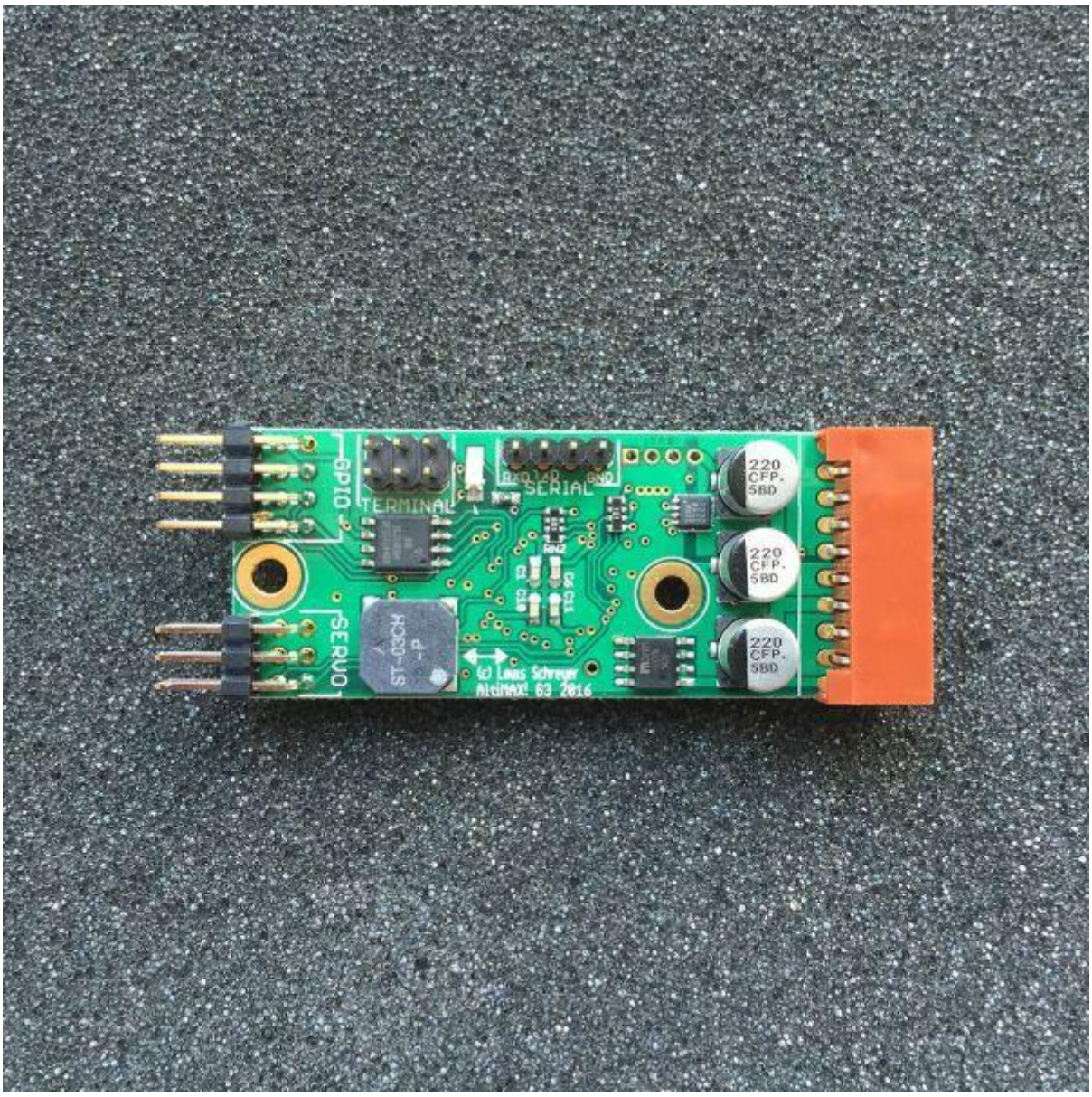
# AltiMAX!
## Rocketry Altimeter

# User Manual
# AltiMAX G3 2016

## Version 1.0 EN
17 ocotober 2019



# Table of Contents:



# Introduction

The AltiMAX series 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 flights 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 mini Altimeters on board. The new generation, G3, 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 an Altimeter.

In addition to the normal two-stage recovery, the AltiMAX G3 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.

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 PC software for Windows allows convenient analysis of the flight data. These are read directly 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.

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 occured because of a malfunction. The same care taken in the development has been recognized also in G3, which explains the long development time.

The AltiMAX G3 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 myselves. I flew the rockets with different rocket engines from B through M. 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)

# 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.

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

# Included with the AltiMAX you get:

AltiMAX G3:

1 AltiMAX G3
1 Cable 10-poles
1 anti-static box

Available accessories:

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

# Technical data

| | **AltiMAX G3 2016** |
|---|---|
| **Dimensions** | 63x25 mm |
| **Weight** | 13 g |
| **Input voltage:** | 7,2 – 12 V |
| **Power consumption* (without servos and terminal)** | Ca. 23 mA |
| **Pressure range** | 10 – 1200 hpa |
| **Height range** | -170 – 31000 m ASL |
| **Memory** | 4 Mbyte |
| **Number of ignition channels** | 3 |
| **Number of servo channels** | 2 |
| **Number of additional IOs** | 3 |
| **Ignition duration** | 2 seconds |
| **Ignition voltage** | =battery voltage |
| **Max. Ignition current** | 14A (With external ignition battery) |
| **Acceleration sensor** | Yes +-105G |
| **Servo supply** | 5V, max 1 A |
| | |
| **Resolution Height** | ca. +- 0,15 m |
| **Resolution Acceleration** | +- 0,04G |
| **Samplingrate Pressure** | 204.800 sps |
| **Samplingrate acceleration** | 200 sps |
| **Storage rate**** | 200 sps / 40 sps |
| **Storage time approx.** | 5 flights a 10 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 32 MHz XMega128A4U controller from Atmel, it has a 128 KB flash for the program, which utilizes about 50%, most of whom are service routines for the terminal, data management, and the serial communication.

8 KB RAM stand for variables. It was extended with a 4 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 3.3V 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 not startup below 6.0V. An additional system contained in the LDO will supply the servos with electricity in order to decouple from the CPU supply.
Note: The operating voltage may temporarily fall to 1.8V in flight

Sensors:
2 on board are: a pressure sensor and acceleration sensor
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 G3 works in the flight direction and can measure +-105G, 0.04G resolution. Their orientation is no matter, the system depending on the location itself.
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, 3 GP-I/Os and 2 servo ports are available.
The firing outputs are each equipped with a reliable MOSFET, these hold up to 12A current. 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 the system battery, because the current is limited to 800mA, 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 outputs 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.
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: SPI-Port and general purpose I/O Ports usable as input and logic 3.3V-output, as input these can trigger events.

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 built a vapor phase oven that, in spite of the small contacts of the components, solders very reliable. Since that I make all the parts myself, a very good surveillance is possible during production, I can also respond quickly to shortages. Assembly 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.

# Function

To determine altitude the AltiMAX measures the amount of air pressure. This requires an 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 G3 in addition can measure the acceleration with the onboard G sensor.

After switching the altimeter, a selftest 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 G3 (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 1 second 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.
**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.**
**In Landing Mode, it will continuously beep out the reached maximum height.**

# 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 4 MB of data, enough to store six flights of about 10 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.

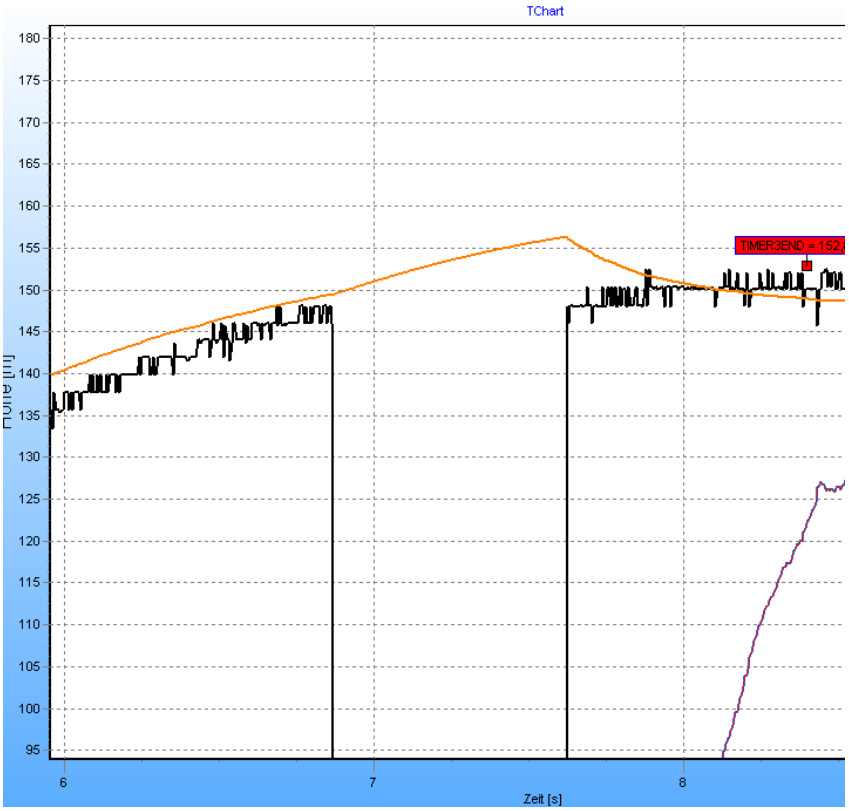
# Kalman Filter

The AltiMAX G3 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.

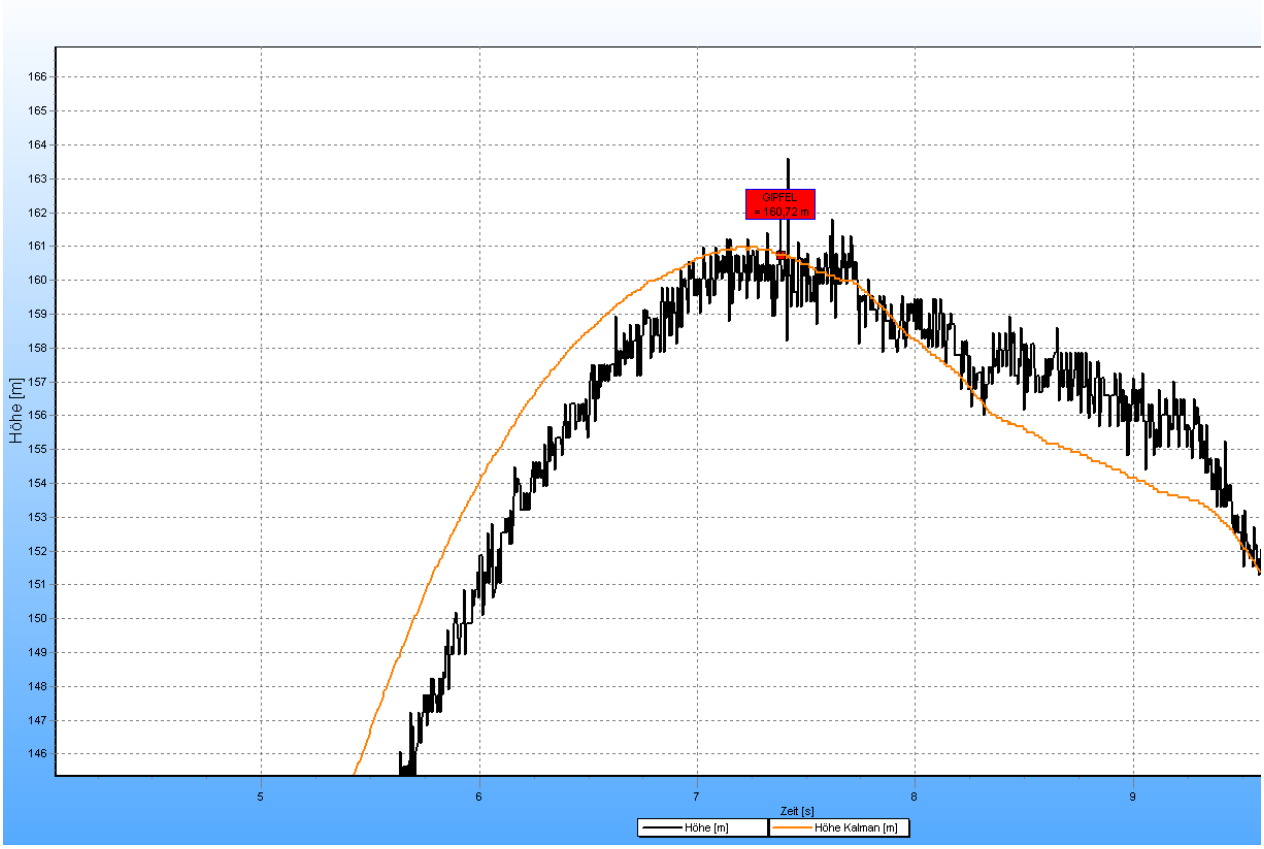


The Apollo Guidance Computer was actually one of the first computer using a Kalman filter for filtering position data. The filter also contributed significantly to the very high precision and was crucial to the success of the Apollo program.

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 G3 also has an 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 G3 has a unique event system.

This new feature permits completely free allocation of Inputs, outputs, 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)** – Launch-detection via acceleration, 3G more than 0.1 second.
**Start (Pressure)** – Barometric launch detection in approx. 10-12 m Height.
**Burnout** – Burnout of the motor (only G3)
**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 G3)
**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
**INPUT1** – level change on aux input 1
**INPUT2** – level change on aux input 2
**INPUT3** – level change on aux input 3

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 end position
**Servo 2** Drives Servo 2 to end position
**AUX1** Auxiliary 3.3V-Level-Output 1
**AUX2** Auxiliary 3.3V-Level-Output 2
**AUX3** Auxiliary 3.3V-Level-Output 3

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

**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 recovey**
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 G3 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 iss et 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 ist 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 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 set
At event „Apogee pressure” the action „Pyro 1“ is set
At event „Height descend“ the action „Pyro 2“ is set

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.

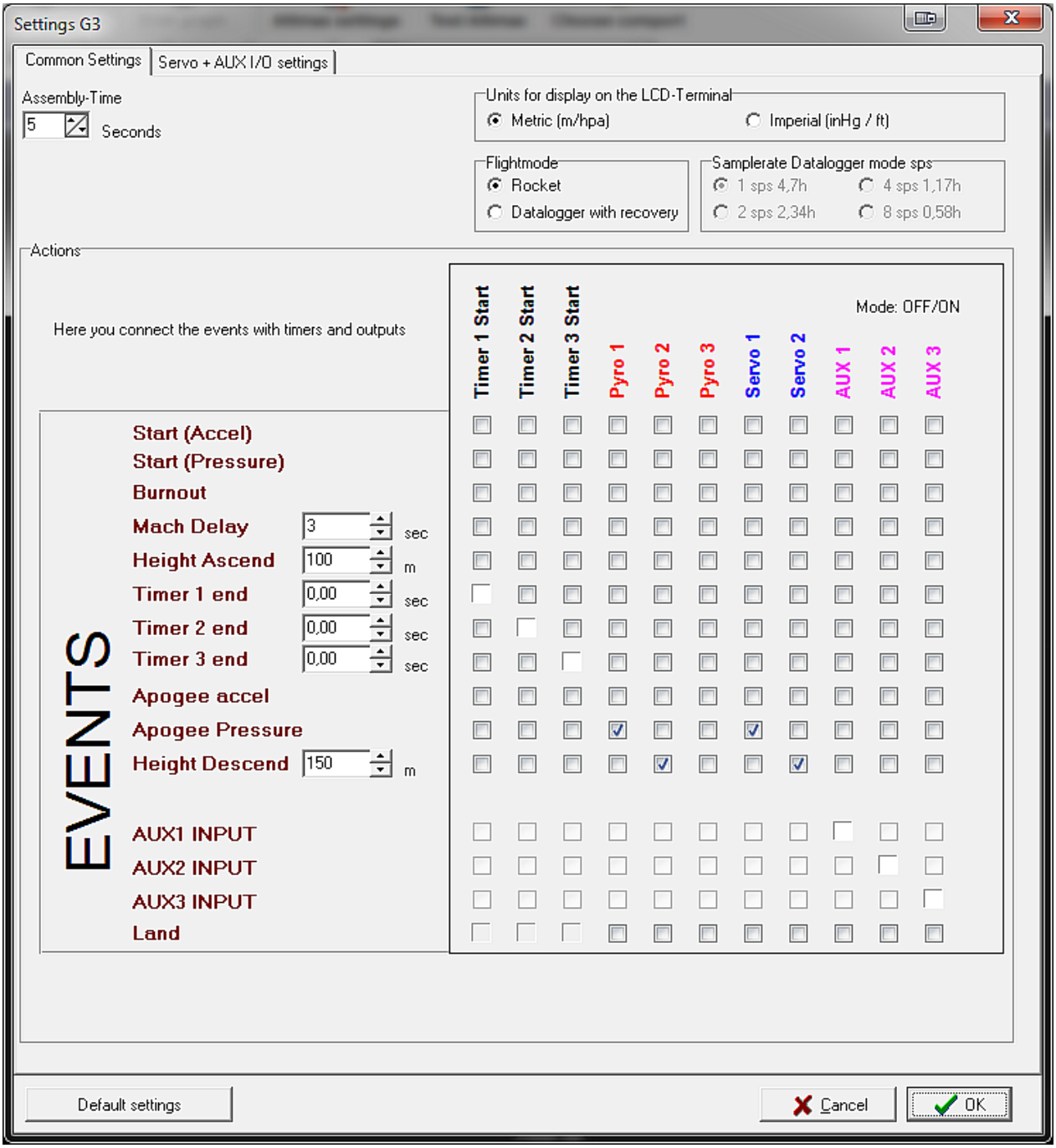
**Attention: All Timers can be used once in a flight, you can not use timer 1 at burnout and again timer 1 at apogee. Please keep this in mind!**

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 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.




These are the default settings.

# Installation

These things are to watch for when installing an AltiMAX G3 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 approx. 1.5mm each should be sufficient in most cases. The pc-Software has a calculation aid for these holes.

- **G3: Installation only in flight direction!** The connector must look up of down, not to the side of a rocket, otherwise the acceleration sensor cannot measure the acceleration. The AltiMAX G3 mini can be installed in any direction.

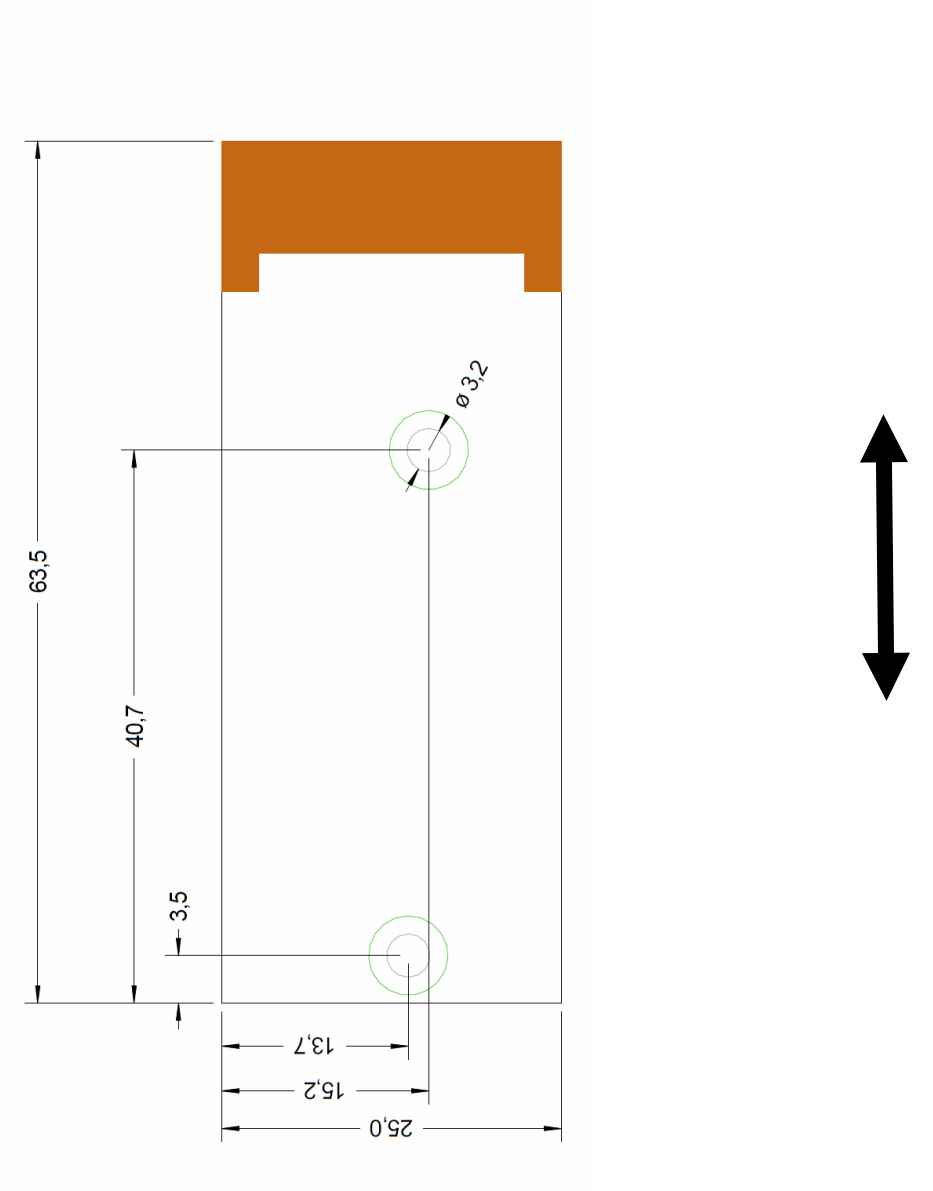
- **Rigid installation – User screws, the altimeter should be fixed so it cannot move in flight**

- **Prevent Pressure from ejection charges** – The electronic bay housing the altimeter should be airtight to the 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 e-bay.

- **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.

# Allowed flight-direction G3!




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

# Power

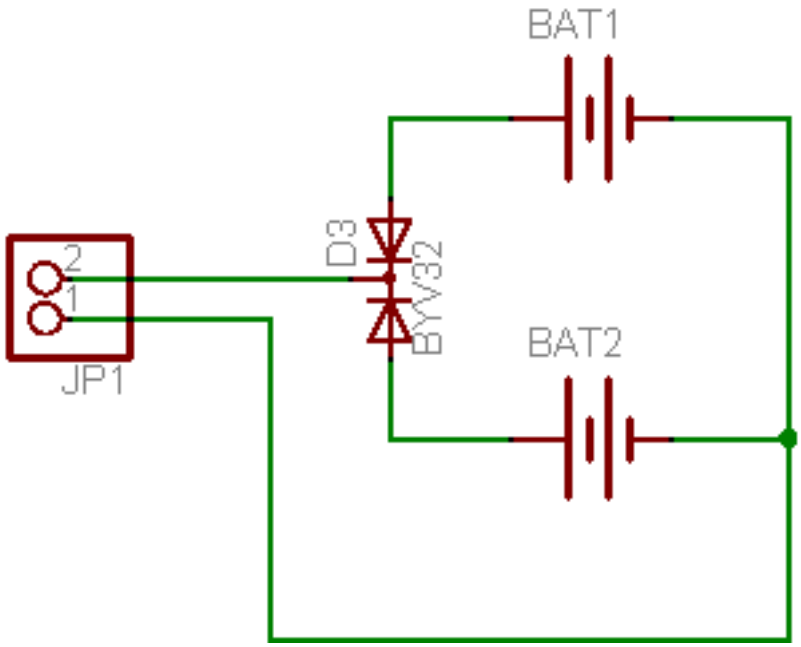
The AltiMAX requires at least 6 V, below this voltage, it will refuse to function and beeps with a continuous beep and alarm sound. In this case, DO NOT START!
The terminal then also shows a low voltage selftest error.

I recommend the use of LIPO accu, 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. 150mAh is more than sufficient as long as you do not drive large servos.

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.



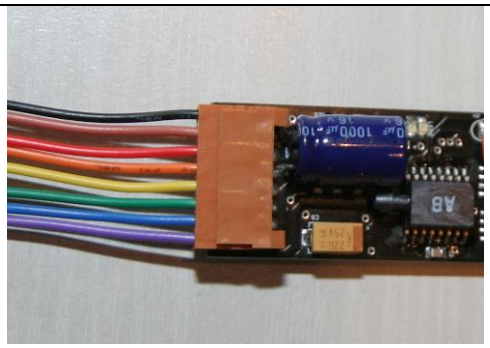

 

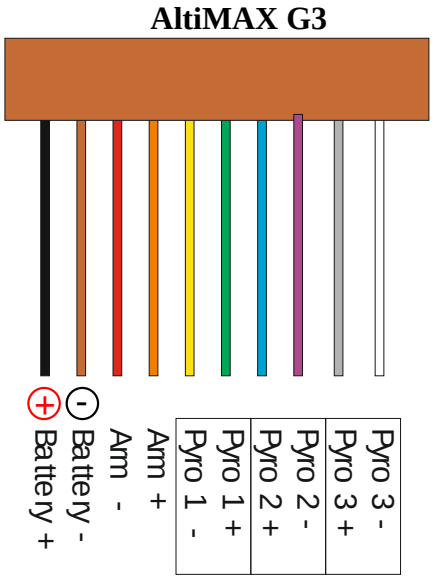
# *Electrical connection AltiMAX G3*

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.

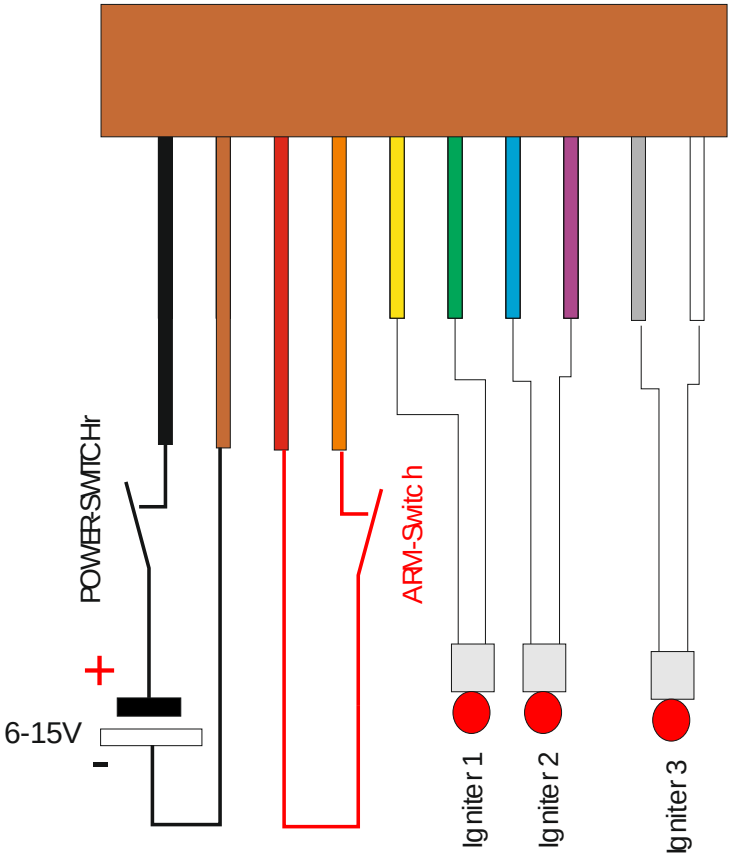
**The BLACK cable is PLUS, the BROWN cable is MINUS!**

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



# *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.

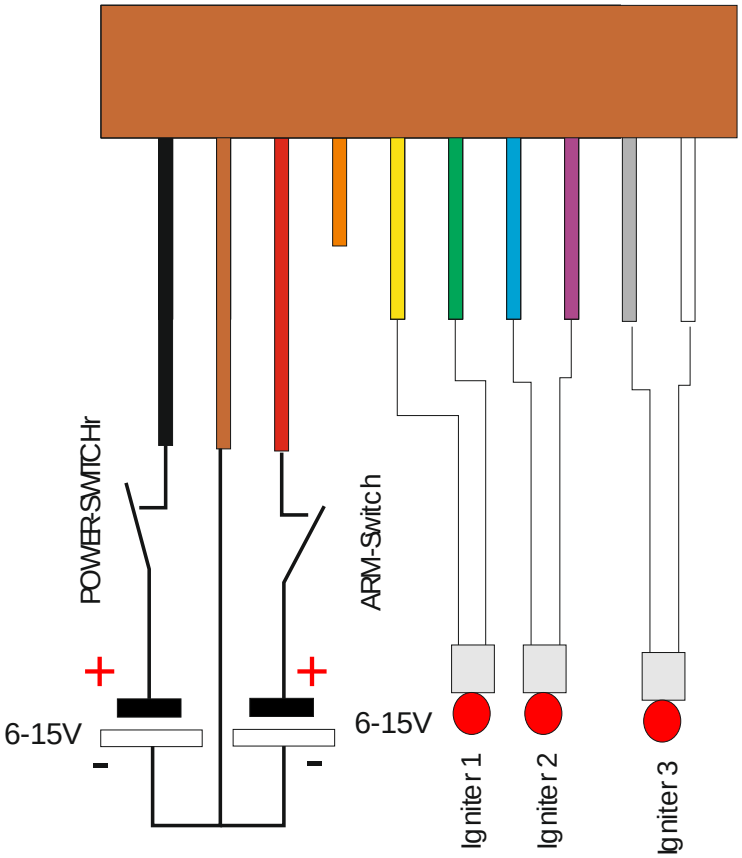
 

# *External ignition power source:*

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 12 Amps, you can light up Highpower-motors with this, as long as your ignition power source can deliver the current.



# 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 G3 has 3 pyro ports.

## *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.

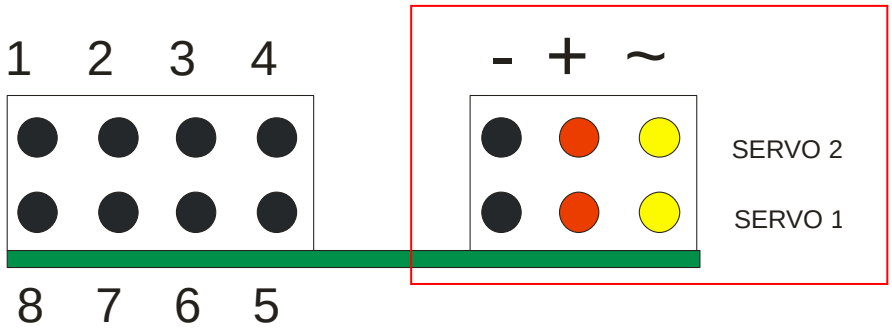
The AltiMAX will beep for 20 seconds, then fires pyro 1 to 3 with a 5 second pause after each firing.

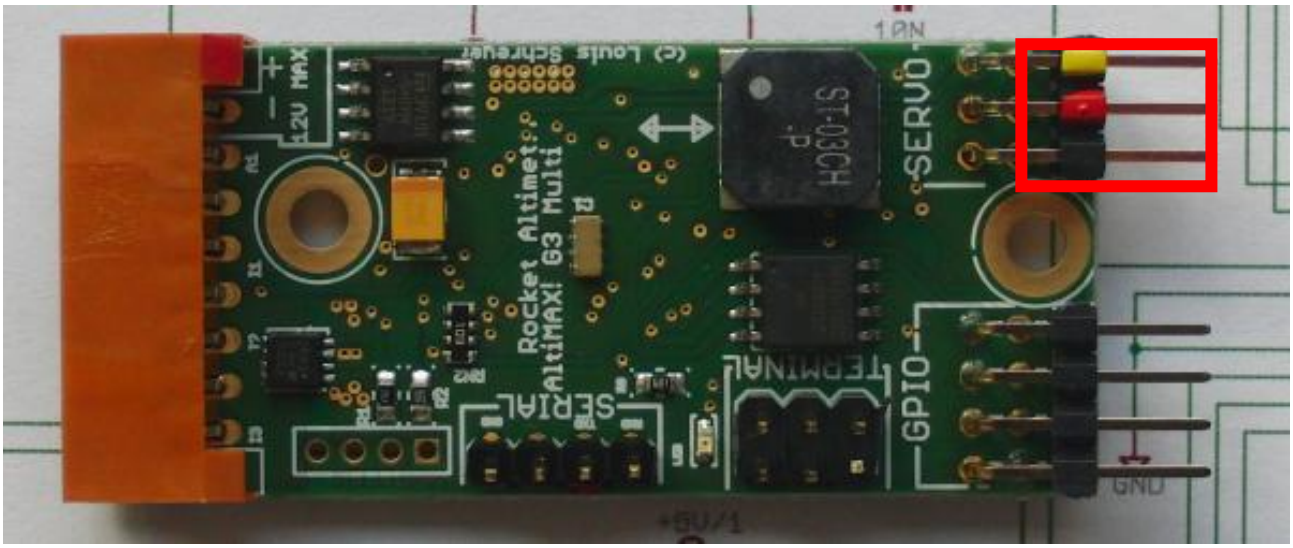
To abort a running test, just switch of the altimeter!

# *Servos*

The AltiMAX G3 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**

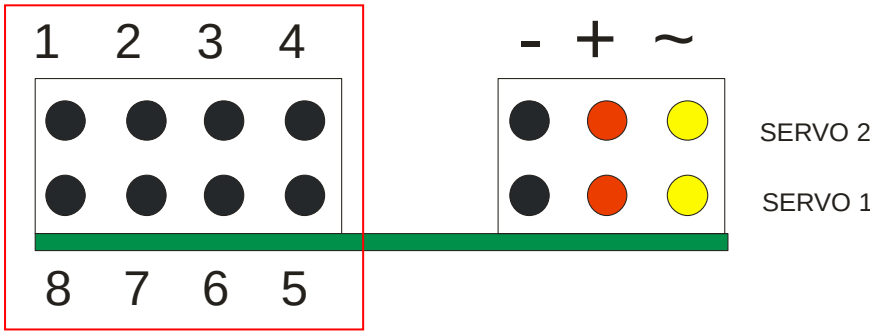
The 3-pin connectors are the servo connector, please observe the polarity. Control signal is on the top pin in this image, marked yellow

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.

# Auxiliary outputs and inputs (GPIO)

Pinout:




1: GND
2: AUX 3
3: SCK / SPI
4: MISO / SPI
5: MOSI / SPI
6: AUX 1
7: AUX 2
8: VCC 3,3V

The Altimax G3 has 3 pins that can be used either as Input or as Output. Also, a complete SPI-Port is available but not in use yet.
AUX1 – AUX3 can be set to input- or output-mode.

**USAGE AS OUTPUT:**

As output, the pin is switched to GND, if activated switched to 3.3V
Beware: There pins are logic outputs, they are not protected against overload!

Maximum allowed current as OUTPUT:
Current: 20 mA
Voltage: Max. 3.8 V

With a resistor of about 180 ohms these pins can drive LED directly with 10 mA.
If you need more current you need to use a logic level FET to switch higher loads. Also here, use resistors to current the switching limit. Also observe, that not all FETs switch at 3.3V, most need higher voltage, so select one which switches at 3.3V

AUX 2 und 3 can be switched to output-function “Armed-LED” and “BEEPER”, you can use that for connecting a led showing that the G3 is armed, and to lead the beep-signal to an external beeper.

**USAGE AS INPUT:**

As INPUT the pins are high-Z and have a pull-up resistor to 3.3V
To activate an input you need to change its level, that is important: A level change is detected!
So you can switch it to GND or close the pin to GND and open the connection. Either way creates a level change which is detected. So you can use Normally-Open or Normally-Closed switches, even Breakwires.

With the GPIOs you have a powerful system to solve many problems in complex rockets.

**Example:**

You can use it for save ignition of the rocket motor, this way your motor can only light up if the altimeter is ready for take-off:

- AUX1 is set as INPUT
- The event AUX1INPUT activates PYRO3.
  Connect the motor igniter to PYRO3
- You connect a relays to the input, which draws it to GND upon switched.
- Then you switch the relays with your ignition box.

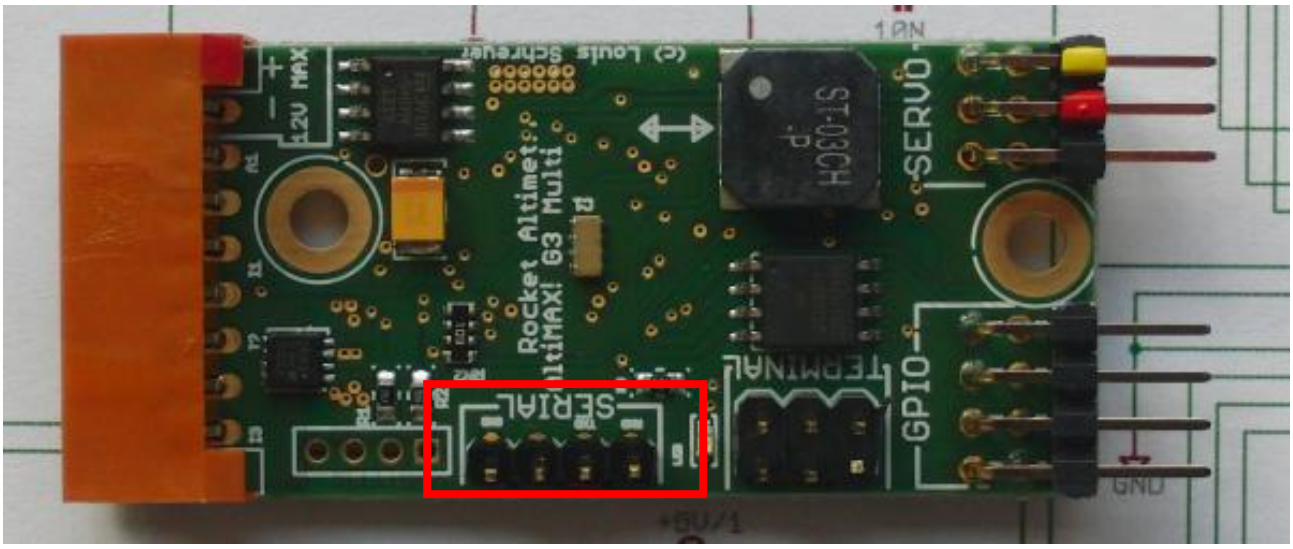
This draws the input to GND, the event of this input is fired and makes the altimax to activate the Pyro-Output PYRO3, this lights up your motor.

This way, you can never ignite the motor when the altimeter is not ready! You will never ever again forget to switch on your electronics before you ignite your motor ☺

# *Serial connector*

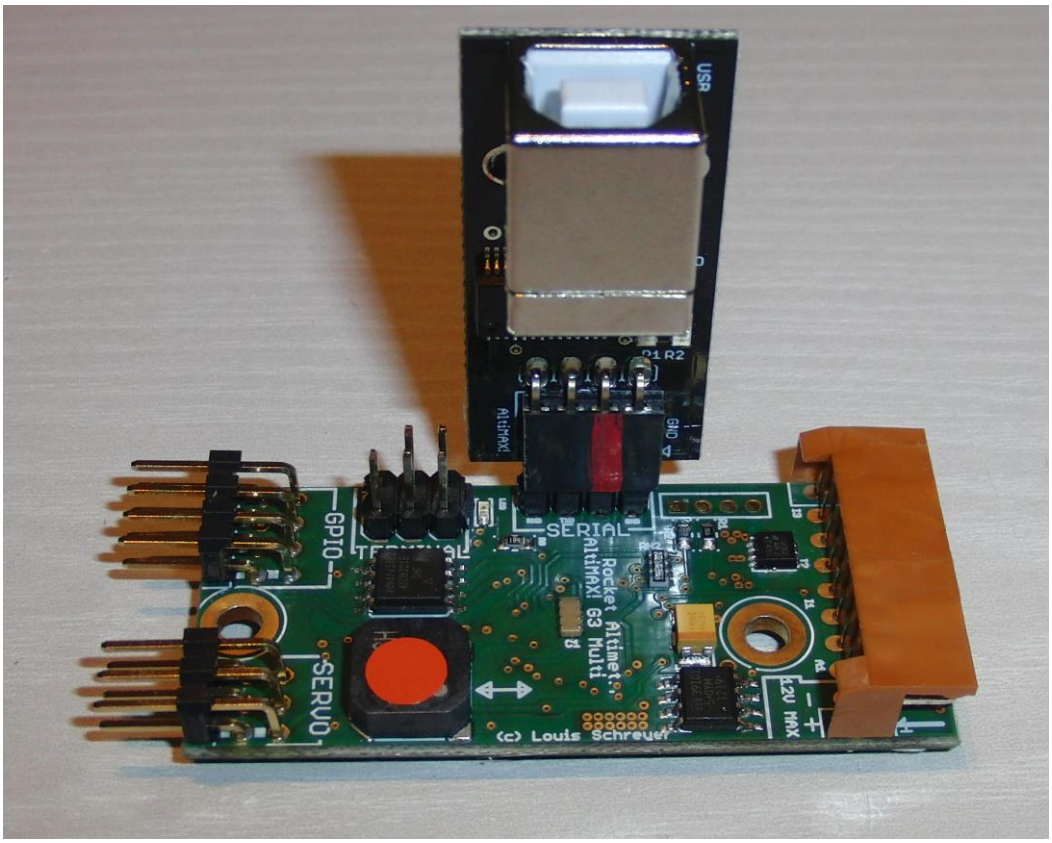
**Where to find the serial connector:**




**GND VCC TXD RXD**

**BEWARE: The signal has 3.3V TTL-Level, do not connect RS232 lines directly!**

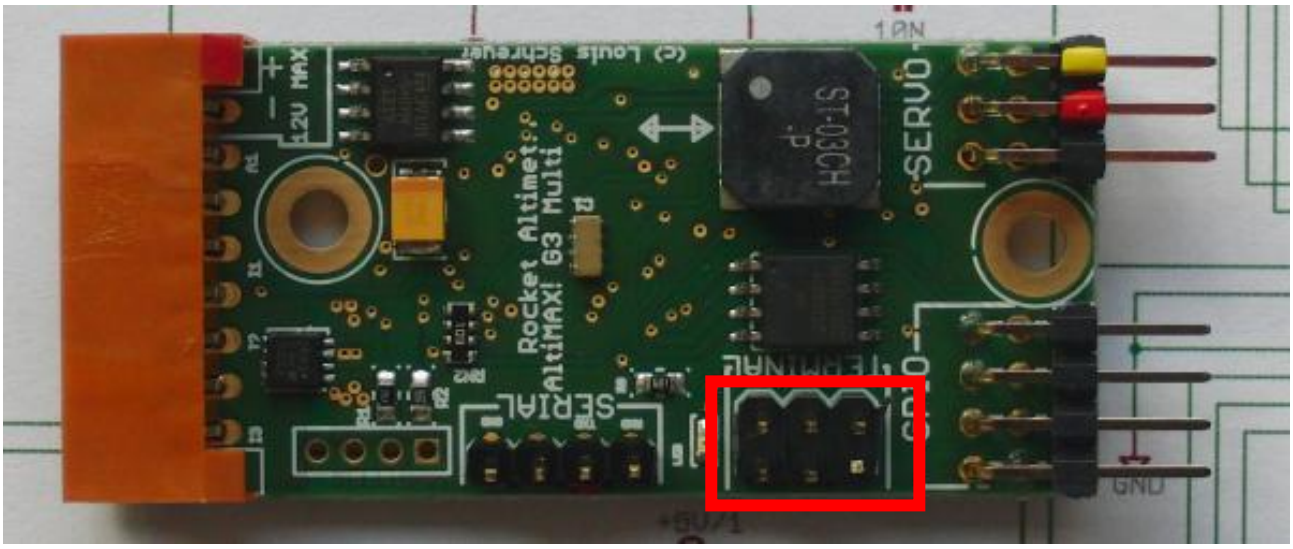
**This is the way to connect a usb connector:**



# *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.

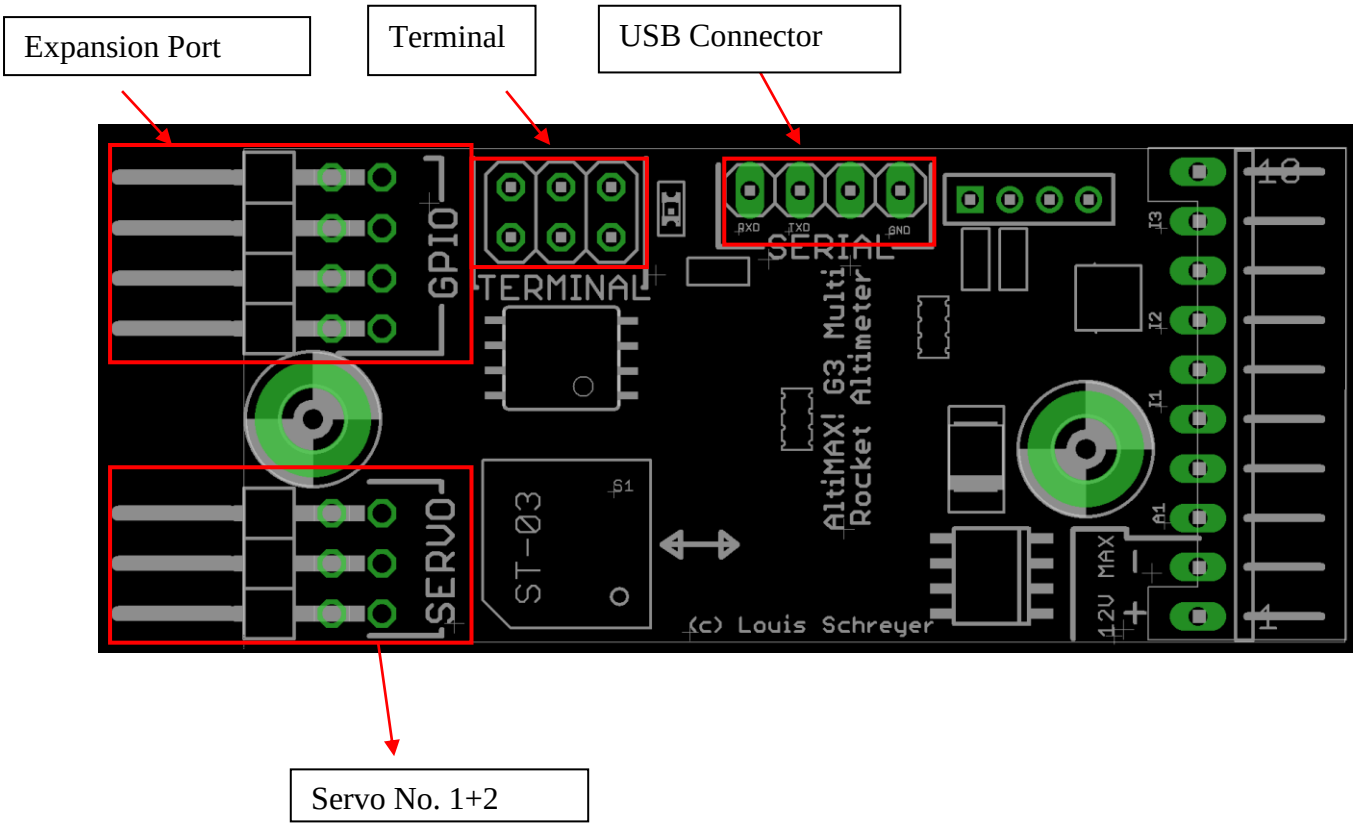
After connecting the terminal you need to reset the AltiMAX so it can connect to the terminal.



# Connection overview:

## AltiMAX G3:



# 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 ----------beeeeeeep ----------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. **Last height beepout**
   You will hear short beeps for the meters of height you reached in the last flight. Long beeps are "0".
   Example:
   Beep-beep-beep = 3
   BEEEEEP = 0
   Beep-beep-beep-beep = 4 > means: 304 meters
4. 1 second pause
5. **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 – beeeeeeep
6. **Calibration**
   The AltiMAX will go in ready mode and starts to calibrate the sensors. After that it will go to the..
7. **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.
8. **Event-system**
   After launch detection the flight-program runs until land detection. According to its settings the altimeter will fire events, activates the actions and measures flight data.
9. **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
10. **Land**
    The landing of the rocket is detected when the height did not change for 4 seconds. When ready, the altimax continuously beeps out the reached height.
    **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.**

# Disclaimer

The use of ALTIMAX is at your own risk. Always us 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.

# Contact

**Manufacturer:**

**Rocketronics**
**Dipl. –Ing. (FH) Louis Schreyer**
**Hugo-Grotius-Str. 18**
**27404 Zeven**
**GERMANY**

**Email: info@aquarix.de**
**www: http://www.rocketronics.de**