

Brauniger COMPEO



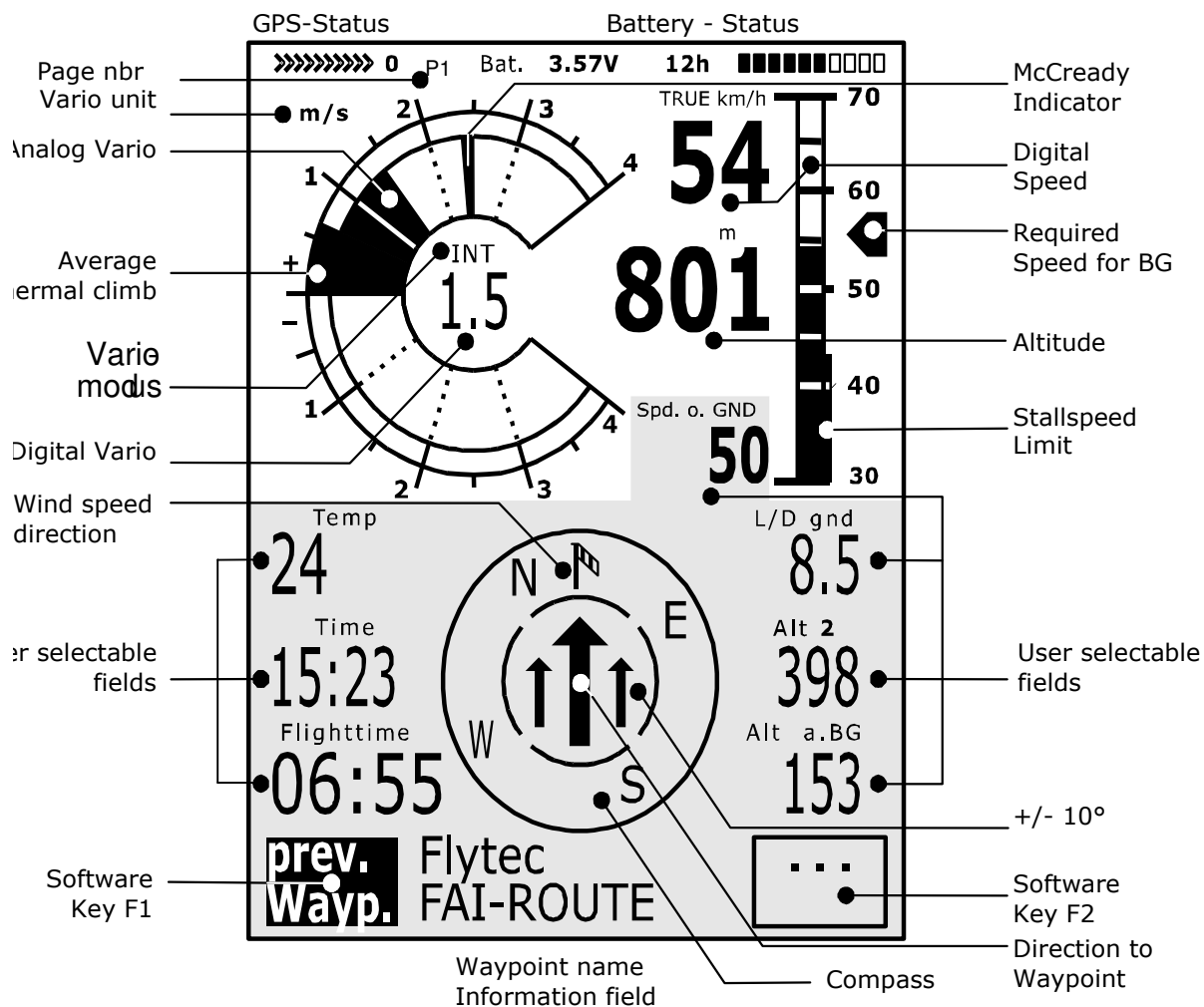
# BRAÜNIGER FLUGELECTRONIC



## **IQ-Compeo Version 2.24**

**BRÄUNIGER** Flugelectronics GmbH  
Dr.-Karl-Slevogt-Str.5 D-82362 Weilheim, Tel. +49 881 64750  
[info@brauniger.com](mailto:info@brauniger.com) [www.brauniger.com](http://www.brauniger.com)

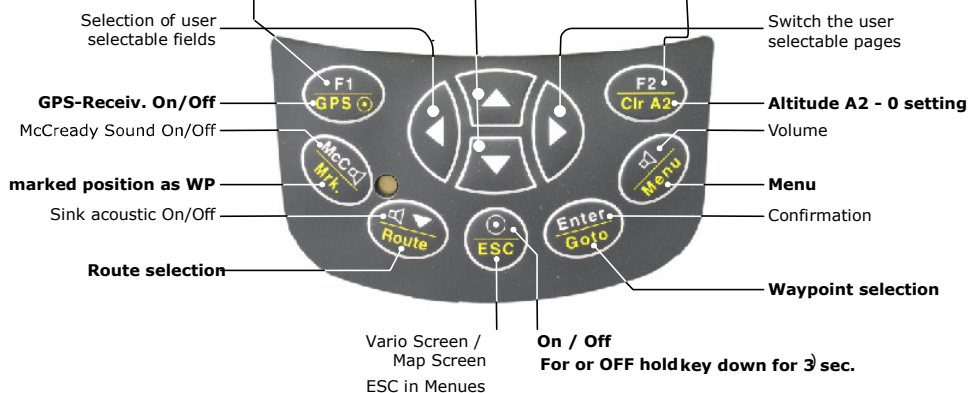
# Brauniger COMPEO



## Arrow key's in Standard Mode

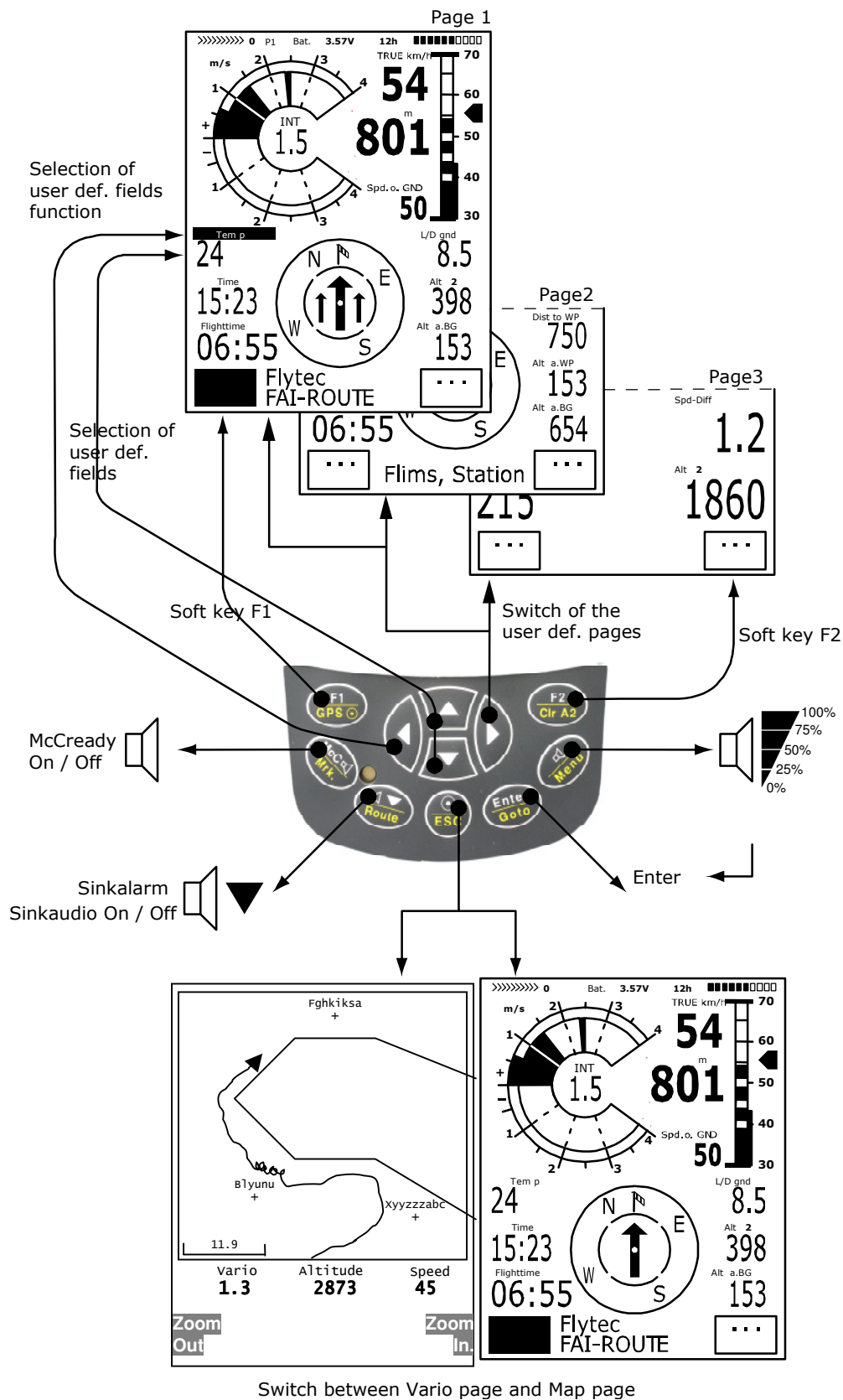
Display INFOFELD

Nxt	↓	---	QNH/Gps
Fnc	↓	Mod A1↑↓	SET0
	↓	Mod A2↑↓	SNK OFF/ON
	↓	S.Thr -0.8	Man Wnd
	↓	HT auto	



Function above the line: Press briefly    **Function below the line: Press for 2 seconds**

# 5030 Display and Audio functions



## Introduction

Although it is quite possible to turn on the Brauniger Compeo and go flying straight away, we recommend that you study these operating instructions and make yourself familiar with the various functions. ( the latest changes are marked in grey )

We have kept the operating instructions as brief as possible. For people who would like to freshen up on the basics, or those who want to learn the individual functions and their uses, we have included in-depth explanations in the appendix. These are referred to within the basic instructions.

As with all the other operating instructions for our flight instruments, this manual will be posted on our homepage under *Service/Download* on the internet. Only the latest version posted provides the most up-to-date information, any new innovations, or technical alterations. It is, therefore, highly recommended that you check back on our web site from time to time.

The software program of the Brauniger Compeo is stored in a 'flash' memory. Upgrading your unit's software to the most recent version can be done with the help of a PC and does not necessitate outside service. The cable required is included.

As with any electrical unit, you should protect your Brauniger Compeo from excessive heat, hard impacts, dirt or moisture. To ensure the best possible performance, try and keep the instrument as far away as possible from where the radio antenna is attached.

Please look first at the pictures of the Brauniger Compeo (see page 2), then study the descriptions so that after scanning the index briefly, you will have an overview of the unit's functions.

For the first time with flight instruments, we have included two 'software' keys on the Brauniger Compeo. These are the **F1 and F2** keys; their function depends on the display mode. For example, after switching on, **F1** means “**next function**” and **F2** “**adopt 1013 hPa or GPS Altitude**”. However, in the Set Mode for the waypoints, **F1** stands for “**Insert WP**” and **F2** “**Delete WP**”. In each case the meaning of the keys is shown on the display.

The Brauniger Compeo has a **simulation mode** feature which helps you get a better understanding of the numerous possibilities which the Brauniger Compeo offers as well as the theory of gliding flight. With this feature you can simulate just about any situation encountered during flight. The user can change many settings, from descent and ascent, to airspeed or groundspeed as well as the flight direction, or also the altitude and can observe the effects of these on other indicators, such as Best Speed to Fly, McCready ring , arrival altitude at destination, and distance from the destination etc. The acoustics are also simulated.

## Turning the Unit On and Off

The unit is switched on by pressing the **☉/ESC** key. You must confirm the switch on by pressing the “*Enter*” key.

To switch it off you need to press the same key for three seconds. The unit will then display the question 'Really switch off?' Confirm by pressing “*Enter*”. After a long flight with short record intervals the calculation of the digital signature can take up to one or two minutes. Please wait until this process is finished. Press **☉/ESC** key again to turn off the unit.

<b>Table of Contents</b>		<b>Page</b>
<b>1</b>	<b>Flight Functions .....</b>	<b>6</b>
1.1	Analogue Vario .....	6
1.2	Altimeter and Air Pressure .....	6
1.3	Digital Vario and Netto Vario .....	7
1.4	Speed .....	7
1.5	Speed without speed sensor .....	8
1.6	Stall Alarm .....	8
1.7	Acoustics and Volume Level .....	8
1.8	User selectable fields .....	10
1.8.1	Temperature .....	12
1.8.2	Time and Date .....	12
1.8.3	Flight time .....	13
1.8.4	Track and Bearing .....	13
1.8.5	Distance to Waypoint .....	14
1.8.6	Glide Ratio (=L/D Ratio) .....	14
1.8.7	Dist to Goal .....	15
1.8.8	Alt ab.Goal .....	15
1.8.9	Distance to cylinder of a waypoint in a competition route .....	15
1.8.10	Userfield L/D req to goal .....	15
1.8.11	XT Error, Crosstrack Error .....	16
1.9	Speed to Fly (For best Glide) .....	16
1.10	McCready Ring .....	16
1.11	Average Thermal Climb .....	17
1.12	Battery Management .....	17
<b>2</b>	<b>GPS Functions .....</b>	<b>18</b>
2.1	Assessment of Reception Quality .....	18
2.2	Compass and Flight Direction .....	19
2.3	Ground-Speed .....	19
2.4	Head, Cross and Tail Winds; the Wind Component .....	20
2.5	Wind Direction and Windspeed .....	20
2.6	Waypoints and Coordinates .....	20
2.6.1	Current Coordinate Indicator .....	21
2.6.2	Saving the Current Position .....	21
2.7	Goto-Function .....	21
2.8	Flying Routes .....	22
2.9	The Competition Route - For Record Flights, Performance Flyers and Competition Pilots .....	23
2.10	Relocating Thermals .....	29
2.11	Restricted areas CTRs .....	29
<b>3</b>	<b>Unit's Setting Menu (Set-up Mode) .....</b>	<b>30</b>
3.1	Basic Settings .....	30
3.2	Flight Memory and Flight Analysis .....	31
3.2.1	Graphic Display of Flights in Map Format .....	33
3.3	Waypoints - Alter, Delete, or Add .....	34
3.4	Routes Set - Delete - Alter .....	35
3.5	Competition - Route Set - Alter - Delete .....	36
3.6	Restricted areas CTRs Set - Alter - Delete .....	36
3.7	Simulation .....	38
3.8	Factory Settings, Unit Specific Parameters .....	39
3.9	Optional Software Packages .....	39
3.10	NMEA data output .....	39
<b>4</b>	<b>Data Transfer .....</b>	<b>40</b>
4.1	Data Exchange Via PC .....	40
4.2	Transferring New Software to the Brauniger Compeo GPS .....	41
<b>5</b>	<b>Appendix .....</b>	<b>42</b>
5.1	Stall alarm .....	42
5.2	Netto vario .....	42
5.3	True or Indicated Airspeed; TAS or IAS .....	43
5.4	Polar Curve and Required Speed .....	43
5.5	McCready Theory - Optimized Speed to Fly .....	45
5.6	Final Glide Calculation .....	47
5.6.1	Safety Altitude ( = Alt above BG ) .....	50
5.6.2	Final glide calculation with several Waypoints inbetween .....	50
5.6.3	Manual Windcomponent .....	50
5.7	TEC Total Energy Compensation .....	50
5.8	New Regulation for Record Flights or Decentralized Competitions .....	51
5.9	Proof of Flights - Security against Manipulation .....	51
5.10	Digital Signature and OLC Registration .....	51
<b>6</b>	<b>Miscellaneous .....</b>	<b>52</b>
6.1	Landing on Water .....	52
6.2	Guarantee and liability .....	52
6.3	Technical Data .....	52

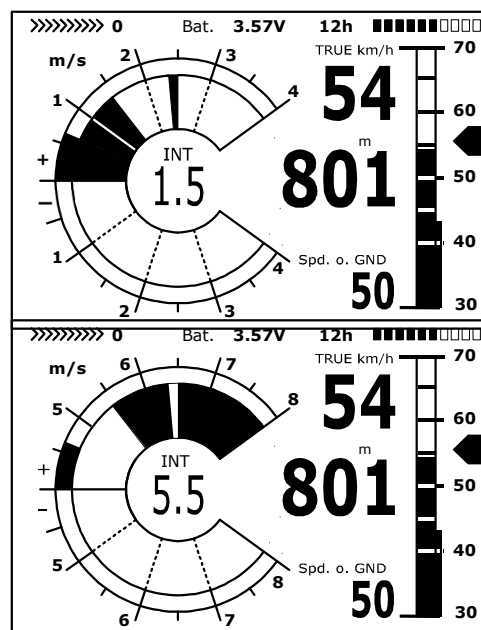
# 1 Flight Functions

## 1.1 Analogue Vario

The most important instrument for any kind of glider is, without a doubt, the vario. It displays the vertical speed in metres/sec. (ft/min) and informs the pilot whether he/she is climbing or sinking. It is only by using the vario (and its accompanying acoustics) that a pilot can discover the most efficient climb, and in the opposite situation, to recognize when they are sinking too rapidly in descending air which must be avoided.

The scale of the analogue display is 0.2 m/s (or 40 ft/min).

The first full-scale range is from 0 to +/-4m/s (800 ft/m), after which the display switches automatically to a range from 4 to 8 m/s (800 to 1600 ft/m). The time delay of the analogue vario is factory set at 1.2 seconds. This can be changed to any value between 0.6 sec and 4 sec, in the Set Mode/Basic-Settings/Vario-Speed response delay. If the time delay is too short, the vario is very twitchy; if too long, it's rather sluggish.



## 1.2 Altimeter and Air Pressure

The Brauniger Compeo has 4 altitude displays.

**Alt1** is always the absolute altitude altimeter above sea level (QNH).

**Alt2** in the user selectable fields is a relative reference height altimeter and can be changed with the arrow keys  $\blacktriangle$   $\blacktriangledown$ . The Next Func/F1 must be set to Mod A2, to perform this setting; Alt2 can be zeroed at any time by prolonged pressing on *F2/Clr A2*.

**Alt3** Shows the **total height gained** during a flight. With thermal flights this is dependent on the flight time. If several pilots complete exactly same flight task, then the one who climbed the least would have flown most efficiently.

Alt2 and Alt3 are among the user selectable fields

As well there is another altimeter called "Flight-Level" FL (ft) ; It cannot be adjusted by the user and is based on an air pressure of 1013 hPa at mean sea level.

Altimeter Alt1 should be adjusted to display the correct height above sea level. It is originally set by the manufacturer to a sea level pressure of 1013hPa. Since this is seldom the case, the correct altitude should be set before commencing each flight by using the arrow keys,  $\blacktriangle$  increases altitude,  $\blacktriangledown$  decreases altitude. The Info line is telling Mod Alt1  $\blacktriangle$   $\blacktriangledown$ . By means of this adjustment the air pressure display changes too. This air pressure (QNH) always refers to sea level.

During flight recording Alt1 adjusting is blocked.

The user can obtain the altitude of a location even if this is unknown by setting the sea level air pressure (QNH) (rec. from the radio) in the set up menu. Or he/she can press the *F2* key. If the unit receives satellites the GPS altitude is taken over to Alt1. If there is no Satellite reception the 1013 hPa altitude will be used. (Same as FL (ft))

A2, A3, FL (ft) and QNH can be displayed within the user selectable fields. (See A7)

If Alt2 is set to zero for any planned landing area, then the height above this location will always be indicated after starting. The associated air pressure (QFE) is the actual air pressure in hPa at this spot, which deviates from QNH, the pressure at sea level, according to the difference in altitude.

### 1.3 Digital Vario and Netto Vario

The digital vario has a scale of 10 cm/s (20 ft/m) and a very wide measuring range of +/- 70 m/s. It is therefore also ideal for displaying extreme vertical speeds, such as parachute jumping.

The digital vario can be set to function as an averager (also called integrated vario), with an average time delay between 1 and 30 seconds. This is very useful in determining the actual strength of a rough thermal. The digital vario can also serve as a net or air-mass vario, which shows the vertical motion of the surrounding air. (Please read section 5.2 Net Vario.) Additionally, it is possible to set the digital vario to serve as an **averager** during climbing and as an **air mass vario** during gliding. (Set-Mode/Basic Settings/Digital Vario Mode)

### 1.4 Speed

Airspeed is one of the most significant pieces of information besides vertical speed and altitude. Increased safety is not the only result of having an exact ASI;( Air Speed Indicator ) it also increases performance during distance flights. The Best Glide, the best McCready Speed, as well as the Net Vario can function with gliders only when the exact airspeed is known.

The Brauniger Compeo has two independent speed sensor connections.

1. **For paragliders** the wind wheel sensor is still present. Advantage: it shows the true air speed and begins to make correct measurements above 1km/h; it is also well-suited in determining the wind strength at take-off.  
Enter Basic Settings/*Speedmode* ,here it's possible to adjust a lower ( - 10 km/h ) speed range for paragliders ( 20 ... 60 km/h.)
2. **For hang glider** pilots there is a built-in, **pitot** pressure indicator which is capable of showing speeds of up to 150 km/h (94 mph); however, it only begins to work at 30 km/h. If necessary, the pitot tube can be lengthened by a flexible hose to a turbulence-free spot on the glider.  
All "rigid-wing" pilots will appreciate the new analogue speed scale with the precise distance between stall-speed and actual speed! ( see front picture )

Both speed sensors can be adjusted with a correction factor. The factory adjustment is always 100% in each case. (Setmode/Basics Settings/ Airspeed correct)

With 2.24 it is possible to set a constant offset onto the pitot tube speed. This Offset in will be added or subtracted (Depending on the sign) to the actual speed value. This offset is to compensate for the slower air stream under the airfoil. We recommend to keep the "Airspeed correct pitot" on 100% if you enter an offset value

The wind wheel sensor measures the true air speed. True air speed = TAS.  
The pitot pressure sensor, however, measures the indicated airspeed = IAS  
Should you be unfamiliar with the difference in these concepts, please refer to: 5.3 - True and Indicated Airspeed in the appendix.

Speed readings are in both analogue and digital displays. The user can choose whether he/she wants to view this as a True or Indicated airspeed in the Set-Up Menu. It does not matter which sensor is used as internally both speeds (TAS and IAS) are always present.  
For pilots, who are flying both, hang glider and paragliders the pitot-speed-sensor can be switched off in the Set-up menu Basic Settings/Airspeed correct, pitot. ( the pitot-sensor

## Brauniger COMPEO

cannot be used with a paraglider ).

The Brauniger Compeo is offered in two different versions:

For hanggliders with a built in pitot sensor

For paragliders without this sensor

If you plug into a Brauniger Compeo with pitot sensor the wind vane sensor , only the speed of the wind vane will be displayed.

### 1.5 Speed without speed sensor

Many paraglider pilots fly without any speed sensor. In this case, a user selectable field can display a **Calculated Air Speed**. This issue is calculated by a vector operation of ground speed and wind.

**Note:** The wind vector only is available after flying some full circles and it is updated with every following circle during the flight. **The duration for one circle should be longer than 12s.** The calculated air speed always is a true air speed.

### 1.6 Stall Alarm

The speed for activating the stall alarm can be adjusted in the Basic Settings, and likewise, the altitude can be set to the point from where up the alarm is active. If the stall alarm is set at the lowest adjustable value of 0 km/h (mph), it is turned off. The trigger point for the stall alarm is always linked to the **indicated airspeed**. At greater altitudes i.e. in thinner air, the alarm will be activated earlier (i.e. at a higher flying speed) than at sea level. The new analogue scale allows to test this effect very easy by adjusting the height Alt1 at some 1000 m higher.

(Please refer to: 5.1 Stall Alarm in the appendix).

### 1.7 Acoustics and Volume Level

Each time the key **Menu** is pressed briefly, the volume level is increased by 25%. The adjustable sound levels are: 0- 25% - 50% - 75% - 100% - 0. The value of the chosen volume level is displayed on the status line.

**Automatic volume control:** The basic setting levels 25%, 50%, and 75% will be slowly increased automatically once the airspeed exceeds 40 km/h (25 mph). It is impossible for the volume to exceed 100%.

The following settings can be made in the menu under 'Basic Settings /Vario tone'.

**Ascent Freq:** The ascent acoustics start at a climb rate of 0.1m/s at a 'frequency modulated interval' tone (peep, peep, peep,) whereby the pitch and frequency increase rhythmically the faster one climbs. The pulse/pause ratio is 1:1.

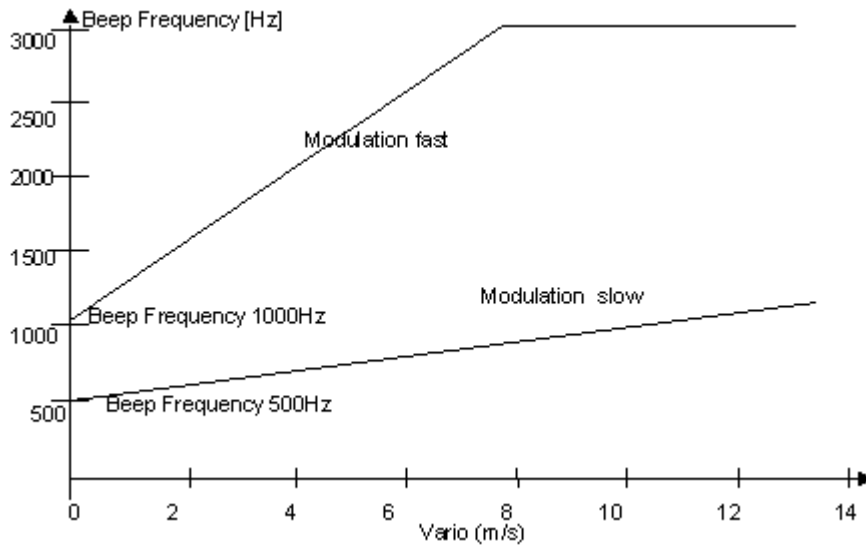
#### AscentF

Beep frequency

The basic frequency will be heard when the vario is at 0m/s, except when it is suppressed at the starting point.

**Modul**

Modulation (see graphic below)



**SinktoneF**

Sink tone/alarm  
Frequency base

The basic tone deepens when sink increases. you can choose the pitch of the sink tone (or sink alarm) under 'Sinkton Freq'. (factory setting = 700 Hz ) The sink tone is continuous and decreases in frequency as the sink speed increases and increases in frequency when approaching rising air. The descent tone can be turned off by pressing the button **Route** briefly. If you turn it back on, you would then hear the start frequency and the analogue vario display would show the starting point of the decent. Under 'Basic Settings/Sink tone threshold' you can choose the point at which the sink tone will start. It cannot be set to a higher frequency than the climb acoustic frequency. The basic tone acoustic may be set lower.

**damp**

Dampening

The vario value is re-calculated every 0.2s. Rapid vario changes may result in wide variations in tone frequency (pitch). The ear registers it as a fast piano effect. In order to change this, a damping may be added. Damping the rapid tone and frequency results in the vario being more settled.

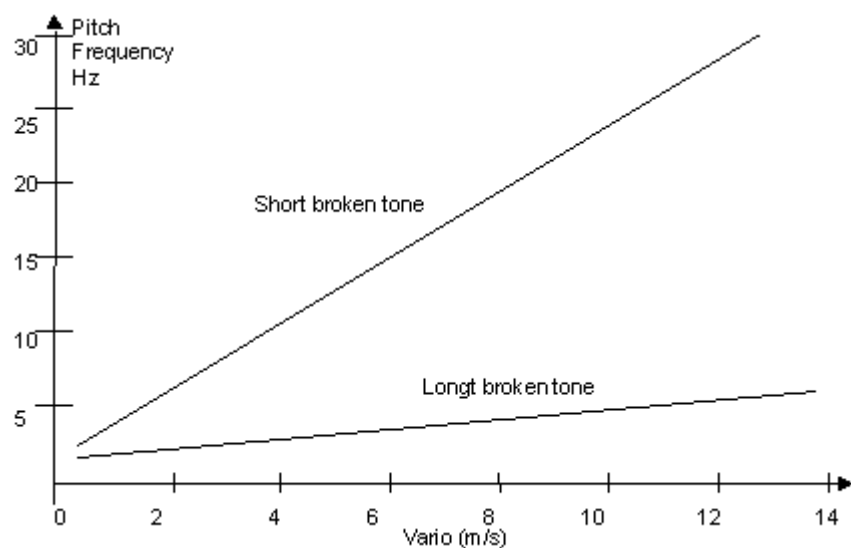
**Beepch**

Beepchouse

From Vers.2.21 on, it is possible to choose two different acoustic settings under „Beepchouse“ in the Basic Settings. 0 is the old setting, and 1 allows you to choose, that the acoustic increases or decreases during a beep.

## Pitch

Pitch, broken tone interval (see graphic below). The broken tone intervals increase in pitch with height



In the basic settings it is possible to set the following thresholds

### Sink tone thres.

Threshold                      The starting point can be chosen as in climb acoustic.

### Audio thresh.

Threshold                      To avoid the climb acoustic starting on the ground or during very slow climbs in flight, the starting point can be set from **0.02m/s to 0.2 m/s**.

The **warning sound for the stall alarm** is a pitch tone of medium height with a very fast interval rate and is always at full volume (100%). (Please, read 5.1 Stall Alarm)

**McCready tone:** When gliding with McCready sound activated, a tone is heard that corresponds to the McCready ring value. This tone cannot be confused with the normal ascent tone, as it has a pulse pause ratio of 1:4. (Please read 5.5 McCready Theory.)

**The warning tone for a negative McCready Ring** value is a deeper tone with a rapid interval sequence, which tells the pilot to fly faster immediately.

All of the sound effects described here can be heard in the simulation mode.

## 1.8 User selectable fields

In the lower part of the display beside the compass rose are **7** user selectable fields which can be used as the pilot desires. In total, there are about 22 measurement options available. In order to assign a field, press the ◀ arrow key. The description of the corresponding display is highlighted by a black bar. Repeatedly pressing the ◀ key switches to the next fields. The ▲ and ▼ arrow keys enable you to select the following measurement to be displayed:

## Brauniger COMPEO

If nothing is changed after selecting a field, the instrument goes back to the normal function after 10 seconds and the previously shown display remains the same.

	Display remains empty	
Dist to ^	Distance to last climb*	2.10
L/R r. goal	Glide ratio needed to reach goal over several waypoints in a competition route*	1.8.10
L/D req.	Glide ratio needed to reach the next waypoint	1.8.6
L/D air	Actual glide ratio (=True air speed divided by sink)	1.8.6
L/D gnd	Actual glide ratio ver ground (= groundspeed dived by sink)	1.8.6
QNH	Air pressure in hector-Pascal	1.2
Alt 3	Total height gained during the flight	1.2
Alt 2	Reference height (if desired can be set at 0)	1.2
Temp	Internal temperature	1.8.1
Track	Flight direction (course)*	1.8.4
Bearing	Direction to chosen destination*	1.8.4
XT Error	Crosstrack Error. Distance to the active leg of a route*	1.8.11
Dist. To WP	Distance to chosen destination (waypoint)*	2.7.4
Alt a WP	Arrival height above the chosen waypoint (acc. to McCready) *	2.7.4
Spd-Diff	Wind component (ground speed minus true airspeed)*	3.4
Gnd Speed	ground speed*(=GS)	3.3
Flight time	Flight time since take off	1.8.3
Time	Time	1.8.2
Wind speed	Wind speed	2.5
Dist T.Cyl	Distance to the circumference of the next waypoint in a competition route*	
Dist T.Takeoff	Distance to the takeoff position	2.4
Calc. Airspeed	The calculated airspeed if you fly without airspeed sensor	2.3
Dist t.Goal	Counted up sectors in front of pilot to the last WP of a route	1.8.7
Alt a.Goal	Calculated altitude above the last WP of a route	1.8.8
Dist t. CTR	Shortest Distance to a restricted area	2.11
FL (ft)	Flight Level not adjustable by the user	1.2
Alt above BG	Safety height above the best glide path*	5.6

\* Only active when the GPS receiver is switched on

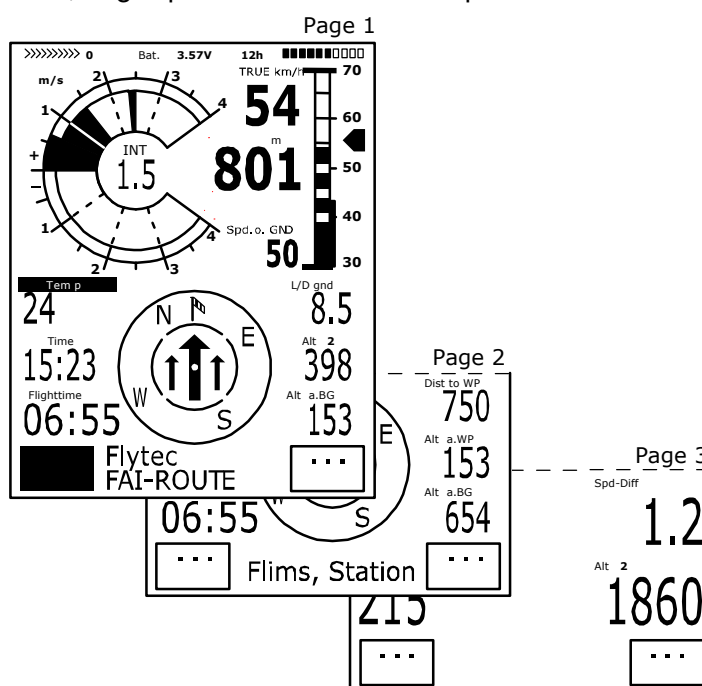
A second and third page of another 7 user defined fields can be accessed by briefly pressing of the ► key. (if nothing different is announced in the info field ) Choose Basic Settings / Userfields if you want to have 5 big fields (without the compass rose ) or 7 normal fields for each page. So, all in all 21 measurements can be displayed.

We would like giving some help to the user, how to preset the 3 pages with the selectable fields. Some of the measurements are so important, we recommend to display these in each of the 3 pages always at the same places; e.g. Speed-Diff and Groundspd

**Page 1** could be invoked if the pilot flies without a specific goal (= without the Goto function). Beside the above mentioned results here can show up the fields for : Dist.to ^ ; L/D gnd ; Flight time ; Alt 2 ; or Temp.

**Page 2** (example to the right) is called up if the pilot has chosen a waypoint to go for. Instead of some suggested fields from above here should be displayed: Dist t.WP ; Alt a.BG ; Alt a.WP

**Page 3** can be used for a final glide to the landing area. Even if the representation of the user fields is in 5 larger fields, the most important functions are displayed: Spd-Diff ; Gndspeed ; Dist.to WP ; Alt a.BG ; Alt a.WP and the big direction Arrow in the centre pointing towards the goal can be used.



### 1.8.1 Temperature

The unit needs a temperature sensor, not only for compensation of the pressure sensors but also for automatically regulating the contrast of the display. The temperature reading can be in either Celsius or Fahrenheit. (Set-Up Menu/Basic Settings/Units)

**Note:** The sensor measures the circuit board temperature. The inside temperature of the casing can be slightly higher than the ambient air temperature, especially when in direct sunlight.

### 1.8.2 Time and Date

Note: Time does not need to be adjusted as it is automatically set by the GPS receiver. However, to set the unit to local time, any time zone difference from UTC (World time) will need to be entered, which corresponds to a positive value if the time zone is east of Greenwich or a negative if west. It is also possible to enter half hour time zones by adding a 0.5h shift to the set time zone

**Note:** After entering day, month, and year, it is essential to ensure that the data is correctly received by the internal RTC (Real Time Clock) which can be executed only when the GPS receiver is active and receives satellites. Otherwise the date will not be accepted. Please note, that internally all times and dates are calculated with UTC

### 1.8.3 Flight time

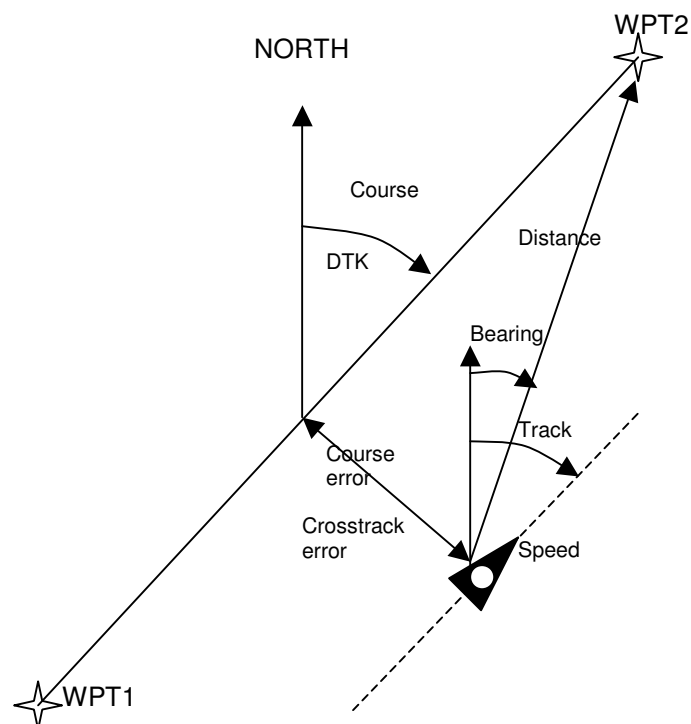
The take off time is automatically recorded. Recording of data and the clock for the flight time start as soon as the speed over the ground or through the air reaches a reasonable flight speed and altitude difference. The condition for starting the record is a ground speed of more than 10km/h for at least 60seconds or an altitude difference of 30m within 60 seconds. The GPS receiver must be active and must have satellite reception. If the GPS receiver is switched off, only the 30m altitude difference are necessary. Only flights with a duration of more than 3 minutes will be recorded in the log book.

The flight time can be displayed in the user selectable fields. The unit will also recognize the end of the flight. The end of a flight is reached if the speed is lower than 10km/H and the vario is lower than 0.1m/s for 60s. In basic settings you can choose between manual and automatic start and ending of flight recordings. (Also see 3.2 - Flight Memory.)

### 1.8.4 Track and Bearing

As is the convention with GPS receivers, the **Track** is defined as the route of the aircraft over ground. Geographic true North is always 0 or 360 degrees (East 90, South 180, West 270 degrees). The bearing is the direction to a specific destination or waypoint from the aircraft, expressed in the same way as above.

**Note:** A Tracklog is the result of recording many different position points during a flight.



### 1.8.5 Distance to Waypoint

The horizontal distance is displayed for the viewer to the chosen waypoint as long as the destination has been input automatically or manually with the Goto function. For distances under 10km the resolution is 10m, if farther it is 0.1km. (Please read – 2.7 Goto-Function)

The distance to a WP is always measured to the centre of a WP cylinder and not its circumference.

### 1.8.6 Glide Ratio (=L/D Ratio)

By definition, the glide ratio is calculated by taking the horizontal distance travelled and dividing it by the height lost

#### Attainable glide ratios in calm air for the following glider types:

Normal Paraglider	High Performance Paraglider	Normal Hang Glider	High Performance Hang Glider	Rigid Wing Hang Glider
5-7	7+	8-10	11-14	15+

Following different types of Glide ratio can be selected within the user-selectable fields.

Glide ratio through the air:

$L/D_{air} = TAS / Sink$  True airspeed divided by sink

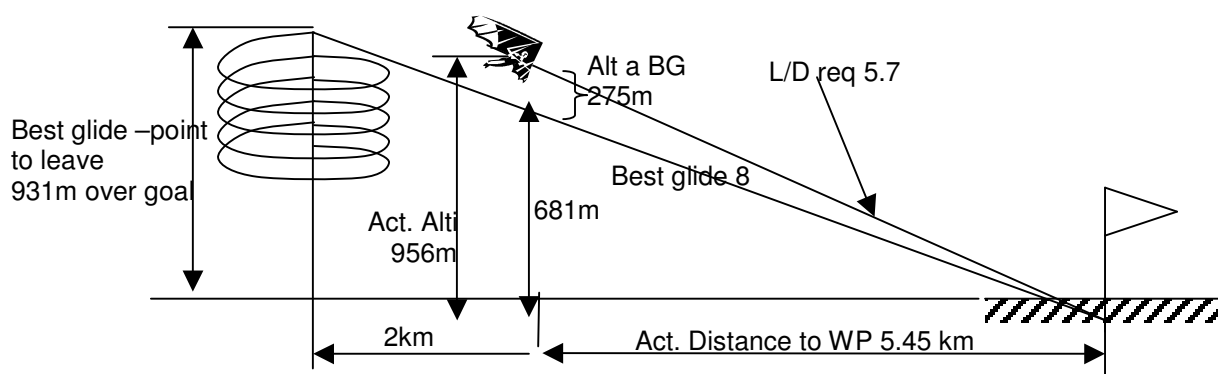
Glide ratio over the ground:

$L/D_{gnd} = GS / Sink$  Ground speed divided by sink

Required glide ratio in order to reach the chosen destination from the present position.

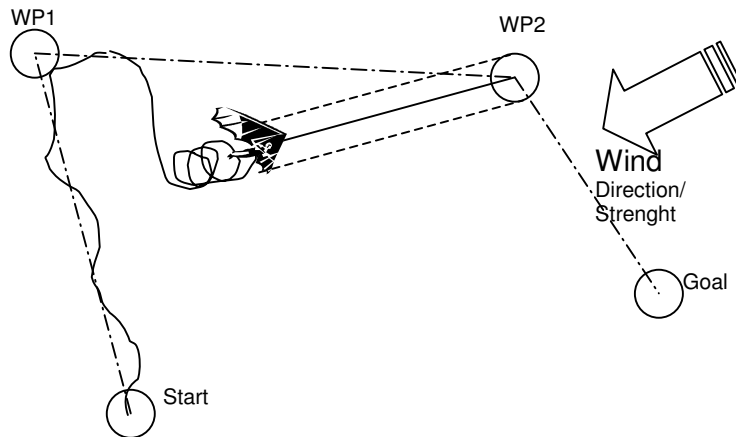
$L/D_{req} = \text{Distance to the waypoint} / \text{height difference to the waypoint}$ .

Example to L/D values



### 1.8.7 Dist to Goal

A new user field showing the counted up sections of a route in front of the pilot. He knows anytime, how many km he still has to fly until goal.



### 1.8.8 Alt ab.Goal

This Userfield shows the calculated altitude above goal (= the last WP of a route) with taking in account all the remaining sectors of a route in front of the pilot. For all sectors the belonging wind component is taken into account. Particularly useful is this function when a competition pilot gets the information when to leave a good thermal even he has to pass by further waypoints. This calculation is based on the speed of best glide.

### 1.8.9 Distance to cylinder of a waypoint in a competition route

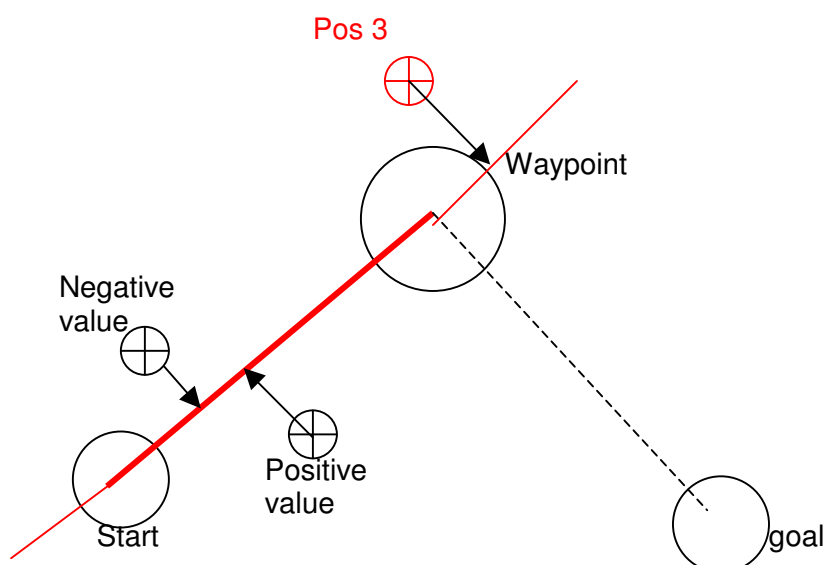
This user defined field shows the distance from the actual position to the radius of the actual waypoint in a route or chosen. This is true from the inside in case of a start cylinder with EXIT or from the outside in case of a Waypoint in a route. This helps to decide how far the next turnpoint is.

### 1.8.10 Userfield L/D req to goal

This Userfield shows the necessary lift/drag ratio above ground to the goal over several Waypoint. This Userfield is indicated only if a route is active. Thus it can be decided whether one can fly directly over several waypoints to the goal, or whether one must gain height before heading to goal. The calculation does not take into account, if there is a waypoint higher than the direct line of the current height into the goal. The distance is calculated as in 1.8.7 Dist t. goal

### 1.8.11 XT Error, Crosstrack Error

This userfield shows the shortest distance (Perpendicular on a map) to the active leg of a route



The accuracy of the indicated value depends on the length of the active leg. Largest inaccuracy arises in the centre between start and a goal, if one is very close at the track (the angles become very flat). With 50 km distance between start and a goal the inaccuracy can reach up to. Positive values are indicated, if one is on the right of the track, negative values on the left of the track. Even if one flew over the next waypoint the distance from the straight line is indicated (see position 3)

## 1.9 Speed to Fly (For best Glide)

Please look at the Analogue Speed scale. On the right hand side of it there is a thick arrow which informs the pilot of the speed for best glide. This will show the optimal glide speed, which is dependent on the polar of the glider, the wind strength and direction and the rising/sinking of the surrounding air. In competition, a pilot will always fly faster than this speed indicator is recommending except when every meter of height is essential. (Please see also 5.4 – Polar curves and required speeds.)

It does not matter whether the pilot has chosen to set true or indicated airspeed, as Brauniger Compeo compensates for this. However, the true value of the best glide speed will increase with increased altitude. (See also 5.3 - True or Indicated Airspeed.)

## 1.10 McCready Ring

The single pointer at the climb range of the analogue vario, shows the value of the McCready ring. (See title photo)

The position of this arrow is dependent on the polar of the glider, the wind, the rising or sinking air and, above all, the flight speed. If a pilot wants to complete a competition task in the shortest time possible, then he/she needs to strive continuously to keep the McCready pointer as close as possible to the average climb rates achieved in thermals. Due to the fact that the indicator is dependent on many conditions, we call it an active McCready pointer. (Please refer to: 5.5 McCready Theory.)

By pressing the key *McCr*  $\blacktriangleleft$  / *Mark* it is possible to turn the McCready sound on or off. The pitch of the tone is linked to the pointer. That means that the zero point of the McCready acoustic is set to this value where the McCready pointer actually points to. Adjust your speed

## Brauniger COMPEO

so that the McCready arrow points to the day specific climb rate and then briefly press the *McCr*  $\blacktriangleleft$ /*Mark* key. The McCready acoustic zero point is now set to this desired McCready position and you can fly purely with the acoustic, optimal for distance travel, and removing the need to glance at the instrument continuously. If the McCready acoustic is switched on, the daytypical climb shows in black, the toneless gap is shaded. If the tone lowers, then you need to speed up and vice versa; you should keep the pointer and the tone at the same position.

In order to offer the pilot additional help it is possible to set an acoustic dead band around the chosen McCready ring value (this is that position of the McCrdy pointer when the user is activating the McCrdy sound by pressing the key *McCr*  $\blacktriangleleft$ /*Mark* ) This means, the pilot flies correct according the McCrdy theory when the instrument is quiet. In the Setup menu Basic Settings/McCready one can adjust the wideness of this dead band. (Factory setting = + - 30 cm/s) With the same key, you can set a delay in seconds for the restarting of the McCready sound after leaving a thermal. (Factory setting = 7 seconds)

### 1.11 Average Thermal Climb

There are good and not so good thermal days. The average climb even varies throughout the day. Climbing is generally better at midday than in the morning or the evening. The Brauniger Compeo has, for this reason, a grey area in the double edge of the analogue vario display which indicates the average thermal climb and is necessary for the McCready theory. We can call this pointer **average thermal climb display** for a selectable time. ( See title photo ) It is solely influenced by the climb and shows the average thermal strength for the last 1 ... 10 minutes of climbing. (adjustable at Basic Settings/Average thermal climb ) The pilot flies optimally, when the active McCready pointer, covers the end of the average thermal climb area. (See also 5.5 – McCready Theory)

### 1.12 Battery Management

The Brauniger Compeo has a high performance NiMh (nickel metal hydride) accumulator. This rechargeable battery can be charged with a plug-in charger (230/110 V AC), by using a vehicle battery (10 –18 V) or by means of a solar panel. The accumulator is built into the casing and requires no maintenance. A charging cycle (for empty batteries) is approximately 4 to 6 hrs. An intelligent charging unit in the Brauniger Compeo recognises when the battery is full and stops charging. It is therefore impossible to overcharge the battery if you forget to unplug the charger. Nevertheless we recommend that you unplug the charger for safety reasons when charging is complete.

A fully charged battery should last for 22 hours with both vario and GPS receiver switched on. The battery life will be more than doubled if only the vario is used. Please bear in mind that the battery's capacity decreases at very low temperatures. When the battery capacity has dropped to about 10 %, an alarm tone sounds and the message "Low bat GPS off" will appear on the display. The GPS receiver, which consumes over half of the energy, will be shut off, and the remaining energy will be sufficient for using the vario for another 2 to 4 hours. However, if a pilot definitely wants to keep recording the GPS position, he/she can turn the GPS receiver on again (within 30 seconds); flight recording will then continue uninterrupted.

If a critically low voltage threshold is exceeded, the unit switches itself off. Although the battery life indicator is temperature compensated, we recommend that you start with at least 50% of the battery capacity for longer flights. A bar graph scale shows the battery charge level. In addition, its voltage is also measured and the remaining battery life is calculated in hours. The indicated battery life will appear too high direct after charging.

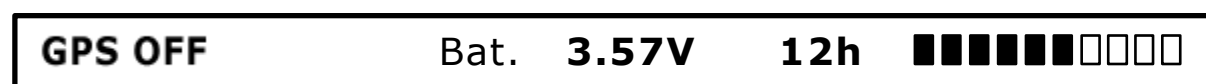
## Brauniger COMPEO

The Brauniger Compeo comes complete with an adapter, a cable with a cigarette lighter plug for your personal vehicle and a computer data cable.

The battery's nominal voltage is 3.6 Volts. During charging the voltage rises to 4.4 volts; in place of the bar scale the word "charging" appears. During normal operation the voltage is between 3.5 and 4.1 Volts.

The yellow light diode will blink several times after plugging the unit in (to test the battery's condition) and stays lit until the recharging is complete. If you leave the unit plugged in to the charger for a few hours after the diode's light has gone out, it will switch to trickle mode allowing the stored energy in the battery to increase by a few percent.

**Note:** The outside temperature should be between 10 and 30 degrees Celsius when recharging the battery. You can check the battery voltage during charging, but normally the unit should be turned off during this process.



After the battery has been permanently built into the unit, the user should not try in any way to replace it himself. In the event that a replacement should be necessary, the unit should be sent to BRAUNIGER AG for testing. We will also take care that the battery is properly disposed of if necessary.

## 2 GPS Functions

The use of GPS receivers has become indispensable for navigation today. A chain of satellites circles the Earth. Their orbit takes approximately 30 minutes. Already more than 30 satellites have been sent into orbit by the USA. Fortunately, these may be used for navigation free of charge. Some of them do not function any more. Nonetheless, it is possible to determine your position very precisely anywhere in the world by receiving several satellites at the same time.

### 2.1 Assessment of Reception Quality

Brauniger Compeo GPS's GPS receiver can be turned on and off by prolonged pressing of the FI button. It can follow up to 16 satellites at the same time. 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 (for 2D positioning) are sufficient for further navigation. However, if you want to record altitude too (3D positioning), then four satellites are required. There is a table in the receiver, **The Satellite Almanac**, in which the path, place, and time 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; it can take 10 minutes to determine the new position. Power is still supplied to the almanac's memory even when the unit is turned off.

When the receiver has been moved a great distance, you can help facilitate the connection with the Almanac by putting in the approximate new position (whole number coordinates suffice) in the Set Up mode under 'Basic settings/GPS Init'. With the antenna unobstructed the unit will normally recognize its position after a few minutes.

If the receiver is turned off for only a short period of time (less than 2 hours), it takes less

## Brauniger COMPEO

than a minute to determine the location. Buildings, mountains or thick forest affect reception quality. Therefore, you should always look for the best possible visibility around you and the antenna under the Brauniger Compeo label should point upwards. When the units is fastened, it should not have more than 45° deviation from a horizontal position. Because the receiving strength of the satellite signal is only 1/1000 of mobile radios, these radio receivers and other disruptive factors (like notebooks) should be kept as far away as possible from the Brauniger Compeo.

Together with the navigation signal, information about the number of received satellites is shown on the right side of the bar scale. The value for the reception quality is determined by the length of the bar. The longer the bar, the more precise is the reception.



## 2.2 Compass and Flight Direction

In contrast to a normal magnetic compass which is oriented to magnetic north, 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 your movements.

If the user remains stationary at the same location, then the course and compass needles are inoperative. The exact course (that 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". When circling in a thermal the compass rose appears to turn; in reality the needle does not move; the unit along with the aircraft, moves around the rose.

## 2.3 Ground-Speed

The GPS receiver fixes its position once every second. Speed over ground is derived from the distance between these positions. Only from the difference between airspeed and groundspeed can one make conclusions about the wind's influence, and ultimately these are the most important pieces of information a pilot needs during flight. The ground speed should appear at all times in an user selected field.

With a paraglider Brauniger Compeo(without a pitot sensor), the GPS speed is shown automatically in the large analogue and digital scales if no vane sensor is plugged in. The same applies when in the Basic Settings /Air Speed correct pitot, the function of the pitot has been deactivated. (Use sensor? = No )

In this case it is possible to use a calculated airspeed in a user selectable field. This issue is calculated by a vector operation of ground speed and wind.

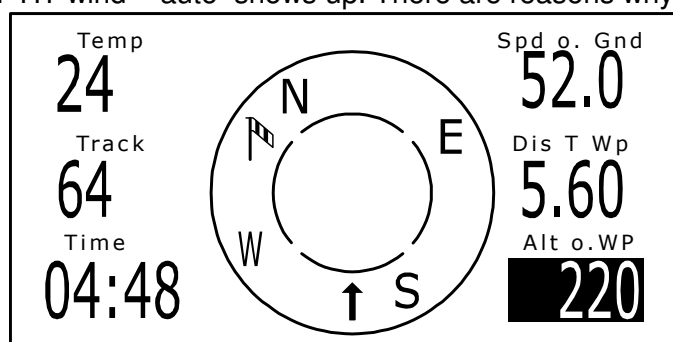
## 2.4 Head, Cross and Tail Winds; the Wind Component

During a goal flight or in calculating a final glide, it is the wind component (i.e. the difference between Ground speed and Air speed) that is important. In most cases the wind does not blow directly from the front or from behind, but from the side. If the 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 it is negative the glide ratio will worsen. The Brauniger Compeo takes the wind into consideration when calculating the best speed to fly and with final glide calculations. (In order to find the correct angle between the destination and the wind when a strong cross wind is present, please refer to the section 2.7 Goto function.)

Press several times at *F1* until the info: HT wind = auto shows up. There are reasons why this automatic calculated

windcomponent can be overwritten by a manual input of a head-wind (with negative sign) or a tailwind. Please refer to 5.6 Final glide calculation. But be careful with this manual wind input. The results will be wrong when changing your flight direction. Anyway the field SPD-Diff always displays the real and actual difference between

Ground and Air speed and could be used for a check or a required correction.



## 2.5 Wind Direction and Windspeed

It is very important to know the wind direction and speed before an out landing.

The wind speed can be selected within the user defined fields. It is necessary to fly one or two complete circles as steadily as possible. Whilst circling, the Brauniger Compeo determines the wind direction and speed. Wind direction is shown in the compass rose by a small windsock. During the landing approach this symbol must always be at the top.

## 2.6 Waypoints and Coordinates

A waypoint is any single point on the earth's surface that you would like to go to. The Brauniger Compeo can save up to 200 different Waypoints. Each Waypoint can have up to 17 characters, e.g. "**Laber Airfield**". In determining the waypoint, it is also necessary to enter the altitude, i.e. "**1865**" meters above sea level. We still need the waypoint coordinates. (Please also refer to 3.3 Waypoints – Alter, Delete or Add.)

For this the Brauniger Compeo utilises the most international and commonly used geographical maps with the name **WGS84** (World Geodetic System 1984). This reference system assumes that latitude is measured from the equator (0 degrees) to the North Pole, 90 degrees North, and to the South Pole, 90 degrees South. Longitude is measured from the Greenwich meridian (London 0 degrees). East is positive (up to 180 degrees). West is negative (-180 degrees)

In Basic settings/Coordinate format one chooses the following Input or Display formats

1. Degrees Minutes Decimal places of minutes dd°mm.mmm
2. Degrees Minutes Seconds dd°mm'ss"
3. Degrees Decimal places of degrees dd.ddddd
4. UTM ( a grid with a 1km raster in both E-W and N-S direction )
5. Suisse grid

Basically one should always try to use Nr 1) (=factory setting) because only this format is using exactly the same calculation format as the GPS receivers do and guaranty the highest accuracy. With the other formats rounding errors could sum up to 15 m in worst case.

## Brauniger COMPEO

The Brauniger Compeo also understands Waypoints entered according to the standardised convention of using 3 letters and 3 numbers. (Created by Brauniger) Example: *LAB167* indicates a waypoint with the name *LABxxx* and an altitude of **1670** metres amsl.

Beside the international Geodetic System WGS84 many countries are using their own map references wherein the coordinates of the same point differ slightly from each other. It is not more possible to choose different Geodetic Systems, because the FAI rules states, that the only valid system for calculating distances is the WGS84 used in conjunction with the GPS System..

### 2.6.1 2Current Coordinate Indicator

Provided the Brauniger Compeo receives GPS signals, the actual position is displayed by pressing the Enter key in the unit's information field. After 20 seconds the previous display will automatically reappear. This function is useful in relaying your location after landing to a person coming to retrieve you.

### 2.6.2 Saving the Current Position

Every now and then a pilot may want to save the immediate position as a waypoint. To do this press the key *McC* / *Mark* for 3 seconds. As confirmation you will hear a double peep and those current co-ordinates will be stored in the memory as a waypoint. The Brauniger Compeo uses the letter M (for marker) for the Waypoint designation and then the date and time.

Example: **M.22.04 11:16:49** for 22 April 11 hrs.16 minutes 49 seconds. (UTC). Of course this WP name can be changed later into a more meaningful name, i.e. "Aunt Renate". (For more information on this please refer to 3.3 Waypoints – Alter, Delete or Add)

## 2.7 Goto–Function

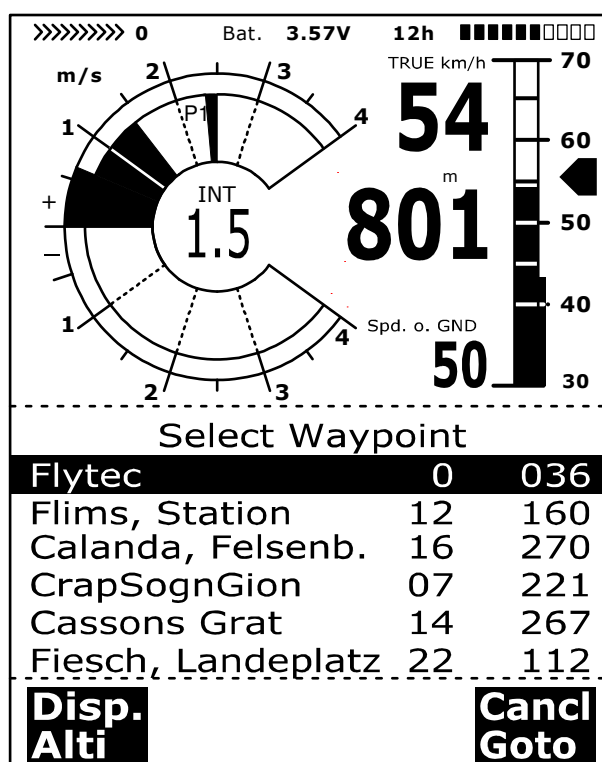
Prolonged pressure on the *Enter/Goto* key switches the lower half of the display into the 'Goto' mode. This function allows you to search for a Waypoint stored in the memory of the Brauniger Compeo and choose it for a flight to goal. At the same time the next five waypoints are listed in the order of shortest distance from the user. The number after the WPs names indicates the distance in km, the 2. number shows the direction to WP (Bearing). After pressing the *F1 (Displ.Alti.)* key the precalculated arrival altitudes to the 5 WPs are shown in place of distance.

In practice there are 5 final approach (final glide) calculations to the WPs made at the same time.

**Note:** Only the WP the pilot is directly flying to (  $\pm 20$  degrees ), the wind component is taken into consideration for the calculation.

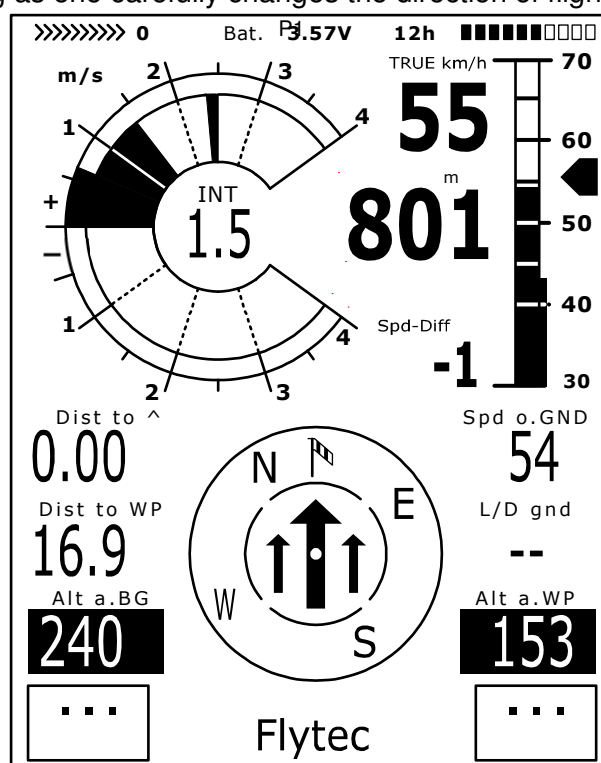
Key *F1 (Displ. dist)* switches back to the distances.

If you search for a WP with the  $\blacktriangledown$  key, it will be selected when *Enter* is pressed. The Goto function can be deactivated with the key *F2 (Cancel Goto)*.



If a strong cross wind is encountered on the way to goal, the correct angle between the destination and the wind 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. The large arrow in the compass will now look like the one at the title photo. By doing this you can be sure that the flight path over ground is in a straight line to goal and thereby the shortest one. The well known 'dog's hind leg' is thus avoided.

In the user selectable fields, in the example on the right, the ground speed, the distance to the WP and the precalculated arrival height over goal have been set. One can describe this height (Alt a.WP) as the height above the **fastest glide path** to goal. The pre-calculated arrival height assumes that there is neither lift nor sink along the flight path and that the wind remains constant. There is certain risk here. From Vers.2.15 up the wind component which is internally used for many calculations can be entered manually. (Please refer to 5.6 Final Glide Calculations.)



Also amongst the user selected displays is the **safety height** above the best glide path (Alt above BG) While circling upwards before an approach to the WP, this height will show 0 when the pilot should be able to reach the goal by flying at the best glide speed. Every meter above that means a greater safety margin. As soon as Alt above WP or Alt above BG are showing positive, both fields will change to inverse display (see photo above) With a good thermal, it makes sense to begin the final glide if Alt a WP shows zero. The Alt a. BG then shows him/her how much height he/she will have available as security, to use if necessary, to compensate for unexpected sink. Under no circumstances should one go ahead and fly towards goal if the Alt a BG (Height) shows zero or negative numbers reaching goal would be impossible without lift on the way.

## 2.8 Flying Routes

A route is an arrangement of various waypoints. Of course, the waypoints used on a route have to be saved in the unit's memory. The pilot should optimize his/her time flying from WP to WP in a similar manner used with the **Goto Function**; this means that he/she can complete a task in the shortest possible time with the help of the McCready theory.

Each time the Goto function is used to choose the next waypoint from a long list by prolonged pressing on the *Goto* button, you can fly along a route by briefly pressing ▲ (next WP) or ▼ (previous WP). (For setting, changing, or deleting a route please read section 3.4.)

To choose a route, you press the button ◀▼ / *Route* for a few seconds. Each route should also be assigned a route name, such as "Karwendel Triangle". 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/she may be high enough to jump a Waypoint on a route, and another time he/she has already found the thermal several kilometres before reaching the Waypoint. Of course there is still the option of looking up other, possibly closer, waypoints without leaving the route one is on by using the Goto

## Brauniger COMPEO

function. Altogether the Brauniger Compeo can have up to 20 routes set. The same waypoint can be used more than once along a route, and the same waypoint may occur on other routes as well. Once a waypoint has been used along a route, it can not be deleted from the list.

### Copy a route into Competition Route:

Call up Route in Setting Mode. With the  $\blacktriangle$   $\blacktriangledown$  keys go to the desired route and press  $\blacktriangleleft$  / *Mrk*. The display asks "copy to Competition route?" confirm with "yes".  
Bear in mind: all cylinder radii are reset to the default value of 400 m.

### Direction arrow to second next waypoint:

In the middle of the compass rose a thick black arrow points to the next waypoint. Under this pointer is a transparent second pointer that points in the direction of the second waypoint. This makes sense in competitions when the pilot wants to know in time in which direction to turn after reaching the waypoint cylinder.

With the Function key F1 one can choose following input options:

Next  $\blacktriangle$  Pr  $\blacktriangledown$  WP = next or previous Waypoint  
Mod Alt1  $\blacktriangle$   $\blacktriangledown$  Modify Alt1 ; (only possible so long no recording takes place )  
Mod Alt2  $\blacktriangle$   $\blacktriangledown$  Modify Alt2 or reset with F2  
HT man  $\blacktriangle$   $\blacktriangledown$  = automatic\* or manual input of wind component (Head/Tailwind)  
Please read also 5.6 Final glide calculations

\*automatic means: the windcomponent is calculated by the difference:  $\text{grnd spd} - \text{air spd}$   
a negative result signifies Headwind a positive result means Tailwind

## 2.9 The Competition Route -

### For Record Flights, Performance Flyers and Competition Pilots

In contrast to the routes described above, the Comp. Route has waypoints which are mandatory and have to be reached; for example turning points in competition or on Comp. performance flights. The regulation, which only recently came into effect in documenting distances flown, replaces the detailed and often difficult to interpret photographic documentation with photo sectors; it is now totally dependent on the recording of GPS receiver position data (Tracklog points).

When flying Comp.-routes the pilot will be warned by an acoustic alarm when crossing the circumference of a turnpoint cylinder or when entering / leaving the start cylinder and the unit switches automatically to the next WP. The Competition route can be called up by prolonged pressing of the  $\blacktriangleleft$   $\blacktriangledown$  / *Route* key and confirmed by pressing *Enter*. (Please refer to 3.5 to set and change routes.) Here any of the WPs can be defined to be the Start WP.

In place of the previous photo sectors, the pilot must enter the radius of the cylinder. This cylinder radius can be set separately for **every WP**, between 20m and 200km,. The customary factory setting is a radius of 400m. Please note that different radii for start/landing cylinders can be changed setting up the FAI-Route.

In the same field he/she choose the Start WP the Start time and if the race begins by exiting or entering the Start-cylinder.

Because Brauniger Compeo GPS's GPS receiver confirms its new position every second, it only takes one second for

COMPETITION-ROUTE	
Fiesch	1.20 S
Flims, Station	0.40
Calanda, Felsenb.	0.80
CrapSognGion	0.40
Cassonns Grat	0.40
-----	
Waypoint 1/5 in Route	
Fiesch	
Total Distance:	49
Radius (m)	1200
Starttime:	12:30 +15min
Startgates:	03 EXIT
-----	
Ins. Wayp.	Del Wayp.

## Brauniger COMPEO

the pilot to know that he/she is crossing the cylinder circumference. In this case a long, unmistakable tone lasting 3 seconds sounds and the unit automatically switches to the next route waypoint. It is guaranteed that several track log points within the cylinder are stored at one second intervals in the memory of the Brauniger Compeo GPS, totally independent of what recording interval is used during a standard flight.

Usually the Start cylinder is the first position of the FAI route. (not mandatory) If during setting or changing the route, the *McC/Mrk* key is pressed, an "S" for Start-Cylinder appears behind the waypoint's name and the cylinder radius. (The "S" disappears if the same key is pressed again) Only if a WP is marked with "S" it is necessary to set also a Start time and a Startmode : Enter or Exit. By confirming Enter or Exit he/she defines if the race begins by flying in or out of the circumference. If no Start-Cylinder is determined the pilots can launch whenever they want; the automatic switch over to the next WP occurs as soon the pilot is inside the cylinder .

During a flight with defined starttime the pilot can see at the Info display how many seconds/minutes are left before the opening of the Start line. The time counter shows decreasing negative numbers **Only when the time counter has reached 0 and starts to count forward** ( now with positive numbers) the pilot can make up his mind to cross the circumference of the start cylinder from outside to inside if the start mode was set to ENTER and the other way round if the mode was EXIT. An unmistakable bleeping sound occurs and the Brauniger Compeo switches automatically to the next WP.

The Dist.to WP always counts the distance from the present pilots position to the centre of the WP cylinder.

When the pilot has left the Start cylinder and the instrument has switched over to the next WP, pressing the  $\blacktriangledown$  key allows you to toggle back and forth between previous and next WP. This is useful when a pilot wants to break off a task and restart at a later time.

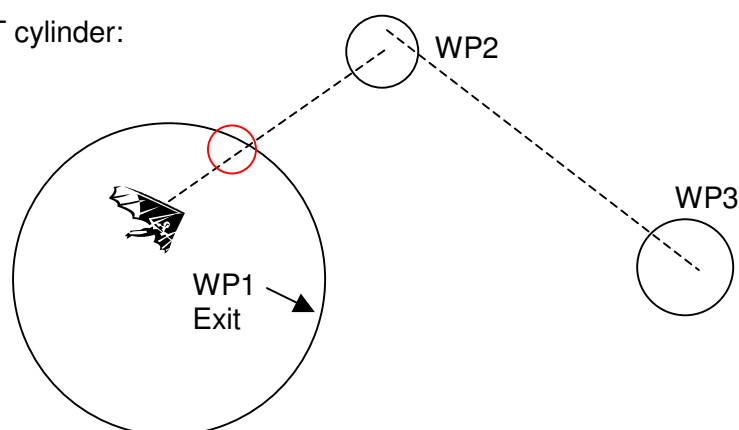
Please study the two task samples on the next pages.

Task1 : Exit Start cylinder

Task2 : Enter Start cylinder

From Version 2.21 on it is possible to chose several Startgate

EXIT cylinder:



When the *Competition Route* is set as an exit start the "waypoint reached" signal will be given as soon as the start time is positive (countdown timer) and your position is in the start cylinder. It will also sound if the start time is positive and the pilot crosses the start cylinder from outside to inside. In both cases the sound is given to alert you that it is time to go to the next turnpoint and the next turnpoint will become active (in this case WP2). All calculations and the direction arrows are now with respect to WP2.

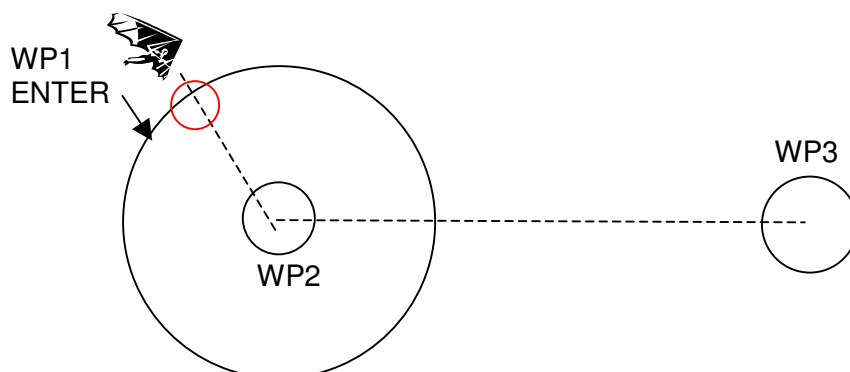
If the pilot wishes to take the next start gate, he must press the Prev WP key. If this soft key

## Brauniger COMPEO

is not visible, it can be brought up by pressing F1 until the bottom line shows Prev/Next WP. By pressing the Prev WP key the instrument will set the start (WP1) as the active waypoint and increments the start time by the interval set in the *Competition Route*. If the last start gate time has passed and the pilot presses Prev WP, the instrument will not increment the start time.

Note: It is required that the first turnpoint after the start cylinder is outside the start cylinder.

ENTER cylinder:



When the *Competition Route* is set as a *enter* start the “waypoint reached” signal will be given, as soon as the start time is positive (countdown timer) and the pilot crosses the start cylinder from outside to inside. The first turn point will become active and all calculations and the direction arrows will be made with respect to the first turnpoint (WP2 in the example).

If the pilot wishes to take the next start gate, he must press the Prev WP key. If this soft key is not visible it can be brought up by pressing F1 until the bottom line shows Prev/Next WP. By pressing the Prev WP key the instrument will set the start (WP1) as the active waypoint and increments the start time by the interval set in the *Competition Route*. If the last start gate time has passed and the pilot presses Prev WP, the instrument will not increment the start time.

Note: It is required that the first turnpoint after the start cylinder is inside the start cylinder (normally at the same position).

Even during the flight along the *Competition route* it is possible to select additional waypoints (thermal sources) by pressing the *Goto* key (prolonged pressing), sorted according to their distance from the pilot. The WPs which are part of the *Comp. route* are marked with an asterisk in the displayed list; this means they must be over flown. The alarm remains active when entering a called up waypoint cylinder along the route, even if a waypoint not belonging to the route has been selected. With the *F2* button it is possible to toggle back and forth between the WP of the *FAI route* and another WP.

After completing a flight task, the WPs belonging to the *Comp. route* will be listed in the data transferred to a PC under the header of the *IGC file*. A corresponding PC program can also check if the assigned task was completed correctly.

When setting up a *Competition route* without a start cylinder and without a Start time, the automatic switch over to the next WP takes part, as soon as the pilot is inside the 1. cylinder. So it makes no sense to choose the “Take off” place for the 1.WP because immediately after receiving satellites the unit switches over to the second WP.

## Brauniger COMPEO

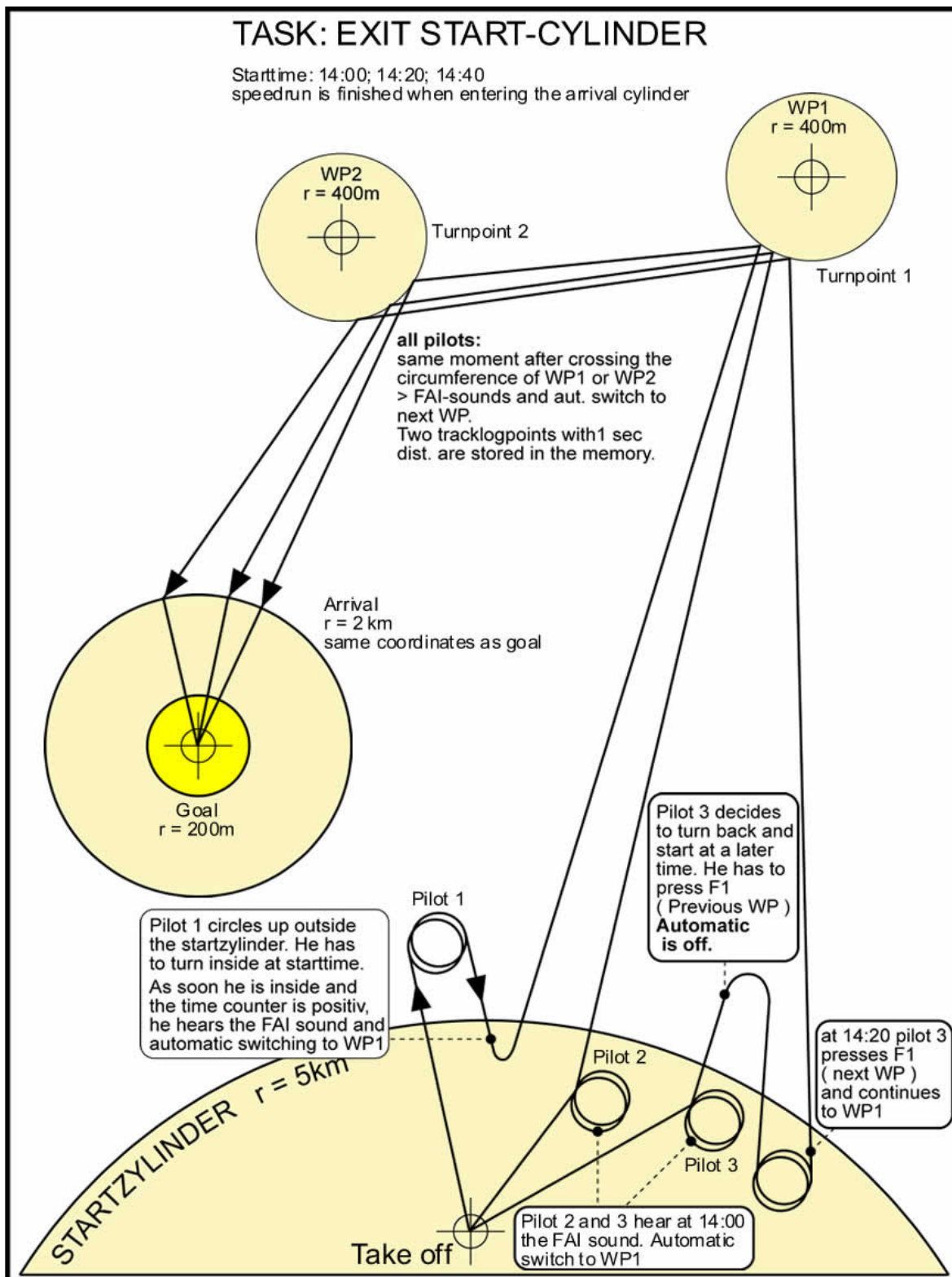
Briefly pressing the software key *F1* let you choose following inputs

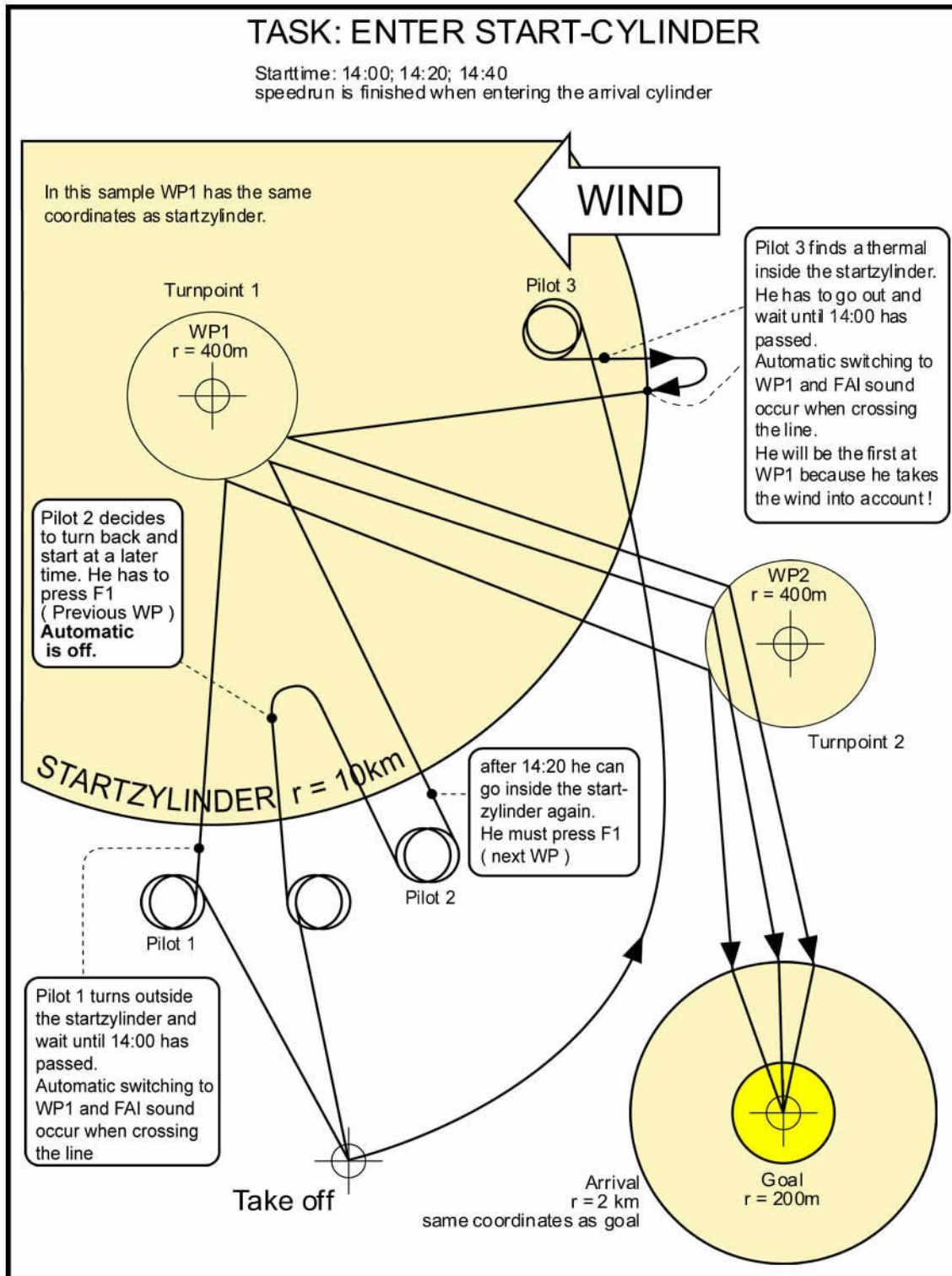
Next ▲ Pr ▼ WP = next or previous Waypoint  
Mod Alt1 ▲ ▼ Modify Alt1 ; (only possible so long no recording takes place )  
Mod Alt2 ▲ ▼ Modify Alt2 or reset with F2  
HT man ▲ ▼ = automatic\* or manual input of wind component (Head/Tailwind)  
Please read also 5.6 Final glide calculations

\*automatic means: the windcomponent is calculated by the difference:  $\text{grnd spd} - \text{air spd}$   
a negative result signifies Headwind a positive result means Tailwind

# TASK: EXIT START-CYLINDER

Starttime: 14:00; 14:20; 14:40  
 speedrun is finished when entering the arrival cylinder





## 2.10 Relocating Thermals

With weak or widely dispersed thermals this function helps to relocate any lost thermals. A small arrow pointing up in the double ring of the compass rose shows the direction to the last thermal with at least a 1 m/s climb. If this arrow is displayed at the top in the ring then you are flying towards the thermal. However, if the arrow is below in the compass rose, you are going away from the thermal. (See title photo ) If you want to take advantage of this function, then the indicator "Dist. to ^ " should be activated in one of the user defined fields. This value indicates the distance from the last thermal (with a climb rate of 1 m/s ) to the pilot.

## 2.11 Restricted areas CTRs

The structure of the restricted areas inside the memory has changed from version 2.19a to 2.21. You can not use the old CTR's, but it is possible to transfer them from the old structure to the new structure. Due to this change it is also not possible too use the well known "Maxpunkte" to transfer CTR data to the instrument.

The advantage of the new structure is, that you can use now unlimited corner points (Only limited by memory capacity). You can use also radii and circle segments. After updating the instrument to version 2.21 you will find one CTR in the list , the CTR "Innsbruck". You can edit this CTR to your needs, or set a new CTR with Flychart, but it is only possible to use one CTR. As an option with costs you can have a release code for the optional SW-packages from Brauniger. This is possible for 20 CTR's or with additional EEPROM memory up to 300 CTR's. It is possible to retrofit a bigger EEPROM in older instruments with only 128kB of memory. The memory size is displayed in the lower part of the startup screen.

When entering these corner points or waypoints , pay attention that the list of waypoints follow one after another, the same way as the lines of the polygon should be drawn. For the last WP it is not necessary to repeat the first one. To close the polygon, the program automatically connects the first and the last WP with a line.

The transfer of the waypoint list of a CTR to the Brauniger Compeo could be done, either manually in Set-up mode / restricted areas or, with less afford, with a PC program, i. e.

**Flychart** which will is available at our website: [www.brauniger.com](http://www.brauniger.com)

A new field Dist.to CTR was created among the user defined fields. It displays the closest distance to the next CTR so long as this distance is less than 50 km. To increase accuracy the distance between two Waypoints of a CTR should not be too long. We recommend to set some free waypoints in the middle of longer straight lines.

Setting up a CTR, one can choose and alter a warning limit. In flight, the graphic as well the normal display will show an additional distance information in the info field CTR 0.75 km

It is possible to enter a comment of maximum 17 characters to each CTR beneath the name. You can show the 5 next CTR's with a brief press onto the right arrow key, if you are in the map screen. The left key shows the comments of the five next CTR's The comment can be used to enter as an example the max or minimum altitude of this CTR or the RF frequency of the tower. The list is sorted in the shortest distance of the next 5 CTR's

Since Brauniger Compeo's market introduction we constantly have made remarkable improvements with many software updates with a lot of benefits for our users. Please appreciate that for the first time we are asking a little fee for a release code to open the option: Restricted areas

Pilots who want to use the CTRs should call us up via phone, fax or e-mail and give us the serial number of the instrument. In return we will send them the Release Code, depending on the units serial number.

Go to Setup mode / Optional SW-Packages

## Brauniger COMPEO

Mark CTRs (restr. Areas ) 01 or 02

Enter - input the release Code with the down arrow and the up arrow - Enter

If the code was correct the unit answers with : Package released

**Attention:** After disengaging the CTR function with the release code, the part of the memory where the CTRs will be stored has to be reorganized; This can last a while. It can also be done manually by performing the command : Init CTRs (last line in the Basic Settings).

### 3 Unit's Setting Menu (Set-up Mode)

The unit's menu is opened by prolonged pressure on the *Menu* key. Using the ▼ key you can choose one of the menu items and get to the corresponding sub menu by pressing *Enter*

#### 3.1 Basic Settings

A series of settings permit the unit to be programmed according to the user's wishes. Every pilot can realize his/her own ideas. If too much information bogs you down and causes confusion, it is always possible to reset the unit at Basic Settings/ Init EEPROM, which are the manufacturer's tested basic settings. You are basically starting again.

**But please note!** All WP and routes will be a deleted too. As a minimum, settings possible and default values set will be shown at the setting points. Should these values be changed, you move to the change mode by pressing *Enter*. The value to be changed will blink and can be modified with the help of the ▲ and ▼ keys. Pressing the *Enter* key confirms the new value. Pressing the ESC key recalls the previous setting.

Term	Meaning	Reference	Factory Setting
QNH	Air pressure at sea level	1.2	1013 mB
Record-Interval	Time interval per recorded (track log)point Range : 2 ... 30 sec	3.2	10 Sec
Sink tone threshold	Activation point of sink tone	1.7	0,8 m/s (ft/m)
Stall speed	Use of stall alarm and altitude limit	1.4, 5.1	0 km/h (mph)
Vario tone	Frequency of Climb and Sink tone, Pitch Modulation, Acoustic Integrator	1.7	1200 Hz ; 700 Hz Mod = 5 ; Pi=3; 8
TEC	Total Energy Compensation	5.6	65 %
Polar data	Two polars: Each with two data pairs 1.) at min.sink and 2.) at higher speed	5.4	40 km/h at 1m/s 76 km/h at 3m/s
Vario/Speed resp. delay	Response time delay for Analogue Vario and Speed new Filter 2 12	1.1	2 12 (≈ 1,2 sec)
Digital Variomode	Averager ; Net Vario; Averager time delay	1.3	1 sec 30 sec
UTC Offset	Difference to UTC also 0.5h possible	1.8.2	Present
Display contrast	Range 0 ... 100 %		70 %
Air Spd correct. vane	Windwheel 70 ... 150 % correction	1.4	100 %
Air Spd correct. Pitot use sensor?	Pitot sensor 90 ... 150 % correction Sensor on/off	1.4	100 %

## Brauniger COMPEO

Airspeed Offset	This value will be added or subtracted to the actual speed value. This value can be used to compensate the slower airflow under the airfoil		0
Vario audio threshold	Fine tuning of climbing tone max 20 cm		2 cm/sec
Pilot name	Pilot name entry; max 25 letters		not set
Speed mode	TAS or IAS; upper or lower range	1.4; 5.3	0 = true airsp.
Units	Meter or feet; Km/h or mph or knots Temp.: In Grd C or Grd F; Km or miles		m ; km/h ; Grd C; Km
Init EEPROM	Back to factory settings	3.1	No
Erase all records	Deletion of flight memory (all records) This command formats the flight memory if an error in the memory occurred. The settings remain unchanged	3.2	no
Erase all WP& routes	Deletion of all WPs and Routes	3.3; 3.4	no
Init GPS	Entry of posit. for faster satellite reception Set of a geodetic map system	2.1 2.6; 6.2	actual position 1 = WGS84
Coordinate Format *	dd°mm,mmm or dd,dddd or dd°mm'ss" UTM ; Suisse Grid #		dd,mm,mmm
Recording mode	Autom. or manual flight recording	3.2	Aut.
Average thermal climb	Time delay for average climb in the thermals	1.10	0,5...10 min 10min
Glider type	Name of glider for OLC		not set
Glider ID	Glider registration for OLC		not set
McCready Tone gap	Delay for McCready acc. to climb Acoustic dead band in +/- xx cm/sec	1.9	7 seconds 30 cm/sec
Vario Display	Circle scale or bar scale	1.1	Yes = circle
Userfields	3 user selectable pages with 6 normal or 4 large fields	1.7	Yes = 6 fields
Init CTRs	Memory Reorganisation	2.11	

**Note:** It can take some seconds to delete the WPs, routes or flights. Please wait until the process is completed and the confirmation "yes" resets to "no".

\* the highest accuracy is achieved when using the same co-ordinate format as most of the GPS modules do. This is: dd°mm,mmm ( degrees; minutes and decimals of minutes ). With all other formats rounding errors can occur. ( up to 15m )

### 3.2 Flight Memory and Flight Analysis

In contrast to previous flight instruments the recording mode does not need to be specially activated as each flight is automatically saved.

The flight logging system used in the Brauniger Compeo registers not only the flight altitude and speed, but also logs, with the GPS receiver switched on, the time, position of the pilot in the WGS84 co-ordinate system, the GPS altitude and flight speed (= air speed).

The value set in the Basic Settings/ record interval determines the time interval in seconds after a new data record is written in the Brauniger Compeo GPS's memory.

A scan rate of 2 second is advisable for tests or aerobatic flights. The factory setting is 10 seconds. In order that such a flight is logged in the flight memory, it has to be at least 3 minutes long . For the beginning of a flight the following rule applies:

The start is recognized as soon as the groundspeed reaches at least 10 km/h or if the instrument recognizes an altitude difference of at least 30m. In each case however, the

## Brauniger COMPEO

previous flight history with up to 30 recording points is logged in the Brauniger Compeo GPS's memory.

Even the last 3 minutes before the start of the logged flight can be recognized as they are recorded with a 10 second recording interval. An end of flight is recognized if there is no movement for 60 seconds, and no change in altitude occurs. Then the **Flight analysis** is displayed. The digital signature is calculated from this moment on and a notice in the user defined field draws attention to it. Please wait until the calculation is completed. You can return to standard mode by pressing the *Menu* key briefly. Or you perform a recalculation of the Digital Signature by briefly pressing F2.

If however, manual recording was chosen, recording starts 1 minute after the instrument is switched on and continues until the Esc key is pressed for 3 seconds. The unit asks you:

“Do really switch off” and you confirm with “Enter”

Now starts the generation of the digital signature which can last 1 or 2 minutes. Wait until this is done and press any key to turn off.

Bear in mind that modifying of Alt1 cannot be done after the start of a record. The user field Flight time starts to count up with the beginning of a record.

Flight Memory is situated in the second position of the Main Setup Menu. If you press the *Enter* key, the list of flights, stored according to date, appears. The most recent flights are in the first positions. The length of the flight is also shown. With the ▼ or ▲ key you can move through the list and choose the desired flight with the *Enter* key. The flight, with its benchmark figures, is indicated in the Flight analysis. Individual flights can be deleted from the list by pressing F2 Del. Flight.

**Note:** Before starting a flight make sure that the GPS receiver shows at least 4 receiving satellites to get a valid recording.

**Remark 1:** In the flight recording the values are recorded, which appeared on the display. Because the display is renewed each second, thus the 1 seconds - values are stored in the flight recording. If one downloads such flight afterwards with a program such as Flychart, SeeYou, CompeGPS, Maxpunkte etc. on the PC, these programs can analyze only the flight recording in the IGC format. In the IGC file the position, the barometric height, the GPS height and the True airspeed with impeller sensor or pitot tube sensor are recorded. The programs calculate now the rate of climb values by the altitude values. If the pilot chooses for example a recording Interval of 10s, and in these 10 seconds an altitude difference of 5m occurred, a climb rate of 0.5m/s is calculated. In this 10 seconds it is possible that however a climb rate of 1m/s occurred.

Main Setup Menu

-----

Basic Settings  
**Flight Memory**  
 waypoints  
 Routes  
 Simulation  
 Factory Settings  
 Optional SW-Package

---

**Flight Memory**

01.03.02	1:14:56
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

**Del.**  
**Flight**

=====

FLIGHT-ANALYSIS

=====

Start:	13.02.02	13:35:43
Stop:	13.02.02	15:13:22
Flighttime:		1:37:34
Record-Interval:	10 s	
Task:	no	
Max A1:	2823 m	
Max A2:	1154 m	
Max A3:	4273 m	
Max Vario:	8.9 m/s	
Min Vario :	6.6 m/s	
Max Airspeed:	73 km/h	

**Show**  
**Map**
**Recal**  
**Sign.**

This value is represented only in the Flight - analysis page and cannot be transferred through the serial interface.

**Remark 2:** Even if the instrument is able to store up to 100 flights, we recommend, to store the flights on a PC and format the memory afterwards with „basic Settings -> Erase all records “. This procedure offers security to your valuable flights, and the equipment can record with a “refreshed” memory..

### 3.2.1 Graphic Display of Flights in Map Format

The flight route of saved flights can also be shown on the display and viewed. Flight Analysis is reached by pressing *F1* to display the function Show Map. The screen-optimized flight route is shown on the display. (North is located at the top) Additionally, stored way-points are plotted with a cross and name. The map scale is displayed too.

The graph can now be changed as follows:

**F2: Zoom in:** The map scale is gradually increased to approx. 0.4 km. Thus, individual circles during a climbing period are clearly recognisable (This is dependent on the set recording interval).

**F1: Zoom out:** The map scale is gradually decreased until the screen display is optimised. The maximum is 47.7km

**Arrow keys: Pan:** With these the plotted area can be shifted up, down, left and right.

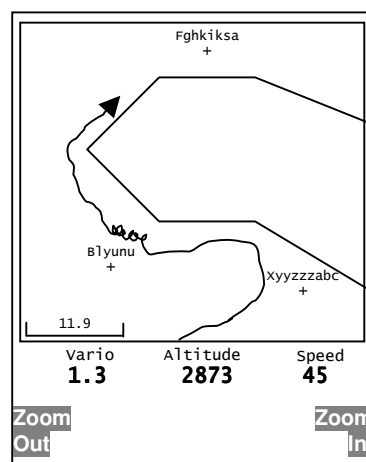
**Enter:** From each graph back again to the screen optimized graph.

**ESC:** Back to the main setup menu. All other keys cause the track in the current selection to be redrawn.

**Note:** As the picture takes a few seconds to appear, depending on the amount of data, Wait and Ready appear on the status line as user information; if a zoom or pan key is touched during the process then it will be broken off and will start over again with new values. You can thus obtain the desired graph quickly. Even past flights can be graphed as long as they are still saved.

**During flight,** touching the ESC key briefly will bring you a real-time track and map display. Vario, height and speed appear digitally under the map. For FAI routes, the cylinder of the active waypoint, WP names, and a thin dotted line to the next WP are also displayed. During the flight the Zoom In/Out functions are accessible.

From Version 2.21 on, the end of the actual track (That means the actual position of the pilot) is marked with an arrow. The zoom out range is increased 4 times to show the whole route and the nearby restricted areas. The waypoints of a competition route are marked as cylinders with their radius and all waypoints of a competition route are connected with a dashed line



### 3.3 Waypoints - Alter, Delete, or Add

Waypoints can be managed at this location of the Main Setup Menu.

After briefly pressing the *Enter* key the display shows the list of logged waypoints (WPs).

All WPs are arranged in alphabetical order.

Waypoints

If this list contains more than 8 visible WPs, a down arrow at the right lower edge of the list shows that additional pages follow. To scroll down to the next page, press the  $\blacktriangleright$  arrow; WP 9 to 16 are now shown, and so on. You can select an individual WP with the  $\blacktriangledown$  or  $\blacktriangle$  keys, and edit it by pressing the *Enter* key.

The first letter of the WP name will blink; again with the  $\blacktriangle$  and  $\blacktriangledown$  arrow keys you can select the desired letter. There are numbers and letters, as well as a set of special symbols to choose from. By pressing the  $\blacktriangleright$  arrow you move forward to the next letter. With the F1 key you can switch between capital and small letters and numbers. You can enter up to a maximum of 17 characters.

Once the name has been entered correctly, confirm by pressing *Enter*. Now the waypoint altitude blinks, asking for any alterations. Again you confirm by pressing *Enter*. The WP position comes next. First the latitude is entered in degrees and minutes, and is confirmed by pressing *Enter*. Next are the decimals of the minutes. (Depending on the Coordinate-Format set in the Basic Settings) The same occurs with the longitude. Holding the key down longer changes the values to be set faster.

Waypoints	
-----	
Flytec	
Flims, Station	
Calanda, Felsenb.	
CrapSognGion	
Cassons Grat	
-----	
↓	
Used Waypoints	
Fiesch	
Alti	1048
Lati	N 46' 24.446
Longi	E 08' 08.264
-----	
Ins WP	Del WP

#### Deletion of Waypoints:

Selecting the waypoint to be deleted is done with the  $\blacktriangledown$  and  $\blacktriangle$  arrow keys. Pressing the F2 key (Del WP) activates the delete function. To be on the safe side, the Brauniger Compeo asks once again, "Delete Waypoint?" Yes or No are the choices available. It is possible, however, to stop the deletion process by pressing *Esc* and returning to a previous level.

#### Insertion of Waypoints

Pressing the F1 key (Ins WP) activates this function. Entering WP names, altitude, and position happens in the same way as described above. After confirming all entries with the *Enter* key, the new WP is inserted alphabetically in the list.

Altogether 200 WPs can be stored by the Brauniger Compeo.

**Note:** After entering the new waypoints (for example, for inputting them into a route) these can be used only after you have switched back to the normal flight mode by briefly pressing the  $\blacktriangleleft$ /Menu key. In addition, the route into which the new waypoint should be inserted must not be active. Therefore, first change into route selection by prolonged pressing of the  $\blacktriangleleft$  /Route key and with the help of the F2 key (Cancel Route) deactivate the route.

### 3.4 Routes Set - Delete - Alter

You reach any stored routes by marking the menu point Routes in the Main Setup Menu. Routes saved in the Brauniger Compeo appear after pressing the *Enter* key again. (Maximum of 20 routes) From these you can select one of the routes to be deleted by using the ▼ and ▲ keys; press *F2* (Del.-Route) to delete or *Enter* key to alter. However, by pressing the *F1* key (Ins. Route) a new route can be created. A route is a string of waypoints. (Of course the WPs have to be already in the Brauniger Compeo GPS's memory). If a WP is used in a route, then it can no longer be deleted.

#### Setting a New Route

After pressing the *F1* key (Ins.Route), first a name has to be entered for the route. The cursor will blink on the first letter of the word "Xxxxx". By using the ▲ and ▼ keys you alter each to the desired letter. By using the ► key you proceed to the second letter, change it, and so forth. By pressing the *Enter* key you conclude the entry of the route name. At this time the individual WPs need to be added. The list of the available WPs appears in an alphabetical order in the bottom half of the screen after pressing the *F1* button (Ins.Wayp). At the same time you see the request: Select Waypoint No1. Again by using the ▼ or ▲ keys you search for the first WP and it is added to the route by pressing *Enter*. This is indicated in the upper half of the screen. Press the *F1* key (Ins.Wayp) again. Once more the waypoint list appears and you can select the second point. Press *Enter* to add this to the route, and so on. The highlighted waypoint (offset in black) in the 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 highlighted in black. If you want to insert an additional waypoint after WP1, then you highlight WP1, press the *F1* key (Ins.WP); the reference Select Waypoint No 2 appears.

If you determine, for example, that Waypoint No. 4 must be changed, then you select it and delete it (with *F2*) and insert a new one by pressing *F1*. Note: The marked WP before pressing *F1* must be WP3. Again the list of available waypoints appears and the prompt Select Waypoint No 4. After selecting and pressing *Enter*, the old waypoint is replaced by the newly chosen one.

If you want to delete a waypoint from the route, then you select it and press the *F2* key (Del. Wayp) The WP is deleted from the list without any additional prompt.

#### Altering a Route:

You select a route to be changed with the ▼ or ▲ keys and confirm with *Enter*. The route name is changed first. If this is not what you want, then it is sufficient to press *Enter* again in order to get to the waypoints. As described in the last paragraph, the additional WP can be added or deleted now.

#### Deleting a Route:

You select the route to be deleted with the ▼ or ▲ keys and press *F2* (Del.Route). To be on the safe side the Brauniger Compeo enquires once again: Delete Route? that can be answered with Yes or No. However, it is not possible to delete the FAI-route.


#### Changing a route into Competition Route:

You select the route you want to be the Competition Route with the ▲ ▼ keys and press *McC* ◀/*Mrk*. The display asks "copy to Competition route?" confirm with "yes". Please note: Start cylinder, cylinder radii and start time have to be set separately. As default all cylinder radii are reset to 400 m .

### 3.5 Competition - Route Set - Alter - Delete





Even when a Competition route, called up during flight, is treated differently from a usual route, there is only few difference when setting or changing it. The route can be set up with the help of the key board similar to a normal route or can be transferred from the PC.

The FAI route can be altered, WPs in it can be erased, but its name, however, cannot be deleted.

Each one of the other routes can be copied to replace a Comp.-route with the *McC* /Mark key. The same key is used to assign the status "Start Cylinder" to one of the waypoints. For the Start-cylinder the user chooses if the race begins by "Enter or Exit" the cylinder circumference. To each of the WPs in the Comp-route a different cylinder-radius can be assigned. There is also a count down timer linked with the Start-cylinder . With its help the pilot knows exactly how many min. and sec. will pass until the window is open.

(Please see 2.9 The Competition Route)

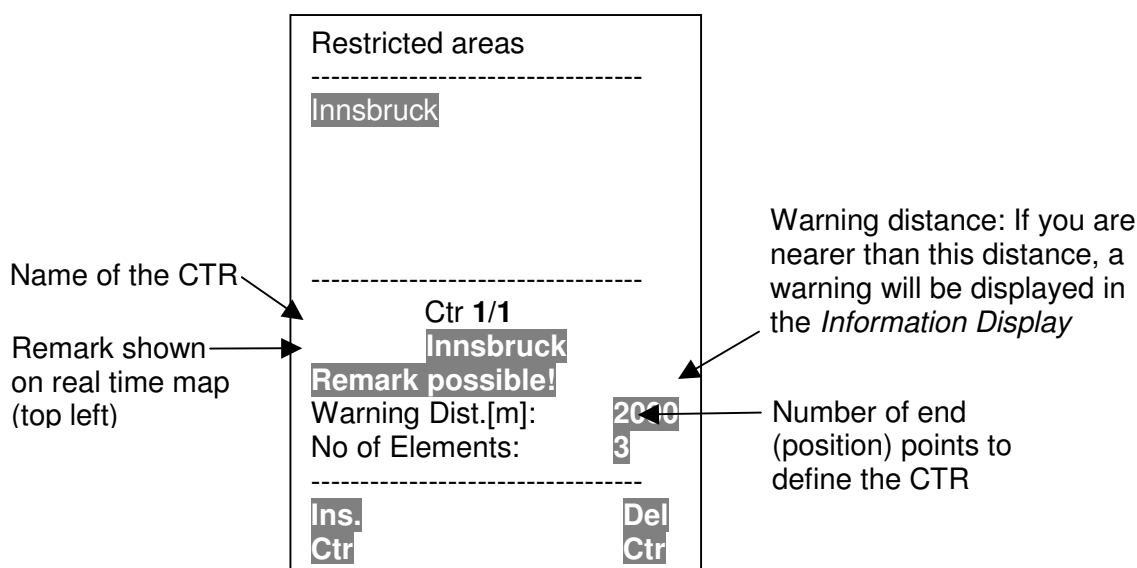
### 3.6 Restricted areas CTRs Set - Alter - Delete

After choosing the 'Restricted areas' in the Main Setup menu and briefly pressing the *Enter* button, all stored restricted areas are listed on the screen. You can choose one with the arrow keys   and you can delete it with *F2* (Del CTR). With a consecutive key press on *Enter* you reach the edit mode for one CTR. You can change any setting like with the WP edit mode. You can chose with the arrow keys   a topic and enter a new, delete or change it. This is possible for corner positions, radii, the warning distance and the comment. We recommend to use Flychart from Version 4.50 on to manage the restricted areas.

It is possible to enter restricted airspace/restricted areas (CTRs) in the Compeo. CTRs will be shown on the real-time map and can be polygons, circles or polygons with arc sections. The number of possible CTR's depends on the memory available in the instrument and the unlocked SW-Packages.

- Without unlocking software packages it is possible to enter one CTR. With Basic Settings>Init CTRs. The default CTR is Innsbruck and can be changed from the keypad/FlyChart.
- Without memory expansion, but with package 01 unlocked (Main Setup Menu>Optional SW Packages) it is possible to enter up to 20 CTR's (depending on the number points required to define the CTR). The unlock code from can be purchased from Brauniger. Practically we reached around 14 CTR's with a 128kB EEPROM, depending on the number of points.
- With a memory expansion to 512kB it is possible to enter up to 300 CTRs (again depending on the complexity of the CTRs). To use this option The Compeo memory must be expanded and software package 02 must be purchased from Brauniger.

## Brauniger COMPEO



A CTR is defined by the end points of lines and arc segments or by the center and radius of a circle. The end points must be entered exactly in sequential order (clockwise or counter clockwise). The instrument will automatically connect the last point entered to the first point so it is unnecessary to repeat the first point at the end of the string. For mathematical reasons the distance between two end points in a CTR should not lie too far apart. The accuracy of the distance calculation will be increased if an intermediate point is inserted between two distant end points.

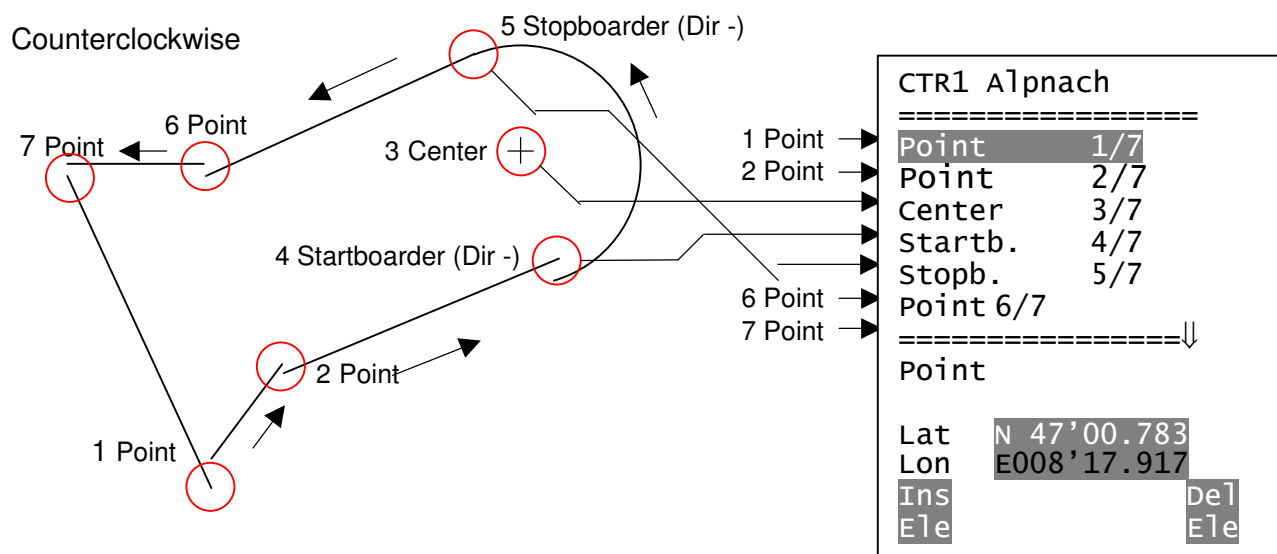
CTR's can be entered into the instrument manually in the Setup menu>Restricted areas, or more easily with Flychart. The procedure for manually entering CTRs is below and the procedure for using Flychart is in the FC help files.

The distance to the nearest CTR can be seen with the user-selectable field "Dist. to CTR". The display is limited to distances of 50 km. If you fly within the warning limit (default = 2000m) as defined in the CTR a warning comment will be given in the *Information Display*. The warning will be given with the distance to the CTR (e.g., CTR 0.75 km). If you enter the CTR the "Dist. To CTR" will display 0.

If you define the points of a CTR the GPS coordinates (lat and Lon) of the point must be entered as well as the *Type* of point from the list below:

- Point: End point of a line or arc
- Center: Center of an arc
- Startboarder: Start point of an arc with direction (+ clockwise/ - counterclockwise)
- Stopboarder: End point of an arc (+ clockwise/ - counterclockwise)
- Circle: Center of the circle with radius in m

**Example:**



To enter **segments** it is necessary to obey the following order.  
 Long, Lat center;  
 Long, Lat start point of the segment;  
 Long, Lat end point of the segment;  
 Direction (+clockwise, - counterclockwise)

In case of **circles** the center and the radius must be entered  
 Long, Lat of the center;  
 Radius in km

### 3.7 Simulation

After choosing the Simulation mode in the Setup menu and pressing the *Enter* button, you reach this very interesting function. With the arrow keys and *Enter* you turn the Simulation to Yes. Now the simulation starts at the last known GPS position. With the *▶* and *◀* arrow keys you can adjust the air and ground speed; the *▲* and *▼* arrow keys change the sink or the climb. If the stall alarm sounds, please increase the airspeed by a few Km/h. Depending upon the polar entered, you will now recognize the relationships between required speed, McCready indicator and acoustics.

The softkey *F1* is used to change different functions:

- Next Func. var ▲▼ Spd ▶◀ to change Climb / Sink air- + Groundspeed
- Next Func. wind ▲▼ Trk ▶◀ Change of groundspeed and flight direction
- Next Func. blank or other info Press ▶ to change user defined pages
- Next Func. Mod Alt1 ▲▼ Modify Alt1
- Next Func. Mod Alt2 ▲▼ Modify Alt2

Likewise, the **Goto** function can be called up to select a waypoint. If the direction arrow in the middle of the compass points upwards, the pilot is moving towards his goal and the distance to WP becomes smaller while at the same time the altitude naturally decreases. If you now initiate a climb with the *▲* key, the Brauniger 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 you also can test the different acoustic adjustments as frequency, pitch and modulation during a virtual climbing. ( Basic Settings/Vario tone )

## Brauniger COMPEO

Please change back again to a sink flight. If on your display there is a user field named Dist to ^ you see now, like during a true flight, how your distance to the last thermal increases, while in the compass rose the symbol  $\hat{u}$  appears and shows you the direction where the last thermal has been.

You can also retrace a route flown. If you select the route as the Comp.-route, you will hear the characteristic tone upon approaching within 400 metres of the waypoint, which tells you, that you are inside the cylinder. You see the automatic switchover to the next WP too. If a starttime was set, take care that the count down timer shows positive values. By pressing the *ESC* key you can switch to map display and observe the approach to the waypoint cylinder. The second transparent pointer in the centre of the compass rose helps to minimize the flight path; no need to cross the circumference of the cylinder right angled.

Unfortunately, wind direction cannot be set; only a difference between Ground- and airspeed simulates head or tailwind influence. Press *F1* until the function: wind  $\blacktriangle$   $\blacktriangledown$  trk  $\blacktriangleright$   $\blacktriangleleft$  appears. It is very informative to see how different head- or tailwinds influence the arrival altitude Alt a. WP above your goal.

The GPS receiver is turned off during the simulation, and in place of its bar the word "Simulation" appears.

A simulated flight is stored into the memory of the Brauniger Compeo, but the Digital Signature is not valid.

### 3.8 Factory Settings, Unit Specific Parameters

Beyond this set up level, which is not accessible to the pilot, all basic factory settings are stored. In particular, both the sensor specific parameters the serial number and all the calibration data are located here. This data is not lost even when the power supply is cut off.

### 3.9 Optional Software Packages

With the help of a password code obtainable from the manufacturer, additional special functions can be activated. For example, restricted areas CTRs are displayed and CTRs itself will be graphically drawn in the map mode.

To Enter a release code

- :Chose the appropriate SW package in the Main Setup Menu
- Press Enter. A Code -29XXX appears
- With the down arrow key the code goes directly to 30000 and begins to count down
- Stop if you see the correct code and adjust with the up and down arrow keys
- Press Enter
- The instruments says "Package released"

If you enter a wrong code, the instruments block for 5minutes or longer!

### 3.10 NMEA data output

The permanent output (1 per sec) of NMEA data via the serial port is now activated, which is sending three NMEA sentences to an attached receiver. (9600 baud; 8 bit; no Par ;1 Stopbit;)

- 1) \$GPRMC to be used with navigational programs
- 2) \$VMVABD Output of flight specific data
- 3) \$BRSF special output like McCready results and Speed to fly and more only this last sentence must be released by a password code.

## 4 Data Transfer

All data entered by the pilot, including waypoints, routes, pilots names, etc. as well as the automatically recorded track log points of the flights undertaken by him/her are in the memory of the Brauniger Compeo. Each track log point contains the time, position, GPS altitude, barometric altitude as well as the flight speed. In this way, it is possible to graph the Barogramm, variogramm, speed gram and course of the flight on a map for later evaluation. Recently, the FLYCHART Programme with Google Earth Interface is now able to depict the flight in its appropriate landscape on a computer screen in 3D.

### 4.1 Data Exchange Via PC

Among the items belonging to the Brauniger Compeo's basic equipment is a data cable for a serial PC interface (9 pol Sub D plug). In this way data transfer can occur in both directions. The connection occurs with: 57.600 baud; 1 startbit; 8 databit; 1 stopbit; no parity, Xon/Xoff

The following can be read and write via this RS232 interface:

- Instrument Configuration (User Setup)
- Waypoint list
- Route list; CTRs
- flight (tracks)

Or can be written to the Brauniger Compeo:

Waypoints, routes, CTRs, and Instrument Configuration (User Setup)

**Important, the unit must already be switched on for transferring the above mentioned data. Only then can the connection cable be hooked up to the PC.**

The unit needs to be switched to the **Main Setup Menu** for transfer. There are a number of PC programs on the market which allow communication with the Brauniger Compeo GPS. The data transfer for the On Line Contest for the DHV is, however, only possible with the full version of FLYCHART, or by using one of the programmes listed below;

For Laptops without serial interface COM1 you need to use a Serial to USB Adapter. Brauniger can only support the USB Adapter from Brauniger. It works fine with Flychart 4.50 and higher. Please don't forget to install the Adapter Driver delivered on the CD.

**Note: This adapter works only with Flychart. It is not possible to use a USB Adapter to update the firmware.**

Additional programs which permit data transfer with our unit:

**Trackview (Freeware)** Daniel Zuppinger (for the OLC and CCC)

<http://www.softtoys.com/>

**Maxpunkte (Freeware)** Program from D.Münchmeyer for the Online-Contest of the DHV

<http://www.flugplatz-beilrode.de/maxpunkte/download.html>

**Compe-GPS**

Ivan Twose (for Competitions u. Privatpilots, 3-D Representation)

<http://www.compegps.com/>

**Seeyou**

(Flightplanning- und Analysis-Software) [www.seeyou.ws/](http://www.seeyou.ws/)

## Brauniger COMPEO

### GPSDump

Stein Sorensen . A simple Program to obtain the IGC.  
<http://www.multinett.no/~stein.sorensen/>

Recommendation: Plug in the cable between Brauniger Compeo and PC **after** starting one of the programs. The BRAUNIGER Company cannot take responsibility for the above mentioned programs for perfect function. If problems appear, please contact the respective software-developers.

## 4.2 Transferring New Software to the Brauniger Compeo GPS

As is the case with many other new developments, improvements or add-ons come afterwards. The BRAUNIGER Company will place programme updates from time to time on our BRAUNIGER homepage on the internet, which can be downloaded by the user free of charge, saved and then transferred to the Brauniger Compeo. ( actual now is Version 2.16 ) In order to be able to write to Brauniger Compeo's flash memory at all with one's own PC, a software tool is necessary, which is a compressed file named "Galflash.zip" (approx. 1MB). In addition, the actual firmware programme to be transferred must be obtained from the home page. It is called "xxxv221.hec" (approx. 400 KB) which corresponds to the version 2.21.

We recommend that you store all the related files in one separate subdirectory. After decompressing the ZIP file a number of files are created. Double clicking on the file "uploader. exe" starts the program. Under "Setup" the serial port (COM1 or COM2) can be chosen. Under File / Open upload file you select the file to be transferred with the extension ".hec" . **Now it is time to plug in the cable into the switched off Brauniger Compeo GPS.** By pressing on the "Open" or the "Upload" key the data transfer starts automatically.

**Important: Contrary to the data transfer of Waypoints or Routes be sure that the Compeo is turned off when plugging the cable into the computer.**

**Note: Never leave the PC cable hooked up to the instrument when it is turned off. If this is done, the Instrument resumes in programming mode energy and the battery can be drained unnoticed.**

It can occur, that the Compeo switches on during plugging in the cable. In this case please remove the cable, wait until the unit is switched off and connect again.

For Laptops without serial interface COM1 it is not possible to load new firmware into the Compeo. Please use a desktop with the appropriate serial interface COM.

## 5 Appendix

### 5.1 Stall alarm

If a pilot gradually slows down his/her glider, he/she will cause a stall when falling below a certain speed, which has 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 is inevitable. For this reason manufacturers are building a so-called cross-setting (washout) into the support areas of the wings; this means during flight that the wing tips, will always have a smaller angle of incidence than the middle of the wing. If the air flow stalls in the middle area of the surface when falling below a minimum speed, then lift still remains on the wing tips. The aircraft does not enter a deep stall or incipient spin. Because the wing tips are situated behind the aircraft's centre of gravity, the wing will drop nose downwards and will try to recover by gaining speed. It is not advisable to stay long in this flight situation, as the glider will react very sensitively to even small air turbulence. A stall can be dangerous, especially during the landing approach. The consequence could be a stall or an incipient spin. The stall alarm is a loud, concise, acoustic signal that tells the pilot to fly faster. It assists, first and foremost, hang gliders and paragliders but the latter to a lesser extent. Anyone who has ever watched a hang glider come in during an approach can observe the following: when a good headwind prevails, many pilots will pull out their steering bar too early; the glider climbs a few more meters so that, in a favourable case, it ends up with the keel stuck in the ground. With no wind or with a light tail wind most pilots wait too long to pull out the bar. With luck the result is only a belly landing, but the result can also be ground-loop with broken base side tubes, or the glider's nose absorbs the impact, causing the pilot to swing like a pendulum, hitting his helmet on the front keel tube.

Different stall speeds apply for varying wing loads and pilot weights. Several tests to determine your own speed are necessary for setting your correct stall alarm limit in the Setup menu. It is worth noting that close to the ground, because of the air cushion under the wings, the stall occurs at approximately 2 km/h lower speeds than in free air. On our own gliders the correct setting has always been between 30 and 34 km/h. The stall speed also depends on the specific weight of the air at different altitudes. In the Brauniger Compeo the level for the stall alarm is automatically raised with increasing flight altitude, corresponding precisely to the indicated airspeed. It makes no difference if the pilot has chosen true or indicated airspeed for the speed display.

The distance to stall speed is easy to control now.

The limit between stall alarm and the speed for minimal sink is very small. Several pilots have complained about the fact that while circling up in weak thermals at the speed of minimal sink, the stall alarm sometimes turns on. For this there is an altitude limit the pilot can adjust in the Basic Settings / Stallspeed, above which the stall alarm will not be initiated. The landing areas should then, of course, lie below this limit.

Experience has shown that about half of the otherwise not so wonderfully executed landings could have been saved by pushing the steer bar upright when the stall alarm turns on.

### 5.2 Netto vario

In contrast to the normal vario, on which the vertical speed of the glider is shown, a netto vario indicates the rising and sinking of the surrounding air mass. The prerequisite for this is a correctly entered polar curve and, of course, a speed sensor. Let's assume that a pilot is flying at 50 km/h through the air. The Brauniger Compeo determines from the polar curve that at 50 km/h there would be a sink rate of 1.1m/sec expected. In our example, the normal vario could only show 0.5m/sec. Therefore, the surrounding air has to rise by 0.6m/sec to reach this pair of values. However, if in our example the normal vario indicates a 2m/sec sink, then the corresponding air would have to sink by 0.9 m/sec. This means, with the

## Brauniger COMPEO

correct polar curve and calm air, the netto vario would have to show a value of 0 at all speeds. Or, the other way around, we are in the position to check our polar curve when we are certain that the air is absolutely still. If the netto vario here in the upper speed range indicates air which is continuously rising by 0.3 to 0.5 m/sec, then we know that our wing is better than the stored polar curve and sinks less than the 0.4 m/sec that the polar curve states. This can be corrected. ( Basic Settings / Polardata)

What else is the netto vario used for?

Another example from common practice:

A pilot crosses a valley rapidly. Suddenly he/she notices a sharp decrease in sink rate and turns in instinctively. This was a mistake because the desired climb turns out to be nothing more than zero lift. A quick glance at the netto vario, which in our case shows 1m/sec rising air, would have kept him/her from losing time and altitude. The netto vario display only makes sense during longer descending glides. While climbing in a thermal it is better to activate the integrated vario, which indicates the average climb over a chosen integration time period.

If you chose Brutto, Netto Sink the following time apply:

Ascent -> Integration time chosen in the Basic Settings

Netto Sink -> Integration time always 1s

### 5.3 True or Indicated Airspeed; TAS or IAS

In general aviation it is custom to measure the airspeed with the help of a pitot tube as a dynamic pressure speed (= IAS) and also to display it as such. The advantage of this method is that at any altitude level the maximum allowable speed or the stall is marked (flight safety) at the same position on the scale. This is also the case for the speed of the best glide (flight performance) at preferred altitudes which have a fixed position on the speed scale. However, the disadvantage of this system is that the indicated speed is correct **only** at a certain altitude (usually at sea level). The glider will fly increasingly faster the higher one climbs due to air getting thinner, without the indicator picking this up. At approx. 6,500m the air weighs only half of that at sea level, and the air speed will therefore increase 1.41 times that ( as a radix of 2). You could picture the physics of it as follows:

In order to create a certain lift, a certain number of air particles have to hit the surface bearing the weight (wing). Because at an altitude of 6'500m there are now only half as many particles present per cubic metre, the surface has to fly faster, but not twice as fast because each particle possesses a higher striking energy, around 41% faster.

However, in calculating wind, arrival altitudes, or arrival times you always require true air speeds. The wing wheel sensor (propeller sensor) shows the true air speed (=TAS) because it runs practically without friction.

Thanks to modern processor technology, our Brauniger Compeo will always use both speeds side by side, regardless of which speed input is used or which type of speed is displayed. The pilot can set the speed he/she would like to see in the display. However, the pilot shouldn't be surprised if he/she sets the display as IAS, for example, that, at high altitudes and with calm air, the difference between groundspeed and airspeed will correctly show zero, although the groundspeed provided by the GPS will be much higher than the indicated airspeed.

### 5.4 Polar Curve and Required Speed

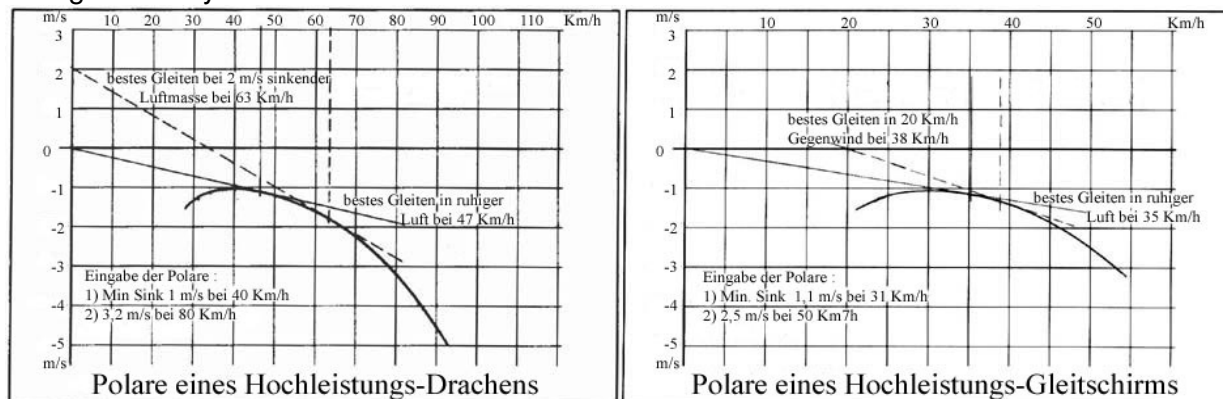
The polar curve of a wing is represented as a diagram. It shows the connection between flying speed and the associated sink rate directly. It provides information about an aircraft's ability to perform. From the polar curve the minimum sink rate and the associated speed can be read immediately. If one plots a tangent from zero on the diagram to the polar curve, it shows the best glide speed in calm air where the points meet. If one divides the speed by the associated sink rate, the result would yield the best possible glide ratio. (Both values

## Brauniger COMPEO

naturally have to use the same units).

When the Brauniger Compeo is turned on, the polar curve entered is calculated and stored in the unit's memory as a very precise chart. At every flight speed the unit knows immediately how strong the associated sink rate should be. If the sink rate measured by the vario, amounts to more than the charted value, the pilot will find him/herself in sinking air. If, for example, the vario announces, with the below mentioned paraglider, a sink rate of only 0.5m/sec when flying at 35 km/h, then the pilot needs to be located in air rising at  $1.3-0.5=0.8\text{m/sec}$ ; this is also shown by the netto vario. (See 5.2)

Because the Brauniger Compeo knows the rise and sink rate of the surrounding air mass, it can continually plot new tangent lines to the polar curve in order to indicate the speed of the best glide in any situation.



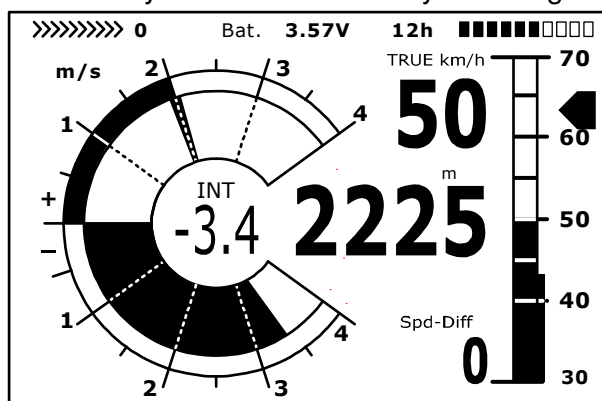
Polar curve of a high performance hanggliders: Polar curve of a high performance Paraglider

$$\text{Best L/D: } 47 / (3.6 \times 1.2) = 10.9$$

$$\text{Best L/D: } 35 / (3.6 \times 1.3) = 7.5$$

In the example for the hang glider above, the dashed line of the tangent is assigned a sink rate of the air mass of 2m/sec. The required speed related to this is 63 km/h. The required speed is the speed indicated which allows the pilot to fly constantly at the best possible glide ratio. He/she will, i.e. arrive higher at a valley crossing than his/her colleagues, who are only flying according to feel (during the same conditions).

The pilot flies, in the example to the right, much too slowly because he/she stays too long in the sinking air; he/she will lose both altitude and time. If the pilot flies faster than the instrument's recommended speed of 62 km/h, then he/she would arrive lower than his/her colleague, who is flying at the optimal speed of 62 km/h. In the paraglider polar curve shown above the dashed tangent line is drawn for a head wind of 20 km/h. The best glide is given at 38 km/h. If the pilot flies with an activated GPS, then this increase in the best air speed will automatically be taken into consideration by the required speed arrow.



In contrast to sailplane gliders for which the manufacturer's measured polar curve has validity for a long time, with hang gliders and more so with paragliders the polar curve is dependent on the age of the surface, the condition of the sailcloth, the weight of the pilot, his/her harness, and other factors. In order to realize the best possible speed during a later flight, it is necessary to input the polar curve as accurately as possible, which means, it should be determined by the pilot. It is obvious that such a measured flight will bring the best results in stable air conditions.

Particularly interesting are value pairs (speed and its associated sink rate) in the upper third

## Brauniger COMPEO

of the speed scale, in the area of the best glide and the speed of the minimal sink rate. (Maximum speed achieves nothing!) Each speed should be maintained evenly over several seconds. With the aid of FLYCHART- PC program, the data attained can be analyzed and the polar curve can be determined. This polar curve can now be entered manually into the Brauniger Compeo in the Set Mode.

Two polar curve points only are needed for the input.

- 1) The velocity (km/h or mph) and the value of the minimum sink rate (m/sec or ft/m).  
At this position the polar curve runs horizontally;
- 2) A pair of values in the upper speed range. (not at max. speed )

It doesn't make sense to mislead yourself; too good a polar curve will, in the end, require a speed that is too high. Because the input of both polar curve points always result in "true" values, the middle altitude at which the polar curve was flown has also to be recorded. In the polar curve chart, which is calculated by the instrument (a value pair for each km/h), all of the documented polar curve points are converted and saved as "Indicated". This means that this polar curve is valid for all altitudes.

### 5.5 McCready Theory - Optimized Speed to Fly

In contrast to the simple required speed which allows us to reach a goal with the least possible loss of altitude (which is synonymous with the maximum safety against landing out), one can get to a goal in the shortest possible time with the help of the McCready theory.

Therefore, competition or record pilots have to deal with this theory. If a pilot finds him/herself thermalling up in order to approach a goal (that can be a turning point, a landing field, or even the next thermal source), then he/she must consider whether to leave the thermal as early as possible in order to reach the goal at best glide, or whether it is better to thermal up higher in strong lift and then glide with higher speed to goal.

McCready has found that with a given polar curve, there is only one departure altitude that enables one to reach the goal in the shortest time. This departure altitude is dependent on the average climb in the thermal and the prevailing wind component. The speed for the final approach is primarily dependent on the average climb in a thermal.

Because the Brauniger Compeo knows all the parameters during thermalling, it can give the all clear to the pilot to leave the thermal to reach the selected goal as fast as possible.

The unit works, making the presumption that, on the glide path to goal, rising and sinking air neutralize each other and the wind remains constant. Because these conditions do not always exist, it is also dependent on experience and care by the pilot to climb to safety height above the glide path before leaving the thermal. This height above glide path, determined in advance, is continuously recalculated and displayed. In addition McCready discovered that, exactly as with speed to fly, the speed of the best glide depends on the sinking of the surrounding air mass. The same flight speed can also be used for the fastest possible arrival at your goal if one takes the average lift in a thermal instead of the sinking air mass. In other words, if the average climb in the last thermal was 2 m/sec, the pilot who will reach his/her goal first is the one who circles up high enough that best Speed to Fly, corresponding to a sinking air mass of 2 m/sec, can be flown directly to the goal.

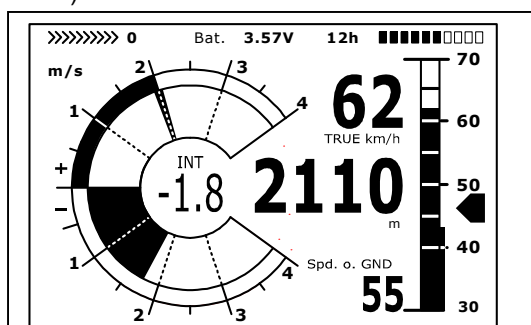
With earlier mechanical vario pilots constructed a ring, which was arranged to swivel around the circular vario scale. In the centre of this McCready Ring a thick arrow stood opposite the vario zero point of the vario. (This is the ring position for the best glide.) In the lower half of the ring, were the required speed recommendations. (in km/h). To use it, the pilot first had to turn the ring so that the arrow stood opposite the average climb mark on the vario scale. Next he/she was able to read the recommended speed behind the current vario indication. Then he/she corrected his flight speed following the recommendation, which of course

## Brauniger COMPEO

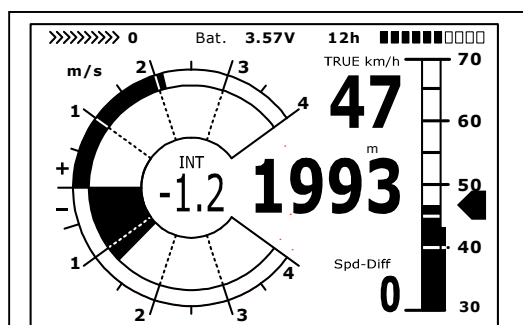
resulted in another vario indication and necessitated another correction.

With the Brauniger Compeo GPS, as with the 5000 instrument series, we are entering a new area for distance optimised Speed to Fly. The pilot does not need to touch the unit to change the McCready ring value (that is the average thermal climb); but this value will be shown to him/her as an active McCready indicator, displayed as a single arrow in the climb range of the vario scale. The indicator goes up when the pilot speeds up, or has less sink. The indicator goes down when the pilot meets stronger sink or flies slower. How much the value changes, depends first of all on the polar curve. The pilot has to adjust his/her speed in such a way that the indicator always stays above the value of the average climb. As the McCready indicator cannot only be seen, but also its value is conveyed acoustically by means of a variable tone (pulse/pause=1:4), the pilot does not need to watch the indicator continuously, but can react to vario changes of the McCready indicator immediately by adjusting his/her speed to the changing tone.

In order to offer the pilot additional help it is possible to set an acoustic dead band around the chosen McCready ring value (this is that position of the McCrdy pointer when the user is activating the McCrdy sound by pressing the key *McCr*  $\blacktriangleleft$ /Mark ) This means, the pilot flies correct according the McCrdy theory when the instrument is quiet. In the Setup menu Basic Settings/McCready one can adjust the wideness of this dead band. (Factory setting = + - 30 cm/s)



Examples of the polar curve from 5.4 hang glider. The McCready indicator with 2m/sec average climb rate corresponds to a flight speed of 63km/h; it is concordant with the indicator for the average thermal climb rate. The speed of the best glide would be 50 km/h here.



Examples of the polar curve from 5.4 The pilot flies with the best glide in calm air. The indicator for required speed corresponds to the flight speed. The McCready indicator is on 0. The average climb in the thermal was previously at 1.3m/sec

### A Case from Experience:

A pilot is crossing a valley at a relatively high speed. Due to a lot of sinking air, the danger exists that he/she may not be able to get over the ridge on the other side of the valley. So that the least amount of height is lost from this point on, he/she will reduce his/her speed until the McCready indicator is on zero. (This is the speed of the best glide too) And on the analogue speed scale of the Brauniger Compeo GPS, the indicator for best glide will correspond with the actual present speed. (See picture last page on the right )

If the pilot were to reduce his/her speed even further, the McCready indicator would run into the negative number range. This is a flight condition which must be avoided, because the pilot loses both time and altitude unnecessarily.

The Brauniger Compeo warns acoustically by a deep tone with rapid intervals, if this flight condition occurs. This happens mostly when a pilot flies in the area of "Best glide" and then ends up in sinking air. In this case he/she has to act very quickly.

Since every longer flight consists more or less of a sequence of thermalling up and gliding away, it is basically unimportant whether the gliding speed conforms with the expected climb

## Brauniger COMPEO

in the next thermal or the climb already achieved in the previous thermals. In order to give the pilot an indication of the average thermal climb, the grey marked double rim at the analogue vario displays the average value of the past 10 minutes of climb. This value is not influenced by passing through sinking air.

To fly at an optimized speed, we have to adjust our speed in such a way that the McCreeady indicator covers the pointer for the average thermal climb (Picture on the left). Of course arbitrary deviations from this indication are possible and the decision lies with pilot as to how these will be assessed. As a rather cautious and conservative pilot, I prefer to fly with the McCreeady indicator in a middle position between 0(= best glide) and the shown value for the average thermal climb.

All the functions described here can be imitated in the simulation mode. The measured values such as speed, sink or climb, flight direction and also ground speed can be varied by the user and their effects on the results can be observed on the LCD screen.

### 5.6 Final Glide Calculation

Here the GPS data and the McCreeady theory go hand in hand. (Please also read the section 5.5 McCreeady Theory) Principally it is about reaching a goal as fast as possible (of course it has to be logged as a waypoint in the list), or rather, to get a signal from the flight instrument of when the last thermal can be left to arrive at the WP as fast as possible. To be able to make a decision about this, the distance to this location (goal/waypoint) has to be known. The distance is calculated with the help of the GPS receiver. Additionally we require the altitude of the waypoint (is in the WP list) and the present altitude of the pilot. From this information the required glide ratio over ground (L/D req) that is necessary to reach the goal can be calculated. All other conditions such as wind and wind direction, flight speed and polar curve are not considered. The required glide ratio can be shown in the user defined fields: L/D req. Only when the flyable glide ratio (over ground) has to be calculated do the conditions just mentioned, play a role.

Basically the final glide (final approach) consists of two phases, to be considered separately:

- 1) Climbing in the last thermal
  - 2) The straightest possible glide path to goal
- 1) Let's assume that our pilot is circling under a cloud in a very good thermal, which provides him/her with an average climb of 2 m/sec. While circling he/she will naturally try to fly with the speed for minimum sink. Besides the polar curve table in the Brauniger Compeo GPS's memory, there is a second table calculated S2F (speed to fly), which knows the associated McCreeady speed for each average climb (30 sec average) in a thermal. To this belongs a glide ratio (through the air). If, while circling, the nose of the aircraft turns again and again in the direction of goal, the wind component and the glide ratio over ground can also be calculated at that moment.
- A zero wind has a wind factor =1; Tail wind >1; and Head wind <1. From the distance to goal and the glide ratio (over gnd) the Brauniger Compeo calculates the altitude which the pilot will lose on his/her glide path to goal. If we also add the altitude of the goal, (input for each waypoint) then we obtain the optimum departure altitude.
- One's own altitude is known; therefore, the flight instrument can tell by comparison (in the display Alt. over WP) whether we still have to thermal up to arrive at the fastest, or whether we are already above the fastest glide path. Of course it depends on the experience of the pilot whether he/she wants to leave immediately during a positive Alt. ov.WP indication, or to climb up further and take some reserve altitude. The Brauniger Compeo naturally does not know whether in the course of the glide path, lifting or sinking

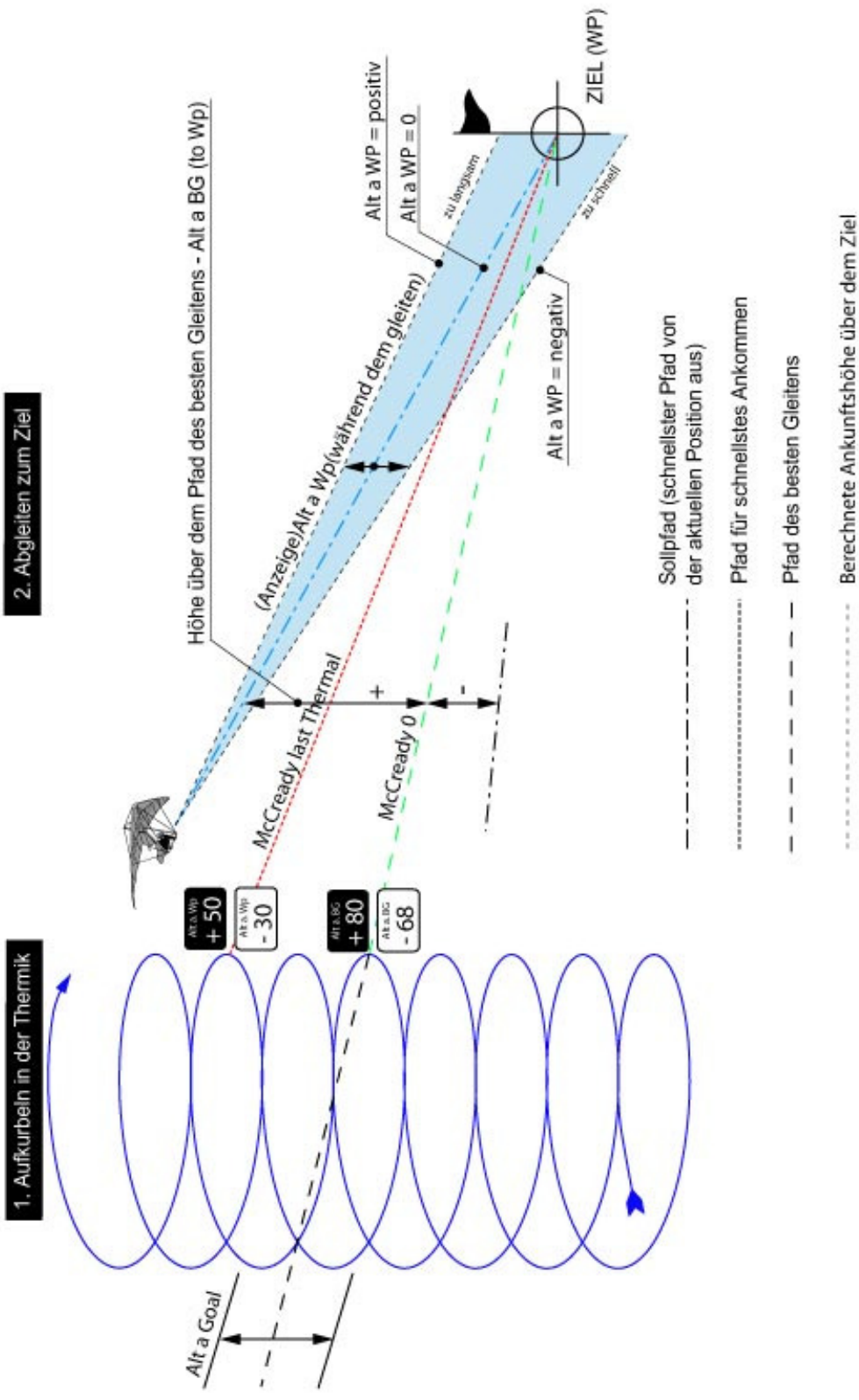
## Brauniger COMPEO

air masses have settled, or whether the wind will change. It takes into account the present wind and assumes that no rising or sinking air masses will be encountered.

### 2) Gliding to Goal

Our pilot has left the thermal at the moment when the Brauniger Compeo shows Alt a. WP = 0 and is flying towards his/her goal. He/she should speed up until the pre-calculated altitude over the goal is at 0 again. His/her McCreeady Indicator will be around 2m/sec. (In our example, he/she is now flying at approx. 62km/h.) He/she can even cross an area of sink, but will have to fly afterwards with a smaller McCreeady ring value. Under no circumstances should he/she allow the McCreeady arrow to go below 0. This means that with good lift in a thermal, before the departure to goal, certain altitude reserves exist because of the higher speed. If the average lift is small, the unit calculates with a glide speed just a little more than the one for the best glide; there are practically no altitude reserves and a small area of sink can force the pilot to land before reaching goal. In this case one should, before leaving the thermal, increase the safety altitude by 'tanking up'.

# Endanflug nach McCreeady



### 5.6.1 Safety Altitude ( = Alt above BG )

The display 'Alt a.BG ' indicates the pilot's current altitude above (or below) the best glide path that leads to goal. The Alt a.BG is also the altitude which he/she can safely lose when a sinking air mass is encountered during flight and still make it to goal.

The Alt a.BG can be continuously shown in the user selected fields; it is identical with Alt a. WP when the pilot flies with the best glide speed.

The fields Alt a.BG and Alt a.WP will switch to inverse display when become positive values during thermal circling. This information allows the pilot to leave the thermal to reach just the goal ( Alt a.BG ) or to reach the chosen WP with fastest glide (Alt a.WP )

See lower pic. Chapter 2.7 Goto.

### 5.6.2 Final glide calculation with several Waypoints in between

With this Version 2.21 we've added a new User field: Alt ab.Goal . Based on the best speed of glide, this is a precalculation of required height gains over all sectors of a route in front of the pilot to reach the goal (= the last WP of the route) . For each sector the belonging wind component is taken into account. Do to so the actual wind vector is used. This wind vector will be actualized always, when flying a full circle. Of course, the instrument does not know any future changes of wind.

### 5.6.3 Manual Windcomponent

In all our considerations up to now, the windcomponent Spd-Diff ( groundspeed - airspeed ) had been calculated automatically. There are some valid reasons instead of using this automatic calculated value to overwrite the internal windcomponent which is responsible for all speed to fly and final glide calculations with a fix manual input value.

1. The true wind outside a thermal always is stronger as the automatic detected wind by the instrument during circling up. How much stronger depends on the vertical speed of the thermal and if the pilot has already reached the thermals upper end. It is up to the pilots experience to enter manually a certain head- or tailwind.
2. During a final glide even small wind fluctuations ( also evoked by yawing) can cause differences of the precalculated arrival altitude. A manual input windcomponent will keep the result more stable.
3. A pilot flying in high altitudes knows by experience how the wind in lower stratus will change. He can take this into account in due time.

To enter manually the wind component press briefly *F1* ( next function) until HT wind = auto shows up. With the up / down keys your desired value can be set. But be aware: Don't forget to change back to automatic wind component when changing your flight direction.

## 5.7 TEC Total Energy Compensation

What's the meaning behind this expression? Is this valid for sailplanes and what can hang gliders and paragliders do with it? If a cyclist rides up a small hill without pedalling, it becomes clear to everyone that he/she gained this difference in altitude from his own momentum. It is precisely this which the TEC explains; he/she converted his/her kinetic energy into height. If he/she rides down the hill again, the exact opposite happens; he/she converts the altitude into speed (distance). His/her total energy remains constant. For pilots the same applies.

If obvious gain in altitude can be achieved by excess speed reduction, the use of TEC always makes sense. A hang glider can well gain 20 or more metres of height when pushing out the steer bar at high speed. It would be a big mistake if this altitude gain were shown by the vario and would even perhaps tempt the pilot to turn. A good flight instrument can

## Brauniger COMPEO

suppress these vario swings caused by speed changes. A vario is only supposed to indicate climb or sink caused by the surrounding air and not by conversion of speed to altitude.

When flying according to Speed to Fly, where speed adjustments are continuously necessary, the TEC is of great help. The TEC also steadies acoustics and vario when centring in a turbulent thermal. The penetration effect of the TEC can be adjusted in the Basic Settings/TEC. From experience we recommend values between 60 and 80%. Complete control (100%) has not proved efficient, because even horizontal wind turbulences can influence the TEC and make the vario a bit jumpy.

### **5.8 New Regulation for Record Flights or De-centralized Competitions**

Since the proof of a completed flight depends entirely on the GPS recording, it is important to ensure that the GPS receiver receives satellite signals before take off. Please turn on the Brauniger Compeo several minutes at least before take off so that even pre-flight events are included in the recording. (Please also read 3.2 flight recording)

A barogram is also included in the recorded IGC data of each flight. Photographic proof and confirmation by flight observers are no longer required for national performance flights. The data can be sent directly to the judging committee (in Germany the DHV) via Internet. (See also 4.1 Data Exchange by PC)

### **5.9 Proof of Flights - Security against Manipulation**

The FAI (Fédération Aéronautique Internationale) and its subsidiary IGC (International Gliding Committee) requires a recording format, which, besides the continuous recording of time, and position, also includes the flight altitude. In so doing it replaces the standard barograph. When transmitting flight data to the pilot's PC, a so-called IGC file is created, which receives a digital signature authenticating the flight data, making the file fraud proof. If only one bit in the flight data were changed, the signature would no longer correspond, and the judging committee would be aware of the manipulation.

### **5.10 Digital Signature and OLC `Registration**

The constantly growing popularity of decentralized competitions is still going on. Up to now, 26 countries have signed the new agreements. (Online Contest) These agreements state that every flight submitted via the internet, has to follow the IGC format and must have a digital signature. All flights have to be recorded in WGS84 map data format. Therefore, from now on we support only WGS84.

In order that GPS receivers generally available on the market can be used, relevant evaluation programmes like Compegps, Gpsvar, Maxpunkte or Seeyou calculate a digital signature to allow submission of flights in the desired form. However, a signature created by a PC provides limited safety against manipulation. Looking further ahead this signature will most certainly have to come from the GPS data logger.

At the automatically or manually end of a flight this digital signature is created, in the Brauniger Compeo and added to the logger's memory as a so called G- record. A message is displayed "Generating Digital Signature" in the Info Field of the instrument. As this calculation is very demanding it may take several minutes following a long flight with a short scan rate set. Please wait until the relevant display disappears.

**In case the OLC does not accept the flight data which were sent, call up again the Flight - Analysis and recalculate the digital signature again by brief press of F2**

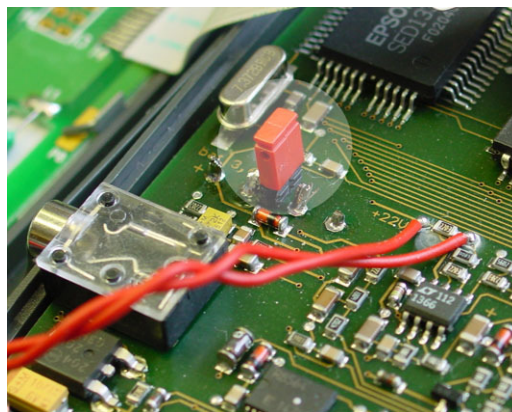
## 6 Miscellaneous

### 6.1 Landing on Water

If you are forced to land on water, water can enter the instrument. However, there is a chance to save the instrument or at least parts of it. Once water has entered the GPS module it is definitely lost.

To save other parts proceed as follows:

- a) Open the instrument at once.
- b) Pull off the red Jumper lead next to the beeper connection cable. This separates the circuit from the power supply (see picture).
- c) If the landing was on salt water – rinse the circuit board and all areas affected, with clean, fresh water. Dry the instrument carefully with warm air. (Hair dryer)
- d) It is also recommended that the flat key-pad cable is removed.
- e) Return the instrument to BRAUNIGER for readjustment and a final check.



**The guarantee is void after a Water Landing.**

### 6.2 Guarantee and liability

Our instruments carry a 24-month guarantee. However, physical damage such as a broken casing or glass breakage as well as damage resulting from water landings are excluded from this guarantee. Brauniger can accept no liability for faults arising from any abuse or unapproved use of your instruments.

#### WARNING

In very rare cases it can happen that a flight instrument does not provide any data at all or the data is incorrect. BRAUNIGER GmbH will not be held responsible for accepting any damage claims arising from a malfunctioning unit. Responsibility for ensuring the safe execution of his/her flights lies with the pilot alone.

### 6.3 Technical Data

Measurements:	178 x 95 x 40 mm
Weight:	425 grams (without harness)
Electrical supply:	Nickel metal hydride accumulator 4.5 Ah; 3.6V
Battery life:	> 20 hrs
Altimeter:	Max. 8000 m; 1 m (3 ft) steps
Variometer:	Analogue +/-8 m/s; (1600 ft/m); 0.1m/s (20 ft/m) steps
Variometer	Digital +/-70m/s; (14.000 ft/m); 0.1m/s (20 ft/m) steps
Speed (pitot pressure)	Analogue 30 - 110 km/h; (or mph or kts) 1 km/h steps
	Digital 30 - 150 km/h (or mph or kts)
Speed (wind wheel)	Analogue 30 - 110 km/h (or mph or kts)
	Digital 0 - 150km/h (or mph or kts)
Waypoints:	200 WP
Routes:	20 routes with max. 30 WP in each
Max. memory time:	110 hrs flying time at 20 sec intervals

## Brauniger COMPEO

Number of track log points: 24 000  
Number of registered flights: 100  
Number of restricted areas 1 free, 20 or 300 with costs

Data memory and transfer according to the IGC format  
Screen resolution 240 x 320 pixel (=76'800 pixel)  
Operating temperature -15...45 °C

Brackets for hang gliders and paragliders are available.

The technical details may be altered without notification. Software upgrades can be made by downloading the latest firmware version from our homepage.