

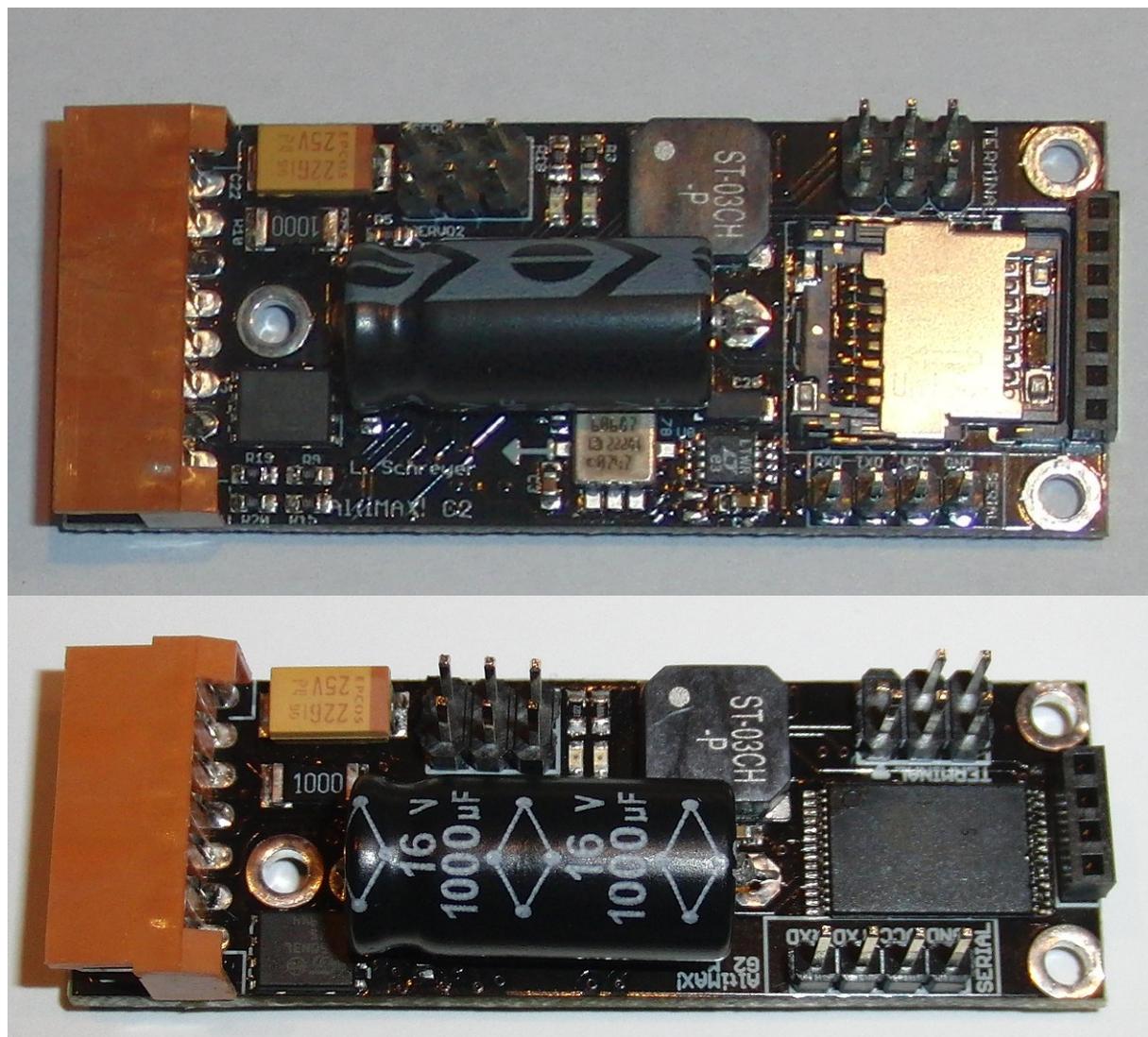
AltiMAX G2 User Manual

AltiMAX!

Rocketry Altimeter

User Manual
AltiMAX G2 SD and G2 Mini

Version 1.5 EN
20.08.2013





AltiMAX G2 User Manual

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Introduction

The AltiMAX G2 G2 Mini SD and AltiMAX are accurate Altimeters and recovery systems for model rockets. They were developed originally for the German rocket enthusiast, but now they're in use everywhere in Europe and had many successful controlled rocket recoveries. The flight were made starting at B class motors up to Level3 flights with powerful engines of the size of M. My L3 rocket flew successfully with 4 mini AltiMAX Altimeters on board. The new generation, G2, has been greatly improved, both in terms of size and weight and functionality.

Why using an altimeter? First of all, as a rocket enthusiast we want to know how high the rocket flew at all. This can be measured with a good altimeter. In addition, an altimeter does not have a control function, ie you can use it to control the recovery of the rocket.

Easy to use rockets use Motors with their own ejection charge for parachute deployment. For larger rocket it is no longer optimal, because often the Motor delay times are not long enough for those high altitudes flights, or with a two-stage recovery. At apogee the rocket separates into two parts and unfolds a Parachute. It is fast but controlled decent of the rocket. In a previously set altitude in the altimeter, a second, larger parachute will be deployed, this will slow down the decent speed enough for a safely and gently landing.

Among other things, this is why you use a Altimeter.

In addition to the normal two-stage recovery, the AltiMAX G2 can do much more; it can ignite another motor when the first motor has burned out, a two-stage rocket is therefore easily to implement. There are many other functions to take care of things at certain altitudes, at apogee, during descent, after Motor burnout or after a certain time.

All this is easily adjustable and usable, even with the optional LCD terminal, which is simply connected, and displays all data.

Thanks to the digital Kalman filter the AltiMAX detects apogee almost perfectly, reward of this effort is a very gentle recovery. The Kalman filter also provides high noise immunity, so peaks and breaks are filtered out. Some other safeties provide additional security, for instance as from Mach 0.7 (850 kmh) a lock is used to detect pressure fluctuations in supersonic speeds and to avoid false apogee recognition. Another safety feature is the constant monitoring of the voltage: The AltiMAX is waiting before each ignition that the igniter has enough voltage. This avoids during very rapid close after each other fired igniters that the connected igniters mutually take away each others power; a reliable ignition is therefore always guaranteed.

Additional security is the very low required operating voltage of the controller. By optimizing the code, the clock rate could be lowered to 10 MHz. With this clock rate the controller is stable up to 3.3V. The battery voltage may therefore temporarily drop to 3.3 V without resetting Altimeter.

The G2 SD has a unique feature: It has a SD Card that will store all the flight data after landing. So you always have all the data at hand, nothing will be lost.

It can also be used like a backup of the flight data.

Everything that is happening in the air can then be stored and viewed on a PC. For instance if your rocket crashes you can determine the cause (if the altimeter has survived).

The with the AltiMAX associated PC software for Windows allows convenient analysis of the flight data. These are either read directly from the SD Card or via USB, which takes a few seconds. All of the flight data are then displayed, in addition you can easily set the AltiMAX and produce tests.

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Because of the expansion port in the future it will be possible to build plug-ins like a small additional board which allows for a break-wire start recognition. Also, a gyro sensor module is planned, this could then be used for securing two-stage flights.

I have developed the hardware and software and accessories alone, the development time of the AltiMAX G2 ran from January to December 2010, and in intermediate stages of the first prototype to final product always test phases were pushed out the software in real flight tested. Some parts of the software of its predecessor of the first and the AltiMAX Mini were used, but on the whole it is a new development.

All hardware is manufactured by me on self-built machines and devices, sometimes under a microscope. The components are soldered with the most advanced soldering process, the vapor-phase soldering, lead free, of course after the ROHS Directive. The corresponding vapor phase soldering oven is designed and built especially for this project. This process ensures a very good connection even with the smallest components.

The first AltiMAX has proved that the concept is very safe, to date no crash is triggered because of a malfunction. The same care taken in the development has been recognized also in G2, which explains the long development time.

The AltiMAX G2 is a very complex system with many variables, it has never ruled out that it contains errors. I have done a lot of test flights with the new hardware and software myself. I flew the rockets with different rocket engines from E through J. This current software has been optimized further and hopefully eliminate any errors. However, if you notice something wrong, then please inform me, I'll fix it soon.

I always wish you good flight!

Louis Schreyer
Dipl. -Ing. (FH) for Microelectronics (FH Esslingen)

My associations:
AGM (currently Chairman)
Tripoli Rocketry Association, USA
Member # 11409
Tripoli Level 3
Member of the Tripoli TAP (Technical Advisory Panel)

As I am a Level3 Tripoli TAP member I can be your TAP for your Level 3 certification.

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Handling

Like any electronic assembly the ALTIMAX is also sensitive to ESD (static electricity). All possible safety precautions have been taken to keep the sensitivity as low as possible. The ALTIMAX's has, in the rocket area a unique, electrically insulating protective layer that protects the contacts from touching.

However, one should not touch the contacts of the ALTIMAX with your fingers. This counts for any other altimeters and timers as well.

The protective layer also keeps out water and dirt and black powder fumes can not harm the ALTIMAX, but you should protect it against it.

For storing the AltiMAX it's sold in a anti-static box, please keep it in there unless it's build in a rocket.



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Included with the AltiMAX you get:

AltiMAX G2 SD:

1 AltiMAX G2 SD
1 Cable 10-poles
1 Micro-SD Card 2GB
1 Adapter Micro-SD to SD
1 anti-static box
Software and manual on the included SD card.

AltiMAX G2 Mini:

1 AltiMAX G2 Mini
1 Cable 8-Poles
1 anti-static box

Available accessories:

USB-Connector
LCD-Terminal
Altimeter Testboard
Cable 8-Poles
Cable 10-Poles

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Technical data

	AltiMAX G2 SD	AltiMAX G2 Mini
Measures	62x25 mm	60x20 mm
Weight	13 g	10 g
Input Voltage:	7,2 – 15 V	7,2 – 15 V
Power consumption: (without Servos and Terminal)*	Ca. 23 mA	Ca. 18 mA
Pressure:	10 – 1200 hpa	0 – 1200 hpa
Max Apogee:	-170 – 31000 m ü.N.N	-170 – 31000 m ü.N.N
Memory:	2 Mbyte + SD-Card	2 Mbyte
Pyro Outputs:	3	2
Servo Outputs:	2	2
Pyro Duration:	2 Seconds	2 Seconds
Pyro Power:	=Battery voltage	= Battery voltage
Max. Current Output:	140A (with strong Pyro Battery)	140A (with strong Pyro Battery)
G-Sensor / Pressure Sensor:	Yes	No
SD-Card, 2GB:	Yes	No
Servo Output:	5V, max 1 A	5V, max 1 A
Altitude accuracy:	ca. +- 0,15 m	ca. +- 0,15 m
Acceleration Sensor:	+ - 0,04G	-
Sampling rate Pressure Sensor:	204.800 sp/s	204.800 sp/s
Sampling rate Acceleration Sensor:	200 sp/s	-
Sampling rate Memory:**	200 sp/s / 40 sps	200 sp/s / 40 sp/s
Max Data Memory:	6 flights of 5 min.	6 flights of 5 min.

* Increasing power consumption when connected to LCD Terminal at about 145 mA, with servos even higher, depending on the power and tension on the servo lever.

The connected battery may be empty more quickly, especially with Lipo batteries you have to make sure. I recommend to connect the LCD terminal only for the duration of use.

** The storage rate is up to Apogee 200 sp/s. 500ms after Apogee it will drop to 40 sp/s to save memory space.

Technique

CPU core:

The AltiMAX has a 10 MHz Mega1284p controller from Atmel, it has a 128 KB flash for the program, which utilizes about 90%, most of whom are service routines for the terminal, data management, and the serial communication. The core is clocked with 10 MHz to save power, this way the controller will also running with 3.6 V as well, which increases the security ..

16 KB RAM stand for variables. It was extended with a 2 MB Flash. The operating system was written in Pascal and E-Lab and has a multitasking kernel, each control processes will run quasi-parallel.

Power supply:

The core is supplied with 5V operating voltage controlled by a LDO voltage regulator. It is therefore designed to operate with a very small 6 V battery, for safety reasons however, the AltiMAX will stop operating below 6.0V. An additional system contained in the LDO will supply the servos with electricity in order to decouple from the CPU supply. A third regulator provides power to the pressure sensor with 3.3 V.

Note: The operating voltage may temporarily fall to 3.6 V, to continue function the core and the sensors. PLEASE MAKE SURE THAT THE POLARITY IS CORRECT!

Sensors:

2 on board are: a pressure sensor and acceleration sensor (Not on the mini AltiMAX)

The pressure sensor is highly accurate and temperature compensated. It is factory calibrated very accurately and can even be used for the calibration of pressure gauges. The expected height resolution is only +-15cm. Most Altimeters have +-3m. The pressure gauge is used to measure heights and reach Apogee.

The acceleration sensor of the G2 SD works in the flight direction and can measure +-70G, 0.04G resolution. Their orientation is no matter, the system depending on the location itself. Only cross-install does not work, (the G2 Mini comes without such a sensor and can be cross-installed).

This sensor is used to measure the acceleration, it can recognize the start, motor burnout and the ascent rate can be exactly calculated. Apogee can also determined but not as accurate as the Pressure Sensor but sufficiently accurate.

Outputs:

3 ignition outputs (2ea on the mini) and 2 servo ports are available.

The firing outputs are each equipped with a reliable MOSFET, these hold up to 140A current, are thus virtually short-circuit protected. They can also be used for high current Igniters in Staged rockets and air-start flights, but only with a separate ignition battery.

The firing stages are fed from a capacitor, because the current is limited, I recommend the use of bridge igniter A (SN0). 4 pieces are fired without problems, even in quick succession. An arming switch can be connected for safety on the pad, it is not desired, the connection must however be bridged otherwise the igniter gets no power. Ignition output are called PYRO1, PYRO2 and PYRO3.

The internal logic waits for each ignition until sufficient voltage is present in the capacitor before it's fired, so that even with all ignition processes theirs is still sufficient power available.

2 servo ports are also available, commercially available servos can be connected. The current can be up to 1A, if required more you should provide it with its own power supply. Power outputs are called Servo1 and Servo2.

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The outputs are completely independent of each other, it can be flown only with servos, igniters don't need to be connected.

Interfaces:

- Serial port: 4 pins allowing communication with the PC. You can connect a UART-RS232 or USB-UART converter to the AltiMAX.
- I2C interface for LCD terminal enables the connection of the terminal, all adjustments can be made without a PC.
- Expansion port: different signals are connected to this port for future expansion. A complete SPI port, an I / O and a 10-bit A / D port is available.

System Test

At the start of the electronics, the system performs a comprehensive system test, the memory, sensors, battery voltage, altitude, and the ignition outputs are tested. If a problem is detected, an alarm sounds and the AltiMAX will be blocked. If connected, the LCD-Terminal will show you the error.

Structure

The whole system is built on a multi-layer circuit board with 4 layers of copper. It uses the latest components, some in very small enclosures. Especially for the production I have build a vapor phase oven that, in spite of the small contacts of the components, solders very reliable. Since that I make all the parts my self, a very good surveillance is possible during production, I can also respond quickly to shortages. Assambly will be done by hand with the help of some special tools, the control of all devices is performed under a 3D microscope. Safety first, I guarantee for the proper function for 1 year with immediate replacement in case of failure.

Crash damage and improper handling of the AltiMAX is however exempted.

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Function

To determine altitude the AltiMAX measures the amount of air pressure. This requires a open connection from the electronics chamber to the outside, usually some holes are drilled into the rocket casing.

Due to the decreasing air pressure during ascent, the height can be calculated very accurately. The G2 SD in addition can measure the acceleration with the onboard G sensor.

After switching the altimeter, a self test is performed, if successfully, a set time to wait will be executed for the assembly of the rocket "assembly time".

Then the altimeter is armed, the sensors are set to "0 ". From then on, the system waits for the lift-off of the rocket, which is determined due to the acceleration ($> 3G$) or by decreasing pressure. A 12 m height increase is recognized as a start. From then on, the various stages are waiting and react according to the set actions.

The AltiMAX determines the air pressure over 200,000 times per second. The pressure value is placed in a filter and every 5 ms a middle value is formed from 1024 readings. This average is used for the evaluation. Values well above the middle value (spikes) are ignored. Interference from wind and errors in the sensor are filtered out this way.

Till Apogee the data will be saved with 200 samples per second, 500 ms after Apogee the data will be saved with 40 sp/s. This reduction saves space in the memory because after Apogee, no major events take place it's more appropriate.

Through the continuous measurement "knows" to controller the position in which state the rocket is that internally sets the flight status. That's enough from "Start" till "landing", where there are various flight stages in between, including motor-burnout, apogee, altitude over and below measurements, etc.

Apogee can be determined in two ways: by pressure (pressure-summit event) or by velocity measurements with the aid of the acceleration sensor in the G2 SD (event G-peak). The latter is not as accurate, but is useful as a backup or in supersonic flights. Even if no ventilation openings are available in the rocket is only the latter method.

There are always values of 2.14 seconds held in a ring memory, these are the values measured before the start. Thus, the AltiMAX also shows what happened before the start.

If after reaching apogee for 4 seconds no change in altitude was found it will turn in landing mode. All flight data is backed up, 5 seconds of data are still stored and then a loud beep is turned on.

After landing, it is necessary to wait for the landing tone to turn on before you turn off the AltiMAX, otherwise the flight data is not written completely.

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Data memory

The flight data such as pressure, filter data, voltages, acceleration will be written with 200x per second till apogee into the internal Flash. 500 ms after apogee, the storage rate drops to 50 times per second.

The internal Flash holds 2 MB of data, enough to store six flights of about 5 minutes. Since this is designed as a ring memory, the oldest flight is deleted. Therefore if after 5 flights the data is not backed up it will erase the oldest flight the next time a flight is performed. Flash memory has the disadvantage that you have to delete prior to writing the cells. Since the cost should be quite a lot of time to do before the flight, actually happened in the AltiMAX after landing, since the cells to take the next flight, automatically deleted. Thus, only 5 records are available.

With the AltiMAX G2 SD after the landing, the flight data of the flight is copied to the SD card. In time it will store all flight data from all flights, making it easier to archive it. Even then the flight data can be easily transferred on the PC.

With the AltiMAX G2 Mini you have to take care of transferring the flight data from the Altimeter to our PC.

The AltiMAX G2 SD will create a folder named "AltiMAX" on the SD Card, the flight data will be written in this folder, the files will have the extension. ".thn".

These files can be read directly with the PC software.

The card also contains preloaded this manual and the PC software, you can also save other data on it, but you should not do that in the "AltiMAX" folder.

When the "AltiMAX" folder is deleted, the system will automatically create a new one.

Kalman Filter

The AltiMAX G2 is one of the few rocket altimeter which will evaluate the data with a digital Kalman filter. Given the pre-filtered data are measured by the digital Kalman filter, the filter delivers the data with an estimate of the air pressure, but also the speed and acceleration of the rocket. It compares the measured values with a theoretical model of the rocket. From these data, the filter determines the pressure value, the acceleration and speed.

This can be thought of like this: The memory is a mathematical model of the rocket flight filed, describe the functions of the relationship between change in pressure, acceleration and speed. The filter calculates from the measured pressure values from these functions, what the values are likely to be for the next moment. It looks in the future and predicts the flight data. At the same time it determines the maximum errors that could be provided the sensor.

This error estimate can be used to filter out false values that may not be the basis of flight movements. For example a supersonic flight produces strong pressure fluctuations, which would be interpreted without the filter as strong air movements. The Kalman filter "knows" that the rocket flies straight up on that moment with high speed, thus can the pressure values not be correct. Therefore, it simply ignores these variations. Also failure of the pressure sensor can be ignored to certain limits, the filter expects then by estimate.

The graph shows this nicely: Black are the pressure readings from the sensor, they are almost a full second cut completely from the sensor. The orange line (the values from the filter), is almost untouched! Without the filter it would had detected an incorrect apogee.



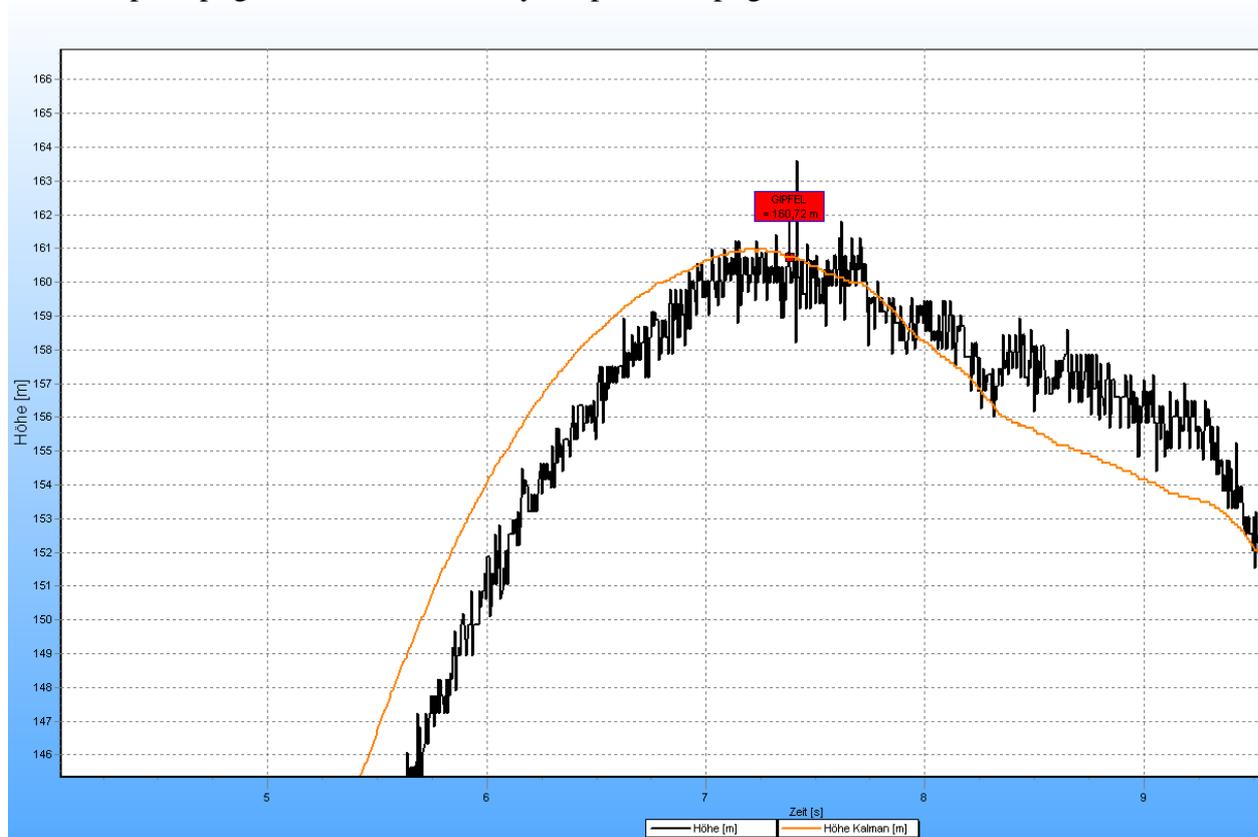
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The Apollo Guidance Computer was actually one of the first computer using a Kalman filter for filtering position data. The filter also contributed significantly to the very high precision and was crucial to the success of the Apollo program.

The filter data continuously determines the position of the rocket 200x per second. Apogee is recognized if the speed is zero. That is the point with the lowest speed.

Through this extensive filtering apogee is much more accurately detected than with the old method that had been waiting for a rise in pressure.

For example, apogee detection at exactly the point of apogee



Apogee detection

The apogee detection is a very important thing in rocketry. To find the apogee there are some different methods. The apogee is normally the highest point of a rocket, after reaching it the rocket will fall back to earth.

At this point the

The Apogee is an important point in the rocket flight. For the determination of this point of the trajectory, there are various methods.

The peak is usually the highest point of the trajectory, after it is reached the rocket falls back to the ground. At this point, the climbing speed of 0, the horizontal velocity can be higher if the rocket for example was launched at an angle.

Most altimeters are waiting for the determination of this point simply by waiting for an increase in pressure, which more or less works well as long as the rocket is flown vertically. The exact apogee is never hit by this method, sometimes the altimeter lays several seconds off the mark.

The AltiMAX uses a Kalman filter for the discovery of the apogee, which applies to almost 100% hit of the exact apogee. On the barometric measured apogee, the event "Apogee pressure" is triggered. For security reasons above Mach 0.7, the peak detection is disabled by the pressure sensor, because strong pressure fluctuations can occur in this speed area.

The AltiMAX G2 SD also has a acceleration sensor on board which can also be used to detect the apogee. The control system integrates the speed data to calculate the climbing speed (which is not flight speed!). On finding the apogee point the event "Apogee Accel" is fired. This way of finding the apogee is not as exact as with the barometric sensor, but can be used in certain cases:

- If you do not have port holes for pressure exchange.
- Flights above mach 0.8
- Flights above 30.000 m

It is possible to chain both apogee events to one action, for example to blow out the drogue parachute. On supersonic flights, I recommend using the accel sensor for apogee detection.

Eventsystem

The AltiMAX G2 has a unique event system.

This new feature permits completely free allocation of timers, pyro-outputs and servos to certain events. Even complex scenarios can be performed, such as Multi-stage flight, delayed ejection, pushing off of boosters, camera triggering and much more.

In the PC software you can easily make this linkage, it goes also with the terminal, but there a little bit more difficult because of the many possibilities

The following events are triggered during a rocket flight:

Start (Accel) – Launchdetection via acceleration, 3G more than 0.1 second.

Start (Pressure)– Barometric launch detection in aprox. 10-12 m Height.

Burnout – Burnout of the motor (only G2 SD)

Machdelay – End of the Machdelay timer

Timer 1 end – End of Timer 1

Timer 2 end– End of Timer 2

Timer 3 end– End of Timer 3

Apogee Accel – Apogee detection by accel sensor (only G2 SD)

Apogee Pressure – Apogee detection by barometric sensor

Height Ascend – Exceeding of a height after launch

Height Descend– Descend of a height after Apogee

Land – Land detection

Each of these events can be assigned to one of these actions:

Timer 1 Start – Starts Timer 1

Timer 2 Start – Starts Timer 2

Timer 3 Start – Starts Timer 3

Pyro 1 – Fires Pyro 1

Pyro 2 – Fires Pyro 2

Pyro 3 – Fires Pyro 3

Servo 1 – Drives Servo 1 to endposition

Servo 2 – Drives Servo 2 to endposition

Rules:

- Every action can only fire once in a flight
- Timer end cannot start the same timer again, which would give a loop
- When a timer is set to 0 seconds it cannot fire a pyro output, because this would fire immediately.

Otherwise, everything can be "wired" free. For example: You can start a timer at Apogee. After running of it can activate a pyro. This way you can delay the firing of a pyro output, to use it as backup. If you connect a pyro output to the burnout event you can fire a second stage motor, this can be delays by using a timer in between.

By default, the normal two-stage recovery is set:

Apogee Drogue Chute= Pyro 1 and Servo 1

Main chute = Pyro 2 and Servo 2

The main chute will be fired at Height Descend= 150 m

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To the timers:

At an event one can start one out of three timers. The timer-time can be set in 0.25 second steps. After running out, the timer creates the event "Timer x end" which can be connected to an action. The timers can be used to make delays, but also to completely run a timer triggered recovery.

Example1: Two stage recovery

Pyro1 = Drogue

Pyro2 = Main chute

„Height Descend“ is set to 100 m

At event "Apogee pressure" we set the action „Pyro1“

At event "Height descent" we set the action „Pyro2“

At reaching apogee the output „pyro1“ is fired.

After descending down to 100 m the pyro2 is fired.

Example 2: Recovery by timers

Pyro1 = Drogue chute

Pyro2 = Main chute

Timer 1 is set to 7 seconds

Timer 2 is set to 20 seconds

At event "Start Accel" we set actions "Timer 1 Start" and "Timer 2 Start"

At event "Timer 1 end" we set action "Pyro 1"

At event "Timer 2 end" we set action "Pyro 2"

After launch the timers Nr. 1 and 2 will start to run.

After 7 seconds timer 1 runs out and fires pyro 1

After 20 seconds (after launch!) timer 2 runs out and fires pyro 2

Example 3: Two-Stage-Flight with 2-stage recovery of the second stage

AltiMAX G2 is assembled in the second stage part of the rocket.

Pyro1 = Drogue chute

Pyro2 = Main chute

Pyro3 = Igniter of the second stage motor

Timer 1 is set to 0,5 Seconds

Height Ascend is set to 100m

At event "Burnout" we set action "Timer 1 start"

At event "Timer 1 End" we set action "Pyro 3"

At event "Apogee pressure" we set action "Pyro 1"

At event "Height Descend" we set action "Pyro 2"

When the first stage is burned out, the altimeter detects it by its accel sensor. The event is fired, which triggers the start of timer 1. After 0.5 seconds this timer fires pyro 3, which in fact lights the second stage motor, the rocket flies higher on the second motor. In Apogee pyro 1 is fired, the

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drogue chute will come out. The rocket descends down, in 100 m the Height Descend event is fired which triggers pyro 2 to get out the main chute.

Exemple 4: Ignition of a sparky motor in 40 m height, the two stage recovery.

The rocket is first started on a normal motor.

Pyro1 = Drogue

Pyro2 = Main chute

Pyro3 = Igniter for sparky motor

Height ascend is set to 40 m

Height descend if set to 100 m

At event „Height ascend“ the action „Pyro 3“ is et

At event „Apogee pressure“ the action „Pyro 1“ is et

At event „Height descend“ the action „Pyro 2“ is et

The main motor is ignited, the rocket launches. After reaching 40 m the pyro 3 is fired, starting the sparky motor. In this height the sparks cannot damage the ground.

The rocket flies further and is then recovered by two-stage recovery.

Attention: All Timers can be used once in a flight, you can not use timer 1 at burnout and again timer 1 at apogee. Please keep this in mind!

Use the timers for backup! For example you can always start a timer at launch detection to be sure the drogue chute will come out. You can also use “Apogee accel” as a backup to Apogee Pressure.

Almost every recovery scheme is possible with this system, but keep in mind: You can setup up things wrong also! **Check your settings!**

The PC-Software has a button “Default Settings” which switches the AltiMAX to a two-stage recovery setting with pyro 1 and pyro 2, pyro 1 on apogee and pyro 2 in 150 m height.

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Settings G2 [Close]

Common settings | **Servo Settings**

Assembly-Time: Seconds

Units for display in the LCD Terminal:
 Metric (m / hpa) Imperial (inHg / ft)

Flightmode:
 Rocket Datalogger with recovery

Samplerate Datalogger mode sps:
 1 sps 4,7h 4 sps 1,17h
 2 sps 2,34h 8 sps 0,58h

Actions

Here you connect events to timers and outputs

	Timer 1 Start	Timer 2 Start	Timer 3 Start	Pyro 1	Pyro 2	Pyro 3	Servo 1	Servo 2	
Start (Accel)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Start (Pressure)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Burnout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Mach delay	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="3"/> sec
Height Ascend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="100"/> m
Timer 1 end	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0,00"/> sec
Timer 2 end	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0,00"/> sec
Timer 3 end	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="0,00"/> sec
Apogee Accel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Apogee Pressure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Height Descend	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="text" value="150"/> m
Land	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

EVENTS

Default settings [Cancel] [OK]

These are the default settings.

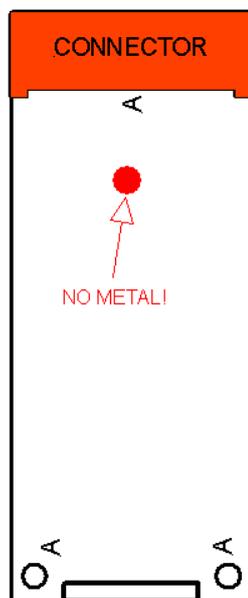
AltiMAX G2 User Manual

Installation

These things are to watch for when installing an AltiMAX G2 into a rocket:

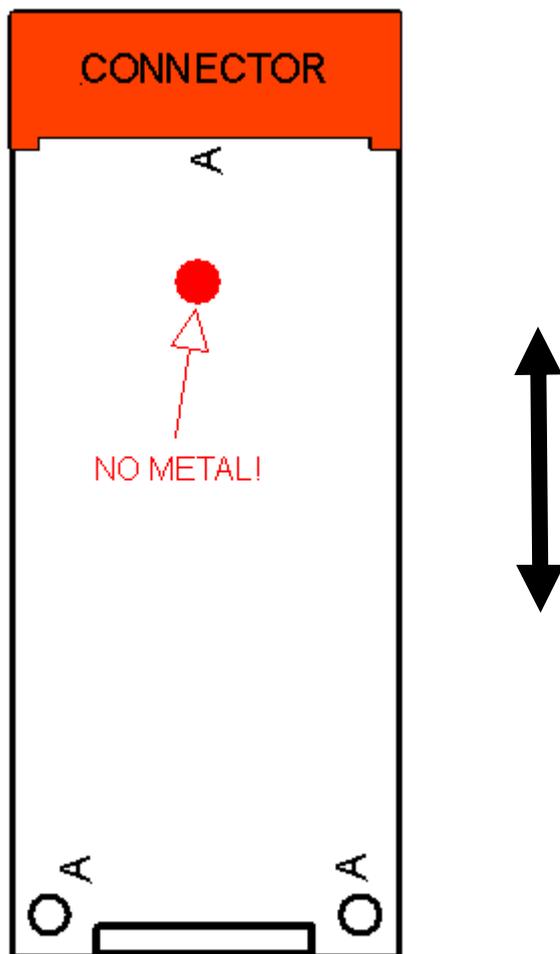
- **Static port holes** - Keep in mind that the pressure sensor need to be able to measure pressure changes, it needs an opening to the outside atmosphere. 3 Holes aprox. 1.5mm each should be sufficient in most cases. The pc-Software has a calculation aid for these holes.
- **G2 SD: Installation only in flight direction!** The connector must look up of down, not to the side of a rocket, otherwise the accel sensor cannot measure the acceleration. The AltiMAX G2 mini can be installed in any direction.
- **Rigid installation** – User screws, the altimeter should be fixed so it cannot move in flight
- **Prevent Pressure from ejection charges** – The electronic bay housing the altimeter should be airtight tot he ejection charges, please be sure that pressure from the charges cannot enter the pressure sensor. Also prevent the ejection gases from blackpowder from entering the ebay.
- **Distance to pressure sensor** approx. 4-5 mm or more. The sensor is on the backside of the altimeter, be sure it does not lay on a board to allow airflow to the sensor.

WARNING: DO NOT USE METAL SCREWS IN THE MIDDLE HOLE! THIS HOLE CAN ONLY BE USED WITH PLASTIC SCREWS!



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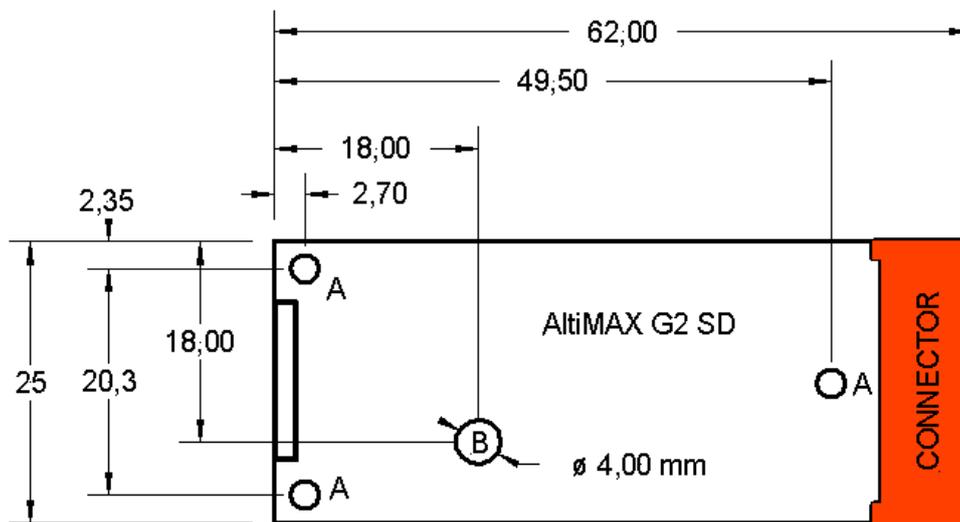
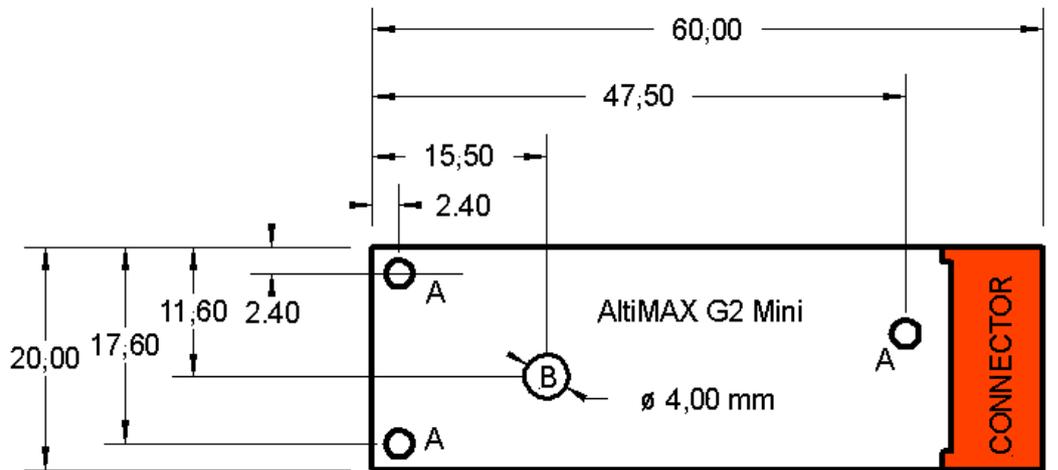
Allowed flightdirection G2 SD!



The acceleration sensor needs to stand upside or upside down in flight direction!

AltiMAX G2 User Manual

Dimensions:



A = Fixing hole 2,5mm
 B = Porthole for pressure sensor
 (B only when space between sensor and board <4mm)

AltiMAX G2 User Manual

Power

The AltiMAX requires at least 6 V, below this voltage, it will refuse to function and beeps with a continuous beep and alarm sound. In this case, **DO NOT START!** The terminal then also shows a low voltage selftest error.

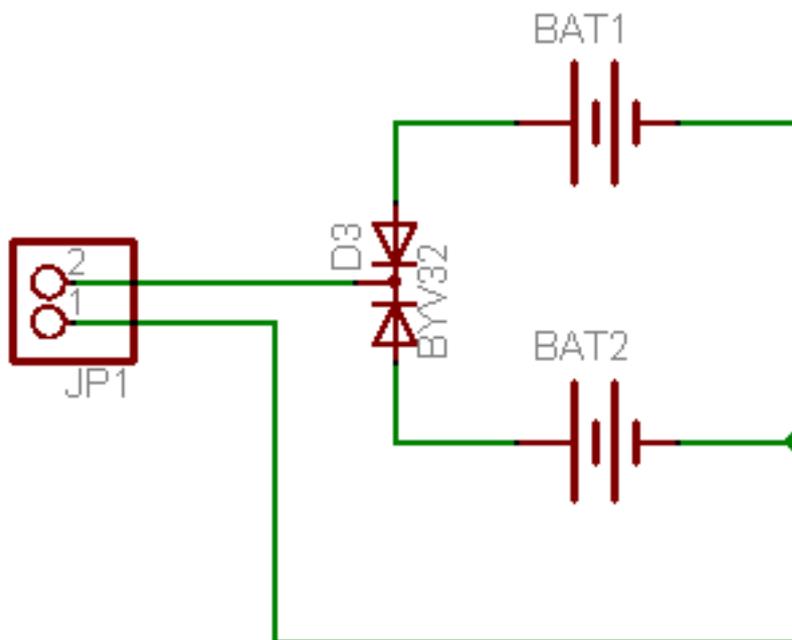
I recommend the use of LIPO accus, these can be charged and can provide high load currents, they are small and light and are ideal for rockets. For the AltiMAX I recommend 2S Lipo with a nominal voltage of 7.4 V. A 30x20 mm, less than 300 mAH battery may well provide the AltiMAX for 10 hours.

9V-batteries come in many versions, and only when new, you know how full they are. Cheap types can fail at high accelerations, so be careful!

The power supply is one of the main reasons for failure in the recovery. Correct sizing is very important.

Redundancy:

Ideally, the supply from 2 batteries are decoupled with a Schottky diode. If a battery fails, the other takes over. BYV32 is a diode in TO220 package, an indestructible choice.



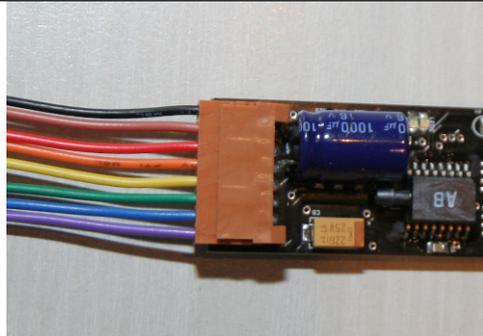
AltiMAX G2 User Manual

Electrical connection AltiMAX G2 SD/Mini

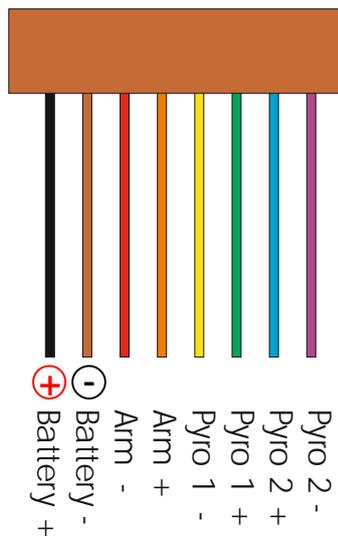
The AltiMAX System comes with a nice pre-connected connector which is built into the rocket. The altimeter is then connected to this connector. This way your altimeter has superb connections, crimped and neat, far better than screw terminals. Also, you can grab your altimeter and put it into another rocket fast.

Use batteries with more than 6V: 2s-lipos of 9V Batteries.

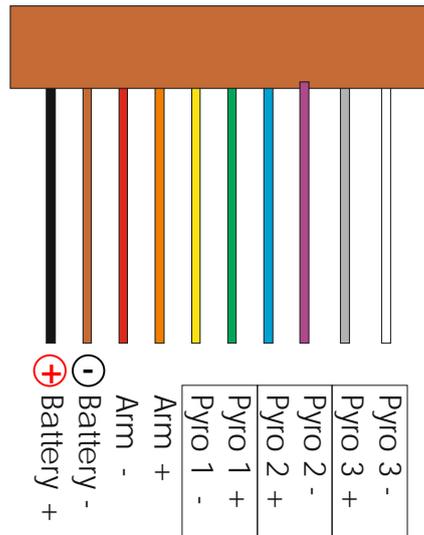
The AltiMAX G2 SD has no Reverse polarity protection! The **BLACK cable is **PLUS**, the **BROWN** cable is **MINUS**! On reverse connection it will damage the altimeter!**

Signal	Color	
Battery +	Black	
Battery -	Brown	
Arming +	Red	
Arming -	Orange	
Pyro 1 +	Yellow	
Pyro 1 -	Green	
Pyro 2 +	Blue	
Pyro 2 -	Violet	
Pyro 3 +	Grey	
Pyro 3 -	White	

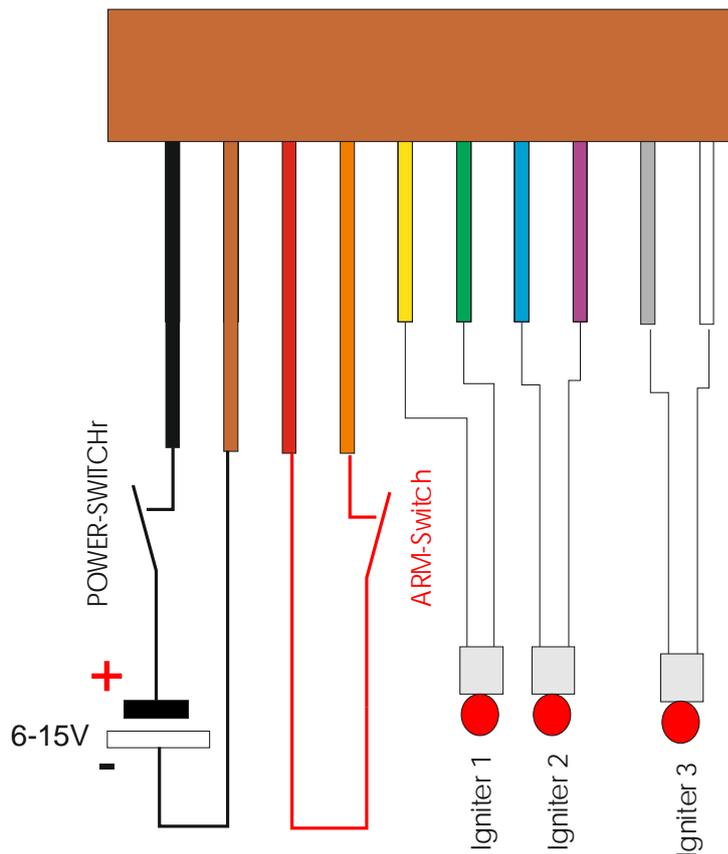
AltiMAX G2 Mini



AltiMAX G2 SD



ARM-Switch



Attention:

**You need to connect the arm-connection, either by a switch or by connecting red and orange!
The power to the pyro outputs is interrupted by this connection!**

For normal rockets I recommend the use of a simple bridge, just connect the two wires.
For larger rockets I recommend the use of an arming switch to prevent firing of igniters on the pad,
The AltiMAX Altimeter is very secure, tests did not show a firing of an igniter on startup, but you never know... To be sure, use an arming switch.

External ignition power source:

Normally, the pyro ports are used to fire low current igniters. For high ignition-currents a separate ignition battery connector can be connected.

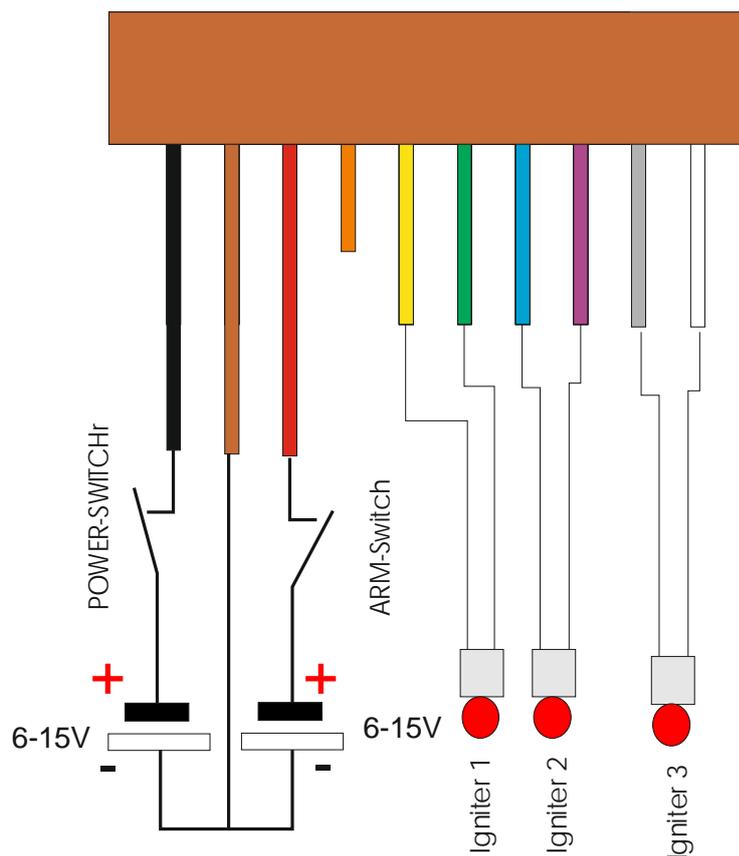
PLUS to terminal 3 (red)

MINUS to terminal 2 (brown) (see figure below).

Leave Terminal 4 open!

Use 15 V max!

The FETS in the AltiMAX are capable to fire up to 140 Amps, you can light up Aerotech motors with this, as long as your ignition power source can deliver the current.



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Igniters:

Without a separate power source for the igniters (see above), the AltiMAX system can only fire low current igniters. Please run a test with your favorite igniter to be sure it works !

The AltiMAX G2 SD has 3 pyro ports, the Mini only two. An onboard 1000 μ F capacitor delivers the power for the igniters, except when you connect a separate battery.

Manual igniter test

With the PC Software you can fire the servo and pyro outputs for tests.

Auto igniter test

You can run an automatic igniter test via the PC-Software and with the help of the LCD-Terminal.

After activating the test the AltiMAX runs in standby.

After switching off and on again, the test starts running.

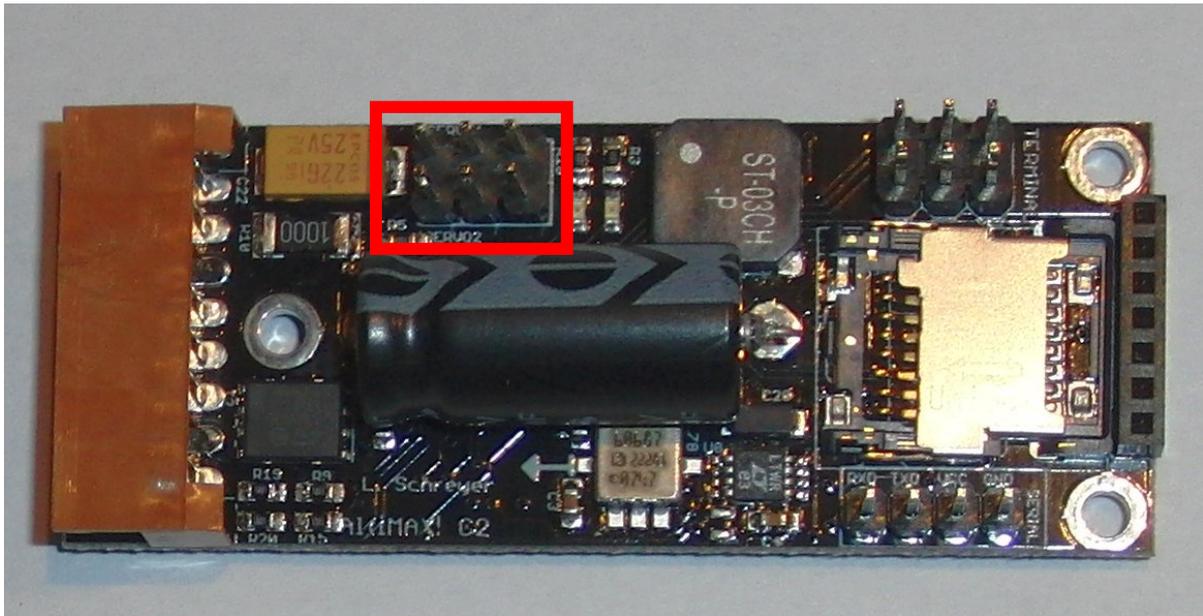
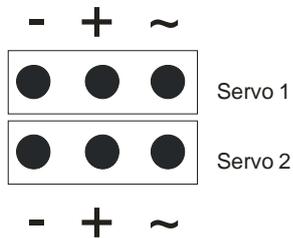
The AltiMAX will beep for 20 seconds, then fires pyro 1 to 3 with a 5 second pause after each firing.

To abort a running test, just switch of the altimeter!

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Servos

The AltiMAX G2 can control two servos, a separate power supply was provided so that the servo motors have no impact related disturbances on the controller. The connection is made like in picture:

**Top is Servo 1, Bottom is Servo 2**

The 3-pin connectors are the servo connector, please observe the polarity. Control signal is on the right pin in this image

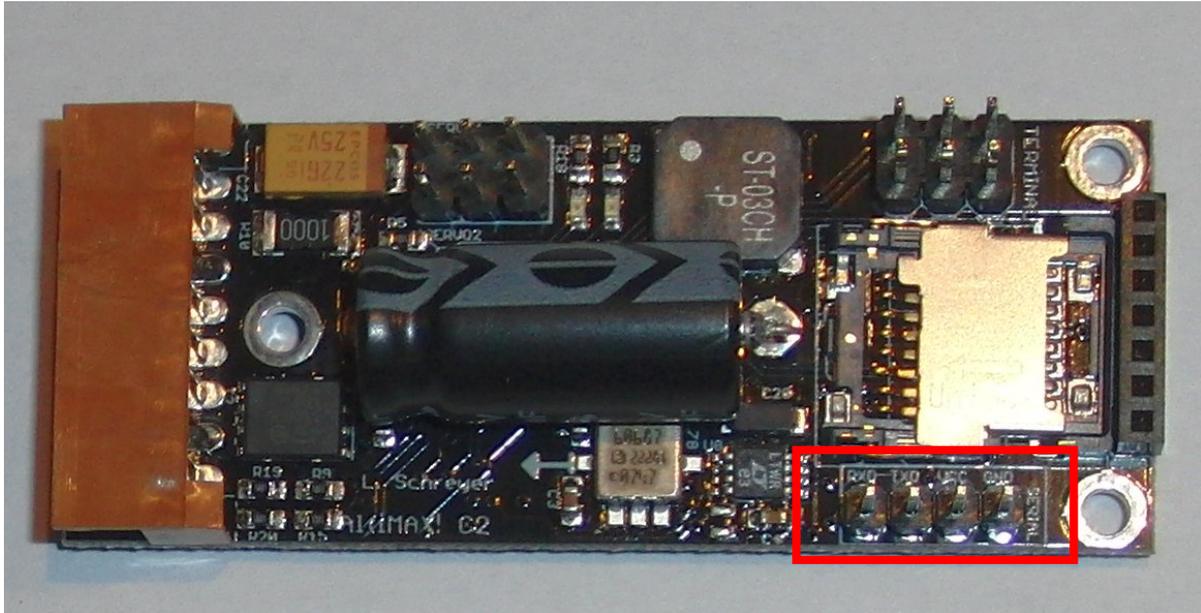
The AltiMAX can deliver up to 1 Amps to the servo motors, you can use normal RC Servos with JR connector. If you need more power you can use a separate power source for the servo.

A slight oscillation of the servos is normal.

AltiMAX G2 User Manual

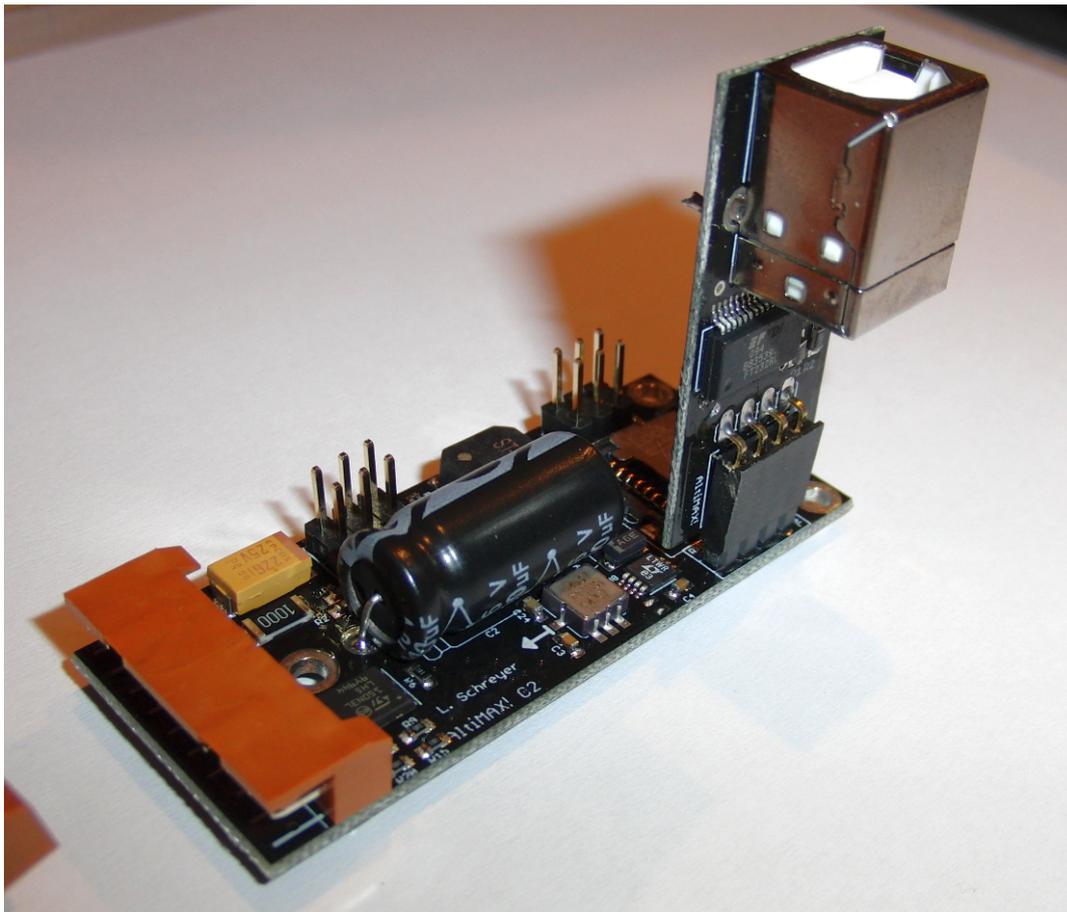
Serial connector

Where to find the serial connector:



RXD TXD VCC GND

This is how the USB Connector is connected to the AltiMAX G2:

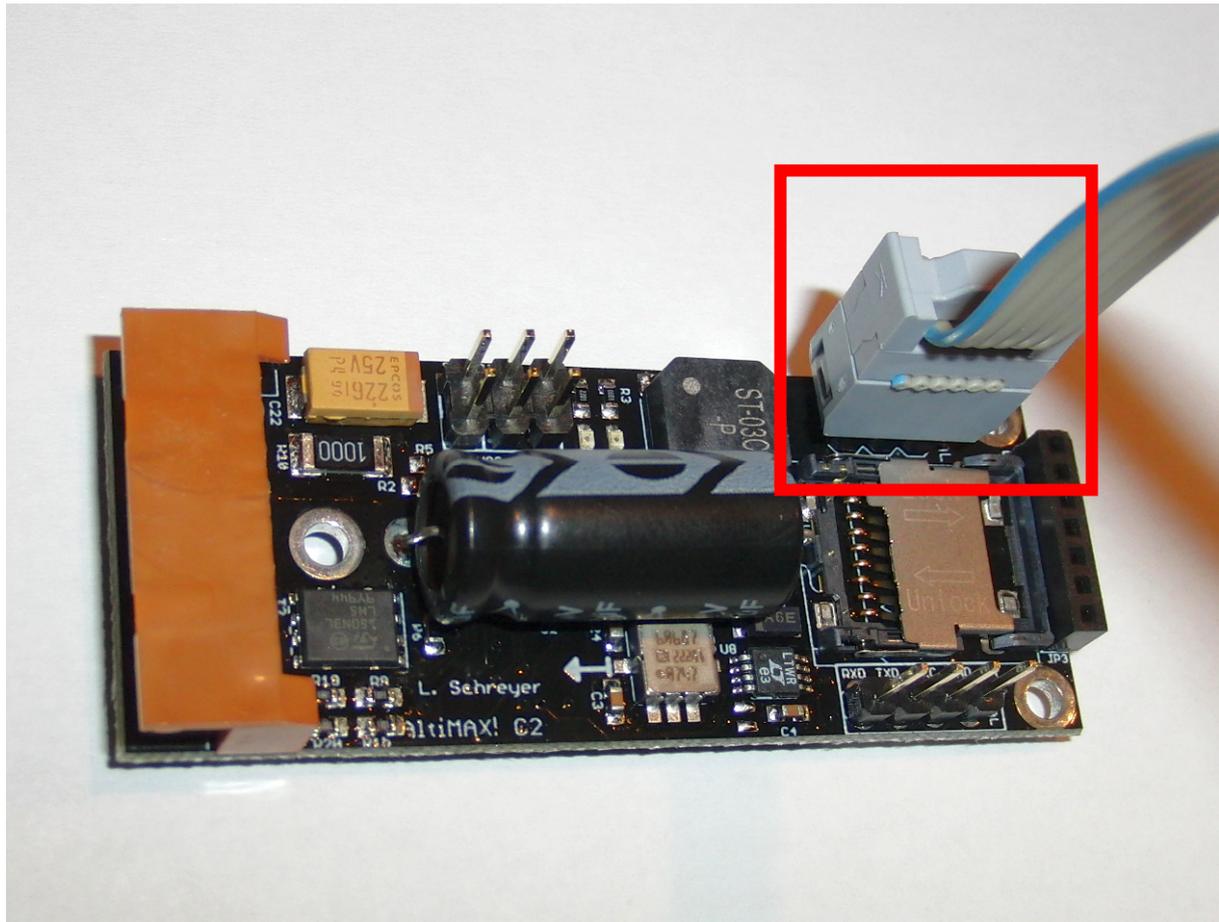


AltiMAX G2 User Manual

Connection of the LCD Terminal

The 6-Pin Connector with the missing pin is the Terminal-Connector. The missing pin is a feature to allow for correct connection of the terminal.

After connecting the terminal you need to reset the AltiMAX so it can connect to the terminal.



Using the μ SD-Card

The AltiMAX G2 SD has a socket for a μ SD-Card. A 2 GB Card is supplied with the AltiMAX. Please only use SD-Cards, not the newer SDHC Cards.

The cards need to be formatted with a FAT16 file system, the AltiMAX creates on every card a folder with the name "ALTIMAX" which holds the flight data files. You can save other files to the card if you like, I do also, the manual, software and usb drivers are saved to the card shipped with the AltiMAX.

The socket is a so called Flip-Socket, to open it do this:

1. Press your finger on the metal part and press it in the direction of the connector. This releases the socket and it will flip up.
2. Then insert the card, connections down.
3. Then press down the metal part of the socket and press it back, it will then lock.

The socket is a fine part, please do not use force!

With the μ SD Card, an adapter for a SD-Card-slot comes with the package. It allows the use of the small μ SD Card in a normal card-slot in a computer.

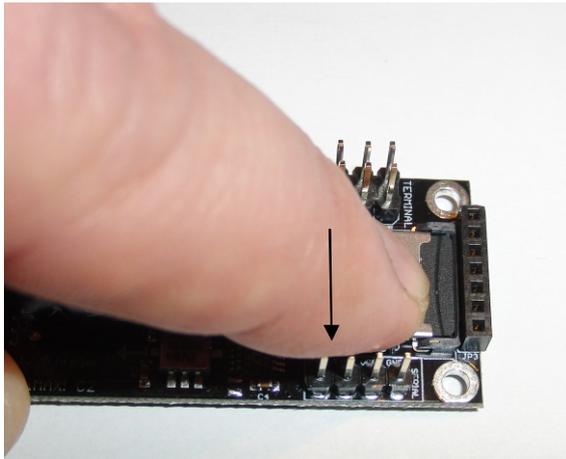
The PC-Software can read the data files directly, you will find all flight data files in the folder „ALTIMAX“. After the landing, the AltiMAX makes a copy of the flight data to the μ SD Card. The flight data remains also in the flash memory of the AltiMAX, it is just copied to the μ SD Card.

You may fly without a μ SD Card, it is not needed for proper functioning!

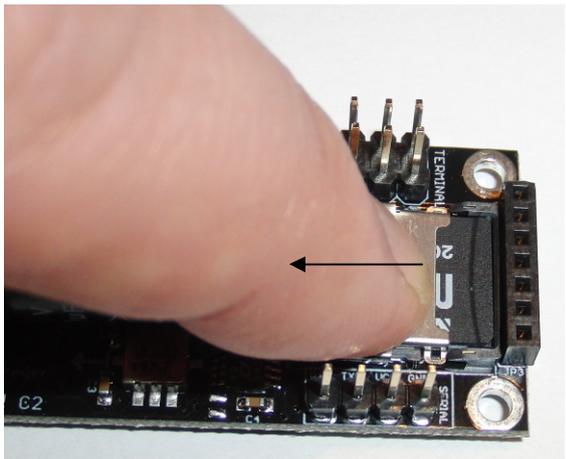
Please exchange the card only when switched off!

On the card is the Software, Manual als USB drivers for the connector!

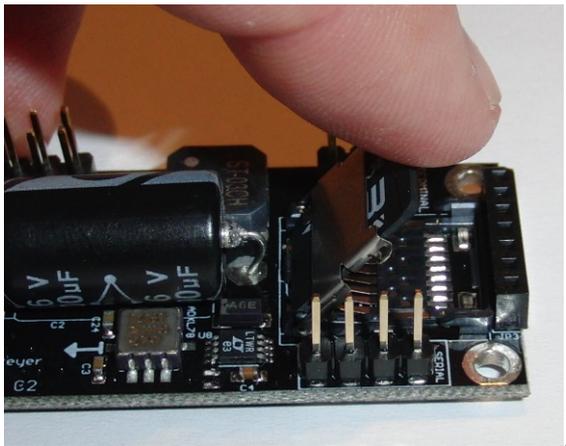
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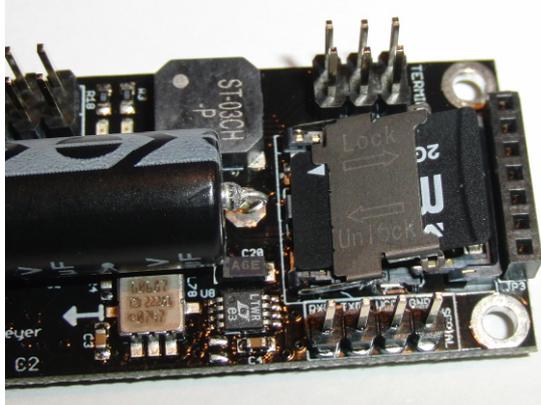
Press down..



..push back



..open up and take out card!

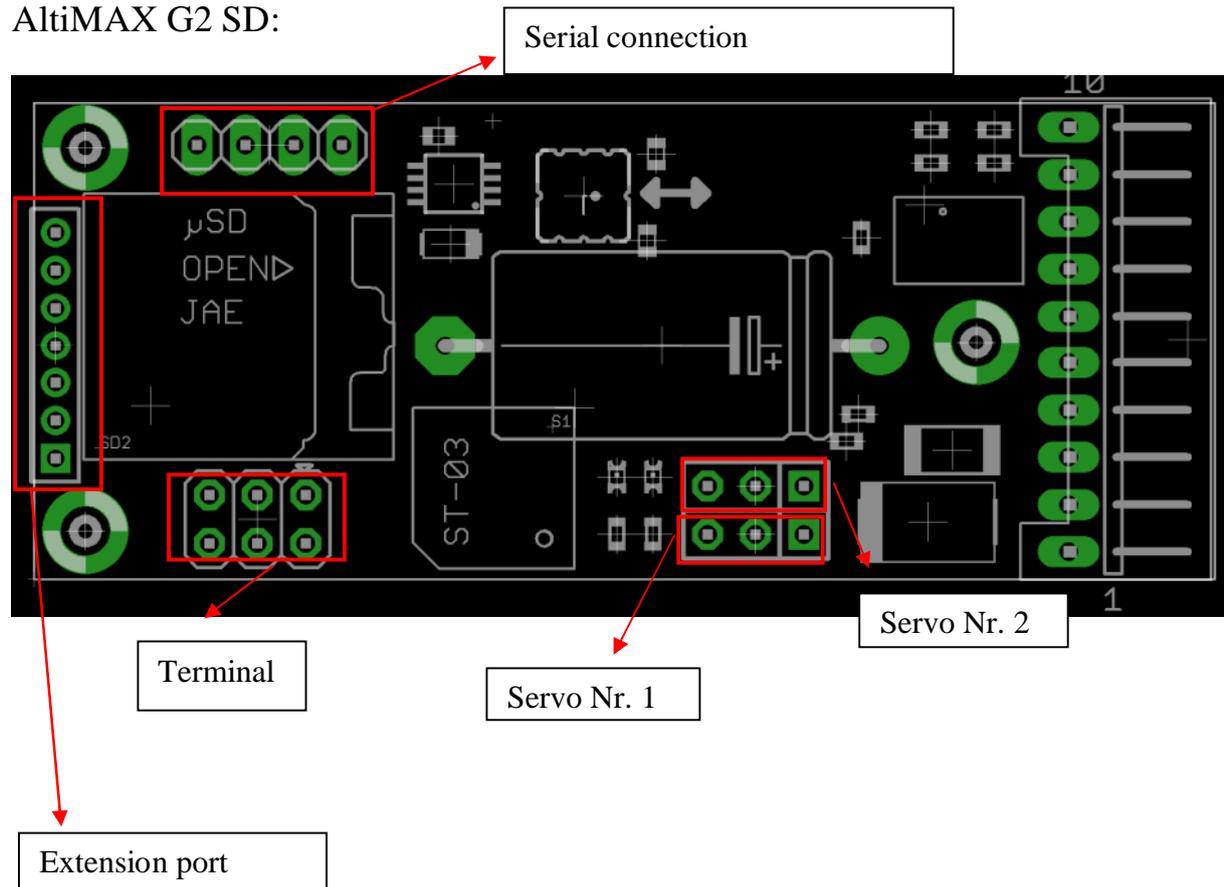


Reverse to enter a card

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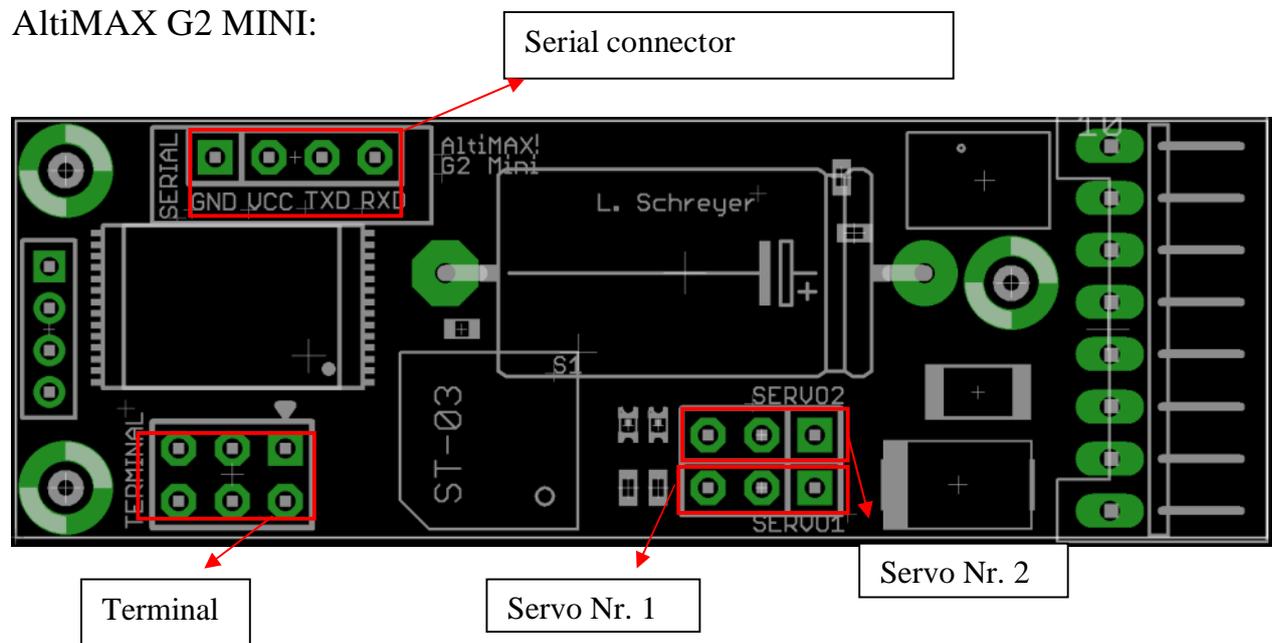
Connection overview:

AltiMAX G2 SD:



The extension port is not used yet, it was planned to use it in a later sensor add-on board.

AltiMAX G2 MINI:



Power-on sequence

1. Switch on

The AltiMAX runs a selftest, if the test is not passed you will hear an alarm beep, the error is showed in the LCD-Terminal. If the test is passed, we proceed to step 2

2. Ignitertest- The igniters will be checked and their status is beeped:

Two short beeps show: Igniter OK!

One long beep shows: Igniter broken!

You will hear the beeps for pyro 1 till pyro 3.

beep-beep -----beep beep -----beep beep = All 3 pyros OK

beep-beep -----beeeeeep -----beep beep = pyro1 OK, pyro2 not, pyro3 OK

You do not need to connect igniters, the AltiMAX will fly with or without! If you only use servos you do not need to connect anything to the pyro ports.

3. Assembly time

You will hear a beep for every second assembly time you set up. In this period, you can assemble your rocket without risking a launch detection. After the assembly time is over, you will hear a long beep.

So for 5 seconds:

beep – beep – beep – beep – beep – beeeeeep

4. Calibration

The AltiMAX will go in ready mode and starts to calibrate the sensors. After that it will go to the..

5. ARMED MODE

Now the AltiMAX waits for Launch. While waiting for Launch it beeps the pyro port status every 3 seconds. If the rocket reaches 12 m height or an acceleration of more than 3 G for 0.1 seconds is measured, it considers the rocket as LAUNCHED.

6. Event-system

After launch detection the flightprogram runs until land detection. According to its settings the altimeter will fire events, activates the actions and measures flight data.

7. Descent until landing

During descent after reaching apogee the AltiMAX measures the height until reaching the height set up in “Height Descend“, most used for firing the main chute

8. Land

The landing of the rocket is detected when the height did not change for 4 seconds. The last flight data is saved and a backup is made to the µSD Card if available. When ready, a loud beeping will be heard which aides in finding the rocket.

9. **Please do not switch off the AltiMAX before you hear the land-beeping! You may lose the flight data if you do, because the AltiMAX needs to close the datasets in memory, that takes a few seconds.**

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Disclaimer

The use of ALTIMAX is at your own risk. Always use a backup for recovery of your rocket, for example another altimeter, timer or motor ejection.

The manufacturer is not liable for any damages that have occurred in any way related to the usage of ALTIMAX Altimeters, not against third parties.

Software cannot be developed completely error-free, according to current state of the art.

On the ALTIMAX a limited warranty will be given one year from date of purchase, at the discretion of the manufacturer. Among them are explicitly no damages resulting from crashes or mishandling by the user. Since the manufacturer has no control over the handling of the module, that contains electrostatically sensitive components, damage caused by ESD (electrostatic discharge) is also excluded. A free repair or replacement will be granted only in cases of obvious manufacturing defects.

ATTENTION: THE ALTIMAX IS NOT YET TESTED WITH HYBRID MOTORS!



AltiMAX G2 User Manual

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