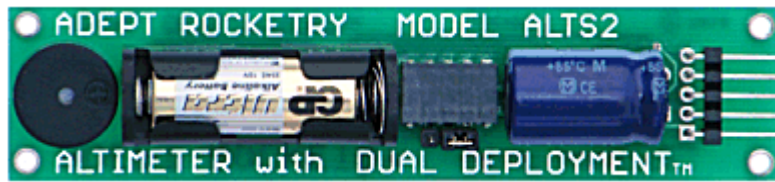


Adept Rocketry - ALTS2 Instructions and Data Sheet

ALTS2 and ALTS2-50K Altimeter with Dual Deployment™



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DESCRIPTION

The ALTS2 Altimeter with Dual Deployment™ is a maximum altitude altimeter that precisely measures and reports the maximum above-ground altitude value obtained during a rocket's flight. The ALTS2 also has two altitude controlled deployment switches that are typically used to fire deployment charges, based on altitude. The first charge fires when the rocket reaches its maximum altitude (apogee), and the second charge fires when the rocket descends to 1200 feet or 600 feet or 300 feet above ground (3 choices, user selectable) for both the ALTS2 standard version and the ALTS2-50K extended version. One common usage is to deploy a main parachute at apogee by using only the first output. However, the most typical usage is to deploy a drogue chute or streamer first, then to deploy a main parachute when the rocket descends to 1200 or 600 or 300 feet above ground, in order to avoid significant drifting due to wind.

This device is used in rockets that will reach at least 150 feet altitude. Either or both deployment switches may be used, or the device may be used as a maximum altitude altimeter only. The ALTS2 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 ALTS2 units (or other altimeter devices) may be placed in each stage of interest to report maximum altitudes obtained by each stage, and/or to handle deployment for each stage.

The ALTS2 precisely captures the highest altitude obtained during a flight to a maximum of 15,000 feet above sea level for the standard version (50,000 feet above sea level for the ALTS2-50K extended version). **The maximum value obtained above the local ground-zero altitude is precisely measured and reported in one-foot increments (one-foot resolution).**

The ALTS2 measures 0.9" wide by 0.67" thick by 4" long. It fits inside a tube with a minimum ID of 23.1 mm, or 0.91 inch. The device weighs only 25 grams (0.9 ounce), including the battery. It uses a 12-volt alkaline lighter battery with a battery life up to 10 hours, so you need not be concerned about how long your rocket sits on the launchpad after the unit is powered up. The ALTS2 is a totally stand-alone device including the battery holder, the arming mechanism, and the current source for firing deployment charges. Nothing more is required except for the wires (Adept **CAB5-xx** series or **CAB5/6-xx** interconnect cable) that connect to the deployment charges and to an On-Off switch.

The altimeter uses a custom absolute pressure device to precisely measure altitude values up to 15,000 (or 50,000) feet in one-foot increments. It uses a logarithmic amplifier along with a 17-bit analog to digital converter to precisely (one-foot resolution) measure the nonlinear pressure versus altitude relationship over this large altitude range. Once powered up, the ALTS2 reports that neither, or one or both deployment charges has continuity. It also constantly measures the ground-level altitude and waits for a quick 150-foot change upward. It then precisely captures the maximum altitude obtained above ground zero. The first deployment switch fires at the very moment when the rocket reaches the maximum altitude. The second switch fires when the descending altitude reaches 1200, 600, or 300

feet above the ground (user selectable). The ALTS2 then begins to report the maximum altitude value. The ALTS2 uses the copyrighted and patented 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. Note: the ALTS2 cannot be used for, and will not function for, maximum altitudes less than 150 feet.

SPECIFICATIONS

- Altitude Capability: to 15,000 feet Above Ground Level (AGL), to limit of 15,000 feet Above Sea Level (ASL) for the standard version (50,000 feet for the ALTS2-50K extended version).
- Nonvolatile Memory: remembers and reports the altitude of the most recent flight, no matter how long the device has been powered down.
- Lowest Maximum Altitude Readable: 150 feet above ground. Liftoff is detected when the altitude quickly increases by 150 feet.
- Mach Compatible; the ALTS2 uses Adept's proprietary Real Time Dynamic Lockout™ system that tracks speed in real time to ignore pressure glitches that occur when transitioning through the sound barrier, both in and out. This system is possible due to the extreme precision of one-foot resolution measurements.
- Resolution of Measurement: one foot; system uses a logarithmic 17-bit A-to-D converter.
- Calibration Accuracy Over Full Range: +/- 1%, typical.
- Uses 12-volt lighter battery and has large integral capacitor to fire flashbulb or low-current electric match charges.
- Battery Life: up to 10 hours.
- Piezo beeper reports altitude and operational status including the continuity of the deployment devices. One repeating beep if neither device has continuity, two beeps repeating if only device #1 has continuity, three beeps if only device #2 has continuity, and four beeps if both devices have continuity.
- Switch #1 fires when the altitude reaches maximum; Switch #2 fires during descent at 1200, 600, or 300 feet above ground, as selected by the user, or 2 seconds after Switch #1 fires, whichever occurs last.
- Measures 0.9" wide by .67" thick by 4" long and fits inside a tube with a minimum ID of 23.1 mm, or 0.91 inch, or on either side of a center plate inside a 38 mm ID tube. Also, it may be mounted to plates, or flat against a bulkhead in larger diameter tubes. Avoid mounting it vertically with the battery holder spring toward the bottom.
- Weighs only 24 grams (0.9 ounce) with battery installed.
- Accessories Required: one 12-volt alkaline lighter battery, and one cable (Adept **CAB5-xx** series or **CAB5/6-xx** series) to connect an On-Off switch and deployment charges.

CONNECTING THE CABLE AND CHARGES

View the ALTS2 vertically with the five-pin connector at the top and the battery holder toward the bottom. An Adept **CAB5-xx** or **CAB5/6-xx** series Interconnect Cable plugs onto the five-pin connector on the upper end.

The deployment charges connect to a **CAB5-xx** cable as follows. The first charge connects to the ORANGE wire and to the RED wire. This charge will fire when the rocket has reached the maximum altitude (apogee). The second charge connects to the YELLOW wire and also to the RED wire. It will fire when the rocket descends to 1200, 600, or 300 feet above the ground. The RED wire is common to both charges when using a **CAB5-xx** cable.

On a **CAB5/6-xx** cable there are two RED wires connected to the center pin of the 5-pin connector. This allows the convenience of connecting a separate RED wire (instead of one common wire) to each charge. A **CAB5/6-24** Interconnect Cable is supplied with the ALTS2.

The BLACK wire and BROWN wire connect to an On-Off switch, or some other gimmick for completing a connection between the two wires. A non-elegant but very effective way of making the connection is to simply twist the two wire ends together. Before power up, these wires can simply hang out a hole in the rocket body, such as one of the static ports. After twisting the ends together, fold a piece of masking tape over the exposed ends to electrically insulate them, then push them back inside the rocket body.

TESTING AND USING THE ALTS2

NOTE 1: The precision amplifier circuitry and continuity sensing circuitry on the ALTS2 may be sensitive to noise and static when being held. *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; however, pink-colored or smoke-colored antistatic bags are ideal. Storage in a small cardboard box, or wrapped in a paper towel inside a plastic bag is acceptable. Do not use Velcro to secure the device.* 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 ALTS2 must be installed in an area that is totally sealed from motors and charges. **After passing wires through holes in bulkheads and such, seal them with epoxy or removable putty.**

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 avoid prolonged stress on the battery holder and possible long-term disfigurement of the battery holder.

Select 1200, 600, or 300 feet above ground for the second output. While viewing the ALTS2 vertically with the five-pin connector at the top, there is a 3-pin connector at the upper right of the battery holder. **To select 300 feet**, the lower selection, install a small shorting jumper on the lower two pins. **To select 1200 feet**, the higher selection, install a small shorting jumper on the upper two pins. These small shorting jumpers may be purchased from Adept Rocketry, or from Radio Shack (Cat. No. 276-1512) if you need some spares. **To select 600 feet**, do not install the jumper.

To turn the unit on, connect the BLACK wire and the BROWN wire together. Typically these wires will connect to a normally-open On-Off switch or other device. Or the two wires simply may be twisted together. The unit sounds out a long pulsating beep when powered up, to indicate proper operation. **Then the altitude of the most recent flight is beeped out twice.** After another ten seconds of silence the unit starts beeping once every 1.6 seconds to indicate that it is now taking altitude readings and is waiting for liftoff.

In actual use in a rocket with live deployment charges connected—do not power up the ALTS2 until it is secure inside the rocket, and the rocket is in a ready to launch position. Note that this indicates that the device should be turned on remotely from the outside of the rocket. **Never touch or hold in your hands an active detonating device that has explosive charges connected.**

If flashbulbs (or low-current electric matches at a safe distance) are connected (don't connect anything quite yet), the beeping changes from a single beep to other beeping patterns to indicate continuity of the deployment charges. A single beep every 1.6 seconds indicates proper operation with no deployment charges connected. A double beep indicates continuity of only the first output or first deployment charge, the one that fires at apogee (maximum altitude). A triple beep indicates continuity of only the second output or second deployment charge, the one that fires during descent at 1200, 600, or 300 feet above ground. Four beeps repeating indicates that both Deployment Switch outputs (both deployment charges) have continuity.

To simulate rocket liftoff it is necessary to pull a vacuum on the altimeter while it is inside a sealed chamber. You need only hold the vacuum for a few seconds, then slowly release. The best method is to put the whole device (including wires and flashbulbs or small light bulbs, for testing the output switches) inside a small wide-mouth juice bottle, and pull a vacuum on the bottle (or you may use an Adept VCK2 Vacuum Chamber—see [VCK2 Vacuum Chamber](#) and [VCK2 Instructions](#)). 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 ALTS2 will start beeping at the faster rate of one beep every 0.8 second. This is the indication that 150 feet has been reached (liftoff). If deployment charges are connected to the altimeter, the continuity indicator beeps will stop at this time. The beeps every 0.8 second will continue during the flight until both outputs have fired. The unit then begins reporting the maximum altitude.

After a flight, the altimeter will be beeping out the maximum altitude in this manner: (1,321 feet) BeepBeep Beep Beep.....Beep Beep.....Beep. A zero is indicated with a long Beep: (1,302 feet) Beep.....Beep Beep Beep.....Beeeeeep.....Beep Beep. After each sequence there is a long pause before it repeats. This system works for three, four, or five digits depending on the value. **This readout system is an Adept Rocketry invention. It is copyrighted and patented.**

Warning: never install this device in a rocket without first testing its controlling outputs. Always test before each flight. Also, backup deployment systems and/or instrument redundancy (use of two similar systems in the same rocket) are highly recommended.

If an output is not to be used to fire a deployment charge, then leave the two wire ends disconnected. Protect any unused wire ends with tape to keep them electrically insulated. **Do not connect unused wires to each other or to anything else.**

MAXIMUM ALTITUDE VALUE FROM THE PREVIOUS FLIGHT

Whenever the ALTS2 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 ALTS2 (before the end of the ten second pause if possible) and wait for it to shut down. Turn it on again to hear the previous flight's maximum altitude.

NOTES ON MOUNTING AND INSTALLING

The ALTS2 may be installed lengthwise in a small-diameter rocket tube. It will fit lengthwise in a tube with an ID of 24 mm (0.95 inch). It may be mounted in any orientation to plates or bulkheads inside larger diameter tubes. The mounting holes are 0.090 inch diameter for #2 hardware. Use #2 screws, standoffs, and hexnuts when mounting the altimeter to a plate or bulkhead. **Do not enlarge the mounting holes, and do not use Velcro.** When installing lengthwise, always mount the ALTS2 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 vacuum caused by the aft end of a rocket during flight. 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.

The 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. The vent 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 could affect the 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.

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 four diameters before it dissipates.

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.

ALTS2 Maximum Altitude Altimeter with Dual Deployment™

Price: \$89.00 - Includes CAB5/6-24 Interconnect Cable and GP-23A Battery.

ALTS2-50K Maximum Altitude Altimeter with Dual Deployment™

Price: \$119.00 - Includes CAB5/6-24 Interconnect Cable and GP-23A Battery.

ADDITIONAL ACCESSORIES

Additional **CAB5/6-24 Interconnect Cable**

Price: \$6.89 - 24 inches long. Connects ALTS2 to On-Off Switch and to Deployment Charges.

CAB5/6-12 Interconnect Cable

Price: \$5.49 - 12 inches long.

CAB5/6-36 Interconnect Cable

Price: \$7.99 - 36 inches long.

CAB5-24 Interconnect Cable

Price: \$6.25 - 24 inches long. Connects ALTS2 to On-Off Switch and to Deployment Charges.

CAB5-12 Interconnect Cable

Price: \$4.99 - 12 inches long.

CAB5-36 Interconnect Cable

Price: \$7.29 - 36 inches long.

Additional **GP-23A Alkaline Lighter Battery**; **Price: \$2.25.**

GP-23A50 Alkaline Lighter Batteries (box of 50 at 50% Discount); **Price: \$56.25.**

Shorting Jumpers are used to connect two connector pins together in order to turn on the power for some of the Adept devices. Shorting Jumpers are also used on some devices to program certain values or functions. One jumper is used on the ALTS2 to program the value for the Second Output Function, the output that fires the Deployment Charge for the Main Parachute.

Shorting Jumpers

Price: \$1.39 per pack of 10.

VCK2 Vacuum Chamber, Complete with Bottle.

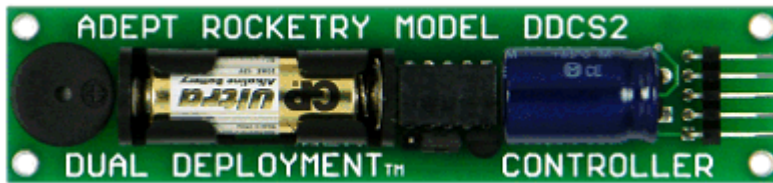
Price: \$16.79. Use for simulating flights, and for testing Altimeters with or without deployment.

Electronic Instrumentation is not compatible with the fumes and residue created by rocket motors and deployment charges. Seal holes and gaps in bulkheads and such with epoxy or removable putty.

Tac'N Stik Removable and Reusable Putty

Price: \$1.99 per 2 ounce pack.

The perfect mate for the ALTS2 or ALTS2-50K when used in a dual redundancy backup system is the DDCS2. The ALTS2 or ALTS2-50K would function as the primary device to measure altitude and to control Dual Deployment™. The DDCS2 would function as the redundant backup device to also control Dual Deployment™.



DDCS2 Dual Deployment™ Controller

Price: \$69.00 - Includes CAB5/6-24 Interconnect Cable and GP-23A Battery.

www.adeptrocketry.com 8-12-10