LARUS Gliding Sensor Unit

Installation Manual and Operating Instructions

Version 1.51

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info@stefly.aero www.stefly.aero

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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 unit 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 signalizes 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 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. A separate display device is required to display the data, such as an OpenVario or a Bluetooth-enabled device with XCSoar.

LARUS sensor unit as well as the GNSS antenna(s) shall be installed in the inside of the fuselage.

This 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 optimized for normal flight conditions.
- Operating it outside the operation conditions defined in technical data section, e.g. input voltage, temperature and humidity.
- Operating LARUS without connected WiFi / Bluetooth antenna, even if Bluetooth is not needed

3 LARUS Quick Start Manual

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.

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

1. Connect the GNSS antenna(s) to the sensor unit. For LARUS DUAL-GNSS: connect the front antenna to GNSS1, the rear antenna to GNSS2.
2. Insert the SD-card, that is part of the delivery.
3. Mount the sensor unit in the aircraft as far away from metal and magnetic parts as possible while paying attention to the orientation of the unit, which is provided by the label on the sensor unit.
4. Connect the sensor unit’s static and total pressure ports.
5. Power the sensor unit through one of the USB-ports, the CAN-port or the RS232-port. Power can be provided to the device through all four connectors. If the CAN- or RS232-port is used to provide power to the sensor unit, the voltage shall be in the range of 8-28V.

6. Connect a glider navigation system on which XCSoar / OpenSoar is running, like the OpenVario or your smartphone, to the sensor unit to display LARUS' data. If a smartphone is used, OpenSoar has to be installed, a bluetooth connection to the sensor unit must be established, LARUS must be selected within Opensoar's device-menu and the LARUS-driver must be used for operation.
7. Your LARUS is ready to fly and will continuously optimize its calibration during flight!

4 Product Description

4.1 Scope of Delivery

The scope of delivery contains the following:

- LARUS sensor unit in black anodized aluminum housing
- 1 GNSS antenna (LARUS Essential) or 2 GNSS antennas (LARUS Dual-GNSS)
- brass mounting screws and nuts
- 2 fastening clamps
- 4 GB micro SD card with adapter
- RJ45 cable 1 m

A separate display device is required to display the data, such as an OpenVario or a Bluetooth-enabled device like a smartphone with XCSoar / OpenSoar

4.2 Design and Function

LARUS is a sensor unit specially designed for gliders by the LARUS project team led by Prof. Dr. Klaus Schäfer, Horst Rupp and Maximilian Betz. The hardware is licensed accordingly to **Creative Commons NonCommercial Share-alike 4.0 International**, Larus software accordingly to **GNU General Public License v3.0**.

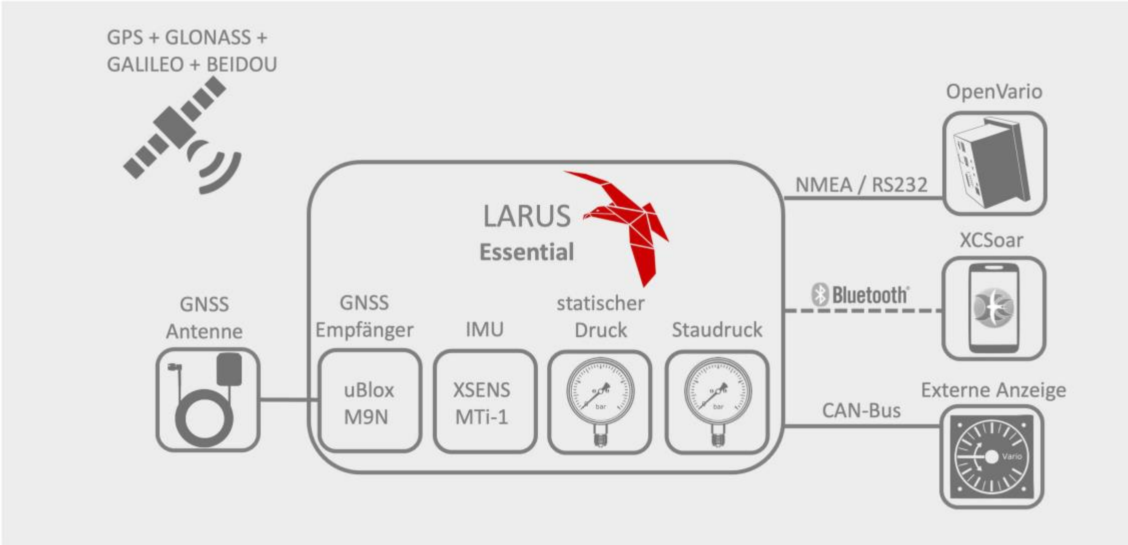
LARUS incorporates state of the art pressure sensors, an advanced IMU and GNSS receivers as well as sophisticated algorithms to gather precise flight information data, e.g.

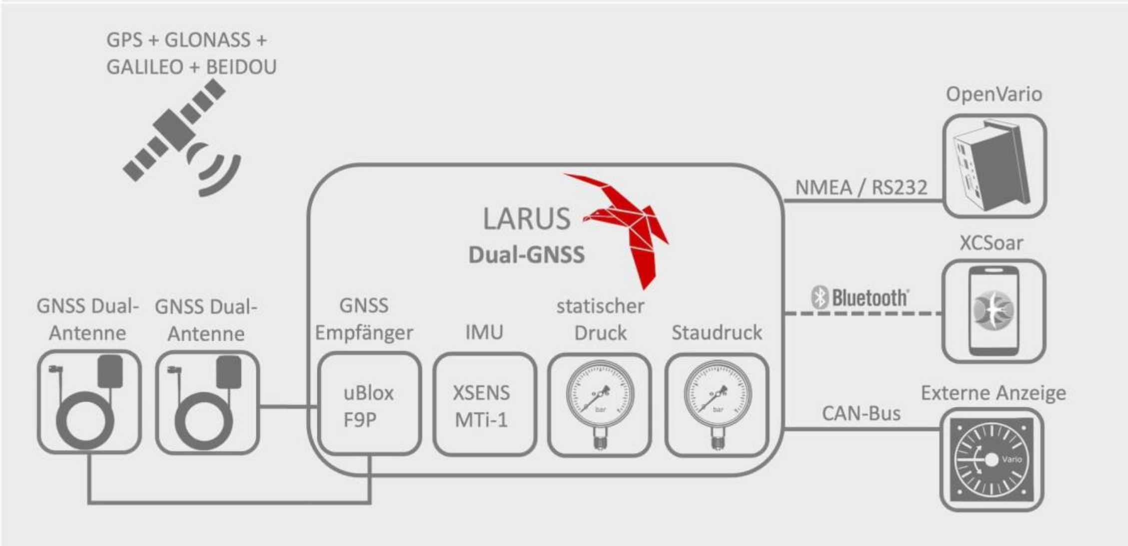
- energy-compensated climb or sink (variometer)
- horizontal wind speed as an instantaneous value (live / real-time wind) and a value averaged over an adjustable period (e.g. 30 s)
- attitude for display in an artificial horizon
- pressure altitude / flight level FL
- true airspeed (TAS)
- course over the ground (track)
- drift angle (difference between track and heading)

LARUS is a self-learning system that automatically adjusts some parameters saved in its memory during flight. These include e.g. 3D magnetic calibration parameters or magnetic calibration error.

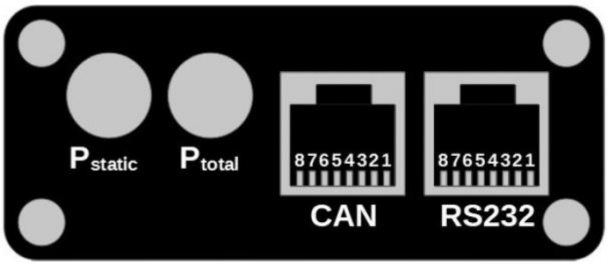
There are two different LARUS versions available, LARUS ESSENTIAL and LARUS DUAL-GNSS. In the Essential variant, LARUS is equipped with a precise GNSS receiver with an external active antenna. In the LARUS Dual-GNSS variant, on the other hand, a high-precision dual-band receiver is connected to two active, multi-frequency band antennas. Please note that the GNSS front antenna needs to be connected to the connector marked with GNSS1, the rear antenna to GNSS2.

The system architecture of LARUS ESSENTIAL and LARUS DUAL-GNSS is shown below.





4.3 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	RS232_2_RX
6	NC	RS232_2_TX
7	VCC [9-28V DC] (internally connected)	VCC [9-28V DC] (internally connected)
8		

4.4 Status LEDs

LARUS has four status LEDs:

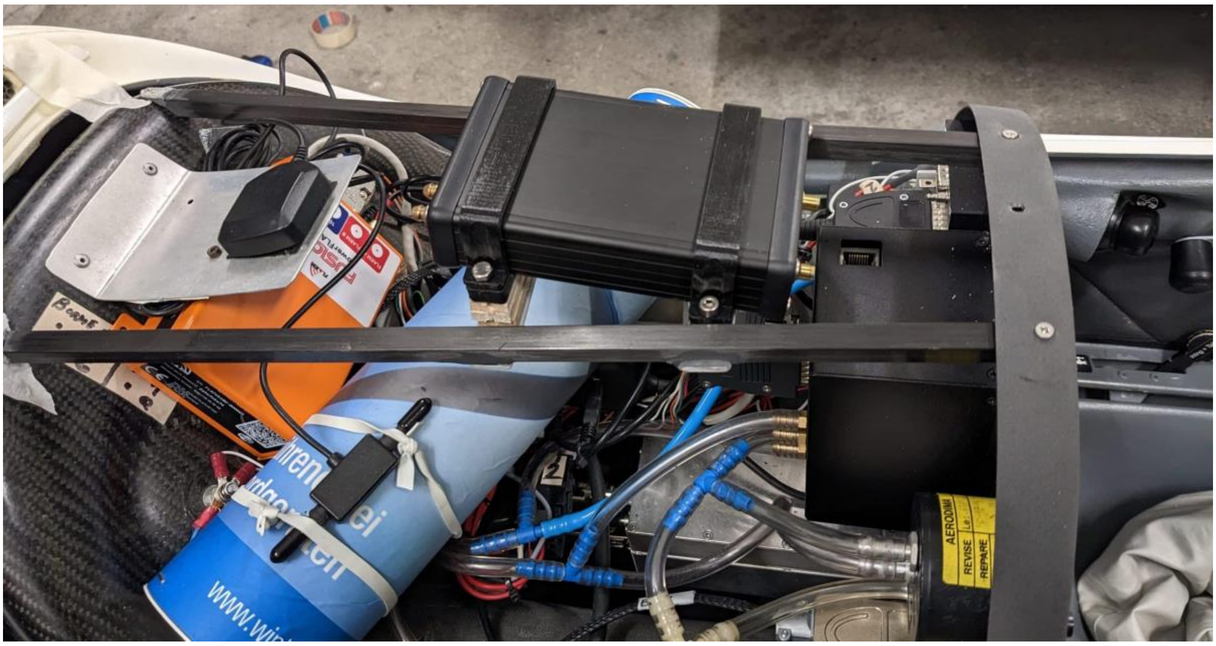
- SD-CARD (blue)
  - Off: No uSD-Card detected
  - On: uSD-Card detected
  - Flashing: Actively logging (writing) to card
- SYSTEM (blue)
  - Off: System not working at all
  - Flashing: Indicates that FreeRTOS and the tasks are running.
- GNSS (blue)
  - Off: No GNSS fix
  - Flashing: GNSS fix
- ERROR (red)
  - Flashing: at least one of the sensors IMU, static pressure, dynamic pressure or GNSS is not working.
  - Sporadic flashing: DGNSS heading fix is briefly missing.

5 Installation

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. OpenVario) via USB, CAN or RS232, please make sure that the main instrument is protected by an external fuse.

5.1 Installation Location

The following picture shows a typical installation situation of the LARUS sensor unit in front of the instrument panel of a glider.



For obtaining flight information data as precise as possible, please take account of the following advice:

- Mount the sensor unit absolutely fix so that the position of the sensor unit in relation to the aircraft structure does not change under the influence of acceleration forces
- The LARUS sensor (especially LARUS Essential) must be positioned as far away as possible from magnetic fields and bigger iron parts
- The GNSS antennas must be mounted in such a way that there is "line of sight" to as many satellites as possible. For this reason, they must be installed in the instrument panel or fuselage tube approx. in-flight-horizontal and above electrically conductive materials (also CFRP!).

Explanations regarding LARUS Essential

A requirement for the high accuracy of LARUS Essential is that the disruptive influence of magnetic fields in the vicinity of the sensor unit is minimized. This is particularly high priority for LARUS Essential. In particular, the correct operation of the inertial measuring unit IMU, which among other things measures the magnetic induction, is severely impaired by magnets, changing magnetic fields or iron parts. We recommend keeping the LARUS sensor unit as far away as possible (at least 20 cm), especially from loudspeakers and magnets (often contained in GPS / GNSS antennas, simply check with magnets). In addition, the fastening elements in the immediate vicinity of the sensor should be made of stainless steel, brass, plastic, aluminum or fiber composite materials and the usual nuts and bolts made of steel should be avoided. Iron parts are unsuitable because they generate a variable interference field with every movement of the aircraft.
The GNSS antenna, on the other hand, is not sensitive to magnetic fields.

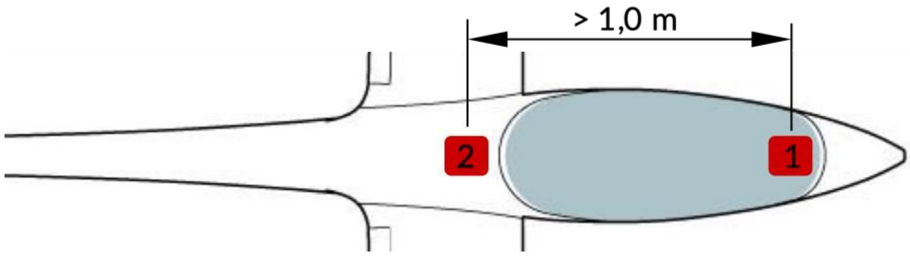
Explanations regarding LARUS Dual-GNSS

For LARUS Dual-GNSS it is important

- that both antennas are installed with distance to metallic parts (especially equipment with changing magnetic fields like loudspeakers)
- For all GNSS antennas, it is important that the laminate above the antenna is made of GFRP and not CFRP, because carbon fibers block satellite signals. In case of aircraft with a CFRP

fuselage without GFRP areas, however, mounting the antennas in the front and rear area of the canopy can also be considered.

- that the two GNSS antennas are installed with at least 1,0 m distance



GNSS 1 (=front) antenna is usually mounted at the level of the instrument panel or in front of it in the nose of the aircraft.
GNSS 2 (=rear) antenna should be mounted on the inside of the fuselage tube (luggage compartment / end of the canopy / engine compartment), ideally near the center of gravity of the aircraft. The shorter the distance between the rear antenna and the center of rotation around the pitch axis, the less the influence of pitching movements (forward or backward movement of the stick) on the measured altitude.
The cables leading from both antennas to the LARUS sensor box must exit the antenna housings on the same side for high precision differential GNSS:

5.2 Ground Plane

Ground planes consist of solid aluminum sheets or copper plated printed circuit boards (PCBs) and are mounted directly underneath the GNSS antennas. Research show, that appropriate supplementary ground planes significantly improve the GNSS position accuracy in the majority of test cases (see e.g. Stefan Punzet and Thomas F. Eibert “Impact of Additional Antenna Groundplanes on RTK-GNSS Position Accuracy of UAVs”, https://ars.copernicus.org/articles/20/23/2023/ars-20-23-2023.pdf).

Ground planes furthermore mitigate multipath interference and if coaxial antenna cables are routed underneath ground planes, negative effects on the radiation patterns are avoided.
https://www.navtechgps.com/wp-content/uploads/Tallysman_Ground-Planes.pdf

To sum it up, we recommend using round ground planes with a diameter of 150 mm to get best results.

5.3 Installation Orientation

The installation orientation of the LARUS box is possible in all directions and only needs to be adjusted in the configuration file "sensor_config.txt".
Nevertheless, we recommend selecting the orientation with regard to the longitudinal axis of the aircraft during assembly according to the coordinate system printed on the LARUS housing. Ideally, the LARUS sensor unit is also mounted in such a way that it is roughly horizontal in normal flight.

5.4 Hardware Installation Process

The scope of delivery contains 2 3D-printed fastening clamps for the sensor unit, which may be used to fix the box to the fuselage in a position and orientation as described above.

If the clamps are not ideal in your installation situation, please make sure to use only fastening material made of nonferrous materials (GFRP, aluminium, plastic, brass or stainless steel (test the latter with a magnet prior usage).

For attaching the GNSS antennas we suggest using Velcro.

Please connect the pneumatic tubes to the correct port of the sensor unit and perform a leak test after final installation.

- P_{static}: static pressure connector
- P_{total}: pitot or total pressure connector

LARUS sensor unit does not have a total energy TE connector.

5.5 SD Card

The SD card is part of scope of delivery and is already configured for standard installations. Nevertheless, the following sections describe what to do if an adjustment of parameters or a reset to factory settings are required.

5.5.1 Configuration File “sensor_config.txt”

The Larus sensor is configured with this TXT file.

This file should normally only exist during initial setup and should then be deleted or renamed (e.g. sensor_config_disabled.txt). Later, however, you can still change individual parameters with this file if desired. This file should not be present on the card during normal operation. Otherwise, the data of the automatic magnetic configuration may be overwritten the next time you switch on the device!

Resetting the Parameters to the Factory Settings

Should it be necessary to reset the LARUS configurations to the factory settings, proceed as follows:

1. Remove the micro SD card from LARUS and connect it to a computer (via an SD card adapter)
2. Download the "sensor_config.txt" file from Larus GITHUB page https://github.com/larus-breeze/sw_sensor/tree/master/configuration
3. Copy "sensor_config.txt" on the SD card
4. LARUS and the OpenVario / OpenSoar / XCSoar have to be switched off at this point at the latest
5. Insert the micro SD card into the SD-card slot of the LARUS housing, switch on LARUS and wait until both LARUS and the OpenVario / OpenSoar / XCSoar have booted up completely; the configuration parameters are now saved on the EPROM
6. Remove the micro SD card and rename “sensor_config.txt” in “sensor_config_disabled.txt”. Insert the micro SD card into the SD-card slot of the LARUS housing

Individual Adjustments of the Parameters

In order to set LARUS parameters individually, proceed as follows:

1. Remove the micro SD card from LARUS (may be switched on) and connect it to a computer (via an SD card adapter)
2. Open the “sensor_config.txt“ file
3. Change the numerical values of individual parameters (see "Overview of Parameters" below)
4. Save and then close the file
5. Insert the micro SD card into the SD-card slot of the LARUS housing, switch on LARUS and wait until both LARUS and the OpenVario / OpenSoar / XCSoar have booted up completely
6. Remove the micro SD card and rename “sensor_config.txt” in “sensor_config_disabled.txt”. Insert the micro SD card into the SD-card slot of the LARUS housing

Overview of Parameters:

The sensor_config.txt configuration file consists of any combination of configuration lines. Only the numbers after the equals sign may be changed. Other changes (e.g. changing the parameter designation) must not be made, otherwise LARUS will ignore the respective configuration line.

The file contains any combination of the following configuration lines (parameters that are particularly important are marked in yellow, additional parameters required for LARUS Dual-GNSS are marked in blue):

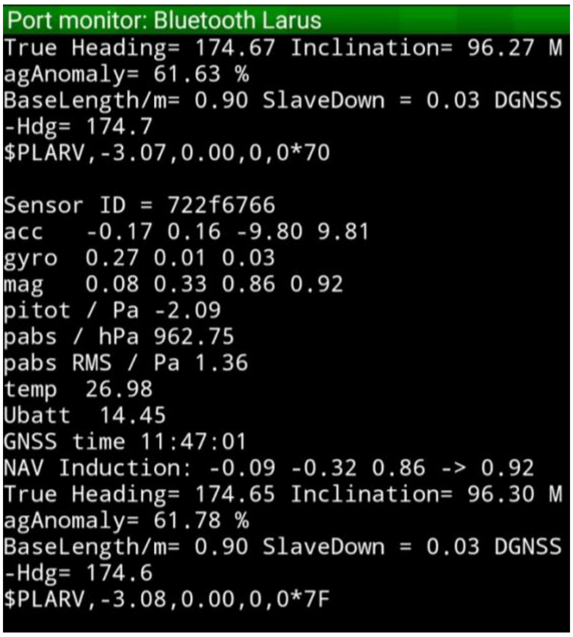
Configuration Line with Standard Value	Description
01 SensTilt_Roll = 0	Rotation of the sensor around the roll axis (sensor - longitudinal axis) in degrees; increase this value for rolling to the left on the attitude indicator
02 SensTilt_Pitch = 0	Rotation of the sensor around the pitch axis in degrees; increase this value for moving the nose down on the attitude indicator
03 SensTilt_Yaw = 0	Rotation of the sensor around the vertical axis in degrees; increase this value for yawing to the left
04 Pitot_Offset = 0.0	Preset from us before delivery. Offset of the differential pressure sensor in Pa (read out the value “pitot / Pa” (e.g. -5.0) out of the NMEA data stream when sensor.readings file is on the SD card; then set this value for 04 Pitot_Offset in sensor_config.txt (here -

	5.0). Check if displayed wind speed returns slowly to 0 when the aircraft is on the ground (V_{IAS} = 0 km/h), after having slightly blown into the pitot tube.
05 Pitot_Span = 1.0	Gradient correction of the differential pressure measurement (IAS → CAS)
06 QNH-delta = 0.0	Zero point correction of the absolute pressure measurement
17 Mag_Auto_Calib = 1	Turn on automatic compass calibration
20 Mag_Declination = 3.5	Magnetic declination in the area of operation; type in positive values for “East”; software version 0.3.0 and newer contains a magnetic model, which determines the value automatically, therefore manual setup not required and not included in sensor_config any more.
21 Mag_Inclination = 66	Magnetic inclination in the area of operation; type in positive values for “Northern Hemisphere”; software version 0.3.0 and newer contains a magnetic model, which determines the value automatically, therefore manual setup not required and not included in sensor_config any more.
22 Mag_Earth_Auto = 0	Not included in software version 0.3.0 and newer, because automatic determination of inclination and declination is now always active
30 Vario_TC = 2	Damping time constant of the instantaneous variometer in seconds. Reasonable values between 0.5 and 5 s.
31 Vario_Int_TC = 30	Damping time constant of the variometer integrator in seconds
32 Wind_TC = 5	Short term damping time constant of the wind measurement in level flight in seconds
33 Mean_Wind_TC = 30	Long term damping time constant of the wind measurement in level flight in seconds
34 Horizon_active = 1.0	If it is necessary to disable the artificial horizon (e.g. for competitions), set the value to 0
40 GNSS_CONFIG = 1.0	1.0 for LARUS ESSENTIAL with uBlox M9N; 2.0 for LARUS DUAL_GNSS with uBlox F9P
41 ANT_BASELEN = 1.0	Distance of the D-GNSS antennas in flight direction in meters
42 ANT_SLAVE_DOWN = 0.0	Position of the front D-GNSS antenna (=antenna 1) relative to the back antenna (=antenna 2) downwards in meters
43 ANT_SLAVE_RIGHT = 0.0	Position of the front D-GNSS antenna (=antenna 1) relative to the back antenna (=antenna 2) to the right in meters

5.5.2 Display Current Sensor Values using sensor.readings

This file makes it possible to output a NMEA dataset that can be easily read by the user. For example, the following values can be read out:

- the exact distances between the two DUAL GNSS antennas (this is relevant for the configuration file "sensor_config.txt")
- the current orientation of the LARUS sensor unit – useful for the calibration of the magnetic compass
- the estimated standard deviation of all magnet data from the current measurement (parameter 16) in order to assess how strong the effect of ferromagnetic fields due to the installation situation is



```
Port monitor: Bluetooth Larus
True Heading= 174.67 Inclination= 96.27 M
agAnomaly= 61.63 %
BaseLength/m= 0.90 SlaveDown = 0.03 DGNSS
-Hdg= 174.7
$PLARV,-3.07,0.00,0,0*70

Sensor ID = 722f6766
acc   -0.17 0.16 -9.80 9.81
gyro  0.27 0.01 0.03
mag   0.08 0.33 0.86 0.92
pitot / Pa -2.09
pabs / hPa 962.75
pabs RMS / Pa 1.36
temp  26.98
Ubatt  14.45
GNSS time 11:47:01
NAV Induction: -0.09 -0.32 0.86 -> 0.92
True Heading= 174.65 Inclination= 96.30 M
agAnomaly= 61.78 %
BaseLength/m= 0.90 SlaveDown = 0.03 DGNSS
-Hdg= 174.6
$PLARV,-3.08,0.00,0,0*7F
```

To display the values, proceed as follows:

1. Remove the micro SD card from the LARUS housing (LARUS and OpenSoar do not need to be turned off)
2. Open the SD card folder on a computer, rename the file “sensor.readings_disabled” in sensor.readings and save it on the micro SD card
3. Insert the micro SD card into the slot of the LARUS housing
4. In OpenSoar click twice on the middle of the screen, click on “Config” -> “Devices” and select the line with Larus, then click "Monitor"
5. The current measured values are now displayed (see picture above). Click “Pause” for easier reading.
6. After the relevant measured values have been read out:
    a. Remove the micro SD card from the LARUS housing
    b. Rename the sensor.readings file in “sensor.readings_disabled” and safe it
    c. Insert the SD card into the slot in the LARUS housing
    d. Wait until LARUS has GNSS connection again

A file with the name sensor.readings must not be present on the SD card during normal use, because otherwise no data is displayed in the Info Boxes of OpenSoar.

5.6 Initial Operation and Function Test

For initial operation please follow these steps:

1. The LARUS housing is mounted in the aircraft as described in chapters 5.1 - 5.3
2. Connect the GNSS antenna(s) to the sensor unit. For LARUS DUAL-GNSS: connect the front antenna to GNSS1, the rear antenna to GNSS2.
3. Ensure that the WiFi / Bluetooth antenna is connected to the LARUS housing

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LARUS must not be connected to supply voltage without connected WiFi / Bluetooth antenna, even if Bluetooth is not needed

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4. Insert the micro SD card, that is part of the delivery.
5. Connect the sensor unit's static and total pressure ports.
6. Power the sensor unit through one of the USB-ports, the CAN-port or the RS232-port. Power can be provided to the device through all four connectors. If the CAN- or RS232-port is used to provide power to the sensor unit, the voltage must be in the range of 8-28V. USB power is 5V.
7. Connect a glider navigation system on which XCSoar / OpenSoar is running, like the OpenVario or your smartphone, to the sensor unit to display LARUS' data. XCSoar has not yet implemented a LARUS driver, but OpenSoar can be downloaded here: https://opensoar.de/releases/
8. Establish the data connection between LARUS and the glide computer / smartphone via an RJ45 cable or Bluetooth
9. In the OpenSoar "Device" menu, the port needs to be set to "ttyS…" (choose the right port according to the physical connection); "38400 baud", driver "LARUS"; if the connection is established via Bluetooth, then the Bluetooth device "LARUS" and the driver "LARUS" must be selected
10. Now the flight information determined by LARUS should be shown in OpenSoar.
11. Jack up the aircraft so that it is approximately in normal flight attitude.
12. If LARUS DUAL-GNSS is installed:

    - Determine the exact x and y position of the front GNSS antenna in relation to the back antenna. Either use the "sensor.readings" file (as described in chapter 5.4.2) or by measuring with a meter rule.
    - Enter the values in configuration lines 42 and 43 of the configuration file "sensor_config.txt" on the SD card (as described in chapter 5.4.1)
    - Restart LARUS and OpenSoar

13. Activate the attitude indicator (artificial horizon) in one info box of OpenSoar or on a new page. If the displayed artificial horizon does not correspond to the real attitude of the aircraft, the configuration lines 01 - 03 of the configuration file "sensor_config.txt" on the SD card need to be adjusted (as described in chapter 5.4.1). Therefore, eject the Micro-SD Card of LARUS, insert it in a computer and open the file "sensor_config.txt". Change the numbers (unit is degrees) in lines 1-3. E.g. if the artificial horizon should roll to the right, increase the value in line 01, if it should nick down then increase the value in line 02. Insert the SD card back into LARUS and wait some seconds, until the artificial horizon has changed.
14. Plausibility check before first flight:

    - display current sensor values using sensor.readings (see chapter 5.5.2). Check the number of satellites received. Check, if displayed "True Heading" corresponds to the aircraft orientation. Please note for Larus Dual-GNSS: the value for the "True Heading" is provided by the magnetic compass as long as there are not enough satellites available. Afterwards, the "True Heading" heading is calculated from the two GNSS positions of the antennas ("D-GNSS Heading").
    - carefully blow into the tube for total pressure from a little distance. The displayed wind and airspeed must increase.

15. Your LARUS is ready to fly and will continuously optimize its calibration during flight!

5.7 Software update

The LARUS team is continuously improving the software. New software versions are released here: https://github.com/larus-breeze/sw_sensor/releases

For updates until sw_sensor version 0.3.0 it was necessary to connect a computer to LARUS STM port via USB cable. Please see the manual “STM 32 Update” published on our webpage https://www.stefly.aero/product/larus_glider_sensor/

From firmware version 0.3.1 onwards it is possible to do the update without using any micro-controller programming hardware using a firmware image "larus_sensor_V2_image.bin" on the microSD. Please note that it is required that firmware version 0.2.3 or newer has been installed via USB cable once before.

5.8 Disable AHRS

For competition flying it is possible to manually disable AHRS. In this case, the configuration file on the SD card must be adapted:

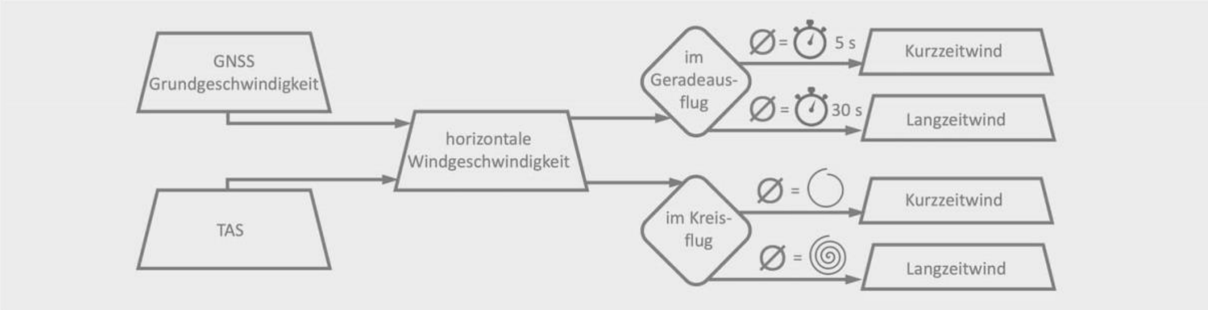
Include the line "34 Horizon_active = 0.0". The output of roll and pitch angle and therefore the artificial horizon will be disabled, until "34 Horizon_active" is manually set to 1.0.

Restart Larus and check that the artificial horizon is fixed. Therefore e.g. put down one wing to simulate a roll movement or lift the tail of the glider to simulate a pitch movement.

It is not possible to perform the update via RJ45 ports or WLAN / Bluetooth. For this reason, the competition organizer / contest official can also seal the SD card slot as well as the two USB-C sockets of the LARUS housing during technical approval.

6 Operation

OpenSoar is based on XCSoar and is therefore similar to use. However, for example two wind arrows are now displayed on the map. These differ as follows, whereby the time constants can be adjusted by adjusting the respective configuration line in the "sensor_config.txt" file as described in chapter 5.4.1:



- In straight flight, the time period for short-term wind is by default 5 s and for long-term wind 30 s (default setting; both times are configurable)
- When circling, the short-term wind is the mean of the last circle, while the long-term wind is the accumulated mean over the entire time of the last circling phase

The following settings in OpenSoar are important:

- Config / Wind / Wind setting: “External wind” on, “ZigZag wind” off and “Circling wind” off
- It is recommended to set the connected IGC logger, e.g. Flarm, to device A and LARUS to device B, because then the IGC logger height is displayed in XCSoar/ OpenSoar. In competition flights, only the altitude recorded by the IGC logger is used for task evaluation. This may deviate from the altitude determined by LARUS, since LARUS automatically adjusts the QNH during the flight.

The acoustic vario output can be activated under Menu - Gauges – Audio Vario. The volume can also be adjusted in the same menu.

The blue wind arrow indicates the average wind (e.g. 30 sec), the green arrow indicates the real-time wind (e.g. 5 sec).

LARUS provides AHRS data to XCSoar. This AHRS is not certified and you should not fly with it in non-VFR conditions!

7 Maintenance

The whole system has no serviceable parts.

To obtain warranty service, please SteFly directly.

Opening the housing of LARUS or the GNSS antennas or shortening the antenna cables will void the warranty!

8 Troubleshooting

Problem	Possible Causes	Solution
XCSoar / OpenSoar does not show the position of the aircraft, when the aircraft is on the ground	Larus is not connected to XCSoar / OpenSoar	Go to “Config” / “Devices” and check, if Larus is connected. Otherwise check port, baud rate and driver settings according to Initial Operation and Function Test
	Not enough time passed after Larus has booted up	Please wait. Depending on the number of received satellites it may take up to 5 minutes until the position has been determined.
	GNSS reception is poor and the status LED “GNSS” of the Larus box is not flashing blue	Move the aircraft away from surrounding buildings / trailers, allowing unobstructed view to GNSS satellites
XCSoar / OpenSoar does not show two wind arrows	Wrong configuration of OpenSoar	Config / Wind / Wind setting: “External wind” on, “ZigZag wind” off and “Circling wind” off
Displayed wind speed is too high during straight flight and correct during circling	For Larus Dual-GNSS: antenna 1 (front) and antenna 2 (rear) are interchanged	Trace the cables to find out which antenna is connected to which port. Alternatively, display current sensor values using sensor.readings (see chapter Display Current Sensor Values using sensor.readings) and check, that “D-GNSS Heading” is roughly the heading you expect. If it is 180° wrong, then the antennas at the Larus box must be interchanged.
	For Larus Essential: magnetic compass is disturbed by surrounding magnetic / electric fields	The LARUS sensor must be positioned as far away as possible from magnetic fields and bigger iron parts. Examples are loud speakers and electric wires for higher current flow.
Vario and wind is completely unrealistic (sudden changes between high sink rates and high climb rates / sudden changes of wind direction and speed)	Hoses for total pressure p_{tot} and static pressure p_{stat} are interchanged	Interchange the two hoses at the pressure connectors of the Larus box
	Number of satellites received is limited	Check the installation position of the GNSS antenna(s). Antennas must be installed horizontally in the fuselage, pointing to the sky with no metal parts / carbon fibre parts blocking the connection to the satellites. Also make sure there is a large lateral distance to metal parts like the cockpit ventilation flap, screws, canopy flasher.
	sensor_config.txt file not configured	Check, if the config file was setup correctly. Turn on the artificial horizon

		in OpenSoar / XCSoar. Pay particular attention to the installation orientation of the Larus box and antennas (parameters 01-03 and 40-43).
	For Larus Essential: function limited due to strong magnetic fields in the vicinity of the sensor box	Check the value MagAnomaly, when sensor.readings is active. Try to figure out, which ferromagnetic part / electric instrument causes the problem e.g. by switching off individual instruments. Mount the sensor far away from these disturbance sources.
No GNSS position and artificial horizon displayed, but if you click on “config”-> “devices” it says Larus GPS connected	The file “sensor.readings” is on the SD card	Rename the file to “sensor.readings_disabled”
Orientation of the aircraft symbol in OpenSoar / XCSoar does not match the true aircraft heading	sensor_config.txt file not configured	Check, if the config file was setup correctly. Turn on the artificial horizon in OpenSoar / XCSoar. Pay particular attention to the installation orientation of the Larus box and antennas (parameters 01-03 and 40-43).
Displayed wind direction constantly 0°	Wrong setting in OpenSoar / XCSoar	Check: Config / Wind / Wind setting: “External wind” on, “ZigZag wind” off and “Circling wind” off
	Software bug in sw_sensor version 0.3.1	Update sw_sensor version

9 Technical Data

Size	Unit	Value
mass LARUS Essential	g	300 (incl. GNSS antenna)
mass LARUS Dual-GNSS	g	630 g (incl. 2 GNSS antennas)
dimensions LARUS Essential housing	mm (length x width x height)	145 mm x 79 mm x 28 mm (incl. antenna connectors and hose connectors)
dimensions LARUS Dual-GNSS housing	mm (length x width x height)	145 mm x 79 mm x 43 mm (incl. antenna connectors and hose connectors)
input voltage	V DC	9 – 28 V DC (RJ45), 5 V DC (USB-C)
amperage LARUS Essential	mA (@ 13,0 V DC)	120
amperage LARUS Dual-GNSS	mA (@ 13,0 V DC)	150
interfaces		RS232 (x2) - RJ45 CAN (x1) - RJ45 Bluetooth – SMA reverse polarity GNSS-Antenna – SMA normal polarity microSD
pressure connectors	mm	6
operating temperature	°C	-30 to +60
operating rel. humidity	%	0 - 95
material housing		black anodized aluminium
cable length GNSS antennas	m	4,0 (LARUS Essential) 5,0 (LARUS Dual-GNSS)