

LARUS Vario Display

Installation and Configuration Manual

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1 Preliminary Remarks

1.1 Important Notices

Before using any part of the system, please read and understand this manual. All information in this document is subject to change without notice. The latest version can be downloaded from www.stefly.aero.

CoTexx GmbH does not accept responsibility for damages which are the result of installation and operation of the device.

1.2 Limited Warranty

The LARUS Vario Display as well as its accessories are warranted to be free from defects in materials or workmanship for two years from the date of purchase. Within this period, CoTexx will, at its sole discretion, repair or replace any components that fail in normal use. Such repairs or replacement will be made at no charge to the customer for parts and labour, provided that the customer shall be responsible for any transportation cost. This warranty does not cover failures due to abuse, misuse, accident, or unauthorised alterations or repairs.

1.3 Conventions and Pictograph Definitions

The safety instructions in SteFly operating manuals are the result of risk evaluations and hazard analyses. In this document, the following hazard levels and information are considered:



Pay special attention to critical notes marked with a yellow caution symbol, because non-observance may result in damage or any other critical situation.



A red caution symbol signals that non-observance may result in injuries.



Command to perform an action or task associated with a source of danger, the disregarding of which may result in serious accidents.



A blue cloud indicates useful information or tips.

2 Safety

2.1 Safety Precautions



Duty to inform

Each person involved in the installation or operation of LARUS must read and observe the safety-related parts of these operating instructions.

2.2 Proper Use

LARUS Vario Display visualises data which are measured and calculated by the LARUS sensor box. LARUS was designed to calculate direction and strength of thermals and wind quickly and reliably. Therefore, the sensor unit combines data from high-precision sensors and GNSS receivers in sophisticated algorithms.

LARUS Vario Display shall be installed in the instrument panel.

LARUS Gliding Sensor Unit is an additional feature to supply glider pilots with accurate information about wind, vertical air movement as well as additional attitude of the aircraft. Its use is limited to day VFR conditions. Security decisions must be made regardless of having installed LARUS.

2.3 Improper Use

Improper use will cause all claims for liability and guarantees to be forfeited. Improper use is deemed to be all use for purposes deviating from those mentioned above, especially:

- Using LARUS data in non-VFR conditions or during night is forbidden. LARUS is not certified. Although LARUS provides AHRS data to XCSOAR you must not rely on the artificial horizon display.
- Using LARUS data during aerobatics or during flight conditions with high angle of attack (stall) or high g-forces. The algorithm was optimised for normal flight conditions.
- Operating LARUS Vario Display outside the operation conditions defined in technical data section, e.g. input voltage, temperature and humidity.

3 LARUS Vario Display Quick Start Manual

LARUS Vario Display may be operated out of the box. Simply perform the following actions:

1. Disassemble both rotary knobs with a 1,5 mm HEX key (scope of delivery)
2. Mount LARUS Vario Display in a 57 mm cutout of the instrument panel with 3 screws. It may be mounted in all four directions.
3. Assemble both rotary knobs
4. Connect the CAN port of LARUS Vario Display and LARUS Sensor Box with a 1:1 patch cable included in scope of delivery.
5. Power on LARUS
6. Check that the satellite symbol on the screen is yellow or green and the current heading is shown.
7. Choose or create a proper polar for your glider.
8. Your LARUS Vario Display is ready to fly!

4 Product Description

4.1 Scope of Delivery

The scope of delivery contains the following:

- LARUS Vario Display
- Mounting screws
- 1:1 standard RJ45 cable
- Micro SD card with adapter
- D-Sub-9 solder connector and housing
- 1,5 mm HEX key for mounting the rotary knobs

4.2 Design and Function

LARUS Vario Display shows the data measured and calculated by LARUS. LARUS is an advanced variometer with real time wind measurement capabilities. It incorporates state of the art pressure sensors, an advanced IMU and GNSS receivers to gather precise flight information data.

Key features of the display are:

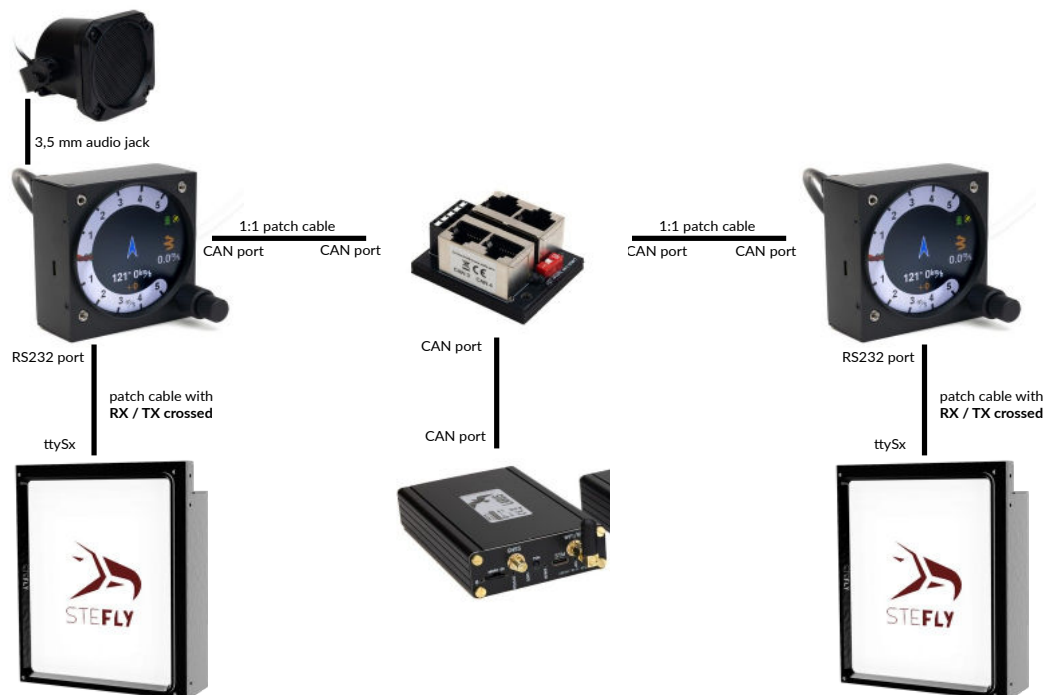
- Round display for 57 mm standard instrument panel cutouts
- Bright and colourful screen
- Lightweight, compact design with black anodised aluminium housing
- Two rotary knobs with push-button function to change settings and enter the menus

LARUS Vario Display is designed and continuously improved by Prof. Dr. Klaus Schaefer, Maximilian Betz, Winfried Simon, Peter Simon and the SteFly team.

The system architecture of LARUS in **Single Seater Configuration**:



The system architecture of LARUS in **Double Seater Configuration**:



4.3 Connectors and Cabling

4.3.1 Overview of the Connectors



4.3.2 CAN and RS232 Ports

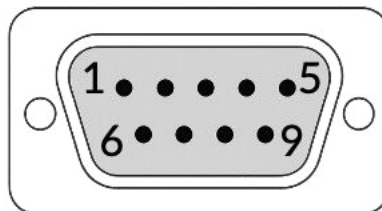


Pin	CAN	RS232
1	GND (internally connected)	GND (internally connected)
2		
3	NC	RS232_1_RX
4	CAN Low	RS232_1_TX
5	CAN High	NC
6	NC	NC
7	VCC [9-28V DC] (internally connected)	VCC [9-28V DC] (internally connected)
8		

4.3.3 GPIO / D-SUB 9

Several other switches, sensors and devices can be connected via the d-sub connector. Please note that not all functions have been implemented at date of release of this manual.

The following sketch shows the view into the male connector of the LARUS Vario Display.



Pin number	Pin name	I/O
1	GND	(Ground)
2	DI3 - Gear	Input
3	DI1 - Water Ballast	Input
4	DO2	Output
5	GND	(Ground)
6	DI4 - Speed Brakes	Input
7	DI2 - Speed to Fly	Input
8	GND	(Ground)
9	DO1 - Canopy Flasher	Output

For easier pin identification these numbers are also moulded into the female connector (scope of delivery).

After wiring, settings must be made in the LARUS Vario Display.

4.3.4 Audio

An audio socket is available for connecting a loudspeaker with a 3.5 mm jack plug. The internal resistance of the speaker must be between 4-8 Ω (max. output of 3 W @ 8 Ω).



A single loudspeaker must not be connected to more than one device.

4.3.5 SD-Card

The device has an SD card slot for firmware updates.



As SD card extensions can damage the LARUS Vario Display, we do not accept any liability for damage resulting from their use.

4.3.6 Cabling

If a serial connection (RS232) is established between SteFly NAV and LARUS Vario Display, the MC value settings, for example, is synchronised/transferred between the devices. In addition, the LARUS Vario Display processes inputs from a Speed to Fly / Vario switch that is connected directly to the SteFly Remote Control Stick.

The following steps are required:

- Connect devices with cable:
 - The LARUS Sensor Box CAN-port needs to be connected with 1:1 patch cables with the CAN-port of the LARUS VARIO Display (in double seater configurations using the cablebox)
 - The devices running XCSOar can be connected between Vario Display RS232 port and SteFly NAV ttySx port with **patch cable RX/TX crossed**
- Optionally connect switches for automatic adjustment of water ballast and gear warning to the appropriate DSUB-9 pin and any GND pin. For the gear warning you have the option to use two distinct directly connected switches for the gear and speed brake (recommended) or one cable with the two switches connected in series to the DSUB-9 connector.
- The SteFly Remote Control Stick can be connected in two different ways:
 - if available: with a separate cable to the DSUB-9 pin 7
 - Using the USB-Cable (always available)
- Adjust settings in XCSOar (Version 7.44 or higher) / OpenSoar (7.43 or higher):
 - If the Vario Display is connected directly to the SteFly NAV, select the corresponding ttyS port: Config -> Devices -> select a free line and enter the port, Baud rate 38400, Driver Larus, Sync. to device on
- Adjust settings in LARUS Vario Display settings for the connected optional switches
 - Gear warning
 - water ballast
 - StF Switch configuration (if not automatically switched)
 - Input Pin: To use an external switch (at the control stick, flaps lever etc), set *Vario Control* to *Input Pin* and choose the right setting in [StF Pin Config](#) (active: when open/closed)
 - NMEA for SteFly Remote Control Stick. In addition to the setting in the vario you need to enable install an event definition file in XCSOar/OpenSoar (Config / System / Look / Language, Input / Events – check Expert, click on

Events – Download – GLB-XCI-xcremote-XCNAV.xci). Leave XCSOAR config and restart XCSOAR.

4.4 CAN Termination

LARUS Vario Display and LARUS Sensor Box are connected via CAN. CAN bus networks require termination resistors at each end of the network. Therefore, all units have integrated a switch to activate the resistor:



The following table gives examples of how to set the CAN termination switches:

Description	Display front	LARUS box	CAN Splitter	Display rear
Single seater	on	on	-	-
Double seater, LARUS box in front panel	off	on	off	on
Double seater, LARUS box in rear panel	on	on	off	off

Please note: All LARUS Sensor Boxes delivered before March 2025 have no CAN termination switch. CAN termination is always on from default.

4.4.1 Installation



Usually, LARUS Vario Display is powered by LARUS via patch cable between the CAN ports. LARUS needs to be protected by an external fuse (500 mA to max. 3A) like it is common practice for all electric devices in aviation. If LARUS gets its energy from another main instrument (e.g. SteFly NAV via D-Sub connector) please make sure that the main instrument is protected by an external fuse.

4.5 Installation Location

The following picture shows a typical installation situation of LARUS Vario Display in the instrument panel of a glider.



The display fits in a standard 57 mm cutout and is fastened by 3 M3 screws.

For installation it is required to remove the two rotary knobs with a HEX 1,5mm key.



4.6 Installation Orientation



If you intend to replace an existing instrument with the Lars Vario Display, check the desired installation position before drilling the 7.3 mm hole for the rotary encoder due to the asymmetrical housing to the display

The display can be mounted in the orientations 0° / 90° / 180° / 270°.

After mounting the display, its orientation needs to be configured in the menu Display Rotation.

4.7 Initial Operation and Function Test

For initial operation please follow these steps:

1. Check that the LARUS Vario Display is connected to LARUS Sensor Box or CAN Splitter according to the drawings in chapter 4.2
2. Power on LARUS
3. Check that LARUS Vario Displays boots and a yellow or green satellite pictogram appears. The vario pointers should perform slight movements around zero position.

4.8 Firmware Updates

The LARUS team is continuously improving the software and releasing updates e.g. on LARUS Vario Display web page.

To update the firmware, put the new .bin-file on the SD card included in scope of delivery and insert it into the SD-card slot of LARUS Vario Display. The device will only install compatible firmware releases greater than the release installed. After powering on, the device is booting within less than a second. If a compatible firmware is detected on the SD Card, the display keeps black for about 3-5 seconds before displaying the a Firmware Upgrade is in process. Afterwards the name of the new firmware version will appear.

If the update is not initialised after powering on the device with an inserted SD card containing a new firmware release, please use a different SD card.

Requirements for the SD card: min. 4 GB SDHC, FAT32 format (not GPT)

5 Operation

5.1 Display

The Central Display Information distinguishes between **Circling Mode** and **Straight Flight Mode**. If a turn rate of at least 1°/sec is observed for more than 10 seconds **Circling mode** is activated. If the turn rate is less than this value for more than 10 seconds it is switched back to **Straight Flight Mode**.

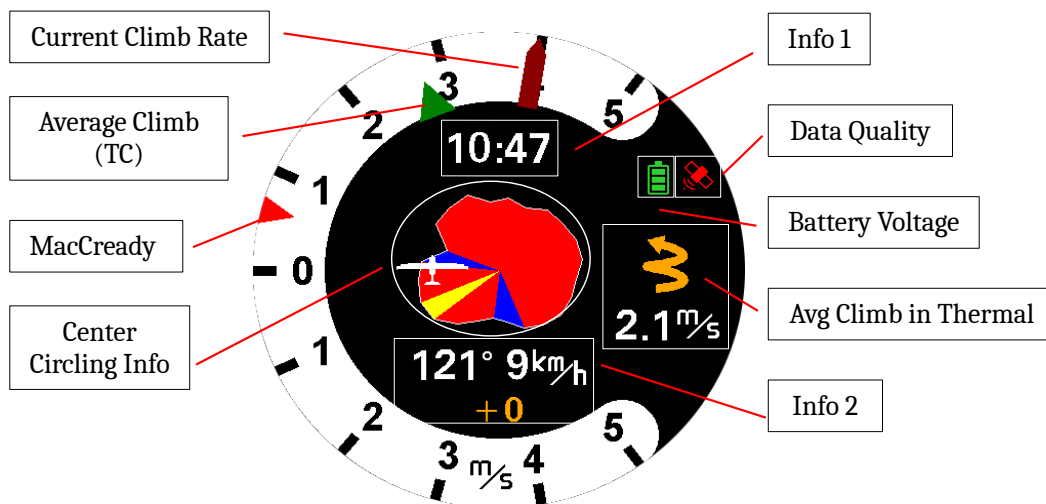
This behaviour cannot be adjusted with the current firmware versions.



Switching from **Variometer Mode** to **Speed To Fly Mode** is independent from switching the central display information.

For details see chapter [Switching from Circling \(Vario\) to Speed to Fly](#).

5.1.1 Circling Mode



Info 1: The parameter show is defined in [Info 1 Content](#).

Data Quality: The colour of the symbol indicates:

- Red: no connection to LARUS Sensor Unit
- Yellow: connection to LARUS Sensor Unit established, Unit has no GPS-Fix
- Green: connection to LARUS Sensor Unit established. Unit has GPS-Fix

Battery symbol: The colour of the symbol indicates:

- Green: Voltage of the battery is above [Battery Good](#)
- Yellow: Voltage of the battery is below [Battery Good](#)
- Red: Voltage of the battery is below [Battery Low](#)

Average Climb in Thermal: The average climb rate since starting circling.

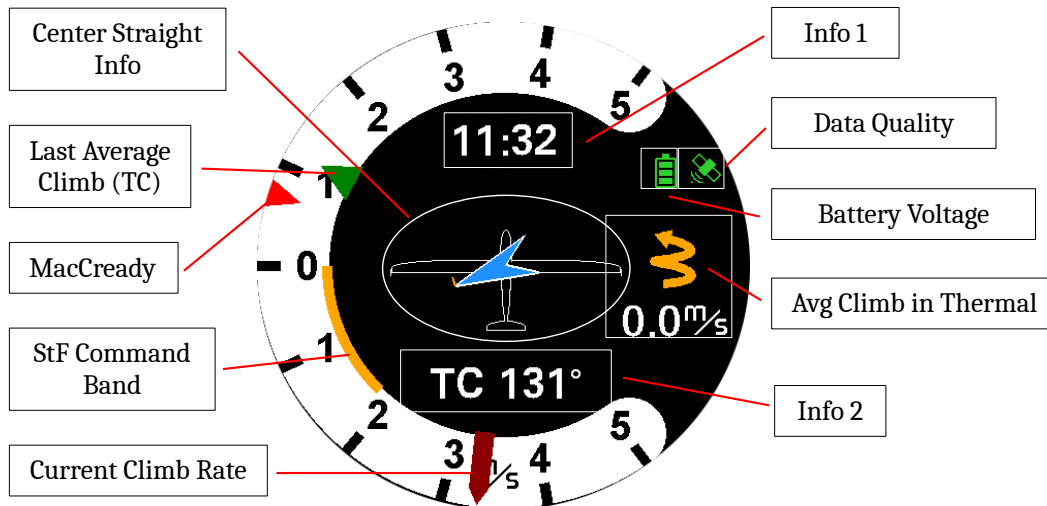
Info 2: The parameter shown is defined in [Info 2 Content](#).

Current Climb Rate: Time Constant can be changed in Sensor Unit settings [Vario TC](#).

Average Climb (TC): The average climb rate in the timespan defined in the [TC Climb Rate](#).

Center Circling Info: Select [a Wind or Thermaling Assistance view in Center Circling](#).

5.1.2 Straight Flight Mode



Displays that differ from Circling Mode:

Center Straight Info: Select one of two available [graphical representations](#)

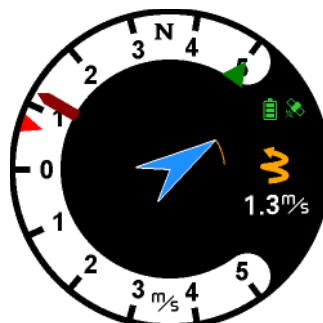
StF Command Band: The position of the band shows whether you are flying too fast or too slowly. Positive values mean you are flying too fast and negative values mean you are flying too slow. The length of the tape tells you by how much. 1 m/s corresponds to 10 km/h.

Last Average Climb (TC): The green indicator for the average climb rate is showing the value for the last thermal. The value is not updated until the next switch from speed to fly to vario.

5.1.3 Available Central Displays

5.1.3.1 Central Displays in Circling Mode

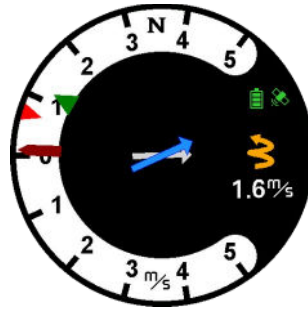
- Single Arrow



The current wind direction is represented by one central arrow. The arrow size is proportional to the wind speed. Changes of the wind direction to a mid term average direction is show by a trailing vane, changes in wind speed to the mid term average speed is represented by the vane's width.

The arrow direction is related to North.

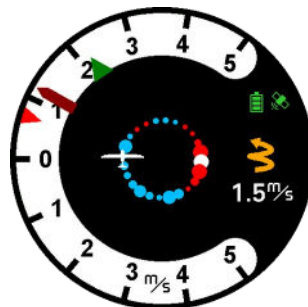
- Double Arrow



Current wind direction and speed is represented by the blue arrow, information related to mid term wind is shown by the grey arrow in the background. Arrow sizes depend on the wind speed.

The arrow directions are related to North.

- Dotted Assistant

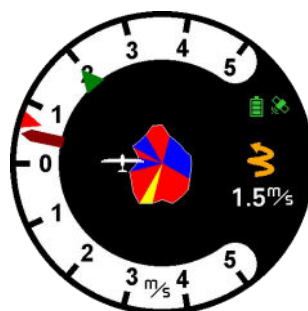


Meaning of the colours of the circle points:

- Blue: climb rate is below the average
- Red: climb rate is about the average
- White/Yellow: climb rate is above the average

The diameter of the dots is proportional to the climb rate.

- Spider Assistant



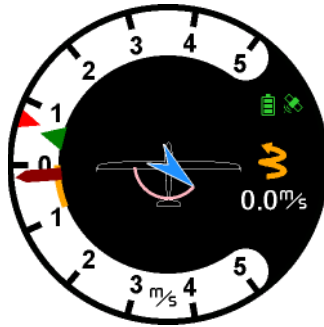
Meaning of the segment colours:

- Blue: climb rate is below the average
- Red: climb rate is about the average
- Yellow: climb rate is above the average

The diameter of the segment is proportional to the climb rate.

5.1.3.2 Central Displays in Straight Flight Mode

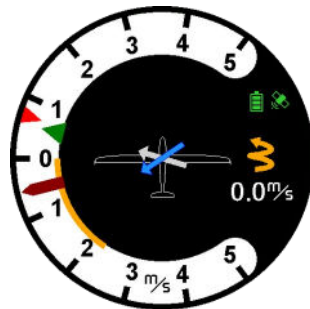
- Single Arrow



The current wind direction is represented by one central arrow. The arrow size is proportional to the wind speed. Changes of the wind direction to a mid term average direction is show by a trailing vane, changes in wind speed to the mid term average speed is represented by the vane's width.

The arrow direction is related to the airplanes longitudinal axis. It is advisable to keep the airplane symbol shown (on) in StF Mode in order to support this details.

- Double Arrow



Current wind direction and speed is represented by the blue arrow, information related to mid term wind is shown by the grey arrow in the background. Arrow sizes depend on the wind speed.

The arrow direction is related to the airplanes longitudinal axis. It is advisable to keep the airplane symbol shown in StF Mode in order to support this details.

5.1.4 Switching from Circling (Vario) to Speed to Fly

Switching the tone information from Speed to Fly to Vario is depending on your [Vario Control](#) configuration:

- Auto: below 1.1 times speed of best glide ratio: Vario mode, above: Speed To Fly mode. If in Vario mode and still circling, Vario mode keeps active even this speed limit is exceeded.
- Input Pin: To use an external switch (at the control stick, flaps lever etc)
- SteFly Remote Control Stick

5.1.5 Acoustic Quiet Zone in Speed to Fly Mode.

You can define a speed range in which the acoustic Speed To Fly signal is quiet. Set the desired values in StF [Upper/Lower](#) Limit in the LARUS Vario Displays advanced settings.

5.2 Control Elements

The device has 2 rotary knobs and a push button that can be used to make various settings.

The following functions are assigned to the button and the two rotary knobs:

- **Turn the small/upper rotary knob:** Volume control
- **Turn the large/lower rotary knob:** Set the MacCready value
- **Short press on the rotary knob:** Menu for common settings
- **Long press on the rotary knob:** Menu for configuration settings of the LARUS Vario Display, configuration and calibration of LARUS Sensor Unit.

The following two chapters show the menu structure of the LARUS Vario. Details on the submenu items are documented in the subsequent chapters..

5.2.1 Short Press Menu Structure

- **Water Ballast**
Set the current value for the amount of water ballast. The entered value is propagated to XCSoar/OpenSoar.
- **Bugs**
Set the fly correction factor in percent to adjust the polar values to the contamination situation of the wing.
- **Pilot Weight**
Enter the pilots weight in kg for the area load calculation.
- **Display**
Use this option to change between Vario and AHRS display.



The purpose Long Press Menu Structure

The purpose of the LARUS Viewsof the LARUS Varios AHRS display is providing information for validating the Larus Sensor Data (magnetic heading course and spatial position of the sensor/airplane).Vario AHRS display is providing information for validating the LARUS Sensor Data (magnetic heading course and spatial position of the sensor/airplane). The AHRS display must not be used as an flight instrument.The AHRS display is not authorised as a flight instrument and must therefore not be used for this purpose.

5.2.2 Long Press Menu Structure

Views		
	Info 1 Content	
		None
		Avg Climb Rate
		Drift Angle
		Flight Level
		Speed To Fly
		True Air Speed
		True Course
		UTC Time
	Info 2 Content	
		Same options as Info 1 Content
		Wind, avg Wind
		Wind and Delta
	Center Circling	
		Single Arrow
		Spider Assistant
		Dotted Assistant
		Spider Assistant
	Center Straight	
		Single Arrow
		Double Arrow
	Display Rotation	
		Rotate 0°/90°/180°/270°
	Glider Symbol	
		On / Off
Advanced		
	User Profile	
	The Vario currently supports four different user-specific settings. The settings are completely independent of each other. All settings must be repeated in each of the user profiles manually, including aircraft polar and pin configurations of the switches. When selecting a user profile, the device will be restarted with this profile.	
		User Profile 1
		User Profile 2
		User Profile 3
		User Profile 4
	Center Frequency	
	Select the centre frequency for 0 m/s (500-1000 Hz).	
	Battery Good	
	Set the voltage value below which the battery symbol is shown in yellow	
	Battery Low	
	Set the voltage value below which the battery symbol is shown in red	
	Flash Control	
	Depending on the setting <i>Activ: open/close</i> : connects or opens D-SUB9 DO1 Pin to GND when the sensor measures more than 40 km/h IAS	
		Not connected

	Active: close	
	Active: open	
	Config Reset	
	Default Config Resets the settings of the current user profile to default values. The airplane polar data is not been touched. The reset includes the configuration of the input and output pins.	
	Factory Reset Resets all user profiles including the airplane polar data to factory settings.	
	Do not change	
	Average Climb Rate	
	Average Climb Source	
		Frontend
		Sensorbox
	TC Climb Rate	
	Speed to Fly	
	TC Speed To Fly	
	Vario Control	
		Auto
		Input Pin
		NMEA
	StF Pin Config	
		Not configured
		when opened
		when closed
		when toggled
	StF Upper Limit	
	StF Lower Limit	
	Gear Alarm	
	Alarm Volume	
	Gear Alarm Config	
		One Pin Mode
		Two Pin Mode
	Gear Pin Config	
		When opened
		When closed
		Not connected
	Air Brakes Pin Config	
		When opened
		When closed
		Not connected
	Drain Control	
	Drain Pin Config	
		When opened
		When closed

		Not connected
		Lowest Flow Value in Liters/Minute
		Flow Slope time based correction value
	Return	
Polar Settings		
	Glider	
	Empty Mass	
	Max Ballast	
	Reference Weight	
	Polar V1	
	Polar V2	
	Polar V3	
	Polar Si1	
	Polar Si2	
	Polar Si3	
	Return	
Sensorbox		
	Left Wing Down	
	Right Wing Down	
	Wings Straight	
	Calc Orientation	
	Straight Flight	
	Reset Sensorbox	
	Ini Settings	
	Sensor Tilt Roll	Rotation from Sensor System to air frame system. Normaly: do not change
	Sensor Tilt Pitch	Rotation from Sensor System to air frame system. Normaly: do not change
	Sensor Tilt Yaw	Rotation from Sensor System to air frame system. Normaly: do not change
	Pitot Offset	Zero pressure reading of the pitot sensor. Normally: no need to change it.
	Pitot Span	Calibrated airspeed fine adjustment. Normally: no need to change it.
	QNH Delta	Abolute pressure sensor fine adjustment. Normally no need to change it.
	Mag Auto Calib	Set to „1“. Do not change.
	Vario TC	Variometer damping fine adjustment. Useful range: 0.5 ... 3 seconds.
	Vario Avg TC	Average variometer time constant. Default 30 seconds, maybe adjusted.
	Wind TC	Wind speed damping time constant. Usually set to 1 .. 10 seconds.
	Wind Avg TC	

		Average wind speed time constant. Default 30 seconds, maybe adjusted.
		GNSS Config Larus Essential: 1 Larus Dual GNSS: 2
		Ant Base Len DGNSS version only: Distance between Front and Rear GNSS Antenna in meter.
		Ant Slave Down (currently named Ant Slave Lend) Vertical Distance between front antenna to rear antenna in normal flight attitude, Unit of measurement: Meter. Positiv if front antenna is lower than rear antenna.
		Ant Slave Right Horizontall distance between front antenna and rear antenna. Unit of measurement: Meter, positiv if front antenna is more right than the rear antenna.
		Return
	Return	

6 Configuration

6.1 Glider Polar

In order to get the right Speed to Fly information you have to select or edit the right polar values for your glider. All glider polars available in XCSOAR/OpenSOAR have been imported into the LARUS Vario. Select the right one in Settings / Polar Settings / [Glider](#).

After selecting the glider you should update the [empty mass](#) of your glider.

If you do not find your glider in the list, you can select any glider polar and change the single settings to the values of your gliders polar. You can currently not change the gliders name.



Every time you enter the glider list in polar settings all values you may have changed before are replaced by the selected gliders hard coded values.

6.2 Calibrating The Larus Senor Box

Before you start your first flight, you should calibrate the position sensor of the Larus sensor.

The individual calibration steps can be carried out using functions in the front end (minimum firmware versions required: sensor box: 0.5.1, vario: 0.3.7). Calibration is performed in two sections.

6.2.1 Calibration on the Ground (Roll Angle)

Assemble your glider, place it on a flat surface. After taking the individual positions, wait until vibrations in the aircraft can no longer be felt before initiating the measurement.

Do not use a tail dolly in order to fix the vertical axis of your glider during the following operations.

6.2.1.1 Left Wing

Place the left-hand tip of the wing on the surface. Invoke the function Settings / Sensorbox / [Left Wing down](#).

6.2.1.2 *Right Wing*

Place the left-hand tip of the wing on the surface. Invoke the function Settings / Sensorbox / [Right Wing down](#).

6.2.1.3 *Level Wings*

Keep the wing horizontal. Invoke the function Setting / Sensorbox / [Wings straight](#)

6.2.1.4 *Calculate Roll Angle Sensor Values*

For this step it is important to carry out all three steps mentioned before. The order of the steps does not matter, but they must have been completed in full.

Invoke the function Settings / Sensorbox / [Calculate Orientation](#)

6.2.2 Calibration During Flight (Pitch Angle)

The pitch angle calibration is performed during flight. It is advisable to perform this step in a flight not disturbed by thermal gusts.

Level your glider out at the speed of the best glide ratio (if you have flaps, with flaps setted for this speed). Invoke Settings / Sensorbox / [Straight Flight](#).

Now you are done. You can check the calibration by swithing to the AHRS Display.

7 Maintenance

The whole system has no serviceable parts.

To obtain warranty service, please SteFly directly.



Opening the housing of LARUS Vario Display will void the warranty!

8 Troubleshooting

Problem	Possible Causes	Solution
LARUS Vario Display boots, but satellite pictogram is red and vario pointers are fixed	Connection to LARUS CAN port with Rx / Tx crossed patch cable instead of standard 1:1 patch cable	Change the patch cable and use the one supplied in scope of delivery
	Connection to LARUS via RS232 port	Connect the CAN ports instead

9 Technical Data

Size	Unit	Value
mass	g	80
Housing dimensions (without knob)	mm (length x width x height)	60,5 mm x 63,4 mm x 31,2 mm
input voltage	V DC	via patch cable with RJ45 connector from LARUS Sensor Box or CAN Splitter, 9 – 28 V DC
amperage	mA (@ 13,0 V DC)	80
interfaces		RS232 (x1) - RJ45 CAN (x1) - RJ45 microSD 3,5 mm audio jack
operating temperature	°C	-30 to +60
operating rel. humidity	%	0 - 95
material housing		black anodised aluminium