LX 1600

V2.10

Variometer / speedcommand system controlled by PDA, with Flarm interface

Pilot`s Manual

1 Overview

The LX 1600 has been designed from the outset as a variometer/ speedcommand system designed to operate with and be controlled by a PDA (iPAQ, for example). When connected to such equipment and when loaded with compatible operating program, and connected to a suitable GPS source, the pilot has at his command a full competition-capable flight management system that needs only one standard 57mm hole in the instrument panel! Version 2.10 makes possible to transfer Flarm data from Flarm unit via LX 1600 toward PDA.

In addition to its operation by a PDA, the LX 1600 also has four push buttons fitted coincident with the 4 mounting screws that allow the pilot to operate the vario independently of the iPAQ. These controls comprise:

- Audio Volume adjustment
- Ballast input
- MacCready input
- Altitude
- Vario Response input

The unit is available without PDA software or can be ordered as a package including software (SW).

Note!
SW packages currently available: SeeYou Mobile, FlyWithCE Navigator, Winpilot

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The LX 1600 cannot operate a second cockpit repeater. If you need this we recommend either the LX 160S or the LX 7000/7007 series.


Note!
Obligatory study PDA program manual, if the unit will work in conjunction with PDA.

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2 Functions

Because the LX 1600 is principally designed for operation with a PDA the really important Pilots` Manual is that provided by the designer of the operating software. This manual for just the LX 1600 will help you to operate the unit as a stand alone unit, or to install the unit and connect it to a PDA.

However, it will be helpful to note the controls that are provided on the LX 1600 permit its operation without PDA. These controls are mounted concentric with the mounting screws and enable to following functions to be controlled:

2.1 Controls
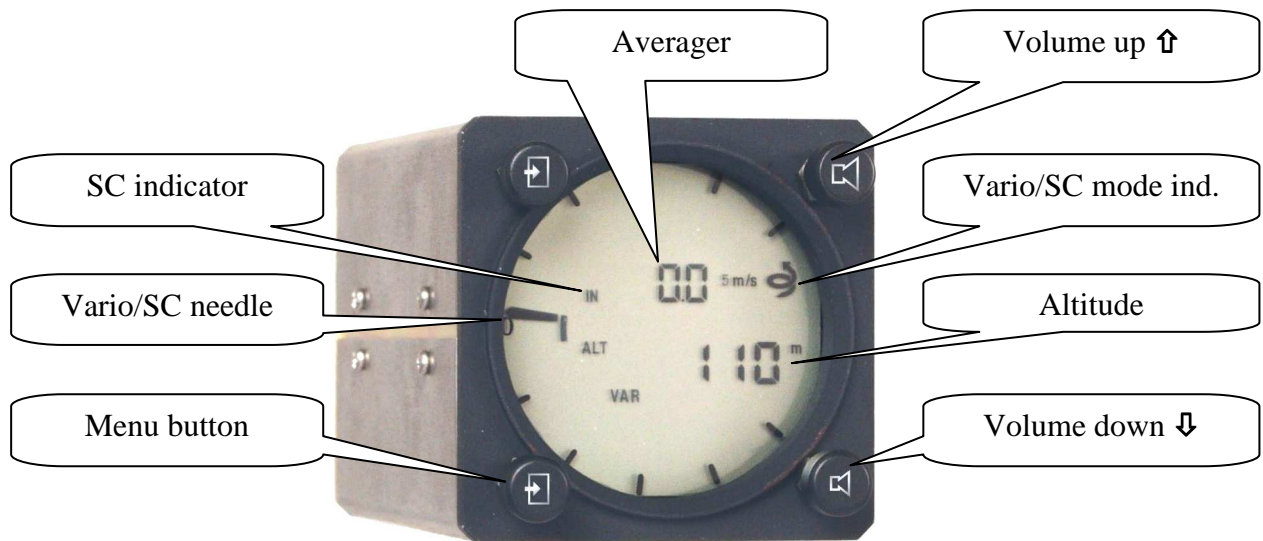
The function of the four push buttons is as follows:

- Speaker knob up to increase audio volume
- Speaker knob down to reduce audio volume
- Menu buttons (doesn't matter which is activated) will allow Mc Cready (MC), Ballast, vario filter (response), altitude and actual baudrate theat is detected from GPS source.

Press Menu button as required to find **appropriate function** and change the value using **volume up or down**.

nc   MC setting after using of vol knob
ALt   altitude adjustment *****
FiL   vario filter adjustment ******
bAL   input of ballast factor***
bAud information about detected baudrate from GPS

* Altimeter adjustment is necessary due to daily pressure changes. This value is sent to PDA, if connected. Recommended setting is field elevation. Altitude adjustment is also possible from PDA. See capture 7.

** To adapt vario needle dynamic, use filter in steps from 0.5 up to 5.0. The most effective filter is 5.0. Recommended value is 3.0.

*** Ballast input can be done exclusively after input of so called overload factor. This factor is calculated as follows:

> **Overload = pilot+glider+ballast / pilot+glider**

Overload value is 1.0, if the flight will be performed without ballast. After using of PDA any other units are possible.

All four mentioned parameters can be adjusted via PDA as well, see subsequent chapters for details.
There is no confirmation procedure after input, if no change on up/down buttons is detected the unit will change over into **main mode automatically.**

The diagram below shows in detail the function capability of the LX 1600 display. Many of these can be re-programmed by the user through the PDA and can be personalised. Use PDA program manual (SeeYou Mobile and Navigator) for details.
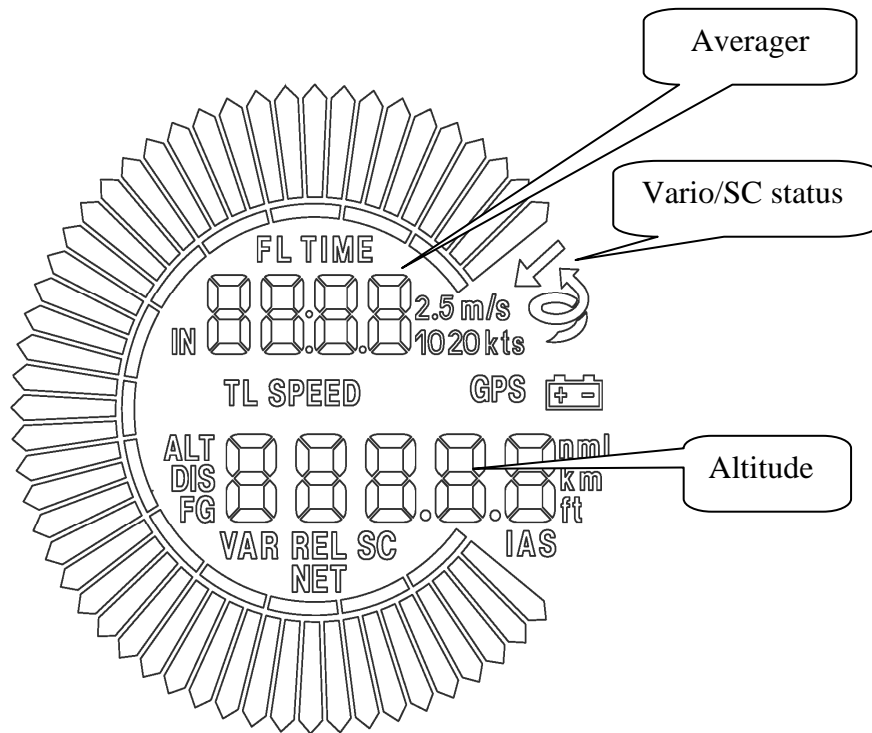

Note!
The unit wiring has a special cable with open ends (marked as SC). This can be used as an external SC/Vario command. This function is normally realized after using of a toggle switch.
*SC external switch has an absolute priority, if activated the unit will change over to SC without respect on settings defined in PDA. By external switch **not active,** PDA is able to send change over commands. Active status of the switch can be defined using of PDA settings.*
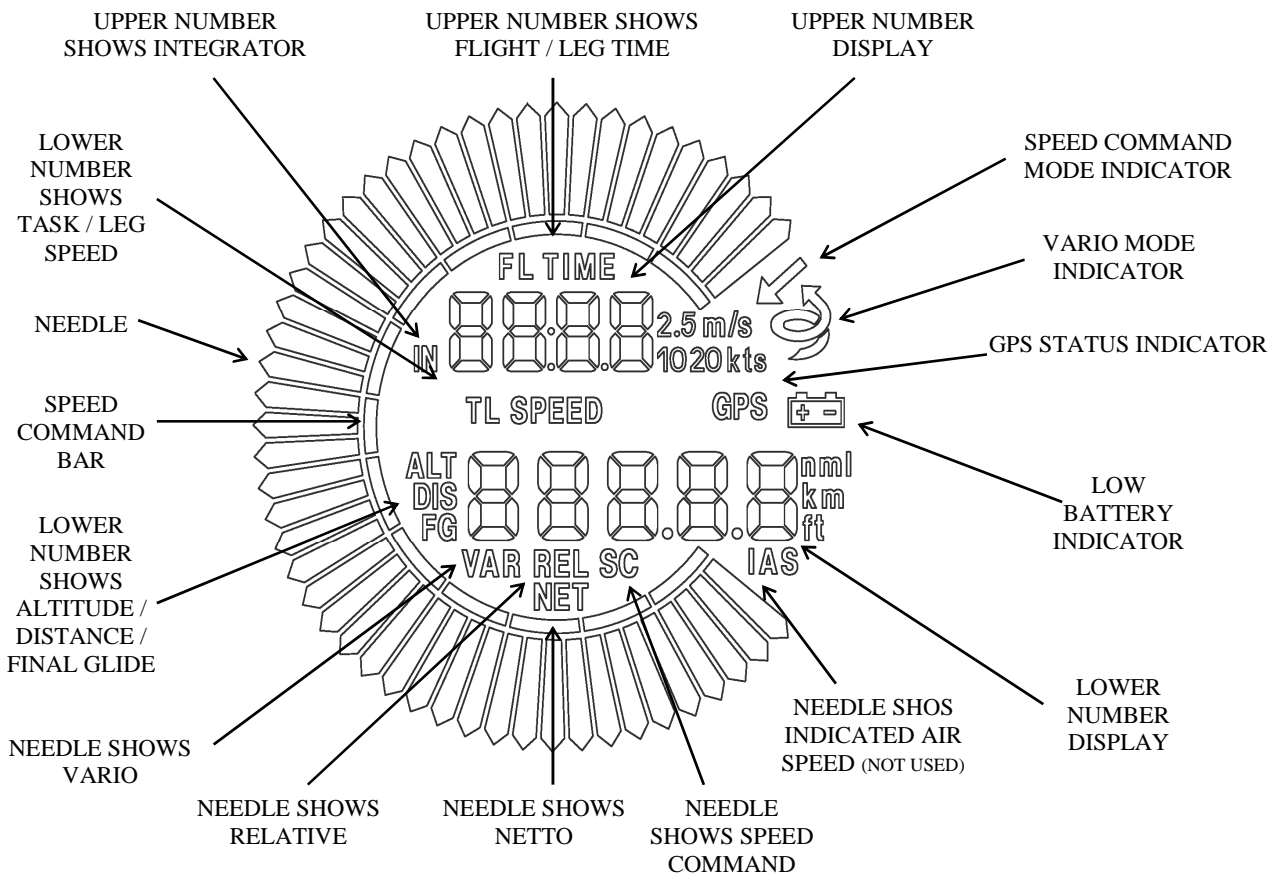
The display functions hardly depend on PDA settings. Default settings without PDA connected are described below.

Note!
The GPS status indicator has the following meanings:

GPS symbol not present   = no GPS data received
GPS symbol blinking   = GPS Bad
GPS symbol present all the time = GPS OK

2.2 Stand alone operation

The unit can be used as a stand alone electronic variometer and speed command instrument at any time. In this case only limited functions will be available and no system setting changes possible. All adjustments have to be made using the push buttons on the unit.

3 Installation

Installation is straightforward and well within the capability of most glider pilots. The following advice may, however, be helpful.

3.1 Mechanical Installation

One 57 mm diameter circular cut out is required but you need to allow for the overall dimensions of the unit which are as follows:

> 60mm   width
> 60mm   height
> 140 mm length with connectors

The unit is attached by 4 hollow bolts at its 4 corners and the positioning of these holes is the same as any other instrument of this size. The control knobs are mounted concentrically around the hollow bolts and are fixed using the internal screw.

Installation procedure

- Extend instrument fixing holes to 6.5 mm
- Remove four buttons from axis, use special tool delivered with the unit
- Remove four bolts, use 8mm tool
- Insert LX 1600 into the cut out and fix it using four bolts provided
- Check functioning of push buttons, if they are blocked or your instrument panel is too thin, place a ring (included) between the instrument and the panel to achieve the correct functioning.
- Fix all four push buttons

Note!
If some push button will block after the bolt has been turned down, it is necessary to insert additionally spring which is also delivery included.

3.2 Pneumatic Connection

There are three (3) pressure inlets on the rear of the instrument and all are clearly labelled. It is fundamental that these connections are made correctly. They are labelled as follows:
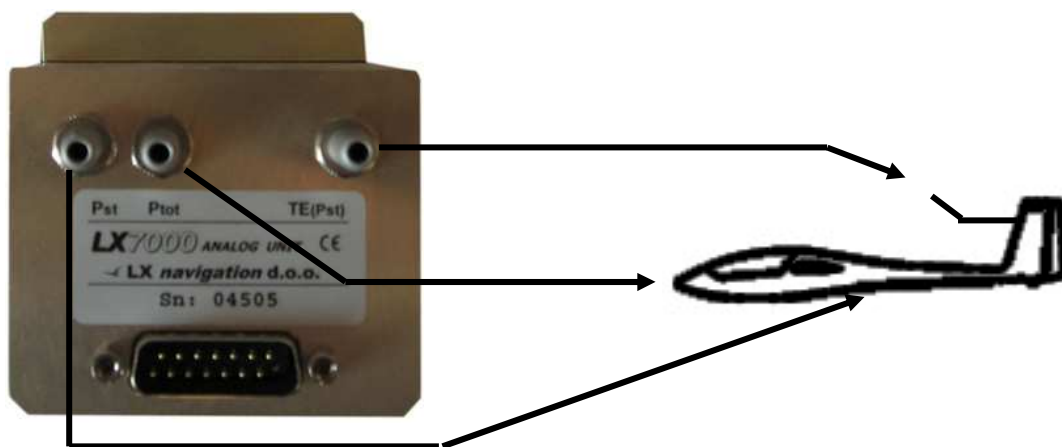
- TE (Pst)
- PSt
- Ptot

The Pst and Ptot are used by the instrument for airspeed measurement whereas TE(Pst) provides the input for the variometer.

There are 2 ways of connecting the instrument depending upon the type of installation required. One provides **TE probe compensation** and the other gives electronic TE compensation. The latter can only be achieved by the use of a **PDA** and SW. The factory setting is TE probe.

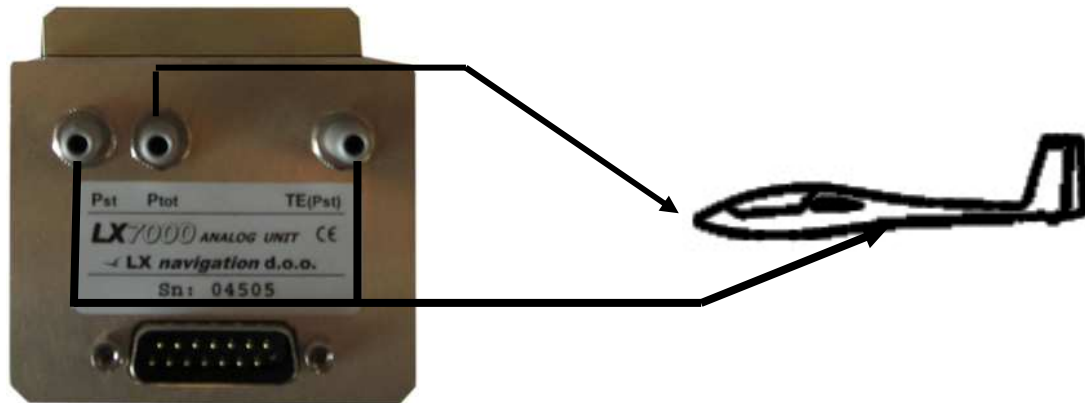TE Probe Compensation

- TE(Pst)   connect to the glider TE probe
- Pst   connect to the glider static
- Ptot   connect to the glider pitot (total pressure)

Example: TE probe connection

Electronic TE Compensation

- TE(Pst)   connect to the glider static
- Pst   connect to the glider static
- Ptot   connect to the glider pitot (total pressure)

Example: electronic TE compensation

If you select the electronic TE compensation system then you must carry out a test flight in smooth air to set it up properly. There are 2 parameters that will need to be checked and adjusted; the TE percentage setting and the vario damping (vario filter). The suggested procedure is as follows:

- Take a tow high enough to find smooth air and release
- Then accelerate up to about 100 knots and stabilise the airspeed
- Pull up at about 1.5g (no more) and observe the vario indication

If the vario indicates up during the ascent after the pull up then the compensation is insufficient. If it indicates sink then the compensation is too high. You adjust as follows:

- Increase compensation by increasing the percentage compensation (the norm is 100% but you can go above or below this)
- Decrease the percentage if the compensation needs reducing

The adjustment is carried out by using the PDA and you will need to cross refer to the PDA Manual to see how this should be done.

The vario damping (vario filter) is set to ensure that the needle response is suitable for your requirements; you may need to adjust this from time to time if you fly in different conditions where turbulence may be a factor. The damping can be adjusted by the knob on the dial of the vario or by using the PDA in which case you will need to refer to the PDA Manual to find out how this can be done.

> *Note!*
> *A very clear indication of electronic TE compensation mode is a **T** symbol in the middle of the vario display.*
> *After electronically TE Compensation has been set (exclusively possible after using of PDA), this setting will remain even during a stand alone flight, means without PDA connected.*

Electronic TE indicator
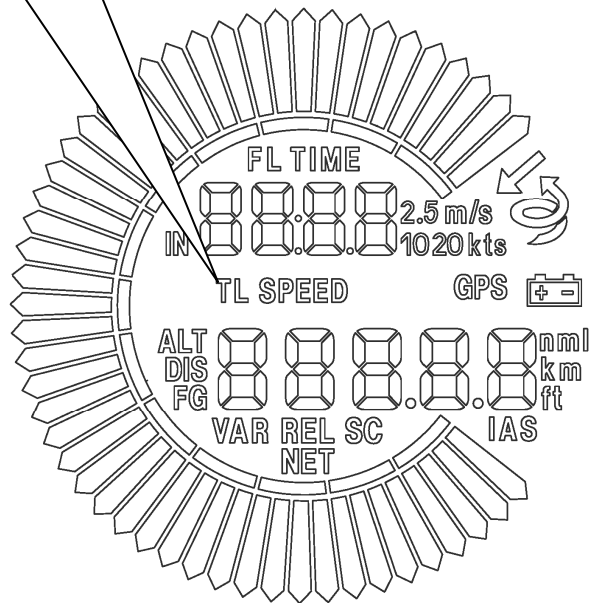
3.3 Electrical connections

The electrical connections are clearly marked and the pre-assembled cables make it very easy to connect all the components. The unit has no **ON/OFF** switch, use avionic master switch or install a separate switch.

> *Note!*
> *There is no internal fuse in the LX 1600 and you must install an external fuse with a rating of 1 amp (quick blow).*

In the LX 1600 delivery box you will find the following cables and accessories:

- Main power supply cable with speaker output and input for an external Speed to Fly/Vario changeover switch (15 P Sub D)

- Power and data cable to connect LX 1600 to the PDA (cables available for iPAQ 36,38,39,19, 22, 38, 41, 43, 51, 54 and 55.)

> *Note!*
> *LX 1600 powers your PDA with excellent 5V DC supply without any special installation works (plug and play).*
> *The type of PDA should be declared when ordering*

- NMEA input cable, open wire to connect to a suitable GPS source

> *Note!*
> *If you use any other GPS data source then the NMEA connection must be made correctly; you will need to configure the system to produce data sentences in GGA and RMC format.*

- Interface cable LX 1600 to LX 20 / Colibri

> *Note!*
> *If you are going to use a LX 20 or Colibri as your GPS source then they can be connected very easily by using the cable supplied that is "plug and play" ready, for power and data.*

- Loudspeaker
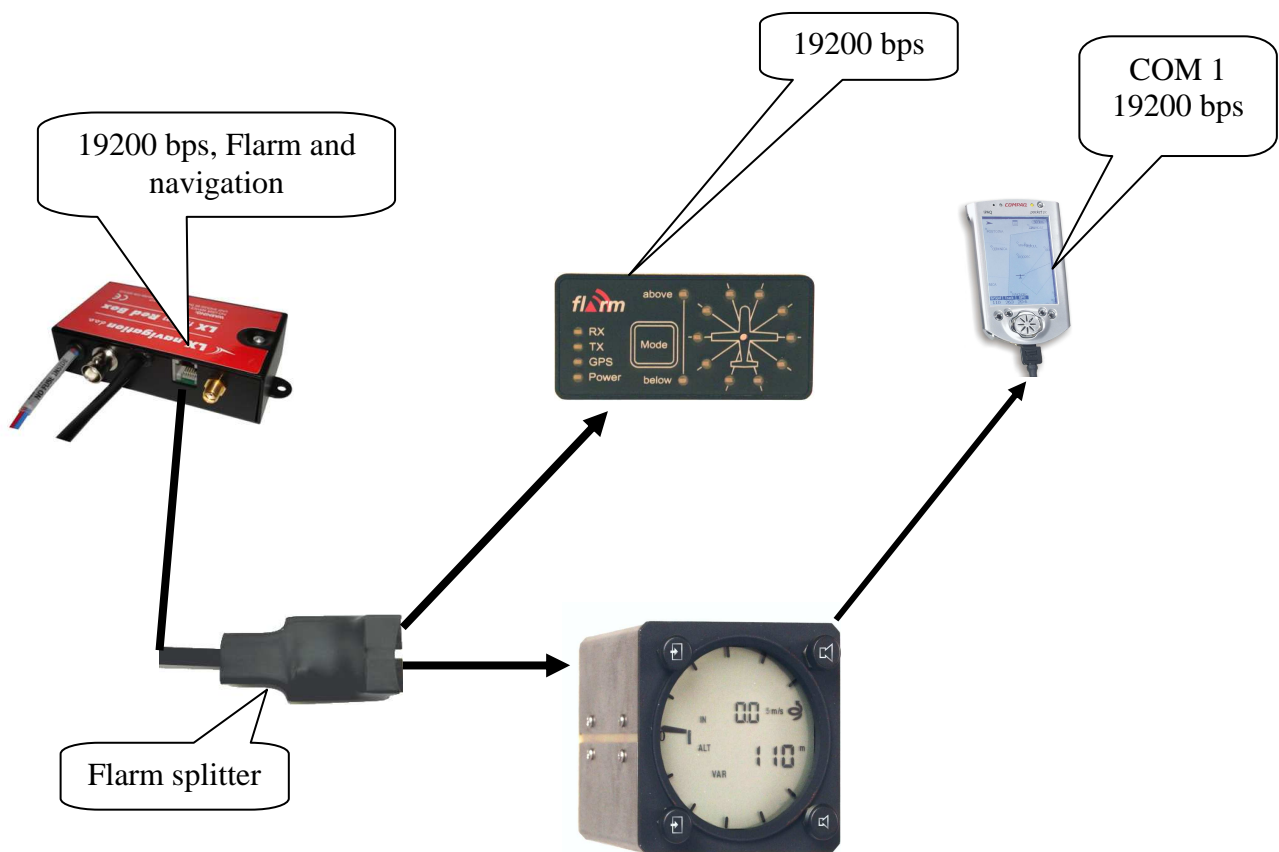- Tool for push button removal and refastening

3.4 Connection Diagrams

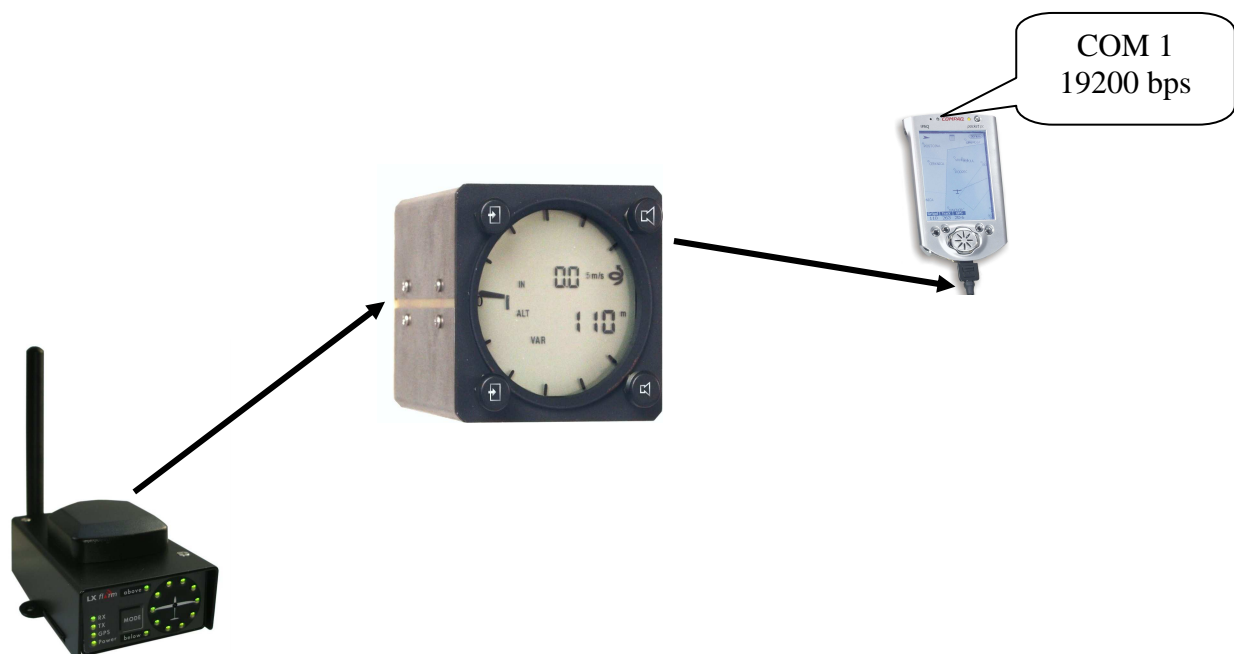### 3.4.1 LX 1600 - Colibri

LX1600

3.4.2 LX 1600 Flarm-Red Box

All cables are delivery included, except **LX Flarm splitter**. Red Box factory setting is 19200 bps and Navigation and Flarm **enabled**, so in general no adjustment necessary. To connect Splitter and LX 1600 use cable marked as **LX 1600-Colibri**.
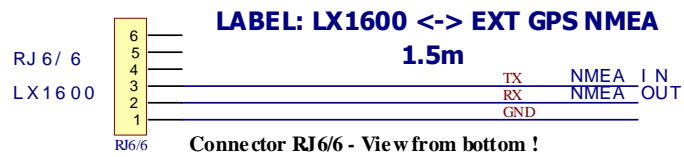
3.4.3 LX 1600 – LX Flarm Mini Box

All cables are delivery included. Mini Box factory setting is 19200 bps and Navigation and Flarm enabled, so in general no adjustment necessary. To connect Mini Box and LX 1600 use cable marked as **LX 1600-Colibri**. Mini box will also receive power from LX 1600.
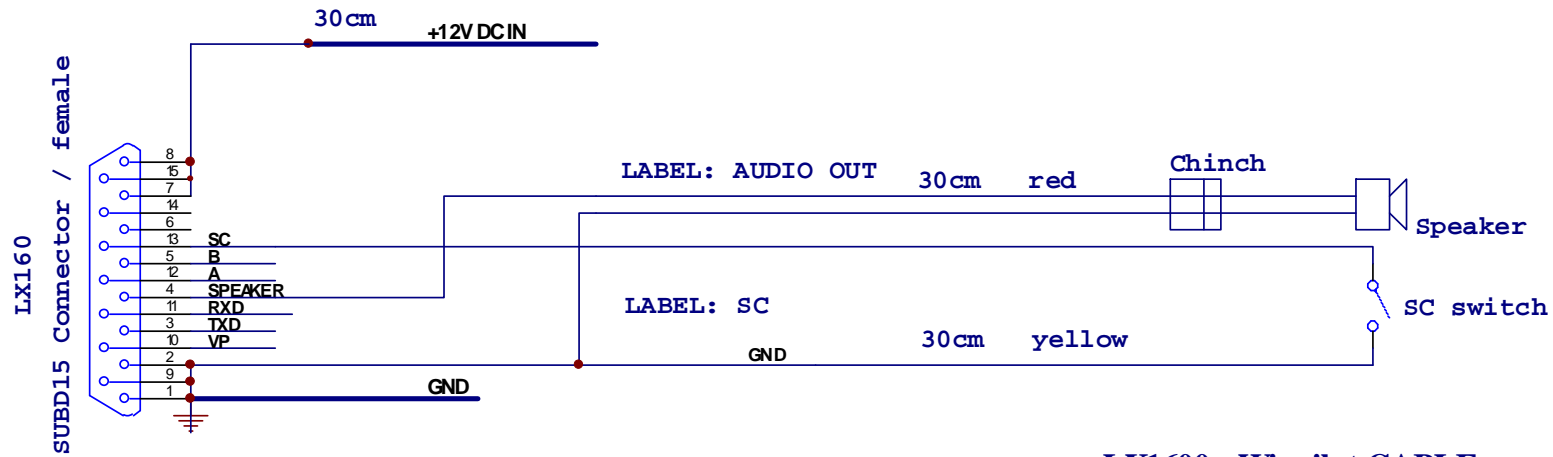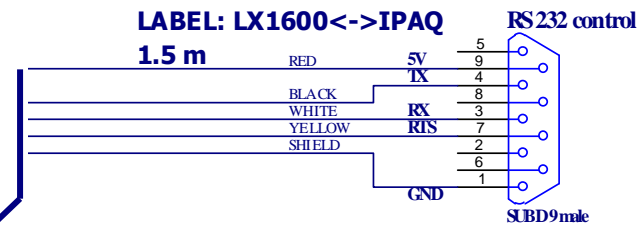

3.4.4 Flarm original units

Use Power/data connector and LX 1600 – Colibri cable. Adjust baudrate to 19200 bps and set navigation and Flarm.

LX160 SUBD15 Connector / female

30cm
+12V DC IN

8
15
7
14
6
13   SC
5   B
12   A
4   SPEAKER
11   RXD
3   TXD
10   VP
2
9
1

GND

LABEL: AUDIO OUT   30cm   red   Chinch

Speaker

LABEL: SC   SC switch

GND   30cm   yellow

GND

LABEL: LX1600 <-> EXT GPS NMEA

1.5m

RJ6/6
LX1600

6
5
4
3   TX   NMEA IN
2   RX   NMEA OUT
1   GND

RJ6/6

Connector RJ6/6 - View from bottom !

LX1600 - Winpilot CABLE

LABEL: LX1600<->IPAQ

1.5 m

RED   5V   5
TX   9
BLACK   4
WHITE   RX   8
YELLOW   RTS   3
SHIELD   7
2
6
1

GND

RS232 control

SUBD9 male

LX1600 - Colibri CABLE

1.5m

IPAQ connector

RJ6/6
LX1600

6
5
4
3
2
1

RJ6/6

RJ6/6
Colibri

6
5
4
3
2
1

RJ6/6

LABEL: LX1600 <-> Colibri
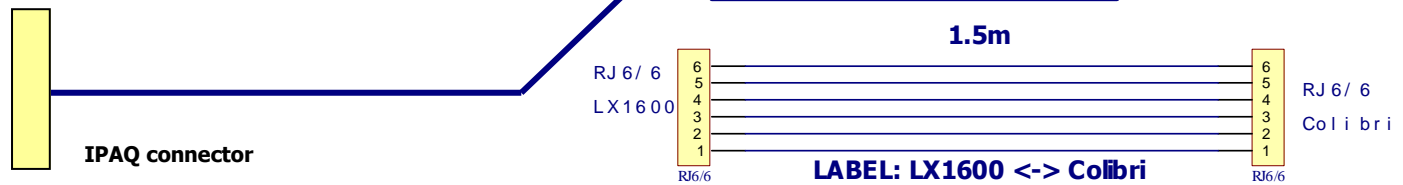
4 Technical Data

The principal features of the LX 1600 are as follows:

- Microprocessor used to compute and display vario and speed command information
- Power supply 8 – 16 V DC
- Power consumption approx 30mA without audio, PDA and Colibri or LX 20
- Dimensions: 57 mm diameter, box is 60 x 60 x 140 mm with connector
- Weight approx 450 g
- Power output for the PDA   5V/3A   (DC/DC converter is integral with the LX 1600), powers Colibri or LX 20
- NMEA input 4800,9600,19200,38400 bps (automatically detected)
- Extended NMEA output 4800,9600,19200,38400bps (depends on NMEA input)

5 First initialisation

To input the system parameters, such as polar, units, electronic TE compensation, it will be necessary to use a PDA. After the data has been entered into the LX 1600, it will remain after power off. See PDA manual for details.

5.1 Function test after installation

Connect GPS source to the LX 1600 without connected PDA. Switch LX 1600 on and check GPS status indicator, which is on the right side of the vario indicator.

- **No GPS** symbol present, means no GPS data received.
  Possible reasons: GPS source doesn't send NMEA data sentences, check settings and wires.
- **Flashing GPS** symbol means, GPS data present, but GPS is BAD
- **Stable GPS** symbol declares GPS OK

Connect PDA (original cables hardly requested) and check communication between both units. For instance:

- Adjust audio volume using commands on PDA

If the communication doesn't work check PDA settings and specially pay attention on com port which could be occupied by another application. Use PDA program manual.

Note!
Never enable more than two NMEA data sentences on GPS source. The necessary sentences are; **GGA and RMC**. *Additionally enabled sentences will overload the system.*

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6 Special functions

To download flights from a Colibri or LX 20 into a PDA without disconnecting any connectors use ConnectMe/ConnectLX or Downloader.ConnectMe and ConnectLX are free ware programs available on on www.lxnavigation.si or www.naviter.si After receiving a transfer request the LX 1600 will automatically connect the PDA and LX 20 or Colibri and will ensure a direct data transfer. The same is possible when transferring TP and task and flight declaration data.

Note!
*A very safe **connect** will be established after following procedure will be ran:*
Switch LX 1600 off, run ConnnectMe/ConnectLX (Com1,19200 on PDA) and switch LX 1600
on. In a few seconds Colibri/LX20 will connect with PDA. Both Colibri and PDA should
*report **connect** status.*

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7 Interaction LX 1600 - PDA

7.1 General

As mentioned before the unit design was focused to develop a unit which will offer basic vario and speed command functions in stand alone configuration and a high sophisticated vario/navigation system, if connected to a PDA. There are several programs which are adapted to support LX 1600. Suggested PDA program is SeeYou Mobile, which will offer most comfort and benefits. Table below shows programs which are able to interact with LX 1600.

7.2 PDA Program Compatibility

Program	Navigation	Exchange of settings	Communication with Colibri/LX20	Declaration transfer to Colibri/LX20
SeeYou Mob.	Y	Y	N	Y
Winpilot	Y	Y*	N	Y*
FlyWithCE	Y	Y	Y	Y

[*]Not tested by LX navigation.

7.3 How to prepare PDA

LX 1600 is able to communicate with PDA using two way communications that means both units are able to send and receive data. LX 1600 also powers PDA with 5V DC power.

7.3.1 COM port setting

It is absolutely obligatory to set:

COM 1 and 4800,9600,19200,38400bps (depends on GPS that is connected on LX1600. Colibri transmits data on 4800, LXFlarm on 19200) on your PDA, as LX 1600 sends data on same baudrate as it receives from GPS (Colibri or LX flarm). Baudrate is detacted automatically. If no gps is connected on GPS port baudrate is set to 4800bps.
Use also PDA manual to arrange this. After mentioned settings are set, PDA should detect incoming NMEA data from LX 1600.

Actual baudrate that is detected from GPS, can be checked in last menu of LX1600 (Pressing page up button twice)

Note!
*A message **NO DATA detected**, informs that PDA doesn't receive any data from LX 1600.*

Possible reasons:
- GPS **source** (Colibri, LX 20, LX flarm…) not connected to LX 1600
- PDA **port** isn't in order: close all other applications, check com 1 and different baudrates (4800(Colibri), 9600,19200(LX flarm),38400 bps) or simple provide a **hard reset** of PDA

7.4 Data exchange LX 1600 – PDA

This explanation will mostly base on SeeYou Mobile – LX 1600 interaction. Anyhow there will be enough information for the pilots who are using other PDA programs.

7.4.1 Navigation data

LX 1600 receives NMEA position data from GPS source which is connected to LX 1600 (Colibri, LX20….). Required data format:

NMEA format	GGA, RMC	4800, 9600,19200,38400 bps (auto detected)

LX 1600 sends toward PDA beside NMEA additionally data sentences including TAS, pressure altitude, serial number... This makes possible that PDA program is able to calculate exact final glide and is also able to calculate wind after using of more methods.

7.4.1.1 Flarm as GPS source

Any Flarm unit can be used as GPS data source for LX 1600 having program version 2.10 or higher. It is important that the Flarm unit is sending **Navigation and Flarm** data at 19200 bps. Both you can adjust after using of Flarm tools and PC.
As LX 1600 will recognize Flarm data, those will be also sent toward PDA and PDA will be capable to show traffic situation. See capture 3.4.

7.4.2 Exchange of settings

As mentioned before LX 1600 and PDA are able to exchange data bidirectional. LX 1600 will send any change happened on LX 1600 (MC,Filter, Ballast and Altitude) directly to PDA without any pilot manipulation. PDA will be automatically updated.
Otherwise any change on PDA side will be sent to LX 1600. After using of this principle both units will use the same final glide and sped command data, doesn't matter on which unit a change has happened.

7.4.2.1 LX 1600 configuration via PDA

As you know only MC, Filter, Altitude and Ballast can be manually adjusted on LX 1600. Anyhow LX 1600 offers a wide range of settings which will configure the unit more detailed and this makes LX 1600 extremely flexible. Detailed information you will find in individual PDA program manuals, this explanation is based on LX 1600 – SeeYou Mobile interaction and will help you to understand the materia easily.
Some important remark:

- Select **device type** to LX 1600 on PDA

Setup of LX 1600 (1)

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Function	Data direction
Vario Filter: will pre set default value in LX 1600	LX 1600 ⇔ PDA
Range: will define vario range of LX 1600	LX 1600 ⇐ PDA
Averager: time adjustment of averager	LX 1600 ⇐ PDA
TE Filter: see 3.2	LX 1600 ⇐ PDA
TE level: see 3.2	LX 1600 ⇐ PDA
Smart*	LX 1600 ⇐ PDA
Autozero**	LX 1600 ⇐ PDA
Speed to fly mode***	LX 1600 ⇐ PDA

Switch style****	LX 1600 ⇐ PDA
TAB (dead audio area in SC)	LX 1600 ⇐ PDA
Spd. change over speed only valid if Auto Speed selected	LX 1600 ⇐ PDA

*Smart filter is an additionally filer which is cascaded to the vario filter. This kind of filter will reduce vario needle dynamic. Value 5 will reduce dynamic significant and 0 will not influence at all.

**After activation of this function an auto zero procedure of vario and speed signal of LX 1600 will follow. The procedure may be used, if there is suspicion about zero degradation of mentioned signals. The procedure should be carried out exclusively on ground without wind influence.

***LX 1600 offers several ways how to switch over from vario to SC and vice versa.
   External: the only way is to use external switch mounted usually on the top of the stick.
   **On circling**: this selection will arrange change over to SC and vice versa after circling will be detected.
   Auto speed: change over is based on IAS which is set in Spd.

****Setting open means open switch will change over to SC and setting closed will switch over to SC after the switch will become closed. Taster will react on any change, so a push button may be used.
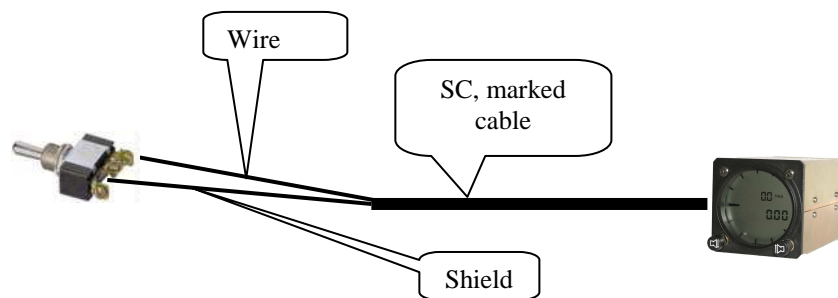
Example: **external switch** wiring
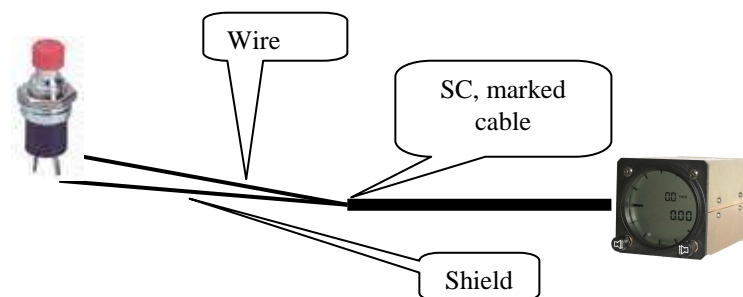
Example: **push button** wring (Taster selection obligatory)

| Wire	Shield	**Closed**	Setting: closed	Staus: SC
Wire	Shield	**Open**	Setting: closed	Staus: VAR
Wire	Shield	**Closed**	Setting: open	Staus: SC
Wire	Shield	**Open**	Setting: open	Staus: VAR

> *Note!*
> **Check** WRITE SETTINGS TO EEPROM **obligatory.** *This will store settings permanently into LX 1600 memory and the settings will remain active even during stand alone flight.*

LX 1600 (2) –Audio and LCD indicator settings

Two packages of LX 1600 custom settings about audio and LCD vario can be individually set from this page.

Function	Data direction
Style: 6 audio variants can be used, use **TEST*** to perform	LX 1600 ⇦ PDA
SC Style: defines audio style during SC mode**	
Freq.: defining of min.,max and zero audio frequency, use TEST	LX 1600 ⇦ PDA
SC Volume: audio volume in SC mode, H means more loud in SC	LX 1600 ⇦ PDA
LCD indicator: select. regarding to VAR respectively SC, see below	LX 1600 ⇦ PDA
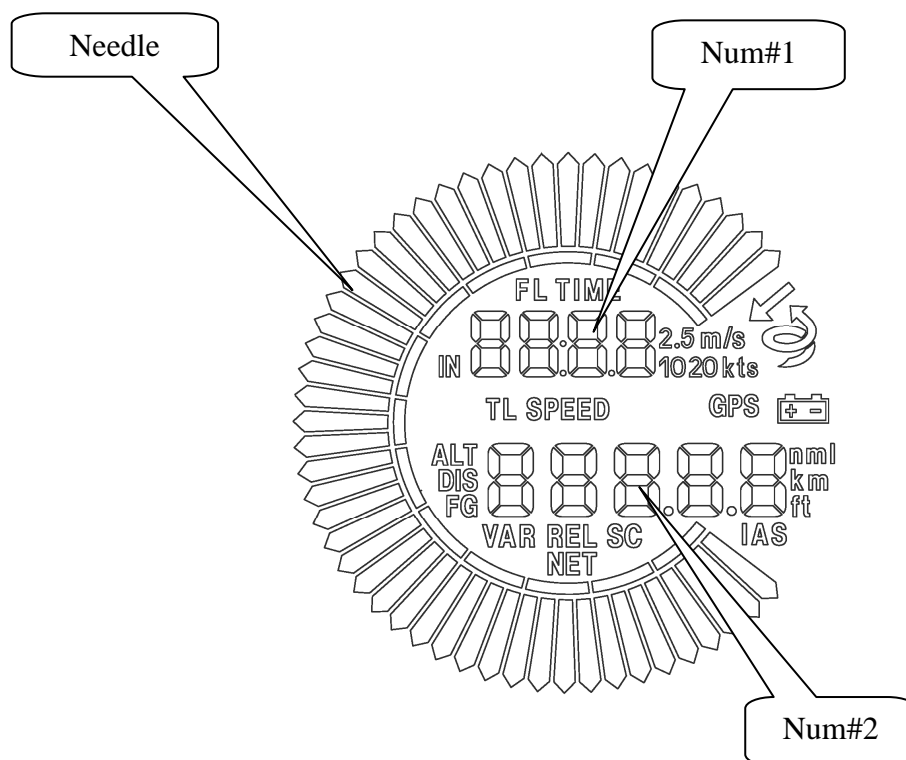
*After selection, press OK, return into LX 1600 (2) and press TEST. Execute audio demo exclusively from vario mode.
**SC: continuous audio during positive needle deflection. SC neg interrupted audio (piep,piep) during negative needle deflection. There is no SC audio demo, please select during flight.

8 Revision History

02.March 2004	New issued
26.Dec. 2004	Added chapter 5.1
25.Jun 2006	Ch.6 added connect procedure
3.Jan. 2008	Ch.7 added, Ch. 2 and 3 updated