PowerFLARM BRICK

Manual

Version 2.20 US

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Contents

Parts List

Your PowerFLARM™ BRICK™ contains the following parts:

- 1 BRICK, a golden metallic box
- 1 FLARM radio antenna with 6.5ft cable and RP-SMA connector
- 1 GPS antenna with magnetic socket and 15ft cable
- 1 PCAS/ADS-B antenna with 6.5ft cable and SMA connector
- 1 power / data cable with 3ft cable and an open-cut end

PowerFLARM BRICK does not have an integrated display, but connects to a wide range of display interfaces, PDA's, on-board flight computers, moving map applications and MFD.

The typical installation connects to a Remote PowerFLARM Display. Suitable cables providing power and data are delivered with the display.

Working Principle

Based on GPS and the pressure sensor, PowerFLARM predicts your short-term future flight path and continuously transmits this to nearby aircraft by a digital radio message. FLARM-compatible systems in nearby aircraft receive your radio message and send you a similar message with their data. With such you not only know the whereabouts of aircraft around you, your BRICK is also able to calculate conflicting flight patterns and alert you of such traffic on a suited display (FLARM functionality).

PowerFLARM also receives data from aircraft with transponders (Mode C and S) or ADS-B OUT (1090ES), and uses these messages for traffic information and alerts (PCAS functionality).

The effective range depends very much upon the position in which antennas are fitted and facilitates a warning, visual identification, and appropriate action by the pilots in both aircraft.

FLARM-warnings are issued in accordance with the time remaining to a possible collision, not the geometric distance between the aircraft. The first warning is typically issued between 19 and 25 seconds in advance to the calculated possible collision with aircraft or obstacle (time to impact); the second is issued 14 to 18 seconds in advance, and the third 6 to 8 seconds in advance. Warnings are

sustained as long as the threat remains as calculated. Depending upon the prediction, the threat may be downgraded or deleted. Warnings are selective, i.e. they are only issued if the calculation detects a high probability of a collision in the immediate future.

In the future and with costs, PowerFLARM BRICK will also be able to alert you of known fixed obstacles stored in the unit's data base (optional functionality at cost), and store your entire flight in the common IGC-format for analysis and documentation.

Installation

General Advice on Installation

Installation and operation is on a non-interference and non-hazard basis, and may not endanger the safe operation of certified equipment that is either necessary or required by regulation for safe flight. Installation must comply with official requirements.

BRICK must not obstruct the pilot in his operation of the aircraft (including emergencies); in particular at all times it must not obstruct his view of the airspace, even in the event of serious vibration or acceleration. BRICK is not suitable for use in conjunction with night vision equipment, for night flying, or in pressurised cabins.

For updates and configuration, the USB connector must be accessible, where required with an installed extension cable.

Cables must not be cracked or installed under tension. Adequate space must be left for the cable connectors.

Only one single FLARM-compatible system may be installed per aircraft.

BRICK should be located at least 1ft away from the magnetic compass.

After installation, an inspection must be made to ensure that the BRICK does not interfere with any mechanical, electrical, electronic (radio) or magnetic (e.g. compass) system, and this fact must be recorded in the aircraft documents. In addition, the aircraft documents must bear a record of the PowerFLARM BRICK serial

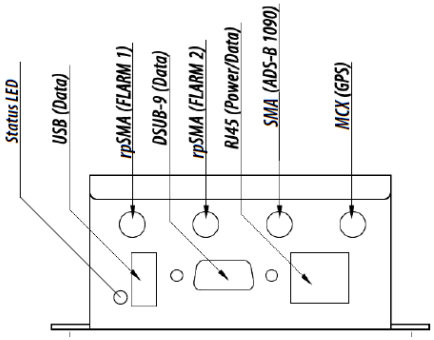
number and Software Version Number. The Means of Compliance must be recorded in the aircraft documentation, an AFM Supplement is to be carried on board the aircraft.

Housing

The metallic housing is not watertight and users should avoid the ingress of solid particles and liquids. Should the unit get moist, it must be completely dried prior to further use. If the unit becomes wet, it may be permanently damaged and rendered unusable; no warranty claim will be accepted for any unit damaged by moisture or liquids. Should the unit be suddenly cooled this may result in the formation of condensation.

Connections

Overview



RJ45: Power and Data Connections

The 8-pin RJ45-socket is in accordance with IGC GNSS FR specifications, except for pin 3. Pin numbering follows IGC's convention (http://www.fai.org/gnss-recording-devices/igc-approved-flight-recorders):

Pin 1 Pin 8

1: +12 to +28VDC power supply
2: +12 to +28VDC power supply
3: BRICK supplies +3VDC for display
4: GND
5: TX, BRICK sends (RS232)
6: RX, BRICK receives (RS232)
7: GND
8: GND

Pin 5 transmits NMEA-0183 Version 2.0 data at a configured data rate (default is 19.2kBaud). Further FLARM-specific data is available for periphery devices (e.g. remote display). Never connect more than one external application on pins 5 and 6. Don't draw more than 200mA on pin 3.

DSub9: Power and Data Connections

The female 9-pin DSub9-socket pins are as follows:

2: TX, BRICK sends (RS232) brown
3: RX, BRICK receives (RS232) red
5: GND yellow
7: +12 to +28VDC power supply blue
8: BRICK supplies +5VDC for PDA grey
9: BRICK supplies +3VDC for display white
(colours used in the open-cut end 3ft cable)

Pin 2 transmits NMEA-0183 Version 2.0 data at a configured data rate (default is 19.2kBaud). Further FLARM-specific data is available for periphery devices (e.g. remote displays). Never connect more than one external application on pins 2 and 3.

The serial port of Pins 2, 3 of the DSub9 is independent of the serial port of Pin 5, 6 of the RJ45.

Pin 9 can supply 3V up to 200mA. It is independent of pin 3 of the RJ45 connector.

Pin 7 of the DSub9 connector and Pins 1 and 2 of the RJ45 connector are internally connected. So are pins pin 5 (DSub9) and 4, 7, 8 (RJ45).

Pin 8 can provide a 5V supply of up to 700mA to PDA's and similar devices. The available current is, however, shared with the USB port. It is recommended to only use ONE of the two concurrently.

FLARM radio antenna (Reverse Polarity SMA)

Always check type and polarity of antenna connectors carefully! Failure to do so will cause permanent damage to the device and will void the warranty.

FLARM A and B Ports are reverse polarity female SMA connectors, with a (male) pin as centre conductor. ADS-B is a standard female SMA connector with a female centre receptacle.

BRICK has two separate FLARM radio transceivers: **FLARM A is used to receive and transmit and must always be connected to an antenna**; FLARM B is only used to receive, an optional antenna may be used for better reception performance.

Ensure the antennas are properly and fully screwed into BRICK. **Never swap the FLARM and the PCAS/ADS-B antennas.** Use only little force when inserting and tightening (1 Nm max). Ensure the antennas are not in contact with any other object through which there might be a regular electrostatic discharge, e.g. the canopy. In case you use two FLARM antennas, ensure they are separated by at least 5ft.
Ideal locations for the FLARM antenna are:

- On the coaming of the instrument panel, in front of the compass (4 inch, 10cm minimal distance to compass)
- In the tail fin of the glider (use low loss 50 Ohm RF cable for the antenna cable extension)
- Behind the pilot's head in the fuselage (not in gliders with carbon fuselage)

PCAS/ADS-B antenna (Standard SMA)

BRICK has one PCAS/ADS-B receiver operating on 1090MHz. Ensure you properly and fully screw the antenna stub into BRICK. Never swap the FLARM and the PCAS/ADS-B antennas. Use only little force when inserting and tightening (1 Nm max).

This antenna should be placed at least 1ft away from the FLARM antenna(s). The FLARM antennas have priority over this antenna for best placement.

GPS antenna (MCX connector)

PowerFLARM BRICK contains a 50 channel GPS receiver, connecting to an external antenna. Ensure you properly and fully plug the GPS antenna cable connector into BRICK. PowerFLARM will not work without good GPS reception.

The GPS antenna should be located in a horizontal position such that it has an unhindered sky-view, including when the aircraft is in a turn. There should be no electrically conducting surfaces (e.g. metal, carbon fibre) over or immediately alongside the antenna. Ideally, the antenna will sit atop the instrument panel coaming. Conducting surfaces under the antenna may have a positive effect upon antenna function.

If more than one GPS antenna is present in the aircraft, it is recommended that they are at least 1ft apart; the same holds for separation from all other BRICK antennas.

USB

BRICK has a built-in USB A 2.0 connector where you can insert a memory stick. Ensure BRICK is disconnected from power, wait for the LED to turn off, insert the stick, connect to power, then BRICK will get configuration data and firmware updates from the stick. Don't remove the stick as long as the LED flashes alternatively in red and green.

All settings can be configured through the USB stick.

Some periphery (e.g. PDS software, glide computers) may allow configuration of some parameters (e.g. Stealth Mode), but FLARM has no control over their implementation.

Power Supply

BRICK requires external electrical power at 12 to 28VDC nominal, drawing up to 1.2W. Power can be connected either through the DSub9 or the RJ45 connector; don't provide power to both!

Connect BRICK via a dedicated pilot-operated 500mA circuit breaker to the battery, separate from any other instruments that are essential for the safe conduct of the flight. In flight the pilot must be able to isolate BRICK from the aircraft's electrical power system without interrupting the power supply to any other important systems. Possible reasons might be a suspected fault in other on-board systems, the presence of smoke or the smell of smoke.

PowerFLARM BRICK can supply power to one remote display (3V, <200mA) and PDA (5V <500mA), however this increases the total power consumption of the device.

LED

BRICK has one LED indicator with the following modes:

- green: BRICK operates normally
- red: BRICK does not operate normally (e.g. no GPS reception, low voltage)
- orange: start-up sequence, may take up to 20s
- red/green flashing: on-going data upload/download with USB memory stick
- off: no power

Configuration

Prior to first use, PowerFLARM BRICK must be configured correctly.

Failure to configure or a false configuration may lead to failure to alert, operate or cause nuisance alarms!

The configuration file must be text only and reside in the top directory of the USB stick. It must be named FLARMCFG.TXT

Commands are the same as on the serial port 'Dataport': http://www.flarm.com/support/manual/FLARM_DataportManual_v6.00E.pdf

Example configuration file (FLARMCFG.TXT)

```
########################################################################
# Template for aircraft configuration.  Uncomment and adapt values as
# required.
########################################################################

########################################################################
# Configures aircraft as a glider.
#
# Possible values as per Data Port spec, the most important ones:
# 1 ... Glider
# 2 ... Tow plane (important for alarm suppression during tow)
# 8 ... Propeller aircraft
########################################################################
$pflac,s,acft,1

########################################################################
# Sets vertical ADS-B range in meters.  For gliders, a vertical range
# of +-1000m is recommended
########################################################################
$pflac,s,adsbvrange,1000

########################################################################
# Configures ICAO ID.  Setting ffffff (default) will use FLARM ID
# Only required if aircraft carries a Mode S transponder
# MUST be the correct ID in HEX (!)
#
# Remove '#' sign at the start of the line to activate
########################################################################
# $pflac,s,id,abc123

########################################################################
# Possible values for transponder setting:
# 0 ... no XPDR
# 1 ... Mode C
# 2 ... Mode S
#
# Remove '#' sign at the start of the line to activate
########################################################################
# $pflac,s,xpdr,0

########################################################################
# Writes a diagnostic dump (PFSSSSS.DMP) to the USB stick.
Existing files with the same file name will be overwritten
########################################################################

$file,dump
```

Essential Settings Prior to First Flight

There are a number of device settings that *must* be configured prior to the use of the device. These are aircraft-specific settings, that can be found in the configuration file. The values chosen depend upon the aircraft and ***must*** be altered before the device is used in another aircraft.

These settings are mandatory for correct operation of the device.

Selection of Aircraft Type

This setting is required to specify the type of aircraft in which your device will be used.

Transponder

Select whether your aircraft has an operating transponder (any Mode) installed and switched ON, or not.

ICAO Address

Under this heading the user enters the hexadecimal ICAO address of the aircraft in PowerFLARM device, also known as Mode S Code. The aircraft address or Mode S Code is the aircraft-unique address assigned by your Civil Aviation Authority, regardless whether you have a Mode S transponder or not; in case your aircraft is equipped with a Mode S transponder, this is the address transmitted by the transponder.

The aircraft's ICAO address is found in the aircraft documents, in the USA, consult registry.faa.gov/aircraftinquiry/NNum_Inquiry.aspx .

Make sure to use the 6-digit hexadecimal number, not the 8-digit octal number, for number transformation consult www.kloth.net/radio/icao24lookup.php . Don't truncate the first 6 digits of an 8-digit octal address to the 6-digit hex address! In the US, addresses are always in the range between hex A00000 and AFFFFF (equivalent to octal addresses between 50000000 and 53777777).

Incorrect settings will result in false warnings or a failure of the warning function. This also applies to your Mode S/ADS-B transponder (if installed).

Both PowerFLARM and the transponder must be set to the correct address.

Register your hex ICAO address for free at www.flarmnet.org

Legal Notes

Product Warranty

The warranty is immediately void should the unit be opened, misused, installed faulty, and any breach of copyright.

Limitations

Your BRICK may only be operated in North America.

PowerFLARM has been designed as a non-essential situation awareness only unit, whose task is solely to support the pilot; it is not always in a position to provide a reliable warning. In particular, PowerFLARM does not provide any resolution advisory (recommended evasive action). Under no circumstances does PowerFLARM facilitate a change in flight tactics or pilot conduct. Even though you have installed PowerFLARM, you remain responsible and liable for the safety of all passengers and other aircraft. Operation of PowerFLARM is solely a matter at the discretion of the pilot. The unit may only be operated by persons who have carefully studies all user instructions.

A display attached to PowerFLARM can only alert of the presence of other moving aircraft if the other aircraft is equipped either with a FLARM-compatible systems, an ADS-B OUT (1090ES) on 1090MHz or an interrogated transponder Mode C or S. PowerFLARM does neither interrogate transponders nor operate as a transponder, and is thus neither detected by TCAS nor air traffic control.

PowerFLARM has not undergone the conventional aeronautical certification process. PowerFLARM software development was conducted in accordance with the usual standards and procedures required for industrial electronics products. The use of public access unlicensed radio bandwidths in the air is subject to a number of limitations, with some national differences. The pilot is solely responsible that PowerFLARM is operated in accordance with the valid local regulations.

The use of PowerFLARM is strictly limited to non-commercial flights in daylight under VFR (Visual Flight Rules). PowerFLARM may not be used for navigation.

FLARM® Radio Communication

The PowerFLARM radio communications are made using a public frequency band not requiring a user licence. This means that the band is also used by a number of other applications. PowerFLARM has no exclusive rights to use the frequency band, so there is no guarantee that PowerFLARM reception will be free from interference by other users.

Essentially, the PowerFLARM communications protocol places little limit on the number of units that may be contacted within the working range. However, an increasing number of units within range leads to a reduction in the probability (graceful degradation) that a single radio message can be received. But the probability that the next signal from the same transmitter will not be received is generally small. A large number of signals from other aircraft does not reduce the working range.

Communications between FLARM-compatible units such as PowerFLARM employ a proprietary copyright protected protocol. The design is patent protected. Any unlicensed use, copying, distribution, conversion, replication, de-compiling, reverse engineering, or further transmission of knowledge so acquired relating to the system components or software, in whole or in part, is forbidden and will result in legal enforcement action. FLARM® is an internationally registered trademark and may not be used by third parties without a license. Technical data may be changed at any time and without prior warning. Some named functions are not provided in all versions, but may be provided at extra cost.

Legal Liability

FLARM Technology GmbH, also its agents, designers, component suppliers, manufacturers and data suppliers accept no legal liability or responsibility for damage or legal claims.

Conformity Declaration

FLARM Technology GmbH, Lindenstrasse 4, CH-6340 Baar, Switzerland, declares that the product *PowerFLARM Collision Warning Device* in Hardware Version FLAPFC1*E and typical configuration, meets the requirements of the CE mark.

CE

The communications conformity meets the requirements of EN 300 220 (power class 9), EMC- Conformity EN 301 489 (class 3 SRD-Device, equipment type I). The device is in accord with the requirements of the European R&TTE Directive.

This device complies with Part 15 of the FCC. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC ID:
ZKUGC625162

Within the USA, the device may only be used in transportation vehicles such as aircraft or motor vehicles.

This Class A digital apparatus complies with Canadian ICES-003.

IC ID Number:
10154A-FLAPFC10

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Maximum Antenna Gain

Currently, the maximum antenna gain for external antennas is limited to 2.0dBi for operation in the 902MHz to 928MHz bands. The antenna gains must not exceed maximum EIRP limits set by the FCC / Industry Canada.

Actuellement, le gain d'antenne maximal d'antennes externes est limité à 2.0dBi pour un fonctionnement en 902MHz à 928MHz par points à bandes. L'antenne gain doit pas être supérieure à maximum EIRP limites fixées par la FCC/Industrie Canada.

Industry Canada Notice and Marking

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

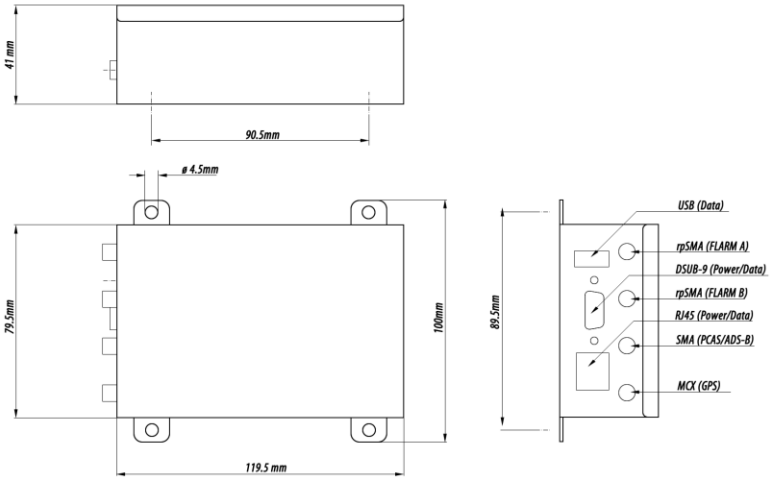
Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Appendix A: Mechanical Drawings

BRICK



FLARM and PCAS/ADS-B remote antenna