Important

not reading this manual properly may cause damage to the Variometer or other components of your aircraft. Please fly responsibly and within the boundaries of regulations, R/C club recommendations and law!

Variometer installation instructions

Manual last updated on: Tuesday, May 18, 2010

Quick start & installation

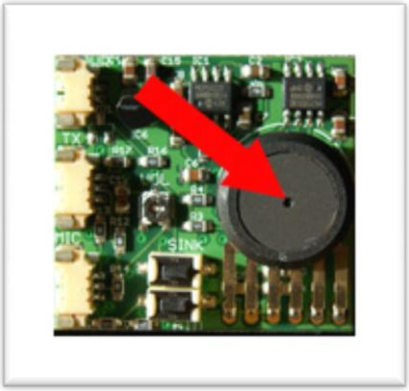
For minimal operation you only need to attach the L1D Variometer to your A/V transmitter ("TX" connector) and to the power (PWR connector). The L1D accepts anything between 5.5V to 17V, 2S - 4S LiPo recommended. Less electrical noise translates to a better resolution of your altitude sensor. The supply power should therefore be as noise-free as possible. Please refer to the connection cheat-sheet below on how to connect these plugs.

Plug in your battery and you should hear the Variometer go through its startup sequence.

Variometer Startup Sequence (from top to bottom)	
Battery cell count	One beep for each detected cell
Pressure Sensor calibration	Simulation of a climb and sink tone while the pressure sensor calibrates itself
Sink rate compensation	Confirmation of the sink rate compensation (see "Sink rate table")

Your Variometer is now ready for installation.

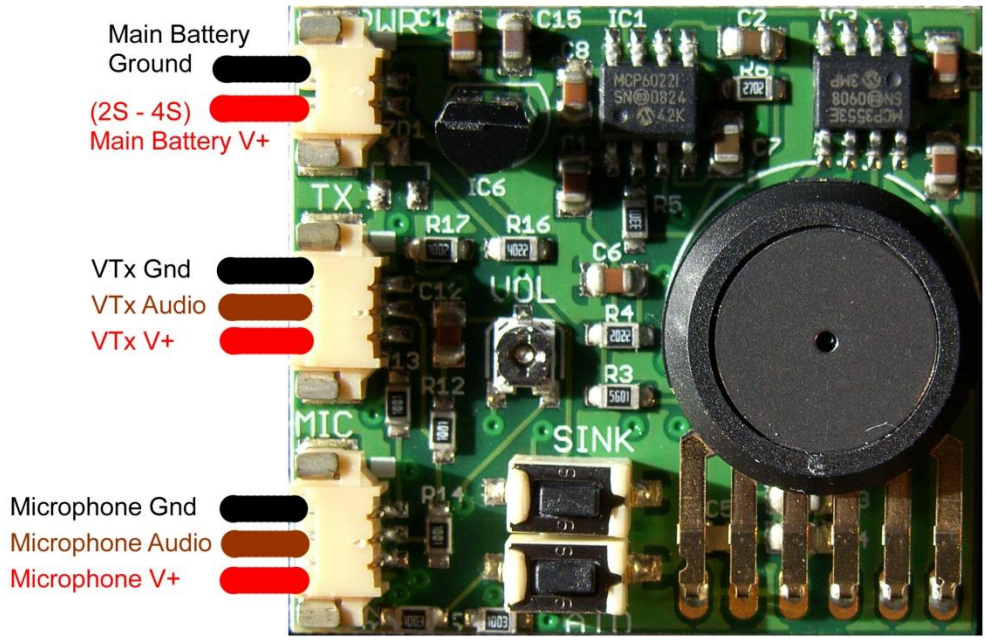
When installing the Variometer in your aircraft, make sure that the pressure sensor (the big round component) is **not exposed to direct sunlight**, as it will decrease its accuracy. Also, it should not be installed in an area where there is pressure buildup (behind an air scoop, for example). If this situation cannot be avoided, make sure that the air inlet is smaller than the air outlet.

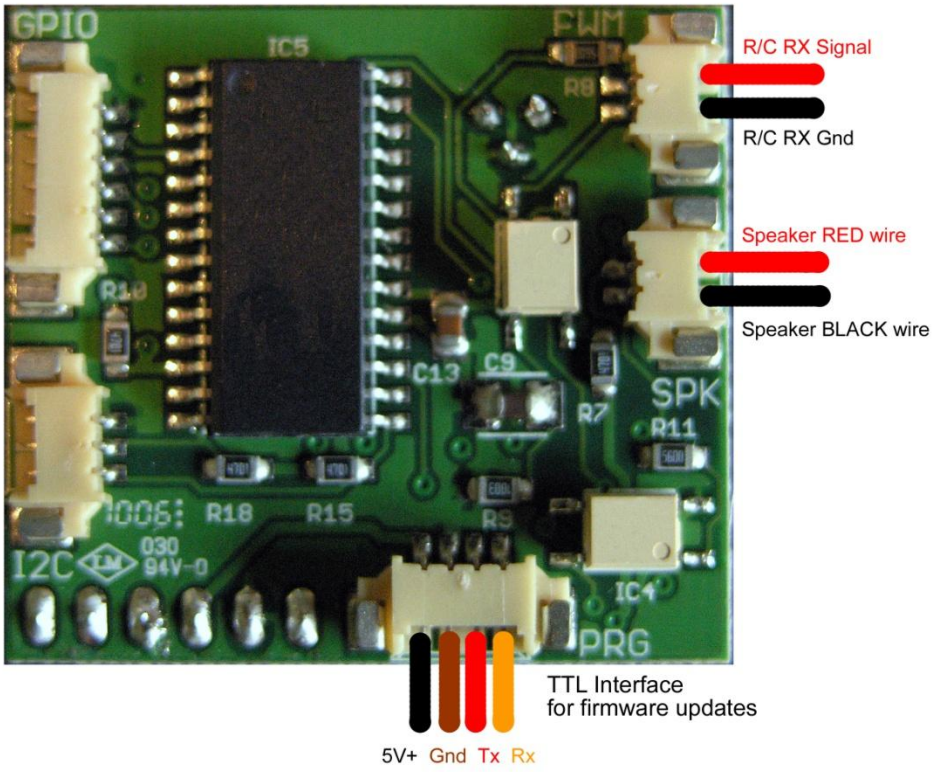


A clean, well thought out installation is critical to providing the greatest accuracy possible. A good place to put your Variometer is embedded in the wing or below the battery in the fuselage. You can cover the Variometer with packing sponge to even further increase its accuracy. While it is not recommended to shrink-wrap your Variometer as it can be damaged in the process, it is certainly possible to do so. Make sure you do not cover the round hole of the pressure sensor.

Connection cheat-sheet

Pictures speak more than words. Here's photos showing the Variometer and explaining a host of connections it supports.





Settings cheat-sheet

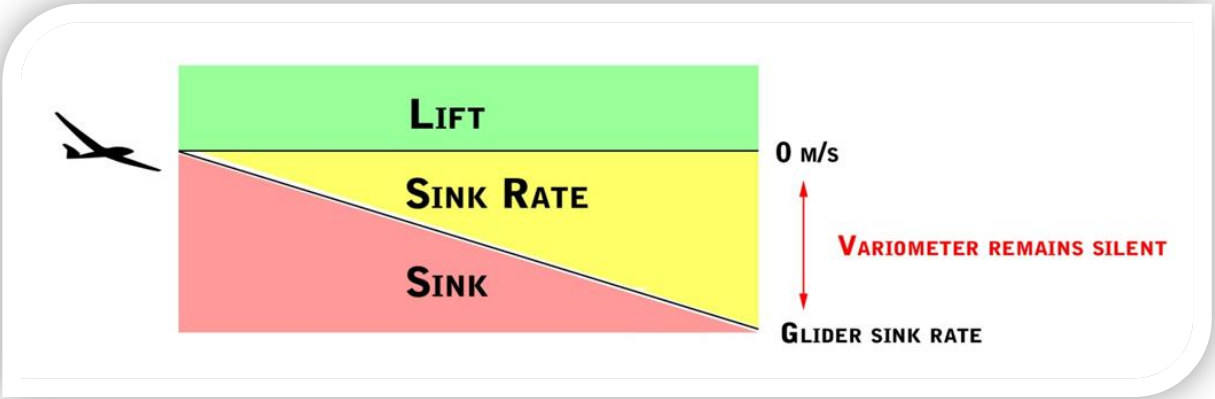
Different types of planes will work best with different types of settings. Here's what we used during the testing period and found it to work best. If you do not have a spare R/C channel, it is recommended to connect the PWM to the throttle channel via a Y-harness. For a lengthy description of the settings, please see the next chapter.

Aircraft type	e.g.	Suggested settings
Motorized Pusher Glider	EasyStar, Zephyr, Maxi Swift	PWM (R/C on off) on separate switch Sink rate setting 5 on good days, 1 on bad days
Motorized Tractor Glider	Parkzone Raiden, EasyGlider, Cularis	PWM (R/C on off) on the same channel as Throttle Sink rate setting 4 on good days, 1 on bad days
High performance electric glider	Pike Perfect, Supra, AVA, Pulsar, Signal	PWM (R/C on off) on separate switch Sink rate setting 4 on good days, 5 on bad days
Pure glider foamy	EasyGlider, SAL, DLG, Slope Zagi	PWM (R/C on off) not needed Sink rate setting between 2 and 5
Powered trainer models	MPX Mentor, Cessna	PWM (R/C on off) on separate switch Sink rate setting 8

Variometer settings & features explanation

Sink Rate Toggle

The sink rate specifies the rate of altitude loss for your plane. The Variometer will signal remain quiet when the plane is between level flight and the configured sink speed.



Please find below a table with the beeps and their corresponding sink rates and their suggested application. It is on a separate page to make it easier to print – you can take it with you for on-the-field programming of your Variometer.

Toggle through the different preset sink rates by pressing the **SINK** button. The more beeps, the larger the silent range. Once you reach the end of the table it jumps back to the beginning (first row).

Sink Rate Table

Beeps	Sink rate	Comments / Description
1	--	Silent mode. Sink is completely ignored, only lift is signaled. Best for flying on slopes or weak thermal conditions in maximum silence.
2	0.4m/s	Standard sink rate configuration for high-end Thermal Duration gliders
3	0.7m/s	
4	1.0m/s	Standard sink rate configuration for purpose-built gliders (Cularis/EasyGlider with folding prop, lightweight)
5	1.3m/s	Standard/suggested configuration
6	1.6m/s	
7	1.9m/s	
8	2.2m/s	If thermal performance is not critical to your flight, use this setting (it will give you a lot of silence and signal only heavy sink)

Low Voltage Alarm

The Variometer will let you know when it's time to turn around from your beautiful soaring adventure. It will start to alarm, by using distinctive beep tones, when you have consumed 50% of your battery and then for each additional 10%.

This is especially useful if you are doing thermal long distance flying. At the 50% mark it is usually a good way to think about your return trip. 40% should be the "turnaround point" to still make it back safely. We do not recommend using this feature to drain your batteries to the limit; it should be used responsibly. Always fly with enough battery margins!

Amount of beeps	Battery Voltage (per cell)	Est. capacity remaining
1	3.8V	50%
2	3.7V	40%
3	3.5V	30%
4	3.3V	20%
5	3.1V	10%

R/C on/off switch

The Variometer tone can be turned on and off during flight. You can connect the Variometer to your throttle channel using a Y connector, which makes the Variometer silent when you're using the motor. You can also assign the Variometer to a separate channel on an external switch on your remote control.

You need a supplied 2 pin cable connected to the PWM connector on the Variometer and feed that to your R/C receiver. Normal R/C cables have 3 wires: Ground, +5V DC and Signal. You will only need the Ground and the Signal. The Variometer does not need the +5V DC (red) cable, so you can remove that from the R/C.

R/C transmitter programming:

The Variometer switch detects **ON** at 0% - ~25%, and **OFF** at >25%. If you assign a 2-way switch and a separate channel to the Variometer, please make sure this criterion is met when programming your transmitter. You can also connect the Variometer via a Y-harness to your throttle channel. This will have the effect that the Variometer is on when your engine is off, perfect for gliding!

Volume knob

Specify the volume of the L1D Variometer tone produced at the TX output in relation to the volume of the MIC input. Turn the knob using a screwdriver. One hint to adjust the volume is to have music playing next to the microphone. If you can hear the music through the speakers and the Variometer tone at the same time, then the volume is set properly. The default setting is usually fine.

AT0 Altitude reset

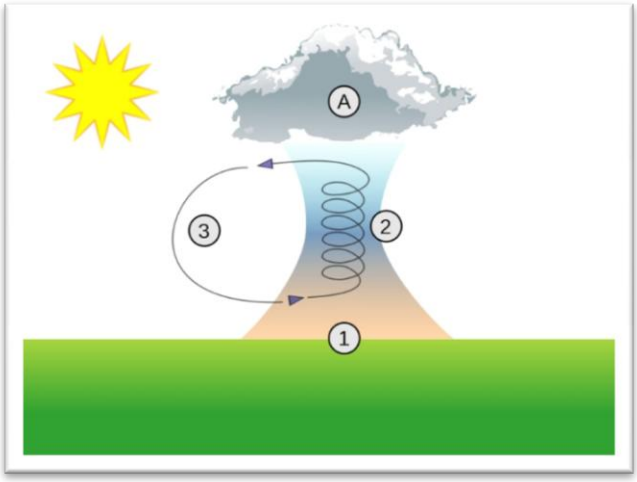
This button sets the internal altitude back to 0. This button is important when using the L1D Variometer in connection with compatible OSD products: Your altitude will be recalibrated to 0 at launch point. Wait about 15 seconds after powering up the Variometer before pressing this button for maximum accuracy.

Thermal techniques

This chapter will educate you on the basics of locating strong thermals from the ground and then how to stay in them once you found them in the air. Regular thermals, good enough for staying in the air, usually form anytime during the day and anyplace. The L1D will help you find them just by flying around. Stronger thermals require a little more strategy to find and stay in them.

The best weather for finding thermals is zero to low-wind days with lots of sunshine.

Schematic of a thermal



1) Hot air forming the thermal, air rises. Your glider climbs slow at first

2) Air steadily moving up, your glider is now climbing very fast. It's hard to stay inside the thermal. Climb until you reach the cloud base

3) Around the thermal cold air sinks. Between hot and cold air there is turbulence.

A) Cumulus Clouds. They form at the tip of a thermal. As hot air cools down, the excess humidity condenses into a cloud.

Locating thermals before the flight

Before launching your plane, look for indicators on the ground, then in the sky. On the ground what you want to look for is large patches trees, big industrial buildings, exposed rocks / mountains, roads (4 lanes and above) or parking lots. They all heat up when the sun shines on them and emit a lot of heat which turns into rising air.

For thermals to form, you also need cool air. Only hot air will not make the hot air rise, it requires cool air to push downwards to get the cycle going. Hot air pushes upwards at the general area where it meets cool air. So for example a car park or big forest (hot) next to a river (cold) will give you plenty of thermal activity during a warm day.

In the air the best indicator for thermals are Cumulus Clouds. They form at the tip of a thermal, so if you see one developing you can draw a vertical line down to the ground and look for above-mentioned

features that might cause these thermals. The next best indicators for thermals are birds. Wherever they circle, there are sure to be thermals. Be careful, though: Compared to our R/C gliders, birds are a few notches ahead in terms of efficiency. So if they don't climb fast, you won't climb at all ☺

… and in flight

The Variometer will signal when the aircraft climbs. This also includes climbs/descent due to stick movement. So if you turn and push/pull the elevator a lot, it will be hard to find thermals. The suggested way of finding thermals is to fly straight at the area where you expect thermals and fly triangles with at least 500m sides. The straight lines should not be spent by moving your sticks. Just enjoy the view and relax – similar to fishing. Once you've got a "nibble" (no more fishing references from here on, I promise ☺) this is when you start to take action.

The thermal must first be tested for its strength. To do this you immediately get the plane into a bank of about 45 degrees. The direction of the bank is determined by the direction that the thermal pushes you. If your plane banks a little to the left, you will want to do a right turn. This is because the thermal is strongest at the center, so it will push you away from the center. By doing the turn into the opposite direction, you are banking towards the core of the thermal.

If you have a rudder, gently push your plane into the turn (left rudder in a left turn) and keep the bank angle. The Variometer should continue to beep for at least 1 to 2 circles without interruption. That's when you've got a thermal that lifts you instead of just keeping you at the same altitude. If not, keep looking.

Staying and centering in thermals

Now you've found a thermal that lifts … this is when you **gently** open up your turns and listen for the Variometer tones go higher. Once they reached their highest point and start to go down, you start to close the circle again. This is a repetitive process, so you are continuously opening up and closing in the circle while working the thermal. Practice makes perfect, and since you're not consuming a lot of battery while doing this, you've got plenty of time ☺

Once in a while you may notice your Variometer go wild extremely quickly and then die off again, and your plane gets thrown around like crazy. That means you've hit a "bubble". Picture a gas bubble in your mineral water for a good comparison. It's a small unit of warm air shooting up into the atmosphere at

up to 10m/s. To stay in these you will need to fly a very steep bank angle and constantly pull your elevator. Bubbles should be your goal, as they take you up to very high altitudes in very short time.

Happy soaring! Be sure to send us videos of your flights and share your experience at our RCGroups thread: http://www.rcgroups.com/forums/showthread.php?t=923652

Disclaimer

Conceptos Pirker GmbH cannot he held liable for any damage caused to your equipment or your aircraft.