LX Salus

Digital ASI, altimeter, climb rate indicator and simple navigation with internal backup battery.

User's manual
(version 1.4)

Refers to LX Salus FW version 1.4

Index

1 Introduction

The LX Salus is "all-in one" ASI, altitude, rate of climb indicator, simple navigation system with internal backup battery and audio warnings. LX Salus has built in high precision digital sensors based on latest MEMS technology for altitude, vario, IAS and G-force. All sensors are sampled with more than 100Hz sample rate. All real time data is shown on its indicator. IAS 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.

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 Salus features are:
- Extremely bright direct sunlight readable display.
- Integrated G-meter.
- 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 air data acquisition.
- Rotary knob with push function, for simple and effective handling.
- Internal beeper for warnings (altitude, Vne, stall).
- CAN Bus, for connection to other devices.
- External SD Card interface, for firmware updates.
- Standard 57 mm size.
- Built in rechargeable battery serves for up to three hours of autonomy.
- Charging of battery is realized via main power.

Functions:
- Altimeter.
- IAS / TAS indicator.
- Rate of climb indicator.
- Simple navigation to WP and RTE.
- System extensions: remote control operation (LX Joy), LX NavBox, other Indicators(IAS, Rate of climb, Altimeter)...
- Logbook.
- Flight information with Barograph.
- Accurate wind calculation.
- AHRS indicator when external AHRS module is connected.

Later in manual "backup mode" will be written from time to time. Backup mode is when system loses main power. LX Salus will use internal backup battery to continue working. All functions of LX Salus are operational in backup mode so pilot can safely navigate back to home.

Unit has capability to be updated to any later FW release.
Please refer to Setup/SD Card/Update, how to update the system.

1.1 *Hardware specification*

Picture shows the LX Salus unit. It is "all-in one" ASI, altitude, rate of climb indicator, simple navigation system with internal backup battery and audio warnings etc… One rotary switch with push button is used 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

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.

1.4 *Switching off the unit*

When on ground (statistic is not running), disconnect main power supply from system. LX Salus will start to count down 3 seconds before it will turn off. If you are flying (LX Salus detects IAS – indicated air speed) it will not switch off until plane has landed (IAS is 0).

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.
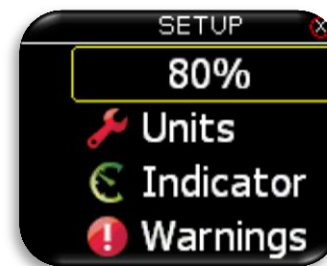

Exit at the bottom.

Exit at the top.

Value can't be change (white frame).

Value can be changed with rotary switch (yellow frame).

3 Structure of main pages

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

Main page

Flarm radar page

WP navigation page

RTE navigation page

G-Force page

AHRS page **(*)**

GPS info page

Logbook / statistic page

Setup page
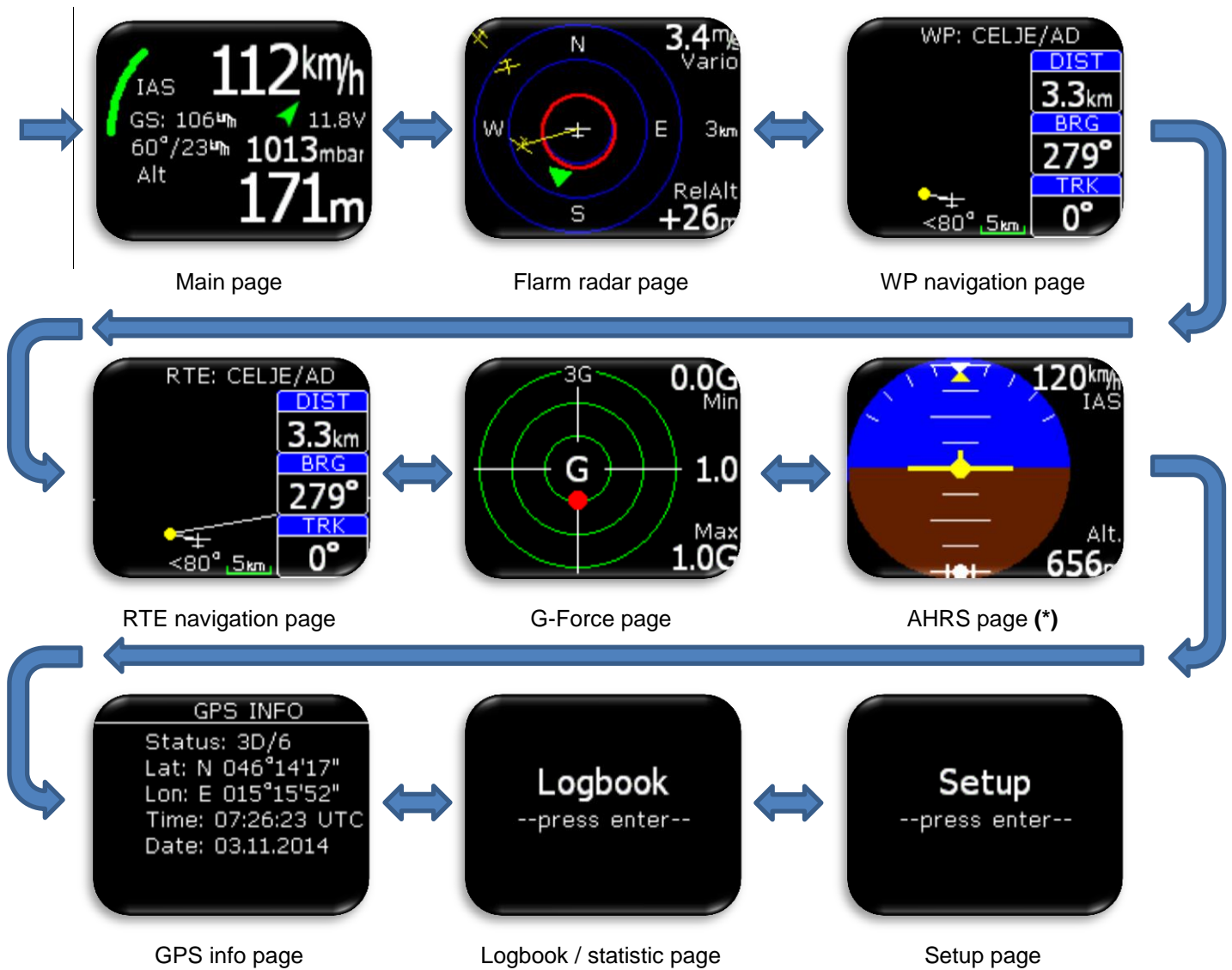
* Only when AHRS module is detected on CAN bus.

4 Main page

Main page is most commonly used page while flying. On this page lots of information can be found.
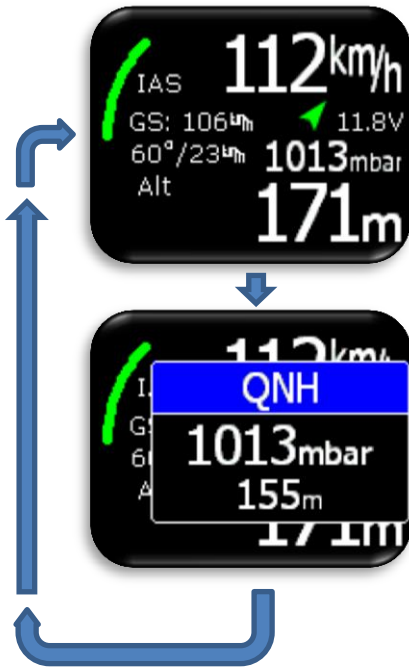
On top and bottom different values are shown. For list of all available options please refer to Setup/Indicator section.

In middle row different status icons are shown:
- Main battery indicator displays battery in volts.

- 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.

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

- Green arch is rate of climb indicator.

- Wind indicator and ground speed are displayed on the left

- On the right there is current QNH value

With press on enter button, pilot can change QNH. To exit from sub option, press enter again or wait for 2s and main page will be active again. To change QNH use rotary switch.

Configuration with LX Joy:
When LX Joy is connected to LX Salus, up/down keys will change QNH settings.

5 Flarm radar page
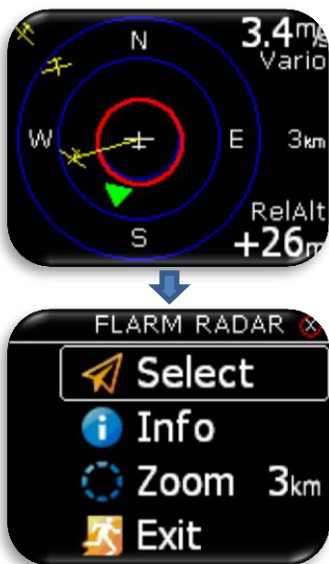
The graphic display is divided into 2 or 3 circles (depends on zoom setting). Last circle represents zoom distance. The white glider symbol is always positioned in the middle of the screen and shows the current position of the plane.
Near gliders are displayed as yellow. All gliders located in radio 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 Salus, up/down keys will change zoom settings on Flarm radar page.

5.1 *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.

5.2 *Flarm Info*

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

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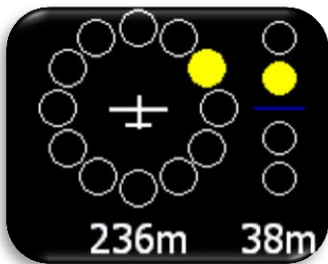
When flarm warning is detected, Salus will show Flarm warning page with direction, above/bellow indicator and numerical information for distance and relative altitude.

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

6 WP navigation page

This page can be used for simple navigation to waypoint (WP). Before this page can be used, pilot must import WPs from external SD card (.CUP file) to internal WP database. How to import WPs, please refer to section Setup/SD Card/Load WP. WP 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".
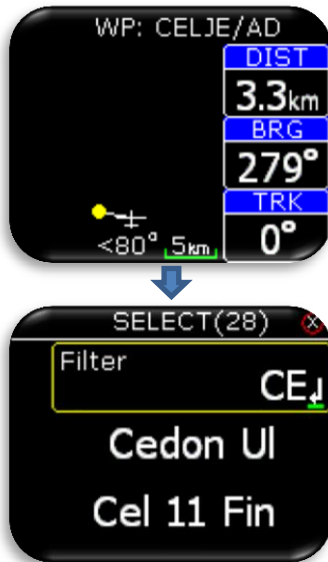
On the top of this page pilot can find name of navigated WP. Navbox-es show track (TRK), bearing (BRG) and distance (DIST) to selected point.

Under the plane, steering symbol information will give pilot information for how many degrees (°) does he need to correct his track to fly directly to the point.

Pilot can select a WP, to which he would like to navigate, with press on enter button.
On header, number of WPs found, is reported in brackets.

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

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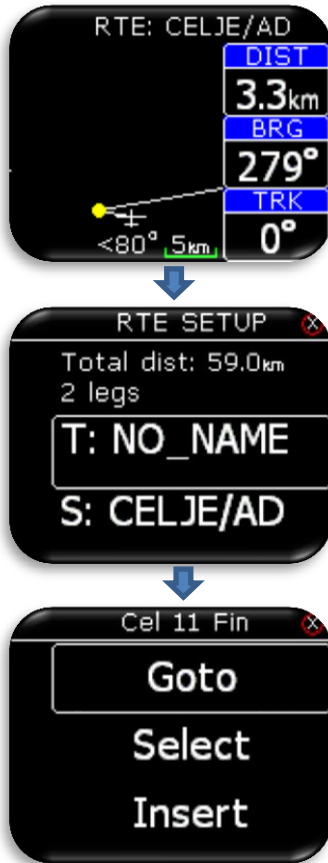
Selected point is saved after power reset.

Configuration with LX Joy:
When LX Joy is connected to LX Salus, up/down keys will change zoom settings on WP page. In configuration without LX, zoom change is not possible!

7 RTE navigation page

This page can be used for simple navigation on predefined route (RTE). Before this page can be used, pilot must import WPs from external SD card (.CUP file) to internal WP database and set a route in RTE SETUP. Alternatively you can import already prepared route. For this please refer to section Setup/SD Cards/Load RTE. How to import WPs, please refer to section Setup/SD Card/Load WP. Navigated route WP is displayed as yellow dot and white line from dot to plane is showing direction in which the pilot should fly. White line from dot will show next leg of route. Navigation is always "track up".

On the top of this page pilot can find name of navigated WP. Navbox-es show track (TRK), bearing (BRG) and distance (DIST) to the navigated point.
Under the plane, steering symbol information will give pilot information for how many degrees (°) does he need to correct his track to fly directly to the point.

Configuration with LX Joy:
When LX Joy is connected to LX Salus, up/down keys will change zoom settings on RTE page. In configuration without LX Joy, zoom change is not possible!

Pressing enter, "RTE SETUP" is activated where route WP can be added, selected or removed from route. WP database must be first uploaded using Setup/SD Card/Load WP option.
On first row route total distance with number of legs is displayed.

Additional options:
- Goto: Navigate to that point on route.
- Select: Select new point. See WP select.
- Insert: Insert new point before selected one.
- Delete: Delete this point.

8 G-Force page

During the flight red dot of G-force page is showing current detected G-force. On right top and bottom corners, minimal and maximal detected G-force during the flight are displayed. This values can be cleared anytime during the flight in G-FORCE menu. In the middle, current G-force value is displayed. Range setting is presented with small text on top of G-force scale (example is showing 3G range). This range can also be set in G-FORCE menu.

To enter G-FORCE menu, press enter on G-force page.

- Set range of G-force scale.
- Clear min/max values to 1.0G.

Configuration with LX Joy:
When LX Joy is connected to LX Salus, up/down keys will change G-Foce range.

9 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.

10 Logbook / statistic page

10.1 *Logbook*

On the ground (IAS = 0km/h) logbook can be accessed by pressing enter on logbook page.

Last 50 flights are listed. Any older flights will be erased from logbook list.

10.2 *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.

11 Setup

Under setup, pilot can set all parameters of the unit.

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

- Set brightness of LCD backlight.

- Set units.

- Set displayed values on main page (upper number, lower number...)

- Set displayed / processed warnings.

- Access to SD card functions.

- Enable / disable main pages.

- Access passwords protected functions.

- Unit information.

- Turn off device.

![LX navigation logo]

11.1 *Brightness*

Pressing enter on "Brightness", pilot can change LCD backlight brightness.
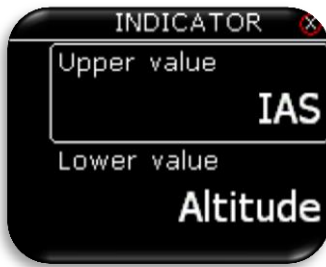
11.2 *Units*

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

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

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

11.3 *Indicator*

Upper/ lower represents the upper/ lower numerical display indication on main page.

In both cases the pilot can choose from:
- Integrator: average climb rate value for last 20 seconds,
- Time: UTC time,
- Flight time: flight time,
- Altitude: altitude accordingly to QNH data inserted,
- Distance WP: distance to waypoint selected on WP page,
- TAS: true air speed,
- IAS: indicated air speed,
- Alt. QNH – ft: QNH altitude in feet,
- Flight level: flight level,
- G-force

11.4 *Warnings*

Warnings are used to inform pilot that some flight related data is outside margins. When warning state is detected by LX Salus, pilot will get red warning message box with description of what is outside margins.
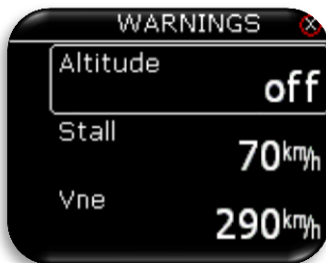
Pilot can set:
- Altitude warning: warning when flying over selected altitude.
- Stall: warning when the glider speed is lower than stall speed.
- Vne: warning when speed exceeds Vne speed.

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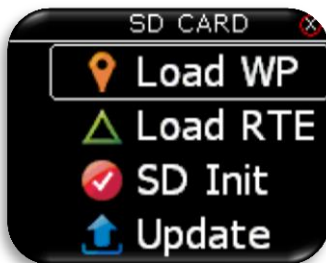
External SD card is used for all data transfers to LX Salus. In this menu all import/load functions from SD card can be accessed.

11.5.1   Load WP

After selecting "Load WP" 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 WPs to internal database.

Cup file is commonly used file for transferring WPs and routes (optionally).

LX Salus can import waypoints by name or by code.

Warning: CUP file is usually alphabetically sorted by name. LX Salus must have alpha sorted WP database or it will do it on import. If this is the case, import can take a long time (depends on number of WPs). 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 on number of WPs and alphabetical sort inside CUP file). Number of WPs is not limited but we recommend using CUP file with up to 1000 points. Name of every WP will be cut to max 11 characters after import.

11.5.2   Load RTE

After selecting "Load RTE" 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 RTE to internal memory.

After selecting file from which you wish to import route, first 20 routes found in the file will be listed. Select route you wish to import and press enter.

Warning: Due to internal route limitations, only first 18 waypoints of selected route will be loaded from file.

Wait until load is finished.

11.5.3   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.

11.5.4 Update

Pilot should copy new version to **root** of external micro SD card, then insert it into the LX Salus 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.

11.6 *Pages*

Pilot can select which main pages are active. Page is active when checkbox is checked. Default main page is always enabled. There are three main pages available:

- Flarm (Flarm radar page).
- WP (waypoint).
- RTE (route).

- G-Force.
- Gps Info (basic GPS information).

11.7 *Password*

To access some options, password is required. Available password's are:
- 46486: sets LX Salus to factory settings.
- 99999: clear all flights from logbook.

11.8 *Shutdown*

When shutdown option is selected, this screen will be showh to confirm that you wish to shutdown the device. Selecting "No" will return you back to setup menu, while selecting "Yes" will turin off the unit.

If shutdown option is selected during flight, this message will be shown. Plese finish the flight first and then turn it off!

11.9 *Info*

LX Salus info page.
Displayed information:
- Serial number.
- Software version.
- Hardware version.

12 Installation of the unit

12.1 *Mechanical installation*

LX Salus fits in standard 57mm hole in instrumental panel so no extra cut out is required. To fit LX Salus in instrumental panel unscrew three mounting screws (black) with a screwdriver and knob of rotary switch. **Do not use force** to remove the knob**.** Remove the press-in cover first to get to the screw. After unscrewing the screw pull off the knob. Place the LX Salus 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.
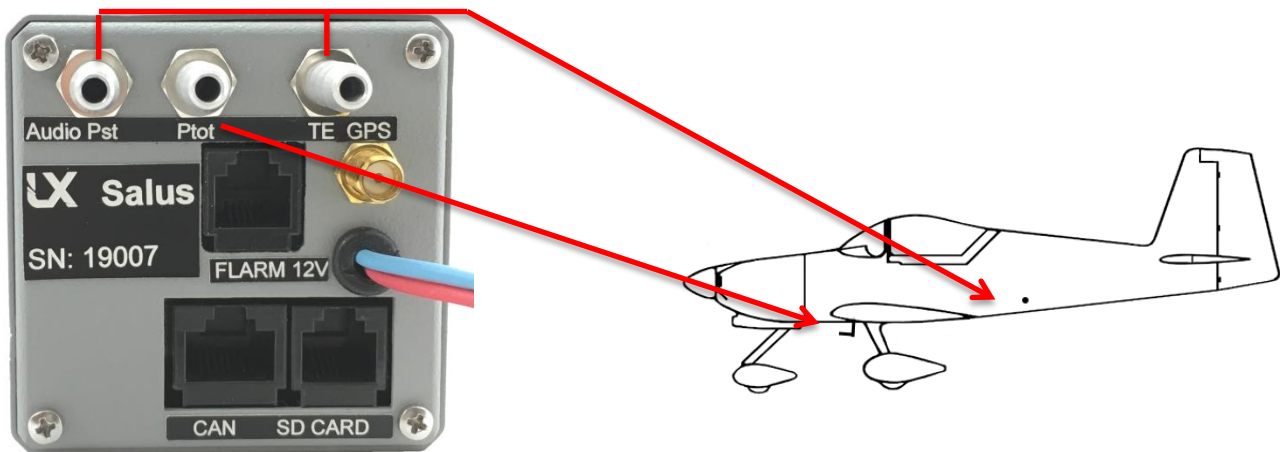
12.2 *Pneumatic connections*

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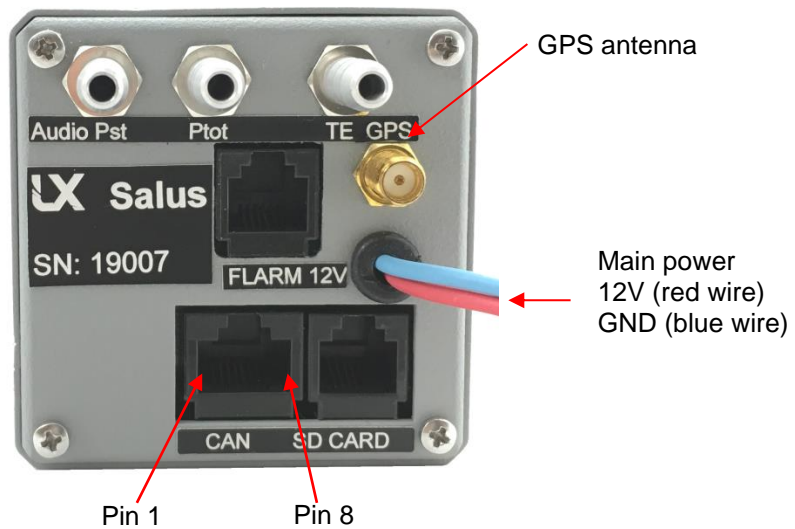Ptot = Pitot or Total pressure
Pst = Static pressure
Pst/TE = Static pressure/TE probe

![LX navigation logo]

12.3 *Electrical installation*

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

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

Flarm port – BR19200 (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

SD port (RJ11 – 6pin connector)
Use only LX SD card adapter.

GPS antenna
Connect external GPS antenna to this connector. If you want to use some LX Salus functions you should connect external GPS antenna. Unit is working without antenna (some functions are not available).

13 Flying with LX Salus

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

13.1 *Flight preparation on ground*

- Check if you have desired WP database uploaded.
- Prepare a route.

13.1.1   Before take off

- Switch the unit ON at least 3 minutes before take-off (this will ensure sufficient GPS reception).
- Check if route it is correct after using of RTE setup**.**

13.2 *During flight*

The LX Salus 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.

13.2.1   Set QNH

Change of QNH in will adjust altitude reading to actual QNH setting.

13.2.2   Route start

It is started automatically when plane leaves start WP zone. Navigation to next waypoint will start. If pilot wishes to navigate to next waypoint, he must simply use "Goto" option in RTE setup menu. Please refer to RTE navigation page chapter.
No route statistic is available on LX Salus.

14 Revision history

Date	Version	Changes
17.07.2015	1.0	- Initial user manual
17.11.2015	1.3	- Added Flarm chapter and new units has Flarm port on the back
6.1.2016	1.4	- Added G-Force page. - Added Shutdown option under Setup menu.