BRÄUNIGER
FLUGELECTRONIC

IQ Motor+
Operation Manual

Display readings visible on device:

- P1
- 4 3 2 1 + 1 2 3 4
- Alt 1 **503**   Vario **1.1**
- Time **15:08**   Flt Time **13:58**
- Compass (N E S W)
- Mot RPM **5380**   Temp **27**
- Track **246**   Alt GPS **1443**
- **Alt QNE**   Mod A1↑↓   **Alt Gps**

Keypad labels:
- F1   Alt1/Mrk
- F2   Alt 2
- OK Menu
- McC / WP
- H/Twind
- Route
- Page/ESC On/Off
- Goto

Firmware Vers.1.00c 11.3.2011
Revision: 18-11-2013

Table of Contents

1   Operation

1.1   Instrument summary

Connection jack for
vane sensor
(Option)

Loudspeaker

Cover right
side

Reserve jack
not connected

SD Card Slot

USB Mini B plug for data
exchange

USB plug
PC side

Keypad

Safety cord

On / Off
switch key

Temperat.sensor cylinder head-temperature

Radio module FlyLink

Magnetic ignition sensor

Status LED
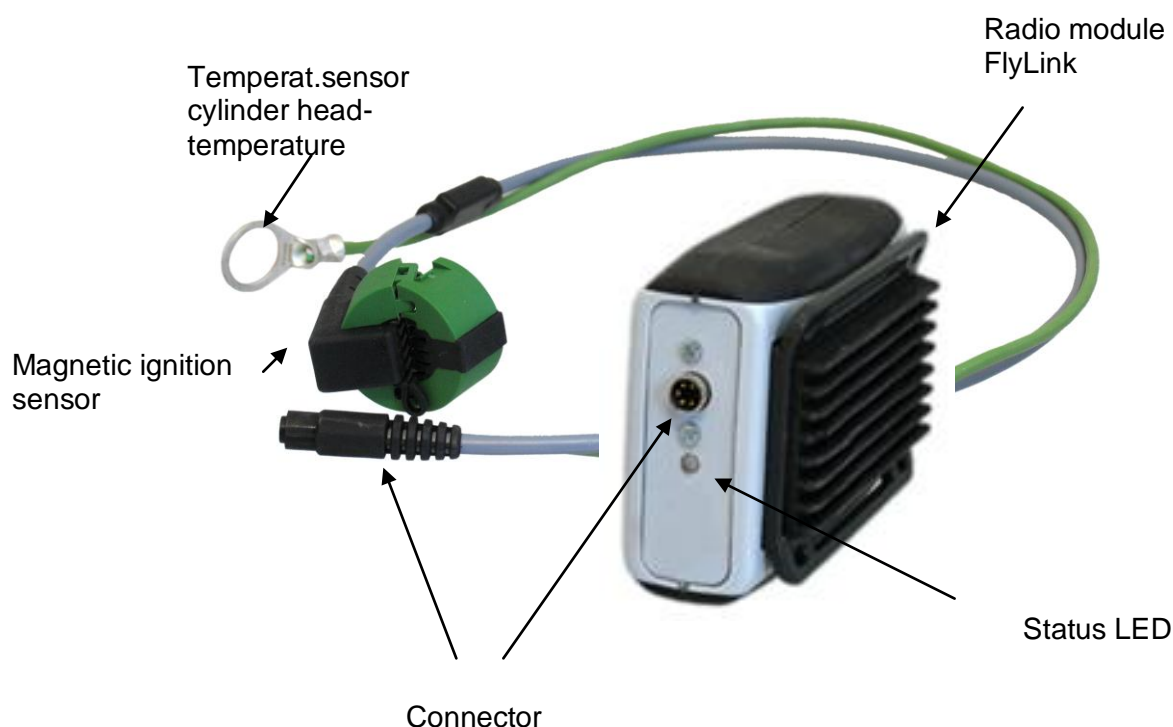
Connector

Changes at the Flylink module valid as up from October 2012 (illustration above shows the previous module, the new one is in translucent blue without switch and has 3 connector ports)

The new Flylink module *FL-Motor 2* is now provided with 2 LED signal lights. The right side LED diode is the status LED, the left side diode is the operating LED.

Flashlight signals of status LED:

      Fast red   **= error inside system, verification of sensor cable recommended**
      Slow green   **= battery ok**
      Slow orange **= battery capacity approx. 30 ... 40%**
      Slow red   **= battery discharged, needs replacement**

Flashlight signals of operating LED:

      Slow green   **= radio link to Vario OK**

      New FL-Motor 2 box:

Battery compartment

FlyLink LED

Battery LED

Sensor Connection ports

Attachement with rubber damping

1.2 IQ-Motor+ and Radio module – Switch-On and Off

1.2.1 Instrument switch-on

```
Init EEPROM

English              ↑
Deutsch
Francais
Espagñol
Italiano
Magyar               ↓
- - - - - - - - - - - - - - - -

        (OK)
```
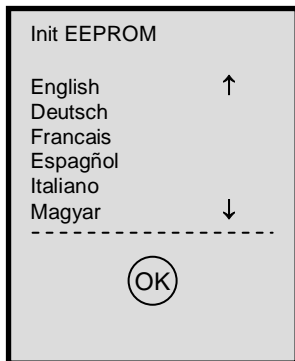
The instrument is switched-on by pressing the **On/Off** key.
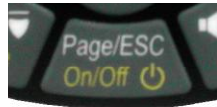
To prevent unintentional switch-on, it needs to be acknowledged upon display prompt : **Instrument on?**

by pressing the **OK** key.

```
      Brauniger
      IQ-Motor+
   Sn  8642
Version 1.00c
22.12.10

Date     Time (UTC)
08.03.11       13:36

battery check  3s
Bat  Bank 1:      55%
Bat  Bank 2:    100%
…… wait ……..
```
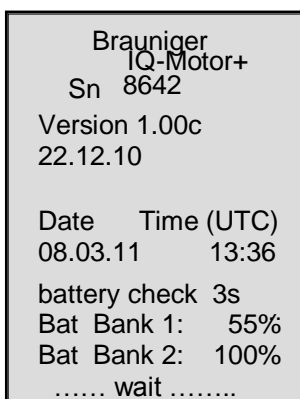
Following acknowledgement, the display will shift for 15 sec.to the switch-on display screen presenting the following information:

- Instrument type and serial number
- Software (Firmware) Version
- Time and date
- Battery charge indicator

1.2.2 Instrument switch-off

```
Bat Bank 1:  xx %
Bat Bank 2:  xx %

switch off ?
press OK

storing data
please visit us
www.brauniger.com
wait 10s before
next power on!
```
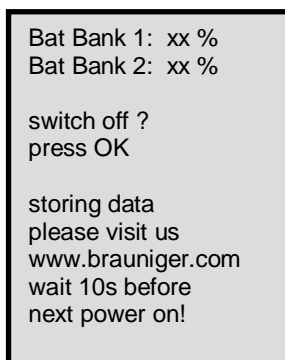
For switch-off press the **On/Off** key as long until the query:

Switch-off?
Press OK

Is prompted on the display screen.

Again, to prevent unintentional switch-off, also the switch-off action needs to be acknowledged by pressing the **OK** key.

1. Following OK acknowledgement the instrument is immediately switched-off, in case no flight recording had been programmed.

2. Following an active flight recording, the read-out screen **Flight – Analysis** is displayed. If you want to quit he flight analysis display, press briefly the OK or ON/OFF key, the instrument will then be switched-off immediately.

```
==========================
      FLIGHT-ANALYSIS
==========================
Date:     23.07.07  UTC
Start:    14:29:34  UTC
Stop:     14:58:39  UTC
Flighttime:    0:29:08
Scanrate:      10 s

Max  A1: 980m
Max  A2: 980m
       A3: 444m
Max Vario ( 1s):    2.1 m/s
Min  Vario ( 1s):   -0.6 m/s
Max Vario (10s):   2.1 m/s
Min  Vario (10s):  -0.6 m/s
Max Speed:   37 kh

Show                    Recal
Map                     Sign.
```
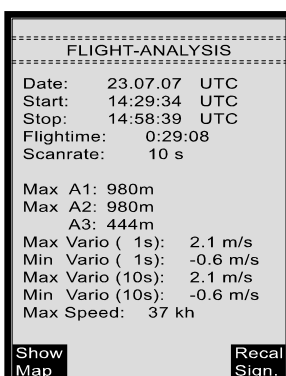
1.2.3   Radio module – switch-on

The Flylink radio module will be activated automatically by any movement. (build in acceleration sensor)

Significance of LED flashing signals

No ignition signal from sensor
Motor not yet running

Ignition signal from sensor
Motor is running

2 seconds

10 seconds

Time
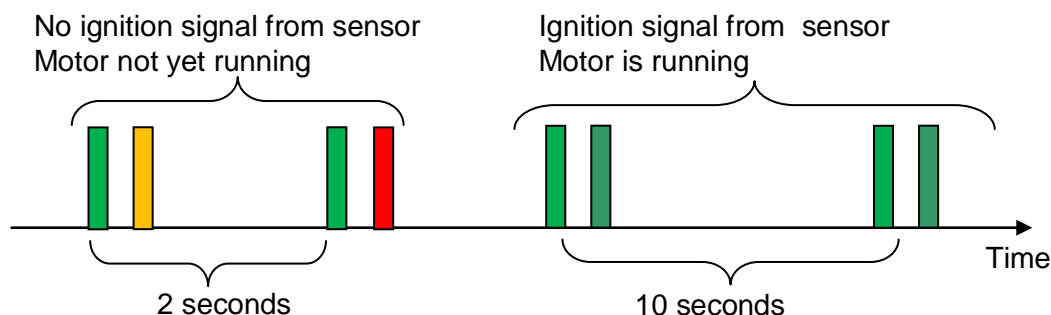
1. Flashing	Battery status	2. Flashing	System status
green	Good, enough reserve for	green	System OK
yellow	Battery should soon be replaced	yellow	There is no connection to to IQ Motor+
red	Battery no longer sufficient for the next flight	red	General system error

1.2.4   Radio module - switch-off

The Flylink radio module is switched-off automatically at 30 minutes after the last ignition impulse.

Caution: important note!

New high performance ignition devices, such as mounted on numerous paraglide motor systems, may partially generate extremely disturbing HF interferences. These impulses may seriously hamper the radio transmission from the FlyLink transmitter to the Vario. We have certainly mounted important HF filters, but in some cases it is in fact possible that strong interferences are generated, so that no safe signal transmission can be performed!
Sometimes the careful grounding of the ignition system to the motor case may find a remedy. We recommend checking this grounding when using the FlyLink transmitter, resp. to complete it thoroughly!
Likewise, another positioning of the FlyLink module, such as a modified cable routing, may rectify the problem.

1.3   Operation philosophy

- white key lettering: all acoustic signal settings, the F1 / F2 key commands, the display screen shifts and an information query (*i*) , can be made rapidly during the flight by **short pressure** on the key.

- yellow key lettering: by **long pressure** of 3 sec. important functions may be called up directly during the flight and may also be edited. The selected function remains active, until another function will be called up!

- Main menu: all instrument settings, but also Waypoints- Routes- and Flight obstacle-editing, can be set before the flight via the **Main menu** (MENU key).

Tip: all instrument settings of the Main menu can be set comfortably by use of the freebie PC-Software Flychart on the PC and be transferred via USB-interface onto the instrument.

1.4   Keypad

Function of F1 key

Selection for revision of user defined fields

Setting altitude A1
Insert marker during flight into flight recording

Function short press not existing
Selection of Waypoints within a Route

Sinktone On/Off
Selection of Routes

Display shift / in menu 1 step backward
On/Off key

Function of F2 key

Shifting the user defined pages

Setting altitude A2

Acknowledgement key OK
Instrument Main menu

Info key - display of current coordinates or information about next CTR's …
Wind Functions menu

Audio Sound level
WP-Selection

1.4.1   Function related keys F1 and F2

The two **F1** and **F2** keys alter according to function or readout screen their setting possibility. The significance of the keys is indicated in the lower part on the right and left hand side of the display screen.
Example: In map screen the function **Zoom Out** is assigned to the F1 key, whereas **Zoom in** is assigned to the F2 key. In Set mode Waypoints the function of F1 key is **"Add WP"** and of F2 key is **"Delete WP".**

1.5 Display screen

Following to the switch-on screen, the main page will automatically be displayed.

Variometer page

P1	Time	FltTime
	18:48	2:08

Alt 1	Vario
452	-1.1

rpm	Gnd Geschw
4715	56

Alt QNE   Mod A1↑↓   Alt GPS

Navigation page

	Time	FltTime
	16:53	2:08
	WindSpd	GNDSpd
	36	67

N E W S

rpm	Cyl.temp
4715	289
Alt 1	Vario
1687	2.8

Alt QNE   Mod A1↑↓   Alt GPS

Map page

WP1
WP2
10.0

Vario	Altitude
4.2	2645

Zom Out   Mod A1↑↓   Zom In

Page/ESC On/Off ⏻ → Page/ESC On/Off ⏻ → Page/ESC On/Off ⏻

After briefly pressing the Page-key the display screen can be shifted.

1.5.1 Variometer page

Battery status Bank 1
Bank 2

Data fields page number

GPS - Number of Satellites

Analog Vario

Variometer - sequence of last 30 seconds

P1	Time	FltTime
	18:48	2:08

Alt 1	Vario
452	-1.1

rpm	Gnd Geschw
471	56

User defined Data fields

Function of F1 key

Function of F2 key

Alt QNE   Mod A1↑↓   Alt GPS

Infoline 1
Infolinle 2
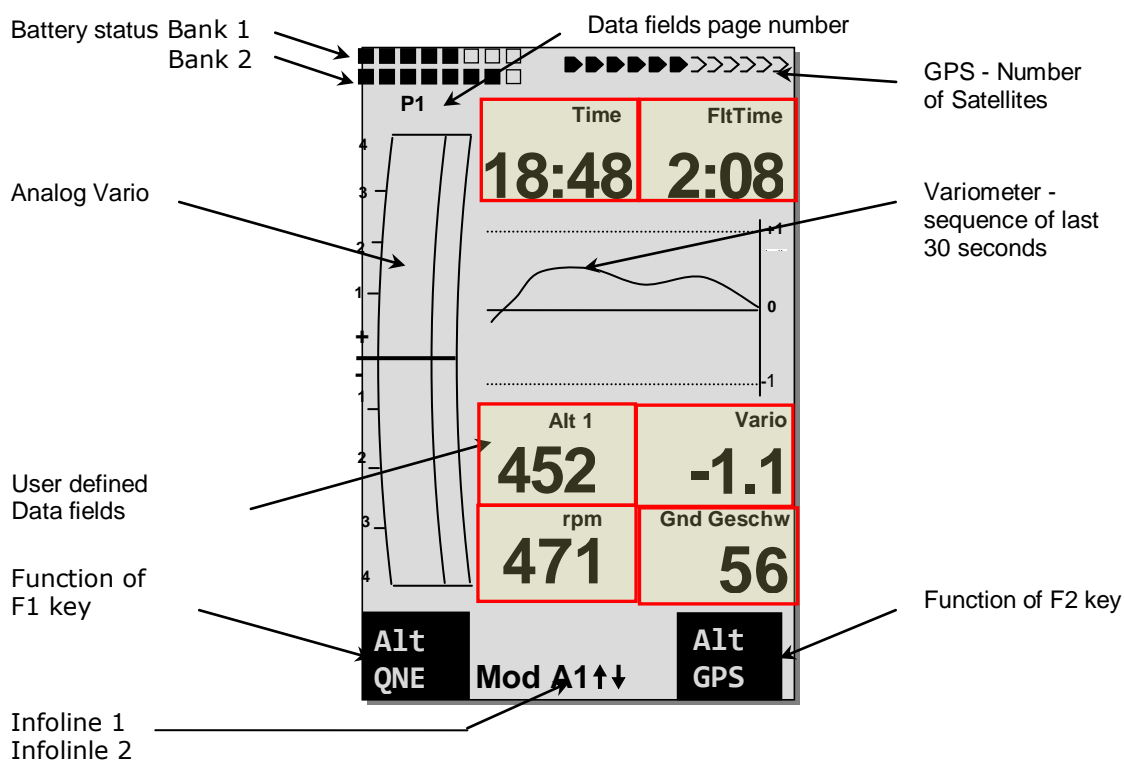
1.5.1.1 <u>User defined data fields</u>

In Vario- and Navigation display screen are provided three display fields each, which can be allocated individually by the user. In total more than 30 selectable data fields are at user's disposal.

In both display screens can be selected, if 6 data fields with large font or 8 data fields with smaller font are pictured. In Menu item -> *Main Setup Menu -> Instr. Sett. -> User Fields* these 6 or 8 fields can be selected.

```
==================
Benutzer Felder
8 = Yes   6 = No
Var   P1   P2   P3
     Yes  Yes  No
Nav   P1   P2   P3
     Yes  Yes  No
```

Example:
Nav P1 -> Yes -> 8 fields with small font   Var P1 -> No -> 6 fields with large font
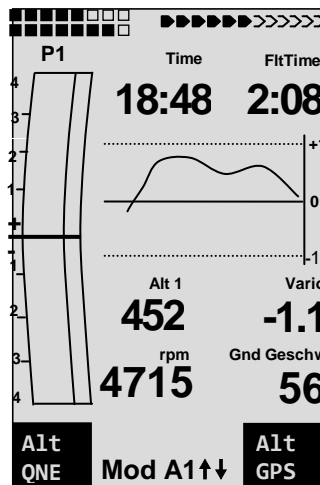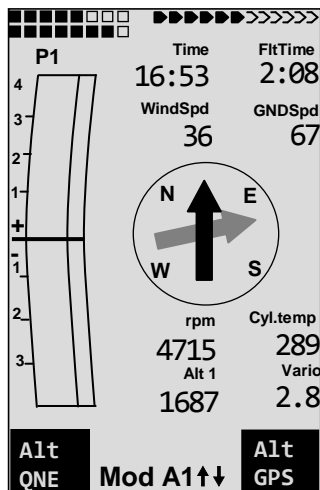
For list of data fields see 1.6 User defined data field page 13 (depending on firmware version)

Alter data fields manually
Mark by repeated (several times) pressing of the arrow key ◄ the data field to be altered. The selected data field shall be designated by a black bar. By using the ▲ or ▼ keys it is possible to assign a new display value to the selected data field. The field designation is displayed at the same time in large font in Info line 1.
If nothing is changed after having selected a field, the instrument returns to normal function after 10 sec. and the previous display remains preserved.

Alter data fields on the PC
All user defined readouts can be set comfortably by use of the freebie PC-Software Flychart on your PC and be transferred via PC-interface onto the instrument.

Caution: for safety reasons it is not possible to alter the user-fields during the flight!

1.5.1.2 Data fields page - shifting

The three data fields exist 3 times on the main page and on the page of final approach. Therefore you have the possibility to configure in total 18 data fields individually!

Short pressing on the right side arrow key ▶ gives access to the next page. The page number is shown in the upper part of the display nenext to the Ba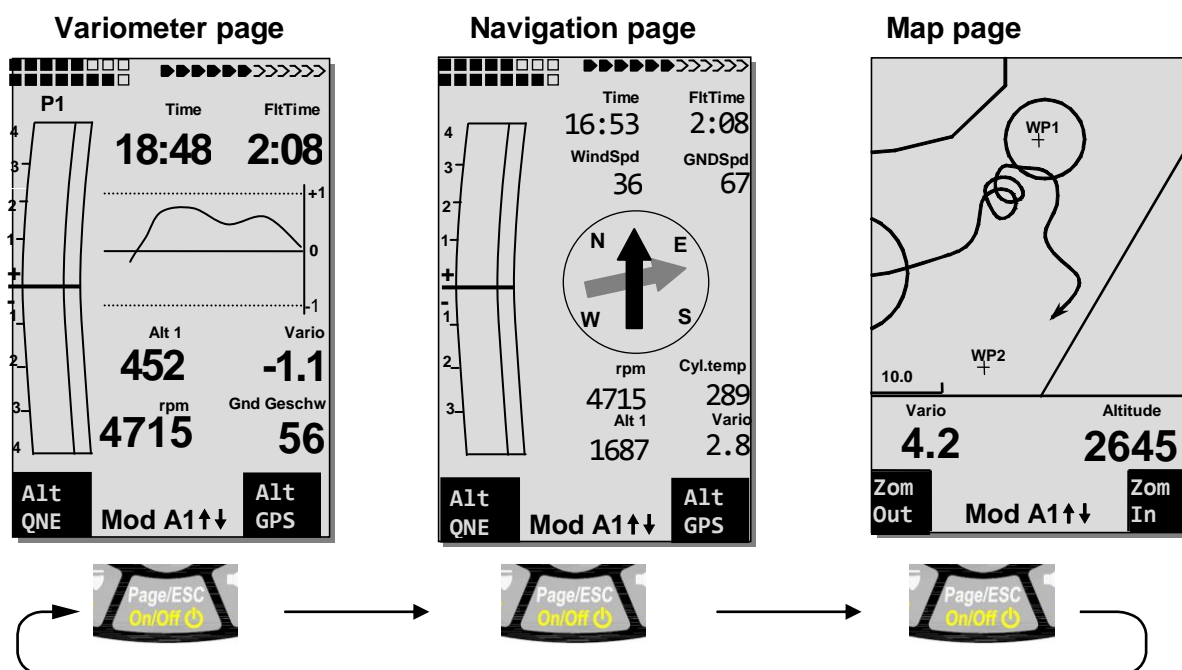ttery-status indicator as **P1, P2** or **P3**. In   -> *Main Setup Menu -> Instr. Settings ->User fields* it is possible to configure these display pages each with 4 large or 6 small fields!

We would like to present to the user some proven recommendations in regard to the default values of the 3 adjustable pages. Some of the readouts are of such interest that we recommend to keep them on each of the 3 possible pages always at the same position. For example: the "Speed over ground - Gnd-Speed".
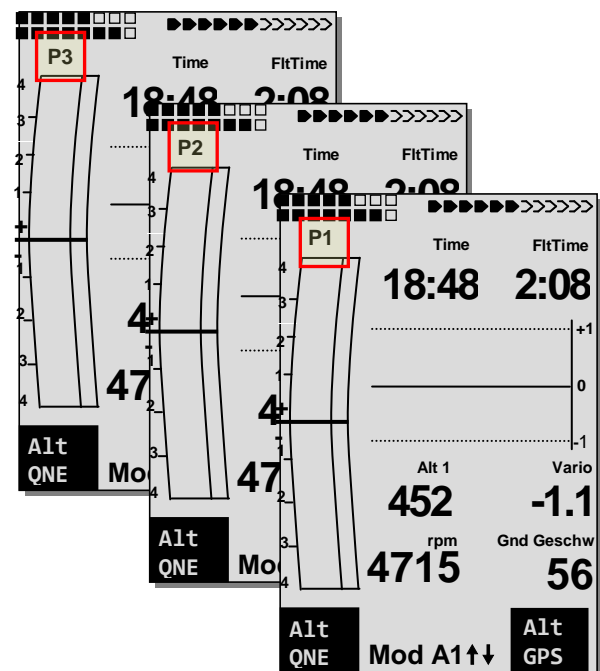
Example:
page 1) general flight information is called up prior to the start, or when the pilot is currently in normal Thermal flight.

page 2) Navigation page is used if a Waypoint (WP) has been selected as goal to fly to. Instead of the values recommended above, this field should mainly contain navigation readouts, such as Dist to WP; Alt a. BG; Alt a. WP.

page 3) personal page presents data being important to you personally, such as Glide ratio over ground; wind speed; Dist Therm.

1.5.2 Navigation page
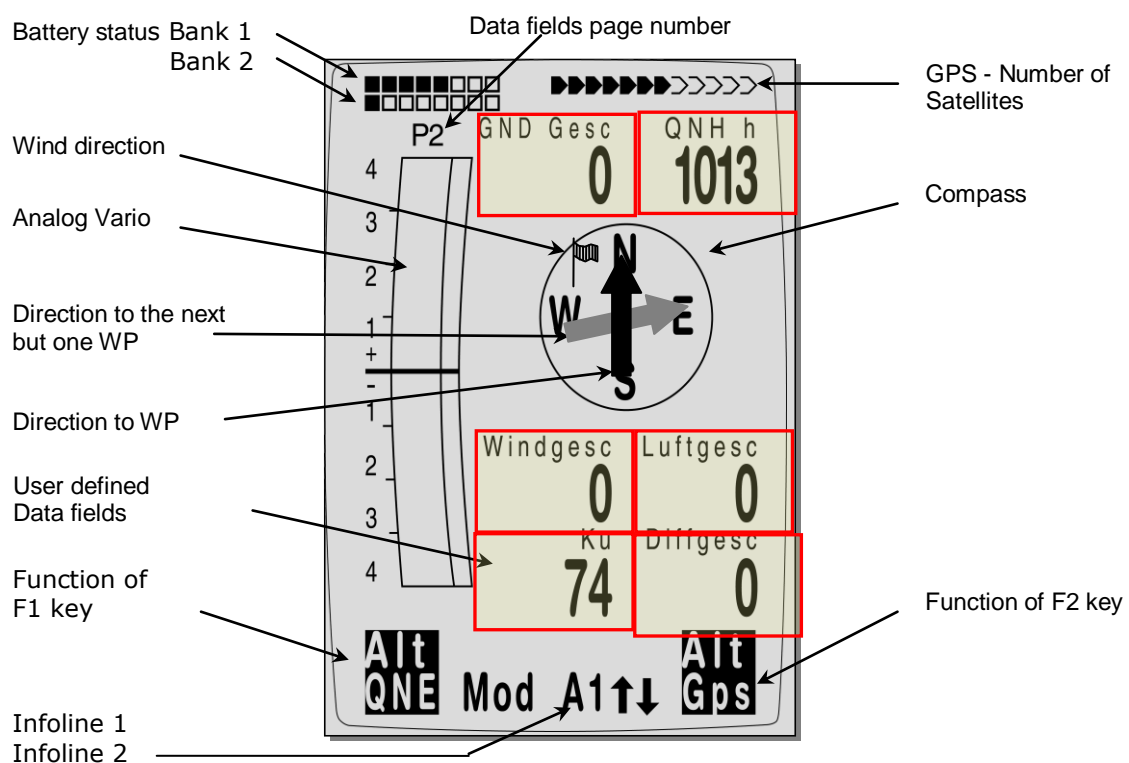
Navigation page is selected by briefly pressing the "Page" key.

1.5.3   Map page

Defined Air space

Waypoint in a
Route with Cylinder

Track, flown distance

Waypoint

Scale

Digital Variometer

Altimeter

Function of F1 key

Function of F2 key

Information lines
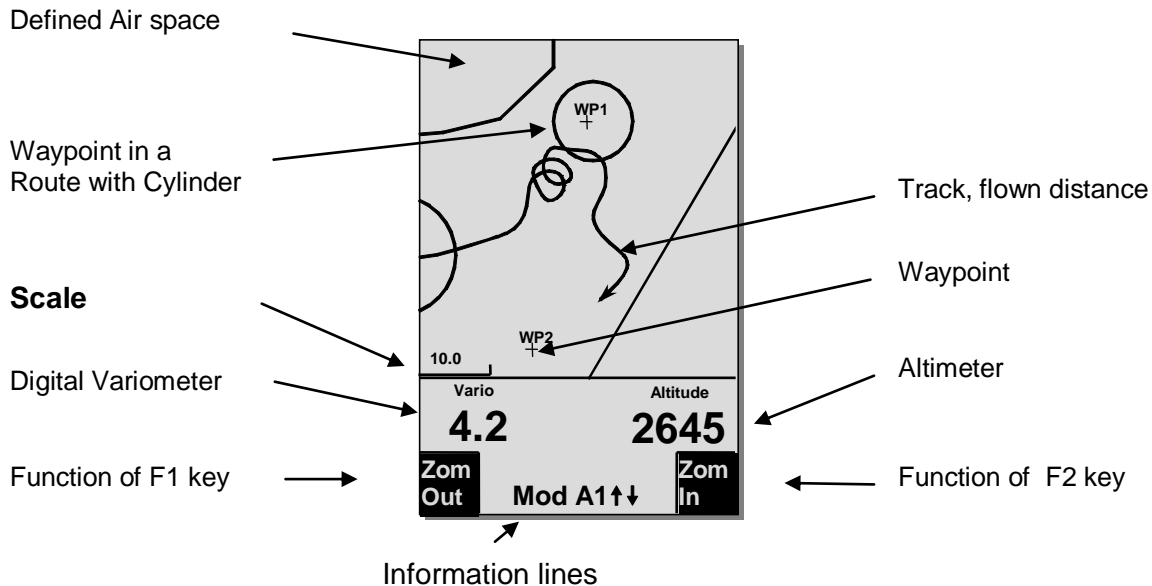
By short pressing on the „Page" key the map format page is selected. (North is always at the top!)
The map mode display screen illustrates the current track. In addition, Air space data such as
TMA, CTR, Wildlife protected areas and stored Waypoints with cross and its name are displayed.
In case of active *Competition Route* the start and Waypoint cylinder as well as Waypoint
interconnections of the Route are also displayed.
This screen also displays the flight relevant data such as analog Vario display and altimeter.
By using the two function keys **F1** and **F2** you can magnify or also scale down the map segment.
The map scale is shown in the lower part on left side.

F1: Zoom out: the map scale is gradually decreased until the total map overview is achieved.

F2: Zoom in: the   map   scale   is   gradually   magnified,   hereby   individual   details   of   the
                   recording are clearly recognisable !

OK: from each graph back to the screen optimised graph.

Page: return to main screen page.

All other keys cause the Track in the current selection to be redrawn.

Arrow keys:
By using the right side arrow key during the flight, you can fade out all Wayoints not being part of the
Route. For any new map-/screen graph selection, all Waypoints are always presented.
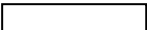
During the flight the active position is in the centre. The display screen is scrolling by half when the
active position has reached the map border, or if one returns from another readout screen to map
mode.

When viewing a stored flight in the Flight Memory, and using the arrow keys, the illustrated area can
be shifted up, down, left or right. However, this function is not enabled during an actual flight.

Remark: the display time may take a few seconds according to the relevant data volume.
The more Track points are already stored in memory, the more time is required for the completion of of display time. If a zoom or pan key is activated during the screen layout, the momentary layout process will be stopped and will resume with the new values. Thus one can obtain the desired graph rapidly.
The Track is plotted back from the active position. This may be important for the screen layout during very long flights and short recording intervals.

1.6 User defined data fields

The main display page contains 3 pages each which are stepped forward by using the ►key.
Thus it is possible to display almost all of the following measuring values in the right context.
The page number is shown next to the battery-charge status indicator as P1 .. P3.

		page
☐	display remains empty	
FLARM	If FLARM is activated this field shows the number of FLARM devices within radio range	55
Mot Temp	Cylinder head temperature of radio module. If there is no reception from the radio module two dashes " –" will appear	27
Mot RPM	Motorspeed. If there is no reception from the radio module two dashes „ –„ will appear	27
Time	Time of day	27
Flight time	Flight time since take-off	50
Vario	Digitalvario	22
Altitude 1 m	Absolute altitude	20
Altitude 1 ft	Absolute altitude in ft	20
Altitude 2	Reference altitude, can be set arbitrarily to 0	21
Altitude 3 Sum	Cumulated gain in height during the flight	21
Altitude GPS	GPS altitude	60
FL (ft)	Flight level in feet. Not alterable	20
QNH hPa	Air pressure in Hektopascal	19
Gnd Speed	Speed over Ground * (= GS)	41
Air Speed	Speed thru the air	26
Wind Speed	Wind speed *	41
Speed Diff	Wind component (Groundspeed – True Airspeed)*	41
Track	Flight direction (Track)*	30
Bearing WP	Direction to selected Waypoint *	30
Dist WP	Distance to selected Waypoint *	33
Dist Goal	Counted up sectors in front oft he pilot * up to the last WP of a Route	39
Dist Start	Distance from take-off position	39
Dist Cylin	Distance to Waypoint cylinder in a Competition-Route	39
Dist Air space	Distance to next Air space	44
L/D Gnd	actual glide ratio (L/D) over Ground (= Ground speed/Sink) *	42
L/D Air	actual glide ratio (L/D) thru the air (= TAS/Sink)	42
L/D reqWP	required glide ratio over Ground to reach the WP*	42
L/D Goal	required glide ratio to reach goal, over the Waypoints of a Route	42
Diff BGWayp	Safety altitude over the path for best glide*	42
Diff BGGoal	Pre-calculated arrival altitude over the last Waypoint of a Route *	43
Temperature	Temperature of circuit board	28
SMS p/t	Number of SMS pending/transmitted	

If nothing is changed after having selected a field, the instrument returns to normal function after 10 sec. and the previous display is shown again.

1.7   The Setting menus

Long pressure on the **MENU** key gives access to setting mode. By use of ▼ and ▲ keys one of the Menu items is selected and by pressing the **OK** key access is given to the corresponding subdirectory.

1.7.1   Menu navigation summary

1.7.1.1 <u>User Settings</u>

A series of settings allow the instrument to be programmed in accordance to the user's wishes. Every pilot may realise his very own ideas here. **All the basic settings may be set comfortably on the PC by use of the PC-Software „Flychart" and be transferred later to the instrument via the PC interface.**

In most cases the possible setting range and its previously valid value is indicated individually for each one of the settings. If this value should be modified, pressing on the **OK** key gives access to change mode, the value to be modified will blink and can now be altered by use of the ▼ and ▲ arrow keys. Pressing the **OK** key confirms the new value, pressing of the **ESC** key recalls the previous setting.

Term	Meaning	more info	Factory setting
Variometer			
Basic filter	Diagnose time constant f. Vario and Speed	22	0 slow – 4 rapid (3)
Digital Vario Integrator	Shifting Integr.- Netto-Vario; Integr.- time constant	22	Integr. 1 30 sec 1 sec
Variometer Acoustics			
Acoustic settings	Climbtone-frequency, modulation; sinktone-freq., acoustic-dampening; Pitch	23	800 Hz; Mod = 5, 700 Hz, 8, Pi = 3
Climb acoustics threshold	Fine tuning of climbtone activation, max 20 cm	23	2 cm/sec
Sinktone threshold*	Activation point of sinktone	23	0,8 m/s (ft/m)
Speed			
Sensor sett. Wind vane	Wind vane correction 70 ... 150 %	26	100 %
Stall speed	Activation of Stall alarm a.altitude limit	23	0 km/h (mph)
Flight Memory			
Recording Auto/Man	Autom. or manual flight recording	50	Aut.
Recording interval	Time interval per recording point - 2 up to 30 sec.	50	10 sec
Ctr Alarm	The audible alarm is activated with Yes, and is switched-off with No	44	No, switched-off
Polar curves	Glide ratio at speed of best glide	43	L/D 8 at 40km/h
Pilot's name	Entry of pilot's name; max 25 charact.	17	not set
Aircraft type	Name of aircraft for OLC	17	not set
Aircraft ID	Ident No. of aircraft for OLC	17	not set

1.7.1.2 <u>Manage Mmemory</u>

Delete flights	Deleting the entire flight memory. This command reformats the flight memory, without the remaining settings being lost	50	No
Delete WP & Routes	Deleting all WP and Routes	31	No
Memory formating	Reset of Basic values to factory settings	50	No
Delete Air space	Reorganisation oft he Memory zone for the Restricted Areas (CTR's)	44	No

Caution: when deleting WP, Routes or flights the deletion process will take a couple of seconds, please wait during this time span.

1.7.1.3 Instrument Settings

Term	Meaning	more info	Factory setting
Display contrast	Range 0 .. 100 %	-	50 %
Language	Selection possible from 5 different languages	-	Englisch
Battery type	Battery type. Selectable between Alkaline or NiMH	page 57	Alkaline
Time zone	Difference to UTC; also 0.5h time zones are adjustable	page 27	-2
Units	Meter or feet; Km/h or mph or knots - Temp. In °C or °F	-	m ; km/h ; °C
Coordinates format	dd'mm.mmm or dd.ddddd or dd'mm"ss UTM or Swiss-Grid	page 31	dd'mm.mmm
Pressure sensor correction	Due to this setting it is possible to remediate a possible ageing of the pressure sensor. As monitoring value the QNH value is applied. If you know the QNH value of a certain location (e.g. airfield altitude) the altitude must be concordant to the effective altitude. 1hPa corresponds at 500m to approx. 8m.	page 21	0 hPa
Bluetooth	Only active if the SW package Bluetooth is enabled. At this item is made the Pairing of Bluetooth interface for the SMS function.	page 55	Pls. see separate documentation
SMS	Only active, if the Bluetooth and SMS SW Package is enabled. At this item is entered the target telephone number as well as the mode	page 55	Pls. see separate documentation
FlyLink	At this item are entered additional pairing settings for FlyLink	page 55	1,0,0,0
Flarm	At this item Flarm (in option) is switched-on or switched-off. At this menu item is also activated the programming of the FLARM module	page 55	Switched-off, No
Optional Software	At this item additional SW functions (Packages) are activated. For this purpose the relevant manufacturer's Code is required.	page 54	
Factory settings	Disabled zone	page 16	

1.7.1.4 Instrument specific factory settings)

This setting item, which is not accessible to the pilot, contains all basic settings of the instrument. In particular, both the sensor specific parameters and all calibration data are located here. These data are not lost, even when the power supply is switched-off.

1.7.1.5 Fllight memory and data evaluation

Flights are recorded in a Flash-Memory (see hereunder). Each Trackpoint contains time of day, position, GPS-altitude, barometric altitude as well as flight speed. In this way, it is possible to graph the Barogram, variogram, speed gram and course of the flight over a map for later evaluation. These data are processed for flight analysis by various evaluation programs. In Flychart 4.52 it is possible to show the flight on the PC monitor in 3D mode on the corresponding landscape. (Google Earth)

The IQ Motor+ is provided in total with 4different memory zones

Content	Type	Access with	Deleting
Program memory	Flash	Flasher Tool at instrument-off status	The Flasher tool overwrites the memory each time
Flight memory	Flash	*Main Setup Menu ⇒ Flight memory* Readout of flights via the USB interface	*Main Setup Menu ⇒ Manage Memory⇒ Delete all flights*
Waypoints, Routes and Air space	EEPROM	*Main Setup Menu ⇒ Waypoints* or *⇒Routes* or *⇒Air space*	*Main Setup Menu ⇒ Manage Memory ⇒Delete all Wp&Rt* or *⇒ Delete any Air space*
User and Instrument settings	EEPROM	*Main Setup Menu ⇒ User Settings* or *⇒ Instr. Settings*	*Main Setup Menu ⇒ Manage Memory ⇒Formatting Memory.*
Serial number, Aligning data	EEPROM	*Main Setup Menu ⇒ Instr. Settings ⇒ Factory settings.* Only password access	Not possible
Flight data, Waypoints and Routes as files on SD Card	SD Card		Data management only possible on PC

With *Main Setup Menu ⇒ Manage Memory ⇒ Formatting Memory* manufacturer approved basic settings are called-up and are saved again in the settings. This function should only be used in case of emergency, as by its activation also all Waypoints and Routes shall be deleted.

1.7.2   Entering Text

It is possible to enter on certain fields, as for example pilot's name, type of aircraft, aircraft ID, or in regard to Waypoints and Routes, the desired text directly on the instrument.
Text entry on the instrument is demonstrated here for the example of a Waypoint:
By use of the ▲ and ▼ arrow keys a WP is selected and after pressing the **OK** key it is altered with the arrow keys. The 1st letter of the WP name shall be flashing, again by using the ▲and ▼ arrow keys the required letter is selected; numbers, letters as well as a range of special characters are available. By pressing the ► key the cursor moves to the next letter position etc In this mode the **F1** key is used to switch between capitals and minuscules. The **F2** key is used to rub out one character. It is possible to enter max. 17 characters. When the name has been entered completely, it is to be confirmed by pressing **OK**.

It is much more easier to carry out the text entry by use of the PC using the program Flychart 4.52, and to transfer it to the instrument.

1.8   First steps

1.8.1   Prior to the first flight

1.8.2   At take-off

1.8.3   Handling during flight

The most important commands during flight are:
- Page key for shifting both between Vario, Navigation and Map pages.
- Right arrow key for shifting to user data field page.
- Audio keys to switch-on and switch-off the audible information, such as Sink alarm,
  Variometer climb.

1.8.4   Data evaluation after the flight

then download the flight from the instrument.

Several programs allow for direct entry to the OLC or similar online competitions.

Download the flights regularly from the instrument to the PC and format the flight memory from time to time with *Del. All Records* in Menu „Manage Memory".
This way you are ensured to record successfully your flights at any time.

2   Functions

2.1   Altimeter and air pressure

2.1.1   How does an altimeter work?

A barometric altimeter calculates altitude from the present air pressure of the atmosphere. Air pressure will decrease at increasing height. Due to the fact that air may be compressed, the pressure decrease is not linear, but indeed exponential. The basis for altitude calculation in aviation is an international formula which defines a standard atmosphere.
In the **CINA- Standard atmosphere** the basic pressure on sea level is **1013,25 hPa** (Hektopascal) at a temperature of **15°C**. Furthermore it defines a continuous temperature decrease at increasing height of **0,65°C per 100m** ascent.
Therefore is binding: a barometric aviation altimeter displays the precise altitude only if weather conditions are in exact accordance to the standard atmosphere. In practice, such analogy is more likely to be the exception!
Air weight and pressure are strongly influenced by air temperature. If temperature deviates from standard atmosphere, the display of altitude calculated as per the international formula is no longer correct. The altimeter displays during summer, when temperatures are higher, indeed altitude parameters which are too low, and during wintertime it is exactly the contrary!
Flying at lower temperatures is effectively done at lower altitude, and at higher temperatures flight altitude is higher than the altimeter displays! The deviation of 1 °C per 1000 height meters induces approx. 4 m error. (This empirical formula is valid for up to 4000m!)
If you are flying during summer through 2000 height meters in an air mass being too warm by 16 °C compared to standard atmosphere, the altimeter will then display 2 x 4 x 16 = 128m difference in altitude below real height! Based upon the internationally determined altitude calculation with standard values, this display error caused by air temperature shall not be rectified by the instrument.
Air pressure changes in relation to weather conditions. In order to compensate for display fluctuations, an altimeter always needs to be gauged. This means that the altimeter has to be set precisely before take-off for any flight to a well-known altitude value. Caution: the atmospheric pressure may change during the timeline of one day up to five Hektopascal (for ex. cold front). As a result this is after all the equivalent of more than 40 meters height difference.
There is another possibility to gauge the altimeter which is to enter the current QNH pressure value. The QNH (Question Normal Height) applied in aviation matches the current local air pressure, as it would be at sea level, so that the altimeter would indeed display 0m. Due to this process the local pressure data recorded by the various measurement stations is area-wide comparable, irrespective of the geographical height.
The QNH-value is subject to be continuously updated and may be read in the flight weather report, or required by radio from airfields, or by enquiry on the Internet.

The instrument provides 5 altitude displays and one QNH pressure indicator.

ALT1	The altimeter absolute altitude shows the altitude over sea level.
ALT2	The altimeter relative altitude shows the altitude towards a reference point.
Höhe Sum	Displays the cumulated altitude for one flight.
FL (ft)	Flightlevel pressure altimeter display in relation to 1013hPa
QNH	Actual air pressure at sea level in relation to A1
GPS Alt	The actual GPS altitude

2.1.2   Altimeter Alt1, Absolute altitude

Altimeter **Alt1** is always the absolute altitude above sea level. The Alt1 display is permanently shown on the Main page as well as on the Map page.

The Alt1 display is also shown in both user defined readout screens **Altitude1m** and **Altitude1ft.** Due to this feature it is possible to readout the absolute altitude besides the main display in unit meter but also in unit feet. This fact is important for communication with air traffic controllers during flights in Restricted Areas!

2.1.2.1   Altimeter A1 - configuring

The altimeter function A1 is called-up by long pressure on the ALT1 key. The possible settings are shown in the Information line and in both function key fields.

Manual setting
By brief pressure on one arrow key the readout value can be adjusted meter by meter. Under keystroke the display shall be changed automatically until the key is released.
Due to this adjustment the QNH display (user field) is also altered.
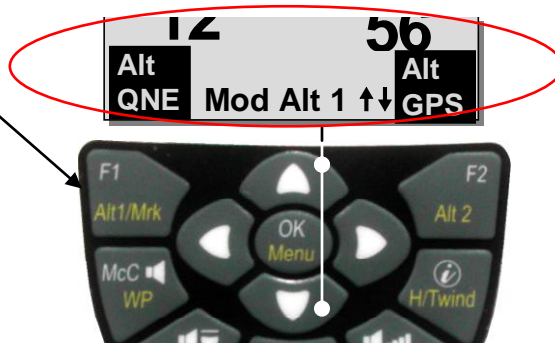
Adopt GPS altitude
By brief pressure on the **F2 (**Alt1 GPS) key it is possible to adopt the GPS altitude. Please consider that the GPS-receiver only provides the reliable altitude value after approx. 2 minutes! In case of poor Satellite constellation or bad reception, altitude deviation of up to 100 m will occur!

Setting altitude to pressure standard 1013hPa
By brief pressure on the F1 key the altitude is set to 1013hPa.

2.1.2.2   User defined fields related to Alt1
-Altitude 1m → Altimeter display 1 in Meter
-Altitude 1ft → Altimeter display 1 in feet
-QNH hPa→ locally reduced pressure readout at sea level in relation to Alt1

Tip:
Altitude A1 can be selected as unit ft in the user defined fields. This information might be important when being in contact with an air traffic manager.

If the user does not know the altitude of his present location, he may obtain the data by fading in the User Field QNH and, using the arrow keys, by changing the altitude value until the QNH matches the actual QNH as per weather forecast or indication issued by air traffic management.

2.1.3 Altimeter Alt2, Relative altitude (user field)

The altimeter Alt2 is in any case a difference altimeter. Thus it always displays the difference compared to such altitude at which it was reset to zero the last time. This function is often used for measuring the start site raising, or to recognise easily during flight under weak thermal lift the gain or loss in height.
The A2 readout is displayed in user defined display screen **Altitude2**.

Example: if Altitude A2 is set at start site to 0 m, then after take-off is always shown in field Altitude2 the altitude value over start site.

2.1.3.1 Altimeter Alt2 - configuring

The altimeter function Alt2 is called-up by **long pressure on the ALT2 key.** The possible settings are shown in the Information line and in both function key fields.

Manual setting
By brief pressure on one arrow key the readout value can be adjusted meter by meter. Under continuous keystroke the display shall be changed automatically until the key is released.
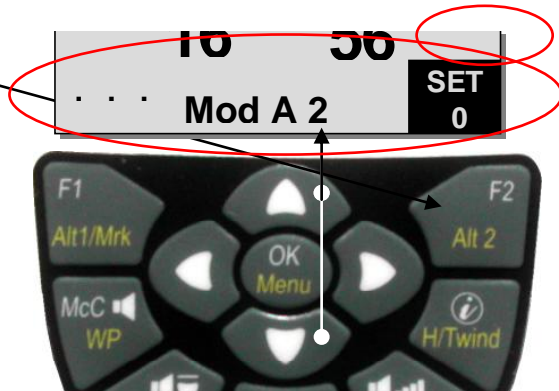
Setting altitude A2 to 0m
By brief pressure on the **F2** (SET 0) key the Altitude is set to 0m.

2.1.4 Cumulated altitude display (user field Altitude Sum)

The user defined field **Altitude Sum** adds up all meters of ascent cumulated during one flight. The cumulated altitude is also indicated in the flight analysis.

Tip: If several pilots complete the same flight task, then the one who had the least gain in height (A3) would have been the best to accomplish the task.

2.1.5 FL Flightlevel altitude display (user field FL ft)

The FL altitude display in feet is not adjustable. The altitude display is always related to a QNH-value (air pressure at sea level) of 1013 hPa. This readout is particularly important for aircraft pilots to whom is assigned a Flight Level by air traffic-controllers during flights in Restricted Areas.

2.1.6 Pressure sensor correction

In Menu item -> *Main Setup Menu -> Instr.Sett. ->Pressure sensor Corr* it is possible to rectify the ageing of the pressure sensor. The QNH value is the basis for control. If you happen to know the QNH value of a certain location, (e.g. air field altitude) the altitude on display must match the actual altitude. 1hPa corresponds at 500m altitude to approx. 8m.

2.2 Variometer Functions

2.2.1 Analog Vario

The most important indication for a non-motor driven aircraft is without any doubt the Variometer.

It displays the vertical speed in meter/second and informs the pilot about the actual climb or sink rate.

It is only possible for the pilot by using the Vario (and its accompanying acoustics) to determine the most efficient thermal climb, and in the opposite situation, to recognise when he is sinking too rapidly in downwind and should leave them at best speed.

The scale of the analog display is consistently 0,2 m/s over both scale ranges! (Flytec Patent!). The range of the first scale extends from 0 up to +/- 4 m/s. (fig. 1)

Thereafter the scale display switches automatically to the second scale range which extends from 4… 8 m/s. The second scale is afterwards displayed with a white bar on black base. (fig. 2).

The response characteristics of the analogue Vario and of climb- or sink acoustics can be adapted within a wide range in accordance to pilot's needs or the weather conditions. In order to simplify the settings, Flytec has defined 5 basic- resp. turbulence filters.

Bild 1 Vario 2.2 m/s

Bild 2 Vario 5.8 m/s
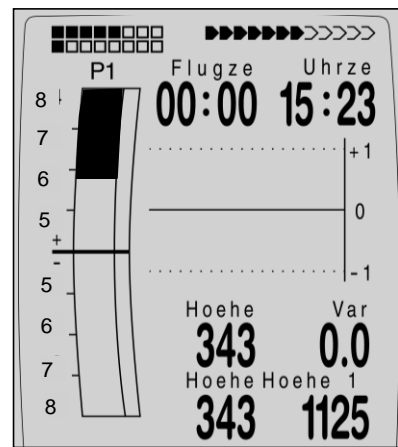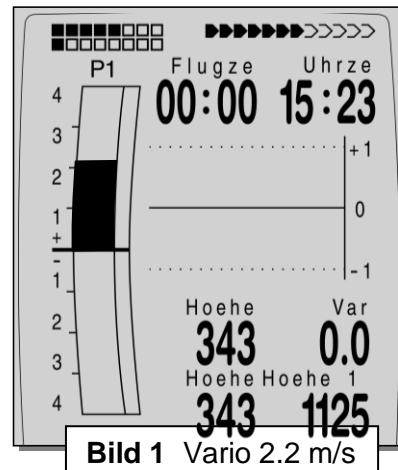
Tip: by use of the PC Flychart Software *Extras -> Fight instrument Options*, all Vario characteristics can be set easily and comfortably. With the tone simulation the adjusted values can easily be checked simultaneously!

2.2.1.1 Basic filter (turbulence filter)

Main Setup Menu ⇒ UserSettings ⇒ Variometer ⇒ Basic filter .

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Filter No.			Filter
0	Very high turbulence filtering	for very rough strong thermal	1.8s
1	High filtering	thermal with turbulence	1.4s
2 Default	Normal Filter	for enjoyment thermal with light turbulence	1.2s
3	Weak filtering	for weak thermal	0.8s
4	Very weak filtering	for very calm air in Winter	0.6s

2.2.2 Digital-Vario (average value Vario)

The Digital Vario has a scale of 10 cm/s and an extensive measuring range of up to +/- 100 m/s. It is therefore also appropriate to display and record even measuring flights up to the free fall.

2.2.2.1 Average value-Vario (integrating Vario)

The Digital-Vario display can be set under *Main Setup Menu -> User Settings -> Variometer -> Digital Vario Integrator* as average value-Vario (also designated as integrating Vario)
with a time constant of 1 .. 30 s. The values are recalculated per second and display the average value of climb or sink rate within the adjusted time span. At gruff narrow hillside up-wind this helpful readout may be used to determine if a circle or aft flight would provide better climb values. Integration time should be selected more longer in accordance to the thermal's roughness. Based upon practical experience, Flytec recommends an average value of 10 seconds.

2.2.3 Variometer Acoustics and Volume level (Sound)

In order to enable the pilot to follow the current climb- resp. sink rate without looking on the instrument, the Vario-Acoustics generate a tone sequence dependent on the value data.
It varies in relation to climb- and sink rate in tone pitch, as well as for interval frequency (number of beep tones per second).
The Vario-Acoustic corresponds always to the value of Analog-Vario and is therefore reproducing the direct values, i.e not the average values being selected in the digital Vario readout screen.
The Variometer Climb- and Sink Acoustics can be adapted with high flexibility on the IQ Motor+ in manifold fields to one's individual and personal requirements.

2.2.3.1 Audio volume

The volume level of internal loudspeaker is adjusted by use of the key **Audio Level.** Indeed for five values from soundless to maximum sound level. The selected value is displayed on the Info-line and is confirmed with a short beep or double-beep. The adjustable sound levels are:
0 - 25% - 50% - 75% - 100% - 0. .

Briefly pressing the Audio Level-key shall increase the volume level each time by 25 %.

Automatic volume control: with the basic setting levels 25   50 and 75 % the volume level will be slowly increased automatically, once the airspeed exceeds 40 km/h. However, it is impossible for the volume level to exceed 100%.

2.2.3.2 Variometer Acoustics settings

The climb tone is a frequency modulated beep tone whose pitch and beep tone sequence increase rhythmically at increasing climb rate. The pulse/pause ratio is 1:1.

The following settings are possible in *Main Setup Menu -> User Settings -> Variometer Acoustics:*

-> Acoustic settings:

AscentF	= Basic tone pitch Vario Climb
Modul	= Increase of tone pitch (frequency alteration per m/s)
sinktoneF	= Basic tone pitch Variometer Sink
damp	= Dampening of tone alterations
Pitch	= Increase of beep interval per m/s

-> Climb acoustic threshold: threshold of climb acoustic
-> Sink tone threshold: threshold of Sink tone
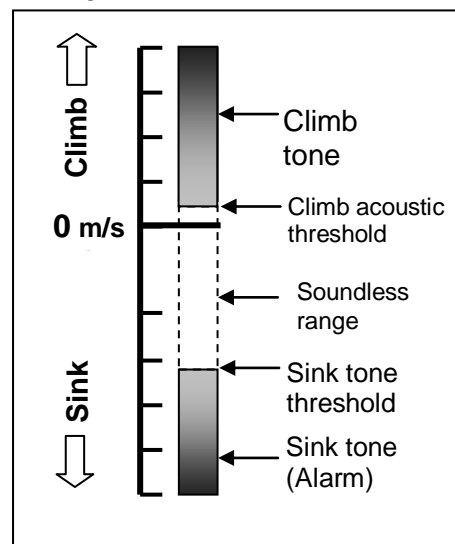
Ascent F = *Basic Tone pitch* The frequency audible at starting climb tone.
Range: 600 -1400 Hz → Factory setting 700 Hz

Modul = *Increase Tone pitch* The interrelation may be seen on graphic below.
Range: 2 to 9 → Factory setting 5

Tone pitch strongly increasing
per m/s Vario alteration.
Setting = 9

Tone pitch only slightly
increasing per m/s Vario
alteration. Setting = 2

Basic tone pitch 600 Hz
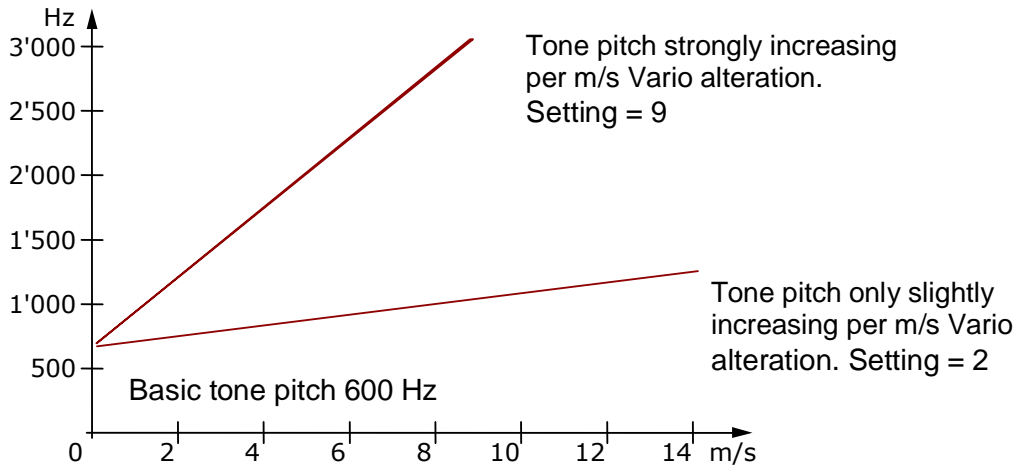
SinktoneF = *Basic Tone pitch - Variometer Sink*

Tone pitch at starting Sinktone. The Sinktone is continuous and is heard with deeper sound pitch at increasing sink speed, and is slowly increasing in frequency again when approaching rising air. The basic tone pitch of sink acoustics may only be set equally to the basic tone pitch for climb acoustics. The descent tone may be switched-off by briefly pressing the **Sinkalarm key**, or also be switched-on again; the analog Vario scale display would then show the relevant starting point. The precise actuation point at which sink rate the sink tone shall start is adjusted in Main *Setup Menu ⇒ User Settings ⇒ Variometer Acoustic ⇒ Sinktone Threshold.*

Damp = Dampening of Tone alteration

The Variometer value is recalculated every 0.2s. In case of rapid Vario alterations and setting for quick tone pitch-increase, it may result between two calculations in a quite intense variation of tone frequency. The ear perceives this incidence as a kind of fast „piano effect". In order to diminish this effect, a dampening feature is fitted. For very rapid tone pitch alterations the frequency alteration is honed. As a result, the Variometer sound is then smoother.

Range: 1 to 35 → Factory setting 10

Pitch = Increase of Beep Interval per m/s

The interrelation may be seen on graphic below.
Range: 1 to 7   → Factory setting 5

Number of beep tones per second

30

25

20

15

10

5

0   2   4   6   8   10   12   14   m/s

7 = Strong beep tone interval alteration per m/s Vario alteration.

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1 = Weak beep tone interval alteration per m/s Vario alteration.
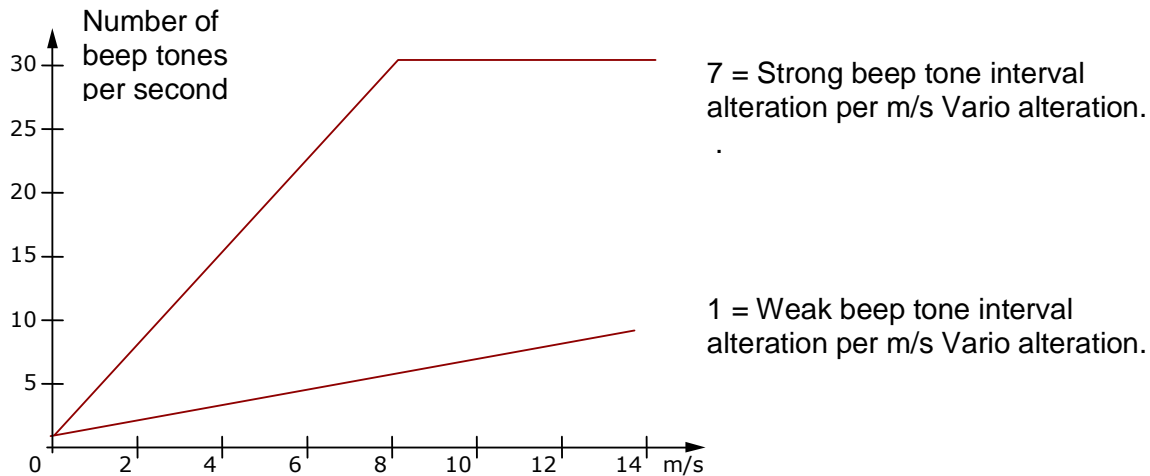
Climb acoustic threshold:
Main Setup Menu ⇒ User Sett. ⇒ Variometer Acoustic ⇒ Climb acoustic Threshold.

In order to avoid the climb acoustics get started with immobile aircraft, for ex. at take-off area, or at only slight climb, the climb acoustics starting point can be set in the range from 0 cm/s up to 20 cm/s.

Sinktone threshold: *Sinktone Threshold*
Main Setup Menu ⇒ User Sett. ⇒ Variometer Acoustic ⇒ Sinktone Threshold .

The Sinktone is continuous and is heard with deeper sound pitch at increasing sink speed, and is slowly increasing in frequency again when approaching rising air.

Starting point   As for climb acoustics, the starting point of sink acoustics can be selected. The threshold can be set by use of the up ▲down ▼ arrow keys.
During flight the Sinktone can be switched-on or switched-off by short pressure on the Sinktone-Audio key. Then one can see upon switch-on the selected starting point in the analog Vario scale. Switch-off is just confirmed by a short beep of the key.

All sound effects as described here are directly audible on the instrument in simulation mode.

Tip: by use of the PC Software Flychart 4.52 *Extras -> Flightinstrument Options-> Acoustics*, all Vario acoustic characteristics can be set easily and comfortably. With the tone simulation the adjusted values can easily be checked!

2.3   Speed

Apart from Vario and altitude the flight through the air (= airspeed) is indeed one of the decisive messages. By use of a precisely indicating speedometer it is possible to increase air safety.

2.3.1   Wind vane sensor

The IQ Motor+ is provided with a speed measuring system, this means one entry with analysis electronics for Flytec wind wheel sensors. Advantage: vane sensors start correct readout already from approx. 1 km/h speed, these sensors also perfectly appropriate for detection of weakest wind strength values at starting site. (Vane wheel sensor is optional).
The speed indicator display can be precisely calibrated by means of correction factor,
Factory setting is by default 100 %.
Main Setup Menu -> User Settings ->Speed -> Sensorsett.Vane
Due to these speed dependent correction factors it is possible to slightly rectify faulty measurements caused by inappropriate placing of the sensor inside lee position, or of the blister in front of the body.

The vane sensor measures the true speed of the air - True airspeed = TAS.

In case you are not familiar with the difference of these terms, please read article **11.2** of the appendix.

Speed display is in digital mode. The user can select in *Main Setup Menu -> User Settings -> Speed -> Speed mode,*if he prefers the display to show the **True or Indicated airspeed**.

2.3.2   Speed without speed sensor

Frequently hangglider pilots fly **without any speed sensor.** In this case only the speed over ground shall be displayed.

2.3.3   Stallalarm

This alarm is consisting of a deep tone with short beeps and always with 100% sound level.
In *Main Setup Menu ⇒ UserSettings ⇒ Speed ⇒ Stallspeed* it is possible to set the speed for activating the stall alarm, and also the altitude to the point from where up the alarm is active.
The alarm is only enabled below its activation limit! If the stall alarm is set to the value of 0 km/h, the alarm is turned off. (see chapter 11.2.2 Stallalarm page 59) The trigger point for the stallalarm is **always** linked to the **indicated airspeed.** At higher altitudes, i.e. in thinner air, this alarm shall be activated earlier (i.e. at higher flying speed) than for ex. at sea level.
Please study the related article of the appendix:

2.4 Motorspeed

Motor speed is captured via a magnetic sensor. By contrast to the previous capacitive method
with one wire over the ignition line, the magnetic sensor captures the ignition current only
if the spark effectively ignites. For this reason the registration is much less vulnerable than
the capacitive detection.
The sensor is in addition monitored in regard to wire-breakage.
The direction of mounting the sensor on the ignition wire does not matter.

Picture - mounting example

2.5 Cylinder head temperature or exhaust gas temperature

The temperature is captured with a thermocouple type K.
The spark plug CHT sensor is supplied as a standard.
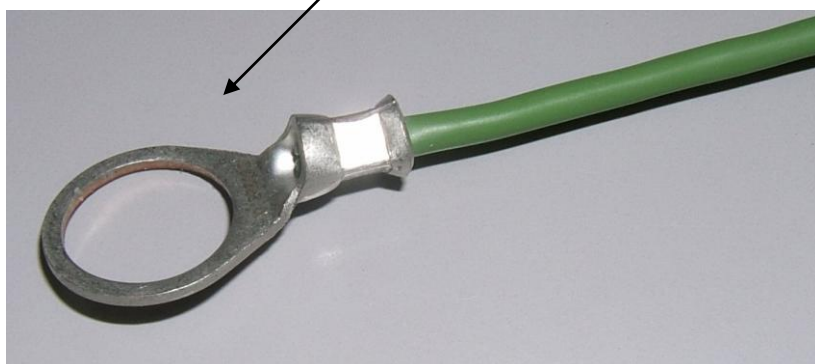
Upon request it is possible to supply an EGT sensor with a thermocouple – plug pair.
This element can easily be replaced by the user.

2.6   Time of day and Date

Notice: time of day and the date do not need to be adjusted. They are taken automatically from the GPS-Receiver. However, any time zone difference from UTC (World Time) needs to be entered with a positive value if the time zone is located East of Greenwich, or a with a negative value, if it is at the West of it. Time zones with 0.5h UTC Offset are also adjustable.
This setting is entered with *Main Setup Menu ⇒ Instr. Settings ⇒ Time zone.*

Important: all internal calculations of the instrument are made in UTC (Coordinated Universal Time). The local time is just used as „Time" display and calculates simply the UTC plus or minus the UTC Offset.
For the take-off time at Competition Routes the local time is binding.

2.7   Temperature Instrument

The IQ Motor+ is provided with a temperature sensor for the temperature compensation of pressure sensors, as well as for the automatic display contrast control. Temperature reading is possible in degree Centigrade or Fahrenheit. *Main Setup Menu ⇒ Instr. Settings ⇒ Units.*
Notice: the temperature sensor measures the internal circuit board temperature, but in no way the outside air temperature! The inside temperature of the casing may be higher or lower than the ambient air temperature, especially when the instrument is exposed to direct sunlight.

3 Navigation

Navigation activities without operating GPS-Receivers is unthinkable these days. Indeed a chain of satellites is orbiting the Globe. It provides the possibility to determine worldwide one's own position very precisely, if minimum 4 satellites are received simultaneously. The IQ-Motor+ calculates several readouts by position determination made by GPS.

3.1 Assessment of GPS reception quality

The IQ Motor+ is fitted with a 16-channel GPS-Receiver which is featured with lesser power consumption and also a significantly shorter satellite detection time. Precision of position is between 7 to 40m. As an average one may assume approx. 20 m.

Normally the instrument recognizes its position under unobstructed view conditons after maximum 1 to 2 minutes. If the receiver is switched-off for a short time (less than 2 hrs.), the time for new position finding is less than 10 seconds as a rule. Buildings, mountains or thick forest affect reception quality of the receiver. Therefore, you should always look for the best possible visibility around you and the antenna in the casing should point upwards to the sky. In particular when mounted on the steering holder of the hangglider, we recommend not to have the instrument fixed under the pilot's head on the middle of the basis, but indeed sideways. In this position the IQ-Motor+ should not have more than 45° deviation from horizontal position so that the antenna points upwards.

GPS
Antenna area
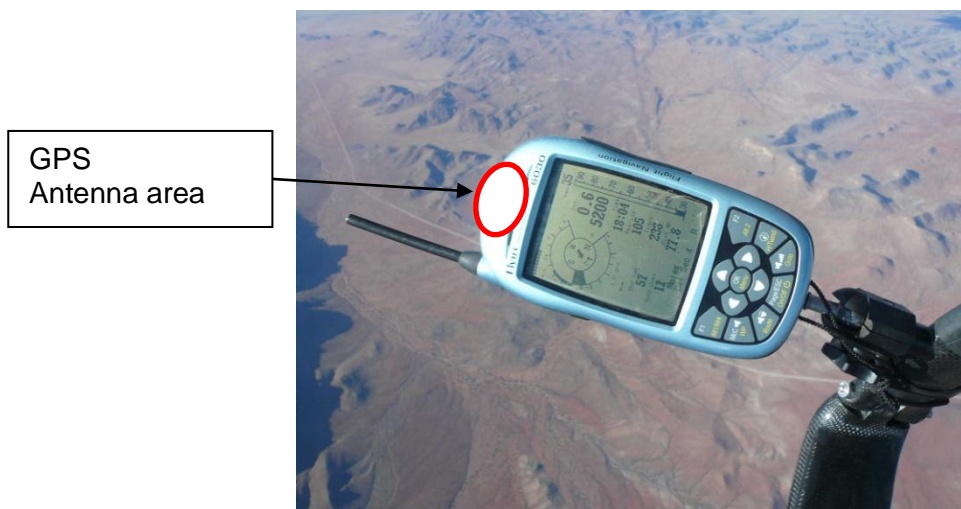
Because the receiving strength of the satellite signals is only approx. 1/1000 of mobile radios, these radio sets and other disruptive factors (like notebooks) should be operated as far away as possible from the IQ-Motor+.

The number of received satellites is shown on the upper right side of the bar scale. The longer the bar, the more precise is the reception quality.

As soon as the instrument has sufficient GPS reception after energising, the date and time of day is recorded into the internal memory. This action is signalled by the instrument with a slight beep tone.

3.2   Compass and Flight direction

In contrast to a standard magnetic compass which is oriented to the magnetic lines of force of the Globe, the GPS compass can show direction only when the user moves about.

However, it has the advantage that it is not subject to any grid deviation and does not show any deviation as a result of iron or any magnetic material either. Its zero point always corresponds with true geographic north (0 or 360 degrees).

The course, that is the flight direction **(=** Track), is calculated from a series of positions. If the user remains stationary at the same location, then the course (track) and compass needles are undefined. The exact course, (this is the direction in which the user travels over ground), is always at the top of the compass, but can also be read in the display *Track.*
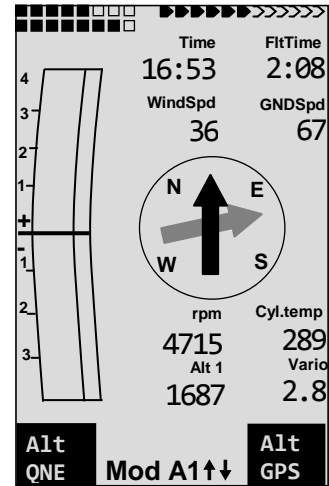
3.2.1   Track and bearing

Track is the direction into which an aircraft is moving over ground. The geographic true North direction is always 0 or 360 degrees. (East = 90 ;   South = 180 ;   West = 270 degr.)

Bearing is the direction (according to the system described above) to a selected Waypoint seen from the viewer.
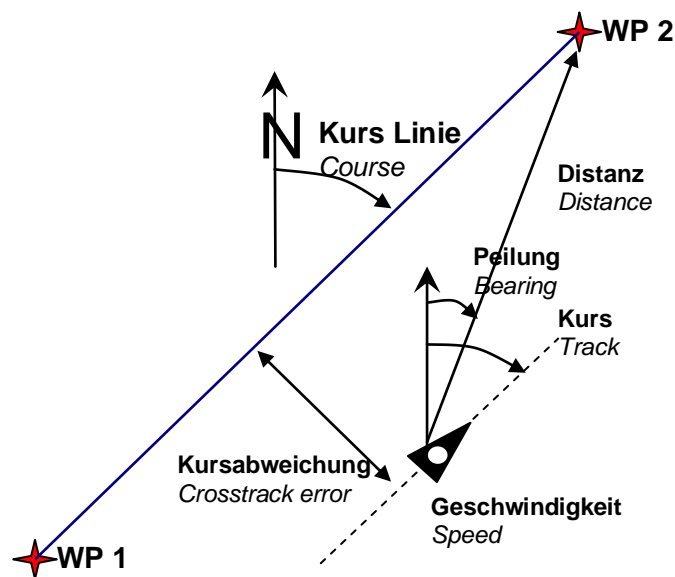
Caution: Track or Tracklog is also called the sequence of recorded positions during one flight.

3.3 Waypoints and coordinates

A waypoint is any single point on the earth's surface that you would like to go to.
The IQ-Motor+ can save up to 200 different waypoints. Each waypoint can have up to 17 characters, e.g. **"Fiesch Airfield".** In determining the waypoint, it is also necessary to enter the altitude, i.e. **"1123"** meters (always above sea level). We now only need the position of Waypoint on the earth's surface. For this purpose the IQ Motor+ utilizes the geographical map system named **WGS84** (World Geodetic System 1984). This reference system assumes that latitude is measured from the equator (0 degrees) to the North Pole, 90 ° N, and to the South Pole - 90 ° S. Longitude is measured from the Greenwich zero meridian (near London), East is counted positive and West is negative up to +/-180°.

However, the IQ-Motor+ also converts Waypoints entered according to the previous norm, introduced by Bräuniger: **3 letters and 3 numbers.** Example: **FIE112** indicates a Waypoint with the name **FIExxx** and an altitude of **1120** meters above sea level

In Basic Settings / Coordinate Format the data entry format is selectable between:
1) ***Degrees Minutes Decimal places of Minutes (dd°mm.mmm)*** (***Factory setting***)
2) Degrees Minutes Seconds (dd°mm'ss")
3) Degrees Decimal places of Degrees (dd.ddddd)
4) UTM (a grid system with a 1 km raster in both N-S and also in E-W direction)
5) Swiss Grid

Basically one should always try to use possibility no. 1 (=factory setting), because only this format is using exactly the same calculation format as the GPS receivers do. With all the other formats rounding errors could sum up to 20 m.
It is exclusively calculated with the WGS84 system. Differing geodetic systems are no longer selectable.

3.3.1 Waypoints, edit, delete or insert

In this position of Set-Menu the waypoints may be managed. After briefly pressing the *OK* key the display will show the list of saved WP. In case this list contains more than the visible 8 WP, then a down arrow ⬇ at the right lower edge of the list warns that more pages are to follow.
To scroll down to the next page, press the ► key, now WP 9 … 16 are displayed etc.

Tip: Waypoints may also be set comfortably on the PC by use of the „Flychart 4.52" PC-Software and be transferred via the PC-interface to the instrument.

Using the keys ▲ and ▼ it is possible to select an individual WP and to alter it after pressing the *OK* key.
The 1st letter of the WP-name will blink, again with the ▲ and ▼ keys the required letter is selected; there are numbers, letters, as well as a set of special characters to choose from. By pressing the ► key, you move forward to the next letter etc. With the *F1* key you may shift between capitals and small letters. With the *F2* key one single character is deleted (Rub out). You can enter a maximum of 17 characters. Once the name has been entered completely, confirm by pressing the *OK* key. Now the WP altitude will blink and require alteration. With the keys ▲▼ the altitude value is entered and confirmed by pressing the *OK* key. Now the position of WP is next. At first the latitude is entered in degrees and confirmed with *OK,* afterwards the minutes and then the decimals of the minutes. The same procedure is applied for the longitude.

```
 Wegpunkte
=================
Flytec
Calanda
Stanserhorn
Niesen
Fantasy of Flight


=================
Flytec
Alti      450m
Lat    N  47' 00.849
Lon    E 008' 18.478
Ins.            Del.
Wayp.          Wayp.
```

Continuous keystroke changes the values to be set faster

Delete Waypoints

The selection of WP's to be deleted is effected with the ▲ and ▼ keys.
Pressing the **F2** key (Del WP) enables the delete function, for data safety the COMPEO+
is asking again: "Delete Waypoint?". The reply "Yes" or "No" is at choice, but it is also possible
to discontinue the deleting procedure by use of the **ESC** key and return to one level before.

Insert Waypoints

Pressing the **F1** key (Ins WP) enables this function. Entering Waypoint names, altitude and
position is operated following the same scheme as described above. After confirming all
entries with the **OK** key, the new WP is inserted to the list in alphabetical order.
In total 200 WP may be saved in the IQ-Motor+.

Remark:

after entering new Waypoints, (for ex. for a new Route entry) these can be used only if
in between you have switched back to the normal flight mode with **ESC**.
In addition, the Route into which the new Waypoint was inserted must not be active.
Therefore, first change into route selection by prolonged pressing of the **Route** key and
with the help of the **F2** key (Cancel Route) deactivate the Route.
The more Waypoints are saved in the memory, the more slowly the navigation becomes in
Main Setup Menu, as the list is rearranged again in the background over and over.

3.3.2 Display of active coordinates

If the IQ-Motor+ receives satellites by GPS-Receiver, the actual position is displayed by
briefly pressing the *i Info* key in the instrument's information field. After 20 sec. the previous display
screen will automatically reappear. This function is useful in relaying your location to some person
after landing, who will retrieve you from there. Also when entering a Waypoint
with **WP** ⇒ **F1***AddWp* the coordinates are displayed.

3.3.3 Memorizing the active position

It may happen from time to time that the current
position should be saved as a Waypoint. For this
purpose the **WP** key should be pressed during 3
seconds and subsequently ⇒ **F1***AddWayp.*
In response a beep will chime and the momentary
coordinates shall be saved in the memory as a
Waypoint.
As the Waypoint name the IQ-Motor+ uses the letter
M (for marker) and afterwards the actual date and the
time of day in UTC.
Example: M.22.04. 11:16:49 stands for 22nd April
at 11 hrs. 16 min. 49 seconds (UTC).
Naturally this WP name may be altered later into
a more meaningful name, for ex. "Fiesch Airfield".

3.3.3.1 <u>Goto – Function</u>

Prolonged pressure on the **Goto** key switches the lower half of the instrument into the Goto-mode. This function allows for searching a Waypoint stored in the memory of the IQ Motor+ and to select it for a flight to goal.
 At the same time the next Waypoints are listed in the order of shortest distance to the user.
The figure behind the WP-name indicates the distance in km.
If a WP was selected with the ▼ arrow key, it can be confirmed by pressing the **OK** key. The Goto-function may be deactivated by pressing the **F2** key *(Can WP Goto).*

Tip: the large compass arrow points directly to the goal. If a hefty crosswind is encountered on the way to goal, the correct **correction angle** can be found as long as one carefully changes the direction of flight against the wind, until the directional pointer in the compass rose points directly upwards. In that way it is ensured that the flight path over ground is in a straight line to goal and is thereby the shortest one. The well known and so called *"pursuit curve"* is thus avoided.

3.3.3.2 <u>Distance to Waypoint (user field)</u>

It is only in case a Waypoint has been selected manually with the *"Goto"* function, or automatically with the *"Route"* function, the horizontal distance seen from the viewer to the waypoint is displayed here.
The scale is 10 m (for distances below 10 km) otherwise it is 0,1 km.
Also when the Waypoint is used as turning point in a competition, it is always the distance to the centre of the cylinder which is displayed.

3.4   Routes

A route is an arrangement of various Waypoints over which one would like to reach a goal.
Of course, the Waypoints used on a Route have to be saved in the unit's memory. Similarly to the Goto-Function the pilot should fly from WP to WP in a travel optimized mode, which means that with help of the McCready-theory he will be able to complete his task within the shortest possible time. While inside the Goto-Function the next Waypoint needs to be selected from a list each time by prolonged pressing of the *Goto* key, when flying Routes it is possible to switch forward by briefly pressing the key ▲ *(next WP)* or ▼ *(previous WP).*
It makes sense to store many well-known thermal sources as Waypoints along a route. The pilot does not have to feel compelled to reach these Waypoints, at times he may be high enough to jump a Waypoint on a Route, while at another time he may have already found the thermal he had hoped for one or more kilometers before reaching the Waypoint. Of course there is still the option of looking up other, possibly closer, Waypoints without leaving the current Route by using the Goto-function.

Altogether, the IQ-Motor+ can have up to 20 Routes created. Each Route may contain max. 30 WP's. The one and same Waypoint can be used more than once along a Route, and the same Waypoint may be included on other Routes as well.

Remark: in a normal Route, when reaching a waypoint, there is no automatic shift to the next WP! For the automatic forward shift it is required to use the Competition-Route function!

Important: once a WP has been used along a Route, it can no longer be del,eted from the WP list.

3.4.1   Creating a Route

With *Main Setup Menu* ⇒ *Routes* access is given to the list of stored Routes. (max. 20 Routes). Within this list one can select by use of the arrow keys ▼ or ▲ one of the Routes, or by pressing the **F1** key (Ins. Route) a new Route can be created. .

After pressing the **F1** key (Ins. Route) at first a name has to be entered for the new Route. The cursor will blink on the 1st letter of the word " Xxxxx ". With arrow keys ▲ or ▼ it is altered up to the desired letter. By use of the ► arrow key one proceeds to the 2nd letter, alters it, and so forth. By pressing the **OK** key the data entry of the Route's name is completed

At this point the individual Wayoints need to be inserted into the Route. After pressing the **F1** key (Ins.Wayp.) the list of available Waypoints will appear in the bottom half of the readout screen in alphabetical order. At the same time one shall see the request: "Select Waypoint No 1". Again by using the ▲ or ▼ arrow keys the 1st Waypoint is selected and is added to the Route by pressing the **OK** key. This is indicated in the upper half of the screen.

By pressing the **F1** key (Ins.WP.) one can select the 2nd WP and add it to the Route by pressing the **OK** key again, and so on. The highlighted Waypoint (offset in black) of a Route is always the last one entered, which means that the function "Ins.WP" will set the next WP to be entered after the one being highlighted in black. If, for instance, you want to insert an additional waypoint after WP No. 1, then WP 1 has to be highlighted, followed by pressing the **F1** key (Ins.WP); then the request "Select Waypoint No 2" shall appear.

If you notice, for example, that Waypoint No. 4 must be changed, then you select and delete this WP and insert a new one after the existing WP3 by pressing **F1**. Again the list of available Waypoints appears along with the request "Edit Waypoint No 4". After selecting and pressing **OK**, the old Waypoint is replaced by the newly chosen one.

If you want to delete a Waypoint from the Route, it is marked and deleted by pressing the **F2** key (Del.Wayp.). The Waypoint is then deleted from the list without any further prompt.

3.4.2   Altering a Route

You select a route to be altered with the ▲ or ▼ arrow keys and confirm with **OK**. The Route's name is changed first. If this is not required, then it is sufficient to press **OK** again in order to get access to the Waypoints. As described in the last paragraph, additional Waypoints can now be added or deleted.

3.4.3   Deleting a Route

By using the ▲ or ▼ arrow keys one selects the route to be deleted and confirms by pressing the key **F2** (Del.Route). For data safety the IQ-Motor+ inquires once again: "Delete Route?" which should be answered with "Yes" or "No".

Notice: Routes may also be set comfortably on the PC by use of the *„Flychart 4.52-xx"* *PC-software* **and be transferred via the PC-interface to the instrument.**

3.4.4   Flying Routes

The Menu **Routes** is enabled by long pressure on the
Route key**.**

After this selection the list of Routes stored in the instrument
appears in the lower part of the screen.
Within this list one of the Routes can be selected by
use of the ▼ or ▲ arrow keys and can be activated by
pressing the **OK** key.

 For an activated Route a thick black arrow positioned
in the centre of the compass rose points to the direction
of the next Waypoint. The direction to the next but one
Waypoint is illustrated by an arrow in shaded mode. .

Remark: an activated Route is kept enabled even after
switch-off and switch-on of the instrument! The Route
may only be deactivated by the "Cancel Route" function!
If following switch-on of the instrument a black direction
pointer is visible in the compass rose, it indicates an
activated Route or a "Go To" function still in activity!

3.5   The Competition-Route

In contrast to the normal Routes the Competition-Route has Waypoints **which are mandatory
to be reached;** for example turning points in competition or FAI-record flights, or on performance
flights. The regulation, which only recently came into effect in documenting distances flown, relies fully
on the recording of GPS-Receiver position data (Tracklog points).

**It is only when flying Competition Routes that the pilot will be warned by an acoustic alarm
when approaching his Waypoints or when leaving the start cylinder, and then the unit switches
automatically to the next Waypoint.**

3.5.1   Competition-Route - create, alter, delete
Even so a Competition Route is treated differently than a usual Route during flight and also
for data transfer, there is no difference when setting or altering it. The route can be set up with
the help of the keypad or can be transferred from the PC. Please read: 3.4.1 Creating a Route page
34. This is particularly useful for Competitions when in a short time the flight tasks on the basis of
turning points have to be distributed error free to many pilots. The Waypoints of the Competition Route
can be altered, however **its name „COMPETITION Route" is not subject to be deleted.**
If the Competition-Route does not contain Waypoints it is not ready to be selected.

Notice: it is possible to use the same Waypoint several times with different radii in a row
(e.g. the goal cylinder and the landing site)

3.5.2   Copying a normal Route as Competition-Route
Each one of the existing Routes may be copied into the memory of Competition-Routes.
Menu item *Main Setup Menu ⇒ Routes ⇒ key* OK gives access to the list of stored Routes.
Select the Route to be copied by using the ▲or ▼arrow keys. By long pressure on the **WP** key
the selected Route can now be copied into the Competition-Route. For safety will appear the prompt
"Copy to Competition Route? Yes/No ?" in the lower part of the screen.
After confirmation by pressing with **OK** on "Yes" the copied Route is definitely included.!

**Please note that after this entry the start cylinder, radii and start time need to be set separately,
because all cylinder radii are reset to the default value of 400 m.**

3.5.3   COMPETITION Route - Definition

The definition of start cylinder with start time, number of start gates, flying mission, such as Enter- or Exit from start cylinder, as well as setting the differing WP-cylinder radii, can be effected in Menu Competition Route. *Main Setup Menu ⇒ Routes ⇒ COMPETITION-ROUTE ⇒* **OK** key.

3.5.3.1   Starting Waypoint - Definition

Usually the start cylinder is in first position of the Competition-Route. (However this is not mandatory). If during setting the Competition-Route, after marking a Waypoint the key **WP** is pressed, the letter **"S"** for **Start-Cylinder** appears behind the WP name. The "S" disappears if the same key is pressed again.

3.5.3.2   Start cylinder – Definition of characteristics

Only if a WP is marked with "S" it is necessary to set also a start time and as mission: ENTER or EXIT and the number of start gates, as well as their chronological interval.

For definition of start cylinder characteristics just select the Waypoint marked **„S"**, thereby the screen for adjustable start characteristics in the lower part is opened. By pressing the **OK** key one can switch forward from input field to input field, while the values are defined in each blinking field. The example illustration on the right shows the start cylinder set to **1200m** radius, and possible start time values are set for **3** start gates of 15min. each to **12:30; 12:45** and **13:00 h** and the start is set to EXIT cylinder.

If no WP is designated as Start cylinder, the pilots are not bound to observe a start time and the automatic switch over to the next WP is effected as soon as the pilot is inside of a cylinder.

3.5.3.3   Waypoint Cylinder Definition

Instead of the previous photographic sectors the pilot only needs to reach a predetermined distance to the turning point. It is also called the entering flight into the cylinder. This distance or cylinder circumference may be set in *Main Setup Menu ⇒ Routes ⇒ COMPETITION-ROUTE* for each Waypoint separately in the range of 20 m up to max. 200 Km. **Pre-set default- or factory setting is a cylinder radius of 400 m.**

```
COMPETITION-ROUTE
====================
Stanserhorn      1.20S
Rotstock          0.40
Diepen            0.40
Scheidegg         0.40
Landeplatz        0.40

====================
 Wp  1/5      in Route
Stanserhorn           .
Total Distance: 53
Radius (m) : 1000
Start: 12:30+15 min
Gates: 03         EXIT
```

```
COMPETITION-ROUTE
====================
Stanserhorn      1.20S
Rotstock          0.40
Diepen            0.40
Scheidegg         0.40
Landeplatz        0.40

====================
  Waypoint 3/5 in Route
Diepen
Total Distance: 12
Radius (m) 400
Ins           Del
Wp            Wp.
```

Remark:

Because the GPS-Receiver of the IQ Motor+ identifies its new position every second, it takes only this one second to inform the pilot about his crossing of the turning point cylinder circumference, or that the time has come to leave the start cylinder. In this case a long, unmistakable tone sounds during 2 sec. signalling **„Waypoint reached"** and the instrument automatically switches forward to the next Waypoint of the Route. Independently of which recording interval for storage is used during a standard flight, it is anyway ensured that several track log points are saved at one second intervals in the memory of the IQ Motor+ when crossing the cylinder circumference.

3.5.4   Flying Competition-Routes

Competition-Route is called up and activated by long pressure on the **Route** key and acknowledgement with the **OK** key.

If a Competition Route has been activated once, it is kept enabled even after switch-off and switch-on of the instrument. The Route can only be disabled within this menu item by the command *Cancel Route* (prolonged pressure of the **F2 key** and then **OK)**!
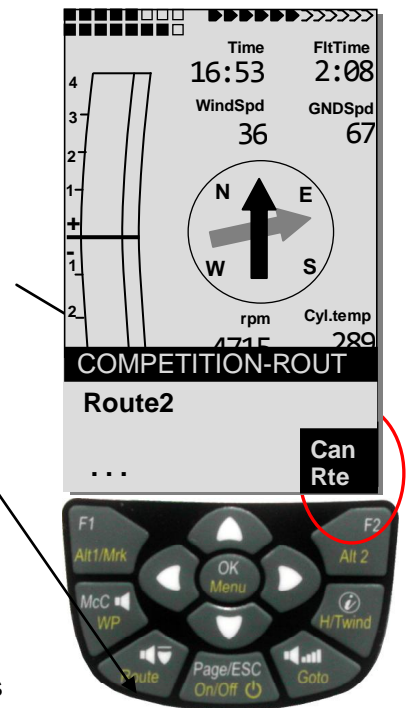
3.5.5   Competition Start

If in a competition a start cylinder is predetermined, the valuation starts as soon as the start time is reached under these conditions:

Startmode EXIT: when the pilot leaves the cylinder from inside to outside.
Startmode ENTER: when the pilot is entering the start cylinder from outside to inside
Several start gates may be selected.

3.5.5.1   EXIT Cylinder
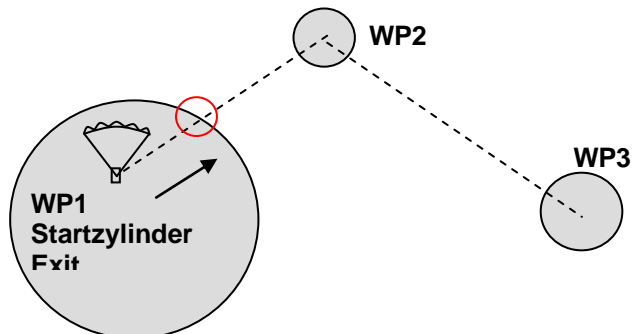
The „WP reached" signal will be given as soon as the start time is reached and the pilot is inside the start cylinder. It will also sound if the start time is positive and the pilot is crossing the start cylinder circumference from outside to inside. In both cases the next active Waypoint will be enabled, in this case it is Waypoint 2. All calculations and the direction arrows are now related to Waypoint 2

If the pilot decides to take the next start gate, he must press the Prev WP ▼ key. (Select with **WP** the submenu Prev/Next WP).
The instrument then enables WP 1 again and will increment the start time by the preset difference. When the last start gate is reached, the start time will no longer be increased after pressing of „Prev. WP ▼".
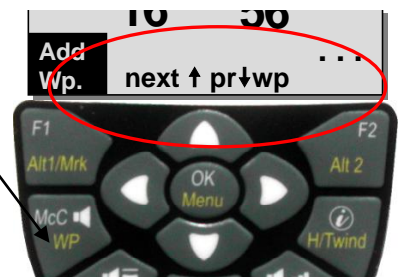
Caution: for EXIT-Cylinder it is required that the first Waypoint after the start cylinder is outside of the start cylinder! For details please see graph 11.5.5 Graphic: Task Exit Start Cylinder page 68

3.5.5.2 ENTER Cylinder
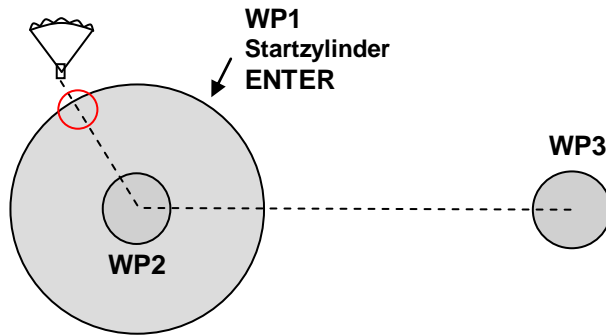
The „WP reached" signal will be given as soon as the start time is reached and the pilot is crossing the start cylinder circumference from outside to inside. In this case the next active Waypoint will be enabled, that is WP2. All calculations and the direction arrows of the compass rose are now related to WP2.

If the pilot decides to take the next start gate, he may press the Prev WP ▼ key. (Select with long pressure on **WP** the submenu Prev/Next WP). He may perform this operation regardless if he is inside or outside of the start cylinder. The instrument then enables WP1 again and will increment the start time by the preset difference. When the last start gate is reached, the start time will no longer be increased upon pressing of „Prev. WP ▼".
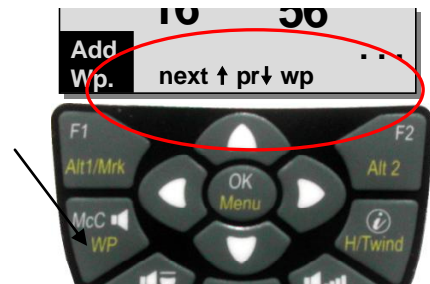
Caution: for ENTER-Cylinder it is required that the first waypoint after the start cylinder is inside and usually in the centre of the start cylinder! For details please see graph 11.5.6 Graphic: Task Enter Start Cylinder page 69

During the flight the pilot can see on the Info-field display or on user field „**RaceStart**" via **Count-Down** how many seconds and minutes are left before "all-clear" start. If start time is reached, the readout screen of user field „RaceStart" is switching to inverse display mode (white on black). At the same time he can read in the display **„Dist toWP"** and **„Dist StCyl"** if he is inside or outside of the start cylinder. (negative figure is inside, positive figure is outside of the cylinder). The user field **„Dist StCyl"** always indicates the distance to start cylinder.
For precision and better understanding here again the different distance terms:

„Dist Cyl"	displays the distance to the radius of active Waypoint cylinder. This is before the start the start cylinder and after the start it is the next Waypoint.
„Dist StCyl"	displays the distance to the radius of the start cylinder, independent from the position at which one is flying in the Route.
„Dist Start"	displays the distance to the position from where on the instrument has started recording.

If the pilot has flown out of the WP-Cylinder and the instrument has shifted to the next Waypoint, it is possible to switch back by pressing the arrow key ▼ in any order to the previous Waypoint, or by pressing ▲ to switch forward to the next Waypoint again. This is useful when a pilot, after having left the start cylinder, has decided to fly back and to restart at a later time. It is then possible to orientate oneself with user field „Dist StCyl" about the return distance required until start cylinder is reached again.
It is also possible when flying a Competition-Route by use of the *Goto-key* (prolonged pressing) to call-up additional Waypoints (thermal sources), sorted according to their distance from the pilot. The Waypoints being part of the Competition-Route are marked with an asterisk in the displayed list; which means it is mandatory that they are approached. Even in case a Waypoint not belonging to the Route has been called-up, the alarm remains enabled when entering the cylinder of the Waypoint belonging to the Route.

With the **F2** key it is possible to toggle back and forth between the Waypoint of the Competition-Route and the other Waypoint.

After completing a flight task, the Waypoints belonging to the Competition-Route will be listed in the data transfer to a PC under the header of the IGC file. Therefore, a corresponding PC program can also check if the assigned task was completed correctly.

When setting up a Competition-Route without a start cylinder, i.e. without a start time, the automatic switch over to the next Waypoint is performed, as soon as the pilot is inside the 1st cylinder radius. So it makes no sense to choose the "Take off" (start site) as 1st Waypoint, because the instrument switches immediately over to the next Waypoint when receiving satellites.

3.5.5.3 Approaching a WP Cylinder

Upon reaching a WP-Cylinder a long, unmistakable tone sounds during 2 sec. signalling **"Waypoint reached"** and the instrument automatically switches forward to the next Waypoint of the Route.

Notice: in order to facilitate the decision to peel off the user field **"Dist Cyl"** displays the distance to the radius of active Waypoint cylinder.

3.5.5.4 Dist to Goal (total distance to goal of a Route)

In this field there is displayed, when flying a Route, the sum of the legs still lying in front of the pilot. This distance is calculated from the current position. He thus knows at any moment, how much km are still in front of him until completion of the task.
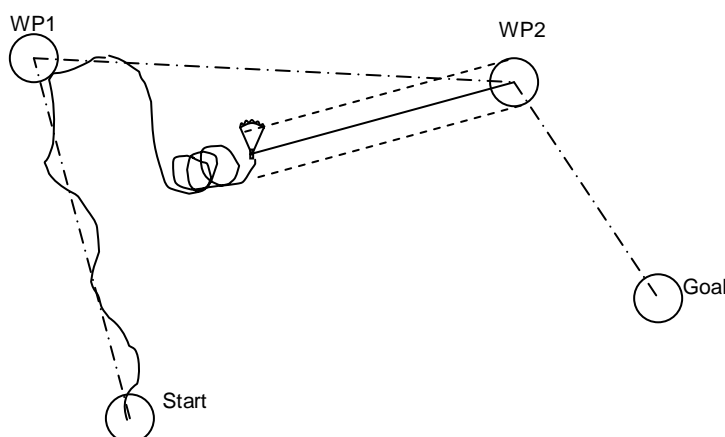
3.5.5.5 Distance to starting site

The instrument memorises the coordinates of the point where the **start recognition** (flight acceptance) has begun. Precondition for the start recognition: **GND Speed of 10km/h for more than 60 seconds**. With user field "Dist Start" the distance to this point can be displayed. Normally this is the point from where one has made the take-off.

3.5.5.6 XT Error,   Crosstrack Error

This field indicates the shortest distance (perpendicular to the Track in relation to a map view) to the active leg of a Route.
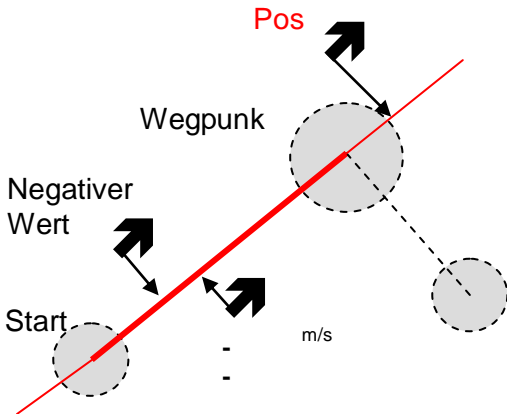
The accuracy of the displayed value depends on the length of the active leg. The largest inaccuracy arises in the centre between start and the next Waypoint if one is very close to the track (the angles become very flat). With 50 km distance between start and Waypoint, the inaccuracy in the centre can reach up to 400 m.

Positive values are displayed if one is on the right side of the track, negative values when being on the left of the track. Even when one has flown over the next Waypoint, the distance to the straight line is displayed (see pos. 3)

3.6   Flight optimisation

3.6.1   Groundspeed (speed over ground)
The GPS-Receiver calculates its new position once every second. Speed over Ground is derived from the distance between these positions. It is possible to reach conclusions about the wind's influence from the difference between flying speed (Airspeed) and the speed over ground.

3.6.2   Head- Cross or Tailwind; the Wind component
During a flight to goal or in calculating a final glide, it is not really the absolute value of wind, but the wind component, i.e. the difference between Groundspeed and Airspeed, which is decisive. In most cases the wind does not blow directly from the front or from behind, but somewhat from the side. If this wind component "Spd-Diff" (in the user defined fields) is positive, then the pilot will fly with a tail wind and the glide ratio over the ground will improve. If, however, it is negative, it contains at least a part of head wind and the glide ratio over ground will decrease. The IQ Motor+ takes anyway into consideration this wind component in the course during for calculating the final glide. The entire "windspeed" as well as the speed difference of the course „Diff.Speed" can be displayed as user field readout.
If the windsock indicating the wind direction covers the wind symbols N E W S, then for reasons of clarity the corresponding letter below shall disappear!

3.6.3   Winddirection and Windforce
It is very important to know the wind in direction and force, especially in case of an out landing. The wind force can be selected within the user defined fields.
For this purpose it is necessary to fly one or two complete circles at similar speed as possibly can be done. Duration time for one full circle should at least be 12 seconds, some more time would be better.
Whilst circling, the IQ Motor+ determines the direction of least speed over ground, and checks also synchronously if in opposite direction there might be the fastest speed over ground.
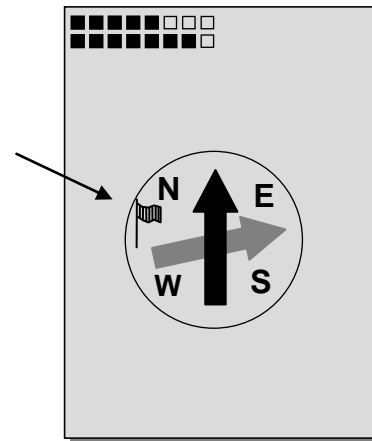
The calculation of wind speed and wind strength is the result hereof.
Wind direction is shown in the compass rose at the position from where the wind is blowing by a small windsock symbol. During the landing approach this symbol should always be at the top.

3.6.4 Glide ratio (= L/D ratio)

By definition, the glide ratio is calculated by taking the horizontal distance traveled and dividing it by the height which was lost.
If instead of the horizontal speed is taken the speed through the air, the error is 2% at glide ratio 5 and just only 0,5% at glide ratio 10. This small inaccuracy may be disregarded.

The glide ratio may also be selected within the user defined readout screens.
Hereby the following facts are applicable:

Glide ratio through the air:

L/D Air = TAS/Sink   True Air Speed divided by Sink

Glide ratio over Ground :

L/D Ground = GS/Sink   Speed over Ground divided by Sink

Required Glide ratio over Ground to reach the selected WP from the momentary position.

L/D ReqWP =   Distance to WP / Height difference to WP

Required Glide ratio over ground to reach the last WP (Goal) of a Route from the momentary position.

L/D Goal =   Distance to WP / Height difference to Goal WP

This field shows the required glide ratio over ground to the Goal over several Waypoints. Hence it is possible to decide wether one can fly directly to the Goal over several Waypoints, or if in between one must gain height within a Thermal. For this calculation it is not taken into account if there is a waypoint in between, of which the altitude is higher than the direct line from current altitude to goal. The distance is calculated alike as explained in 3.5.5.4 Dist to Goal (total distance to goal of a Route) page 39
This user field is only displayed if an active Route is enabled.

Required glide ratio over ground to reach the goal from the momentary position.

Example for explanation of glide ratio (L/D) values
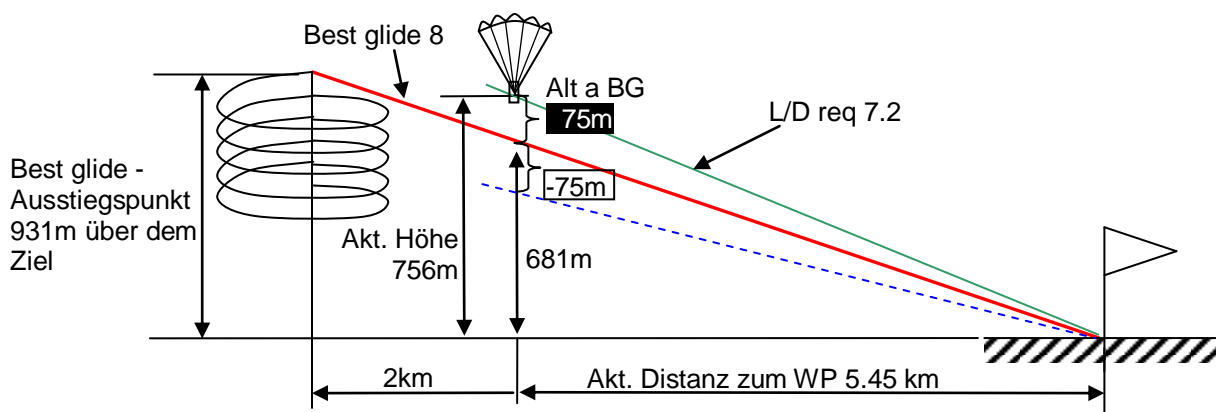
3.6.5 Safety altitude over the path for best glide DiffBGWayp and DiffBGGoal

Diff.BGWayp

This user field displays the difference between the current height and the required altitude for reaching the next waypoint with the best glide. If this altitude readout is negative, the pilot needs to circle upwards at least to such an altitude that the displayed value is now positive and shifts to the picture mode "inverse" 0010.

If the **DiffBGWayp** display is positive, this is then indicating a safety altitude, i.e. one is at higher altitude than is required to reach the waypoint with the best glide!

Important: only the correct data entry „*best L/D ratio of your aircraft*" in the instrument settings allows for a precise calculation!

The automatic wind component detected by the instrument by flying a full circle, is also considered for the calculation. However, the possible presence of upwash or downwash on the path is not taken into account.

H/Twind Manual setting

For all reflections we made so far we have taken it for granted that the wind component is automatically calculated from the difference of: *Gndspeed – Airspeed*. However, there are good reasons to justify the overwriting of this automatically collected Spd-Diff by a manually entered value.

1. When circling inside the thermal, the wind prevailing outside of the thermal shall always be of higher strength than the measured one. The strength is depending on the value of climb, and also if the pilot is in the upper or lower part of the thermal. .
2. If the pilot knows by experience, when down gliding from high altitude, in which way the wind will change in the lower atmospheric layers, he can account for this fact before.
3. When paraglider pilots fly without speed sensor, the manually entered wind component may provide a significant improvement of the final glide calculation.

The function for head- or tailwind is called up by **long pressure** on the **H/Twind key**. By using the F2 key it can be shifted between automatic and manual mode.
The active setting is indicated in the information line.

H/Twind Manual setting

In the HTman. function it is possible to adjust the display stepwise as precisely as to 1Km/h by brief pressure on one of the arrow keys. With continued keystroke the display shall be automatically changed until the key is released.

Headwind = negative entry e.g. -12 for 12Km/h headwind component

Tailwind = positive entry e.g. 15 for 15Km/h tailwind component
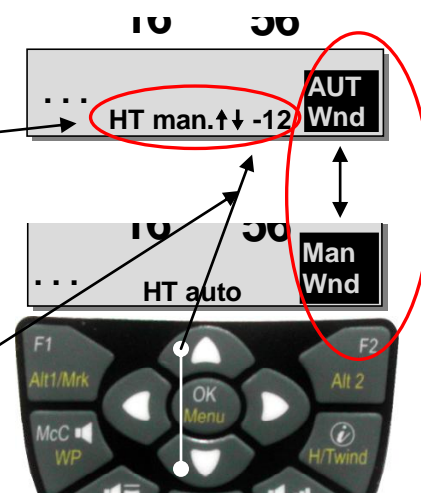
DiffBGGoal

Diff. BGGoal is calculated alike as BGWayp but with the difference that the **entire** distance over all remaining waypoints to the goal (last WP in the Route) is calculated from the momentary position. Hereby it is assumed that one is flying from the current position in direct track to the next waypoint and then continues from there on the Route. The calculation here is also based on the presumption that the route is flown with the speed of best glide.

3.6.6 **Flight duration** (Flight time)

The take off time is automatically recorded. The flight start time is perceived as soon as the instrument has diagnosed a difference in height of about 30m upwards or downwards, **or if** the speed over ground has been measured with more than 10 km/h since min. 60s.
For this purpose the GPS needs to be activated. In case the GPS-Receiver has no or only poor reception quality, only the difference in height of about 30m is valid as criteria for flight recording.
Moreover, only flights which are lasting more than 3 minutes, are log recorded.
The flight time can be displayed in the user selectable fields. The unit will also recognize autonomously the end of the flight. It is the basic condition for the end of the flight that neither speed over ground has been measured with more than 10 km/h during min. 60s, nor that the Vario pointed to more than 0.1 m/s. In Basic-Settings one can select instead of automatic flight recording the manual procedure. Please also read 5.1.1 Flight logbook and Flight Analysis page 50

4   Map of flight obstacles (Restricted areas)

It is possible to enter on the IQ Motor+ up to 150 flight obstacles such as CTR's, TMA's, air fields, danger areas, cables or also a wildlife protective area, of which the graphs are displayed on the map page. These restricted area zones may comprise straight lines, but also arc segments or just circles. These sectors are displayed in map mode. Each CTR may be composed of max. 110 Waypoints.
In order to recognize the precise air space borderline, the map scale can be increased to 0,5km. For obtaining an entire overview of the Air space areas, it is also possible to decrease the map scale down to 50km, by using the Zoom Out function.

The map section can be altered das follows:

F2: Zoom in: the map scale is gradually increased up to approx. 0,5
Thus even details are clearly recognisable.

F1: Zoom out: the map scale is gradually decreased, down to the screen-optimised illustration. Maximum is 50 km.
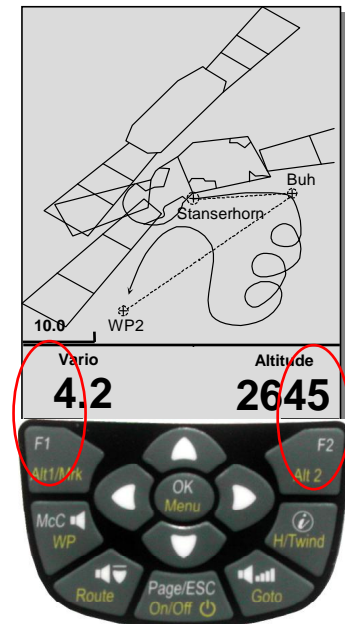
4.1   Flight obstacles - Manual editing

CTR's can be entered into the instrument either manually under *Main Setup Menu ⇒ Air Space or* more easily by use of a PC program, e.g. **Flychart** which is available for download via Internet on our homepage (www.Bräuniger.ch). The procedure for manually setting, altering and deleting CTRs is operated according to the same system which is used for setting, altering and deleting Waypoints and Routes.

Without activation code the user has 20 CTR's at his disposal. He can under *Main Setup Menu -> Manage Memory -> Delete All Air Space* store the CTR Innsbruck into the instrument and subsequently alter it under *Main Setup Menu -> Air Space.*
With activation code it is possible to use up to 300 CTR's, depending on how complex these are. For this purpose it is necessary to require the chargeable activation code for the SW Package 02. .

```
Luftraeume
===================
Innsbruck: CTR
Lugano:CTR
Sion:CTR
Meiringen:CTR


===================
       Ctr 1
Innsbruck : CTR
Bemerkungen!
No Elements:   7
Ins            Del
CTR            CTR
```

Name of CTR

Comments

Number
Elements / Points

The CTR is defined by key points and arc segments or just by a circle. When entering these key points it must be taken care of that the key points are precisely created in their order of appearance (to the right or to the left) in which these lines should be displayed later.
The IQ-Motor+ draws automatically a line from the recent Waypoint to the first one.
It is therefore not necessary to repeat as last waypoint the first one.

As type the following elements can be selected:

Point: key point
Center: center of arc segment
Startboarder: start point of arc segment
Stopboarder: end point of arc segment
Circle: centre of the circle plus Radius

**Example
counter clockwise**

5 Stopboarder Dir
7. Point
3 Center
6. Point
4 Startboarder Dir -
2. Point
1. Point
1. Point
2. Point
6. Point
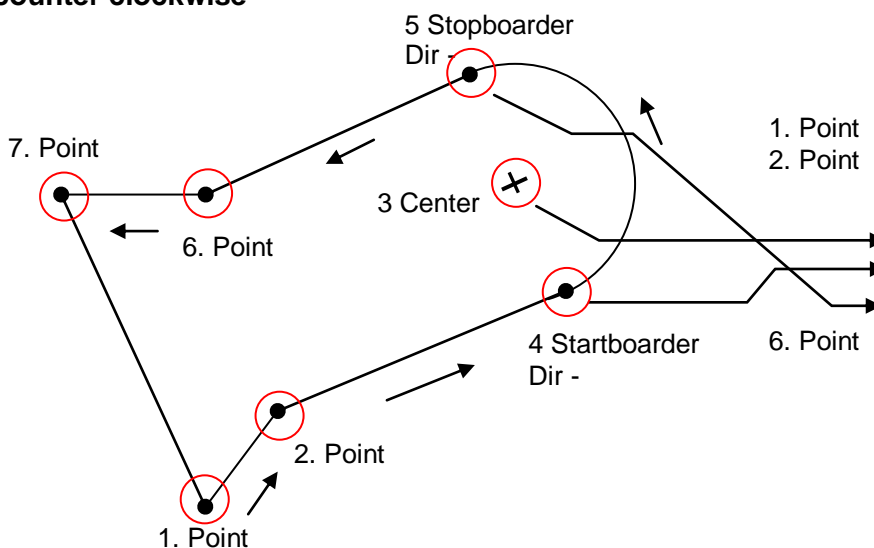
```
Innsbruck
===================
Point      1/7
Point      2/7
Center   3/7
Startb    4/7
Stopb    5/7
Point      6/7
Point      7/7
===================
Point
Lati:    N 47'19.500
Longi:   E011'04.500
Ins             Del
Ele             Ele
```

To enter **arc segments**, the following sequence must be observed:
Long, Lat centre;
Long, Lat start point of arc segment;
Long, Lat end point of arc segment;
Rotational direction (+clockwise, - counter-clockwise)

For **circles** the centre and the Radius are sufficient.
Long, Lat of centre;
Radius in km

4.2   Map of flight obstacles – edit with Flychart

The Air Space map can be entered into the instrument comfortably on the PC by use of the freebie software program Flychart via PC-interface**.**

4.2.1   Air space areas in OpenAir Format *.txt or *.fas

Flychart is appropriate to download Air Space areas in the so called OpenAir Format. On the Internet the Air Space areas are normally made available as *.txt file, e.g. on http://soaring.gahsys.com/SUA/
For Switzerland Air Space can be downloaded under http://www.flyland.ch directly in Flychart Format *.fas. For Germany and Austria the website http://www.dfc-saar.de/ -> GPS Lufträume is recommended.
Tip: create within the Flychart folder a new folder with the name **Air Maps** or *Airspace* in order to facilitate recovery and management of the Air Space files which had been downloaded

Flytec Air Space ending with *.txt or*.fas can be edited with any text editor, or very comfortably with the Flychart Air Space editor. Start point and end point do not need to be identical.
Start point and end point do not need to be identical.

Example for such a Restricted Area:

```
*##    (CLASS D) INNSBRUCK CTLZ   ###
AC D
SB 0,255,0,120
AN OVV: 120.1
AL SFC
AH 11000 MSL
DP 47:25:00 N   011:44:20 E
DP 47:18:20 N   011:48:10 E
DP 47:07:55 N   011:10:05 E
DP 47:10:40 N   011:00:45 E
DP 47:19:30 N   011:04:30 E
DP 47:16:55 N   011:13:30 E
```

4.2.2   Calling-up the function Air space in Flychart

Click on the Icon „configure flight instrument".
In instrument flight options select Air Space. An empty Air Space window shall appear.
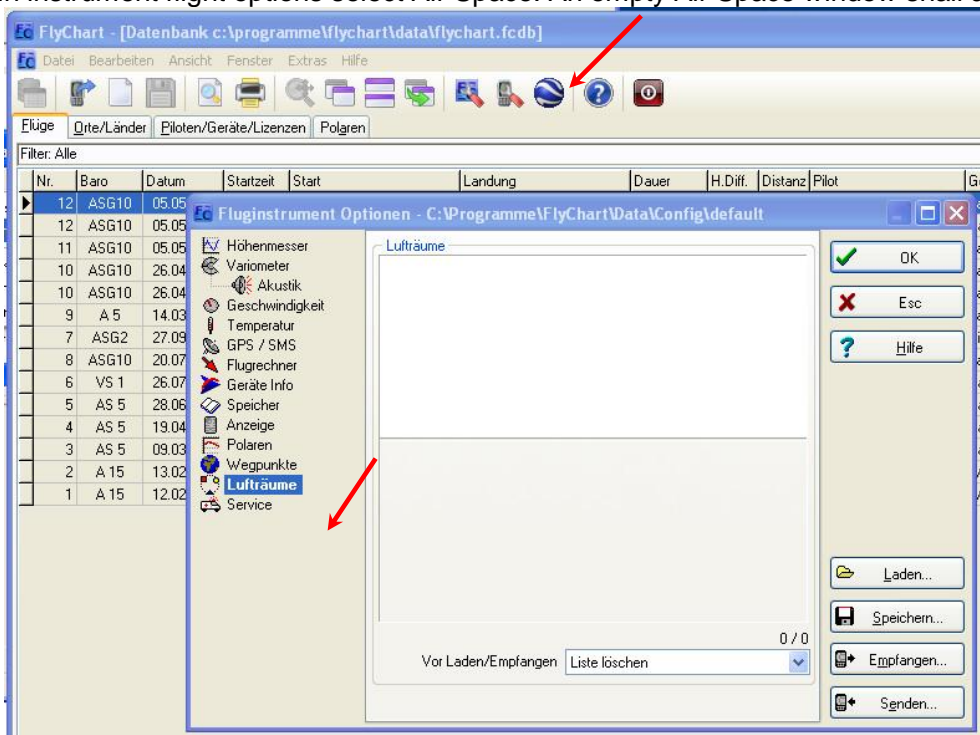
4.2.2.1   Downloading Air space
Air space can now be downloaded by pressing the button Laden (Load).
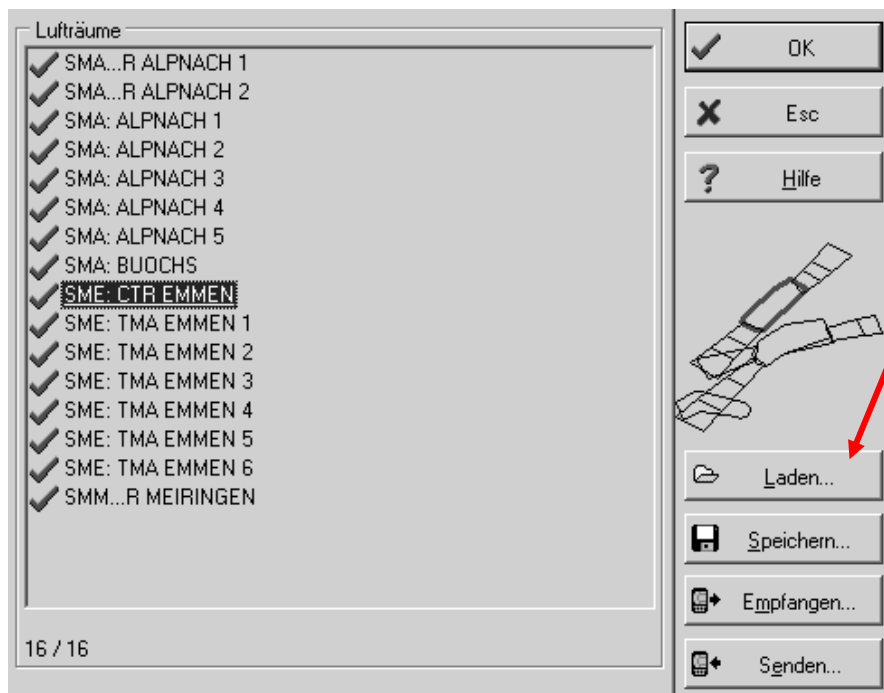
4.2.2.2   User Air space ending with *.fa5
These are Air Space areas which have been readout by the user out of a list and subsequently saved with the button "Store" (Speichern). These Air Spaceareas are not subject to be edited.

4.2.2.3   Selection of Air space areas
The standard version of Flytec's basic list allows selection of up to 20 Restricted Areas for transmission to the instrument, storage and for being called up again. The upgraded version allows selection of up to 300 Restricted Areas for transmission to the instrument, storage and for being downloaded to the instrument. The Restricted Areas which are stored in the instrument shall be overwritten upon transmitting.

The active selection which is stored or transmitted to the instrument, is marked with a green check. Non active Air Spaces are marked with a red cross. For change of selection one can call up a dropdown menu by using the right side mouse button and carry out the following action:

with Select-> Reverse (Wählen -> Invertieren) the current selection can be altered. A red cross becomes a green check and converse.
with Select -> All (Wählen-> Alle) all Air Spaces of the list are selected and are marked with a green check.
with Select-> None (Wählen -> Keine) all Air Spaces of the list are dropped and are marked with a red cross.

By clicking with the left side mouse button on an Air Space this item is selected and will then be marked in blue.
With Ctrl click several Air Spaces are selected.
With Shift click one zone of Air Spaces is selected.

After having called up this function it is at first required to click into the list in order to activate all Air Spaces contained in the list. The graph is displayed in the right side part of the screen. The activated Air Space is each time marked in red.
As from Flychart Version 4.52.31 on it is possible to display Air Spaces also graphically by using the mouse in Map mode, which may then be selected or dropped with the right side mouse button.

4.2.2.4 Editing Air space areas

I n the same dropdown menu some more activities may be executed:
with „alter" („Ändern...") it is possible to alter the name, comment or also the coordinates.
With „new" („Neu...") it is possible to enter new Air Spaces manually. This is convenient for specific Air Spaces such as wildlife protective areas or exceptions in official Air Spaces made on bilateral agreement.
With „delete" („Löschen") Air Spaces are erased from the list.

With double-click of the left side mouse button access is given to the detail view screen.
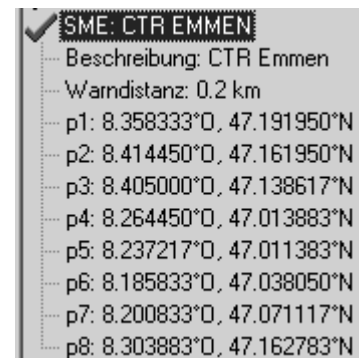
The **name** can be altered user defined with the right side mouse button ->alter (-> Ändern).
One and the same name is only admitted once in the list and may contain up to maximum 17 characters. We recommend to apply a clearly comprehensible abbreviation. As a standard are used for data files of the DAFIF data base the official 3-digit aviation name of the airfield, as well as an abbreviation of the type and of the radio channel. However this results in double names in the list, because the description may be longer than 17 characters and is then barely comprehensible.
The **description** can be altered user defined with the right side mouse button ->alter (-> Ändern). This description is displayed on the instrument and may also contain up to maximum 17 characters. We recommend to apply a clearly comprehensible abbreviation of the Air Space, as well as complementary information, such as upper or lower height limits or the radio channel data of the control tower. As a standard the altitude is indicated in meter or as Flight Level in the DAFIF data files
The **warning distance** is the vertical distance to the Air Space from which on a warning is emitted in the lower info line of the instrument. The warning displays an abbreviation of the name and the remaining distance.
The coordinates of key points need to be entered in the sequence of key points of the polygon. The rotational direction can be clockwise or counter-clockwise.

Coordinates of key points
Example
counter clockwise
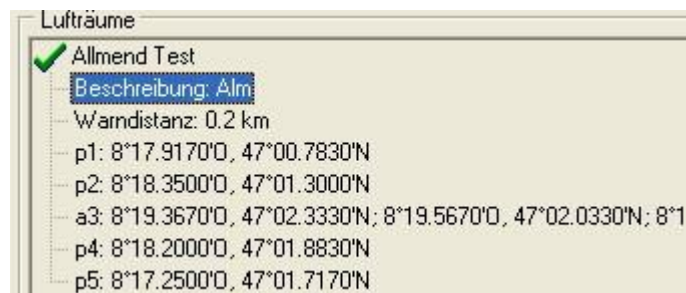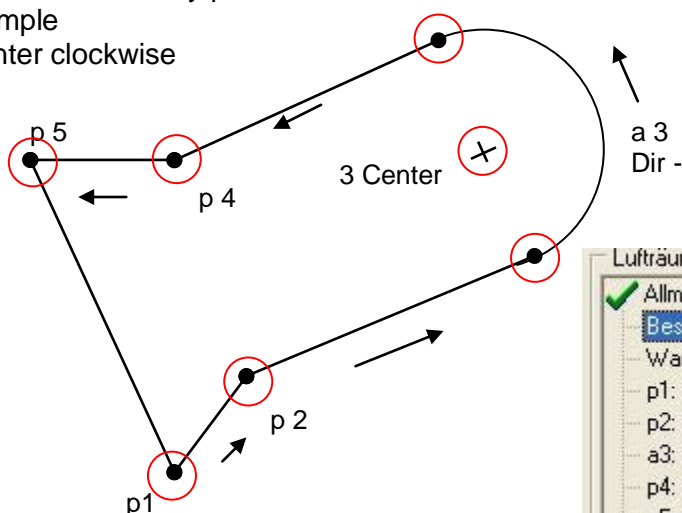
Arc segments or Radii
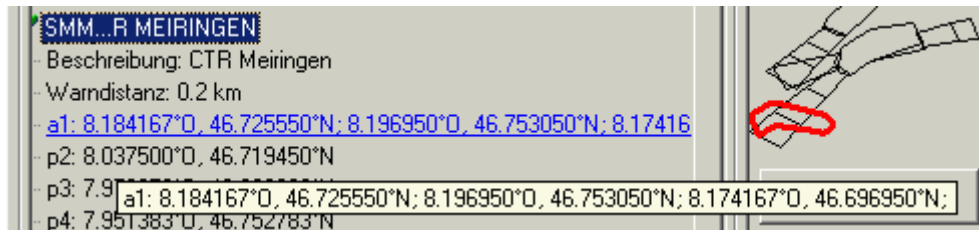
Radii are indicated in the following format:
Long, Lat centre; Long, Lat start point of Radius; Long, Lat end point of Radius;
rotational direction (+clockwise, - counter-clockwise).

Circles

Circles are indicated in the following format:
Long, Lat centre; Radius in km

We recommend the following procedure:
- Select with the button „Download" ("Laden") a Flytec Air Space file (*.fas, *.fa5 or *txt). You will now receive a long list and a complex graph.
- Click into the list, all Air Space areas appear in blue. Now select with Ctrl + left side mouse button the single Air Spaces, for zones use Shift + left side mouse button. Select the Air Spaces being important for you. They shall be displayed on the right side of the screen. Please consider that in Map mode of the instrument it takes the more time for the screen layout, the more Air Space areas are in the active zone.
- Now alter for the individual Air Space areas the name and description in abbreviations which are comprehensible to you.
- Simplify complex Air Spaces of which only some parts are interesting to you by deleting key points.
- Combine Air Space areas which are nested into each other and for which you are not permitted to penetrate.
- Now you can store this file for later use with "save" ("Speichern").
- With „send" ("Senden ") the selected Air Spaces are transmitted to the instrument. If acoustic is energised, a high pitch beep is audible for each Air Space which was transmitted successfully. In case of unsuccessful transmittance the tone is somewhat deeper, e.g. in case of double names. With "received" ("Empfangen") one can check which Air Spaces are currently stored in the instrument.

Tip: create at first a user Air Space file containing the Air Space in your flight area.
This file may contain numerous Air Space areas. Open this file prior to the flight and download only the Air Space areas to your instrument which you are likely to approach during this day. .

5   Flight-Memory and Flight-Analysis

5.1.1   Flight logbook and Flight Analysis page

The recording mode does not need to be specifically
activated, as each flight is automatically saved.
The flight memory provided with the IQ Motor+ not only
records flight altitude and flight speed (TAS), but it also
logs the position of the pilot and the GPS-altitude
in the WGS84-coordinate system. In *Main Setup Menu* ⇒
User Settings ⇒*Flight memory* ⇒*Record. Intervals* the
recording intervals can be set. The selected value determines
the time interval in seconds, according to
which a new data set is entered into the memory
of the Compeo+. Minimum value is 2 seconds, which
corresponds to a recording time of approx. 9 hours.
At the maximum value of 60s interval the recording time will
add up to approx. 291 hours.

For tests or acrobatic flights a sampling rate of 2 seconds is
recommended. Another recommendation is the
Recording Interval between 5 and 10 s. Hereby also
narrow curves are well recognisable and the number
of data points for the external calculation of the OLC
points is kept conveniently clear.
Factory setting here is 10 seconds.

For the beginning of a flight the following agreement
is applicable:
**start is recognised as soon as Groundspeed reaches
more than 10 km/h during min. 60s, or if altitude
difference of more than 30m was detected within 60s.**
In any case, however, the previous flight history over
30 recording points is logged into the memory of the
 IQ-Motor+. Even the last 3 minutes prior to the start of
the logged flight are recognisable, as they are recorded
in 10 sec. recording interval.
**The end of the flight is recognised in automatic
recording mode, if there is no speed for min. 60 sec.
(less than 10km/h GPS-speed or air speed)
and if no change in altitude occurs.**
Then the standard display screen is automatically
switched to Flight-Analysis mode. From this moment on
the „digital signature" of the flight is calculated and
shown by a notice in the Info-line. Please wait until this
calculation is completed. By briefly pressing the **ESC** key
one returns to standard mode.

```
   Main Setup Menu
================
Flugspeicher
Wegpunkte
Routen
Luftraeume
>Benutzer Einst.
>Speicher

================
```

```
     Flight Memory
=================
01.03.02      0:43:12
13.02.02      1:37:34
28.01.02      0:24:05
23.01.02      1:02:24
12.01.02      2:11:45
15.12.01      0:34:55
24.11.01      1:07:32
=================
```

```
Start:   13:02:02  UTC
Stop:    15:55:32  UTC
Flight time:    2:53:30
Scanrate:    10 s
Max A1:   2823 m
Max A2:   1154 m
     A3:   4273 m
M. Vario:      8.9 m/s
M. Vario:      6.6 m/s
M. Speed:    73 km/h
Shw                   Rec
Map                   Sig
```

It is also possible to switch the instrument to **manual recording**. For this purpose one has to select under
Main Setup Menu ⇒ *User Settings* ⇒*Flight memory* ⇒*Recording Auto/Man* the item "No".
**By use of this setting the recording starts approx. 2 minutes after switch-on and is only
finished after the key** ESC **has been pressed for 3 seconds.**

Begin of the recording is visible by the running „Flight time"- counter.

Caution: make sure before take-off that the GPS-Receiver indicates to receive at least
4 Satellites in order to achieve valid recordings.

Comment 1: in the Flight Analysis are displayed max. values which occured during the flight. Due to the fact that the display screen is updated every second, these 1-second values are saved for the flight analysis. If one undertakes a download of such a flight afterwards on the PC using a program such as Flychart, SeeYou, CompeGPS, MaxPunkte etc., these programs are only appropriate to evaluate the flight records in IGC format. In the IGC file are saved the time (UTC), position, barometric altitude, GPS-altitude and True Air Speed of the wind vane or pitot pressure sensor. The programs now calculate the Variometer values from the altitude data. If for instance, one has set a recording interval of 10s, and has covered a height difference of 5m during these 10 seconds, there will be calculated a Vario value of 0.5 m/s. However, during this time a 1-second Vario value of 2m/s may have been performed. It is only this value which shall be indicated on the Flight-Analysis page and it is not subject to electronic readout. On the flight analysis page both values are displayed.

Comment 2: although the instrument is capable to store up to 100 flights, we recommend to save the flights in regular intervals from the instrument to a PC and to reformat the flight memory afterwards under *Main Setup Menu ⇒ Memory⇒Delete all Flights.* This procedure ensures the safe data storage of your precious flights and that the instrument may perform new recordings again with a „refreshed" flight memory.

5.1.2   Graphic display of flights in map format

The flight route of saved flights can also be shown on the Display screen for appraisal. Within the item Flight Analysis the F1 key is taken for the function *Show Map*. After pressing this key the screen-optimised illustration of the flight route is shown (North is at the top!). In addition, stored Waypoints are presented with a cross and the name, as well as the map scale as a short line with km indication. Now the illustration can be altered as follows:

F2: Zoom in: the map scale is gradually increased up to approx. 0,4 km.Thus individual circles are clearly recognisable (dependent on the recording interval which was set).

F1: Zoom out: the map scale is gradually decreased, up to the screen-optimised illustration. Maximum is 47.4km

Arrow keys Pan: ◀ ▲ ▼ ▶ by use of these keys the illustrated area can be shifted up, down, left or right.

OK: from each graph back again to the screen-optimised illustration.

ESC: Return to the Main Setup Menu
All the other keys cause the Track in the current selection to be redrawn.

Remark: as the display layout time will take a few seconds to appear in accordance to the data volume, the message *Wait* and *Ready* appears on the status line as user information.
If a zoom or pan key is activated during the screen layout, the momentary process will be stopped and will resume with the new values.
Thus it is possible to obtain the desired graph rapidly.
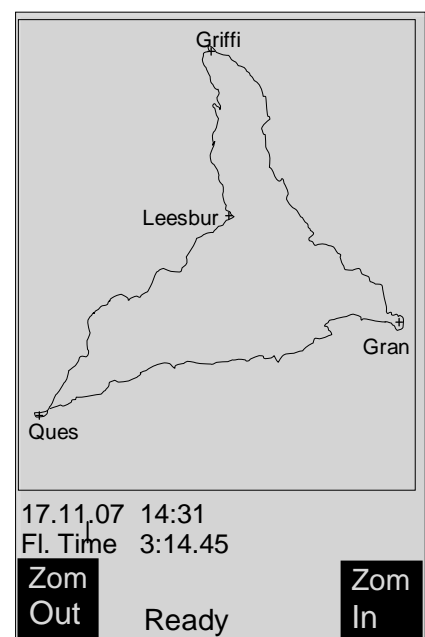
6   Data transfer

In the memory of the IQ Motor+ are saved all data entered by the pilot, including Waypoints, Routes, pilot's name, etc. as well as the automatically recorded track log points of the flights undertaken by him. Each of these track log point contains the time of day, position, GPS altitude, barometric altitude as well as the flight speed. In this way, it is possible to graph the Barogram, variogram, speed gram and course of the flight on a map for later evaluation. In Flychart 4.52 it is even possible to show the flight on the PC monitor in 3D on the corresponding landscape.
For this purpose the program Google Earth needs to be installed, along with an active internet connection.

6.1   Data exchange via PC

The basic equipment of the IQ-Motor+ includes a data cable for a USB PC interface USB Mini B. Due to this feature the data transfer can be carried out in both directions. The data transmission is effected via serial interface COMX with: 57.600 baud; 8 databit; 1 stopbit; no parity; Xon/Xoff.

The IQ-Motor+ can also be operated for **data readout and entry** via USB interface:
- entire instrument configuration (Basic Settings, user defined fields)
- list of Waypoints
- list of Routes

Only readout of flights saved in the flight memory is possible.

> **Important:** for transmission of a.m. data the connection cable to the PC may only be plugged into the IQ-Motor+, after the instrument has been **switched-on** and the program required for the data transfer was called up.
> **Important:** at first the USB driver from Prolific included in the scope of supply needs to be installed from the CD. For the installation of Flychart the installation of USB driver is effected automatically.

To perform data transfer the instrument needs to be switched to the *Main Setup Menu* by prolonged pressing on the **Menu** key.
Please observe the instructions of the software being used for transfer of stored flight data.
(for most of the software programs it is required to switch to Flight Memory resp. to Flight Analysis mode). There are various software programs available for creation of IGC-files, partly even for OLC-files. More detailed information under http://www.onlinecontest.de/holc/ .
We recommend the use of Flychart which you may download from the Website www.flytec.ch

With Flychart it is possible to perform all instrument settings comfortably on the PC

Trackview (Freeware)	Daniel Zuppinger (für den OLC and CCC) www.softtoys.com/
Maxpunkte (Freeware)	Program from D.Münchmeyer for Online-Contest of DHV- www.dm-sh.de
Compe-GPS	For Competitions a. privat pilots, 3-D illustration - www.compegps.com
Seeyou	Flight planning- and analysis software - www.seeyou.ws/
GPSDump	Stein Sorensen . A simple program for obtaining IGC Files http://www.multinett.no/~stein.sorensen/

6.1.1 Flight instrument Options

All settings can be performed or altered comfortably with Flychart 4.52
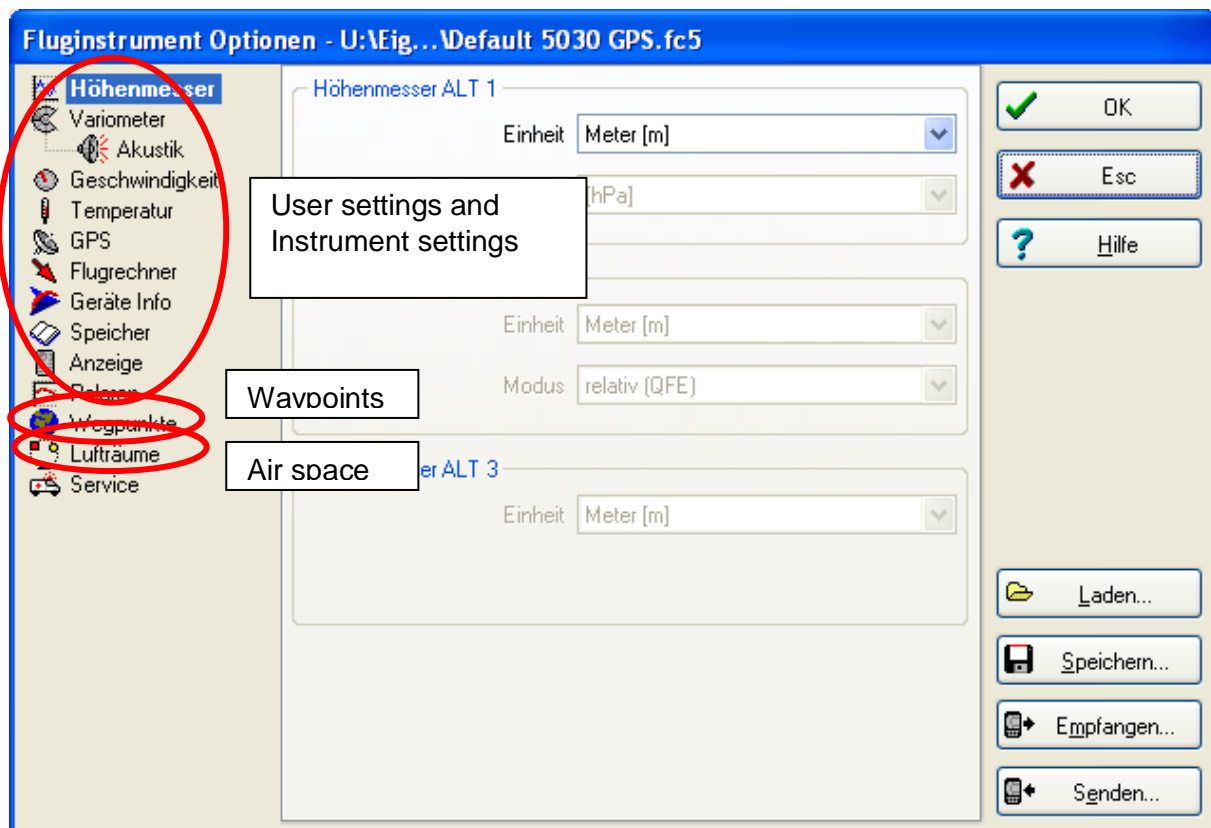
6.1.2 Waypoints and Routes

In Flychart the Waypoints and Routes may be transferred to the instrument within the same
Menu. Flychart is also appropriate to import Waypoint files from SeeYou or CompeGPS
or Garmin for transfer to the instrument.

6.1.3 Air space areas

The same applies to Air space areas. For this purpose please press the button „Air space"

7 New Software-(Firmware) – transferring to the IQ Motor+

As is the case with many other present-day instruments, there is also the possibility to up-date
the software (firmware) version. Hereby even future requirements presented by pilots or new
Competition regulations may be rapidly implemented. The manufacturerFlytec shall post from
time to time program up-dates of the IQ Motor+ firmware on his Internet homepage, which can be
downloaded by the user free of charge for storage and subsequent transfer to the IQ Motor+.
In order to be able to write into the IQ Motor+ flash memory with a PC, the program „**Flasher.exe**"
is required, which is available in zipped format file under the name of "Flasher.zip". Moreover
also the intrinsic firmware to be uploaded needs to be obtained from the homepage.
Ist name is e.g. "6018_V100c.moc" (approx. 500 KB) which corresponds to Version 1.00c.

Tip: we recommend to store all the related files in one single subdirectory (e.g. C:\Programs\
Flytec\Flasher\). After decompressing the ZIP file a number of files are created.

Double click on the file " Flasher.exe" starts the program.
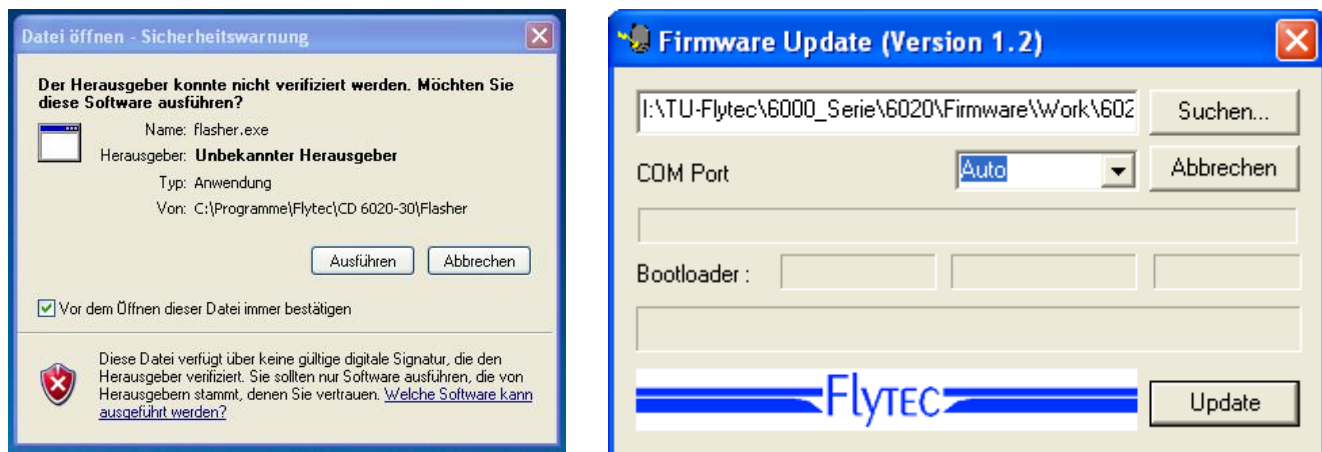
For the safety warning press **„execute"** (**Ausführen)**, after this the program will start.
With „Search" ("Suchen") you select the program to be transferred and ending " *.moc ", e.g.
6020_V328.moc, or you drag it from the Explorer by „drag & drop" into the field.
Now connect the USB cable with the instrument, after that you can set the interface in the field Com
Port, or if it is unknown to you, set to **Auto** and have thereby an automatic search prompted.
The virtual interface COM should be positioned between 1 and 9. Above this value the Flasher
can no more recognise the interface.
Start the data transfer by clicking on **Update**. Then the version of the instruments's Bootloader
shall appear and the relevant bit rate. The numbers appearing in the field on the right are the response
data of the instrument.

Important: by contrast to flight data transfer make sure that the IQ Motor+ **is not
switched-on** when the connection cable to the PC is plugged to the instrument. .

Caution: never leave the PC cable hooked to the instrument for a longer period when
it is turned off. Indeed this is energy consuming and the battery could be discharged
unnoticed.

Tip: under Windows the characteristic noise for USB devices should be audible when the unit is
plugged.

8   Miscellaneous

8.1   Optional Software (additional Software)

By means of an activation code which is available from Flytec, it is possible to enable additional special
functions. For example by use of a 5-digit Code the illustration of Air Space areas (CTR's) may be
activated.

Procedure for Code entry:
- Select in Menu Optional SW Packages the respective package.
- Press OK. Then a Code –29XXX will appear.
- By use of the arrow-down key the Code jumps to 30000 and counts downwards.
- Set the Code by use of the arrow-down key and press OK.
- The instrument signals - Package released!

If a wrong Code has been entered, the instrument remains blocked for min. 5 minutes!

8.2 FLARM

As an option it is possible to assemble a collision warning device model FLARM. In Menu item -> *Main Setup Menu -> Instr. Sett. -> Flarm* the FLARM-module can be switched-on or switched-off. Moreover it can be programmed at this point. For details please study the separate Manual "Operation Manual FLARM"

8.3 FlyLink

Headset

Radio - throttle

IQ Motor+

Motor, (petrol or electric)

Radio nodes for speed measurement, temperature or petrol consumption
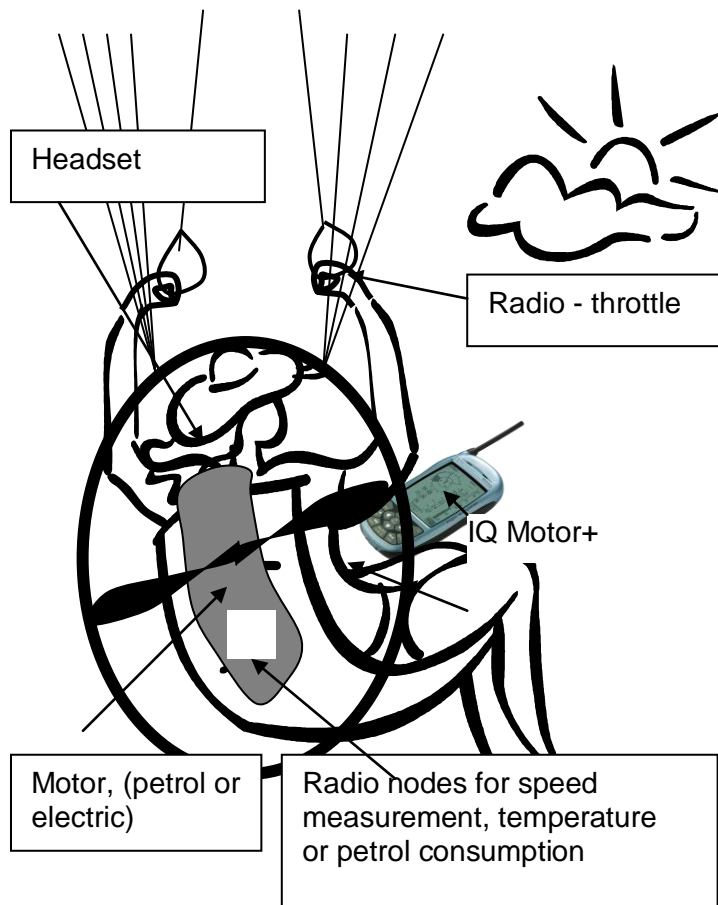
FlyLink® is a small radio network surrounding the pilot. In Menu -> *Main Setup Menu -> Instr. Sett. -> FlyLink* it is possible to enter basic settings for the FlyLink feature. These settings are already implemented upon delivery of the device.

8.4 Bluetooth

As another option it is possible to assemble a Bluetooth module. It is only possible to assemble either the Bluetooth or otherwise the FLARM - FlyLink. Both devices together is not possible. By means of the Bluetooth option the internal data can be transferred either to a mobile phone or a PNA (Personal Navigation Assistant) device. As another possibility the position can be sent as SMS text by a mobile phone. Datatransfer to a PC is not possible. In Menu -> *Main Setup Menu -> Instr.Sett. -> Bluetooth* it is possible to enter basic settings for the Bluetooth feature. Please study the separate Operation Manual „Bluetooth and SMS Setup".

9   Simulation

After choosing the Simulation mode in the Setup menu and pressing the OK key, you have access this highly interesting function. With the *arrow keys and* OK you turn the Simulation mode to: "Yes" and confirm again with OK. Now the simulation starts and the last known GPS position is applied.

With the ► and ◄ arrow keys you can adjust the air and ground speed; the ▲and ▼ arrow keys change the sink or climb. If the stall alarm sounds, please increase the airspeed by a few km/h. The F1 key is used for switching to various functions.

Next Func.	Var ▲▼ Spd ►◄XX	to alter Climb/Sink Air + GND-Speed
Next Func.	Wind ▲▼ Trk ►◄	to alter an assumed Wind strength during climb and
		to alter the Track (Flight direction) during sink phase
Next Func.	Mod A1 ▲▼	Modify altitude Alt1
Next Func.	Mod A2 ▲▼	Modify altitude Alt2
Next Func.	S.Thr –▲▼	altering activation point of sink acoustic
Next Func.	Change page ►	

Likewise, the **Goto** function can be called up to select a Waypoint. The distance to this Waypoint appears. If the direction arrow in the compass centre points upwards, the pilot is moving towards his goal and the distance to WP becomes smaller while at the same time the altitude is naturally decreasing. If you now initiate a climb with the ▲ key, the Compeo+ simulates circling up in a thermal; the compass rose turns and the distance to goal continuously changes between somewhat closer and somewhat farther away. Under simulation mode you can also test the different acoustics of climb tone when altering frequency, pitch and modulation. Please shift back to sink flight mode. After pressing the **F1** key it is now possible by use of the ▲and ▼ keys to alter the Speed over Ground, i.e. simulate the wind influence. When using the ◄ and ► keys it is also possible to change the flight direction, e.g. to fly directly to a WP.

You can also retrace perfectly in simulation a called-up Route. If you select this Route as Competition-Route, you will hear the characteristic tone upon approaching within 400 meters of the Waypoint, which tells you that you are inside the cylinder. Moreover you can see the automatic switchover to the next WP too. (Caution: for automatic switch-over the countdown timer must show positive values). By pressing the ESC key you can switch to map display and observe the approach to the Waypoint cylinder.

If one has selected the function Wind Track with the F1 key, it is real fine to simulate the influence of head or tail wind during approach to the goal. It is indeed informative to see the influence of head wind when approaching the goal.

It is really instructive to see how far the head wind will influence the readout of Alt a BG.

During simulation mode the GPS-Receiver is switched-off and instead of its bar graph appears the word "*Simulation*".

A simulated flight is well stored into the memory of the IQ Motor+, however for such flight the "Digital Signature" is not valid.

10 Battery - Management

The IQ Motor+ provides 2 Banks of 2 accumulators each
On the Main Display screen there are two scales to indicate
the approximate charge level of the accumulators.
Upon switch-on and switch-off the respective capacity of each
one is displayed in percent for information. In this respect it
should be considered that Bank 1 must always be loaded.
Bank 2 is the spare Bank and may be kept unloaded if
unavoidable. However, it is highly recommended to have
Bank 2 also equipped. As soon as batteries of Bank 1 are
discharged, the instrument automatically switches to this
second spare Bank. After having completed a long flight,
we recommend to put the used batteries of Bank 2 into the
Bank 1 and to put new batteries into Bank 2.
Hereby it is ensured that the batteries can always be fully
used up without the risk that the batteries may be
discharged during the flight.

The following batteries are appropriate for use:

- 2 pieces each per Bank Alkaline High Power Batteries
  1.5V size AA. Estimated operation time 2 times 20h =
  40h in total
- 2 pieces each per Bank NiMH Accumulators 2100mAh
  or more, 1.2V size AA.. Estimated operation time
  2 times 15h = 30h in total
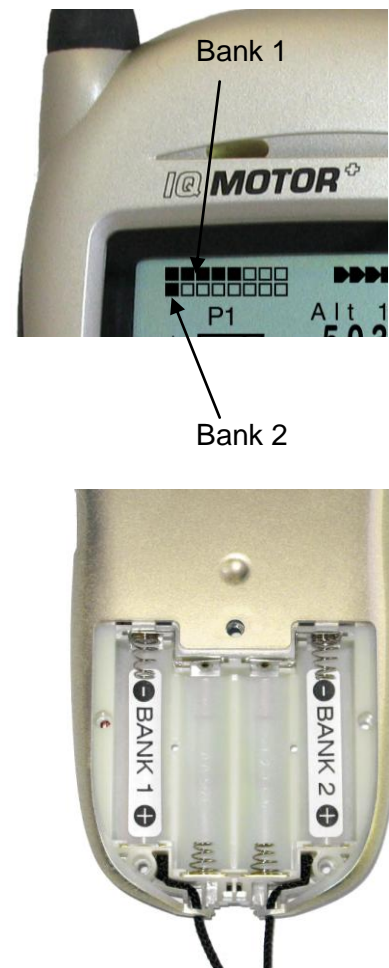
The relevant battery types are to be set under *Main Setup Menu ⇒ Instr.Settings ⇒Batterytype.*
**A wrongly entered setting may lead to the result of the instrument's premature and complete
switch-off when shifting from Bank 1 to Bank 2 and thus provides incorrect status information!**
We recommend not to use NiCd Accumulators. These batteries have significantly reduced capacity and
they are less environment-friendly. Also the switching threshold is not laid-out for NiCd Accumulators.

Remark: the estimated operation time as mentioned before is based on normal temperatures
of approx. 20 – 25 °C. At low temperatures the batteries and accumulators have a significantly
shorter service life.

When batteries are not in use for some time, they need always to be removed!
Defective batteries can seriously damage the instrument by leaking acid!

Corrosion damage caused by defective batteries is not covered by warranty!

11   Complementary Information

11.1   Altimeter

An altimeter is really a barograph because it doesn't directly measure altitude, but air pressure. Altitude is then calculated from air pressure. The pressure at sea level is used as zero point height for the calculation of absolute altitude (according to the international height formula).

Why does pressure change with altitude? Pressure at any given point on the earth is created by the weight of air in the atmosphere above it. Therefore, pressure reduces with height – there is less air above your head! A change in pressure of 1 mbar (mb) at 500 metres above sea level is a height difference of about 8 metres.

In practice, however, it is not as simple as that because of the many other factors that influence air pressure. Therefore, air pressure is also depending on temperature and of course, on weather conditions. On a stable day, temperature induced differences of 1mbar mean a height difference of ± 10 metres. Depending on the weather conditions, air pressure at sea level (QNH) may vary from 950 mbar to 1050 mbar. In order to eliminate this influence of weather, the altimeter has to be calibrated at certain intervals. This means the altimeter has to be set to a known altitude and it must then show this value.

During rapid weather changes (e.g. passage of a cold front), the air pressure can change by 5 mbar during one day. This means a height difference of 40 metres!

Another way to calibrate an altimeter is to set it to the actual QNH.

What is the QNH? General air traffic needs a common zero point. This means that at a certain altitude all aircraft show the same altitude on the altimeter. The common basis for this is the QNH. The QNH is the actual pressure in hPa (1 hPa=1mbar) calculated back to sea level. It is calculated several times a day and can be taken from the weather forecast for aviation or it may be requested by radio from airfields.

11.2   Speed

11.2.1   True or Indicated Airspeed   - TAS or IAS

In general aviation it is customary to measure the airspeed by use of a pitot tube as a dynamic pressure speed (=IAS) and also to display it as such. The advantage of this method is the fact that
at any altitude level the maximum admissible speed or the stall is marked (=flight safety) at the same position on the scale. Furthermore it is the same for the speed of best glide at any defined altitude which is on a fixed position on the speed scale (flight performance).
It is however one disadvantage of this system that all geographic calculations such as glide angles and distances, as well as final approach calculations require the value of True Air Speed (TAS) to perform the correct calculation.
It is even another disadvantage that the indicated speed is correct **only at one** certain altitude (generally at sea level). The higher one climbs, the glider will fly increasingly faster due to the air getting thinner, without the indication display following this fact.
At approx. 6,500 m the air weighs only half of that at sea level, therefore the air speed will increase by 1.41 times (as a radix of 2).

The physics could be pictured as follows:

In order to create a certain lift a certain number of air particles need to hit the airfoil. Because of the fact that at 6,500 m altitude there are now only half as many particles present per meter, the wing surface has to fly faster, but not twice as fast, because each particle has a higher striking energy and is then only 41% faster.

For the calculation of wind, arrival altitude or arrival time at goal, however the true air speed values are always required. The wind wheel sensor indicates the True Air Speed (=TAS), because it runs practically without friction.
The IQ Motor+ generally indicates the True Air Speed - TAS.

11.2.2 Stallalarm

If a pilot slows down his glider gradually, he will cause a stall when falling below a certain speed, which will have different consequences, depending on the type of aircraft.
If the air current is suddenly cut-off from the entire surface, then a completely unforeseeable crash would be pre-assigned. For this reason, our aerofoil manufacturers are building a so-called cross-setting (washout) into the support parts of the wings; this means that during flight the wing tips will always have a smaller stalling angle than the middle part of the glider. If the air flow stalls in the middle part of the surface when falling below a minimum speed, then lift still remains on the wing tips. The aircraft is now in stall flight. Due to the fact that the wing tips are positioned behind the aircraft's centre of gravity, the aircraft will drop nose downwards and try autonomously to increase the air current by gaining speed.
It is certainly not advisable to stay a longer time span in this excessive flight situation, as the wing will react extremely sensitive to even small air turbulences. A stall can be dangerous, especially during the landing approach. The consequence could result in a stall over one wing surface or an unintentional 180-degree curve. The stall alarm is a loud, concise acoustic signal that requests the pilot to fly faster. It assists first and foremost hang gliders, however para gliders to a lesser extent. Anyone who has ever watched a hang glider come in during an approach can observe the following situation:
always when a good headwind prevails, many pilots will pull out their steering bar too early; the glider then climbs a few more meters to end up in a favourable case afterwards with its keel stuck in the ground.
With no wind or with a light tail wind most pilots wait too long to pull out the bar. In this case, and with luck the result will only be a belly landing; but also a ground-loop with broken base side tubes may be the result, or the glider's nose absorbs the impact when touching ground and the pilot will swing pendulum wise, hitting his helmet on the front keel tube.
There are different stall speeds to apply for each glider and varying weights of the pilots.
Several tests are necessary to determine for the own arrangement the setting of correct stall alarm limit under *Main Setup Menu ⇒ User Settings⇒Speed⇒Stall Speed.*
Moreover it is worth to note that close to the ground, and because of the air cushion under the wings, the stall occurs at approx. 2 km/h lower speed than in the high air.
In addition, the stall speed is also dependent on the specific weight of the air, i.e. the flight altitude.
On the IQ Motor+ the stall alarm level is automatically raised with increasing flight altitude, corresponding precisely to Indicated Airspeed. It is then unimportant if the pilot has selected True- or Indicated Airspeed for indication on the speed display screen.

The border limit between stall alarm and the speed for minimal sink is indeed very small.
Hence several pilots have complained about the fact that while circling up in weak thermals at the speed of minimal sink, the stall alarm is triggered sometimes.
In *Main Setup Menu ⇒ User Settings ⇒Speed⇒Stall Speed* there is an altitude limit to be

adjusted by the pilot above which the stall alarm shall not be initiated. Of course, in this case, the landing areas should be located below this limit. **Warning:** sometimes it may be helpful also to be warned by the stall alarm when circling in a thermal of unstable flight attitudes.

Experience has proven that about half of the otherwise unattractive landings have been saved by pushing the steering bar upright when the stall alarm was triggered.

11.3 Navigation

11.3.1 Reception quality of GPS

The GPS-Receiver of the COMPEO+ can follow up to 16 satellites simultaneously. After turning on the unit it is necessary to receive at least 4 satellites to fix position for the first time. Once logged on, 3 satellites are sufficient (for 2D positioning) to determine the location. However, if one wants to record altitude too (3D positioning), then definitely four satellites are required. There is a table in the receiver, **The Satellite Almanac**, in which the path, place, and time data of all satellites are kept with reference to the receiver. The Almanac is continuously updated during signal reception. However, if the signal to the Almanac memory is disrupted completely or the unit is taken 200 km or more from the last reception point, then the Almanac has to be re-established. Power is still supplied to the almanac's memory even when the instrument is turned off.

Normally the instrument recognizes its position under unobstructed view conditions after a few minutes. If the receiver is switched-off for a short time (less than 2 hrs.), the time for new position finding is less than a minute. Buildings, mountains or thick forest affect reception quality of the receiver. Therefore, you should always look for the best possible visibility around you and the antenna in the casing should point upwards if possible. In particular when mounted on the steering bar of the hang glider, we recommend not to have the instrument fixed under the pilot's head on the middle of the basis, but indeed sideways. In this position the IQ Motor+ should not have more than 45° deviation from horizontal position so that the antenna points upwards.

Considering that receiving strength of the satellite signals is only approx. 1/1000 of mobile radios, these radio sets and other disruptive factors (like notebooks) should be operated as far away as possible from the IQ Motor+.

Das IQ Motor+ is fitted with a 16-channel GPS-Receiver which is featured with lesser power consumption and also a significantly shorter satellite detection time. Accuracy is between 7 to 40m. As an average one may assume approx. 15 m.

11.3.2 Accuracy of GPS altitude

A good explanation on the GPS Altitude accuracy is found on the following website: http://www.kowoma.de/en/gps/errors.htm

First of all the word accuracy has to be defined. On the website mentioned above you can read: "The declaration of the accuracy used by Garmin for their GPS receivers leads sometimes to confusion. What does it mean if the receiver states an accuracy of 4 m? This readout refers to the so-called 50 % CEP (Circular Error Probable). This means that 50 % of all measurements are expected to be within a radius of 4 m. On the other hand, it also means that 50 % of all measured positions are outside of this radius.

Assuming a norm repartition, 95 % of all measured positions are within a circle of twice this radius, i.e. 8m and 98.9 % are within a circle of 2.55-fold of the radius, that is in this case within a radius of 10 m.
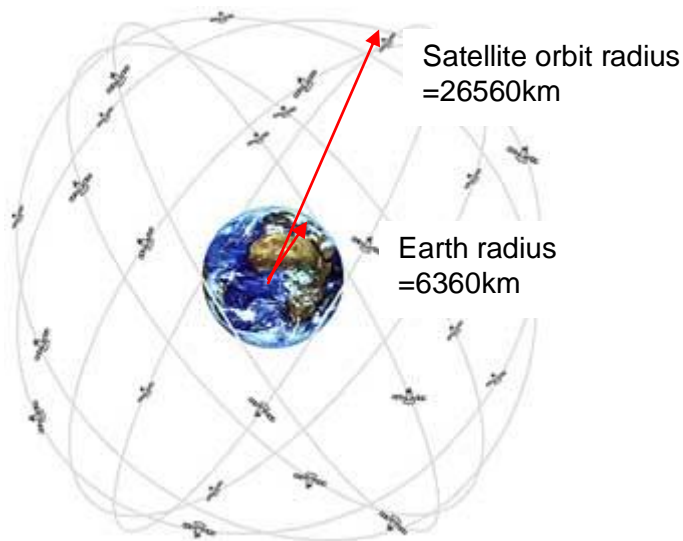
The calculation of GPS position is derived from a triangulation. The GPS receiver measures the time needed by the signals and calculates over the speed of light the distance to the respective satellite. With three satellites the horizontal position finding is determined, and with 4 satellites the spacial position with altitude.
You may find a good explanation of the involved calculations on Wikipedia.

For the spacial position finding (3D position) 4 satellites are required. One of the satellites is used for synchronisation.
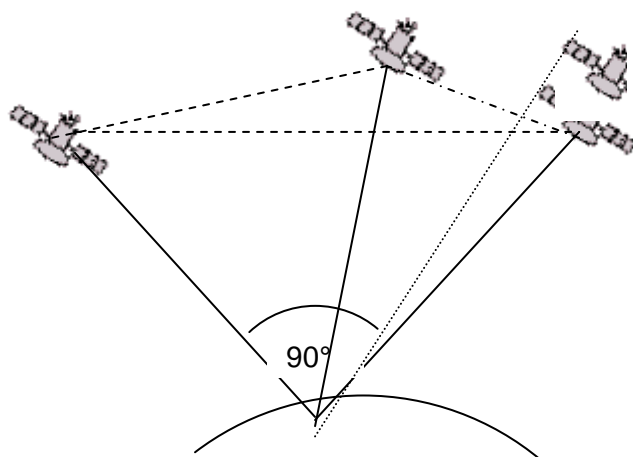
4th Satellite for time synchronisation

Best accuracy is achieved if the angle between 2 satellites is 90°. The defined triangle between one's own position and the two involved satellites has then the biggest possible area.
The unit DOP (Dilution Of Position) is proportional to the inverse value of this area.

In case of a 3D position finding, best accuracy is achieved if 3 satellites are in 90° to each other. In this case the volume of the defined pyramid is the biggest. Again the DOP (Dilution Of Position) is the inverse value of the volume of this pyramid.

For a good 2 D position finding on the earth surface it is best, if you have 2 satellites at 90 ° near to the horizon. Thus for example one satellite to the North, the other one to the East. The third satellite perpendicular above you does not contribute to more accuracy, it just gives rough information in regard to altitude, but this is sufficient for a good lat/long triangulation.
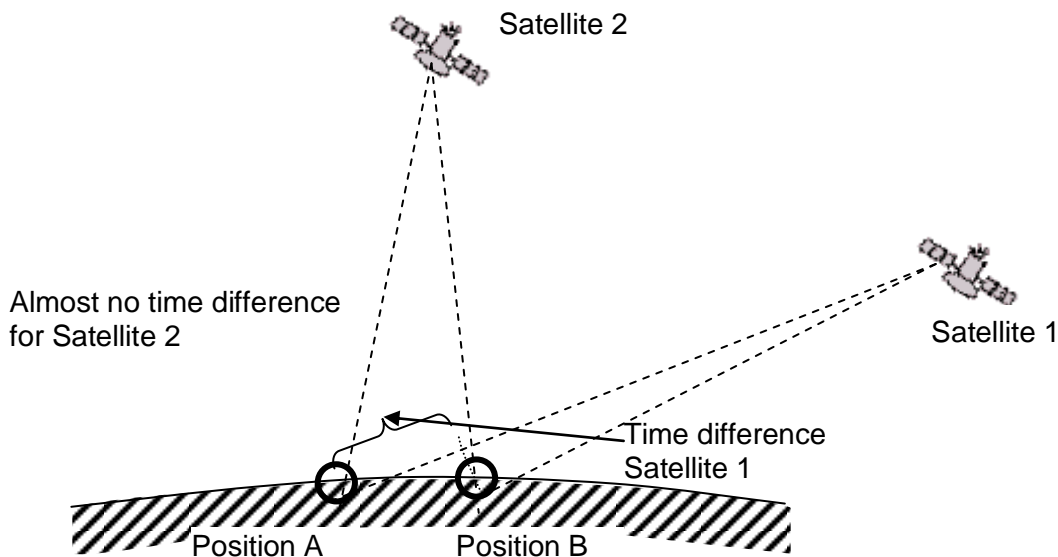
Moreover there is a better chance to find 2 satellites at 90° near the horizon,
than to find 3 satellites at 90° to each other directly above your position.
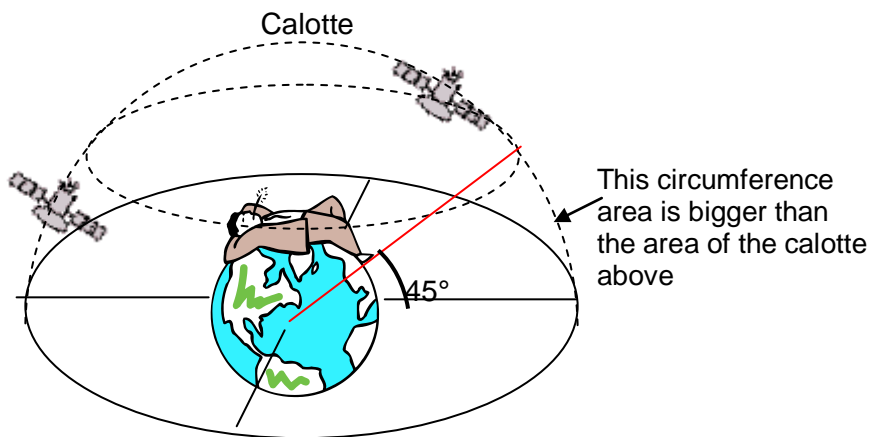
Because the circumference area at the horizon is bigger than the vertical area above the position,
and because it is assumed that the satellites are about equally dispersed, there is a better chance to
find convenient satellites near to the horizon.
The GPS module will therefore prefer satellites near the horizon for the horizontal position finding.
The module will calculate all possible combinations of visible satellites and makes every second
an average of these combinations.

In order to perform the same with the vertical position, the receiver would need twice the calculation
power. Due to the fact however that automobiles and pedestrians normally need the horizontal position,
this complexity is economised and calculation of altitude is performed from the best combination and by
the average value of time. That is the explanation for the smallish accuracy and the slow follow behind
movement of the vertical position.

The GPS module of Flytec instruments makes no time filtering over the horizontal position, but at good
reception it performs a filtering of around 5 seconds in the vertical position.
The poorer the GPS satellite reception, the longer this time constant.

11.4 Flight optimisation

11.4.1 Final glide calculation

Although final glide optimisation features are not that important for Paramotor pilots, it might yet be helpful to know if you could reach your goal even without propulsion. The IQ Motor+ calculates these values based on the theories which are known from the domain of hanggliders and Delta paragliders.

Here the GPS-Data and the McCready theory go hand in hand. In principle it is about reaching a goal (of course it must be logged as a Waypoint in the list) as fast as possible, or rather, to get a signal from the instrument of when the last thermal can be left in order to arrive at the WP as fast as possible. In order to be able to establish a statement about this item, the distance to this location must be known. This distance will be calculated with help of the GPS-Receiver. In addition, we need the altitude of the Waypoint (as mentioned in the list of Waypoints), as well as the current altitude of the pilot. From this smallish amount of information it is possible to calculate the **required glide ratio** over ground (L/D req.) which is necessary to reach the goal. For this purpose all other conditions, such as climb, sink, wind and wind direction, flight speed and polar curve, are not taken into account. The required glide ratio can be displayed in the user defined fields: **L/D req.** It is only when the **flyable glide ratio** (over ground) has to be determined, that the before mentioned conditions have indeed an important role.

Basically the final approach consists of two phases which are to be considered separately:

1.) climbing in the last thermal and
2.) the straightest possible glide path to the goal

The IQ Motor+ does not calculate with the McCready Theory, but with the speed of best glide. In order to reach optimally his goal, the pilot can make some decisions based on the final glide display screen which will assist him to reach goal safely in the shortest possible time. It will be useful in this regard to have in mind some details of the McCready Theory. The McCready Theory reveals that one is flying in time optimized mode if you fly so fast, after having left the thermal, as if you were in a sinking air mass at the same speed as the climb in the thermal typical for the day. This speed needs to be calculated based on the polar curves with the result of the figure "Speed to Fly". Considering that IQ Motor+ does not calculate with the polar curves, it is necessary to estimate this "optimal" speed.

1.) Let's assume that the pilot is circling under a cloud in quite a good thermal which provides him an average climb of 2 m/s. While circling he will naturally try to fly with the speed for minimum sink. If, while circling, the nose of the aircraft turns again and again in the direction of the goal, the wind component, and, derived from this the wind factor, may be determined at this moment and consequently the glide ratio over ground (Gnd) be calculated.
From the distance to goal and the glide ratio (gnd) the Compeo+ calculates the loss in height which the pilot requires on his glide path to the goal. If the altitude of the goal is added (for each WP also its altitude is saved), then we obtain directly the minimal departure altitude. As the own altitude is known, then the instrument can display directly by comparison at which altitude the path of best glide has been reached, and also if we still have to thermal up in order to arrive safely.

It is of course subject to the pilot's experience whether he wants to take-off immediately upon positive *Diff.B Wayp,* or whether he will prefer to climb up further and take some reserve altitude.
The COMPEO+ naturally does not know whether in the course of the glide path lifting or sinking air mass zones are present, or if the wind intends to change. The instrument calculates with the current wind and assumes that no lifting or sinking zones are to be expected.

On the one hand one shall ascent for safety reasons somewhat above the path of best glide. On the other hand one shall ascent even higher on a day with good thermal and then slowly give up this reserve altitude by flying at higher speed and for this reason arriving earlier at goal.

2.) Gliding down to Goal

The pilot has left the thermal with sufficient safety altitude above the path of best glide and is heading towards his goal. He should speed up until the readout display *"Diff.BGWayp"* will slowly begin sinking. This indicator shows that by flying faster one will slowly give up the reserve altitude. However, one should be prepared to encounter sinking air mass or head wind. This situation is indicated by the readout of *"Diff.BGWayp"* which is quickly reduced, and also by the para glider symbol of the final approach screen which is moving faster towards the point of intersection. In this case it is recommended to fly more slowly.

For all previously made considerations we assumed that the wind component is automatically calculated from the difference: Gndspeed – Airspeed. However, there are good reasons which justify to overwrite this automatically logged Spd-Diff with a manually entered value.

1. While circling up in thermals the wind prevailing outside of the thermal shall always be stronger than the measured one. The strength is dependent on the value of climb and also on the fact if the pilot is at the top or at the bottom of the thermal.
2. As for the final approach, also slight wind fluctuations, for ex. induced by yaw, will take effect on the pre-calculated arrival altitude. A wind component logged as fixed value shall then calm the result.
3. When the pilot being in down glide from high altitude knows by experience, in which way the wind shall change in the lower layers, he can consider this fact already in advance.
4. When para glider pilots are flying without Speed sensor, the manually logged wind component can provide a significant improvement of final glide calculation.

11.4.2 Safety altitude (Alt a. BG)

The display „*Alt a. BG*" indicates the pilot's current altitude above (or below) the best glide path leading to goal. The safety altitude (Alt. over Alt a.BG) is also that altitude which one could safely lose when flying through a sinking air mass and still make it to goal.

„*Alt a. BG*" can also be shown continuously in the user selectable fields. It is only then identical to „Alt a. WP" if the pilot is flying with the speed of best glide. The fields „*Alt a. BG*" and „*Alt a. WP*" will switch to inverse display during thermal circling at the moment when the pilot could leave the thermal *(Alt a.BG)* in order to just arrive; or when the pilot should definitely leave the thermal *(Alt a. WP)* in order to reach the selected WP as fast as possible. (please see picture on page 17).

11.4.3 Final glide calculation over several Waypoints

As of the IQ Motor+ a new user selectable field „Alt a. Goal" has been added. This is a pre-calculation, based on <u>best glide ratio</u>, of required altitude above (or below) the last WP of a Route, irrespective of how many WP's are still in front of the pilot. The related actual wind vector is taken into account for all sectors, as well as the various glide ratio values resulting from it.
Naturally this result requires that the detected wind does not change on the way to goal.
The wind vector is updated again by each flown full circle.

11.5 Flight Memory and IGC File

11.5.1 Content of IGC File

In the IGC File are saved all important data of a flight in readable format. One can edit the
IGC File by using any desired Editor.

Though editing or altering is possible, the signature at the end of IGC File shall be invalidated.
This signature is calculated over all data and therefore covers the flight, as well as the pilot's
personal data and the date. The signature is generated by the instrument itself.
Any misapplication is therefore practically excluded.

Sometimes it is helpful if one can import to Excel the raw data being stored in the IGC File
in order to practice own calculations.

Proceed as follows: in Excel Program click on open file
In file types select **all files**
Follow the 3 Import steps
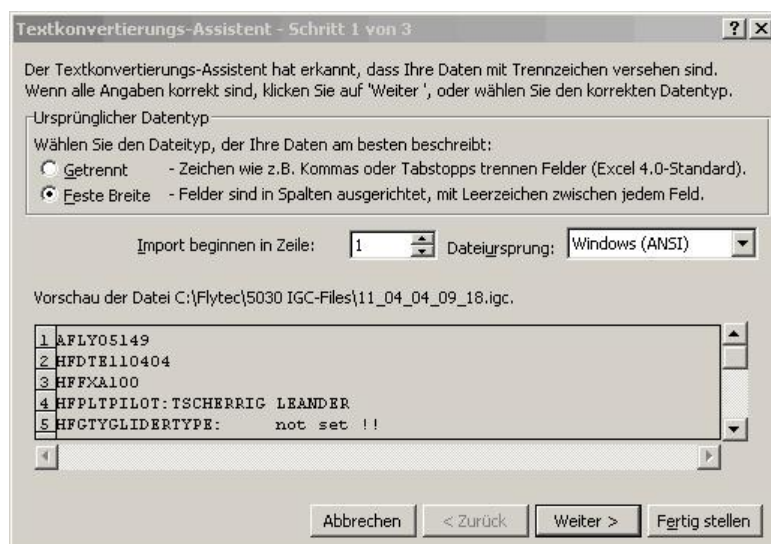
Set the arrows for column separation as follows:

Select standardformat for columns

The present head in lines 1 – 13 contains internal flight data.
These are no longer needed any more and can be erased.

	A	B	C	D	E	F	G	H	I	J
1	A	FLY051	49							
2	H	FDTE11	404							
3	H	FFXA10	0							
4	H	FPLTPI	LOT:TSC	H	ERRIG LE	A	N	DER		
5	H	FGTYGL	IDERTYP	E	: no	t		set !	!	
6	H	FGIDGL	IDERID:		5 876 not	s	e	t !!		
7	H	FDTM10	0GPSDAT	U	M:WGS84					
8	H	FGPSGP	S:FURUN	O	GH-80					
9	H	FRFWFI	RMWAREV	E	RSION:2.	1	5			
10	H	FRHWHA	RDWAREV	E	RSION:1.	0	0			
11	H	FFTYFR	TYPE:FL	Y	TEC,5030					
12	H	PTZNUT	COFFSET	:	02:00					
13	I		13638	TAS						
14	B	91525	4619616	N	740199	E	A	1346	1401	34
15	B	91533	4619616	N	740200	E	A	1346	1401	34
16	B	91541	4619616	N	740201	E	A	1346	1401	34
17	B	91549	4619616	N	740201	E	A	1346	1401	34

For better understanding content and unit of column are captioned.

	A	B	C	D	E	F	G	H	I	J
1										
2		Time UTC	Latitude X	Breitengrad	Longitude Y	Längengrad	Fix Valitity	Altitude	Altitude	Speed
3		HHMMSS	DDMMmmm	N/S	DDMMmmm	E/W	A oder V	Druck	GPS	SSS
4		09.15.25	46°19.616	N	7°40.199	E	A=3D V=2D	(bei 1013hPa)	(vom GPS)	km/h
5										
6	B	91525	4619616	N	740199	E	A	1346	1401	34
7	B	91533	4619616	N	740200	E	A	1346	1401	34
8	B	91541	4619616	N	740201	E	A	1346	1401	34
9	B	91549	4619616	N	740201	E	A	1346	1401	34
10	B	91557	4619616	N	740202	E	A	1346	1401	34
11	B	91605	4619616	N	740203	E	A	1346	1401	34

The columns now need to be set into the configuration required by the Software
Caution: the Co-ordinates are in XX°XX.XXX' format. Therefore the number 4619616
should be read as 46 degrees 19.616 minutes, which corresponds to 46°19'39.96".

More detailed information in regard to IGC Format is available on the FAI Website under:
http://www.fai.org/gliding/gnss/tech_spec_gnss.asp

11.5.2 New Regelations for Record flights or decentralized Competitions (OLC)

Since the proof of a completed flight depends entirely on the GPS recording, it is important to ensure before take-off that the GPS-receiver indeed receives satellite signals. Therefore please switch-on the COMPEO+ at least a few minutes before take-off so that even pre-flight events are included in the recording.

The Barogram is also included in the IGC-File which is generated for each flight. Photographic proof and confirmation by flight observers are no longer required for national performance flights. The file can be sent directly to the judging committee of the OLC via the Internet. (At present, the OLC is evaluated in Germany by the DHV).

11.5.3 Evidence of flights - Security against manipulation

The FAI (Fédération Aéronautique Internationale) and its subgroup IGC (International Gliding Committee) require a recording format which, while memorizing continuously the time of day, position and also the flight altitude, substitutes the barograph. When transmitting flight data to the pilot's PC, a so-called IGC-File is created, which receives a digital signature (=G-Record), authenticating the flight data and making it fraud-resistant. If only one character of the file containing the flight data would be changed, the signature would no longer be compliant to the data and the judging committee would be aware of the manipulation.

11.5.4 Digital Signature and OLC-Registration

The popularity of decentralized competitions has been growing enormously over recent years. Meanwhile 26 countries have accepted the OLC (Online Contest) convention. These agreements declare that any pilot can submit flights at will over the Internet for approval and evaluation. The submission has to be compliant to IGC-format (WGS84) and must have a digital signature. In order to facilitate further on the utilisation of usual GPS-Receivers, relevant PC-evaluation programs such as Compegps, Gpsvar, Maxpunkte or Seeyou calculate a digital signature to allow submission of flights in the required form. However, a "signature" created by PC provides only half the safety against falsification. In the long term this signature shall be mandatory to be provided by the GPS-Recorder instruments, as for ex. the IQ Motor+.

After completion of a flight, effected automatically or manually, this „Digital Signature" is calculated autonomously and attached to the flight data file as so-called G-record. A correlative remark „Generating Digital Signature" is displayed in the info field of the instrument. As this calculation is extremely complicated, it may take several minutes following a long flight with setting of a short scan rate. Please wait until this message will disappear.

If it happens that the OLC does not accept the digital signature upon the transfer of flight data, the signature can be recalculated on the flight analysis display, by pressing the key -
F2 Recalc Signature "Rec Sig.".

11.5.5 Graphic: Task Exit Start Cylinder

TASK: EXIT STARTZYLINDER

Startzeit: 14:00; 14:20; 14:40
Flugzeit endet beim Einfliegen in den Ankunftszylinder
Landung im Zielzylinder ist vorgeschrieben

WP2
r = 400m

Wegpunkt 2

WP1
r = 400m

Wegpunkt 1

Wenn Pilot 1,2 oder 3 die Weg-
punkte WP1 und WP2 ber   ühren,
ertönt das akustische Signal und
das IQ Motor+ schaltet automatisch
zum n ächsten Wegpunkt weiter.
Mindestens 2 Punkte innerhalb
des Zylinders werden aufge-
zeichnet.

Ziel r = 200m
Ankunft r = 2 km

Pilot 1 kreist ausserhalb des Startzylin-
ders in einer Thermik. Desshalb muss
er zu einer der Startzeiten in den Start-
zylinder zur ückfliegen um den Task zu
starten. Sobald er in den Startzylinder
eintritt und die aktuelle Zeit gr össer ist
als die Startzeit (z.B. 14:01 Uhr), ert   önt
das akustische Signal und das IQ Motor+
schaltet zum n ächsten Wegpunkt (WP1).

Pilot 1

Pilot 3 entscheidet
sich sp äter zu starten
und kehrt in den
Startzylinder zur ück.
Die Automatik ist nun
ausgeschaltet. Er
muss F1dr ücken und
das IQ Motor+kehrt zum
vorherigen WP zur ück.

Um 14:20
muss Pilot 3
manuell zum
nächsten WP
schalten, indem
er F1 dr ückt.

Pilot 2

STARTZYLINDER r = 5km

Pilot 3

Take off

Piloten 2 und 3 sind innerhalb des Start-
zylinders. Sie h ören das akustische Signal
zur Startzeit. Das IQ Motor+ schaltet auf WP 1

11.5.6 Graphic: Task Enter Start Cylinder

TASK: ENTER STARTZYLINDER

Starttime: 14:00; 14:20; 14:40
Flugzeit endet beim Einfliegen in den Ankunftszylinder.
Landung im Zielzylinder ist vorgeschrieben

WIND

In diesem Beispiel hat WP1 die gleichen
Koordinaten wie der Startzylinder

Pilot 3

Wegpunkt 1

WP1
r = 400m

Weil Pilot 3 innerhalb des
Startzylinders H öhe ge-
winnt, muss er gegen
14:00 aus den Startzylin-
der ausfliegen und nach
14:00 wieder einfliegen.
Beim durchfliegen des
Startzylinderkreises er-
tönt das akustische Signal
und das 5030 schaltet
zum nächsten WP.
In diesem Fall erreicht Pi-
lot 3 als erster WP1, da er
mit Rückenwind startet !

Pilot 2 entscheidet
sich, zu einem sp ä-
teren Zeitpunkt
(14:20) zu starten
und fliegt wieder
aus dem Startzylin-
der. Die Automatik
ist nun ausgeschal-
tet und er muss F1
drücken um zum
vorherigen WP
zurückzukehren.

WP2
r = 400m

Wegpunkt 2

STARTZYLINDER r = 10km

nach 14:20 kann
er erneut einfliegen.
Er muss nochmals
F1 drücken um den
nächsten WP zu
wählen

Pilot 1   Pilot 2

Pilot 1 und 2 kreisen
ausserhalb des Start-
zylinders in einer Ther-
mik. Sie warten bis 14:00
Uhr und fliegen dann in
den Startzylinder. Sobald
sie in den Startzylinder
einfliegen, ert önt das
akustische Signal und das
5030 schaltet zum n äch-
sten WP (WP1).

Take off

Ziel r = 200m_
Ankunft r = 2 km

12 Maintenance and care

This premium-quality multifunction instrument is fitted with sensitive sensors which
necessitate a gentle handling of the instrument. Excessive pressure, as may be caused
by vehemently slamming the trunk lid of an automobile, must absolutely be avoided.
In the same way storage of the instrument in humid environment is to be avoided.
The optimal cleanup should be performed by use of a slightly humidified, soft drapery.
Optimal storage is ensured with the textile bag as was supplied along with the instrument.
Self-evidently this bag needs to be clean and dry. In case of malfunction it is necessary
to retrieve the accumulators for min. 1 minute from the instrument. As a result of this short time span
the instrument shall perform a self-test after re-installation of the accumulators.
If the malfunction continues to exist, please return the instrument with a short but complete
statement about the problem to your dealer or directly to BRAUNIGER GMBH..

12.1.1 Exposure to water

If the instrument was immersed under water or was exposed to water ingress, the batteries
need to be removed immediately in order to prevent a destructive short-circuit.
In the case of salt water, rinse the instrument and all parts affected by the salt water with clean,
hand-hot soft water in order to avoid corrosion.

Thereafter dry the instrument carefully by blowing warm air of max. + 60°C (hair dryer).

Never place the instrument into a microwave-stove! Microwaves shall destroy the instrument immediately!

After complete drying please return imperatively the instrument to your dealer or directly to
BRAUNIGER GMBH for final check over.

Any claim under Warranty is null and void after a water landing.

13 Warranty

BRAUNIGER GMBH provides the warranty that this instrument does not carry any material
or manufacturing defect for the period of **two** years from the moment of its first purchase.
The warranty extends to manufacturing defects and failures for which the owner is not
responsible.

The warranty will become invalid in case of inappropriate handling, or exposure of the instrument
to strong heat or water and also when unauthorised manipulations to the inner parts of the
instrument have been effected.

If defects should occur within the two-years warranty period, please contact your dealer from
whom you have purchased the instrument, or contact directly the manufacturer, Bräuniger GmbH
Germany.

Bei Defekten während der zweijährigen Garantiezeit kontaktieren Sie bitte den Fachhändler, bei
dem Sie das Gerät gekauft haben oder wenden Sie sich direkt an die BRAUNIGER GMBH.

Please study this Operation Manual carefully and to its entire content. Please do it anyway at the
latest before asking questions or presenting complaints to the dealer or manufacturer.

Disclaimer of Warranty:
In rare cases it might not be excluded that the instrument does not provide any data at all
or incorrect data. In regard to the legal fact that it is solely the pilot who has the responsibility of
performance of his flights, the Company Bräuniger GmbH shall reject any claim on damage resulting
from data loss or wrong data of your instrument.

14   Technical Data

Altimeter:	max. 11000 m scale 1m
Variometer:	analog ± 8 m/s scale 0,2 m/s
	digital ± 100 m/s scale 0,1 m/s
Speed	
Wind vane	0 up to 120 km/h (Sensor Optional)
Waypoints:	200 WP
Routes:	20 Routes with max. 30 WP each
Max. recording time:	48 hrs. flight time at 10 s recording interval
	max. 291 hrs. at 60 s recording interval
Restricted Areas	20 CTR's free, 150 CTR's to be charged
Number of Tracklog-Points:	21 000
Number of recorded flights:	100
Dimensions:	178 x 95 x 40 mm
Weight:	425 Gram (without harness)
Power supply:	2 or 4 pieces NiMH Accu or Alkaline Batteries AA, 1.5V
Operation time:	> 20 Std per Bank, i.e >40h in total

Data memory and transfer according to the IGC format

Screen resolution	38400 Pixel / 240 x 160Pixel (= 1/8 VGA)
Operating temperature	-+15 ...+50 °C

FlyLink Radio module	
Frequency	ISM Band 2.4GHz
Range	max. approx. 10m
Speed measuring range	$1000min^{-1}$ up to $8000min^{-1}$
Temperature measuring range	- 20°C bis 800°C

Accessories harness items for hang gliders and para gliders are available.

Technical data may be altered without prior notification at anytime. Software upgrades can be made via Internet by downloading the latest firmware version from our homepage via user's PC.

15   Approval / Conformity

Europe

Maynufacturer:	Bräuniger GmbH/Brauniger GmbH
Country of origin:	Switzerland

Type: IQ Motor+ Marking: CE

The instrument was tested according to following Standards and is compliant to the required Standards.
- ETSI EN 301 489-1 V1.6.1/ETSI EN 301 489-3 V1.4.1
- IEC/EN 60950-1:2006: Safety Europe.

USA /Canada

FC according 47CFR15, ICES-003, Issue 4

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.