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The logo for Logstream, featuring the word "Logstream" in a bold, italicized, blue sans-serif font, enclosed within a thin blue rectangular border.

## GNSS Flight Recorder

*Logstream FR-1*



Owner's manual

revision 1.0  
November 2015

## Introduction

**Logstream FR-1** is an electronic device equipped with appropriate hardware and software protections, used for recording of flights in accordance with the FAI IGC GNSS Technical Specification for Flight Recorders. Its main features include:

- small dimensions 85 x 83 x 27 mm
- internal memory enabling storing of over 8000 flight hours ( 1 fix / 5 secs )
- modern, sensitive 66 channels GPS receiver with the ability of connecting an external antenna
- powerful 32-bit MIPS microprocessor that allows quick generation of digital signature
- strong digital signature with 1600 bits RSA key
- **Environmental Noise Level ENL** recording
- acoustic signaling presence in turn point observation zone
- ability to load declarations and download IGC files using USB flash drive
- ability to easily select one of two pre-declared tasks
- PILOT EVENT pushbutton
- Supply voltage quality indicator
- DC 10-16V power supply
- Bluetooth module
- NMEA stream from GPS receiver output

Device records among other things:

- UTC time,
- GPS position,
- GPS altitude,
- pressure height,
- ENL level,

The data is saved to a file format compatible determined by the FAI IGC that contains an encrypted digital signature allows to confirm its authenticity.

## Hardware

Recorder enclosure is composed of aluminium profile enclosed on two sides with plastic caps secured with metal screws.



*Front panel*

At the front panel are:

- PILOT EVENT pushbutton,
- USB A receptacle,
- 4 LEDs ( POWER, GPS, TASKA/B ),

### **IMPORTANT !!!**

Do not attempt to open the device enclosure.  
There are no user serviceable parts inside.  
Opening the device breaks internal seals and cause that recorded IGC files cannot generate valid electronic signature.



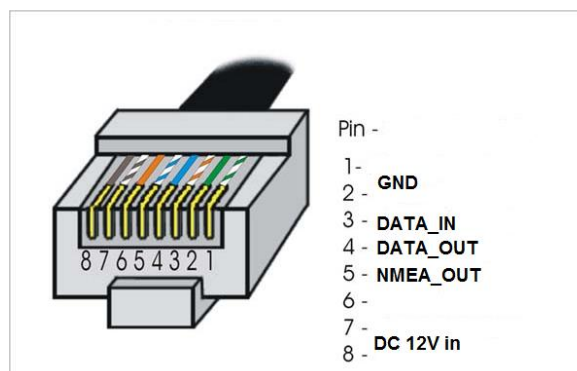
At the rear panel:

- USB mini B socket
- RJ-45 socket
- SMA A – external GPS antenna socket

## Connections

**USB A receptacle** – is used to connect a USB flash drive which is intended to uploading configuration file, task declaration files, and downloading recorded IGC files.

### RJ-45 socket



Pin description:

1,2 – GND

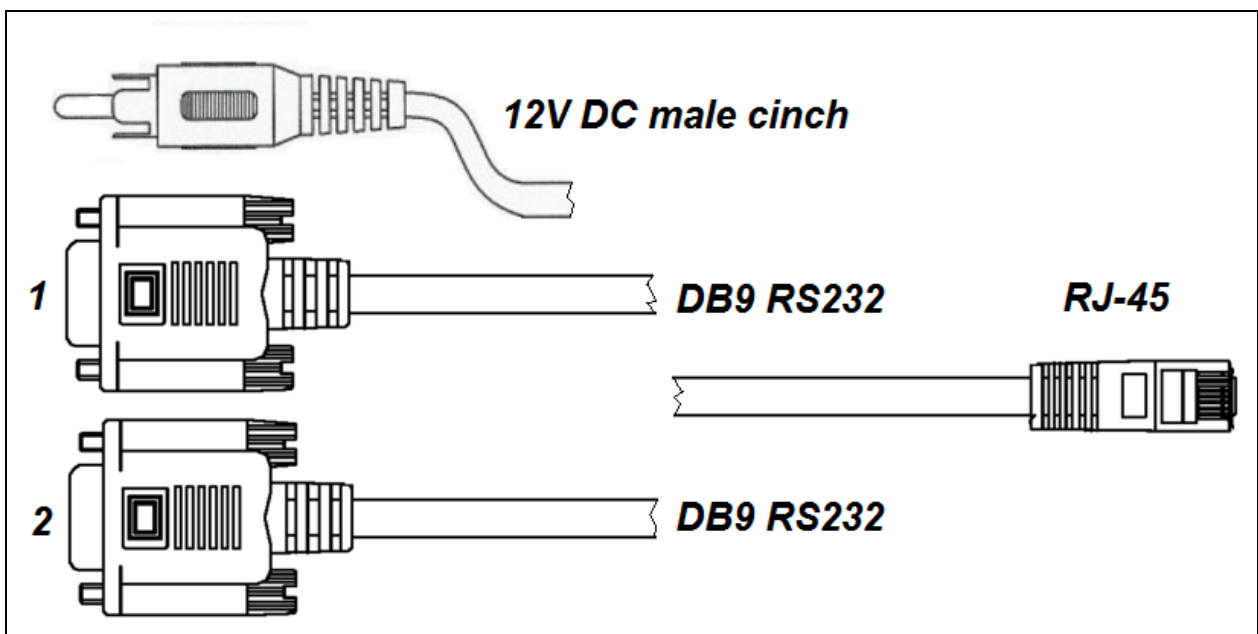
3 – Serial data input RS232 ( for connection with PC )

- 4 – Serial data out RS232 ( for connection with PC )
- 5 – Serial data out NMEA output RS232
- 6 – not used
- 7,8 – DC 10-16V power supply input

**USB mini B** – is used to supply 5V DC to recorder and connect the recorder to a PC as USB mass storage device. Recorder is seen by the PC as two drives *LGS\_nnn\_IGC* and *LGS\_nnn\_CFG*

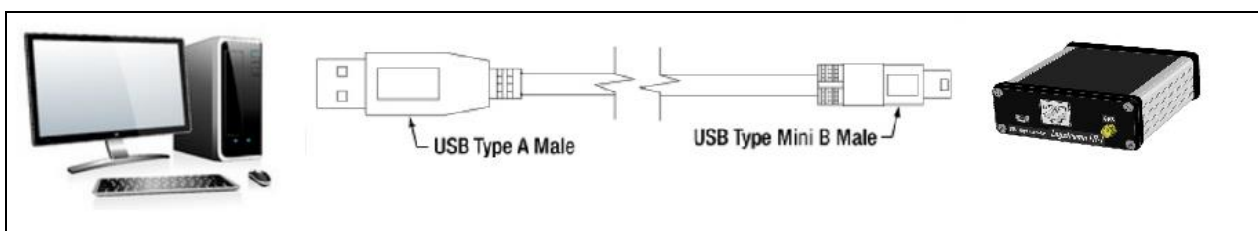
**External GPS antenna socket** – is used to connect an optional external GPS antenna SMA-A

Flight recorder is supplied with proprietary connection cable.



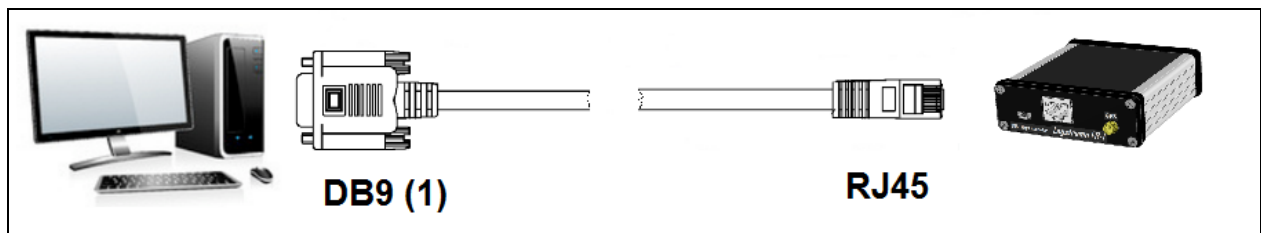
Cable has RJ45 plug to put in recorder RJ45 socket, male cinch plug to connect to 12V DC source and two female DB9 RS232 plugs. DB9 plug marked as 1 is designed to connection with PC and *LGSCoconnect* application using RS232 protocol next DB9 plug marked as 2 is designed to receive NMEA stream from FR GPS module.

### USB connection



Use standard USB A -> USB mini B cable ( not included ). Connect to PC to download IGC files or upload declarations and settings to FR. Connect to stable 5V DC source ( e.g. backup power bank for smartphones ) to power FR without using 12V.

## RS232 connection



Plug RJ45 to FR and DB9 to PC Com port. If your PC do not have physical COM port use USB to RS232 converter ( [http://en.wikipedia.org/wiki/USB\\_adapter](http://en.wikipedia.org/wiki/USB_adapter) ). Use *LGSCONnect* application to establish connection PC -> FR.

## Signaling and control

### LED-s

The recorder is equipped with 4 LED:

**POWER red LED** - lights when the unit is properly powered, and blinks when the supply voltage drops below a predetermined value. Blink frequency is proportional to the voltage drop.

**GPS green LED** - lights when the GPS receiver obtains the correct 3D Fix. During the flight recording blink means write the current position to the log.

**TASK A orange LED** - lights when declaration A is selected as the current

**TASK B yellow LED** - lights when declaration B is selected as the current

**When creating an IGC file and encrypting signature** - all LEDs blinks quickly

**When connected to a PC through USB cable** - LEDs blink in sequence from left to right

**When an critical error occurs ( device not working )** - all LEDs are switched off

### Acoustic signaling

After FR start:

Error - 3 short beeps

System critical error (device not working) - 3 x 3 short beeps

Electronic seal violation - 3 x Morse SOS - 3 short + 3 long beeps

Before start recording:

PC connected, PC disconnected - 2 short beeps

Task selecting - 2 short and 1 long beep

Start recording - 4 short beeps



During recording:

- Stop recording – 4 short beeps
- Pilot Event pressed – 1 long beep
- Presence at turn point observation zone – 3 x long and short beeps
- Low voltage warning – long and short beep

## Pilot Event button

Pressing the **EVENT** button on the front of the device causes:

**Before flight recording** : press and hold the button for 3 seconds to switch the selected task (A->B or B->A)

**After the start of the flight recording**: generates PEV record in IGC file, save current position and increase the sampling rate to 1 fix per second for 30 seconds.

**How switch to other task when recording starts ?** : press and hold the button for 6 seconds. FR start beeps. Release button and press again for 3 seconds. After that FR switches task reboots and start recording new IGC file.

**During connection to the PC through USB cable**: exit the USB mass storage mode

## Uploading configuration and tasks

Transferring configuration and tasks to the device is possible in several ways:

- 1) Connection to the PC via the RS232 cable or Bluetooth. Using the *LGSCconnect* application supplied by the manufacturer.
- 2) Connection to the PC using the USB cable. Export configuration and tasks files previously created in the *LGSCconnect* application to **LGS\_nnn\_CFG** drive.
- 3) Export configuration files and task declarations to USB flash drive. Insert the USB stick into USB A receptacle. Switch on the recorder. The recorder reads and copies the appropriate files from the USB stick.

## Recorder internal file system structure

When you connect the recorder to a PC via the USB cable to the USB mini B on the rear panel PC, detects FR as two drives. First **LGS\_nnn\_IGC** (nnn-FR serial number) as a CD-ROM (read-only) about the size of 3GB. This drive contains the folders structure:

```
Drive: LGS_IGC_nnn
       YY_MM
       YYYYMMDD
```

Folders **YYYYMMDD** – mean year month and day of the flight and contains IGC files with flights on a given day in the filename format

**YYYY-MM-DD-LGS-nnn-FF.IGC**

where



nnn - FR serial number  
FF - the number of flight in day

The second drive is visible by the PC as **LGS\_nnn\_CFG** 1MB in size. It contains directories **CONFIG** and **TASKS**.

To **CONFIG** directory copy the configuration file **LgsCfg.xml** generated by the program *LGSCconnect*.

To **TASKS** directory copy task declaration files **TaskA.xml** and **TaskB.xml** generated by *LGSCconnect* application.

## Start recording

Connect the recorder to the power supply. DC 12V supplied by the RJ-45 or DC 5V to USB mini B. After starting the recorder can perform additional tasks such as generating the electronic signature of the IGC file from the recent flights.

The flight recording starts immediately as motion is detected in a horizontal or vertical pre-defined limits. It is recommended to switch the unit on a few minutes before takeoff. This will ensure a straight base line of pressure height trace.

End of recording is done after disconnecting the power supply or the recorder will remain motionless for a pre-defined period of time ( at least 10 minutes). When power is lost during recording and next recovered within 5 minutes current IGC file is continued.

## Downloading IGC files

Downloading saved logs from recorder is possible in several ways:

- 1) Connect the recorder to a PC using a USB cable. Copy IGC files from the drive **LGS\_nnn\_IGC**.
- 2) Connect the recorder to a PC using RS232 cable through the RJ-45 connector or via Bluetooth. Read IGC files using :
  - a. *LGSCconnect* application
  - b. *IGC Shell* application
- 3) Insert USB flash drive to USB port A. Switch on the recorder. Recent IGC files are copied to a directory **LGS\_IGC** on a USB stick. Number of IGC files copied in that way can be set up by user in *LGSCconnect*

## NMEA output

On pin 5 RJ-45 socket recorder is continuously sending NMEA data stream from the GPS receiver ( at RS232 level). You can also configure pin 4 and Bluetooth to transmit NMEA data stream.

## Bluetooth module

The recorder is equipped with an internal Bluetooth module. The module enables wireless communication with the recorder (tasks and configuration uploading, downloading IGC files) as well as transmitting NMEA stream form GPS receiver. The module works in UART mode SLAVE and is seen on the outside as **Logstream-FR1-nnn** (nnn-FR serial number) Password to connect to is "1234". UART port module is permanently set to 115200 baud connection speed.



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## Connection with PC via RS232 cable

PC connection is possible using the included cable with DB9 RS232 output as well as through the Bluetooth module. Connection can be established if recorder do not start flight recording yet and don't acts as USB mass storage device.

## Pressure sensor calibration

Using *LGSCONNECT* application setup recording interval to 1 fix/sec. Turn recorder on wait 1 minute and put it into pressure chamber. Apply pressure jump to start recording. Climb 4 m/s and make a stop for 30 secs every 1000 m. After reaching highest altitude sink 4 m/s and make stops every 1000 m. After reaching zero open the chamber and wait 1 min. Next switch off the recorder. Switch on the unit and download recent IGC file.

## Firmware updating procedure

Contact by e-mail with the manufacturer. If a firmware update is available manufacturer sends specially prepared and encrypted binary file with the new firmware version and further instructions. Each recorder must receive a copy of firmware update intended only for him.

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