# LX navigation

# LX Eos

Speed to fly variometer, flight recorder, final glide calculator and simple navigation system with internal backup battery.

User's manual
(version 1.5)

Refers to LX Eos FW version 1.4

**For standalone use and for use in LX Zeus configuration.**

![LX navigation logo]

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# 1  Introduction

The LX Eos is "all-in one" standalone speed to fly variometer, flight recorder, final glide calculator and simple navigation system with internal backup battery, audio warnings, vario beeps and voice messages. The unit has User and Flarm input/output to connect PDA/PNA and Flarm units to the system. It is the smallest vario system with outline dimensions of 60mm x 60mm with standard 57mm cut-out. It will fit into every glider panel. It is able to supply PDA/PNA units with 5 V/500 mA and 3.3 V/100 mA output on User output connector. LX Eos has built in high precision digital sensors based on latest MEMS technology for altitude, vario, speed and G-force. All sensors are sampled with more than 100Hz sample rate. All real time data is shown on its indicator. Vario data is shown with mechanical needle via stepper motor. As integral part it has 1.8" sunshine readable LCD display to show all user defined data during flight. For accessing all system options, a rotary switch with a push button is used.

A double seater installation is possible by adding LX Eos Repeater on system CAN bus.

An integral IGC approved flight recorder with ENL level detector will record flight to internal solid state memory (8GB). All flight can be copied to external SD card after flight.

For backup and safety reason, it has internal battery, which will work for about three hours after main power supply is disconnected. Integral charger will charge up backup battery when external power supply is connected (12V).

LX Eos features are:
- Extremely bright direct sunlight readable display.
- Integrated G-meter (g-forces recorder).
- 3-axis gyroscope.
- 3-axis accelerometers.
- 50ch – GPS receiver as an integral part of the system.
- Completely new design using latest pressure transducers technology.
- Extremely fast vario data acquisition.
- Rotary knob with push function, for simple and effective handling.
- Nearly unlimited memory space for flight recorder.
- ENL (Environment Noise Level) sensor.
- 5 user defined status inputs (SC, VP, gear, brakes and ballast).
- OAT probe input (outside air temperature).
- Internal beeper (for Flarm warnings…).
- Flarm port (input of Flarm data).
- PDA/PNA port, supplies navigation and Flarm data to PNA/PDA.
- Bluetooth 2.0 interface.
- Voice module as an integrated part of the system.
- CAN Bus, for connection to LX Zeus or other devices.
- External SD Card interface, for firmware updates, flight downloads and TP/TSK transfers.
- Standard 57 mm size, the smallest vario ever built.
- The unit can be used as stand-alone, or as a part of LX Zeus system.
- Built in rechargeable battery serves for up to three hours of autonomy.
- Charging of battery is realized via main power.
- Pre-loaded polar database.

Functions:
- Variometer, TE compensation (TE probe or electronic way).
- Speed-to-fly function.
- Final glide calculator based on GPS data (for TP and TSK).
- Simple navigation to TP and TSK.
- High level IGC approved flight recorder.
- Flarm radar screen.
- Thermal assistant screen.
- System extensions: Second seat configuration, Remote control operation (LX Joy).
- Logbook.
- Flight information with Barograph.
- Multi pilot support.
- Accurate wind calculation in straight flight and circling.
- Voice announcement.
- User warnings.

Later in manual "backup mode" will be written from time to time. Backup mode is when LX Eos is used in LX Zeus system and while flying, system loses main power. LX Zeus will turn off, but LX Eos will use internal backup battery to continue working. All functions of LX Eos are operational in backup mode so pilot can safely navigate back to home or complete the task.

LX Eos can be used in two different configurations:
- a standalone: LX Eos represents vario navigation system and has all options active. Unit will turn on when enter switch is pressed.
- LX Zeus configuration: LX Eos serves as vario system controlled from LX Zeus. Unit will turn on automatically when main switch is turned on. All setup settings are set on LX Zeus. Flarm radar settings and thermal assistant settings must still be set on LX Eos. Some of options are disabled (setup, task edit) but all of LX Eos options will become active when backup mode is detected.

Unit has capability to be updated to any later FW release.
As standalone system, please refer to Setup/SD Card/Update, how to update the system.
As LX Zeus configuration, LX Zeus will automatically update LX Eos if required to latest version, so no extra action is required.

## 1.1 *Hardware specification*

Picture shows the LX Eos unit. It is 57 mm sized all in one vario – final glide calculator, flight recorder, Flarm display, basic navigation etc… with one rotary switch with push button for all operations.



| Dimensions | 60 mm x 60 mm x 75 mm |
|---|---|
| Weight | 220 grams |
| Input Voltage Range | 9.0 – 20.0 VDC |
| Average Current | 140 milliamps @ 12 VDC |
| Bluetooth range | up to 20 meter |

## 1.3 *Switching on the unit*

To switch the unit on, press push button on rotary switch until LX Navigation logo is shown on LCD screen. Device name with serial number and software version information will follow after logo. After boot procedure, the initial setup with pilot selection and elevation/QNH setup will be shown. If device is used in LX Zeus configuration, it will turn on when LX Zeus main switch is turned on (no need to push the button). Initial setup screen is not visible, because all initial setup is done on LX Zeus unit.



## 1.4 *Switching off the unit*

When on ground (flight recorder is not running), disconnect main power supply from system. LX Eos will start to count down 3 seconds before it will turn off. If you are flying (LX Eos detects IAS – indicated air speed and flight recorder is running) it will not switch off until flight is ended. Flight will end 10min after landing or manually by the user. How to manually end flight, please refer to section of statistic page.

# 2   Use of rotary switch

To move around and access all functions of the unit, one rotary switch with push button is used.
Push button operation will be later in manual called as "enter".
To change value of setting, enter must be pressed to activate field (white frame will change to yellow).
Yellow frame indicates that selected value can be changed by rotation of rotary switch.
To exit edit mode press enter again (frame becomes white again).

For quick change (multiplication by 10 steps) press enter button and while being pressed, rotate rotary switch.

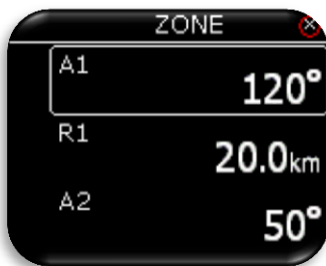To exit from any subpage or list, pilot has 2 options:
- Select "Exit" option which is always located at the end of each page / list
- Move to the top of each page / list where red circle with white X is located. Exit option is activated, when this circle becomes filed with red.

| | |
|---|---|
| Exit at the bottom. | Exit at the top. |
| Value can't be change (white frame). | Value can be changed with rotary switch (yellow frame). |
| Green cursor indicates the character which is being edited. Edit character with rotary switch. | Pressing enter on "arrow" symbol will finish the string. |
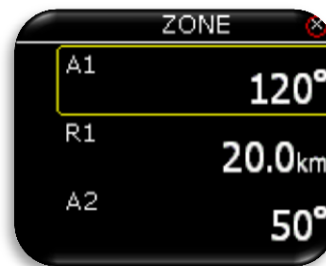
# 3 Initial setup

Initial setup screen is first one after power on, where user can select pilot from internal database and set airfield elevation with daily QNH setting. This screen is visible only as standalone version. If used in LX Zeus configuration, all this settings are done on LX Zeus and this screen is not visible on LX Eos.
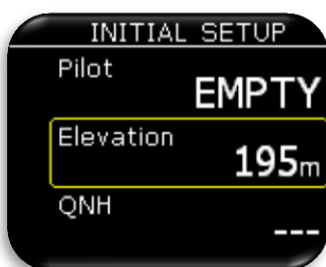
Select pilot from the internal database with rotary switch. If there is no pilot in database, "Empty" pilot is offered and can be later edited (name, surname,…) in Setup/Pilot menu. Code input will be required if selected user has his profile protected with user code.

Set airfield Elevation.

Modify suggested QNH setting.

# 4 Structure of main pages

To switch between main pages use left/right rotation of rotary switch. Complete structure of main pages is seen bellow.



Vario- main page



Thermal assistant page



Flarm radar page



TP navigation page



Task navigation page



AHRS page **(\*\*)**



GPS info page



Logbook / statistic page



Setup page **(\*)**
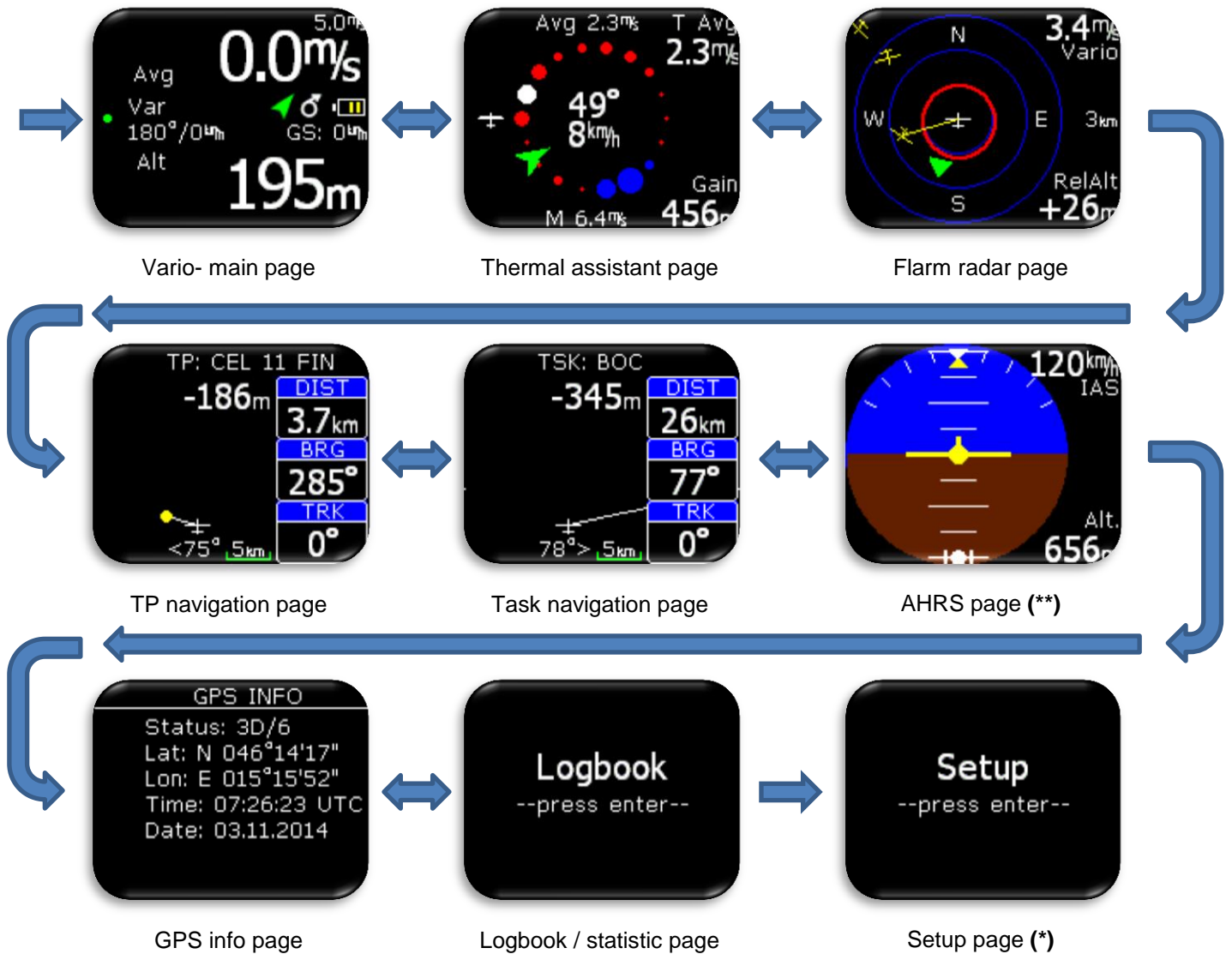
**\* Only as standalone or in backup mode when used in LX Zeus system.**
**\*\* Only when AHRS module is detected on CAN bus.**

# 5 Vario page

Vario page is most commonly used page while flying. On this page many basic information can be found.

On top and bottom different values are shown. For list of all available options please refer to Setup/Indicators section.

In middle row different status icons are shown:
- Main battery indicator (outline of symbol is white):
  - 3 green bars – more than 12.0V.
  - 2 yellow bars – more than 10.8V.
  - 1 red bar – less than 10.8V.
- Backup battery indicator (outline of symbol is red):
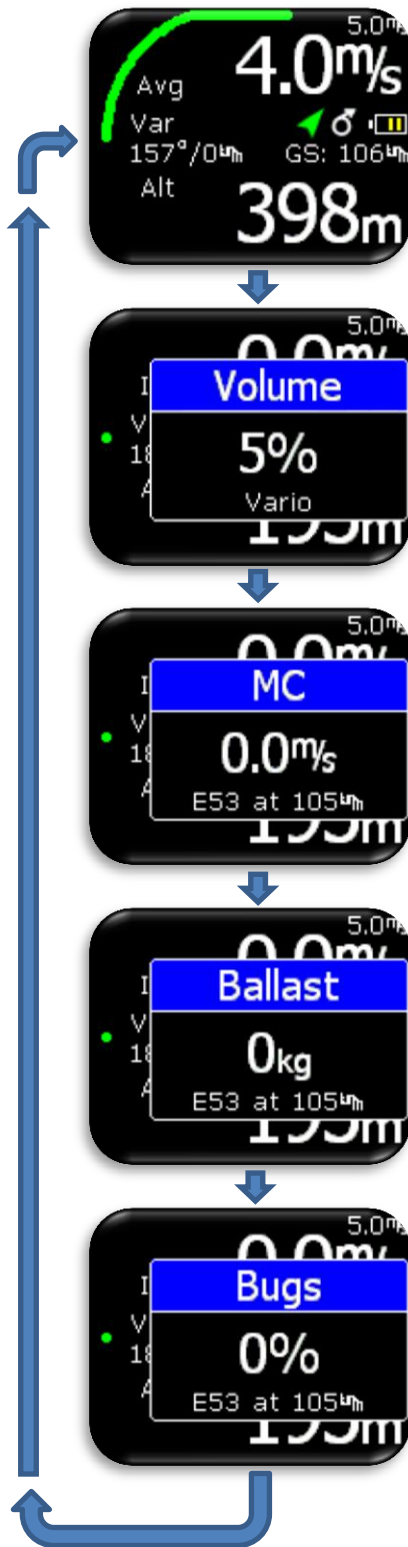  - 3 green bars – more than 80% left.
  - 2 yellow bars – between 20% and 80% left.
  - 1 red bar – less than 20% left.

- SC/Thermal icon:
  - Straight arrow – SC Mode.
  - Circle with arrow – thermal mode.

- GPS status:
  - Green arrow – GPS ok (3D).
  - Red arrow – GPS bad.

- Bluetooth icon:
  - Is visible when Bluetooth connection is active.

- Flarm icon:
  - Is visible when Flarm is detected on system

- Green arch is SC bar which will move according to MacCready setting, IAS and status of airmass around the plane.
- Wind indicator and ground speed are displayed under status icons.
- Above wind indicator there is of needle indication:
  - Var – Vario.
  - Net – Netto.
  - SC – Speed Command.
  - Rel – Relative.

With press on enter button, pilot can change volume (vario or SC mode), MC, ballast and bugs values. To exit from sub option, press enter until it disappears or wait for 2s and vario page will be active again. To change any of the values above use rotary switch.

**Configuration with LX Joy:**
When LX Joy is connected to LX Eos standalone configuration, up/down keys will change volume settings on vario page.

# 6 Thermal assistant page
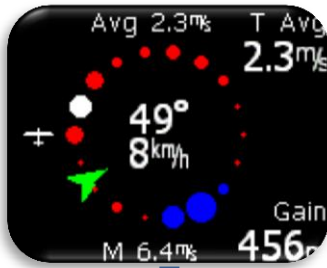
Thermal assistant page can assist pilot when thermaling to get better sense how thermal looks like. Thermal is presented with use of different coloured dots.

**Default color scheme:**
White coloured dots shows maximum climb detected in last turn.
Width of dot represents strength of climb/sink.
Red dots represents climb.
Blue dots represents sink.

**MC color scheme:**
White coloured dots shows maximum climb detected in last turn.
Width of dot represents strength of climb.
Red dots represents climb which is stronger than 1.2*MC setting.
Yellow dots represents climb in range of 0.8*MC and 1.2*MC setting.
Blue dots represents climb less than 0.8*MC setting.

If MC setting is less than 0.5m/s, default color scheme is used!

In the middle, wind indicator is shown as a green arrow with numerical indication for direction and speed. Wind arrow is track up orientated.
Other marks on this page:
- Avg: Integrator value of vario.
- M: Maximum value in thermal – white dot.

Upper and lower navboxes are configurable in TA Setup:
- T Avg: Average of thermal from start of circling until "now".
- Gain: Altitude gain from start of circling until "now".
- Alt: current QNH altitude
- Netto: netto vario

To access TA setup, press enter on this page.

Auto TA: It is possible to enable automatic switch to thermal assistant from any other page when circling is detected.

Max. beep: Position of max thermal (white dot) can be reported as a beep. If thermal beep is enabled, LX Eos will generate beep always when you are at position of maximum climb (white dot).

Beep offset: Maximum thermal is announced with beep sound if max beep is enabled. Set beep offset in second here. Beep will be generated before you reached maximum thermal.

# 7 Flarm radar page
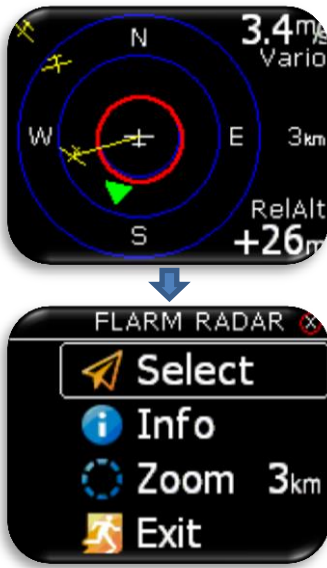
The graphic display is divided into 2 or 3 circles (depends on zoom setting). Last circle represents zoom distance. The white glider symbol is always positioned in the middle of the screen and shows the current position of the plane.

Near gliders are displayed as yellow. All gliders located in radio range will be shown simultaneously on the display.

ADSB object detected will be shown as green triangle pointing to its tracking direction.

Non directional object are represented as red circle, which represents relative distance from plane.

On the right the selected zoom is displayed. In top right corner vario information of selected Flarm object is shown and on bottom right corner its relative altitude compared to your plane is displayed.

The graphic display orientation is always track up. To improve orientation, N, E, W and S are added to the display.

**Note!**
Gliders presented as a dot on the screen, are gliders where pilots have intentionally activated the PRIVACY mode on their Flarm unit. Gliders in privacy mode send limited data strings and can't be visualized completely. However, all warnings will appear regardless of privacy mode.

To access Flarm radar option, press enter on this page.

**Configuration with LX Joy:**
When LX Joy is connected to LX Eos standalone configuration, up/down keys will change zoom settings on Flarm radar page.

## 7.1 *Flarm select*

To select new Flarm object, press enter on Flarm radar page and use "Select" option. Yellow "SEL" string will be visible under zoom information, indicating that you are in selection mode.
Yellow line will point to selected Flarm object and it will be in yellow circle. Use rotary switch to select new one.
Pressing enter will finish select option and Flarm radar will be active again.

## 7.2 *Flarm Info*

To get more information about selected Flarm object press enter on Flarm radar page and use Info option.

## 7.3 *Flarm warning*

When flarm warning is detected, Eos will show Flarm warning page with direction, above/bellow indicator and numerical information for distance and relative altitude.

**Flarm warning setting:**
- enabled, this page will override any Eos menu / page.
- disabled, then this page will be seen only on Flarm radar page.

# 8 TP navigation page

This page can be used for simple navigation to turnpoint (TP). Before this page can be used, pilot must import TPs from external SD card (.CUP file) to internal TP database. How to import TPs please refer to section Setup/SD Card/Load TP. If LX Eos is used in LX Zeus configuration, TP database selected under TP/Task/Eos list on LX Zeus is automatically transferred (first 1000 points). TP is displayed as yellow dot and white line from dot to plane is showing direction in which the pilot should fly. Navigation is always "track up".
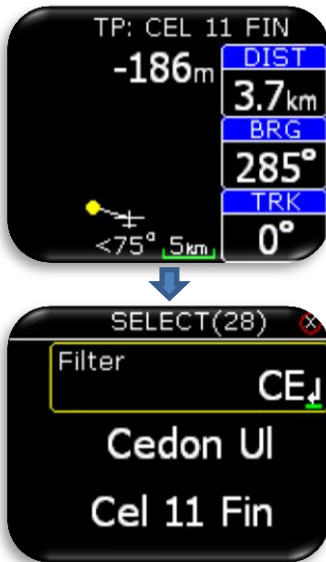


On the top of this page pilot can find name of navigated TP. Under the name, final glide information to the selected point is visible. Final glide calculates reserve altitude into end result. Navbox-es shows track (TRK), bearing (BRG) and distance (DIST) to the selected point.
Under the plane, steering symbol information will give pilot information for how many degries (°) does he need to correct his track to fly directly to the point.

Pilot can select a TP, to which he would like to navigate, with press on enter button.
Select option will be offered only on LX Eos as standalone or in backup mode. To select new point of navigation in LX Zeus configuration, select new TP on LX Zeus TP page. On header, number of TPs found, is reported in bracket.

TP database must be first uploaded using Setup/SD Card/Load TP option.

With filter field, pilot can filter out alphabetically, which point is being searched.
Example is showing use of filter "CE" where 28 points are found.
Pressing enter on any point will automatically select it and navigation will start on that point.

Selected point is saved after power reset.

**Configuration with LX Joy:**
When LX Joy is connected to LX Eos standalone configuration, up/down keys will change zoom settings on TP page. In configuration without LX Joy or LX Zeus configuration, zoom change is not possible!
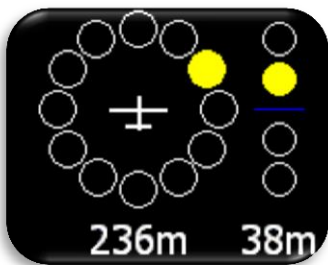
# 9 Task navigation page

This page can be used for simple navigation on predefined task (TSK). Before this page can be used, pilot must import TPs from external SD card (.CUP file) to internal TP database and set a task in TSK SETUP. How to import TPs please refer to section Setup/SD Card/Load TP. Navigated task TP is displayed as observation zone and white line from zone to plane is showing direction in which the pilot should fly. White line from center of observation zone will show next leg of task. Navigation is always "track up".

On the top of this page pilot can find name of navigated TP. Under the name, final glide to the end of the task is displayed. Navbox-es shows track (TRK), bearing (BRG) and distance (DIST) to the navigated point. Under the plane, steering symbol information will give pilot information for how many degries (°) does he need to correct his track to fly directly to the point.

**Configuration with LX Joy:**
When LX Joy is connected to LX Eos standalone configuration, up/down keys will change zoom settings on TSK page. In configuration without LX Joy or LX Zeus configuration, zoom change is not possible!

Pressing enter, "TSK SETUP" is activated where task TP can be added, selected or removed from task. TP database must be first uploaded using Setup/SD Card/Load TP option.
On first row task total distance and task type is shown.

Additional options will be offered to the pilot only in standalone configuration or in backup mode. In LX Zeus configuration, TSK TP options must be set on LX Zeus.
Additional options:
- Goto: Navigate to that point on task.
- Select: Select new point. See TP select.
- Insert: Insert new point before selected one.
- Delete: Delete this point.
- Zone: Edit TP zone. See next chapter.

## 9.1 *Task tp zone*

User can change A1, R1, A2, R2, zone type, A21 and auto next option. If auto next option is enabled, next TP is automatically selected, when pilot reaches TP zone.

Selecting "View zone" will show entered zone for the selected point.

# 10 GPS info page

Basic GPS information is shown here.
- Status: 3D/6 – 3D GPS, 6 satellites found.
- Status: Last fix/0 – currently no satellites are found, last know location is displayed as Lat, Lon.
- Lat: N or W – latitude, north or west.
- Lon: E or S – longitude, east or south.
- Time: only UTC time.
- Date: current date.

# 11 Logbook / statistic page

## 11.1 *Logbook*

On the ground (flight recorder is not running) logbook can be accessed by pressing enter on logbook page. Pilot can copy take-off / landing time to personal logbook and transfer flight to external SD card for OLC upload.

Last 50 flights are listed. Any older flights will be erased from logbook list. Press enter on selected flight to open flight info, where "copy" option is available to transfer flight to external SD card.

Flight is copied to external SD card to LX/FLIGHT folder
After flight has been transfer, "Copy OK" is displayed. Press enter to continue.

In LX Zeus configuration, flight can be downloaded from LX Zeus logbook page to LX Zeus USB key.

## 11.2 *Statistic*
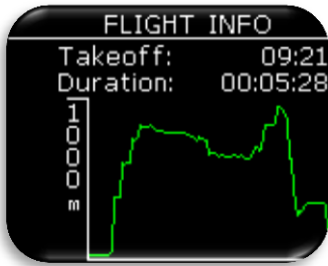


During flight, statistic of the flight is shown on statistic page. Take-off and duration time are displayed on top with baro altitude graph for last hour at the bottom.
Pressing enter on this page, will offer the pilot an option, to end flight immediately on demand.



If "Yes" option is selected, message "Calculating security" will be visible. Selecting "No" will do nothing and statistic page will be visible again.



After pilot has landed, flight recorder will start 10min countdown, before flight will be automatically finished. This page will be shown automatically after 10s of countdown to alert pilot that flight will end after 10min. Pilot can wait until countdown or press enter to end flight immediately.
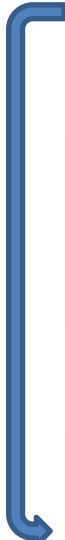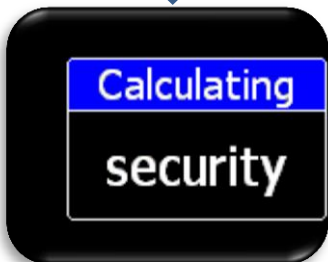
# 12 Setup

Under setup, pilot can set all parameters of the unit. Setup page can be accessed only if LX Eos is used as standalone unit. When connected to LX Zeus, all information is automatically synchronised between LX Zeus and LX Eos. In case of backup operation with LX Zeus, Setup will appear automatically.

To enter setup, press enter. All setup options will be shown as a list. Use rotary switch to select one.

- Select / set new pilot (name, surname, weight, co-pilot).
- Set actual QHN setting and reserve altitude.
- Set vario / SC parameters (filter, range, average time…).
- Select / set polar of the plane.

- Set units.
- Set displayed values on vario page (upper number, lower number...)
- Set flight recorder parameters (interval, event...)
- Set displayed / processed warnings.

- Set voice settings (volume, mix).
- Access to SD card functions.
- Set user defined inputs (gear, SC, VP, event…).
- Set NMEA options (BaudRate, output messages sent to other units…).

- Enable / disable main pages.
- Access passwords protected functions.
- Unit information.
- Exit from the setup.

## 12.1 *Pilot*

All entered data here (except for weight) will be written to flight recorder as pilot declaration info.

Pilot can either select pilot that is already saved in the database or select "EMPTY" to create a new pilot. If pilot is already saved, name initial and surname are shown. Pilot name or "EMPTY" is automatically shown in the second line. Code input will be required if selected user has his profile protected with user code.

- Pilot name: edit the name of the pilot.

- Pilot surname: edit the surname of the pilot.

Pilot's weight is added to the whole weight of the plane to calculate actual wing load factor.
- Weight: edit the weight of the pilot.

Co-pilot's data is visible in flight declaration (IGC file).
- Copilot name: edit the name of copilot.
- Copilot surname: edit the surname of copilot.

Co-pilot's weight is added to the whole weight of the plane.
- Copilot weight: edit the weight of copilot.
- Set user settings password. Password 0000 will unlock protection!

Export/Import user profile to/from SD card.

![LX navigation logo]

## 12.2 *QNH/Res*

Pilot should set actual QNH and elevation of the airport where he will take-, off on initial setup screen. After change of QNH during flight, pilot can change altitude information to which final glide will calculate. If QNH is changed on the ground, altitude will not be corrected and will still be the same as set on initial setup.

Reserve is the safety arrival altitude that instrument adds to the required final glide altitude so that the glider arrives over navigated destination with selected reserved altitude.

## 12.3 *Vario/SC*

In this menu pilot can set vario settings:
- Zero frequency is a frequency generated at 0 m/s
- Positive frequency is frequency at maximum climb shown on scale (depends on range setting).
- Negative frequency is frequency at maximum sink shown on scale (depends on range setting).
- Range is the scale for vario. Three options are available – 2.5, 5 and 10 m/s (5, 10 and 20 kts, according to user selected units).
- Filter defines the dynamic of vario needle and sound. The smaller the time the faster is response and vice versa.
- Avg time is setting that defines integration period for averaging the vario data in seconds.

TE Level is the level of electronic TE (total energy) compensation for variometer. Selection of electronic compensation method is done after selection of TE level. 0% means total energy compensation using a TE probe. After an input of a percentage, which is more than zero the special software routines will be activated and will provide an electronic compensation process.

The TE compensation can be fine-tuned during flight with the following procedure. It is essential that this is only done in smooth air; it is not possible to tune the TE accurately when there is thermal activity.
- Select 100 % TE level.
- Accelerate up to approximately 160 km/h (75 kts) and keep the speed stable for a few seconds.
- Gently reduce the speed to 80 km/h (45 kts).

Observe the vario indicator during the maneuver. At 160 km/h (75 Knots) the vario will indicate about –2 m/s (-4kts). During the speed reduction the vario should move towards zero and should never exceed zero (slightly positive indications are acceptable). If the vario shows a climb, then the compensation is too low, increase the TE level; and vice versa. Repeat this procedure and make further adjustments if necessary.

SC mode:
- Manual: pilot will activate the SC mode with push of an external button. Activate settings of SC button can be set under SC Switch option.
- Speed: SC mode will be automatically activated when the "SC speed" is exceeded.
- Circling: SC mode will be automatically activated when LX Eos detects that you left thermal, and will automatically switch back to vario mode when you enter next thermal.
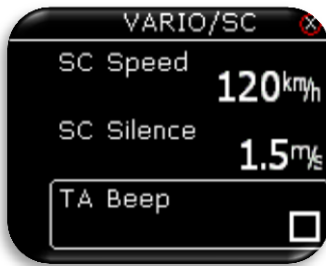
With the use of external switch it is possible to switch between SC and vario manually, if manual SC mode is selected.
- SC Switch:
  - ON means that closing of the switch will cause SC mode.
  - OFF means that closing the switch will select vario mode.
  - Toggle each press of the button will change between SC and vario mode.

- SC Speed setting is the speed value at which the SC Mode is activated if SC mode is set to speed.
- SC Silence defines no audio area around zero in SC mode.

TA Beep: When activated, internal beeper will beep 2 times when glider is passing thru max thermal detected in last circle (white dot in thermal assistant.

## 12.4 *Polar*
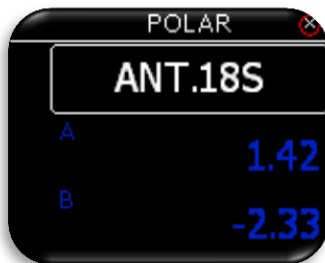
Nearly all gliders polars are stored in the LX Eos memory. It is also possible to create a user defined polar.
Not editable data is coloured blue.
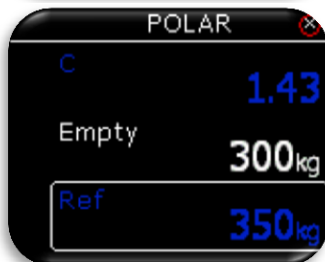
It is always possible to edit empty weight of the glider.

To create customs polar find "USER" in first line. When "USER" is selected all polar data will turn to white so the pilot can edit them.

## 12.5 *Units*
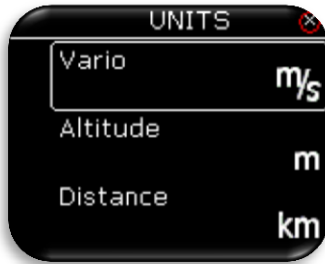
Pilot can set units for:
- Vario (m/s, kts).
- Altitude (m, ft).
- Distance (km, nm, mi).

<br>

- Speed (km/h, mph, kts).
- Wind (km/h, mph, kts, m/s).
- Pressure (mbar, inHg).

<br>

- Temperature (°C, °F).
- Weight (kg, lb).
- Area ($m^2$, $ft^2$).

## 12.6 *Indicators*

Pilot can select needle functios in vario and SC mode.
- Vario: Shows sink of the plane.
- SC:
  - needle on 0, optimal flying condition (MC),
  - needle is above 0, slow down,
  - needle is below 0, speed up.
- Netto: Shows air mass vertical movement at that moment.
- Relative: Shows vario if pilot would start circling on that point.

Vario/SC upper represents the upper numerical display indication in Vario/SC mode on vario page.
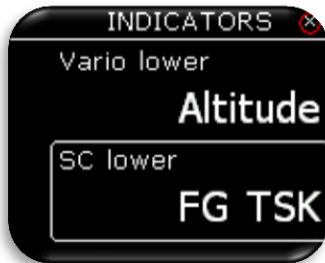
Vario/SC lower represents the lower numerical display indication in Vario/SC mode on vario page.
In all cases the pilot can choose from:
- Vario Avg.: integration period for vario average in seconds,
- Time: UTC time,
- Flight time: flight time,
- Leg time: When connected to Zeus it shows actual TSK leg time.
- Altitude: altitude accordingly to QNH data inserted,
- Distance: When connected to Zeus it shows distance on active page (APT, TP or TSK)
- Distance TP: distance to turn point selected on TP page,
- Distance TSK: distance to next turn point selected on TSK page,
- FG: When connected to Zeus it shows final glide on active page (APT, TP or TSK)
- FG TP: final glide to turn point selected on TP page,
- FG TSK: final glide to next turn point selected on TSK page,
- TAS: true air speed,
- IAS: indicated air speed,
- Alt. QNH – ft: QNH altitude in feat's,
- Flight level: flight level,
- OAT: outside air temperature,
- Vario netto: netto variometer,
- Vario relative: relative variometer,
- IGC Altitude.
- SpeedToFly: Speed to fly at given MC setting and air mass around the plane.
- G-force

## 12.7 *Logger*

The pilot can set recording interval, registration number of the plane, competition id, competition class and event settings.
All this data is then seen as declaration in every IGC flight file.
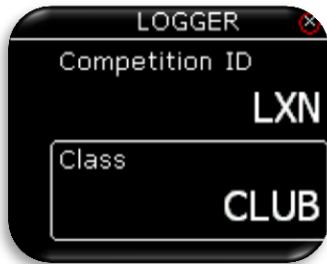
Dec. Flarm: Send declaration on Flarm port. If connected to Zeus, this is done automatically.

### 12.7.1 Event

Set number of event fixes and event record interval.
Event is activated when event button is pressed.

## 12.8 *Warnings*

Warnings are used to inform pilot that some flight related data is outside margins. When warning state is detected by LX Eos, pilot will get red warning message box with description of what is outside margins.

Pilot can enable (box is checked) audio warnings and Flarm warnings.
- Audio: if disabled, voice warning will not be generated – only visual as warning message box.
- Inputs: Must be turned on to enable input port warnings such as airbrakes, gear, …
- Flarm: Flarm warning page will be seen only on Flarm radar page if this flag is disabled, otherwise it will override any Eos page/menu when warning is detected.

- Altitude warning: warning when flying over selected altitude
- Stall: warning when the glider speed is lower than stall speed
- Vne: warning when speed exceeds Vne speed

## 12.9 *Voice*

Pilot can set the voice volume of the device and mixer settings. The percentage of mixer means how much voice is mixed with vario beep. Low percentage means lower voice to vario beep ratio and higher percentage means higher voice to vario beep ratio.

Enabling Flarm traffic option will generate voice announcement when new Flarm object is detected.

Enabling Flarm warning option will generate voice warning when Flarm collision warning is detected.

Enabling Flarm obstacle option will generate voice warning when obstacle from Flarm database is detected in front of the plane.

With F. Horizontal Dist setting, user can enable/disable horizontal voice information for Flarm traffic.

With F. Vertical Pos setting, user can enable/disable vertical voice information for Flarm traffic.

![LX navigation logo]

## 12.10 *SD Card*
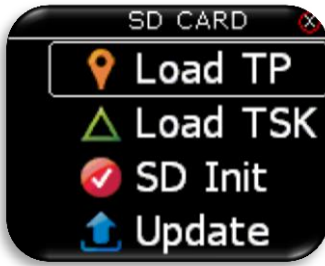
External SD card is used for all data transfers to LX Eos. In this menu all import/load functions from SD card can be accessed.

### 12.10.1    Load TP
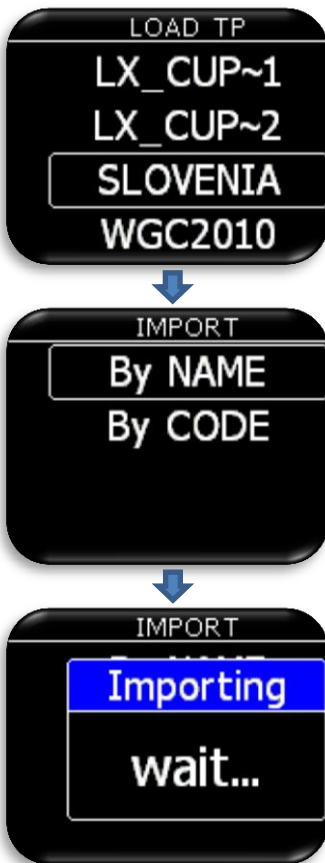
After selecting "Load TP" option, list of all CUP files (up to 20) found on external SD card in LX/TP folder will be listed here.
Select file from which you wish to import TPs to internal database.

**Cup file is commonly used file for transferring TPs and tasks (optionally).**

LX Eos can import turn points by name or by code.

**Warning: CUP file is usually alphabetically sorted by name. Lx Eos must have alpha sorted TP base or it will do it on import. If this is the case, import can take a long time (depends on number of TPs). When import by "Code" is selected, it will take much longer then import by "Name"!**

After selecting import mode, the process can take from 5 sec up to 10 min (depends of TP number and alphabetical sort inside CUP file). Number of TPs is not limited but we recommend to use CUP file with up to 1000 points. Name of every TP will be shorten to max 11 characters after import.

![LX navigation logo]

### 12.10.2 Load TSK

After selecting "Load TSK" option, list of all CUP files (up to 20) found on external SD card in LX/TP folder will be listed here.
Select file from which you wish to import TSK to internal memory.

After selecting file from which you wish to import task, first 20 task found in the file will be listed. Select task you wish to import and press enter. Observation zones will be loaded as well if defined in file, else standard FAI zones are used.

**Warning: Due to internal task limitations, only first 18 points of selected task will be loaded from file.**

Wait until load is finished.

### 12.10.3 SD init

Pressing enter will create LX folders on external SD card. This function is recommended after use of new SD card. The unit comes with already initialized SD card.

### 12.10.4 Update

Before update, user should request update code at: update-service@lxnavigation.si In email request, user should provide serial number of the unit and version to which he wish to update to.

Pilot should copy new version to **root** of external micro SD card, then insert it into the LX Eos and use "Update" option to make an update of the unit. After selecting "Update", list of all version (*.lxu) files will be listed. Pilot should select version, which he wishes to update to.

After selection, update code request will be visible. Update code can be accessed on update-service@lxnavigation.si

After code is entered, LX Eos will report error, if code is not correct or start update. Update can take up to 4 min. Device will automatically restart after successful update. LX Eos will also update all LX CAN devices connected to the system.

## 12.11 *Inputs*
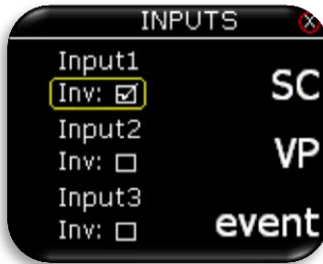
LX Eos has a possibility of five different user defined inputs. Each input can be set accordingly. There are seven options to choose from:
- None: nothing is connected to the input.
- SC: the device changes mode from vario to SC mode.
- VP: (vario priority) the device goes to vario mode no matter in which condition is SC mode.
- Event: event in flight recorder is activated and pilot gets a message shown on display.
- Gear: If enabled under warnings will generate gear up/down warnings after takeoff / before landing.
- Airbrakes: if enabled under warnings, will generate airbrakes warning if they are opened during takeoff.
- Ballast: not yet supported.

**Inv – invert mode:**
Each input has invert option. When invert option is enabled, it will "invert" active state of this input.
Invert option:
- off: input is active when switch is closed
- on: input is active when switch is opened

If two or more inputs are the same, the corresponding action will be made when all of them are active (**active = switch closed or switch open in Inv mode!**).
How to connect switches to external switch interface, please refer to external switch installation section.

**Functions of inputs:**
**SC:**
LX Eos supports two modes of operation Vario and SC. With SC input, user can change between these two modes.

**VP:**
Vario priority is used when user won't to have vario mode active. VP input has higher priority than SC input!

**Event:**
To trigger pilot event in logger with higher recording interval, this option of input should be selected.

**Gear:**
If any of inputs is selected as gear, gear warning will be announced at next conditions:
- gear is out 10min after take-off is detected and height is more than 500m above take-off location.
- gear is not out and altitude is less than 200m in 5km circle of take-off position and flight time is more than 5min.
- on outlanding (if airbrakes are out, elevation less than 600m QFE, distance from takeoff more then 5km) and gear is not out.
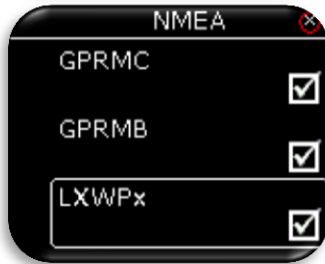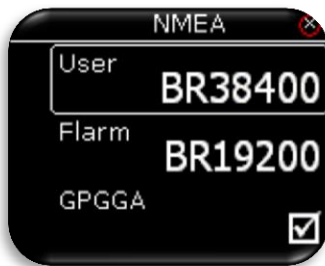
**Airbrakes:**
If any of inputs is selected as airbrakes, gear warning will be announced at next conditions:
- airbrake is out during first 10min of flight (take-off / aero tow time).

## 12.12 *NMEA*

This setup page is used to set which data is being sent to third party unit connected thru BT or user port.



The pilot can set baudrate for communication over User port or Flarm port. Pilot can select from: BR4800, BR9600, BR19200, BR38400, BR57600 and BR115200 options.

LX Eos is capable of sending NMEA data to third party units such as PDA or PNA. The data is available on the connector marked as USER and BT port. Five data strings are offered.

Selected (checked box) NMEA data will be sent over User port and Bluetooth.

- GPGGA – Global Positioning System 3D-Fix Data.

- GPRMC – Recommended Minimum Specific GPS/TRANSIT Data.

- GPRMB – TP navigation info.

- LXWPx – sentences contain pressure and altitude information in addition to IAS data.

- PFLAx – Flarm traffic info. Data must be enabled, if Flarm data is required on a PDA.
- KRT2 – Enable this option when KRT2 radio is connected to user port. Control over the radio is only possible in configuration with LX Zeus. LX Eos as stand alone will not be able to control radio!

**When KRT2 option is enabled all other outputs on User port are disabled, but are still present on BT port. To control KRT2 radio, Baudrate on user port must be set on 9600**

## 12.13 *Pages*
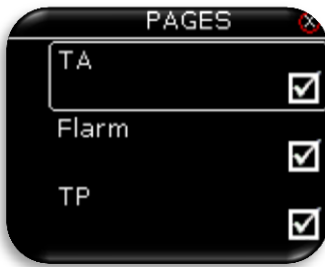
The pilot can select which main pages are active. Page is active when box is checked. There are five main pages available:
- TA (thermal assistance).
- Flarm radar.
- TP (turnpoint).
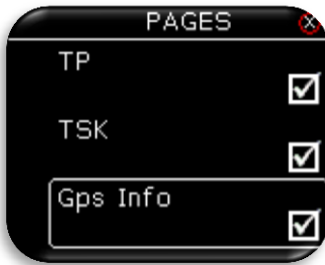
- TSK (task)
- GPS info (basic GPS information's)

## 12.14 *Password*

To access some options, password is required. Available password's are:
- 46486: sets LX Eos to factory settings.
- 99999: clear all flights from flight recorder – logbook is empty.
- 28346: audio player (will play any wav file 8bit 16kHz mono from root of external SD card).
- 66666: clear actual task.
- 55555: clear internal TP database

## 12.15 *Info*

LX Eos info page.
Displayed information:
- Serial number.
- IGC serial number.
- Software version.
- Hardware version.

# 13  Bluetooth module

LX Eos has internal Bluetooth 2.0 module which is always on and cannot be turned off. At the back of the unit, there is external Bluetooth antenna, that enables better range (brown cable).

## 13.1 *Pairing with PNA*

Perform search of BT device on your PNA/PDA (Oudie, Mio, …). LX Eos XXXXX, where XXXXX represents serial nr of the unit, will be visible on device list, when in range and turned on. Pair code will be requested to start communication with PDA/PNA and Lx Eos. Enter pair code: **1234**
After successful connection, Bluetooth icon is visible on main vario page.

## 13.2 *Supported data transfers*

| Description | Supported | Remark |
|---|---|---|
| GPGGA | yes | If enabled in NMEA setting |
| GPRMC | yes | If enabled in NMEA setting |
| GPRMB | yes | If enabled in NMEA setting |
| LXWPx (Lx data) | yes | If enabled in NMEA setting |
| PFLAx (Flarm data) | yes | If enabled in NMEA setting and Flarm is connected to Lx Eos |
| Declaration from Eos | no | |
| Declaration to Eos | yes | |
| CUP file transfer | no | |
| Flight transfer | no | |

## 13.3 *Usage*

Bluetooth communication is designed to be used in double seat gliders, so 2$^{nd}$ seat PDA/PNA can get all the data via BT or when only power cables are provided in glider for PDA/PNA (Club gliders).

# 14 User port

LX Eos uses User port (RS232 standard) to connect to third party devices such as PDA/PNA (Oudie, Mio,..), radio (KRT2)
Connect any third party device only with LX Navigation supported cable. Any unsupported cable may damage LX Eos or third party device beyond repairs. For successful communication correct BR must be selected under NMEA settings.

**Note:** For some PDA (for example HP314 ....) it is preferable to set the USER Port at BR115200 or at least at the maximum BR that is supported by the PDA. This can help to avoid communication problems during the declaration from PDA to LX Eos

## 14.1 *Supported data transfers*

| Description | Supported | Remark |
|---|---|---|
| GPGGA | yes | If enabled in NMEA setting |
| GPRMC | yes | If enabled in NMEA setting |
| GPRMB | yes | If enabled in NMEA setting |
| LXWPx (Lx data) | yes | If enabled in NMEA setting |
| PFLAx (Flarm data) | yes | If enabled in NMEA setting and Flarm is connected to Lx Eos |
| Declaration from Eos | no | |
| Declaration to Eos | yes | |
| CUP file transfer | no | |
| Flight transfer | no | |
| KRT2 radio control | yes | If enabled in NMEA setting and LX Eos is connected to Zeus. |

# 15   Upload Task on LX Eos

The user can transfer the Task to LX Eos using two ways:

- With a microSD as explained in chapter 12.10.2 "Load TSK" in relation to TPs and their view zone.
- With a PDA connected to User port or via Bluetooth. This way the user can only send the IGC declaration according to FAI rules. They will be transferred to LX Eos the TPs and the view zone of the start line and of the finish line. A standard FAI view zone (90°) will be assigned to all intermediate TPs.
The user can later change, if necessary, the view zone directly in Task page of LX Eos (see Chaper.9).

# 16 Installation of the unit

## 16.1 *Mechanical installation*

LX Eos fits in standard 57mm hole in instrumental panel so no extra cut out is required. To fit LX Eos in instrumental panel unscrew three mounting screws (black) with a screwdriver and knob of rotary switch. To remove the knob **do not use force.** Remove the press-in cover first to get to the screw. After unscrewing the screw pull off the knob. Place the LX Eos in the hole in instrumental panel and first screw in the three black screws and then put back the knob on the rotary switch. Don't forget to screw the knob in place and put the press-in cover back on.

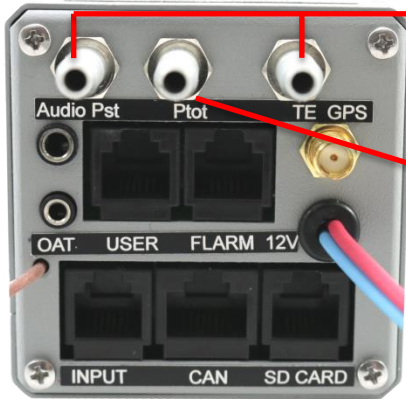## 16.2 *Pneumatic connections*

Three pressure connectors are fitted to the back of LX Eos. **A label shows their functions**.
Ptot = Pitot or Total pressure
TE = TE probe
Pst = Static

**Electronic TE compensation schematics (Set TE 100%)**



TE… Static
Pst… Static
Ptot… Pitot or Total pressure

**TE tube installation schematics (Set TE 0%)**
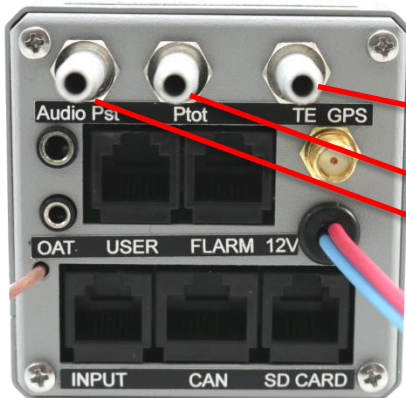


TE... TE probe
Pst... Static
Ptot... Pitot or Total pressure

## 16.3 *Electrical installation*
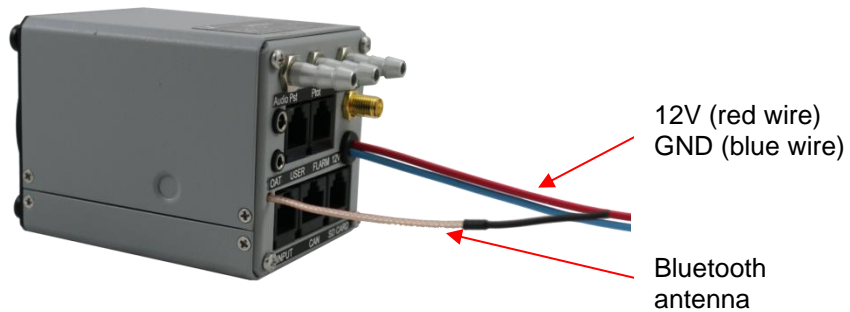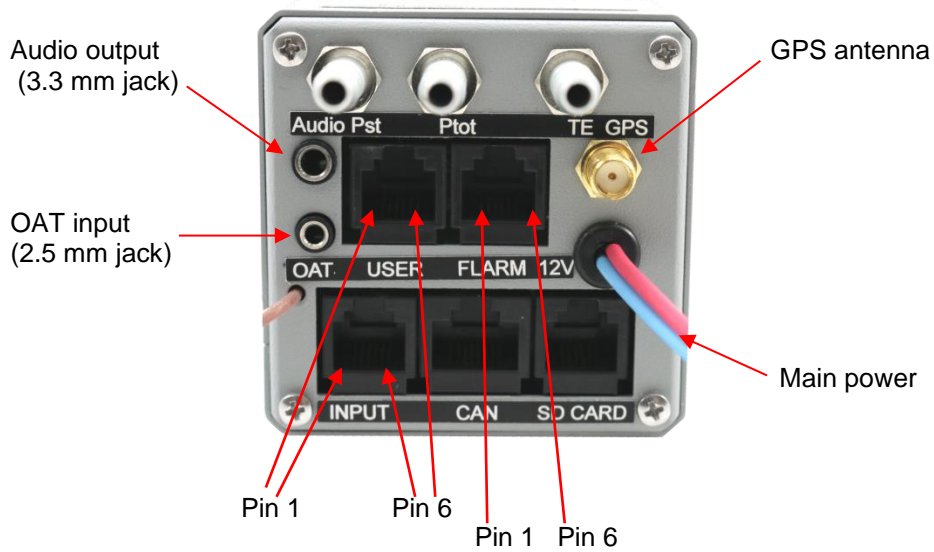


**Pin out on all connectors:**
**Pin 1 to pin 6 or 8 (on picture from left to right).**

**User port (RJ11 – 6pin connector)**

| Pin number | Description |
|------------|-------------|
| 1 | 12 V out |
| 2 | 3.3 V out (max 100 mA) |
| 3 | 5 V out (max 500 mA) |
| 4 | RS 232 data in |
| 5 | RS 232 data out |
| 6 | GND |

**Flarm port (RJ11 – 6pin connector)**

| Pin number | Description |
|------------|-------------|
| 1 | 12 V out |
| 2 | Not used |
| 3 | GND |
| 4 | RS 232 data in |
| 5 | RS 232 data out |
| 6 | GND |

**INPUT (RJ11 – 6pin connector)**

| Pin number | Description |
|---|---|
| 1 | Input 1 |
| 2 | Input 2 |
| 3 | Input 3 |
| 4 | Input 4 |
| 5 | Input 5 |
| 6 | Common ground (GND) |

**CAN port (RJ45 – 8pin connector)**

| Pin number | Description |
|---|---|
| 1 | 12 V |
| 2 | 12 V |
| 3 | 12 V |
| 4 | CAN_L |
| 5 | CAN_H |
| 6 | GND |
| 7 | GND |
| 8 | GND |

**SD port (RJ11 – 6pin connector)**

Use only LX SD card adapter.

**GPS antenna**

Connect external GPS antenna to this connector. LX Eos must have external antenna connected all the time, else internal flight recorder will now work.

## 16.4 *External switch installation*



Common ground

Up to five external switches can be connected to LX Eos. To connect external switch to LX Eos you have to use external switch interface board (included in package). Every slot available has a signal input and ground input. The configuration of inputs can be set under Setup -> Inputs.

User can use two different connection styles:
**- 2 wire connection**: Connect switch signal and ground wires to interface board.

**- 1 wire connection**: Connect switch ground wire to glider common ground and connect switch signal wire to interface.
Be careful not to connect signal wire to common ground input (see picture which are common ground inputs)
Interfaces common ground is connected to glider common ground via power supply cable (GND).

All inputs except SC will be "active" when switch is closed (signal and ground are in short circuit). If "Inv" (Invert) is checked on input setting then "active" means when switch is open.

Example: airbrake warning will be active when switch is not closed and Eos is in flight mode. Warning will disappear when switch will be closed.

SC input has its own setting under Vario/SC menu and can be set to be active on "on", "off" and "toggle" state.

Example of both connections (1 and 2 wire)
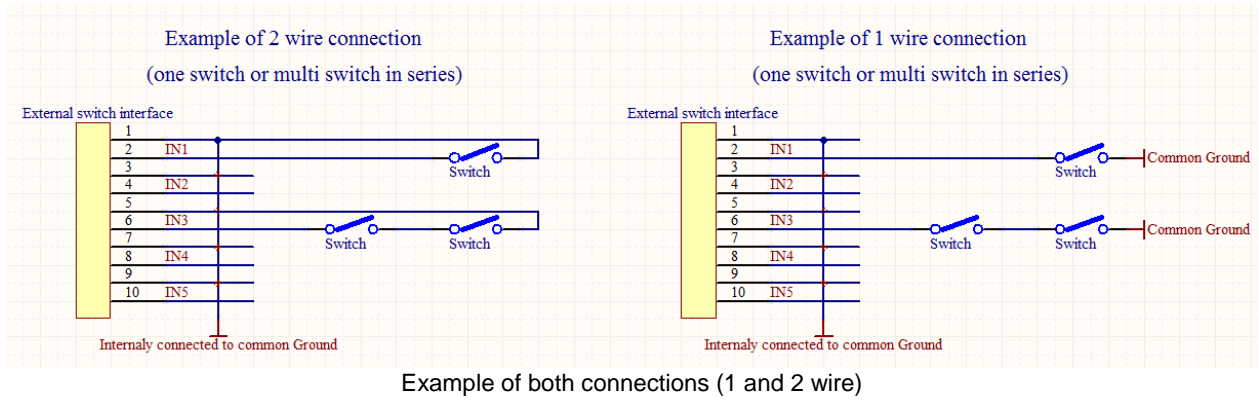
## 16.5 *Installation of options*

LX Eos is compatible with all LX CAN based devices (LX Zeus, LX Joy, LX Eos Repeater, CAN Compass, AHRS, and others). LX Eos has an integrated CAN terminator so other terminator should not be used. Only one CAN terminator should be used (be careful when using LX Eos with LX Zeus).



## 16.6 *Configurations*

### 16.6.1 LX Eos – OUDIE



OUDIE        LX Eos PNA Power & Data        LX Eos

### 16.6.2 LX Eos – Flarm



Flarm / RedBox
MiniBox / Flarm Mobile
FlarmMouse

LX Flarm
spliter

LX Eos        Flarm Colour Display II (optional)

## 16.6.3     LX Eos – Flarm – OUDIE



OUDIE      LX Eos PNA Power & Data      LX Eos

1:1

1:1
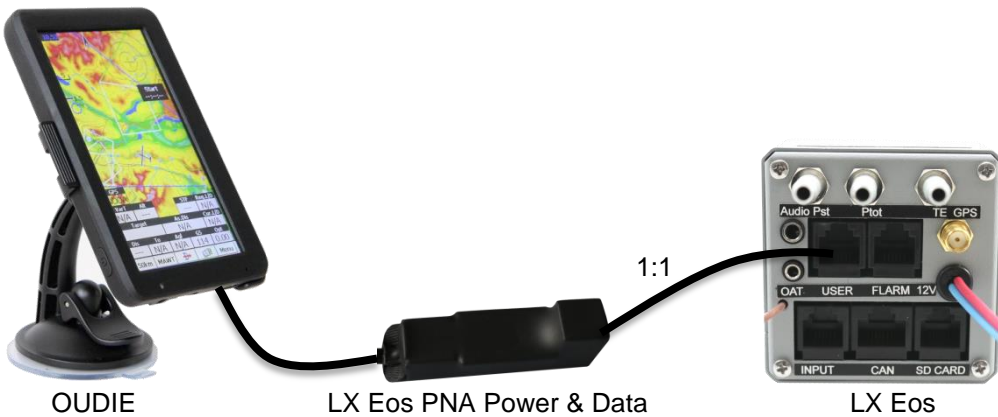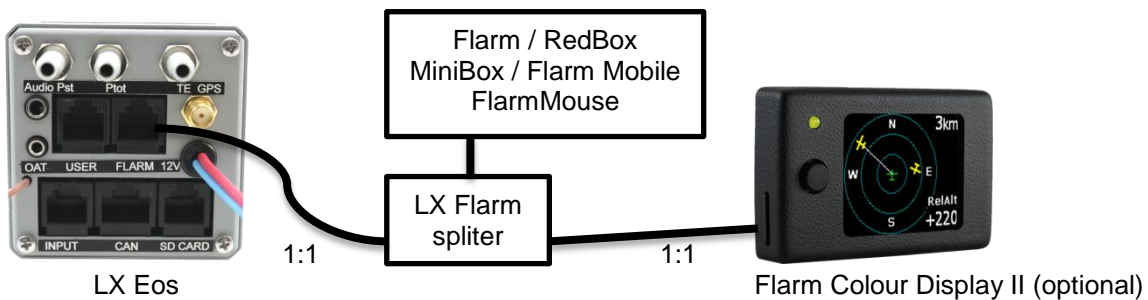
Flarm / RedBox
MiniBox / Flarm Mobile
FlarmMouse
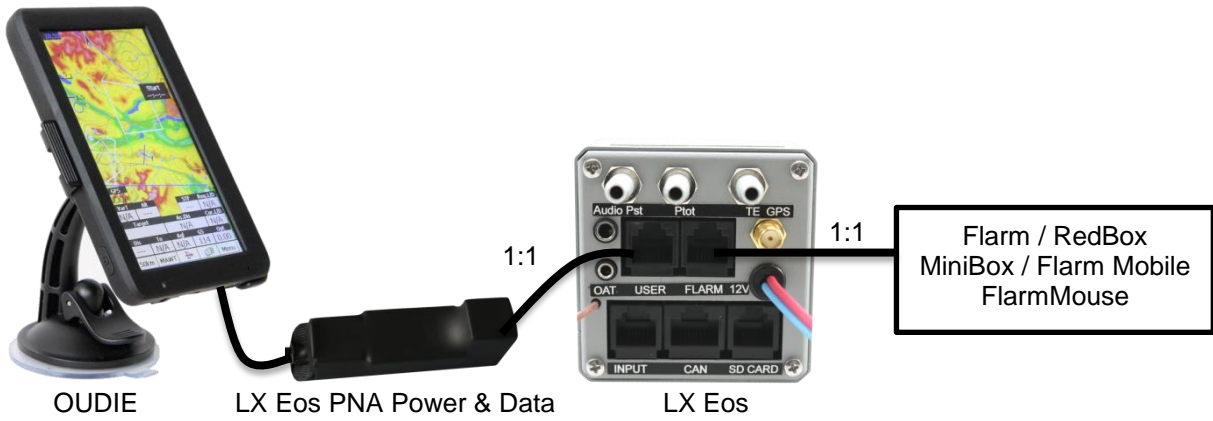
## 16.6.4     LX Eos – Flarm – OUDIE – 2$^{nd}$ seat –2$^{nd}$ OUDIE



OUDIE      LX Eos PNA Power & Data      LX Eos

1:1

1:1

Flarm / RedBox
MiniBox / Flarm Mobile
FlarmMouse

Bluetooth connection

OUDIE      LX Oudie Power      LX Eos Repeater
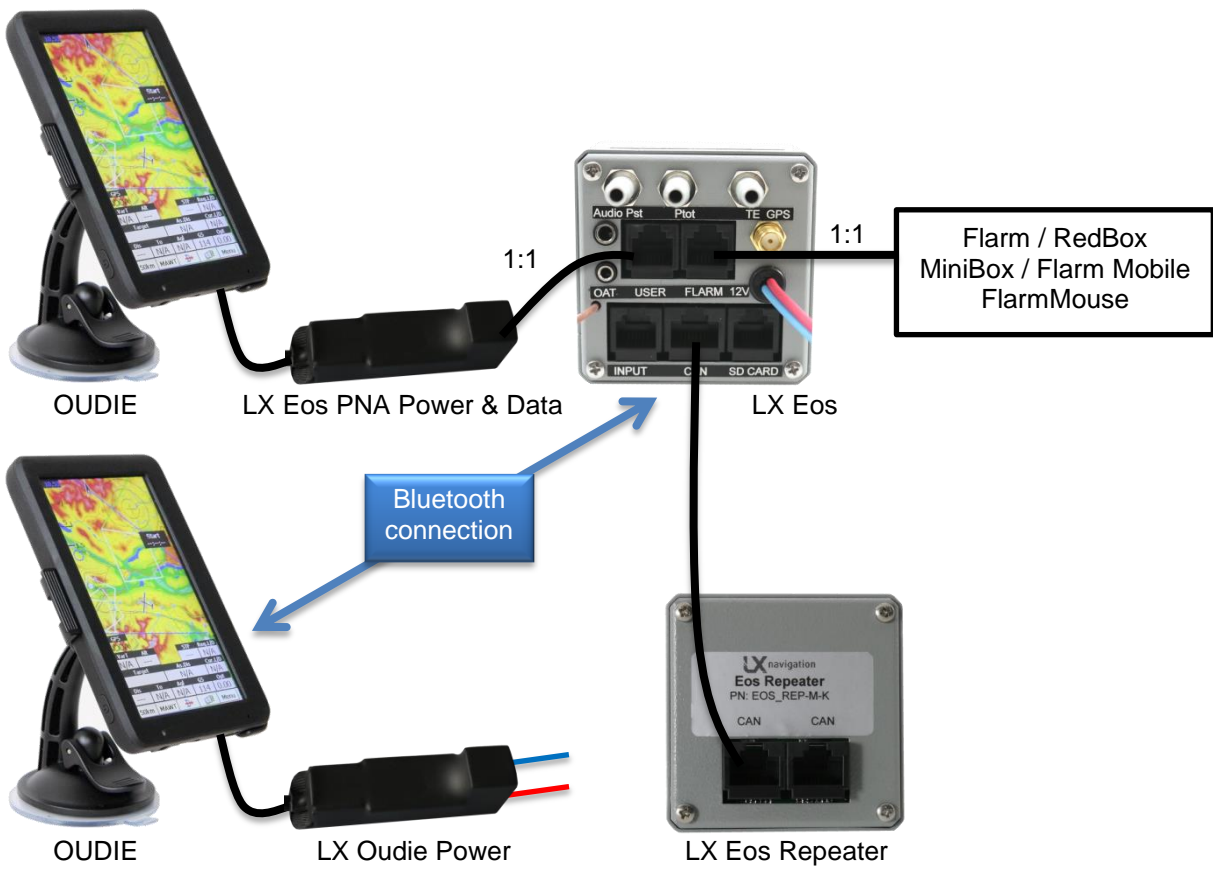
## 16.6.5 Wirings for radio

# Funkwerk ATR833
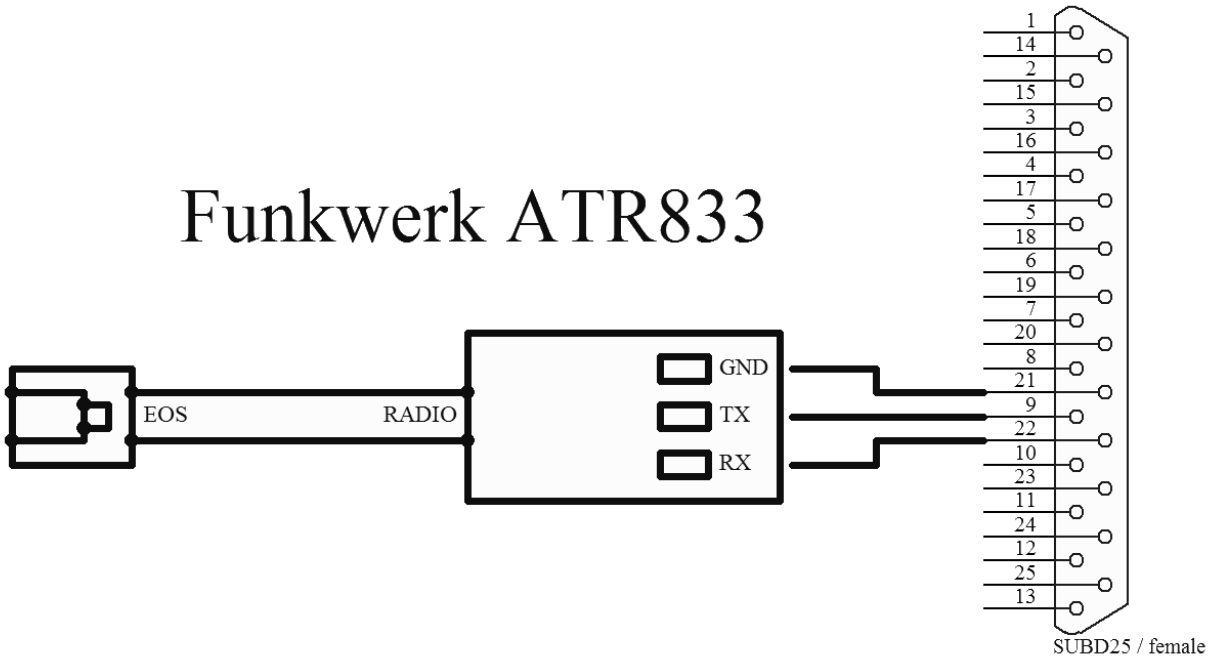


# Dittel KRT2

# 17 Flight Recorder Management

The flight recorder doesn't need any special care as it works nearly automatically without pilot assistance. All the pilot should do is to adapt the logger settings, see the Setup page / Logger menu chapter.

## 17.1 *Start and Stop of flight recording*

The unit will start recording immediately after start conditions are met. Start conditions are based on ground speed and altitude change, so even if the GPS status is bad during takeoff, the unit will start recording.
It is recommended to switch the unit on a few minutes before takeoff. This will ensure a straight base line of baro trace (IGC regulation). Running time before takeoff will not reduce memory space of the flight recorder, due to circular recording before takeoff.
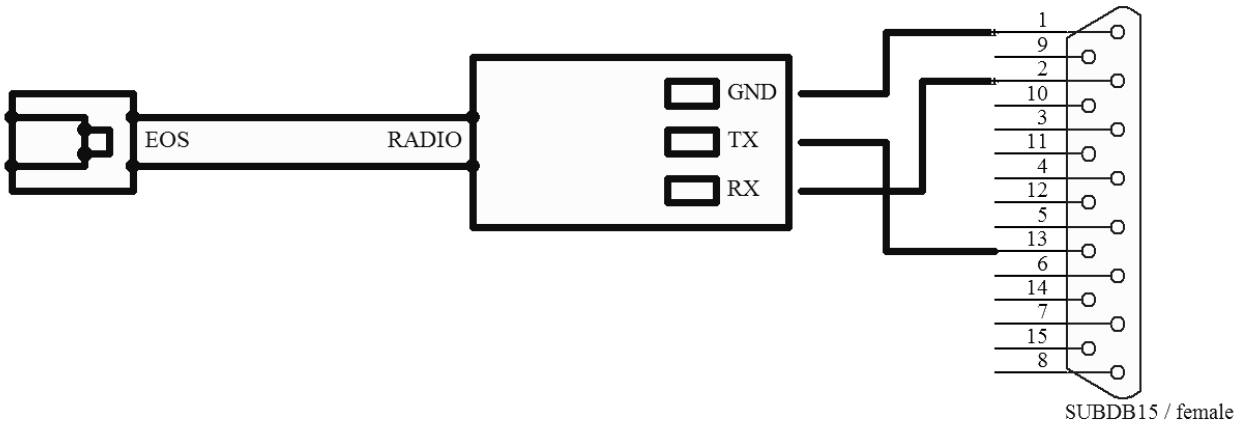After landing the unit will close the flight after approximately 10 minutes at standstill, so it is recommended to keep the unit under power and GPS OK until the Calculating Security message appears on the display. To determine if the flight recorder has closed the flight, goto logbook/statistic page. If the Logbook appears, the recording has finished, if the statistic page appears, the recorder is still active.

## 17.2 *Flight evaluation*

To check the flight data integrity use the IGC shell program. IGC shell is an IGC freeware program specially designed to verify the flight record integrity. Use the latest LXN.dll file to validate LX Eos flights. Latest version of LXN.dll is available on http://www.lxnavigation.com/software/

# 18 IGC file structure

IGC flight record file is text file, meaning the data are simply readable by any text editor.
Example of an IGC flight is printed below:

```
ALXNQ8QFLIGHT:2                    ◄──────────────  Recorder Sn. and flight number
HFDTE080115                        ◄──────────────  Date of the flight
HFFXA015
HFPLTPILOTINCHARGE:NIK SALEJ
HFCM2CREW2:
HFGTYGLIDERTYPE:LAK19-15
HFGIDGLIDERID:
HFDTM100GPSDATUM:WGS-1984
HFRFWFIRMWAREVERSION:1.00
HFRHWHARDWAREVERSION:1.00
HFFTYFRTYPE:LX Eos
HFGPS:uBLOX-LEA-6S,50ch,max50000m
HFPRSPRESSALTSENSOR:INTERSEMA,MS5607,max12000m
HFCIDCOMPETITIONID:
HFCCLCOMPETITIONCLASS:
I043638FXA3940SIU4143GSP4446ENL    ◄──────────────  ENL enabled
C110509143109110509000100
C4619767N02003217ESZATYMAZ
C4622930N02015629ETSKSTART
C4619767N02003217ESZATYMAZ         ◄──────────────  Flight declaration data as C record
C4619767N02003217ESZATYMAZ
F093156023111041307173223025
LLXNORIGIN0926594619153N02003303E
B0926594619153N02003303EA0006900091007000    ◄──  B records as position records
B0927054619153N02003303EA0006800091007000
B0927114619153N02003303EA0006800091007000
B0927174619153N02003303EA0006900093007000
B0927234619153N02003303EA0006800093007000
B0927294619153N02003304EA0006900093007000
B0927354619153N02003304EA0007000093007000
B0927414619153N02003304EA0007000093007000
B0927474619152N02003304EA0007000091007000
B0927534619153N02003304EA0006900091007000
B0927594619152N02003304EA0006800091007000
B0928054619152N02003304EA0006800091007000
B0928114619152N02003304EA0006800093007000
B0928174619153N02003304EA0006800091007000
G33069178E3C800E8CE815DD7F0D6968983E2BC0F44C3DC20645F06CC9F78E84
GAF5B28F33E76C8DC5C105CB2B168472106BA50860B3DC93F72D9439C9B371975
G43221B
```

G record is a digital signiture, ensures data integrity
and is always the last record of the flight

# 19 Baro trace check (calibration)

Each flight recorder should be periodically checked to verify that the built-in pressure sensor is still in limits. The procedure is extremely simple and takes only minutes to finish. The most important action is setting the Rec. interval in Logger Setup to 1 second otherwise the trace will not be uniform. The procedure is as follows:

-Turn the unit on and put it into the pressure chamber.
-Set QNH 1013mBar conditions in the chamber.
-Apply a pressure jump to start recording.
-Climb apr. 4m/s and make a stop for apr. 30 seconds every 1000 m.
-After reaching 8000m sink apr. 4 m/s and make stops after every 1000m.
-After reaching zero open the chamber and wait for 1 min then manually end flight.
-Download the "flight" from the logbook.
-Return Rec. Interval setting to previous value.
-Print baro trace using your preferred PC program, for instance Lxe (available on www.lxnavigation.com).

# 20 Flying with LX Eos

To get the best out of the LX Eos, it is important that some preparation is done prior to the flight – trying to configure the instrument or set up a task while flying the glider may spoil your whole day! Preflight preparation will ensure that the flight will be both successful and enjoyable.

## 20.1 *Flight preparation on ground*

- Check if you have desired TP data base uploaded.
- Prepare a task.
- Enter flight recorder information (pilot name, surname, glider type,  recording interval…).

### 20.1.1    Before take off

- Switch the unit ON at least 3 minutes before take-off (this will ensure sufficient GPS reception and will create a base line of the baro trace).
- Select correct pilot (many settings belongs to pilot) on initial setup or create new.
- Check task if it is correct after using of Task stup**.**
- The actual  task during take-off will be declared in flight recorder automotically.

## 20.2 *During flight*

The LX Eos HW and SW concept is so far optimized that the pilot doesn't spend too much time to operate the unit during flight. A very significant indication that shows that the unit has changed to flying mode is Logbook replacement with statistics page.

### 20.2.1    Set QNH

The pilot should input actual QNH value of the airport where he will take-off. This action should be carried out on ground, after take-off, change of QNH in Setup/QNH Res menu will adjust altitude reading to actual QNH setting.

### 20.2.2    Wind calculation

LX Eos is able to measure wind under two different methods. Wind calculation results are shown on main vario page and on thermal assistant page. LX Eos will switch between straight and circling method automatically and history of wind will be counted in new measurements.

**Circling:**
Calculation is based on ground speed (GS) oscillation due to wind influence in circling. The method is active exclusively during climbing process. The process start automatically after circling is detected. The method is based on fact that the ground speed is affected by wind. GS is maximal by tailwind and minimal by head wind. This phenomenon is used by GS difference calculation method.

**Straight flight:**
On straight flight, wind will be calculated with use of iterative method which is based on IAS, GS and TRK measurements.

### 20.2.3    Influence of wind in final glide

The actual wind data (speed and direction) influences the final glide calculation. In task mode the final glide indication is based on remaining distance over all TP until finish (not over already flown turn points). Wind influence for individual legs is based on current wind data.

### 20.2.4    Event function

User has option to set one of the user inputs to Event. If event switch is pressed during flight, it will enable faster record interval in flight recorder (recording in shorter intervals as default for a limited time). Event parameters can be set in Setup/Logger on LX Eos unit. The action is accompanied with a clear message.

### 20.2.5    Task start

It is started automatically when glider leaves start TP observation zone. Navigation to next point will start. If pilot wishes to navigate back to starting point, he must simply use "Goto" option in task setup menu. Please refer to Task page chapter.
No task statistic is available on LX Eos.

## 20.3 *After landing*

It is recommended to keep the instrument ON for a few minutes after landing. This will ensure base line of baro trace.
10s after landing is detected, statistic page will be shown automatticaly where 10min countown can be seen. Pilot can wait for 10min of press enter to end flight. Calculating security message will follow and then logbook will be offered to the pilot. At this point unit can be switched OFF or flight download process can start.

### 20.3.1    Downloading flights

Insert micro SD card to external micro SD card holder. Select logbook page and search for a flight that you wish to download. Press enter on that flight and select Copy option. Progress bar will inform pilot when flight is copied to external SD card. File format of flight is .IGC.

# 21 Revision history

| Date | Version | Changes |
|------|---------|---------|
| 9.2.2015 | 1.1 | - corrected pinout on Flarm and user port.<br>- GPS antenna connector description.<br>- hardware specification added.<br>- max number of TPs imported in unlimited.<br>- added wind calculation paragraph |
| 11.3.2015 | 1.2 | - small text corrections.<br>- added TA beep under Vario/SC menu.<br>- added SpeedToFly, Vario relative, FG, Distance options under Indicators menu.<br>- added Load TSK under SD Card menu<br>- added gear and airbrakes input<br>- added input warning under Warnings menu<br>- added KTR2 support under NMEA menu.<br>- Load TP chapter has warning based on large CUP TP base import.<br>- added external switch description and connection diagram for 1wire and 2 wire connection.<br>- added Bluetooth module chapter.<br>- added User port chapter.<br>- added Configurations chapter.<br>- when using select option for TP, number of TPs found is displayed on header.<br>- task distance with task type is shown under TASK SETUP |
| 14.5.2015 | 1.3 | - Updated Flarm radar page.<br>- changed TA page layout.<br>- added Flarm options under Voice menu. |
| 16.5.2015 | 1.4 | - Max beep is found under Vario/SC menu.<br>- TP and TSK are displaying final glide with bigger numbers.<br>- Added Flarm warning chapter.<br>- added password for user settings under Setup/Pilot<br>- user settings can be imported/exported to/from SD card under Setup/Pilot menu.<br>- added audio player password |
| 21.8.2015 | 1.5 | - user can control volume in vario mode and SC mode independently. Mode is written down on Volume control box.<br>- added password 66666 - clear actual task.<br>- added password 55555 - clear TP database.<br>- input can be inverted in case of inverted switch - active open state.<br>- non directional object is shown on Flarm radar as red circle.<br>- ADSB objects are displayed as green triangles on Flarm radar.<br>- setup menu on TA page.<br>- removed TA beep setting from Vario/SC menu.<br>- removed Auto TA setting from Page menu.<br>- audio frequency (negative, zero and positive) can be set under Vario/SC menu.<br>- added "Upload Task on LX Eos" chapter.<br>- added Wiring for radio chapter. |