Adept Rocketry ALTIM1 Instructions and Data Sheet

Maximum Altitude Altimeter, Model ALTIM1

ALTIM1, includes GP-23A battery.

DESCRIPTION

The ALTIM1 is a Maximum Altitude Altimeter that precisely measures, saves, and reports the maximum above-ground altitude value obtained during a rocket's flight to a resolution of one foot. ALTIM1 Altimeters are used in rockets that will reach at least 50 feet altitude. These altimeters may be used in any rocket configuration including multistage rockets, in which case maximum altitude information about a particular stage can be obtained by placing the device in the particular stage of interest. Or individual ALTIM1 units (or other altimeter devices) may be placed in each stage of interest to report maximum altitudes obtained by each stage. The ALTIM1 is very small and light weight. It was designed specially for use in small contest rockets, for use in schools in science and math studies, or for use in small diameter rockets or darts.

- The **ALTIM1** precisely captures the highest altitude obtained during a flight up to 3,000 feet above local ground level. **The maximum value obtained above the local ground-zero altitude is precisely measured, saved, and reported with a resolution of one foot.**

Once powered up, the ALTIM1 constantly measures the ground-level altitude and waits for an increasing change upward. It then captures the maximum altitude obtained (above ground zero), and begins to report the maximum altitude value. The value is "beeped" out as a series of counts that can be heard easily, even when the unit is still inside the rocket. The rocketeer knows the maximum altitude as soon as he/she picks it up, or just gets close to it.

SPECIFICATIONS

- Altitude Capability: 50 feet to 3,000 feet Above Ground Level (AGL) to 12,000 feet above sea level (ASL).
- Lowest Maximum Altitude Readable: 50 feet. Liftoff is detected when the altitude quickly increases by 50 feet. Mach compatibility: yes - however, a rocket that will only reach 3,000 feet will probably not reach the speed of sound.
- Resolution of Measurement: 1 foot. The ALTIM1 reports altitude to the nearest one foot. System uses a logarithmic 18-bit A-to-D converter
- Altitude Sampling Rate: 10.0 samples per second.
- Launch Detection: Due to the super fine resolution of the ALTIM1, it is capable of measuring launch velocity and acceleration. To detect a slow launch, it watches the velocity for a period of 3 seconds. Launch detection is at 50 feet for a slow launch with acceleration over one G. An additional launch detect threshold of 150 feet is used for immediate detection of high speed launches. Problems with wind gusts are completely avoided with Adept Rocketry's Wind Burst Glitch Removal™ system.
- Nonvolatile Memory: remembers and reports the altitude of the most recent flight, no matter how long the device has been powered down.
- Calibration Accuracy Over Full Range: better than 2%. Calibration is optimized to the range 500 to 1,200 feet AGL.
- Piezo Beeper reports altitude and operational status. The Beeper uses a push-pull driver for increased volume level, loud enough to serve as a location beacon for a lost rocket.
- Battery Life: 10 hours minimum. Advanced on-board Voltage Regulator that is totally immune to reverse voltage (battery in backwards).

- Custom altitude sensor that is immune to light, including direct sunlight.
- Measures 0.8" wide by 0.65" thick by 2" long.
- Fits inside a tube with a minimum ID of 0.8 inch (20.5 mm), a loose fit in an Estes BT-50 body tube.
- Weight with battery installed is 0.5 ounce (14 grams).
- Conformal Coating of components to avoid problems with carbon contamination.
- Accessory required: one 12-volt alkaline lighter battery (included).

TESTING AND USING THE ALTIM1

NOTE 1: The precision amplifier circuitry on the Altimeter may be sensitive to noise and static electricity when being held. Following power up the ALTIM1 reports the previous flight's maximum altitude from permanent memory. The altitude is reported twice, then there is a 10-second silent period to allow time to get your hands off the unit before it starts taking readings. *Always handle the device by the edges when testing or installing to avoid touching any of the circuitry. Avoid carpeted floors and other sources of static electricity when handling and testing the device.* ***Never store the device in a clear plastic bag****; clear plastic bags are prone to static buildup and discharge. However, pink-colored or smoke-colored antistatic bags are ideal, because they are chemically treated to prevent static buildup. Storage in a small cardboard box, or wrapped in a paper towel inside a clear plastic bag is acceptable. Do not use Velcro to secure the device, as Velcro is a substantial source for unwanted static discharge.* The ALTIM1 is a super precision instrument. Use care to keep the device clean and dry.

NOTE 2: This device must be installed only in a "clean area." *Electronic Instrumentation is not compatible with the fumes and residue created by rocket motors and deployment charges.* **The ALTIM1 should be installed in an area that is totally sealed from motors and charges.**

To turn the unit on, install a 12-volt alkaline lighter battery (GP-23A, Eveready Energizer No. A23, Radio Shack, 23-144, etc.) in the battery holder. The spring end of the battery holder connects to the negative end of the battery. Remove the battery when not in use to turn off the device and to avoid prolonged stress on the battery holder and possible long-term disfigurement of the battery holder. When the battery is first installed, there will be a long beep to indicate that power is on. Then the ALTIM1 will report the previous flight's maximum altitude twice. Then after an additional 10 seconds, the unit will beep every 1.6 seconds to indicate that it is working and looking for an increasing altitude. The start up beeps and pause after power up gives the user time to slip the unit inside the rocket tube before it starts looking for liftoff. Also, it is best to wait at least three minutes after power up, and with the ALTIM1 inside the rocket before launching. This assures that the precision circuitry has ample time to stabilize and adjust to local conditions.

A quick increase in altitude tells the unit it has liftoff. This may be a very small change in pressure, and wind blowing directly on the Altimeter outside the rocket, or improper handling, may cause a false start. The problem is avoided when the unit is inside the rocket. **When the ALTIM1 detects liftoff, the beeping rate of one beep per 1.6 seconds speeds up to the rate of one beep per 0.8 second.** The ALTIM1 constantly measures the ground-level altitude and waits for a quick change upward in order to detect liftoff. It then precisely captures the maximum altitude obtained above ground zero. The ALTIM1 uses the proprietary technique of beeping out (blinking on some models) a value to report the maximum altitude value. The beeps can be heard even when the unit is still inside the rocket. The rocketeer knows the maximum altitude as soon as he/she picks it up, or just gets close to it.

After a flight, the ALTIM1 Altimeter will be beeping out the maximum altitude in this manner: (1,325 feet) Beep ..... Beep Beep Beep ..... Beep Beep ..... Beep Beep Beep Beep Beep. A zero is indicated with a long Beep: (1,310 feet) Beep ..... Beep Beep Beep ..... Beep ..... Beeeeeep. After each sequence there is a pause before it repeats. The Adept Rocketry beeping system works for three, four, or five digits depending on the value. This readout system is an Adept Rocketry invention. Even though this readout system is copyrighted and patented (patent expired), and a registered trade mark of Adept Instruments, Inc, it has become the industry standard.

To simulate rocket liftoff and to see (hear) the unit do its thing, you will need to place the Altimeter inside a bottle or other make-shift vacuum chamber, then slowly pull a vacuum on the bottle. You need only hold the vacuum for a few seconds, then release slowly. The Adept Rocketry VACBOT for $9.95 serves this purpose

well. It is easy to simulate rocket flights to altitudes of several thousand feet. Slowly pull the vacuum, then slowly release the vacuum. As the vacuum (altitude) increases, the ALTIM1 will start beeping at the faster rate of once every 0.8 second to indicate that it has detected liftoff. When it reaches maximum altitude, there will be two quick beeps. Then when the Altimeter starts its descent (vacuum is being released), it starts beeping out the maximum altitude attained above ground. Check out the Adept Rocketry vacuum bottle device **VACBOT**. It is small, and it is a complete Vacuum Chamber Assembly that will accept small altimeters such as the ALTIM1.

MAXIMUM ALTITUDE VALUE FROM THE PREVIOUS FLIGHT

Whenever the ALTIM1 is turned on, the long beep indicates proper operation. Then the previous flight's maximum value is beeped out twice, followed by a 10 second delay before the device starts looking for liftoff. This sequence is repeated every time the unit is turned on. To hear the previous flight's altitude again, turn off the ALTIM1 (before the end of the ten second pause if possible). If the battery is already in the battery holder, you may push the battery forward against the spring to momentarily remove power and restart the ALTIM1. The ALTIM1 will again report the previous flight's maximum altitude.

LIMITED WARRANTY AND DISCLAIMER

Adept Rocketry and Adept Instruments, Inc. warrant to the original purchaser that this product is free of defective parts and workmanship and that it will remain in good working order for a period of 90 days from the date of original purchase. This product will be repaired or replaced within 90 days of purchase if it fails to operate as specified, if returned by the original purchaser and if it has not been damaged or modified, or serviced by anyone other than the manufacturer. Adept Rocketry and Adept Instruments, Inc., their owners, employees, vendors and contractors shall not be liable for any special, incidental, or consequential damages or for loss, damage or expense directly or indirectly arising from customer’s or anyone’s use of or inability to use this device either separately or in combination with other equipment, or for personal injury or loss or destruction of other property, for experiment failure, or for any other cause. This device is sold as an experimental accessory only, and due to the nature of experimental carriers such as rockets, the possibility of failure can never be totally removed. It is up to the user, the experimenter, to use good judgment and safe design practices and to properly pretest the device for its intended performance in the intended vehicle, or reasonable facsimile of same, under controlled conditions to gain reasonable belief that the device and vehicle will perform in a safe manner, and to assure that all reasonable precautions are exercised to prevent injury or damage to anyone or anything.

WARNING: Do not use this device unless you completely understand, agree with, and accept all of the above statements and conditions.

NOTES ON MOUNTING AND INSTALLING

This device is intended to be installed lengthwise in a small rocket tube. It fits inside a 24 mm or BT-50 tube. When it is to be used in a larger diameter body tube, it may be mounted in any orientation. It may be mounted inside a BT-50 tube that is connected to bulkheads or other structural elements. Also, it may be wrapped with or rolled up in foam rubber or paper towels before being slipped into a larger diameter tube. This has the advantage of additional protection against crash damage, and contamination. The Altimeter will still be able to "breathe" through the porous materials. The Altimeter will still work normally.

Do not use Velcro as a mounting device. When installing lengthwise, always mount the Altimeter with the spring end of the battery holder facing upward toward the nose end of the rocket. This will avoid compression of the spring and battery disconnection during a very high acceleration liftoff.

An Altimeter must be installed in a "sealed" chamber with a vent or vents to the outside. A sealed bulkhead below the altimeter chamber is necessary to avoid the strong vacuum caused by the aft end of a rocket during flight. Any leakage around the motor mount or in other areas at the aft end of the rocket will allow the strong vacuum to be partially felt inside the rocket body. In this case an altimeter could incorrectly indicate and record an altitude that is far higher than reality.

A sealed bulkhead above the altimeter chamber is necessary to avoid any pressure fluctuations that may be created at the nose end of the rocket. If the front of the payload section slip fits to another section such as a nosecone, then the fit must be as free as possible from turbulence.

A breathing hole or vent (also known as a static port) to the outside of the rocket must be in an area where there are no obstacles above it that can cause turbulent air flow over the vent hole. Do not allow screws, ornamental objects, or anything that protrudes out from the rocket body to be in line with and forward of a vent hole. Vents must be neat and burr free and on an outside surface that is smooth and vertical where airflow is smooth without turbulence.

Some rocketeers use multiple static ports (vent holes) instead of just one. Very strong wind blowing directly on a single static port may affect an altimeter. Multiple ports evenly spaced around the rocket tube may help cancel the effects of strong wind on the ground, the effects of transitioning through wind shears during flight, the pressure effects of a non-stable liftoff, or the pressure effects that occur due to flipping and spinning after deployment. If you wish to use multiple ports, then use three or four. **Never use two.** Ports must be the same size and evenly spaced in line around the tube.

The general guideline for choosing port size is to use one 1/4 inch diameter vent hole (or equivalent area, if multiple holes are used) per 100 cubic inches of volume in the altimeter chamber. For instance, An eight-inch long four-inch diameter tube has a volume of about 100 cubic inches. Use one 1/4 inch port, or three or four 1/8 inch ports evenly spaced around the tube. An altimeter chamber two inches in diameter and eight inches long (25 cubic inches) needs one 1/8 inch vent hole or three or four 1/16 inch vent holes. Try to keep hole sizes within -50% or +100% of the general guideline. Do not make the holes too small, and **especially do not make them too large**. Obviously, a vent or vents in a small body tube (18 mm BT-20 or 24 mm BT-50) will be quite small. However, in general, the vent holes need never be smaller than 1/32 inch. Also, the vent hole diameter need never be less than the thickness of the body tube.

Adept Rocketry completed the research on static port sizes in 1990. The information provided here has remained the industry standard ever since those early years.

When possible, vent holes should be a minimum of four body diameters below the junction of the nosecone with the rocket body. This is necessary with high performance (high speed) rockets. The tremendous pressure on the nosecone leeches down the rocket body as much as three or four body diameters before it dissipates. However, with lower speed rockets, the "minimum of four body diameters" rule may be reduced to one or two.