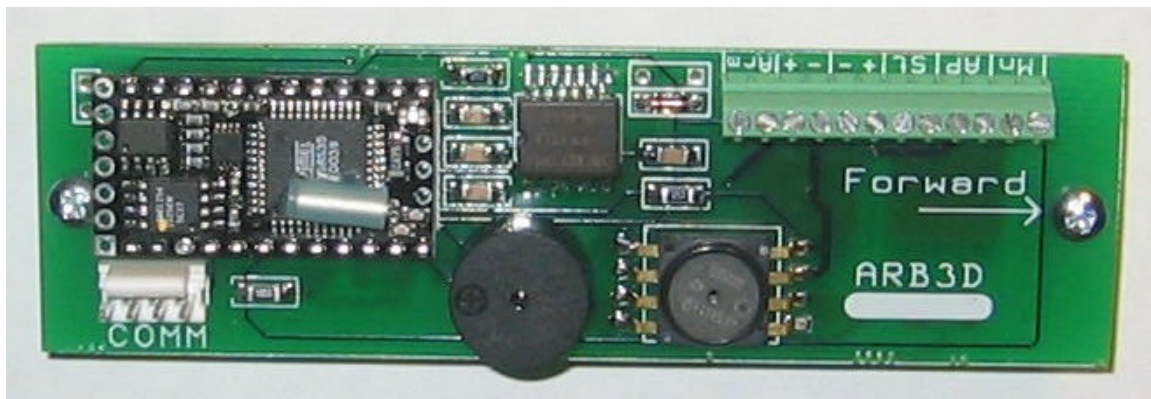

Accele-Rocket

ARB3D Users Guide Version 1.1.0



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1 Getting started

This section illustrates how to get started with Accelo-Rocket. System requirements are summarized, and hardware/software setups are explained. Help information and procedures are outlined, as well as contact information.

The ARB3D includes the following items:

- 1) Accelo-Rocket Board - ARB3D
- 2) Accelo-Graph software and documentation CD
- 3) Serial download cable, 4-pin female to DB-9 female
- 4) 9v Battery lead

1.0 PC System Requirements

The Accelo-Graph requires a PC that meets the following minimum requirements:

- 1) MS Windows 95/98/NT
- 2) Pentium or higher processor
- 3) 16MB RAM, 32MB recommended
- 4) 3MB free hard disk space
- 5) CD disk drive
- 6) Available serial COM port

1.1 Software Setup

This step installs the Accelo-Graph on your computer. It is important to close all open programs before running Setup. If sharing violations still occur, press Ignore and continue Setup. Setup will prompt you to replace system files before continuing the installation.

- 1) Close all running Windows programs
- 2) Remove any previous Accelo-Graph Installations (Start, Settings, Control Panel, Add/Remove Programs, Accelo-Rocket, Add/Remove)
- 3) Insert Accelo-Graph CD into CD Drive (D: for example)
- 4) The installation should start automatically, if not run SETUP.EXE: Start, Run, D:\SETUP.EXE, OK
- 5) Follow prompts for Installing Accelo-Graph to computer
 - a) If prompted, replace some system files and restart Windows
 - i) After restart, proceed from Step 1 again
 - b) If prompted, keep newer files and replace older files
 - c) If prompted, Ignore sharing violations and continue setup

1.2 Hardware Setup

The following instructions outline how to mount, install and connect to the ARB3D:

1. Mount the ARB3D using the supplied #4-40 mounting screws and standoffs to a non-conductive mounting board. Align the arrow on the board with the wording 'Forward' pointing up towards the nosecone or otherwise to the sky.
2. The altimeter bay should be enclosed and protected from any ejection gases that could damage the parts on the altimeter, particularly the barometric sensor. The barometric sensor should be free from any direct obstructions (ie. tape, straps). The altimeter bay should be allowed to vent to the outside of the rocket with typically 3 equidistant 1/4" holes around the circumference of the airframe.
3. When downloading and configuring the altimeter, connect the supplied serial communication cable to an available comport. The other end of the cable will be connected to the 4-pin male port labeled 'COMM'.

2 ARB3D Instructions

2.0 General Overview

The ARB3D flight computer altimeter utilizes both an accelerometer and a barometer for optimal performance in an altimeter. The powerful processor performs real-time floating-point arithmetic for precise readings of logarithmic altitude. Not only are the acceleration and barometric values stored, the exact timing between readings are also recorded. This altimeter embeds a 'Smart-Polling' algorithm. This means during the ascent phase of the flight it is polling at a rate of 30 samples/second and only 10 samples/second during the descent rate until touchdown has been detected. This is to conserve memory for long duration flights or for multiple short flights without downloading the flight data.

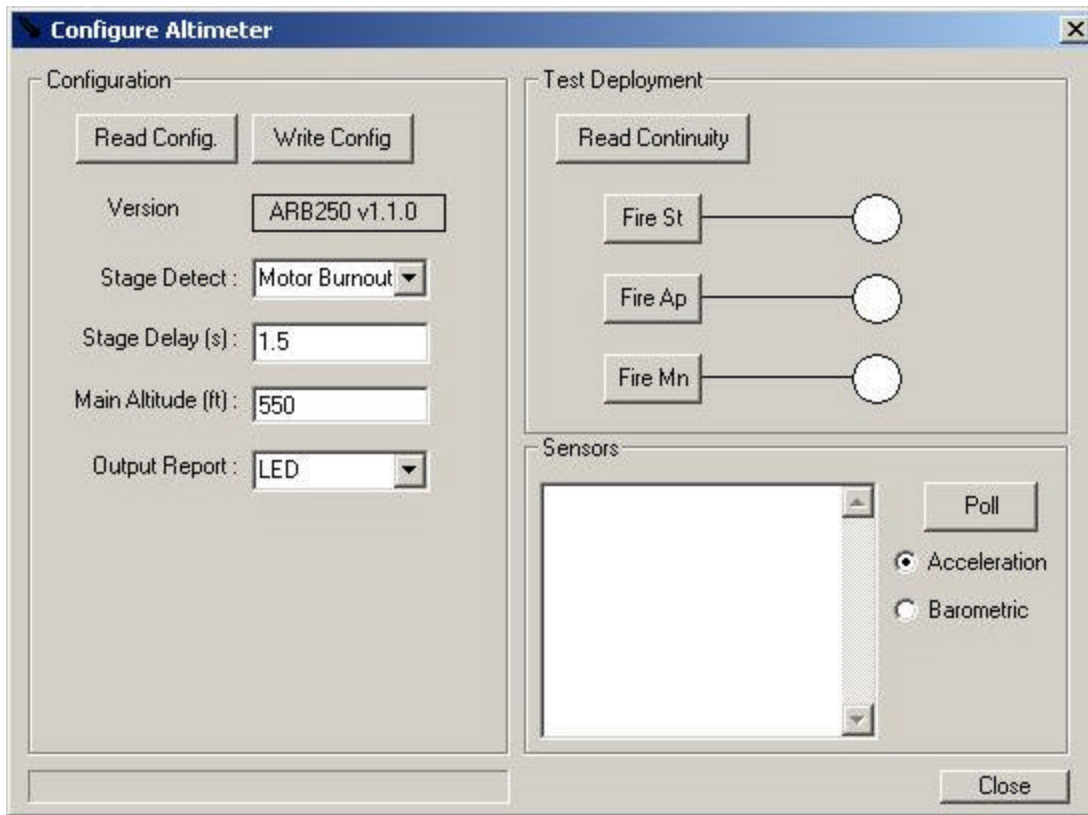
The ARB3D has the ability to deploy 3 high current independent channels: air start/staging with configurable delay, apogee and low altitude deployment. Both the delay and altitude settings are not restricted to pre-set values, but to a range of values in increments of 0.1 seconds and 1 foot.

2.1 Configure the ARB3D

All of the configurable parameters are handled on the Accelo-Graph software program.

1. Disconnect all Pyro devices from the altimeter.
2. Disconnect the 'Arm' terminal block. The altimeter will not respond if it is in the armed mode.
3. Connect the supplied communication cable to an available port on a PC to the altimeter. Close or disable any programs using serial communication.
4. Start the Accelo-Graph program and configure the comport number (Connect->Port Configuration from the menu).
5. Power the altimeter.

Open the configuration window by selecting 'Configuration->Configure Altimeter' from the menu.



Configuration:

As shown above, click the 'Read Config' button to read the firmware version and current configuration. After making the appropriate changes, transmit the new configuration by clicking on the 'Write Config' button. The following describes the configurable settings:

1. **Stage Detect:** Selectable air start/stage event for either launch detection or motor burnout detection.
2. **Stage Delay (s):** The delay (0.0 to 30.0 seconds) for which the air start/stage will fire after the stage detection event.
3. **Main Altitude (ft):** The altitude (200 to 3000) for the main deployment channel.
4. **Output Report:** Selectable output reporting for either the LED or buzzer.

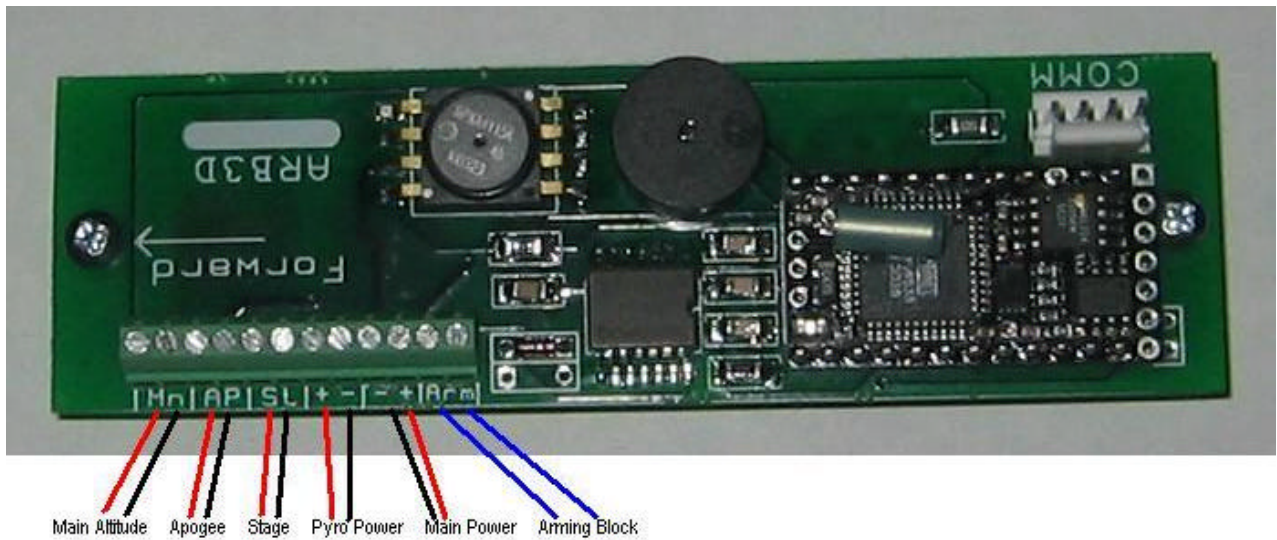
Test Continuity:

Read the continuity of any connected test devices (LED, buzzer, etc.) by clicking the 'Read Continuity' button. For test devices that are orientation sensitive, the positive lead is the capital letter and the negative lead is the lower case letter (ex. 'Mn': positive = 'M', negative = 'n'). The Fire button will signal the channel.

Sensors:

Poll the real-time data from the 2 onboard sensors: acceleration (Gs) or barometric values (Psi). Click the 'Poll' button to start and click the same button (button text changes to 'Stop') to stop.

2.4 Deployment, Power and Arm Connections



Connection Block Label	Description
S	(+): Air start or Staging
t	(-): Air start or Staging
A	(+): Apogee
p	(-): Apogee
M	(+): Main Altitude
n	(-): Main Altitude
+	(+): Pyro Power
-	(-): Pyro Power
-	(-): Main Power
+	(+): Pyro Power
Arm	Arming Block

Single Battery: Connect battery power to the ‘Main Power’ only for low current deployment (0.6 Amps @ 9v battery). The single battery connection can fire only 1 low current igniter (ex. Oxral, DaveyFire) at a time. When clustering more than one igniter on any one channel, use the dual battery configuration.

Dual Battery: Connect 2 separate sources of battery power, Pyro Power and Main Power for high current deployments (10 Amps max).

2.5 Arming

Connect a device or method (slide switch, 2 wires, etc.) to close a connection to the ‘Arm’ block on the ARB250. This connection should be open as default and closed to arm. Verify the correct orientation with the arrow on the board pointing up towards the nose cone before arming. Upon arming, the ARB3D performs calibration and point of reference calculations. Once armed, opening the circuit will disarm the altimeter.

The ARB3D will start once acceleration greater than 2Gs is detected for more 0.25 seconds. The ARB3D has the capabilities of recording multiple flights of data totaling up to 3766 samples of data. One sample of flight data consists of acceleration, barometric pressure and the time delta (time difference between readings). Each flight will record about 30 samples/second from launch detection until apogee, then only 10 samples/second until touchdown.

Upon recovery, it will report the apogee altitude in feet. It reports each digit at a time separately starting with the most significant digit. Digits that are zero will report a long beep. For example, an altitude of 1203 feet will report: ...Beep...Beep, Beep...Beeeeeep...Beep, Beep, Beep... The last apogee value will report even after a reboot when not in the armed state.

2.6 Continuity Checks

The altimeter displays the continuity every 5 seconds, when armed, to the selected output (LED/buzzer). Example: Apogee and Main connected: ...beep, beep...beep, beep, beep...

Connected Channel	# of Beeps
None	1 long beep
Air start/Staging	1 short beep
Apogee	2 short beeps
Main/Low Altitude	3 short beeps

2.8 Downloading Flight Data Files

After recording one or more flights of data, you can download all of the recorded flights to the Accelo-Graph program. Once the files have been downloaded and a new flight has been recorded, all previous files are deleted. Until then, you can download the current files over again. The data files are save as a comma delimited files to allow opening in a spreadsheets program. Follow the steps to download the data:

- 1) Start the Accelo-Graph program and power the Accelo-Rocket board.
- 2) Connect the Accelo-Rocket via the supplied cable to an available serial port on the PC.
- 3) Select the comport from the 'Connect' -> 'Port Configuration'
- 4) Click 'Download' from the 'Connect' menu.
- 5) Open the file(s) uploaded (tmprecord#.rcd, # = the index of files uploaded) one at a time.

3 ARB3D Technical Specifications

Model	ARB3D Altimeter Flight Recorder
Size	1.25" x 4.125"
Weight	1.0 oz. (without battery)
Acceleration	+/- 50 g
Barometric Altitude	40,000 feet
Output Reporting	Buzzer or LED
Smart-Poll Sample Rate	30 samples/second (ascent) 10 samples/second (descent)
Digital Conversion	10-bit Analog to Digital Conversion
Resolution	0.13 Gs
Record Capacity	Multiple files totaling 3766 samples
Record Duration	From liftoff to touchdown
Liftoff Detection	When acceleration is greater than 2 g for more than 0.25 seconds.
Air start/Staging Detect	Launch Detect or Motor Burnout
Air start/Staging Delay	0.0 to 30.0 seconds
Low Altitude Deployment	200' to 3000'
Deployment Channels	1. Air start/Staging 2. Apogee 3. Main (Low Altitude)
Deployment Fire Duration	0.05 Seconds
Single Battery Deployment Current	0.6 Amps
Dual Battery Deployment Current	10.0 Amps Max
Supply Voltage	6 to 15 volts (9v Battery Recommended)
Supply Current Draw	30-35mA

4 Accelo-Graph Instructions

4.0 Uploading Recorded Flights

Configure the port connection by selecting Connect->Port Configuration from the menu. Select a serial communication port from the drop down selection box and click Ok.

For uploading previous recorded flights from the Accelo-Rocket to your PC, follow the directions in section 2.4. Once complete, a message box will appear to notify the number of files or flights that were uploaded. To open the flight(s) that were loaded, go to Files->Open and open a file starting from tmprecord0.rcd. Since the Accelo-Graph overwrites these files every time it uploads, you want save it to a different file name.

4.1 Editing

The following are a list of parameters to fill in. This gives information about the rocket and parameters for calculating the estimated thrust of the engine(s).

Name

Enter the name of your rocket.

Place

Enter the place or location where the rocket was launched.

Date

Enter the date when your rocket was launched. The format doesn't matter.

***Coefficient of Drag**

Enter the estimate coefficient of drag. Usually it will be around 0.6 to 0.7.

***Total Weight (lbs.)**

Enter the total launch weight of the rocket. This includes all motors and payloads.

***Propellant Weight (lbs.)**

Enter the weight of the propellant only.

***Diameter (in.)**

The outside diameter of the rocket's body tube.

Notes

Any additional notes about the rocket and launch, such as, motors used, payload, recovery, weather conditions, etc.

** Required data to calculate the correct thrust.*

4.2 Graph

Select between displaying all curves or just the acceleration and thrust curves for zooming in on just the thrust curve.

4.3 Files – Open, Save & Print

To open a downloaded or previously saved file, click Open from the Files menu. Accelo-Graph can only read *.rcd files. These files can be opened in a spreadsheet style program (ex. Microsoft Excel) as a comma delimited file.

To save a file click Save from the Files menu. This saves all the data to a *.rcd file type. Be sure to save all uploaded files from the Accelo-Rocket to a different name other than the default (tmprecord#.rcd (# is the index of the file loaded)), because Accelo-Graph will copy over the same file the next time it uploads data.

To print a file to a printer, click Print from the Files menu. This will print the graph and all the data on the screen.

5 Upgrade Instructions

5.1 Upgrading the ARB3D

Another great feature is the ability to upgrade the Accelo-Rocket's code when later releases of firmware become available.

1. Start the ARUpgrade.exe program from the Accelo-Graph installed directory and power the Accelo-Rocket board.
2. Connect the Accelo-Rocket via the supplied cable from the 'Com' connection block to an open port on the PC.
3. Click the Options menu and select the 'BX-24' option.
4. Select a serial communications port by clicking the 'Download Port' menu (close all other programs that are using the serial port).
5. Click the 'Open Download' from the 'Files' menu and open the latest firmware file (*.bxb).
6. Download the firmware by clicking the lighting bolt icon.

Open firmware file (*.bxb)

