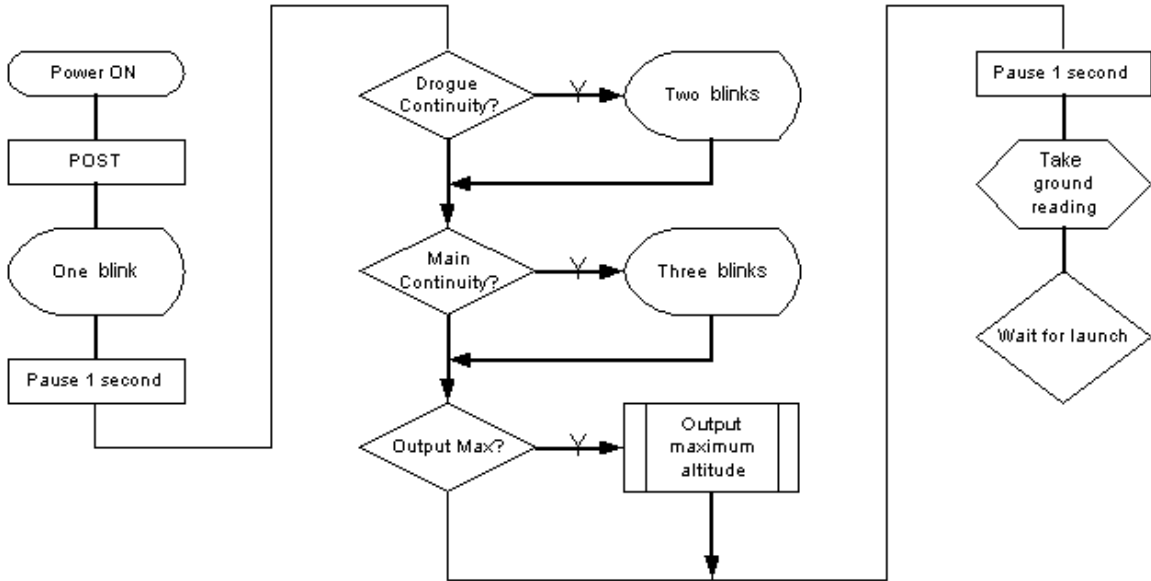


Figure 1 – AD4 flow

Altitude report:

The flight values from the last flight are stored in non-volatile memory so are preserved even without power.

The unit reports altitude in feet.

Each value is reported as a series of blinks.

These blinks indicate numbers, just count the number of blinks in each group.

The groups will be separated by a slight pause. And 10 blinks indicate zero.

Depending upon the value there will be up to 5 groups of blinks or digits.

This is because the unit will not output leading zero values.

For example the number 504 would be represented by:

B-B-B-B-B-P-B-B-B-B-B-B-B-B-B-B-P-B-B-B-B

Where the B is a blink and the P is a pause.

Sensor:

The sensor is sensitive to sunlight as well as pressure. The introduction of sunlight into the sensor will temporarily change the reading due to the thermal heating of the sensor element. This is only an issue if the sunlight is allowed to enter the sensor and heat the element inside it that makes the measurement. To prevent this from occurring don't mount the altimeter such that the vent hole can allow sunlight into the sensor. The effect only lasts while the sunlight is shining on the sensor and does not damage it.

Launch detect:

The launch detect is set at 100feet. If the rocket does not reach the launch detect altitude it will not fire the outputs. It also will not erase the last flight data.

Drogue output:

The drogue output will fire when the rocket starts to descend after apogee and the mach inhibit has timed out. The output will be on for ½ second.

Main output:

The main output will fire after apogee is detected when the rocket reaches the main deployment altitude. The factory default setting for this is 700feet. There is a delay of ½ second after the drogue output is turned off before the main output will turn on. This allows the power system to recover from the drogue event. The output will be on for ½ second.

Mach inhibit:

The unit has a mach inhibit timer. This timer starts at launch detect and continues till it times out. It will prevent the drogue output (apogee) from firing till this timer times out. It can be set in one second intervals between 0seconds and 6 seconds. The factory default value is two seconds and should be fine for most flights.

Wiring:

There are many ways you can wire this system.

This mostly depends upon your space available and the characteristics of your power source.

It also depends a lot on the igniter that you are using.

Always ground test a setup to verify it will work. When you are doing ground testing don't forget the effects of temperature on your batteries. When batteries get cold they can lose their ability to supply the current required by some igniters.

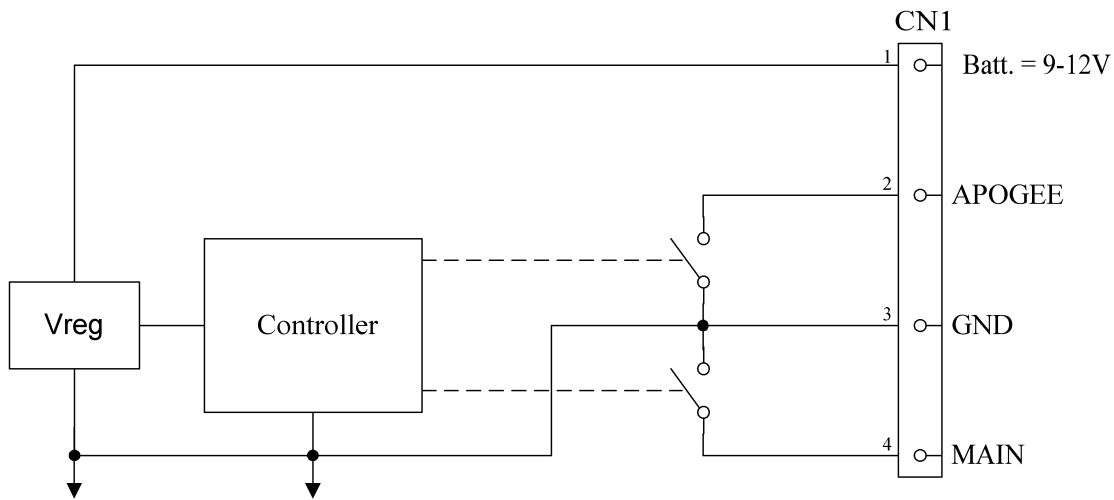
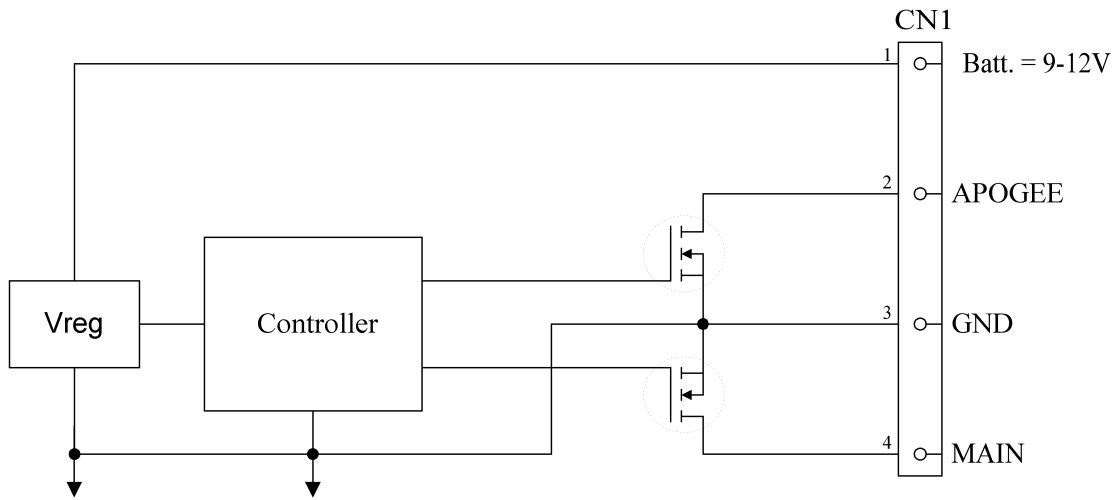
If you are concerned about this install a 1000uF capacitor to supply the extra current required.

You may want to include the capacitor on a single battery setup so there is little chance of a brownout shutting down the altimeter.

You might want to consider a resistor in series with your igniter circuit. I did not put one in the drawings you find below but let's look at an example. Let's say you have a 2ohm igniter rated to fire at 1amp and a 9V battery. If you put that igniter across that battery you are going to draw $9V/1A=9A$ of current. While it is good to have a safety margin it is not necessarily a good thing to have too much current. With this combination given a 20% safety margin you could install a series resistor of value $(9*.8)/(1*1.2)= 6ohms$ and it would fire the igniter. This puts less stress on the MOSFET switches as well. These MOSFET's are rated at 3.5A continuous and 14A pulsed so even without the resistor they should be fine. But if you are using a single battery setup, you want to prevent any possible brownouts. And when that igniter shorts out the battery it can bring down even the best electrical system.

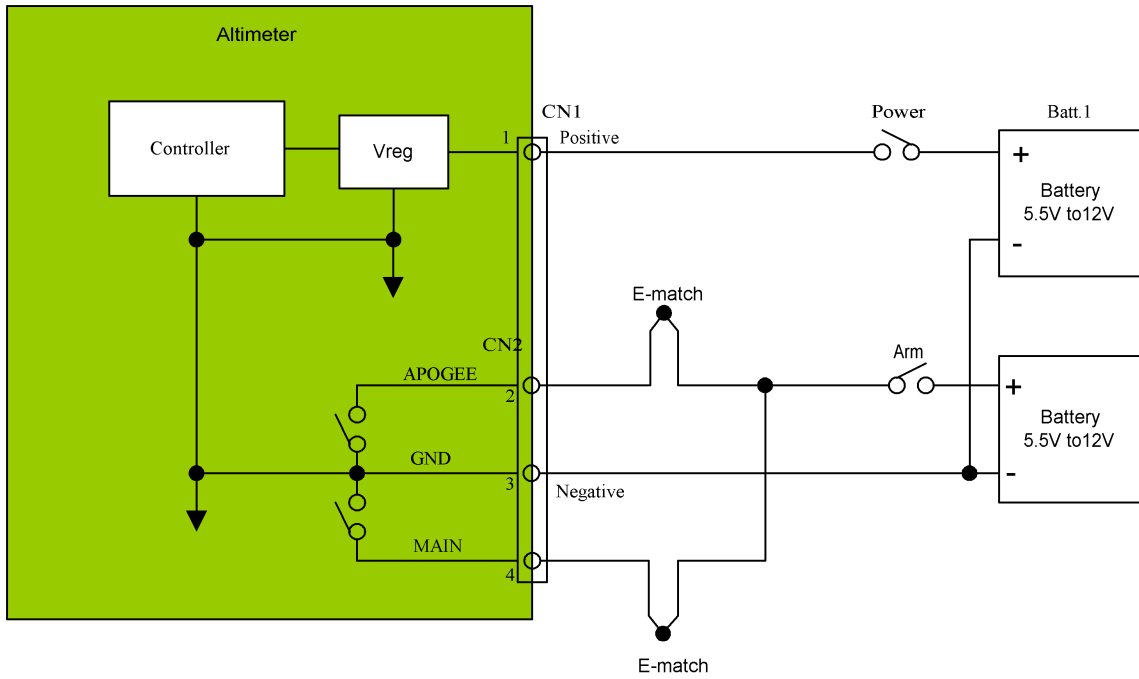
Use of two batteries is recommended. But with proper testing a one battery system can be used. Also note that 1000uF is a starting point and a larger capacitor can be used.

You don't have to use two of the same cell types when designing your power system. For instance you can use one 12V A23 (N size cell) for the controller power and one 7.2V NiCad pack for the igniter power source.



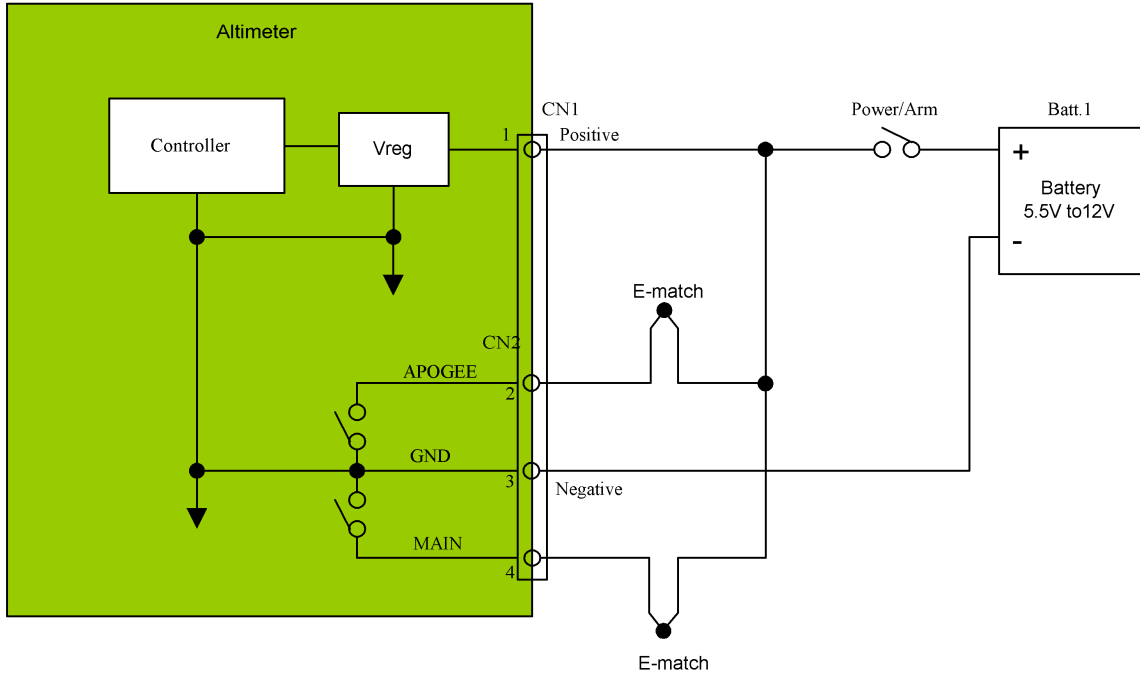
These drawings are simplified drawings of the PICO-AD4.

The unit uses MOSFET's to fire the charges, I also simplified those to make it easier to understand. Just understand that the MOSFET's are polarity sensitive and will conduct if connected backwards. So the ground of CN1 pin 3 should be connected to the negative side of the battery.

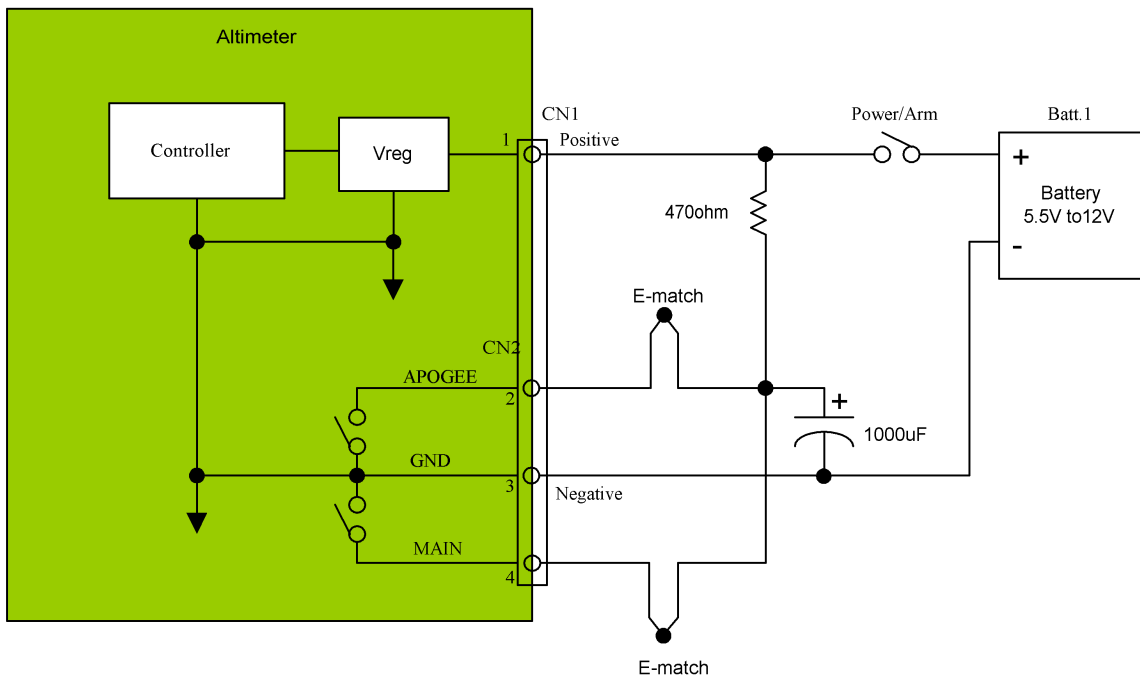


This drawing represents the standard layout using two batteries. If your pyro battery doesn't have a low enough internal resistance and can't supply enough current for your igniter then you should add a 1000uF capacitor.

Minimal connections

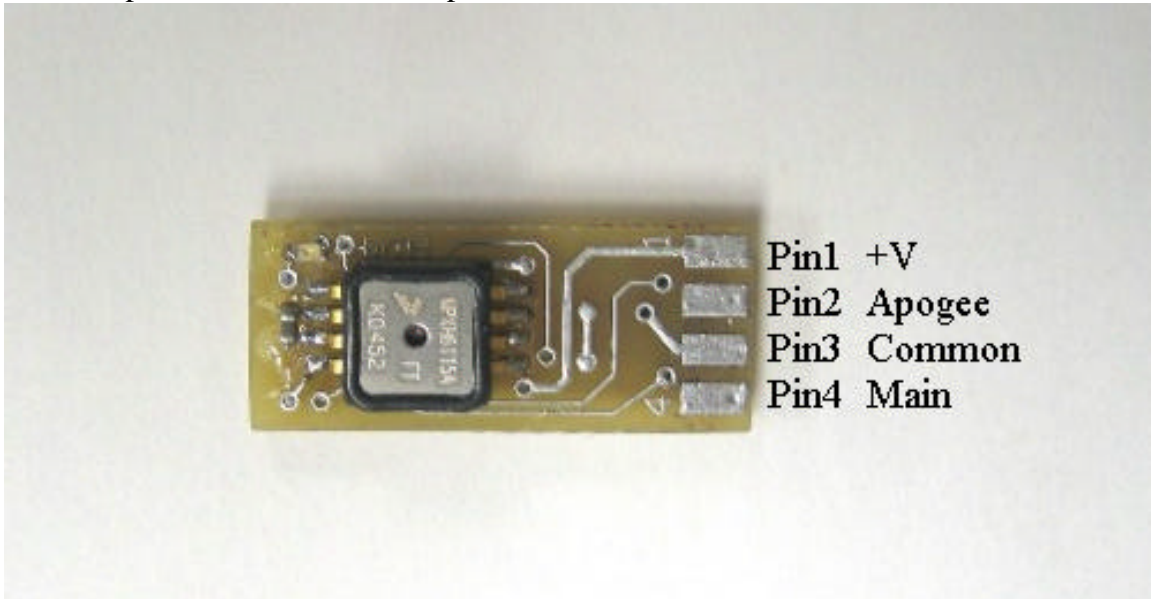


With storage capacitor



These drawings show the minimal connections for the unit. If you want to run it off one battery it is recommended that you use the capacitor and resistor. The resistor is there to limit the charge current of the capacitor. So if a 1000uF capacitor is not sufficient to fire your igniter then you should either increase its value or use a two battery setup. The layout without the capacitor is the minimal layout and should only be used if you are sure the system works. The biggest concern is that the altimeter will brownout when the igniter fires.

Here is a picture that indicates the pinout of the connectors on the AD2 unit.



CN1 pinout	
Pin	Description
1	Positive (+) controller battery connection.
2	Apogee event connection.
3	Negative (-) controller battery connection.
4	Main event connection.

Parameter adjustment:

There are two flight parameters that can be adjusted and should be verified before flight. These are the main deployment altitude and the mach inhibit time.

Due to the small size of the unit it does not have room for jumpers or dipswitches that are normally used to set these values. This unit uses the continuity circuit and LED to indicate the values and allow their modification.

Use a switch or other means to make and break continuity of the apogee(drogue) charge this will be referred to here as pressing the button(assuming a N.O. button).

It is also assumed that you don't have a 'charge' attached, only a button in place of the charge from the previous schematics.

When you power on the altimeter the first blink is the startup blink.

To enter adjustment mode press the button within one second after the startup blink.

You will see four slow flashes to indicate you have entered adjustment mode.

In adjustment mode it outputs 4 values. After it outputs the first two values it goes into an endless loop outputting the last two values. This is because the first two values are information only and not adjustable. Only the last two values can be adjusted.

The values are separated by slow flashes. The first value that's output is the serial number of your altimeter. Then it outputs the version. It then goes into a loop that outputs first the main deployment altitude setting then the mach delay setting. After each of these there is a 1second delay where you can press the button to edit that value using the input mode.

The end of the main deployment altitude setting is marked by a single slow flash.

The end of the mach delay setting is marked by two slow flashes. This helps differentiate between the two.

The input mode starts with 4 slow flashes and ends with 4 slow flashes. It counts the number of times that you press the button, each time giving a flash to indicate its counting. If it goes 3 seconds without any input the unit will exit the input mode and store the number of times you pressed the button. If the main input is 0 it will be adjusted to 1, if its over 9 it will be adjusted to 9. If the mach input is over 6 it will be adjusted to 6.

Due to possible variations it is recommended that you use 300feet or higher for the main deployment altitude. The setting of these values and the verification of their set values is the sole responsibility of the user. Please verify these values before flight.

The following tables lists the values that are available.

Power the unit off the exit adjustment mode.

Value	Main deployment altitude
1	100 feet
2	200 feet
3	300 feet
4	400 feet
5	500 feet
6	600 feet
7	700 feet
8	800 feet
9	900 feet

Main deployment values

Value	Mach inhibit time in seconds
0	0
1	1
2	2
3	3
4	4
5	5
6	6

Mach inhibit values

Specifications:

Circuit board size	1 inch x .4inch
Weight	Under 5grams without battery
Maximum altitude	40,000feet ASL
Readout	LED blinks out Apogee value
Launch detect altitude	100feet (factory default)
Resolution	7feet at sea level
Power requirements	Min = 5.3V, Max = 16V
Outputs	3.5A continuous, 14A pulsed

Limited warranty:

This unit is warranted against defects in workmanship for a period of one year from the date of purchase. The manufacturer will repair or replace the unit at its own discretion. Misuse of or modifications to the unit voids all warranties.

Limitation of Liability:

In no event will the manufacturer, its employees or its suppliers be liable for any incidental or consequential damages whatsoever (including, without limitation, damages for loss) arising out of the use or inability to use this product, even if the manufacturer has been advised of the possibility of such damages..

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitations may not apply to you.

This unit is a toy. As such no claims are made or implied as to the suitability or capability of this product in the manner in which you want to use it. The user accepts all responsibility for use of the unit.