LX160si

Pilots manual

Version 3.04
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1. Contents

2. General

LX160s a modern designed vario-speed to fly director and final glide calculator, based on latest pressure transducer and microcontroller technology. Using of NMEA input will make the system even more sophisticated, and serviceable.
The unit is prepared to drive practically all PDA running navigation programs. Special data set to drive Winpilot pro and SeeYou Mobile is available. The wiring delivered with the instrument allows connecting of PDA without any problems. Using some special accessories offered by LX navigation, will make connection of PDA much simpler.
Flying without GPS input is for sure possible, using such a configuration, the pilot should input distance manually.
Like vario indicator a special custom designed LCD unit is used.

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3. Delivery

- 1 x **LX**160**si** *main unit*
- 1 x **LX**160**si** *wiring*
- 1 x LCD vario indicator
- 1 x Speaker
- 1 x **LX**160**si** *manual*

4. Technical specification

Power input:	9-16V DC
Nominal:	12V
Consumption:	120mA / 12V (**LX**160 + LCD Vario without audio)
Temperature range:	from -10°C till +50°C
Store:	-20°C to +70°C
Weight:	
LX160:	310g
LX160 **wiring**:	100g
LCD Vario:	180g
Speaker:	200g
Total:	790g

5. Switches and their functions

Fig.1 switches

ON/OFF:

On/off (horizontal)

SC/VARIO/AUTO:

- SC speed command
- VARIO
- AUTO (change over vario/speed command automatic, see 9.6)

MC: (key)

MC input, after pressing of MC key up (+) and down (-)
Actual value will be shown in the **upper row** of the vario indicator for apr. 1 second. Longer activation of the key will increase increments. (normal 0.1 m/s increased 0.5 m/s

BUGS : (switch)

- up (2) 10% of glide ratio reduction (See 9.16)
- middle no bugs
- down (1) 5% of glide ratio reduction

BALLAST: (switch)

- up maximum (2) +20% overload (See 9.15)
- middle no ballast
- down (1) +10% overload

FILTER: (Vario dumping)

- up (2) maximum (ca. 3 Sec. time constant)
- middle (FIL) low dumping (See 9.14)
- down (1) medium (1.5 second)

Volume: (key)

Activation will reduce or increase the volume of audio signal. Longer press will increase increments.

6. LCD vario-indicator

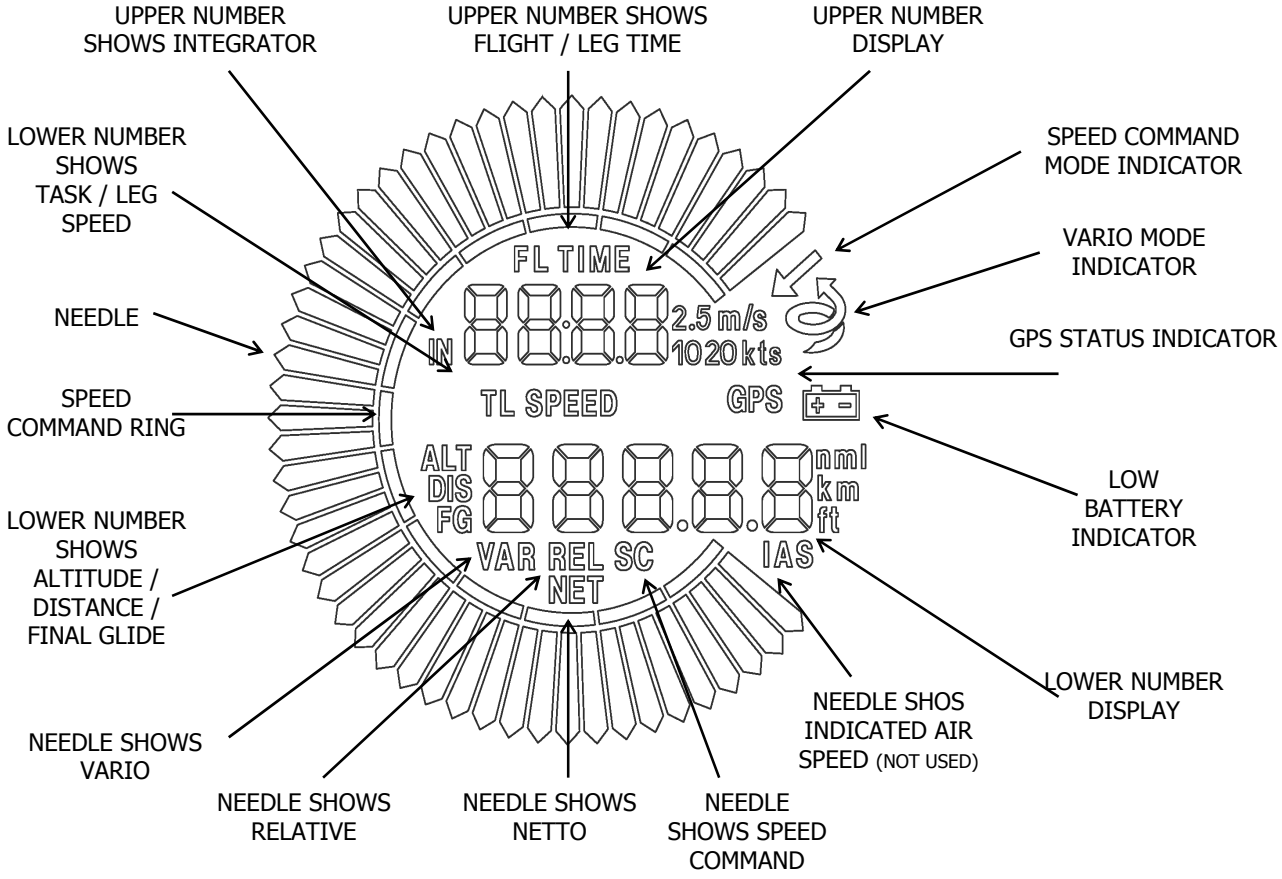


Fig.2 LCD Vario-indicator

LCD Vario-indicator consists of:

- vario needle
- two numeric indicators (partly programmed by pilots)
- Vario/SC status display
- SC bar (continuously)
- units and warnings

The vario indicator is an integral part of the system that means powered and controlled from the ***LX160si*** main unit. The connection is realized like data bus that means unlimited number of units could be connected parallel. The main unit delivers four different data strings and there fore up to four LCD vario units with different read out configuration could be used. To define the string type use DIP switches on the back side of the unit.

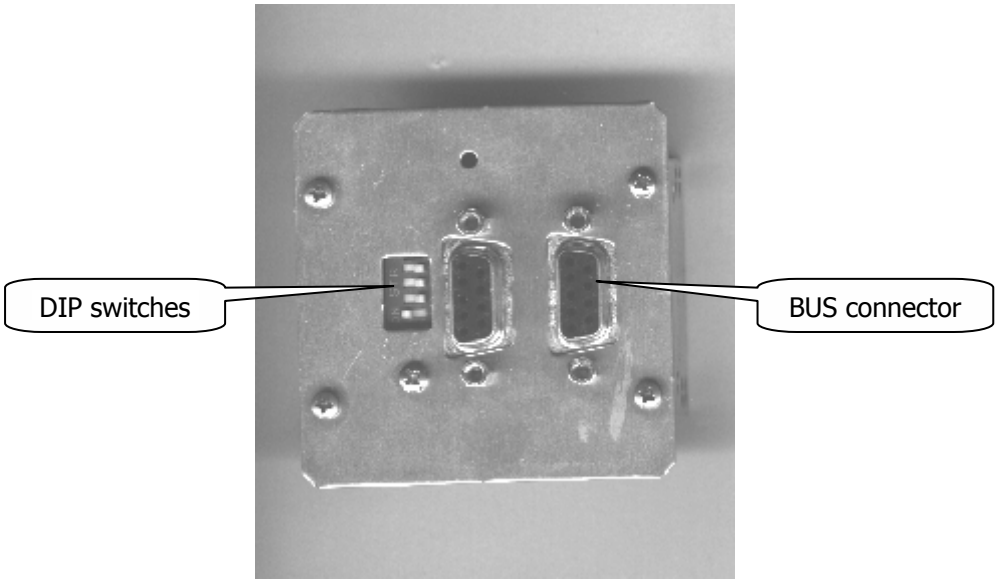


Fig. 3 Vario-indicator back side

Data string	switch 1	switch2	switch 3	switch 4
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	OFF	OFF	ON	OFF
4	OFF	OFF	OFF	OFF
prohibited	OFF	OFF	OFF	ON

For details see chapter 9.4.

7. Pneumatic inputs

All necessary pneumatic inlets are on the rear side of the main unit.

- **TE Pst** –Te probe, or static using electronically TE compensation.
- **Pst** Static for speed measuring
- **Ptot** Total pressure(Pitot) speed measuring

(LX 160 does not require capacity bottle!)

Important!
No average indication during the flight, means that Pst and Ptot are connected opposite.

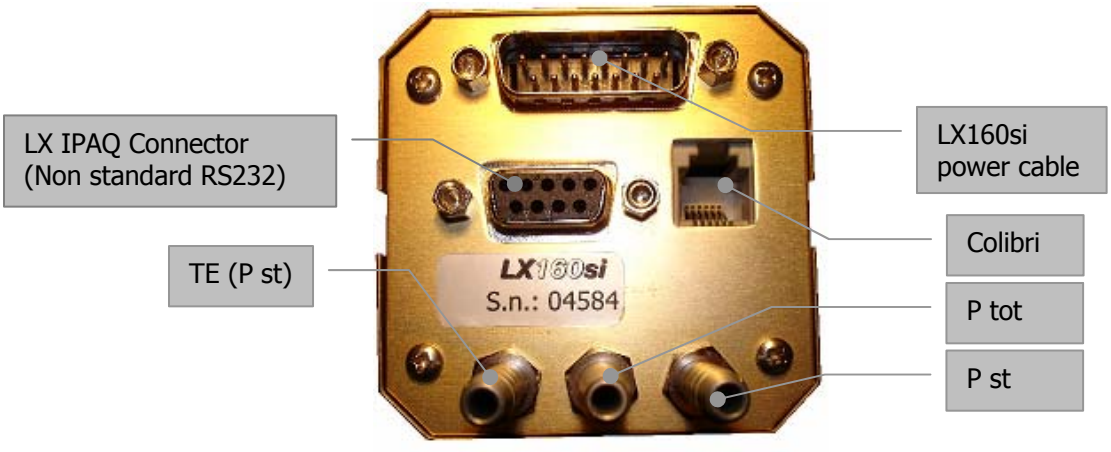


Fig. 4 LX160si main unit rear side

8. After power ON

Following screens will fill follow after power on:

- Program version
- Polar

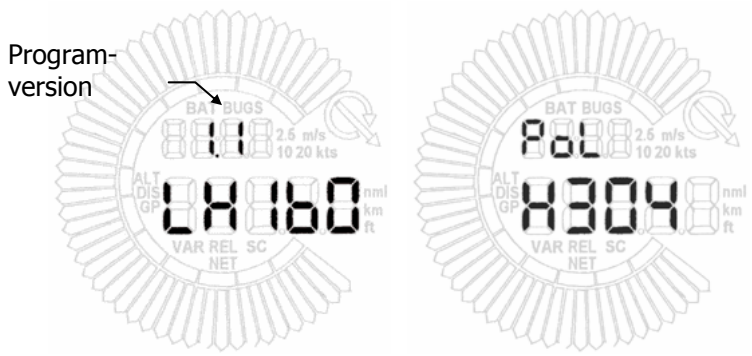


Fig 5 after power on

9. Vario and speed command (SC)

Vario respectively speed command are defined by:
- external switch position
- Automatic

Some functions of LCD vario indicator are connected with status of the main unit (vario or SC). See chapter 11.4.
SC bar indicates continuously SC.

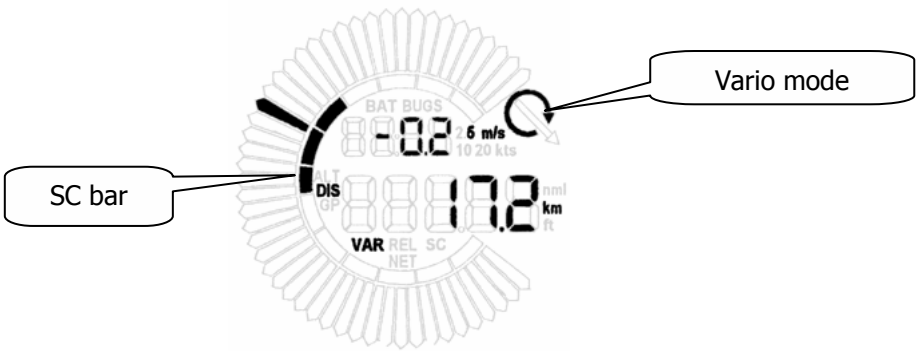


Fig. 6 vario mode

The mode of operation is declared using special symbols for climbing and SC mode.

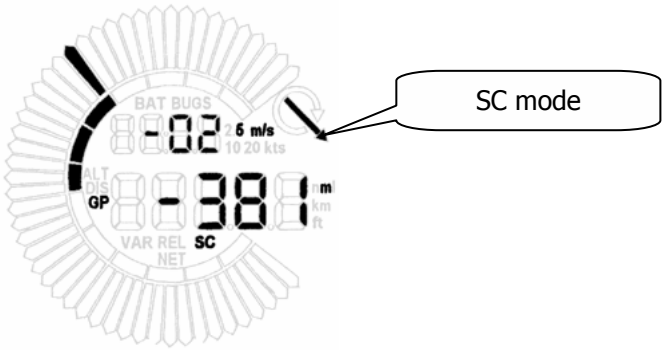


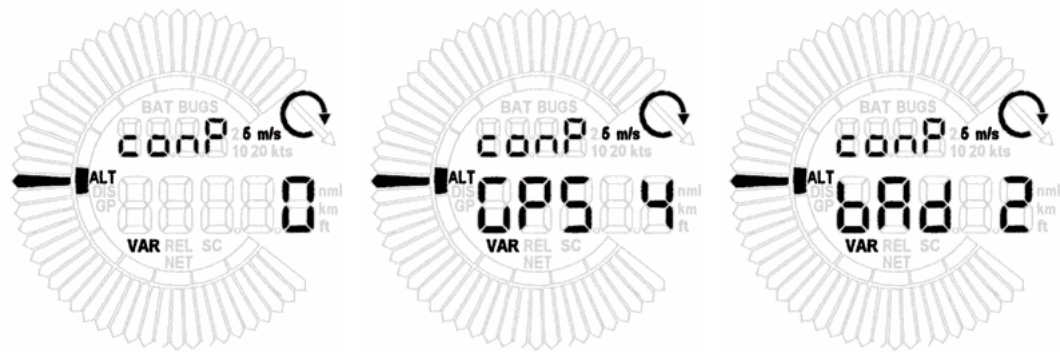
Fig. 7 SC mode

10. Set-up-Menu

To step into setup menu press at the same time MC and VOL up. Individual setup menus will follow after MC + or -.

10.1. CONP (wind component)

The final glide calculation consider head or tail wind component. The wind component value could be input using this menu. Using GPS input an automatic wind component calculation will be active that means no manual input will be possible. The pilot is able to disable automatic wind calculation (see 11.3) using FIX method (manual input). FIX will not remain after power off.
Receiving GPS signals, GPS status indication will replace wind component indicator.



Manual input
no GPS input

GPS-Status

GPS-Status

Fig. 8 wind component display

Wind component = TAS-GS

10.2. DIST (distance)

For accurate final glide calculation is distance the most important parameter. Using of VOL + or – will change the distance. Longer press will increase the increments (10 km).

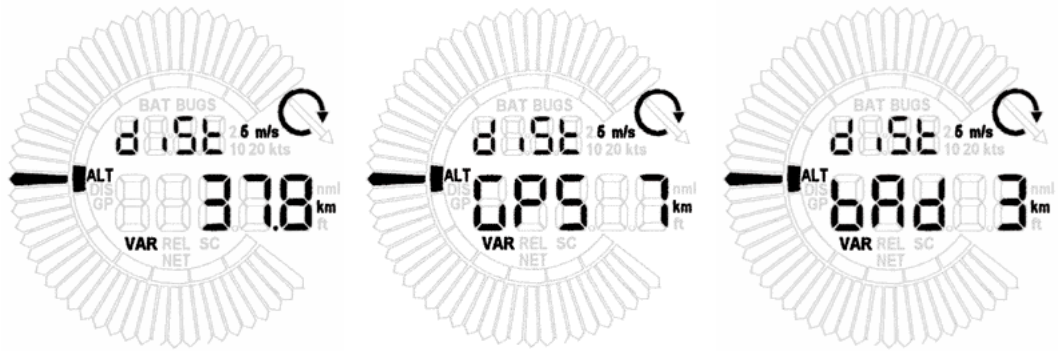


Fig 9 Distance input

The distance count down will be done automatically during the final glide. Necessary adaptations during the final glide should be done the same way like input.
Using GPS input, there will be no **distance input possible**, the distance will come from GPS automatically. The distance and GPS status will be alternately present on the display.

10.3. TARG (landing place elevation input)

For final glide calculation is the elevation of the landing place an important parameter. The pilot should provide this input before final glide will start.
Mentioned input (target) will be possible only, if the elevation of **take off airfield** has been entered like described in chapter 10.4.
Otherwise (no input of take off elevation) only final glide to take off airfield will be possible.

Fig 10 Landing place elevation input (target)

GPS will never deliver elevation of landing place, it should be done manually.

10.4. ALT (altitude)

The input 0m (no input at all), will allow final glide to the take off airfield only. The **LX160si** altimeter will show QFE altitude (0m on ground). After input of take off airfield elevation (before take off) the **LX160si** altimeter will show QNH altitude and the final glide will be possible to any airfield after "target" input.
Altitude setting will remain in case that the unit has been switched off for a short time, during the flight.

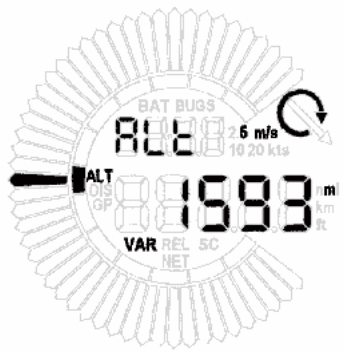


Fig 11 Set elevation

10.5. RES (safety altitude)

To offset the final glide (safety reasons) use this menu. After input of safety altitude the final glide will be adequate shifted, but final glide difference indicator will **remain 0m.**

Fig. 12 safety altitude

10.6. GPS-input

GPS input is default active. The pilot is able to disable GPS input.

Fig 13 GPS input not active
GPS data present

Fig. 14 GPS data not detected

Fig. 15 GPS input not active
No GPS data present

Fig. 16 GPS input active
GPS data present

Using GPS input, both the distance and wind component will be calculated automatically, no manual input through pilot possible. If the pilot wants to change wind component or distance has to deactivate GPS input obligatory (fig 13).

10.7. PASS (password)

After using of password further system parameters could be changed.

Fig. 17Password

passwords:

- 04670 System set up
- 01049 "Auto Zero" (vario and speed, will take some seconds)

The individual numbers should be selected using VOL key. After some time without change of VOL key, the cursor will jump one step forward.

11. System Setup

11.1. POL (polar)

The unit has capacity to store up to 95 glider polars. The pilot has to choose his glider type from the attached library. Selection of number 0 will allow input of user defined parameters. The polar input should be done using VOL key.

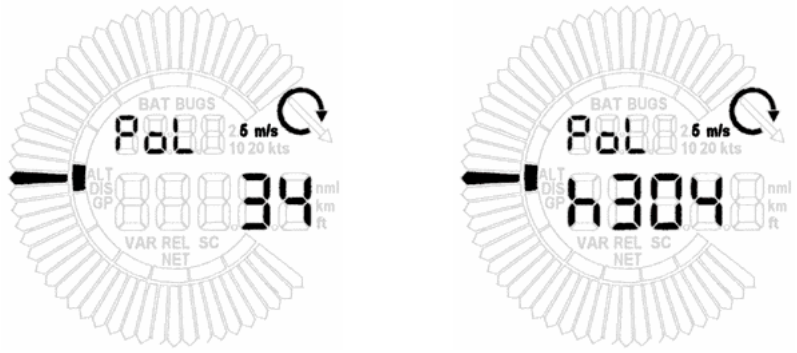


Fig. 18 Polar (number and glider type)

1	ASH 25	33	DIMONA	65	NIMBUS4D
2	ASH 25E	34	DISCUS	66	NIMBUS4T
3	ASH 26	35	DUODISC	67	NIMBUS4M
4	ASH 26E	36	G102CLUB	68	NIMB.4DM
5	ASK 13	37	G103ACRO	69	NIMB.4DT
6	ASK 21	38	H205	70	NIMBUS4M
7	ASK 23	39	H304	71	PHOEBUSA
8	ASTIR C	40	HORNET	72	PHOEBUSB
9	ASW 15	41	JANTAR2B	73	PHOEBUSC
10	ASW 17	42	JANT.ST2	74	PIK 20E
11	ASW 19	43	JANT.ST3	75	PUCHACZ
12	ASW 20	44	JANUS 3	76	S-10
13	ASW 20	45	JANUS B	77	SF26
14	ASW 22	46	JANUS C	78	SF27M
15	ASW 24	47	JANUS C	79	SF27
16	ASW 27	48	JEANSAS	80	SF34
17	CIRUS 18	49	LS 1CD	81	SPEED AS
18	CIR.L26	50	LS 1	82	CIRRUS 75
19	CIRUS ST.	51	LS 3 17	83	ST.LIBELLE
20	CL.ASTIR	52	LS 3	84	SZD 51-1
21	DG100	53	LS 4	85	SZD 53-1
22	DG200	54	LS 6	86	TWINAS 2
23	DG300	55	LS 7	87	TWINAS 1
24	DG400	56	LS 8	88	TWINAS 3
25	DG400/1	57	MININIM	89	VENTUS
26	DG500 M	58	MISTRAL	90	VENTUS
27	DG500/2	59	MOSQUIT	91	VENT.A16
28	DG500 T	60	NIMBUS2	92	VENTUS B
29	DG600	61	NIMBUS2C	93	VENT.B16
30	DG600/17	62	NIMBUS3	94	VENT.C17
31	DG800/15	63	NIMBUS3D	95	VENTUS C
32	DG800/18	64	NIMBUS4		

11.2. POL a,b,c,(user defined parameters)

The parameters a, b and c build a parable which is described like w= av2-bv+c. For a, b, and c calculation use LXpolar.exe available on www.lxnavigation.si. .

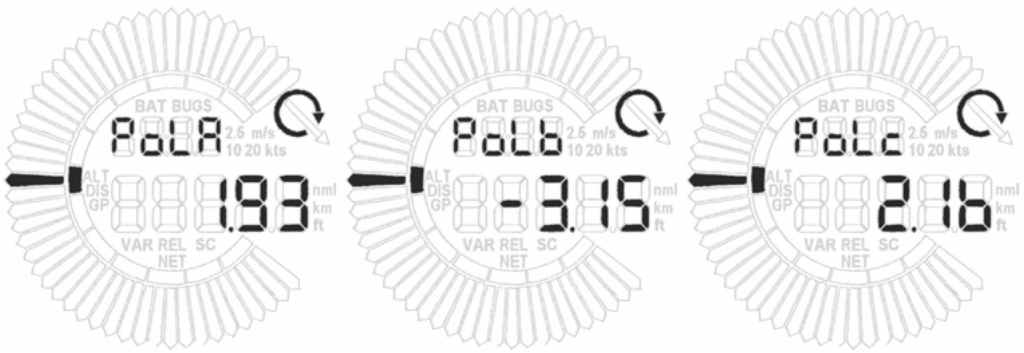


Fig. 19 a, b and c of user polar

MC will search for a, b, and c and VOL will allow input.

11.3. ConP (wind calculation method)

Two different ways could be defined. **Auto** will calculate wind component like difference between ground speed and true airspeed (TAS-GS). **Fix** input will allow the pilot to adjust wind component by hand. The input fix will be active only one flight, after new power on, auto will be set automatically.

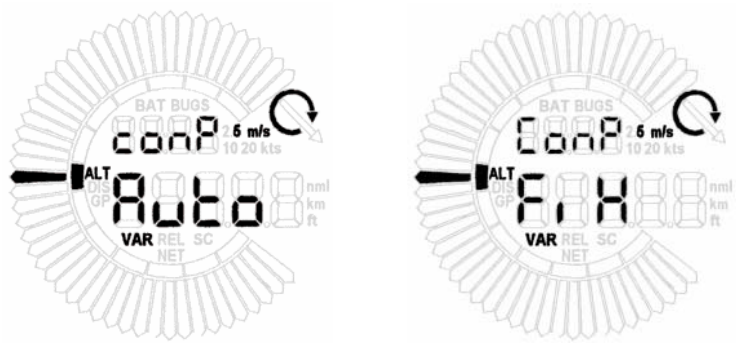


Fig. 20 Wind component calculation options

11.4. IND1..4 (Vario-indicator setup)

The pilot is able to adjust LCD vario indicator readings, to fulfill his individual wishes. Vario-indicator setup will offer 16 variants of settings. Table below will show the variants. It is important to accept that the settings could bring different readings for vario or SC mode. Using more LCD vario units use different DIP switch addresses to realize individual readings for each unit. There are four addresses allowed, that means up to four LCD vario units indicating different, could be used.

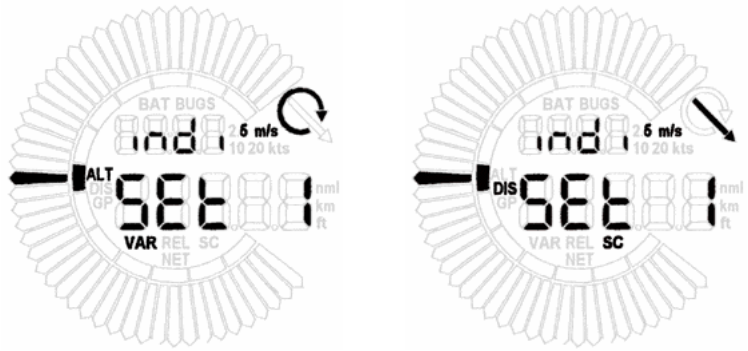


Fig 21 Vario indicator input

mode	VARIO			SC		
	needle	Lower number	Upper number	needle	Lower number	Upper number
SET0	VARIO	DIST	INT	SC	GP	INT
SET1	VARIO	GP	INT	SC	GP	INT
SET2	VARIO	DIST	INT	SC	DIST	INT
SET3	VARIO	GP	INT	SC	DIST	INT
SET4	VARIO	GP	INT	NETTO	DIST	INT
SET5	VARIO	GP	INT	RELATIV	DIST	INT
SET6	VARIO	ALT	INT	SC	GP	INT
SET7	VARIO	ALT	INT	SC	DIST	INT
SET8	VARIO	ALT	INT	VARIO	DIST	INT
SET9	VARIO	DIST	INT	SC	GP	INT
SET10	VARIO	GP	INT	NETTO	GP	INT
SET11	VARIO	GP	INT	RELATIV	GP	INT
SET12	VARIO	GP	INT	VARIO	DIST	INT
SET13	VARIO	GP	INT	VARIO	GP	INT
SET14	VARIO	ALT	INT	NETTO	ALT	INT
SET15	VARIO	ALT	INT	RELATIV	ALT	INT

- INT Averager (Integrator)
- GP Final glide deviation
- SC Speed to fly mode
- ALT Altitude (QFE,QNH depend)
- NETTO Netto vario (sinking or climbing of air mass)
- RELATIV Netto –0.7 m/s, expected climbing

11.5. UNIT (units)

Practically all known combinations of units could be used flying LX 160.

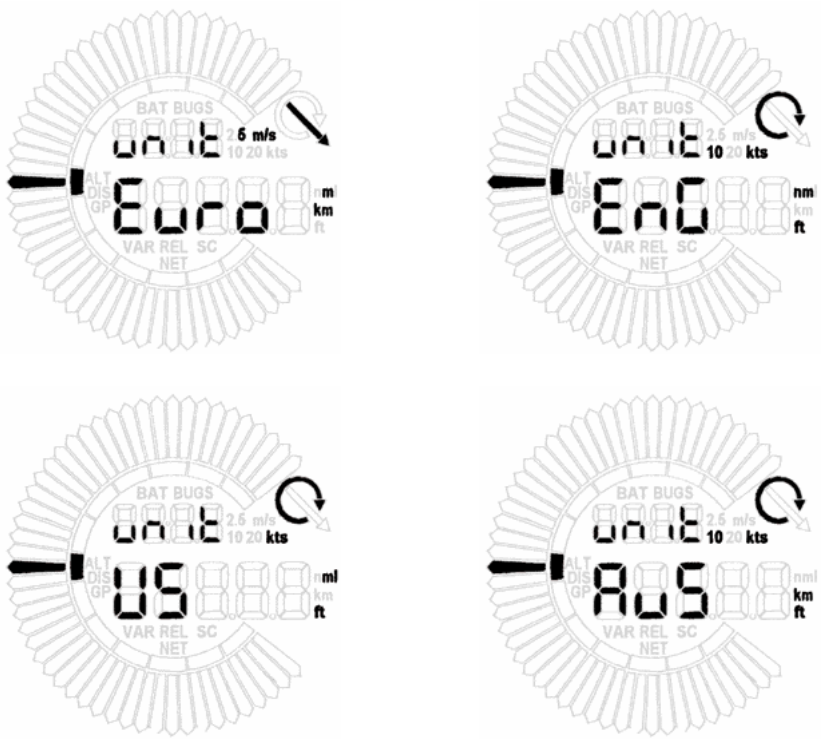


Fig 22 units

	Euro	Eng	US	Aus
altitude	**m**	**ft**	**ft**	**m**
vertical speed	**m/s**	**kts**	**kts**	**kts**
wind speed	**km/h**	**kts**	**mph**	**kts**
IAS	**km/h**	**kts**	**mph**	**kts**
distance	**km**	**nm**	**ml**	**nm**

11.6. ScSp - (vario-SC changeover automatic)

The input done in this menu will be active exclusively after VAR, SC, AUTO switch will be in position **AUTO.** Reaching of speed defined in this setting, the unit will change over to SC automatically and vice versa.

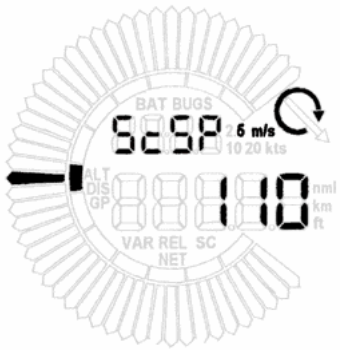


Fig. 23 Vario-SC change over automatic

11.7. Teco (TE compensation)

Two ways of vario TE compensation are offered, using of TE probe or electronic TE compensation. Input 0% will define TE probe and will request to connect TE Pst connector to TE probe source. Using electronically way the TE St should be brought to glider static source. It is very important to use faultless static source to be able to realize usable compensation. Default value is 100 %, having under compensated system increase the % and vice versa. One flight in calm atmosphere is requested to find the right %. Accelerate up to 160 km/h, stabilize speed and pull up till stalling. Vario deflection in + declares under compensation and opposite.

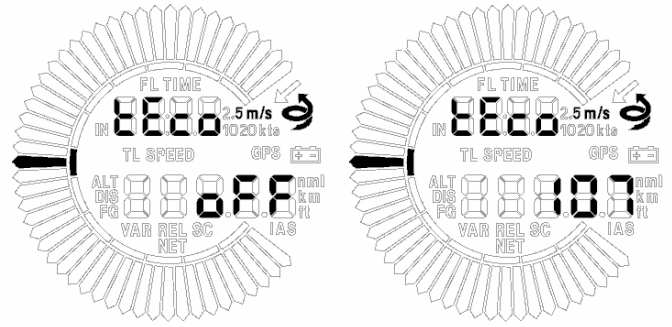


Fig. 24 TE compensation

11.8. TEFi (TE compensation filter)

The **TEFi** (TE filter) is the compensation delay. Larger numbers will increase the delay and vice versa. During the first test is recommended to use TEFi 4.

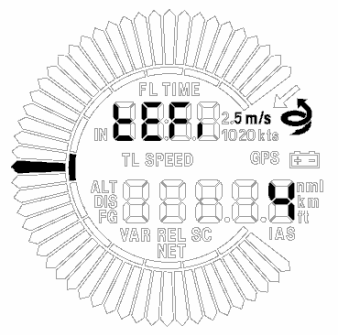


Fig. 25 TE compensation filter input

11.9. tabS (no audio slot by SC)

Flying in SC, the vario needle will be on zero flying correct speed, a very significant signal that the speed is correct is cut off of audio signal. The slot without audio could be adjusted by pilot using this menu.

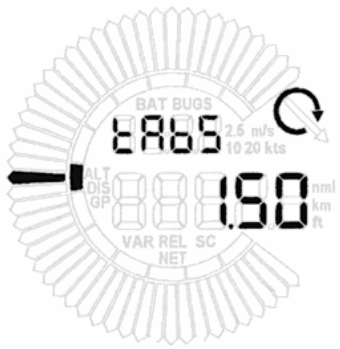


Fig. 26 Audio cut off slot

11.10. INT (integration time of averager)

Vario averager integration time could be adjusted from 1 up to 40 seconds under pilot wishes. Factory setting is 20 seconds.

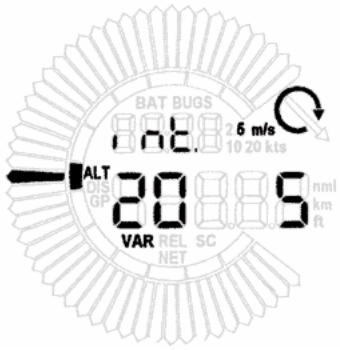


Fig. 27 averger time input

11.11. PASS (password disable / enable,)

Disable, will disable password function during flight.

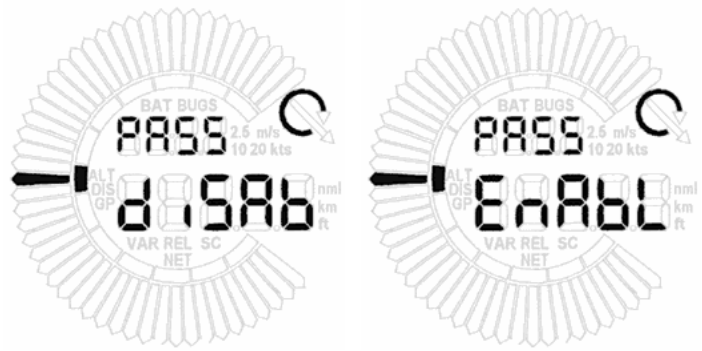


Fig.28 Password disable / enable

11.12. Sc (on/off)

Normally an external switch will be used to change over vario-SC. Active status of the switch to change over to SC (closed or open) could be defined using this menu. Factory set, ON (closed switch means SC).

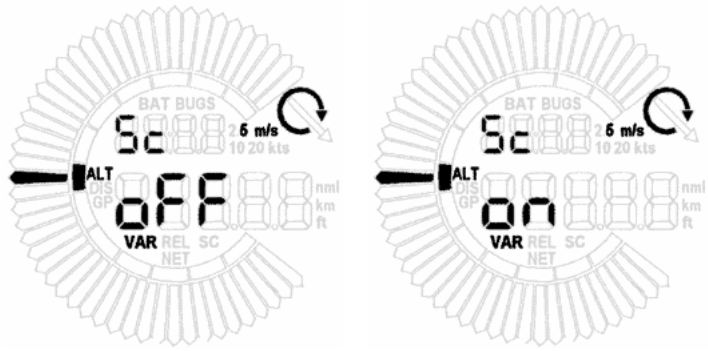


Fig 29 SC active switch on or off

11.13. Batt (battery monitoring)

No inputs expected, the battery voltage will be displayed.

Fig. 30 Battery voltage display

Reaching 11V will activate an alarm, blinking of battery symbol on LCD vario.

11.14. WinPilot/SeeYou Mobile data string

The pilots using Winpilot/CU Mobile are obliged to activate this setting like ENABLE.

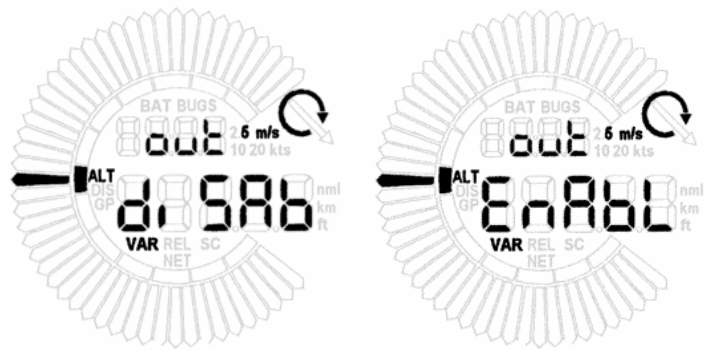


Fig. 31 Winpilot/CU Mobile data string activation

11.15. Fil (user defined vario dumping input)

On the front panel there is a switch with three positions of vario dumping. The pilot is able to define his personal time constants for all three positions separately (from 0 up to 5 seconds). The factory settings will satisfy majority of pilots.

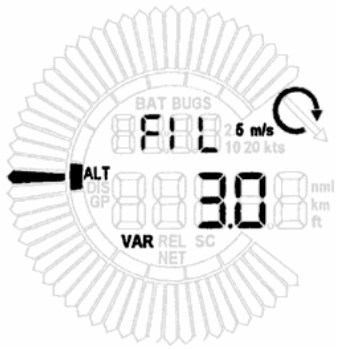


Fig. 32User defined vario dumping

11.16. Bal (individual ballast input)

The ballast input switch has three positions. The pilots are able to define individual values of overload for each position. Overload is calculated like:

$$\text{Overload} = \frac{\text{Glider} + \text{Pilot} + \text{Ballast}}{\text{Glider} + \text{Pilot}}$$

Each position is free programmable from 1.0 up 1.5.

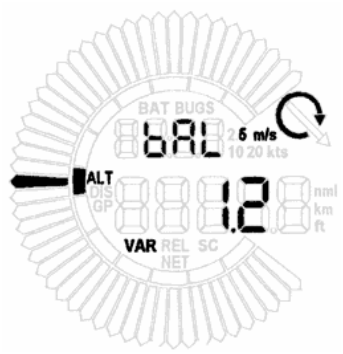


Fig 33 Individual ballast input

Overload calculating example:

Glider: 280 kg
Pilot: 80 kg
Ballast: 90 kg

$$\text{Overload} = \frac{280\text{kg} + 80\text{ kg} + 90\text{ kg}}{280\text{ kg} + 80\text{ kg}} = 1.25$$

11.17. Bugs (individual polar degradation input)

The pilot is able to input polar degradation (% of glide ratio reduction) instead of muddy wings like his personal settings. The default values will satisfy majority of the pilots.

Fig. 34 Individual polar degradation input

11.18. Smart vario (user defined smart vario dumping input)

Gives five levels of dynamic damping of the vario indication and off.

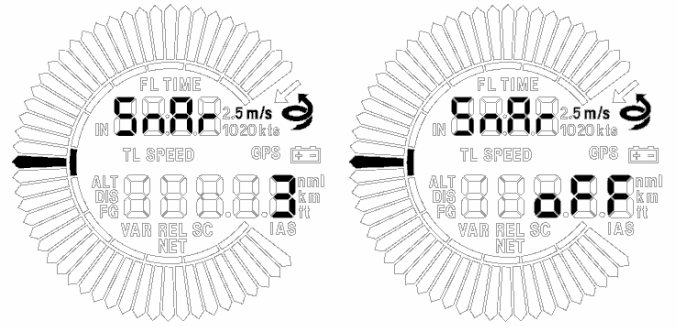


Fig. 35 Smart vario filter input

11.19. Final glide

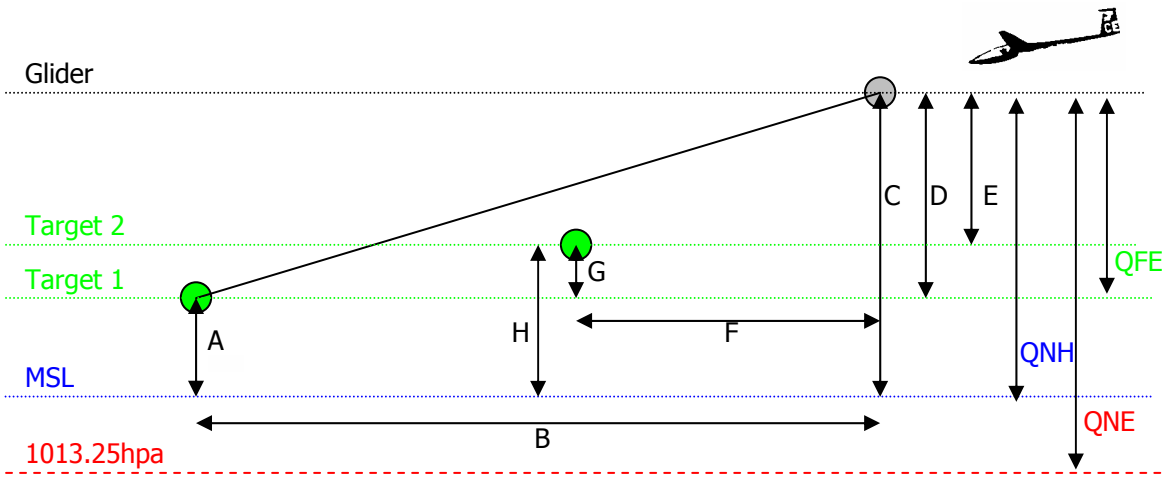


Fig 36 Final glide

Following paramerts will influence on final glide:

- Distance
- Mc input
- Wind component
- Polar and degradation
- Safety altitude

The final glide calculator shows altitude difference (m or feet) to the ideal final glide. + indication means the glider is above the final glide and vice versa.
Flying without GPS, the pilot have to input the distance manually and to control the distance during the final glide, using a map.

Important!
Never forget to select finish point on GPS, before final glide. The distance will be given from GPS, if wrong selected an inadequate distance will be taken in calculation. The GPS will never deliver elevation of finish, should be input manually.

Example 1: final glide without elevation input before take off

Using this solution only final glide to **take off airfield** will be possible, **no target** input during the flight will be allowed, that means should remain on 0. The altitude indication will indicate QFE altitude.

Example 2: final glide after set elevation input

After input of **take off elevation**, final glide to believable point will be possible. The input should be done manually after power on. The altimeter of ***LX160si*** will show QNH altitude in that case.
Before final glide is obligatory to input elevation of (target) landing place in any way, even before final glide to the take off airfield.

Important!
Select the right point on GPS.
Take a look on Fig. 10.

12. Additional functions

12.1. Memory initialization

In case of some anomalies, strange characters…, provide data init memory procedure.

- ***LX160si*** *off*
- VOL und MC down,
- ***LX160si*** on,
- Release both switches.

Data init message will be present for a short time.
All settings will be set to factory **default.**

Fig. 37 Data init procedure

13. Configuration LX 20 or Colibri - LX160si - WinPilot/CU Mobile

General rules

- **LX 20 or Colibri deliver to LX160si NMEA-data (GGA,RMC and RMB) via NMEA input (never activate Winpilot data sentences)**
- **LX160si delivers NMEA+Winpilot/CU Mobile specific data to Winpilot/CU Mobile.**

All necessary cables are delivery included.

14. FAQ –" frequently asked questions"

Q: LCD-Vario indicates no 485?

Fig. 38

A: No data exchange - LX160si , LCD Vario, check cable LX 160-LCD vario

---

Q: No GPS data detected
A: Check, if GPS connection is OK

Q: No averager indication during the flight, vario needle very slow
A: Pst und Ptot connected opposite

Q: After power on CS-err-massage will appear

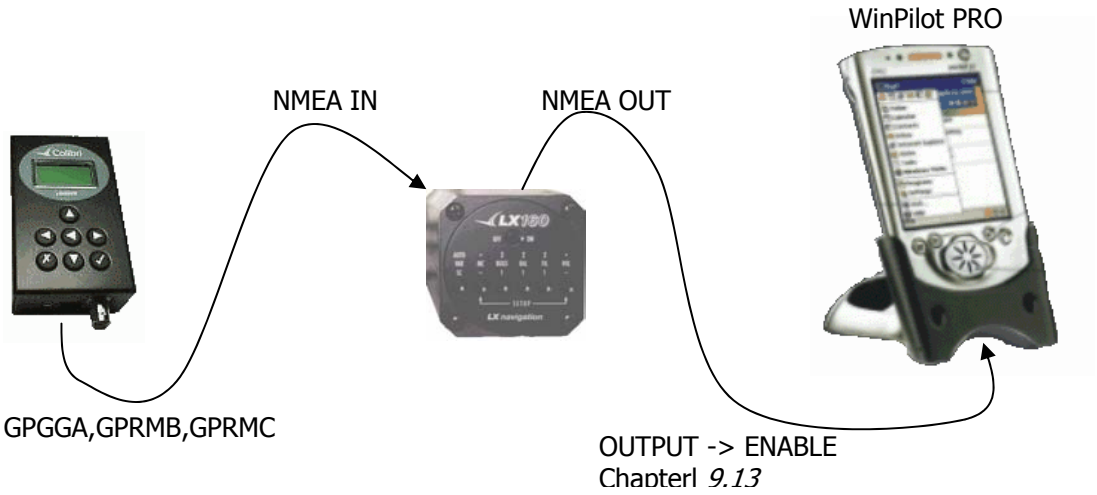
Figure 39

A: EPROM fault, send to the workshop

Q: Vario indicator is slightly out of zero
A: Use password 01049 and provide auto zero procedure

Q: Your glider is not in the library
A: Use LXe, calculate the parameters and input them like user.

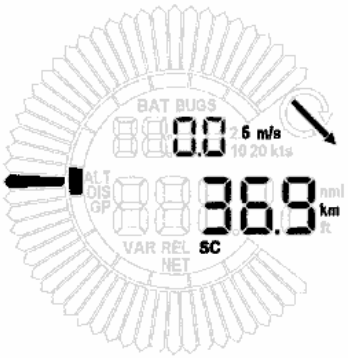
Q: Winpilot/CU Mobile configuration?
A:



Q: What does the needle display in SC :
A:

Flying too slow

Flying at the right speed



Flying too fast

Q: Is there any way to update the FW by customer?
A: Yes, after order of EPROM by producer.

Q: If airspeed is not present average remains on 0.0.
A: Check if **Ptot** probe is connected properly. It should be connected to »**NOSE**«

Q: What is the difference between ***LX***1*60* and ***LX***1*60****s***?
A: ***LX***1*60****s*** is a new shorter unit, version supporting the same functions.

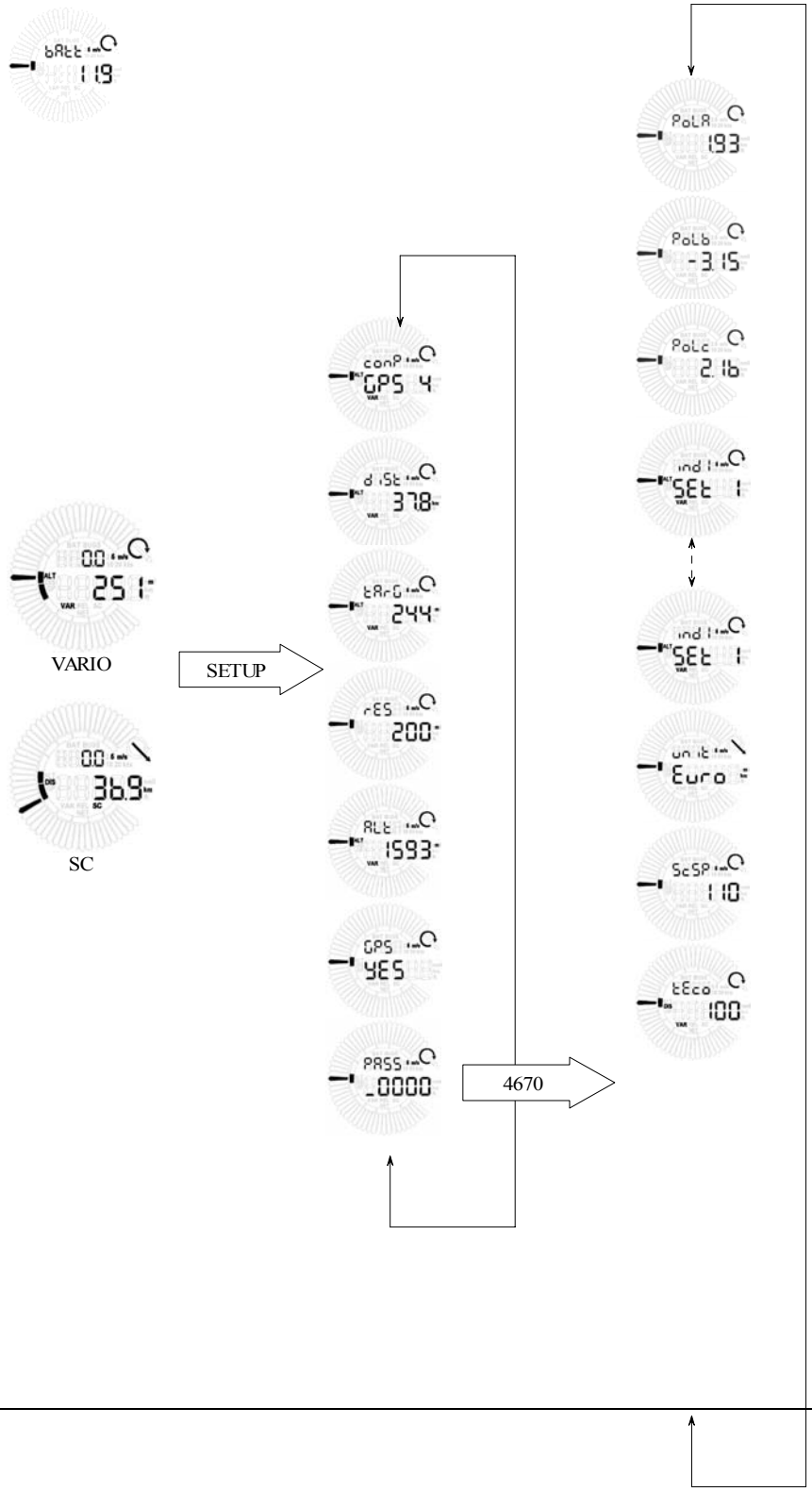
Q: What is the difference between ***LX***1*60****s*** and ***LX***1*60****si***?
A: ***LX***1*60****si*** has built in power supply for PDA and RJ45 connector for direct link with Colibri.

Q: Why my ***LX160si*** does not receive target altitude from GPS.
A: Because there is no standard NMEA sentence which will include that value.

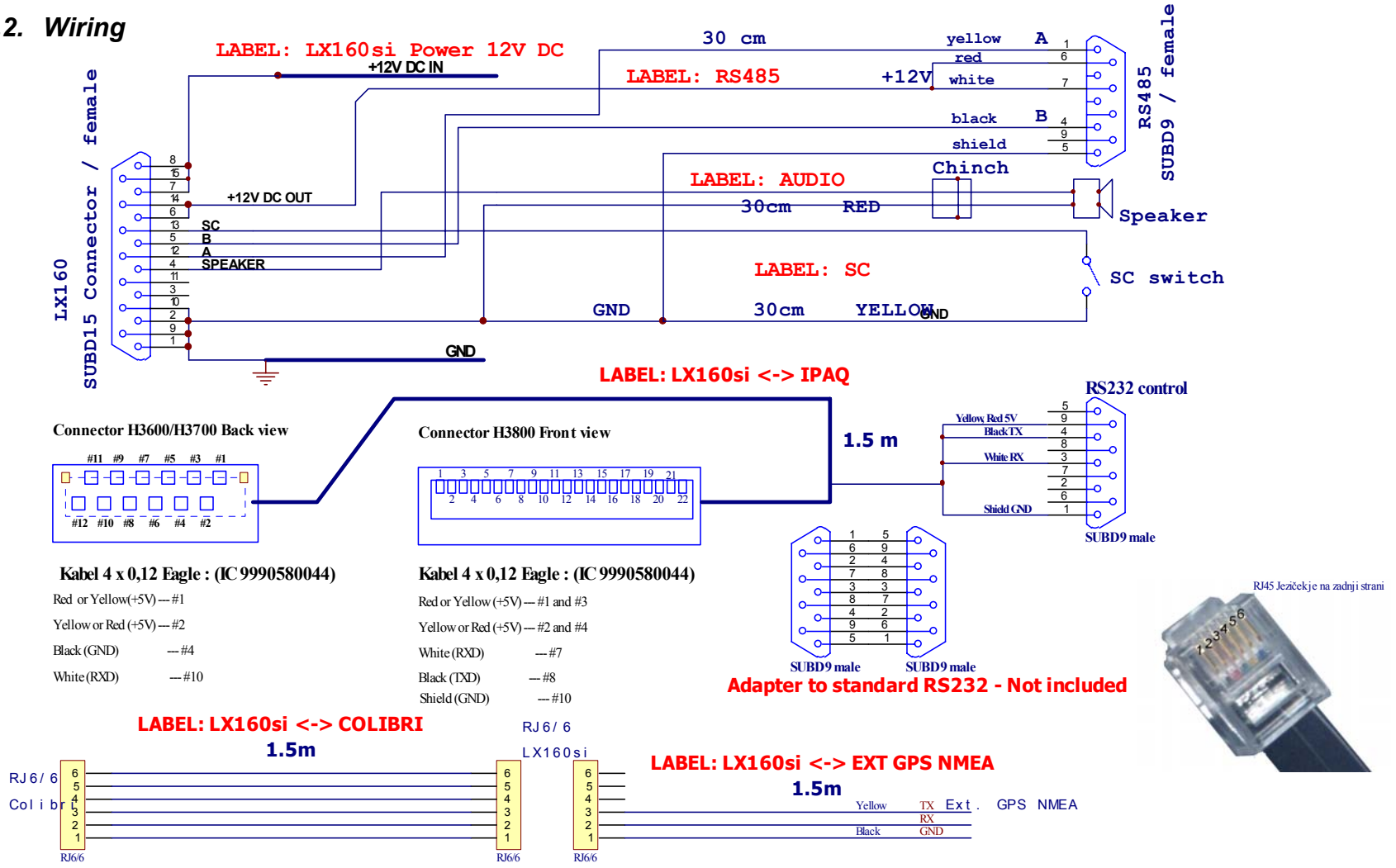
Q: The needle on my ***LX160si*** all the time on zero (doesn't move).
A: Please check if you have connected correct tube on TE probe. Check your smart vario filter. Too strong filter might hold a needle on zero.

15. Appendix

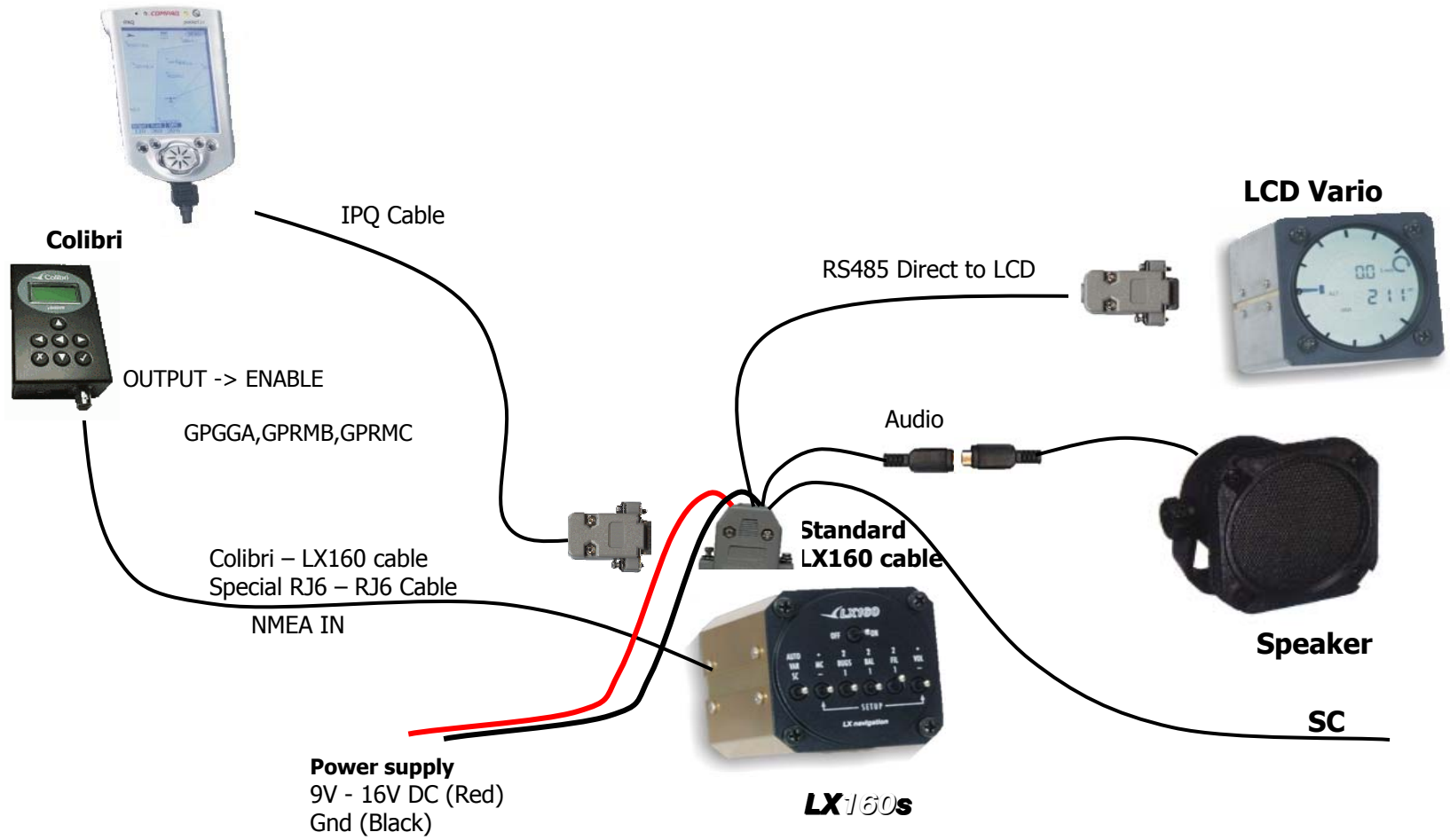
15.1. Menu-structure



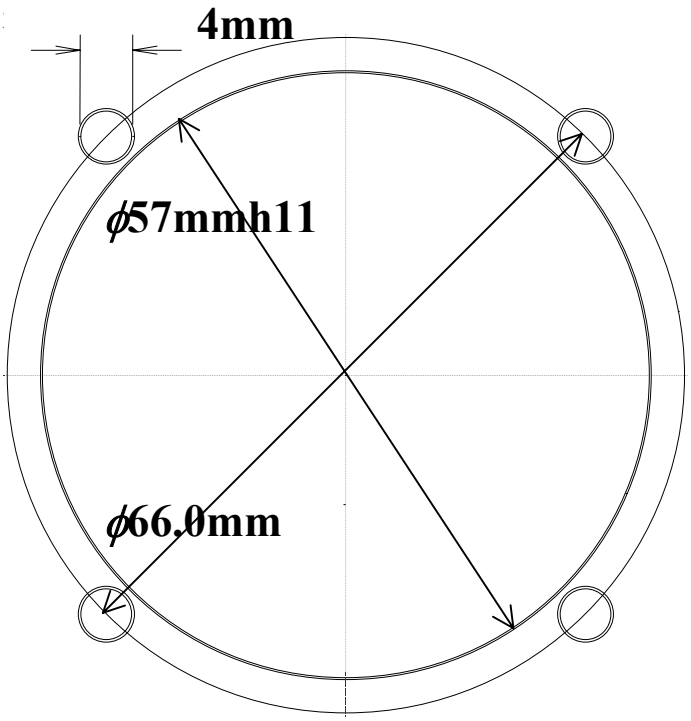
15.2. Wiring


LABEL: LX160si Power 12V DC
+12V DC IN
30 cm
LABEL: RS485
+12V
yellow A
red
white
black B
shield
RS485
SUBD9 / female
LX160
SUBD15 Connector / female
+12V DC OUT
SC
B
A
SPEAKER
LABEL: AUDIO
Chinch
30cm RED
Speaker
LABEL: SC
SC switch
GND
30cm YELLOW
GND
GND
LABEL: LX160si <-> IPAQ
Connector H3600/H3700 Back view
#11 #9 #7 #5 #3 #1
#12 #10 #8 #6 #4 #2
Connector H3800 Front view
1 3 5 7 9 11 13 15 17 19 21
2 4 6 8 10 12 14 16 18 20 22
1.5 m
RS232 control
Yellow Red 5V
Black TX
White RX
Shield GND
SUBD9 male
Kabel 4 x 0,12 Eagle : (IC 9990580044)
Red or Yellow(+5V) --- #1
Yellow or Red (+5V) --- #2
Black (GND) --- #4
White (RXD) --- #10
Kabel 4 x 0,12 Eagle : (IC 9990580044)
Red or Yellow (+5V) --- #1 and #3
Yellow or Red (+5V) --- #2 and #4
White (RXD) --- #7
Black (TXD) --- #8
Shield (GND) --- #10
SUBD9 male
SUBD9 male
Adapter to standard RS232 - Not included
RJ45 Jezičekje na zadnji strani
LABEL: LX160si <-> COLIBRI
1.5m
RJ6/6
Colibri
RJ6/6
RJ6/6
RJ6/6
LX160si
LABEL: LX160si <-> EXT GPS NMEA
1.5m
Yellow TX
RX
Black GND
Ext. GPS NMEA

15.3. Full connection schematic



15.4. Cut out



15.5. Pining of 15 P SUB D

1	GND
2	GND
3	NC
4	SPEAKER
5	RS485 B
6	+12V DC OUT
7	+12V DC IN
8	+12V DC IN
9	GND
10	GND
11	NC
12	RS485 B
13	SC
14	+12V DC OUT
15	+12V DC IN

15.6. Revisions

Version	Date	Description
V3.0	01.07.2002	- new HW LX160s
	19.02.2003	- Full configuration schematic
V3.02	15.04.2003	- New issue
V3.03	10.9.2004	- New Issue *(Ch. 7, 11.8, 11.7, 11.18,15.2,15.3)* - New wiring - New connection schematic
	18.1.2005	- Corrected wiring for IPAQ 15.2
	7.4.2005	- FAQ *(Ch.14)*
V3.04	7.4.2005	- Smart vario Bug fix from Ver 3.03
	6.7.2005	- Misprint in Fig.4 (swapped Pst in Ptot)

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