The LÖFGREN Variometer

User and Installation Manual

Version E

Löfgren Electronics EURL

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www.lofgren-electronics.fr

Foreword

Thank you for purchasing the LÖFGREN variometer! This product is the fruit of many years of development. It is truly an instrument built by pilots for pilots. More than 20 years of cross country flying experience including several world- and European-championships have gone in to this instrument. The goal was to create an instrument that improved the performance of cross country flights. We concluded that better energy management, be it faster climbing or better utilisation of gained altitude, was the most promising area to improve. We also concluded that the reduced drag from an electronic compensated variometer gives direct performance gain. As such we developed for electronic compensation as the preferred compensation type, while still keeping the traditional TE tube option available. To our delight we achieve the goal of making a variometer that improves on every aspect reached for.

Simplicity is the highest level of refinement. On the surface our variometer looks simple and to some degree lacking of features and gadgets. The simple nature of it is highly intentional as we believe that instrument distraction is not only dangerous but it also reduces cross country speed.

The variometer is further built to make life easy and enjoyable for the owner. There is no user firmware updates, it will function perfectly from day one to the day you stop using it. It is built to last, and perform flawless, for a lifetime. It will remember its settings and never change unless you do so.

On top of all this we have made a beautiful instrument which is comfortable to look at, to listen at and also a joy to operate and own.

We wish you many happy flights!

Document revision

Version	Relese date	Reason for release
A	November 2024	Initial release
B	February 2025	Multiple corrections of data and addition of external speaker
C	March 2025	Few corrections and addition of ‘Annex 1 - Pneumatic installation guidance’
D	May 2025	Added ‘Annex 2 - How to calculate A,B and C polar coefficients’
E	November 2025	Updated wireharness drawing & Technical specification. Added speaker Ohm option in setup menu.

User Manual

When turning on the power the instrument runs thru a start up procedure. During this time different information will be displayed in the display. No input, or action, needs to be done to get the variometer in operational mode. When the instrument have started the needle will in most cases have a small offset from zero during the first minutes, this is normal. The instrument can be in one of two modes: Variometer mode or Speed-to-fly mode.

Speed-To-Fly mode

In Speed-To-Fly mode the needle will indicate at which McCready speed you are flying at right now, what we call “The LÖFGREN McCready-Speed Indicator”. It takes into account the set polar curve, air density, gliders weight and momentary climb/sink. The display will always indicate a 1 second average of the netto climb/sink. The needle movement will be filtered according to the setup(see setup menu). The display will clearly show the text "NET" to help identify which mode you are in. The audio is directly related to the position of the needle. The variometer will be quiet between MC0 and MC4, only alerting you when flying too quick or too slow.

Variometer mode

In variometer mode the needle will show total energy compensated climb or sink in m/s. The display will show an average of the needle's position; average time chosen in the setup. The audio is directly related to the position of the needle.

The rotary encoder have the same reaction independent of mode. By rotating the knob the volume is adjusted. By pressing the knob it will enter the flight menu. The flight menu can be disabled in the setup; pressing the button in this case will do nothing.

Flight Menu

The flight menu is the same, independent of mode. It contains only the settings which may be useful to change in-flight or prior to take-off. When the menu is at the first level it will time out and exit after 20s. If you are at a higher level in the menu(editing a number or setting), the menu never times out. After finishing a setting, the menu will exit. When you see “>” in the display it means that rotating the knob will change that value/setting. The settings are as follow:

1.Mass

This is your current mass of the glider. This setting is used to adjust the polar curve accordingly to give correct speed-to-fly indication. Press the button to adjust the value. Value displayed is used directly. Press again to exit menu.

2.Switch

This determines which type of switch is used to go from variometer mode to speed-to-fly; Taster button, Toggle or fixed speed with auto switch. Auto switch have a +-5 km/h hysteresis from set speed. Change setting by turning the knob; adjusting below 70km/h it will jump to Toggle.

3.Info

This menu option contains no settings, just information. The first information is the outside air temperature (OAT). The second information is the Indicated Airspeed(IAS). These two informations are used in the speed-to-fly function and as such it is good to verify that they are reasonably correct.

4.Filter

This menu entry contains the settings to setup the variometer filters correctly. Please see the separate Filter section in this manual.

5.Reboot

If you want to restart the variometer in flight, without turning the main power off, you can do a reset thru this menu option.

EXIT

Pressing the button will exit the menu. The menu will auto-exit if it is in the first level (1-5) if no input is made for 20 seconds. When adjusting anything it does not auto-exit.

First level		Second level		Third level		Fourth level
1.Mass	---->	>330 kg				
2.Switch	---->	>Taster				
		>Toggle				
		>70 km/h				
3.Info	---->	20.0 c°OAT	---->	100 km/h IAS		
4.Filter	---->	>10 S	---->	>10 N	---->	>1.00 T
5.Reboot	---->	> YES				
		> NO				
EXIT						

Menu structure. Turn knob to go up-down and press to go right.

Filter settings

The variometer behaviour is adjusted by the means of a filter in three steps. The steps are: Speed, Noise and Total energy compensation. In the filter menu they are denote S, N and T respectively. The process is to start adjustment with the Speed filter, then the Noise filter and then the total energy compensation. Later they can be individually adjusted by just stepping past the other settings. The Speed and Noise filter should be adjusted when thermaling. Keep the instrument in variometer mode during the whole process. The value that is shown in the display is the value used by the variometer directly. When entering the Filter sub-meny the display will show ">", a number and which parameter is adjusted. This number can be adjusted from 1 to 50. Below 10 it adjust in steps of 1, above 10 in steps of 10. When adjusting the speed filter, the Noise filter is off.

Adjustment of Speed filter

When thermaling adjust the speed filter up or down until you feel the variometer indication is just a bit too slow for what you want. Confirm the setting by pressing the button. A good starting value here is 5.

If you notice, when flying in turbulent air, the needle moves rapidly but with constant speed; your speed filter is set too high and should be reduced.

Adjustment of noise filter

In some cases the speed filter by itself deliver the best variometer indication for you, thus you can turn the noise filter off by reducing it until it reads "OFF" in the display. But, in most cases it is beneficial to have the noise filter running to give a crisp and fast indication. Adjust it up or down until the needle movement is the best for you. There is no right or wrong setting here, this is very individual depending on the pilot and glider. A good starting value here is 5.

Adjustment of Total energy compensation

In the setup menu it is already set if the variometer should use electronic compensation or compensation with a TE probe. This setting will allow you to deviate from the theoretical correct TE compensation. A value of 1.00 indicate you have a 100% compensation.

In flight adjustment:

1. First you need to find air which is calm, without vertical movement.
2. Observe the needle movements when changing the speed smoothly between 100km/h and 170km/h. The needle should follow the polar curve sink when the setting is correct.

3. If the needle show excessive sink during the acceleration, increase the TE value by 0.01 and try again. If the needle show excessive climb during the acceleration, decrease the TE value by 0.01 and try again.
4. Repeat steps 4-5 until the needle moves smoothly following the polar curve sink.

When the variometer is used with our tuned tubes it is possible to get nearly perfect total energy compensation during smooth speed changes. When using other probes and/or pressure ports it might not be possible. We then recommend that you adjust the TE setting so that the variometer will at least not show climb during a pull up.

Switch setting

To switch from variometer mode to speed-to-fly mode there are three options. You can use a push button (Taster), toggle switch or you can set a specific speed at which the variometer will automatically change.

Toggle

With this setting it is assumed the switch is done by a toggle switch. When the contact is open (high ohm) the instrument will be in variometer mode. When the contact is closed (low ohm) the instrument will be in speed-to-fly mode.

Taster

A taster is a push button which springs back, thus it will only shortly be low ohm. When pushing the button the instrument will switch to the other mode. When starting the instrument it always default to variometer. This type of switch is recommended for training gliders as it always will start in variometer mode.

Auto

When auto mode is selected, only the speed of the switch-over is displayed. The instrument will automatically switch to speed-to-fly 5km/h faster than set speed and it will automatically switch to variometer at 5km/h slower than the set speed.

Setup Menu

During start-up the display will show “Press & Hold to setup”. By doing so you will enter the setup menu. This menu contains settings seldomly changed.

Takeoff mass

When the instrument is restarted, it will revert to this mass by default. It is recommended to set this mass to the gliders empty mass + pilot mass .

Compensation

Here you can chose if to use Electronic compensation or compensation by TE probe.

Polar A, Polar B, Polar C, Polar mass

These four settings are the common A, B, C, and mass polar data used by many other flight computers. You can copy these directly from your flight computer or contact us if you are unsure what to set.

AVG climb s

Here you chose how many seconds the average climb should average over. 20 seconds is recommended.

Spd.cmd filt s

This is the filtering time for the needle in speed-to-fly mode, it only affect the needle movement and not the displayed value. The displayed value is always 1 second. 1 second is recommended.

Needle offset

This is used to center the needle to zero. Adjust up or down until the needle is exactly pointing to zero.

NMEA output

Turns the NMEA output on or off. Keep it off if not used.

Speaker Ohm

This menu option is only available if your unit is using an external speaker. Set the value to the type of speaker used.

Menu

It is possible to turn off the Menu. By setting this to off, the menu will be turned off. When set to off, pressing the encoder does nothing during normal operation.

Total reset

This will return all settings to factory standard.

Pressure Probes

Optionally the variometer is supplied with one or two pressure probes. These are specially tuned as a pair to optimise electronic compensation. As such they should not be separated and used individually. While the total pressure probe will give correct pressure the static probe might not, depending on aircraft and installation location. As such, the static probe should only be used together with awareness aid information instrument, such as an electronic variometer. It can not be used for any of the aircraft's safety critical instruments such as air speed indicator or altimeter.

Inspection of the O-rings should be made frequently to ensure they are in good condition. At the same time the probes should also be inspected for integrity and/or damage.

The probes lack, like all other probes for gliding, heating and/or drainage. Caution should be taken to avoid flying in rain, snow or icing conditions as they might be blocked.

Never clean the probes with compressed air. Always clean with a lint-free cloth together with demineralised water to avoid clogging the small holes. Never blow into the probes, only suck to verify there is not blockage.

Do not keep the probes mounted while gridding and de-gridding. Only mount them prior to take-off and remove them after landing.

Pitot Pressure System Leak Test

Before first use the pitot pressure system must be checked for leakage with the probe mounted. If the system have a leak, the indicated air speed will show too slow. Worn O-rings and lose fitting pressure tubing are common leak points. It is recommended to do a leak test once per year. See Annex 1 for good procedure for leak testing.

Installation Manual

Technical Specifications

Panel hole:	Standard aviation 57mm
Dimensions:	63x63x75mm (excluding connectors)
Weight:	290g
Power supply:	9-16VDC, minimum 25mA
Max Current draw:	55mA int.speaker, 65/90mA(8/4 ohm) ext.speaker
External Fuse:	500mA fast blow
Humidity:	5-95% RH, non-condensating environment
Operating Temperature:	-20°c to 70°c
Storage Temperature:	-30°c to 70°c
Compass safe distance	35cm int.speaker, 10cm ext.speaker

Do not use in pressurised cockpits

Installation

Mechanical

The unit is made to fit a standard 57mm aviation cut out. The only difference here is that the lower right hole needs to be made larger for the thicker axel. The axel is 6mm and the hole should be made 7mm. The axel may not touch the panel. If the panel already have a 57mm cut out we recommend using a reamer to enlarge the hole for the encoder, not a drill, since this might damage the panel.

Only use M4x12 screws to attach the variometer to the panel, longer screws will damage the variometer. Tighten all three screws to 2Nm.

Attach the pressure tubes according to the sticker on top of the variometer. The top left is airspeed static, top right is airspeed total pressure and the bottom left is for static/TE. If used with electronic compensation you MUST use the same static pressure for the air speed as for the static sensor.

All wires and pressure tubes needs to be securely attached to a fixed point on the backside of the panel, between 10-30cm behind the instrument. This is called strain relief and it is to prevent that any pull/push force on the wires and/or pressure tubes reach the connection point on the instrument.

Compass safe distance is 35cm due to the built in speaker. We can supply the instrument without the internal speaker free of charge. The instrument will in this case be delivered with a connection for external 4 to 8 ohm speaker.

Knob

The instrument is supplied with two lengths of set screws to attache the knob. Always use the short set screw first like this:

1. Position the knob on the axel, make sure it seats properly.
2. If you wish to use the short set screw, apply a drop of thread locker to the threads. Insert the short set screw and screw it down with a 1,5mm Allen key until it just touches the axel.
3. From the point of touching continu to tighten one full turn. This will make a small indent in the axel and will hold the knob securely in place.*
4. If you wish to use the longer set screw, unscrew the short set screw and replace it with the long one. Add a drop of thread locker to the threads and make sure the tip of the long set screw seats into the small indent made by the short set screw in previous steps. Tightening by hand(no tools) as hard as possible.
5. Wait for thread locker to cure and ensure the knob, and set screw, is secure.

*After performing this step the knob will be difficult to remove. Only do this step when you are sure to not remove it.

Electrical

On the supplied wire harness the power supply wires is marked with positive(red) and the adjacent wire is the negative. The unit is protected from reverse polarity connection.

External fuse is mandatory.
The unit have several layers of built in fuses and protections that might get damaged if this is not in place. Warranty does not cover faulty connections which damages the internal fuses.

The two short wires are the speed-climb switch. Attach these to the glider's cruise-climb switch. Open contact(high ohm) will give speed-command and closed contact(low ohm) variometer. Toggle, Taster button or speed-auto can be set in the menu.

The supplied screw, one short M3 Philips, is for securing the contact on the back side of the instrument. Only use one screw for securing the contact.

All signals requiring a ground must be grounded at their designated point in the contact. They must NOT be grounded/referenced anywhere else.

TX+ and TX- (NMEA output) is only intended to drive an optoisolater at the receiving end. They must be galvanically isolated from receiver! Output impedance is 100 Ohm.

NMEA output

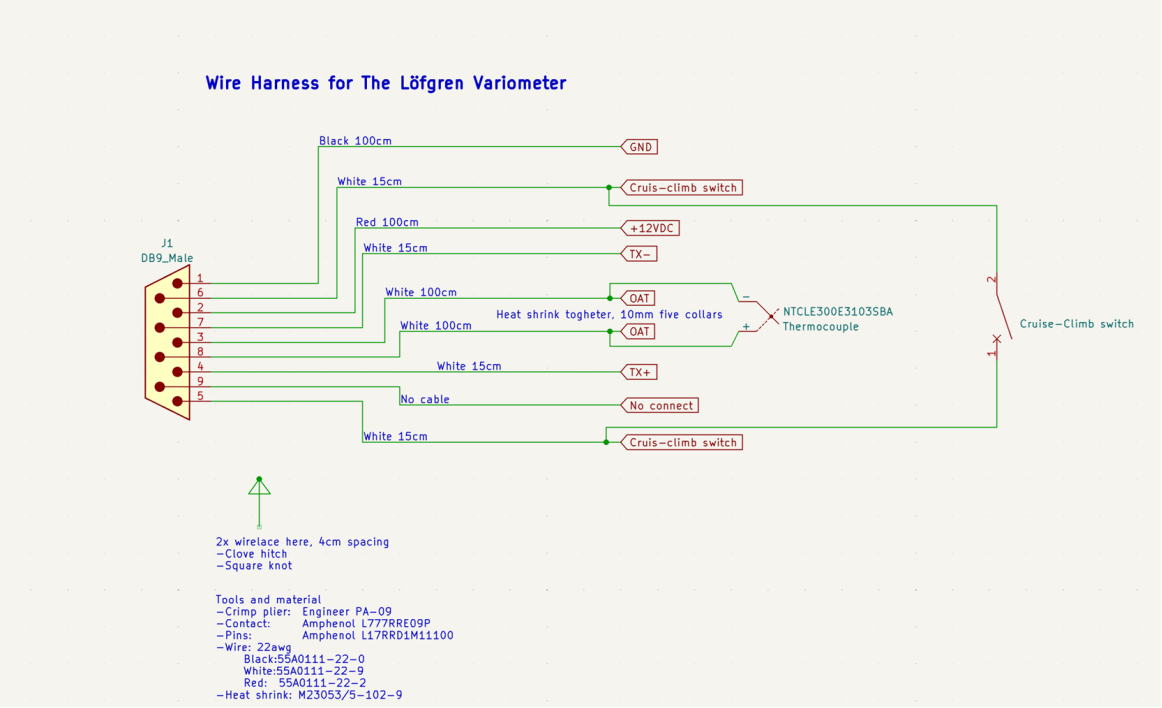
This is solely an output, no input. It's intention is to feed sensor data to flight computers. The output sentence looks like this:

$PLOF,<TE compensated climb/sink in cm/s>,<indicated airspeed km/h>,<temperature in deg c>*<checksum>

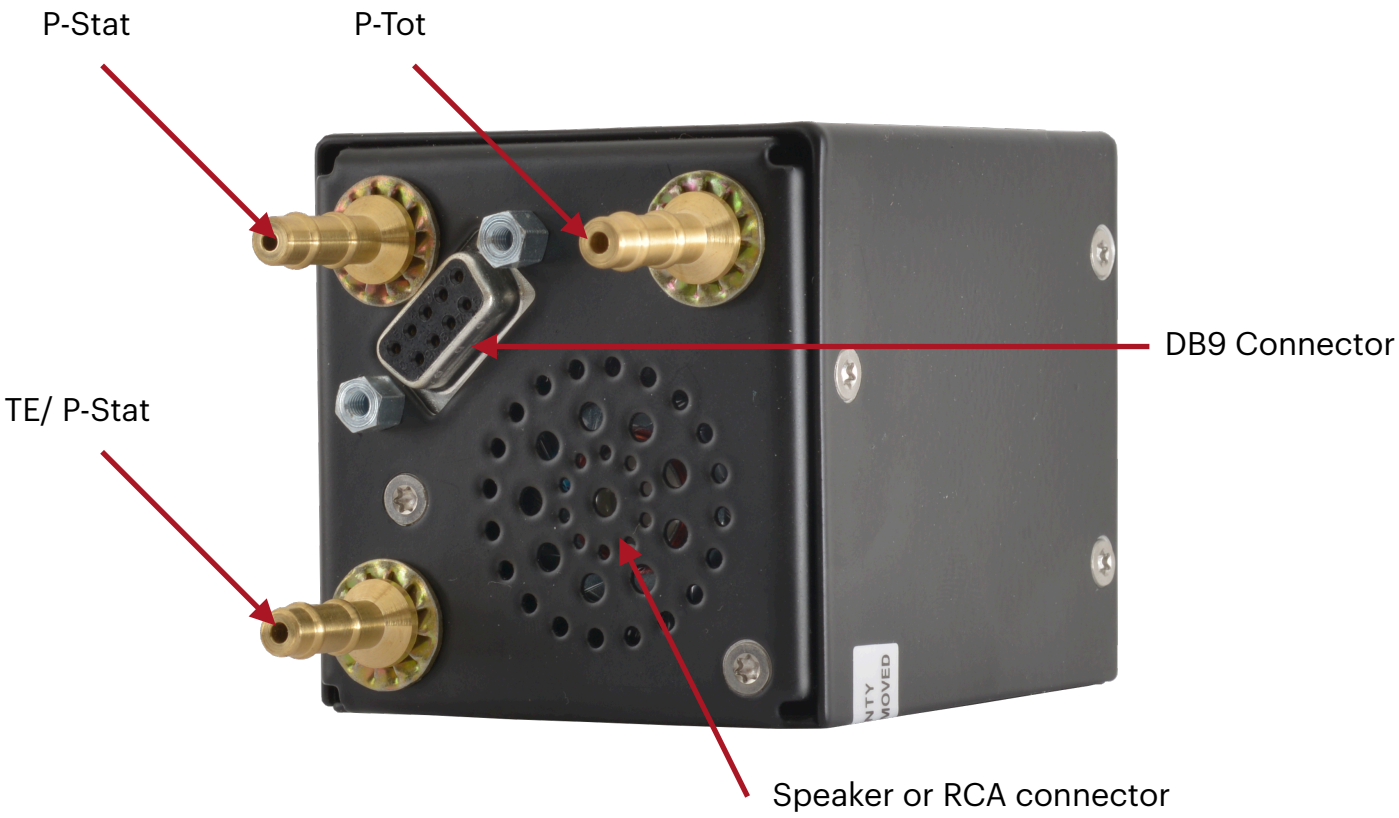
Checksum is standard NMEA checksum.

Voltage: 0-5vdc
Baud: 9600
Data: 8bit
Parity: None
Stop bit: 1bit
Flow control: none

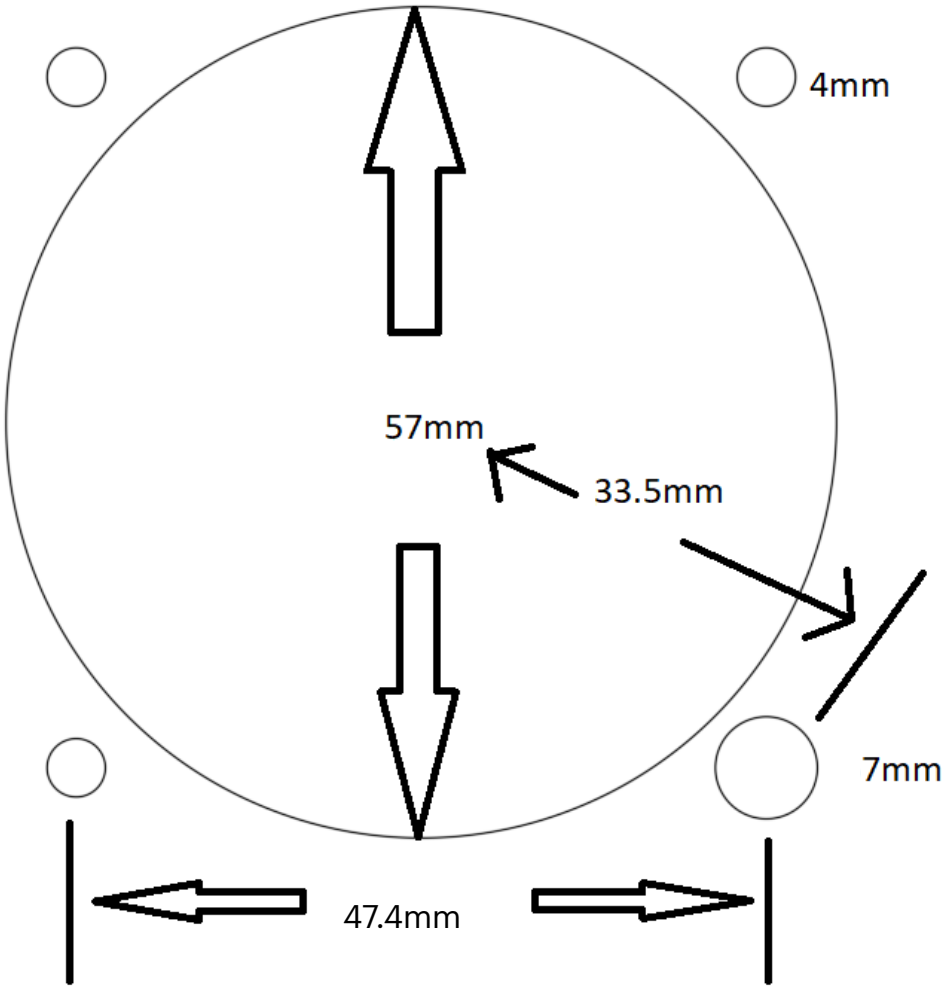
Wire harness



Front and rear description



Panel cut out drawing



Legal

CE Conformity

Löfgren Electronics declares under its sole responsibility that “The LÖFGREN Variometer” conforms to the EMC directive 2014/30/EU.

Warranty

The LÖFGREN variometer is covered by a 2 year warranty for manufacturing defects, from the date of purchase.

The warranty does not cover anything else than manufacturing defects. Please read the manual carefully to not damage your instrument.

The warranty will be void if(including but not limited to):
- Instrument have been opened; electronic seal and/or warranty stickers broken
- Instrument have been subjected to physical abuse, such as dropping it on the floor/ground or use of excessive force during installation/use.
- Instrument have been modified in any way
- Instrument have been subjected to liquids, acids or corrosive chemicals
- Instrument have been used or stored, outside of specified environment stated in the specifications.
- Instrument have been subjected to too high voltage or faulty connections

In case of warranty claim the customer bear the shipping cost to and from the repair center. Repairs, and any spare parts used, will be free of charge.

If the variometer have been damaged, or not working, and not valid for warranty; please contact us for a repair quote.

Limitation of Liability

By purchasing our product you agree to our terms of sale. Please find them attached to the order confirmation email we sent or on our homepage under the “Terms of sale” link.

By purchasing and/or using our product you also agree that Löfgren Electronics EURL shall never, under no circumstances, be held liable for any indirect or direct damage or consequential damages resulting from the use, inability to use, misuse or defect of the product.

The LÖFGREN variometer is an awareness aid and shall only be used in VFR flight. It shall never be used for safety critical operations of the aircraft.

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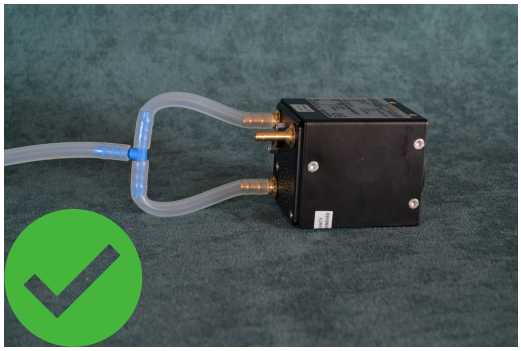
Annex 1 - Pneumatic Installation guidance

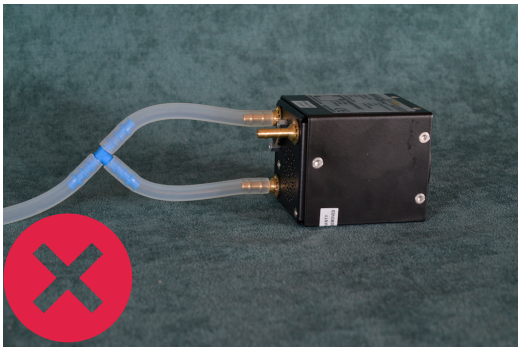
To achieve very good electronic compensation performance, the pneumatic installation in the glider is important. The instrument can not compensate for poor installation.

Symmetry, between the static and pitot pressure hoses, is the key word.

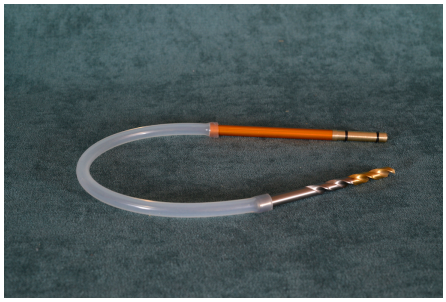
It should be, as far as possible, the same length of the static and pitot hoses. An error of less than 3% should be strived for. Length in this context means all the tube length used in the pressure system. If one hose is split into two, both those hose lengths after the split is taken into account.

At the instrument end the pressure should also be split symmetrically like this:





Further more, both the static and the pitot pressure needs to be leak tight. To test this attache a 5mm ID silicon hose to the pitot and block the other end with the shank of a 7-8mm drill(or similar) like in the picture below. Turn on the variometer and make sure it is set to electronic compensation. Carefully insert the blocked pitot tube in the glider, to not shock the air speed indicator(and not over-pressure it if your pitot is not located in the fin area). When inserted it should show around 70-100km/h. Verify in the information menu that it is reading roughly the same speed as the air speed indicator. If there is a significant leak this will show up as a static offset in the variometer reading, it will show sink. If the system is sufficiently leak tight there should be no offset visible in the variometer. The same can be tested with the static probe by taping over the measurement orifices and connecting it to the pitot port on the instrument. Be careful to not back-pressure any air speed indicators/sensors!



Annex 2 - How to calculate A,B and C polar coefficients

Our instrument use the same A,B and C polar coefficient as other instruments. You can just copy from your other instrument or you can calculate them yourself, which is described below.

The simplest way of doing this is with a calculator, Texas Instrument TI-89. You will also need a polar curve including at which weight the polar curve was made.

TI-89 Procedure

- F6 -> 'clear a-z'
- APPS -> 'Data/matrix editor' -> 'New'
- TYPE: List, Folder: Main, Variable:a. Leave rest of fields as is
- Enter speed as km/h in C1 column and sink as m/s (positive numbers) in C2 column.
- F5
- Calculation type: Quadreg, x=c1, y=c2.Leave rest as is
- Result should be formatted as A*10000 = Alpha, B*100 = Beta, C= Charlie.

In the instrument you input
Polar A = Alpha
Polar B = Beta
Polar C = Charlie
Polar weight = The weight of the aircraft when the polar was measured, in Kg.

Example:

The ASW27 at 333kg have the following points on it's polar curve:

0,6489 m/s at 105km/h
0,9622 m/s at 135 km/h
1,3946 m/s at 157,5km/h

Following the procedure above the calculator gives you

A= 1,66941E-4
B=-0,029613
C=1,9174

After formatting and rounding you will have the result which goes into the instrument settings:

Polar A = 1,67 Polar B = -2,96 Polar C = 1,92 Polar mass = 333 kg