

# GPS FLIGHT DATA RECORDER ZANDER GP 940

## MANUAL

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**Warning:**

The recorder box must not be opened! A security feature will inhibit any valid recording after box was opened! The standard two year warranty is expired when box was opened!

## 1. Introduction:

The flight data recorder consists of one housing with these functions inside:

- GPS receiver
- barometric altitude sensor
- clock
- electronics for recording and storing data
- vibration sensor (for glider with engines)
- one rechargeable battery for data transfer between recorder and IBM compatible PC, to cover short supply power breaks and for data retention.
- one Lithium battery for data retention, if rechargeable battery is empty.

Connections to the outside are: GPS antenna, power supply 12Volt / 170mA, marker push button, data connection to glider computer SR940 or SR820D.

The GP940 is intended to be used as an option for glider computer SR940; together with this glider computer the GP940 has these additional features:

- GPS data transfer to SR940
- automatic photo sector signal to GP940
- declare and transfer a task from SR940 to GP940
- waypoint lists and routes can be entered into recorder and brought to the glider, where these informations can be transferred to SR940
- transfer of nearest airfields from a large list in GP940 to SR940 (not yet ready)
- saving and restoring configuration data of SR940
- transfer of additional data from SR940 to recorder which are included in the stored flight data: indicated airspeed, wind information, next waypoint selected.

If the glider computer SR820D is used together with the GP940, there will be only a display of GPS information. All other functions mentioned for the SR940 are not available with SR820D.

The GP940 also can also be used as a stand alone system without any glider computer connected. But then the only information the pilot gets is if the GPS receiver has reception or not (by external light emitting diode (LED) or by audio signal when pressing the marker button). There is no information on reaching waypoints.

## 2. Installation into glider:

The GP940 recorder should be mounted removable; a mounting fixture is delivered with the recorder.

It is recommended to locate the recorder at a place where the audio signals of the recorder can be noticed. When the recorder is used in connection with a glider computer SR940 or SR820, the audio signals are not that important.

If the recorder has the option „accelerometer / G meter“, then the box must be mounted horizontally (the label with serial number upwards).

If the recorder is used in a glider with engine, the recorder box must be mounted using the original fixture which must have a good mechanical contact to the fuselage to recognize the running of the engine. Besides this the recorder should be mounted in a place which does not allow the pilot to remove the recorder in flight.

The power supply to the recorder is switched by a safety switch which must be lifted when changing between on and off.

To enter a special mark into data recording (to remember a special position) there is a marker pushbutton in the instrument panel; pressing this button must make a connection to minus of supply power. If the standard recording rate of 4 seconds per sample is accepted as sufficient, the marker button can be left out.

To make the power supply for the recorder safe, it is recommended to use always two batteries with a switch to change from one battery to the other. The batteries mostly used in gliders can fail or deteriorate at any time without warning. Besides this you should expect during competitions or when traveling, that the main power may break down during night which leaves you with partly charged batteries in the morning.

### Important for motor gliders:

There are motor glider models which use only one battery for both engine and avionics. In this case the GP940 and all other avionics like glider computer and radio must be switched off while extending, starting or retracing the engine. Otherwise electronic parts of GP940 and avionics may be damaged.

The GPS antenna is mounted horizontally (connector downwards). The antenna must have a undisturbed view all around. Metal, carbon parts and human body will hold off GPS signals from the satellites, glas fiber and acryl glas will not. A good place for the antenna is ontop of the hood of the instrument panel.

For cabling see cabling diagrams at the end of this manual.

### 3. Turning on the GP940:

After turning on supply power to the recorder there is an acoustic signal from the recorder to show that it is operating:

— • • = flight data recorder active

The red light (light emitting diode) shows:

• • • • • • • • ... = no GPS reception

After about 2 minutes (glider away from buildings, GPS antenna unobstructed) the light emitting diode changes to:

• • • • • • • • ... = GPS reception

Checking the GPS mode of the recorder can also be done by pressing the marker button:

press marker button; reply: — = no GPS reception  
press marker button; reply: • • = GPS reception

With a glider computer connected, the checking of GPS operation is done by watching the displayed GPS information: if GPS information is present then the recorder is functioning properly.

As soon as the recorder is supplied with power, data recording is activated. Every four seconds a point is stored with GPS position (if GPS is operating), altitude, airspeed and engine vibration. So even without GPS reception, information is stored continuously.

There is no recording during PC operation and during charging with the charger.

Recording within the GP940 is done in that way that the last 40 hours of recording time are always kept in the recorder. If flights are overwritten, these are always the oldest flights which are deleted.

Begin and end of any recording are stored in a separate list within the GP940. This list will keep the last 200 records. With GPS reception, times for takeoff and landing are automatically inserted into this list. This list can be read as „flight log“ from the recorder to PC.

If recorder power is turned off, there is a beep after 8 seconds (= turn off beep):

— = recorder turned off

The recorder is supplied by an internal battery for several seconds continuing operation before really turning off to cover short breaks of the supply power.

#### **Important:**

**When GP940 is turned off, there must always be the „turn off beep“! If there is no „turn off beep“ then recorded flight data are invalid for FAI purposes. The „turn off beep“ may be missing when the internal rechargeable battery is faulty.**

## 4. Connecting GP940 to PC:

Before the GP940 is used for flight data recording, personal information like name, type of glider and so on should be entered into the recorder by PC.

The PC must be an IBM compatible Personal Computer (DOS 3.0 or higher, minimum 512 KB of memory).

Connection between GP940 and PC is provided by program ZANxxE.EXE (xx = version number 00...99, E = English). To get this program, selfunpacking file GP940EN.EXE is copied from diskette to a new, empty directory and started. Now several files are created together with ZANxxE.EXE. After unpacking, GP940EN.EXE may be deleted to save space on hard disk.

Now connect GP940 with the 9-pin extension cable to serial port COM1 at the PC. At GP940 use the 9-pin socket on the front plate besides the red light. The cable used for this is a standard extension cable and is normally called „monitor extension cable“.

### **Important:**

**Use only a standard 9-pin extension cable between GP940 and PC!  
The „data cable“ used to connect SR940 to PC cannot be used!**

During PC operation the GP940 power is supplied by the internal battery of the recorder. This battery allows PC operation for about 2 hours. If this battery is empty, the charger or the power supply of the glider can be used as well.

To enter personal information into the recorder, select „FDR functions“ from the ZANxxE.EXE main menu, then select „write personal information“.

The recorder will answer with an audio signal:

— • • • = **PC operation active**

Every two seconds the red light of the recorder shows:

• • • • • • • • ... = **PC operation active**

Now you can enter name, type of glider and other information. To be sure, read back the information you have entered.

To read flights, select „FDR functions“ and then „read flight data“ from the menu. On screen the latest 10 recordings are shown. If the last line shows the flight which you want to read then press the ENTER key. If you want to read an older flight then use CSR keys before pressing ENTER.

Flights can be read as often as you want. Flight data will only be deleted by new records after 40 hours of operation. Records which do not show takeoff and landing times are no flights; the recorder was turned on on the ground and was turned off again before a flight occurred.

Each flight read from GP940 is written into a file with extension \*.ZAN . The file name consists of date, FDR serial number and the flight number of the day:

67AZB251.ZAN means:            1996 / July / 10 / ZANDER / B25 / flight number 1  
(numbering system: 1...9,A...Z)

To avoid that flight data files are changed later for cheating, there is a safety feature included in every flight data file from GP940. At the end of the flight data there are some additional informations, which are related to all flight data since the record starts. With a „safety check“ the flight data are checked

against this additional information; this shows the validity of the recorded data. By the way, only a part of the control information is used for this check on the PC, another part can be used at authorized places to perform another safety check.

To view a flight on the screen, program WinFDR must be installed. This is a WINDOWS program which requires WIN 3.1 or later. Installation is done automatically by running WINSETUP.EXE from WINDOWS. Then start WinFDR and open the desired flight data file. With „Options“ you can select the display mode, with „Help“ you get information if you need.

Other evaluation programs (like program CAL.EXE) require a special format as described by the FAI / IGC. After reading flight data in GP940 format (extension \*.ZAN), these data can be converted to IGC format (extension \*.IGC). As this format needs about 10 times more data and 10 times more transfer time from GP940 to PC, the GP940 uses its own format.

The GP940 has some special functions for glider computer SR940. Waypoint lists and routes can be loaded into the recorder and can be retrieved at the glider by SR940.

A data base with up to 4500 airports can be loaded into the recorder; a selection of the nearest airports can be transferred into SR940.

All SR940 configuration settings can be saved from SR940 to the recorder and can be restored back. So several pilots sharing a glider may load their own settings before takeoff.

Important: all these inputs to GP940 have no influence to the recorder part of GP940! None of the waypoints or routes entered into GP940 are used for task declaration or for recording.

## 5. Charging internal battery of GP940:

The recorder has a rechargeable battery inside. This battery is used for two functions: first this battery covers short supply power breaks (to avoid that a flight record is cut into parts) and second to supply power for GP940 during PC operation.

During flight this battery is continuously recharged by glider supply power; so this battery always should be in a loaded state.

But before first use and before the gliding season starts or after longer periods with no flying (after periods of more than two months without recharging), the internal battery should be charged once with the GP940 charger. Instead of the original charger any other charger, which is normally used for 12 Volt glider batteries, can be used too (output voltage 13...15 Volt / >60mA). The charging program is controlled by GP940.

### **Important:**

**Normal charging or recharging works only if the outside temperature is more than +10°C! Between +10°C and 0°C charging and recharging is done only by half of the normal charging current, under 0°C charging is turned off!**

The 9-pin plug of the charger is plugged into the connector at the rear side of GP940 (besides the antenna plug). The charging program has several steps:

When charging starts, the recorder delivers this audio signal:

— • • • • = charging program starts

The light emitting diode informs about the actual charging program step (every 2 seconds):

- • = charging battery (for 14 hours)
- = battery was charged for 14 hours without interruption; charging battery continues

The older FDR version 1.16 has two additional steps in the beginning when charging starts:

- • = charging battery (for one minute)
- • • = discharging battery (for about one hour)

Charging also should be done if the internal battery was discharged by other means.

The battery will be discharged:

- if PC operation is done for a too long time
- if the glider power was not turned off overnight by mistake: when external supply voltage drops below 6 Volt, the internal battery of the GP940 will be discharged.

**Important:**

**When GP940 is turned off, there must always be the „turn off beep“! This shows that the internal battery is o.k. . If „turn off beep“ is missing, recorded flight data are invalid for FAI use!**

If there is no „turn off beep“ after charging, then the internal battery is faulty and must be replaced by the manufacturer.

**Producing „turn off beep“ in spite of faulty internal battery:**

1. After landing do not turn off glider power; recording of FDR continues.
2. Supervised by OO (official observer) connect a laptop to FDR with glider power still on and select any FDR function (like „read flight data“). The FDR will produce a turn off beep after 8 seconds and will switch to PC mode.
3. Disconnect laptop and turn off glider power.

## **6. Entering data from glider computer SR940:**

If the recorder is connected to glider computer SR940 and if the SR940 has the latest program version to allow this (version 9606 or later), data can be exchanged between recorder and SR940. The recorder power supply must be turned on.

The SR940 has a special text page to communicate with the GP940; this text page has several sub-menus:

```

21:FD-Recorder
1= task
   for 21.05.96
00= takeoff at:
347=TANNHAUSEN
declare flight?
   =NO

```

The route selected on text page 11 of SR940 can be transferred to GP940 as a „declared task“. This transfer must be done before takeoff to be valid. The turnpoints are selected on text page 11 only; selection of turnpoints must be done according to FAI rules in this sequence: takeoff point, departure point, turnpoints, finish point, landing point. If takeoff point and departure point or finish point and landing point are the same, the waypoint name must be entered twice each. So an „out and return“ flight consists of 5 waypoints.

The route cannot be programmed on this text page 21; however it is possible on this page to check the correct sequence of waypoints by advancing the two digit leg number.

When a task is declared according to FAI rules, the day of the intended flight must be entered together with the task. A task declared via SR940 is only valid for the same day (the date visible on text page 21).

If cursor is moved to „NO“ and toggle „+1“ is pressed, then „YES“ is shown and the task is written into GP940. Within the recorder the task data get a time and date stamp using the internal clock of GP940 to mark when the task was declared. At the same time the task is copied into the flight data.

After declaration of the task, the recorder and SR940 may be turned off. When power is applied again to the recorder, the task data entered last are copied into the flight data record just when recording starts.

A declared task can be changed as desired up to takeoff time; after takeoff it is still possible to enter tasks but these declarations are of course invalid, as the time of declaration is later than the takeoff time.

Attention: when recording starts, the task which is stored within the GP940 is written to the flight data record. But if the task is old, the day of the intended flight will not be the day of the actual flight; so an old task is invalid.

The following submenus allow transfer of waypoint lists, routes and configuration data between GP940 and SR940. When saving and restoring configuration sets it should be noticed, that sets no. 1..6 can be read to SR940 but only sets no. 1..3 can be saved from SR940 into GP940. So sets no. 4..6 cannot be overwritten by SR940, but sets 1..3 must be brought to 4..6 using a PC and program ZANxxE.EXE .

```

21:FD-Recorder
2=read WPs:
  FDR start:=001
  FDR end:  =100
    to SR: =200
      =NO

```

```

21:FD-Recorder
3= read routes
  from FDR:
    set no. =1
      =NO

```

```

21:FD-Recorder
4=read config.
  from FDR:
    set no. =1
      =NO

```

```

21:FD-Recorder
5=next airfields
  from FDR:
center:
197=KOENIGSDORF
500WPs to SR=400
   =NO

```

```

21:FD-Recorder
6=write WPs:
  SR start: =001
  SR end:   =100
    to FDR:=400
      =NO

```

```

21:FD-Recorder
7=write config.
  to FDR:
    set no. =1
      =NO

```

## 7. Preparing waypoints and routes for SR940 / GP940



The SR940 glider computer has a memory for 990 waypoints. The GP940 offers the possibility to carry waypoint lists and routes to the glider. At the glider they can be transferred to SR940.

Organization of waypoint list (recommendation):

001...200	200 Turnpoints
400...899	500 Airfields

or with airspace information:

001...200	200 Turnpoints
201...990	790 Airfields and airspace points

Turnpoint list:

Must contain all turnpoints used for routes (tasks). If airfields are to be used as turnpoints which are also present within the airfield list, these airfields should be entered or copied into the turnpoint list, but without the airfield tag ( no '1' at first position of waypoint info line).

Airfields and airspace points:

Airfields (tagged '1') are used for the SR940 function „nearest airfields“. Airspace border lines are represented by dots (SR940 version 9606); these dots (tagged '\*') are shown on the moving map „nearest positions“. If airspace information is required, both airfield and airspace dots are loaded into SR940 together.

Prepare turnpoint list and load into GP940:

(GP940 version 1.16 or later)

Use program WPFDR\_E.EXE to write, change, insert or delete turnpoints. Then select routes with these turnpoints. Turnpoint list and routes can be loaded directly from this program into GP940. It is practical to load the turnpoint list always into the same range independent of the actual number of turnpoints (e.g. 001...200). Five sets of routes with 8 routes each (= 40 routes) can be loaded into GP940; all routes must use the same turnpoint list. At the glider turnpoint list and routes can be transferred to SR940 by SR940 function „read waypoints and routes from FDR“. If a turnpoint list is unchanged, only routes are loaded and transferred.

Load data base into GP940:

(GP940 version 1.21 or later)

Up to 4500 waypoints (e.g. large airfield list) can be loaded into data base memory of GP940. At the glider a selection of waypoints can be requested by SR940 with function „read nearest airfields from FDR“.

For airfield information only, data base file AIRFLDxx.WZ (4100 entries) is loaded with program ZAN-xxE.EXE into GP940. At SR940 a center point is selected (e.g. 999=actual GPS position) and „500 WPs to 400“ is set. After 3 minutes the 500 nearest airfields are loaded to 400...899. It is important to load always the same number of waypoints to the same range to avoid deleting old waypoints before transfer.

If airspace information is desired too, so data base file AIRALLxx.WZ is to be used. This file is a combination of AIRFLDxx.WZ and AIRSPCxx.WZ files (8200 entries; if not yet present: run AIRALLxx.EXE to create it). As this file is too large for GP940 data base memory , a selection 4500 waypoints should be done. This is done with program WPNEXT\_E.EXE; you have to select the source file (= AIRALLxx.WZ), to enter the file name of the selected waypoints (e.g. NEXT.WZ entered by hand), a center point (latitude, longitude in degrees, minutes) and the number of waypoints (= 4500). This file can be loaded into GP940; it represents airfields and airspace points of about 600km radius. At the glider the nearest 790 waypoints can be requested by SR940; this gives airfield and airspace information of about 130km radius.

## 8. How to use GP940:

Flight data recorder ZANDER GP940 is approved by FAI since November 10. The original text of the approval can be found at the end of this manual.

Here are some suggestions for competition organizers and pilots and for certification of FAI flights:

### Flights during central competitions:

Before takeoff waypoints must be loaded into SR940 / SR920D. The coordinates of the waypoints must be exactly those which are used for the given tasks. At the SR940 the correct type of photo sector and photo radius must be selected and checked. Name, competition class and competition sign should be entered into GP940 before.

The recorder must be turned on in time before takeoff, so that GPS reception is already active before takeoff.

In the air any point can be stored accurate by one second when the marker button is pressed. These marks are in addition to the standard 4 second fix interval. Pressing the marker button also initiates a sequence of 10 more measurements with 1 second interval (if GPS is operating).

If the marker button is pressed, the audio signal from GP940 gives additional information:

- • (double beep): the last 6 GPS fixes were without interruption
- (single beep): no GPS or not yet received 6 uninterrupted GPS fixes

If SR940 announces entering the photo sector (photo angle less than 40°), an automatic mark signal is transmitted to the recorder, which has the same result as pressing the marker pushbutton manually: the GP940 replies with the audio signal and 10 fixes with 1 second interval are recorded. This automatic mark signal is transmitted only once when entering the photo sector.

Of course the marker button can be hold down continuously to get 1 second interval fixes as long as the marker pushbutton is pressed.

After landing the recorder is turned off and is removed from the glider. The competition organizers will read the flight data from the recorder and evaluate the flight. From the standpoint of data security, there is no objection that the pilot himself or any other person reads the flight data out of the recorder and takes these data on a diskette to the organizers.

If the internal rechargeable battery is faulty, the flight data will be without security data. If a security check is performed later, these flight data will be named invalid. But if flight data are read directly from the GP940 by the organizers, these flight data should be regarded as valid for competition use.

If the internal battery is faulty or weak, the charger or glider power must be used during data transfer to a PC.

### Flights in a decentralised competition:

Before takeoff there should be done a written declaration signed by an official observer. This flight declaration must contain:

date of the intended flight  
full name of the pilot  
type of glider, competition class, glider registration number  
used GNSS flight data recorder: manufacturer, type, serial number

The declared task can be written on the same paper or the flight declaration is marked with „task as written into flight data recorder“. If the task is done by writing then the task within the recorder should be ignored. If a task is declared by writing, the coordinates of all given points must be on the declaration. Only the coordinates are used for evaluation, the turnpoint names will be ignored.

This declaration is signed by the official observer and the pilot with date and time. The time is important to find out the latest valid declaration if several task declarations were done by writing.

The official observer takes care, that the named pilot with the named glider had the named recorder on board when taking off. The takeoff time must be noted.

If the task in the recorder is the valid task, this task can be changed up to the time of takeoff. The task change can be done by SR940 or by PC.

After landing the route flown is written on the flight declaration and it must be marked if that was the declared task. The pilot signs this statement.

Takeoff time and landing time are also written to the declaration. These important times must be confirmed by an official observer, as these times will tell, if the named recorder was used on this flight. If the flight ended with an outlanding then only the takeoff time will be confirmed.

Flight data can be read by any person from the recorder. A diskette with these data and the written declaration is sent to an authorized evaluation center, where the flight data are checked for validity and the flight is evaluated.

The personal information written into the recorder should be ignored as pilot and glider information is already part of the written declaration. This would allow that the recorder can be used in other gliders or by other pilots who have no PC readily available to change these information.

The procedure suggested here allows all official observers to certify flights made with GP940 even if they are not familiar with PCs.

FAI rules allow that task declarations can be made on paper or by entry into the recorder or both; the valid task declaration is always the last before takeoff. But this requires that the time must be written on the declaration paper when signing it. To avoid misunderstandings it is recommended to use only one type of declaration: by writing or by entry into the recorder.

FAI flights:

For FAI flights (world records, badges) with GNSS flight data recorders these informations are required:

Date of declaration  
Time of declaration  
Date of intended flight  
Name of the pilot  
Signature of the pilot  
Type of glider  
Registration number of glider

Manufacturer and type of flight data recorder = ZANDER GP940  
Serial number of flight data recorder  
Geodetic datum used = WGS 84

Task: (Name and coordinates)  
takeoff point  
departure point  
turnpoints  
finish point  
landing point

Barometric pressure (QNH) at takeoff time  
Elevation at takeoff  
Takeoff time

Landing point  
Landing time  
Barometric pressure (QNH) at landing time

Name and signature of official observer

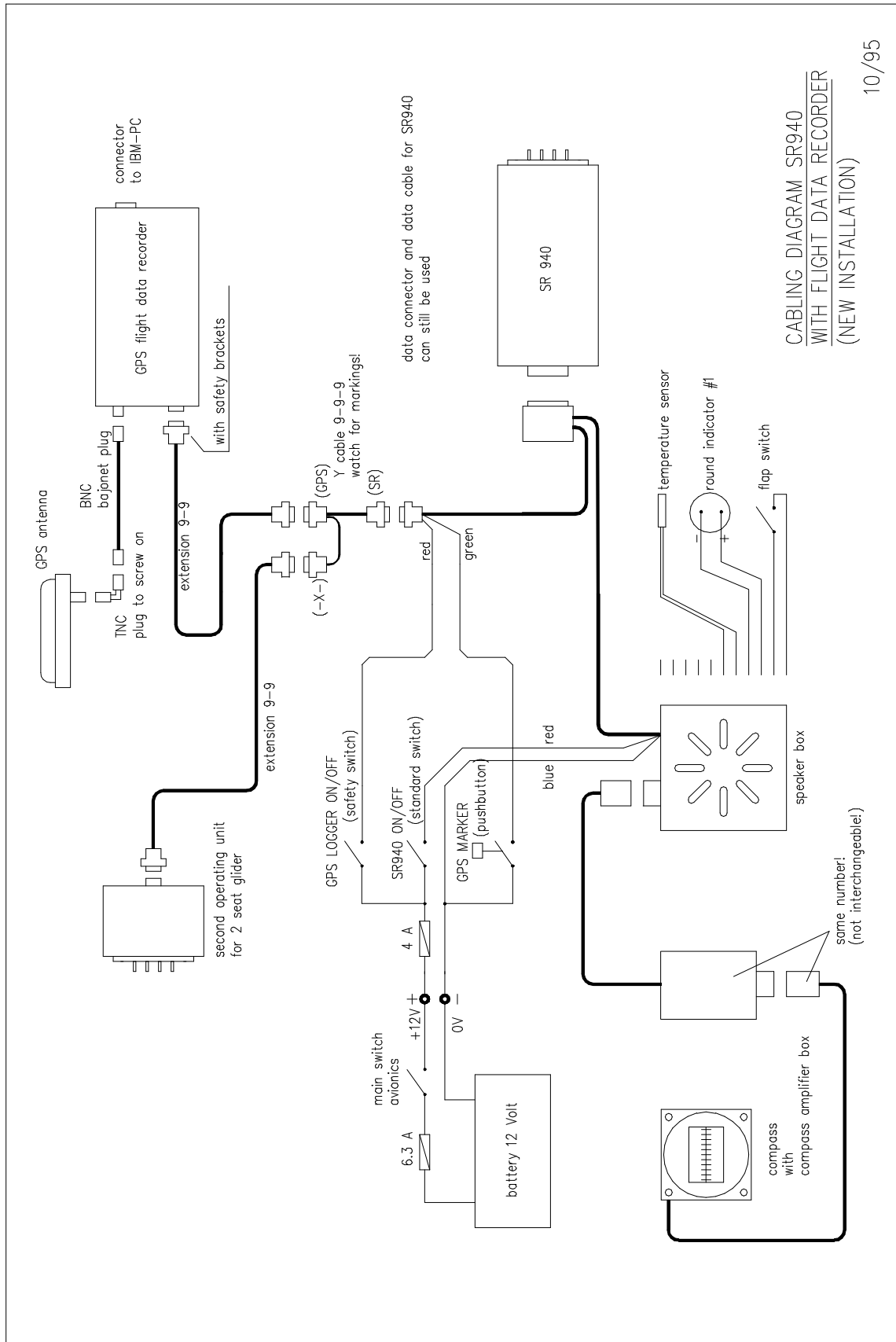
Valid calibration table of flight data recorder altimeter

## 9. Technical data:

mechanical dimensions: weight	92 x 50 x 200 mm 750 g
external power supply supply voltage for charging	10...14V / 170mA 13...14V / 40mA
operating temperature	-20...+60°C
GPS receiver geodetic datum used	8 channel WGS-84
Flight data recording:	
recorded signals	time, barometric altitude, GPS position, GPS altitude DOP, 2D/3D, engine running sensor with SR940: indicated airspeed, measured wind, next WP
recording interval	4 seconds 1 second when pressing marker pushbutton
barometric altimeter: range resolution	-500...+20 000m 1m
resolution of position	0.25 angular seconds
RAM memory recording time recording rate	0.5 MB / 1.0 MB optional 40 hours / 120 hours optional typical 6.5 KB/hour
engine running sensor	vibration (sensor is standard in GP940)

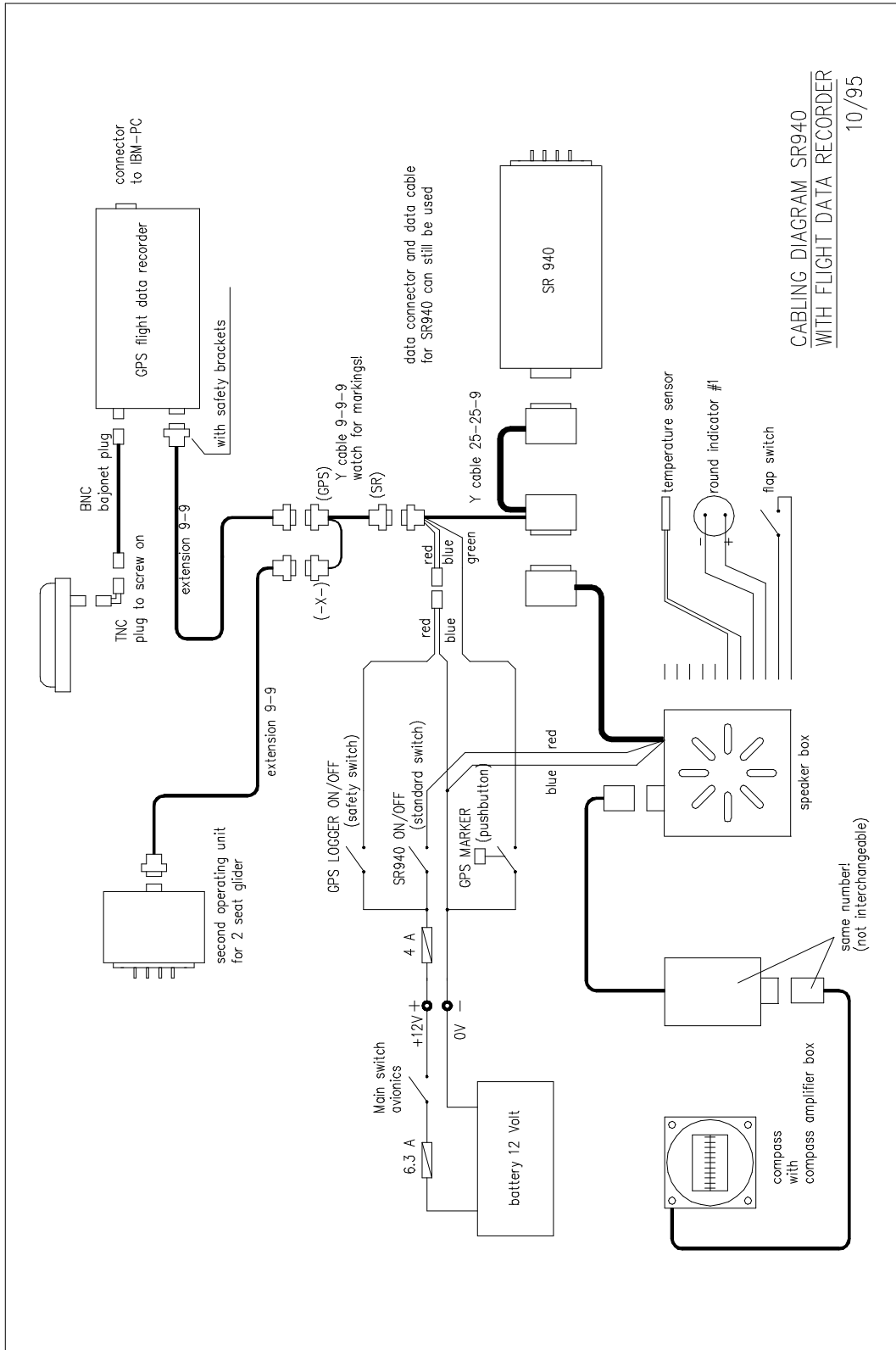
# 10. Wiring diagrams:

## GP940 with SR940 (new version)



**Wiring diagrams:**

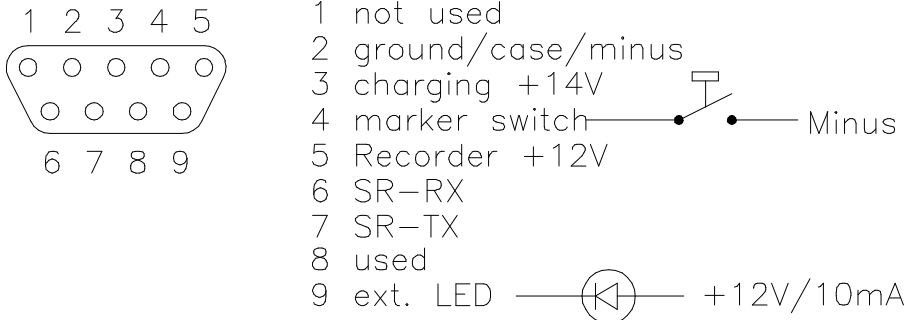
**GP940 with SR940 / SR820D (upgrade version)**



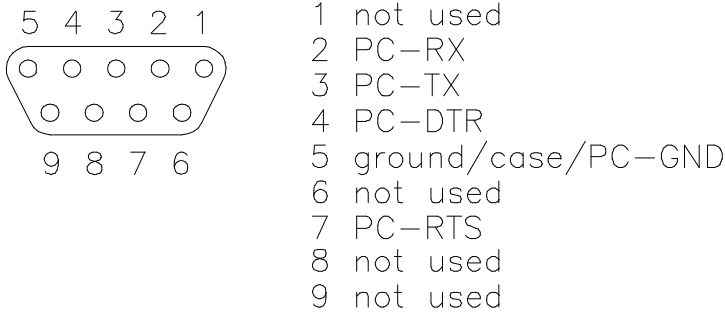
CABLING DIAGRAM SR940  
WITH FLIGHT DATA RECORDER  
10/95

# 11. Pin assignments of connectors:

external power supply, connection to SR940



connection to PC





## 12. Calibration chart for altimeter of GP940:

According to FAI rules an altimeter calibration chart of the recorder must be used for altitude evaluation of recorded flights.

If altitude differences are relevant to a claimed flight, the calibration chart must not be older than one year or a calibration must be done within one month after the flight. Altitude differences are important for all flights, where the difference between release altitude and landing altitude is not much less than 1000m and for altitude gain flights. These flights are normally all aero tow flights and the 3000m / 5000 m gain flights.

If absolute altitude is concerned, the calibration chart must be not older than one year and a calibration must be done within one month after the flight. This is important only for absolute altitude world records.

The calibration chart can be done by the manufacturer of the recorder or by any institution certified by the national aero club.

To get an altitude trace of the GP940, the recorder must be put into a vacuum chamber and be supplied with 12V / 170mA (minus = pin 2, plus = pin 5 of 9 pin plug at the rear of the box besides the antenna connector - see 11. Pin assignments of connectors). The GPS antenna is not connected.

When power is applied the GP940 starts recording. Now the ambient pressure is changed in steps from 0m to 11000m. As the recording rate of the GP940 is one sample every four seconds, the ambient pressure should stay enough stable at each step to get a good reading.

If it can be managed to operate the marker switch from the outside, the altitudes can be marked with one second accuracy. These marks can easily be found later in the data file for evaluation.

After all altitude steps were recorded, a PC can be connected to the 9 pin socket at the front besides the red light. If the internal rechargeable battery of the GP940 is charged, the power supply can be disconnected or not. If the internal battery is empty, the power supply must be on during data transfer to the PC. For data transfer use program ZANxxE.EXE or DATA-ZAN.EXE .

Flight data can be evaluated using WINDOWS program WinFDR or the flight data file \*.ZAN is converted to IGC file \*.IGC . The IGC file is an ASCII file where altitude readings can be found easily. If the marker switch is used, the altitude belonging to the mark is always the last reading before the mark. Each „B“ line represents a reading:

B hhmmss ggmm.ddd N gggmm.ddd E V hhhhh ggggg iii nnn rr  
(hhmmss = time, hhhhh = altitude reading)

**THE FAI INTERNATIONAL GLIDING COMMISSION (IGC)  
GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)  
FLIGHT RECORDER (FR) APPROVAL COMMITTEE (GFAC)**

To: FAI for distribution to NACs and IGC email & hard copy lists  
Internet newsgroup rec.aviation.soaring  
Copy: Manufacturer concerned

10 November 1996

**IGC APPROVAL FOR GNSS FLIGHT RECORDER EQUIPMENT**

This document gives formal approval from the above date for the undermentioned GNSS FR equipment to be used for validation of flights under the FAI Sporting Code Section 3 (Gliders and Motor Gliders), subject to the conditions and notes given later. IGC reserves the right to alter this approval in the future.

GFAC tests are concerned primarily with data accuracy, security, downloading, and conversion to the standard \*.IGC file format. Other aspects of the equipment may not be tested and are a matter between the FR manufacturer and customers.

The attention of NACs, Officials and Pilots is drawn to the FAI Sporting Code Section 3, 1992 edition including all amendments, particularly paragraph 1.9.2 on digital recording and 2.3.3.6. on GNSS evidence requirements.

It is recommended that a copy of this approval including its annexes is kept with each unit of the equipment.

**Manufacturer:** Dipl.-Ing Peter Zander, Oberdiller Strasse 38,  
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**Equipment:** Hardware: Version 1.16 or later of the Zander GP940 GNSS FR.  
Firmware: Version 1.16 or later (ie the programme inside the unit).  
Software: Zander file DATA-ZAN.EXE for downloading flight data from the FR and, through its menu, for conversion of each Zander format (\*.ZAN) flight data file to a separate file in the \*.IGC ASCII format. Also CONV-ZAN.EXE for the conversion function only. These two files are intended to be copied by NACs for use by OOs on a floppy diskette without the need to access a hard disk. These files have unrestricted access and will be placed on the IGC web server. Also, for the same purposes, for Officials familiar with the programme and menus concerned, Zander software release 11 dated November 1996 (ZAN11 file), or later releases. The file VALI-ZAN.EXE is for validation by NACs and FAI of the security and integrity of the \*.ZAN files. The DATA, CONV and VALI files are manufacturer's copyright but are freeware.

**CONDITIONS OF APPROVAL:**

1 Permitted Connections to the Main (FR) Module.

- 1.1 To the 9-pin male socket on the GP940 body near to the antenna port: 12V external battery power and connection to the cockpit display unit.
- 1.2 External antenna to antenna port.
- 1.3 PC to the 9-pin female socket at the opposite end of the FR unit to the antenna port next to the red light. A PC must not be connected between the takeoff of the claimed flight and the transfer of data after flight.

2. **Security of the Equipment.** GFAC is presently satisfied with the physical and electronic security of this equipment subject to para 4 overleaf on the physical security seal.

2.1 **Installation in a glider:** The FR may be fitted anywhere in the glider (subject to para 3.3, and 2.2 for motor gliders). If the antenna or antenna port is accessible to the crew in flight, no attempt must be made to inject data at these places; any abuse of this may lead to a future requirement to place the antenna and antenna port out of reach of the flight crew.

2.2 **Installation in a motor glider (including self-sustainers):** Unless the MoP is sealed (SC3 para 5.5.3.2) or inoperative (SC3 para 5.5.1/2), the FR must be firmly attached to a part of the glider structure which is capable of transmitting the vibration caused by the MG means of propulsion to the case of the FR, inside which is a vibration sensor, and an engine-run must be carried out with the FR in the position used for the claimed flight, in order to prove the vibration recording system (see para A4 later).

2.3 **Sealing of data ports:** no requirement, but no unauthorised data must be passed into the FR during the time between takeoff and the start of the post-flight transfer of data by an OO. Any abuse of this may lead to a future requirement to seal the data port.

3. **Check of Installation in the Glider.** Before flight, an Official Observer must check the place of the equipment in the glider concerned and how it is fixed to the glider. Following this examination; EITHER,

3.1. **Continuous Observation.** The glider must be under continuous observation by an OO until it takes off on the claimed flight (so that the FR cannot be transferred to another glider without this being seen); OR,

3.2. **Sealing to the Glider.** If para 3.1 cannot be met, the FR must be sealed to the glider by the OO so that it cannot be removed without breaking the seal. The sealing method must be acceptable to the NAC and IGC. Paper seals must be marked with the glider registration, the date, time and OO's number and signature. A wire/lead or wax seal with a unique sealing die (imprint pattern) may also be used. Sealing to the glider is allowed to take place at any time or date in advance of the flight. This is because all GNSS fixes have a date/time content, unlike a drum-type barograph. The use of adhesive plastic tape is not satisfactory for IGC-approved sealing because it can be peeled off and re-fitted. Gummed paper tape is recommended, as used for sealing drum-type barographs.

3.3. **Place of Installation in the Glider.** See para 2.1. Where sealing to the glider is required under para 3.2, the OO must seal the FR unit to glider parts which are part of the minimum standard for flight. It is accepted that such parts can be removed for purposes such as servicing; such parts include the canopy frame, instrument panel, and centre-section bulkhead fittings. If such a part is transferred between gliders, any FR seal for the previous glider must be removed. For motor gliders, see para 2.2.

4. **Security Seals, Physical and Electronic.** The FR unit is physically sealed with adhesive security tape across the bottom of the case. An internal electronic security mechanism is also included and its security check will no longer work if the case is opened. If the FR is found to be unsealed electronically, it must be returned to the manufacturer or his appointed agent for investigation and resealing, with a statement of how the unit became unsealed. Whenever any unit is resealed, the manufacturer or agent must carry out positive checks on the internal programmes and wiring, and ensure that they work normally. If any evidence is found of tampering or unauthorised modification, a report must be made by the manufacturer or agent to the Chairman of GFAC and to the NAC of the owner; the IGC approval of that individual unit will be withdrawn until the unit is re-set and certified to be to the IGC-approved standard.

5 **After-Flight Transfer of Flight Data from the FR and conversion to \*.IGC File Format.** Only the IGC-approved standard of software shall be used. This standard is given on page 1 under 'Equipment', and 'software'.

6 **Analysis of Flight Data.** Analysis of flight data may be through any analysis programme which is approved by the relevant NAC such as those which use the \*.IGC file format. The \*.ZAN file which was originally downloaded from the FR must be checked as unaltered by the NAC by the use of an authenticated version of the VALI-ZAN.EXE file (see page 1 under "software"), and the CONV-ZAN.EXE programme then used to derive the \*.IGC file from it; this newly-created \*.IGC file must either be used for flight analysis or be checked as being identical to any earlier version of the \*.IGC format which may have been used for preliminary analysis.

7 **Manufacturer's Changes.** Notification of any intended change to hardware, firmware or software must be made by the manufacturer to the Chairman of GFAC so that a decision can be made on any further testing which may be required.

Ian Strachan  
Chairman, IGC GFAC  
10 Nov 1996

Annexes:           A. Notes for owners and pilots           B. Notes for Official Observers and NACs

Any Queries to:  
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Annex A to IGC Approval Dated 10 Nov 1996

**NOTES FOR OWNERS AND PILOTS -  
PART OF IGC APPROVAL FOR ZANDER GP 940 GNSS FR**

To be read together with the main terms of approval to which this is an Annex. It is recommended that a copy of the approval document including annexes is kept with the equipment concerned, for the use of pilots and Official Observers.

**Pilot's Responsibility.** It is the responsibility of the pilot to ensure or to note the following:

A1 **Signal Strength** - That the antenna is positioned in order to give sufficient signal strength for IGC purposes. No deliberate attempt must be made to inject data via the antenna or antenna port; any abuse of this may lead to a future requirement to position antennas and the antenna port out of reach of the flight crew. Note that tests show that carbon fibre skins covering some centre-sections attenuate the 1.5 GHz GPS signal, and also that proximity to some metal fittings can also attenuate the signal.

A2 **Geodetic Datum.** The FR has a fixed Geodetic datum of WGS84. Any start, turn, and finish, points must be entered with lat/longs which are to this datum. PC-based conversions such as the US DMA MADTRAN programme (non-copyright) are available from NACs and FAI. Other datum transformation programmes are available from commercial software sources.

A3 **Connection to Ports.** Although this approval does not presently require sealing of any ports, no unauthorised data must be passed through any port during the time between takeoff and the start of the post-flight transfer of data by an OO. See para 2.3 in the conditions of approval on page 2.

A4 **Use in Motor Gliders (including self-sustainers):** A vibration sensor is built in to the FR unit and attached to the inside of the case, and must be used for checking the use of the Means-of-Propulsion (MoP), unless the MoP is sealed (SC3 para 5.5.3.2) or inoperative (SC3 para 5.5.1/2).

A4.1 **Use of vibration sensor for MoP recording.** The FR unit must be firmly attached to a part of the glider structure which is capable of transmitting the vibration caused by the MoP to the case of the FR. The FR must be sealed to the glider (para 3.2 on page 1 applies) unless the FR is out of each of the flight crew and an engine run is carried out during the flight to prove the recording system. Where the FR is sealed by an OO to the glider structure, the engine-run which proves the system may be carried out at any time between sealing and unsealing the FR. It is understood that the manufacturer is designing a microphone-based system which, after successful testing, may allow the above restrictions to be withdrawn.

A5 **After Flight** - The pilot should ensure that the time and point of landing has been witnessed and recorded for comparison with that recorded by the GNSS FR. Until an OO has witnessed the FR fit (installation) to the glider and either downloaded the flight data or removed the FR for downloading, the pilot must not alter the FR installation to the glider. The OO will carry out the actions given in Annex B, and the downloaded flight data will be kept secure to the OO and to NAC-approved persons only; the pilot may request a copy of the downloaded data.

A6 **Calibration of Barograph Function.** Pilots are advised to have a barograph calibration carried out either by the manufacturer or by an NAC-approved calibrator before any GNSS FR is used for a claimed flight performance. Altitude and height claims require a calibration for the flight performance concerned, and speed and distance claims need a calibration in order that the altitude difference between the departure and finish points may be calculated. All claims require that (calibrated) FR takeoff and landing pressure altitudes are compared with the separately-recorded QNH pressures. See Annex B para B5, and the Sporting Code for gliders, particularly para 2.2.1.1.

A7 **Entering Lat/Longs for turn points and flight declarations.** Note that lat/longs can only be entered as degrees, minutes and seconds, there is no option at present for decimal minutes to be used.

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**NOTES FOR OFFICIAL OBSERVERS AND NACs -  
PART OF IGC APPROVAL FOR ZANDER GP 940 GNSS FR**

To be read together with the main terms of approval to which this is an Annex. It is recommended that a copy of this approval document is kept with the equipment concerned, for the use of pilots and Official Observers.

**B1. Checks before Flight.**

B1.1. **Glider Installation of the FR.** An OO shall inspect the installation of the FR in the glider before flight and shall note the position in the glider, the serial number of the FR, glider registration, date and time. If the glider cannot then be observed continuously by the OO until it takes off on the flight concerned, the OO shall seal the FR to the glider in a way acceptable to his NAC and to IGC (see paras 2 and 3 of the Conditions of Approval given earlier on pages 1 and 2).

B1.2. **At Takeoff.** The time and point of takeoff shall be recorded, either directly by the OO, other witnesses, or by other means such as an Air Traffic Control or Club log of takeoffs and landings. The local barometric pressure (QNH) shall either be noted or obtained later from a local meteorological office so that this can be compared later with the pressure altitude on the flight data file.

**B2. As Soon as Practicable After Landing.**

B2.1. **At Landing.** The time and exact point of landing shall be recorded, either by an OO, other witnesses (SC3 para 2.2.11.5 (b) (2)), or by other means such as an Air Traffic Control or official Club log of takeoffs and landings. The local barometric pressure shall either be noted or obtained later from a local meteorological office for the time of landing so that this can be compared later with the pressure altitude on the flight data file.

B2.2. **Checking the Installation of the FR.** As soon as practicable after landing, an OO shall inspect the installation of the FR in the glider (including any sealing to the glider), so that this can be compared to the pre-flight check described in para B1.1 above.

B2.3. **Downloading the Flight Data.** If a portable PC is available, the flight data may be transferred at the glider without disturbing the installation of the FR; if a portable PC is not available, the OO shall check and break any sealing to the glider, and personally take the main FR module to a PC. Connect the PC to the main FR module's 9-pin data port, and use either the download file DATA-ZAN.EXE on a floppy diskette (see under 'software' on page 1), or use the manufacturer's full PC programme, following the instructions given in the menu. The floppy disk may be self-booting and may have a short menu with instructions for the OO to follow. It must have originated from an authorised source such as an NAC or someone approved by an NAC. This process will produce a binary-format flight data file \*.ZAN, which shall be on or copied to a diskette signed by the OO, and retained in safe keeping for later checking and analysis. The diskette shall originally either be blank or may be the one which contained the DATA-ZAN.EXE files for downloading. Another diskette with the downloaded \*.ZAN flight file copied on it shall be given to the pilot on request, at this or a later time when convenient.

**B.3. Analysis of Flight Data Files**

B3.1. **Conversion to \*.igc File Format.** After landing or at a future time, an OO or an NAC-approved data analyst must use the approved software to convert the binary \*.ZAN file to the \*.IGC file format. This is through the menu in the DATA-ZAN.EXE file, through the CONV-ZAN.EXE file, or the full ZAN11E/D.EXE (or later) programme, see Page 1 under "software"; if using the CONV file, after CONV-ZAN, type a space followed by the full file name to be converted, followed by ENTER. Note that the original \*.ZAN file remains and the \*.IGC file is in addition.

B3.2. **Flight Data Analysis.** A Data Analyst approved by the NAC can then commence the flight analysis using an analysis programme approved by the NAC concerned. In addition to checking flight data, an authenticated version of the file VALI-ZAN.EXE shall be used by the NAC and/or FAI (if the data goes to them) to check that the flight data in the \*.ZAN and \*.IGC files has not been altered; type VALI-ZAN.EXE followed by a space and the name of the file to be checked. The message "Security Check OK" should appear, not "Security Check Not OK (or "Electronic seal faulty"), Flight Data Invalid".

B4. **Means of Propulsion (MoP) Record - Motor Gliders.** The MoP must either be sealed (SC3 para 5.5.3.2) or inoperative (SC3 para 5.5.1/2), or the vibration recording system used in accordance with para A4.1.

An ENL (Engine Noise Level) value of over 250 indicates engine running or the vibration of takeoff or landing. Consistently lower ENL values indicate gliding flight.

B5 **Calibration of Barograph Function.** The FR can be calibrated in an altitude chamber in the same way as a drum barograph. After the calibration, the data is downloaded as if it was flight data (see B2.3 above) and the calibration data file will then be analysed and a correction table produced of true against indicated altitudes. This table can then be used to correct pressure altitudes which are recorded during flight performances and which require correction for validation to IGC criteria. These include takeoff, start and landing altitudes for altitude difference and for comparison with QNH readings, and low and high points on gain-of-height and altitude claims. The maximum height tested by GFAC (Sep 96) was 50,000 ft.

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