



GNSS FLIGHT RECORDER APPROVAL COMMITTEE (GFAC)
FAI INTERNATIONAL GLIDING COMMISSION (IGC)
of the
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References: See para (i-iv) below

To: IGC GNSS web site under "IGC-approval Documents"
GFAC Chairman's web site
FR Manufacturer, info to igc-news@fai.org, newsgroup rec.aviation.soaring

Date of issue: 20 May 2020

IGC-APPROVAL DOCUMENT FOR GNSS FLIGHT RECORDER
MAKER - RECORDER TYPE **IMI - Erixx V1.0**
APPROVAL LEVEL **IGC Level 2 - See para (i-ii) below**

(i) General. This document gives formal approval from the above date for the Flight Recorder (FR) described below to be used for the validation of flights under the FAI Sporting Code Section 3 (Gliders and Motor Gliders) and under the rules and procedures of other FAI and other activities that use IGC-approved recorders, subject to the conditions and notes given later. This document replaces those with earlier dates. Only the terms of the IGC-approval documents currently posted on the IGC web site are valid for use for IGC/FAI claims, and IGC reserves the right to alter this approval in the future

(i-i) Document Versions and Scope. The initial IGC-approval document for this type of FR was dated 7 June 2008. A future change of IGC-approval level was notified in the document version dated 20 October 2019, and the change was made on 1 January 2020, see (i-ii) below. This version includes a new para (i-iv) with directions to the current web sites for documents related to the FR IGC-approval process, and the GFAC Chairman's new email address on page 4.

(i-ii) IGC-approval Level. This is IGC Level 2 (all IGC badges and distance diplomas). The Levels of IGC-approval are listed in the Sporting Code for Gliding, Annex B para 1.1.4. The rules and procedures for World Gliding Championships (and other Competitions that use the same rules) are given in Annex A to the Sporting Code for Gliding (SC3A). Until the end of 2019 the IGC-approval level was Level 1 (all flights including world records), but this was changed due to increases in IGC Specification conditions for Level 1 that are not met by this type of FR.

(i-iii) GNSS System. The Global Navigation Satellite System (GNSS) in this Recorder is the US NAVSTAR Global Positioning System (GPS).

(i-iv) Current web sites. References for the latest versions of documents relating to IGC-approval of FRs (including the latest version of this document) are given in para 2 on page 1 of the main table that lists all IGC-approvals. The latest version of the table is available through <www.fai.org/igc-documents> and the GFAC Chairman's web site <www.ukiws.uk/GFAC>. The detailed references are placed in the main FR table rather than in each IGC-approval document, so that if the reference changes, only the main table has to be updated rather than all IGC-approval documents.

(ii) Equipment Functions. This document is concerned only with, and applies to, the functions of the equipment that record flight and related data. More specifically, with the accuracy and reliability of recorded data for the exclusive sole purpose of validation and certification of flight performances to the criteria of FAI and in particular, but not exclusively, IGC. FAI is the legal entity and Swiss law applies. FAI Commissions such as IGC and others are agents of FAI; GFAC and its advisors are agents of IGC. Tests made by GFAC on behalf of IGC and FAI primarily concern accuracy and security of data, transfer and conversion to and conformity of the output data with the specified IGC file format for the validation and certification purposes mentioned above. Other functions of the equipment are not part of this IGC-approval and the relevance of this document does not extend beyond the specific validation and certification purposes above. In particular this document does not give the approval of GFAC, IGC and/or FAI to any function linked with aspects that could be critical in any way to flight safety such as navigation, the avoidance of controlled or other restricted airspace, terrain avoidance and any aircraft proximity-warning and/or anti-collision functions. This document does not constitute any approval, guarantee and/or any statement by GFAC, IGC and/or FAI as to the reliability or accuracy of the equipment for operation in flight and any liability in connection therewith is hereby expressly excluded.

(iii) Intellectual Property. This approval is not concerned with, and FAI, IGC and GFAC have no responsibility for, matters related to: (a) Intellectual Property (IP) and Intellectual Property Rights (IPR) and/or, (b) the relations of the Manufacturer listed below with any other entities except with FAI and its agents, including IGC and GFAC, or as they affect FAI, its agents and this approval.

(iv) FAI Sporting Code Section 3. The attention of National Airspace Control (NAC) authorities, FAI National Members, officials and pilots is drawn to the latest edition of the FAI Sporting Code Section 3 (Gliding) including its annexes and amendments. Annex A to this code (SC3A) deals with competition matters, annex B to the Code (SC3B) with equipment used in flight validation, Annex C to the Code (SC3C) deals with guidelines and procedures for Official Observers, pilots, and other officials involved in the flight validation process. Copies of all of these documents may be obtained from the FAI/IGC web sites listed above and links are provided from the IGC web site. A separate document published by FAI is entitled "Technical Specification for IGC-Approved Flight Recorders" and is also available through the IGC GNSS web site shown above.

(v) Keep with the Equipment. It is recommended that a copy of this approval including its two annexes is kept with each unit of the equipment so that it is available for pilots and Official Observers when required.

MANUFACTURER

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IGC manufacturer codes: Three letter IMI, single letter M

1. **HARDWARE**

1.1 **Recorder Name.** IMI Erixx

1.2 **Hardware Version.** The original IGC-approved hardware standard was Version 1.2. Later versions may be used if they are IGC-approved, see para 10 below. The Version number is shown in the header record of IGC files in the form: "HFR HW HARDWARE VERSION:1.2".

1.3 **Dimensions, Weight, Power Source.** The recorder unit is 68 x 52 x 29 x mm in size less the antenna connector that adds a further 12 mm to the 52 mm dimension. It weighs about 100 grammes without external cables or display units. It is designed to be powered by a 12V DC battery but performs normally between 8 and 16 Volts and continues to work down to about 6 volts. When no external power is supplied, a small sustainer battery maintains the Real-Time Clock (RTC) and a number of security functions.

1.4 **External Features.**

1.4.1 **Connectors.** The 68 x 29mm face has four connectors that are described in more detail in para 4.

1.4.2 **Display.** No display is fitted to the recorder unit itself.

1.4.3 **Controls and lights.** One button is on the top 68 x 52 mm face together with a red and green light.

1.5 **GPS receiver.** A 50 channel u-blox (Switzerland) LEA 5H receiver is fitted (http://www.u-blox.com/products/lea_5h.html). This is shown in the header record of IGC files in the form "HFGPSGPS:u-blox,LEA-5H,50,max15000m". The maximum altitude is that processed by the recorder to the altitude resolution requirements of para 2.2 of the IGC Specification.

1.6 **Pressure altitude sensor.** A MS 5534 Pressure Altitude sensor by Intersema Sensoric SA of Switzerland (www.intersema.ch) is fitted. This is shown in the header record of IGC files in the form "HFPRSPRESSALTSENSOR:Intersema,MS5534B,max15000m". The maximum altitude is that processed by the recorder to the altitude resolution requirements of para 2.2 of the IGC Specification. The pressure altitude system is compensated for temperature variation and calibrated to the ICAO ISA. The recorder case is not pressure-sealed and "cockpit static" pressure is recorded on the IGC file.

1.7 **National and other regulations.** These regulations may apply to electrical and electronic equipment and compliance with such regulations is not the responsibility of FAI.

1.8 **Attached modules.** Other modules are attached through the connectors listed in para 4.

2. **FIRMWARE.**

Version 1.0 was the original IGC-approved firmware standard. Later versions may be used if they are IGC-approved, see para 10 below for IGC-approval of updates. The firmware version is listed in the header record of IGC files in the form: "HFR FW FIRMWARE VERSION:1.0".

3. **SOFTWARE.**

3.1 **Downloading of Flight Data.** Downloading is through the Microsoft Windows-based IGC Shell system that is available without charge from the IGC GNSS web site in the file igcdll.zip. Either the RJ-45 socket or the mini-USB connector, both on one of the 68 x 29 mm recorder faces, are used together with the IGC Shell program on the PC.

3.1.1 **IGC Shell Files.** The IGC Shell files should be downloaded into a specific directory that is named in advance (the name IGCshell is recommended). For the shell program to work with a recorder, the appropriate Dynamic Link Library (DLL) file from the recorder manufacturer must be copied to the IGC Shell directory. For this recorder, the file IGC-IMI.DLL is available on the IGC GNSS web site.

3.1.2 **Latest versions.** The latest versions of the files in igcdll.zip and the manufacturer's DLL files must be used, obtained from the IGC GNSS site for software given at the beginning of this document.

3.1.3 **Free availability.** The IGC Shell program is free and the manufacturer's DLL file is freeware but is copyright of the recorder manufacturer.

3.2 **Validation of Flight Data – IGC Standard.** Validation of the data in the downloaded IGC file is by the Validation function of the IGC Shell program described in 3.1 above. The IGC standard for electronic flight data is that the IGC file must pass the IGC Validate check. The Validate function of the IGC Shell program is used to interrogate the IGC file that is to be Validated. The IGC Validate procedure checks that the IGC file has correctly originated from a specific recorder and that it is identical to when it was initially downloaded. See B3.3.1.1 for more details.

4 **Connections to the Recorder.** All connections are on the 68 x 29 mm front face of the recorder.

4.1 **GPS Receiver Antenna.** A circular BNC bayonet-type connector of 9mm diameter is on the 68 x 29 mm recorder face and stands out 12 mm from the face.

4.2 **RJ-45 connector.** A 8-pin RJ-45 socket is next to the antenna connector. This is used with an RJ-45 male connector that has a cable with IGC-standard wiring. This cable includes connections for 8-16V external power and may also have a connector for upload and download of data to and from the recorder or for connecting to other modules such as PDAs.

4.3 **RJ-11 connector.** A 6-pin RJ-11 socket is next to the RJ-45 and is for connecting other modules such as remote displays. Such modules are outside the scope of this document and are a matter between the manufacturer and the customer.

4.4 **USB connector.** A 6 x 4mm USB Mini-B connector is next to the RJ-11 and is for downloading IGC files after flight and uploading set-up data into the recorder.

5 **Security of the Equipment.** GFAC is presently satisfied with the physical and electronic security of this equipment in terms of the integrity of the recorded flight data and the level of this approval for the types of flights concerned. See paras 8.1 and 8.2 on security seals. GFAC reserves the right to inspect production-standard equipment from time to time for security, general compliance with the IGC Specification and the calibration of sensors such as for pressure altitude.

6 **Installation in a glider.** The unit may be fitted anywhere in the glider, subject to para 8 on sealing. However, the position of any displays connected to the recorder used in flight in single-seat gliders should not be remote from sight-lines used for pilot lookout and scan for other aircraft and gliders.

7. **Motor gliders.** No engine sensing system is fitted to this type of recorder, so any Means of Propulsion (MoP) must either be sealed or inoperative, or a separate IGC-approved MoP recorder fitted. An Engine Noise Level (ENL) system is being developed and when this is shown to meet IGC standards, this IGC-approval will be amended to include it.

8. **Check of Installation in the Glider.** There must be incontrovertible evidence that the recorder was in the glider for the flight concerned, and was installed and operated in accordance with IGC procedures. This can be achieved either: by independent Observation at takeoff or landing, or by sealing the Recorder to the glider at any time or date before takeoff and checking the seal after landing. For how this is to be done, see para B1 later in this document.

9 **Security - Physical and Electronic.**

9.1 **Physical Security.** A tamper-evident seal with the manufacturer's name is fitted over one or more of the case securing screws. In addition, an internal security mechanism activates if the case has been opened.

9.1.1 **Sealing of data ports and connectors:** no present requirement, but no attempt must be made to pass unauthorised data into the Recorder.

9.2 **Electronic Security.** If the internal security mechanism has been activated, the security record (G-record) will be marked as insecure and a line placed in the IGC file header record that includes the words "SECURITY CHECK FAILED". Subsequent IGC files will fail the IGC Validation test for electronic security. This test will also fail if the IGC file being analysed is different from that originally downloaded from the Recorder, even by one character in the flight data area.

9.3 **Recorder found to be unsealed.** If either physical or electronic security is found to have failed, before it can be used again for flights to the IGC standard the Recorder must be returned to the manufacturer or his appointed agent for investigation and resealing. A statement should be included on how the unit became unsealed.

9.3.1 **Checks before re-sealing.** Whenever any unit is resealed, the manufacturer or his agent must carry out positive checks on the internal programs 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.

10 **Manufacturer's Changes, later Versions of Hardware, Firmware and Software.** 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 to retain IGC-approval for the change. This includes changes of any sort, large or small. It includes details of later Versions of hardware, firmware and software, also any changes to modules inside the recorder such as GPS receiver boards, pressure altitude transducers and anything related to either physical or electronic security. If in doubt, GFAC should be notified so that the responsibility for any possible action passes from the manufacturer to GFAC.

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

NOTES FOR OWNERS AND PILOTS PART OF IGC APPROVAL

- A(i) *Status.* To be read together with the main terms of approval to which this is an Annex.
A(ii) *IGC-Approval level.* See para (i-ii) on page 1
A(iii) *Copy of this document.* It is recommended that a copy of this approval document 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 **Antennas and their functions.**

A1.1 **GPS Reception.** The GPS antenna should be positioned to give sufficient signal strength for fix recording. No attempt must be made to inject false data via the antenna.

A2 **Geodetic Datum (Earth Model).** For IGC purposes, all latitudes and longitudes recorded by the Recorder must be to a Geodetic Datum (earth model) of WGS84. This type of recorder is fixed on the WGS84 datum and no selection or switching is required except to ensure that other lat/long data such as for start, turn and finish points, is entered also to the WGS84 Geodetic Datum (IGC rule).

A3 **Setting the Fix Interval.** : The fast-fix facility operates when the Pilot Event button is pressed, giving the fix rate and number of fixes that were set through the manufacturer's setup software. At least thirty fixes at one second interval is recommended for fast fixing. The fix interval for cruise flight between PEV events (such as between Waypoints) is set by the pilot before flight through the manufacturer's set-up program that allows fix intervals up to 60 seconds. There is therefore no need to set a very short fix interval for cruise flight because points of interest can be marked by PEV events and take advantage of the fast fix facility. Setting a short fix interval for cruise flight leads to IGC files of large byte size, particularly for long flights. This uses up more of the recorder's memory, causes downloading after flight to take a long time, increases the chance of data corruption and may also cause problems with some analysis programs because of the large number of fixes that have to be processed.

A3.1 **IGC rules.** IGC rules on fix intervals for cruise flight are an absolute maximum of 60 seconds (SC3 para 4.3.1 and Annex C to SC3, para 7.1) and 10 seconds for competitions complying with Annex A to SC3 (SC3A para 5.4C). SC3C para 7.1 says: "10 to 20 seconds has been found to be suitable, and does not use up as much memory as a more frequent setting for the whole flight. A more frequent fix interval is recommended near a Waypoint to ensure that a fix is recorded within its observation zone".

A4 **Checking the Recorder before a Claim Flight.** Pilots should check and analyse a selection of IGC files from their recorder before attempting flights that will require Validation. It is the pilot's responsibility to ensure that the recorder is performing correctly and in accordance with this approval, for instance ensuring that GPS fixes, pressure altitude, and other values are recorded as expected. Also that the flight declaration facility (if required for the flight) is making the appropriate declaration in a downloaded IGC file. See also A5 on declarations, A9 on ENL and A14 on pressure altitude calibration.

A5 **Pre-flight Declaration in the IGC file.** Electronic pre-flight declarations are made through the manufacturer's IMIConnect software program. Pilots are advised to ensure, before making a flight that is to be claimed and requires a pre-flight declaration, that they can successfully use this facility and that the appropriate IGC file is produced that satisfies the Sporting Code on electronic pre-flight declarations.

A6 **Observing the Recorder installation in the glider.** The pilot must ensure that an OO has checked the place of the equipment in the glider and how it is fixed to the glider. If it may be difficult to obtain an OO immediately before takeoff, or to witness the landing, an OO should be asked to seal the Recorder to the glider, and **this can be done at any time or date before flight.** See para 8 in the conditions of approval. Regarding the position of displays concerned with the Recorder, see para 6 in the Conditions of Approval which refers to sight-lines and the need for pilot lookout and scan.

A7 **Takeoff.**

A7.1 **Switch on.** Pilots are advised to switch on at least 5 minutes before takeoff and check that GPS lock-on has occurred before takeoff.

A7.2 **Independent evidence of Takeoff.** The pilot must ensure that the time and point of takeoff has been independently witnessed and recorded for comparison with takeoff data in the IGC file from this recorder, see para B1.2.

A8 **Connection to Ports**. Although this approval does not presently require sealing of any ports or plugs, no attempt must be made to pass unauthorised data into the Recorder. See para 9.1.1 in the Conditions of Approval.

A9 **Use in Motor Gliders** (including self-sustainers). No engine sensing system is fitted to this model, so any Means of Propulsion (MoP) must either be sealed or inoperative, or a separate IGC-approved MoP recorder must be used.

A10 **After Landing**. Until an OO has witnessed the Recorder installation to the glider, the pilot must not alter the installation or remove the Recorder from the glider. The pilot must ensure that there is evidence of the landing independent of the flight recorder data, see A9 below. **Pilots are advised not to switch off the recorder for 5 minutes after landing, otherwise flight data may be lost if the recorder is switched off too early.** After 5 minutes, the recorder may be switched off or connected to a PC for downloading flight data.

A9.1 **After-flight calculation of security**. After landing, the recorder calculates a digital signature for the IGC file for the flight. This process places security codes at the end of the IGC file for the last flight, which is then complete and stored in the memory ready for downloading. These codes are used to verify the integrity of the whole file at any later time by using the Validate function of the IGC Shell program with the IGC-IMI.DLL file in the same directory. The digital signature is calculated and the IGC file is ended after a landing is detected.

A11 **Independent Check of Landing** - The pilot must ensure that the time and point of landing has been witnessed and recorded for comparison with IGC file data from the recorder (see para B2.1).

A12 **Switching Off**. This is by switching off the external power or disconnecting the RJ45 or mini-USB connector from the recorder.

A13 **Downloading the Flight Data**. Downloading of IGC files is either through the RJ-45 socket or the mini-B USB connector. These connectors are used with a PC either with the free IGC Shell program and the free manufacturer's DLL file, or the manufacturer's IMIConnect program, see para 3.1 before the Annexes and B3.3 later. The RJ-45 socket connects to a male RJ-45 with a cable wired to the IGC standard and then to the PC. The mini-B USB socket connects to a USB socket on the PC and works with the IGC Shell program after the recorder manufacturer's driver has been installed.

A13.1 **OO's actions**. For a flight to IGC standards of evidence, an OO will then carry out the actions given in para B3.3, and the OO's copy of the transferred flight data will be sent to the organisation that will validate the flight, such as the National Airspace Authority (NAC). The OO does not personally have to transfer the data from the Recorder, but witnesses the transfer, and immediately after takes or is given a copy on electronic media such as a USB memory stick, storage card or equivalents.

A13.2 **Competitions**. Different rules may apply for competition flights, for which pilots may be allowed to bring their own flight data on portable storage data to competition control, or a central data transfer facility may be used. However, for a flight to IGC rules such as for records and badges, OO monitoring as in A12.1 continues to apply.

A14 **Calibration of Barograph Function**. Pilots are advised to have a barograph calibration carried out by an NAC-approved calibrator before any GNSS Recorder is used for a claimed flight performance. For the procedure, see para B6. A valid IGC-format file showing the pressure steps used in the calibration must be recorded and kept (Sporting Code rule). Altitude and height claims require a calibration for the flight performance concerned, and speed and distance claims need a calibration for calculating the altitude difference of the glider at the start and finish points. Also, the NAC or FAI may wish to compare pressure altitudes recorded on the Recorder for takeoff and at landing, with QNH pressures for the appropriate times recorded by a local meteorological office.

NOTES FOR OFFICIAL OBSERVERS AND NACs - PART OF IGC APPROVAL

B(I) Status. To be read together with the main terms of approval to which this is an Annex.

B(ii) IGC-Approval level. See para (i-ii) on page 1.

B(iii) Copy of this document. 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 Installation in the Glider. Due to the small size and portability of this Recorder, it would be easy to transfer it from one glider to another, or from a powered aircraft to a glider. Therefore, an OO shall witness and record the position of the Recorder in the glider, the type and serial number of the Recorder, the glider type and registration, date and time. Before flight, if requested, the OO shall then seal the Recorder to the glider in a way acceptable to his NAC and to IGC, and such sealing may be at any time or date before flight. If sealing is not used, either a preflight check of the installation must be made after which the glider must be under continuous observation by an OO until it takes off on the claimed flight. Alternatively, an OO must witness the landing and have the glider under continuous observation until the Recorder installation is checked. This is to ensure that the installation is correct, and another Recorder has not been substituted in the glider before the data transfer (B3.3). See para 8 of the Conditions of Approval. Regarding the position of displays concerned with the Recorder, see para 6 in the Conditions of Approval which refers to sight-lines and the need for pilot lookout and scan.

B2 Takeoff - Independent Evidence. The time and point of takeoff shall be recorded, either by an OO, other reliable witnesses, or by other means such as an Air Traffic Control or official Club log of takeoffs and landings. After flight, this will be compared to the takeoff data from the Recorder.

B3 Landing

B3.1 Independent Evidence of Landing. The time and point of landing shall be recorded, either by an OO, other reliable witnesses, or by other means such as an Air Traffic Control or official Club log of takeoffs and landings. After flight, this will be compared to the landing data from the Recorder.

B3.2 Checking the Installation of the Recorder. As soon as practicable after landing, an OO shall inspect the installation of the Recorder in the glider (including any sealing to the glider), so that this can be compared to the check described in para B1 above. The transfer of flight data shall then take place in accordance with B3.3.

B3.3 Downloading the Flight Data. Downloading of IGC files is either through the RJ-45 socket or the mini-B USB connector. These connectors are used with a PC either with the free IGC Shell program and the free manufacturer's DLL file, or the manufacturer's IMIConnect program. The RJ-45 socket connects to a male RJ-45 with a cable wired to the IGC standard and then to the PC. The mini-B USB socket connects to a USB socket on the PC and works with the IGC Shell program after the recorder manufacturer's driver has been installed.

B3.3.1 IGC Shell Program. Download the IGC Shell program from the IGC GNSS web pages under "software" and place all the files in one directory (the name IGC Shell is recommended). These files are available on the IGC GNSS web pages through the file igcdll.zip. For the shell program to work with a Recorder, the appropriate Dynamic Link Library (DLL) file from the recorder manufacturer must be copied to the IGC Shell directory. After copying it to the directory that contains the IGC Shell files, execute IGC-SHELL.EXE. Set the path to the IGCshell directory using the "Set Directories" button on the screen. The IGCshell menu will now appear in a grey rectangular box with 9 software buttons for selecting the recorder type, recorder settings and flight logs. The recorder software box at the top should now include the line "IMI Gliding, Erixx... ". This should be selected. With the recorder connected to the PC and the correct Com Port selected on the IGCshell screen, selections for data Download and Validation can now be made using the screen buttons provided. You can now download the flight data that appears directly in IGC format.

B3.3.1.1 Validation of IGC files. To gain access to the IGC file for this recorder, the DLL file from the recorder manufacturer (IGC-IMI.DLL) must be in the same directory as the IGC Shell program. With the recorder connected to the PC and the IGC Shell program menu selected, select the manufacturer from the top menu box, press the "Validate" button and select the IGC file that is to be checked. If successful, the message "File has been successfully validated" appears. If there is a security problem, the message "Validation check failed" appears, together with a likely reason.

B3.3.1.2 Latest File Versions. The latest versions of the IGC shell and DLL files must be used. These can be obtained from the IGC GNSS site for software listed at the beginning of this document.

B3.3.2 Files Produced. This process will automatically produce an *.IGC-format ASCII flight data file with the file name YMDEXXXF.IGC, where Y=year, M=month, D=day, E=manufacturer, XXX = Recorder Serial Number/letters and F = flight number of the day (full key, Appendix 1 to the IGC GNSS Recorder Specification, copied in Annex C to the Sporting Code, SC3C).

B3.3.3 OO's Copy. A copy of the IGC file shall be retained securely by the OO such as by immediately copying them to storage media such as a memory stick, data card, or the hard disk of the OO's own PC. The IGC file shall be retained by the OO in safe keeping for later checking and analysis under NAC procedures. The OO may keep the required data file on industry-standard portable storage media. The hard disk of another PC may also be used but the OO must be able to positively identify the flight data file as being from the flight concerned. For this purpose, takeoff and landing data independent of the IGC file must also be available, see above in B2 and B3.1.

B3.3.4 Competitions. Different rules may apply for competitions, for which pilots may be allowed to download their own flight data and take it to Competition Control on portable storage media such as a USB stick or memory card, or a central competition data transfer facility may be used. For ease of identification within the competition, file names may be changed, for instance to the glider competition number or the pilot's name. Integrity of data within the file is preserved by the electronic security system and may be checked at any time by using the validation process described in B3.3.1 above.

B4 Analysis of Flight Data Files – Use of the IGC Validation facility. Before a Flight Performance is officially validated, the authority responsible for validation must check that the data in the IGC file has originated from the Recorder concerned, and is identical to the file that was downloaded from the Recorder to the PC. This is done by checking the IGC data file with an authorised copy of the IGC Shell program and using the Validate function in the IGC Shell menu. The manufacturer's DLL file will also be needed in the IGC Shell directory. The shell program and DLL file must be the same as those on the current FAI/IGC web site for software at the beginning of this document. A Data Analyst approved by the NAC shall carry out this IGC Validation check on the IGC file and then evaluate the detailed flight data using an analysis programme approved by the NAC concerned (list, see the IGC GNSS web site under SOFTWARE).

B4.1 Method. Use the IGC Shell program together with the manufacturer's DLL as explained in B3.3.1 above. Scroll to the IGC file to be checked and use the Validate software button.

B5. **Motor gliders**. No engine sensing system is fitted to this type of recorder. Any Means of Propulsion (MoP) must either be sealed or inoperative, or a separate IGC-approved MoP recorder fitted.

B6 **Altitude analysis and calibration** Flight data files will be analysed in accordance with Sporting Code procedures. Part of this is to compare the general shapes of the GNSS and pressure altitude fix records with time and to ensure that no major differences are seen that could indicate a fault in the recorder, malpractice or even manufactured (false) data. Sporting Code rules require that an IGC-approved Recorder is calibrated in an altitude chamber at regular intervals, in the same way as barographs.

B6.1 Calibration method, making a calibration table. For a pressure altitude calibration, the GPS antenna must be disconnected before power is applied. When recording, this is detected and puts the recorder in calibration mode with a fix interval of 2 second. Recording starts after a pressure change of 1 metre per second for 5 seconds, and no GPS fixes are required for a pressure altitude trace to be produced. The calibrator should be advised to make a short, sharp pressure change to trigger recording before starting the calibration itself. The calibrator will record the pressure steps used, for later comparison with the flight file. The stabilised pressure immediately before the altitude is changed to the next level, will be taken as the appropriate value unless the calibrator certifies otherwise.

B6.1.1 After Calibration. After the calibration, the data file containing the pressure steps is transferred to a PC as if it was flight data (see B3.3 above); this may be done by an NAC-approved person other than the calibrator who may not have this knowledge. The IGC format calibration data file will then be analysed, compared to the calibration pressure steps, and a correction table produced and authenticated by an NAC-approved person (for instance an OO or GNSS Recorder Data Analyst). The correction table will list true against indicated altitudes. This table can then be used to adjust pressure altitudes which are recorded during flight performances and which require correction before validation to IGC criteria. These include takeoff, start and landing altitudes for altitude difference and for comparison with independently-recorded QNH readings, and low and high points on gain-of-height and altitude claims. Only pressure altitude is valid for IGC altitude purposes except for proof of flight continuity (no intermediate landing) where GNSS altitude may also be used. and the file should be kept with the calibration paperwork so that it is not confused with other calibration files.

B6.2 GPS altitude figures recorded in the IGC file. Occasional short-duration differences in the shape of the GPS Altitude/time graph have been noted compared to the pressure altitude figures. This is not unusual with GPS receivers operating without a local differential beacon. The altitude accuracy from satellite-based systems will not be as good as accuracy in lat/long, because satellite geometry is not as favourable for obtaining accurate altitude fixes compared to horizontal position. This effect may be increased by less-than ideal antenna positioning in some gliders. Data analysts and NAC officials should allow for the above when comparing the GPS altitude and pressure altitude records. Lat/long fix accuracy is not affected and tests on this recorder show it to be typical of that for a 12 channel GPS system. From GFAC tests after 1 May 2000 when the GPS Selective Availability accuracy reduction system was removed, the lat/long error taken from a moving vehicle at a surveyed point in average reception conditions, shows an average error of between 11 and 12m for all recorders tested since that date.

B6.3 Maximum Altitudes Recorded in the IGC file. The GPS system is capable of recording to almost unlimited altitudes, certainly up to 30km/100,000ft. The pressure altitude sensor is also capable of recording to high altitudes, although as air density reduces at height, a small pressure step becomes a large altitude difference. However, the type of processor in the recorder and the need for good resolution (small steps) across the altitude range, results in limitations in altitudes that can be recorded in the IGC file. The maximum altitude is that processed by the recorder to the altitude resolution requirements of para 2.2 of the IGC Specification. The maximum altitudes for figures in IGC files that apply to this recorder are given below.

B6.3.1 Pressure Altitude. Pressure altitudes are recorded up to 15,000 metres (49,213 feet).

B6.3.2. GNSS altitude. GPS altitude is recorded up to 15,000 metres (49,213 feet).
