

Manual  
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## Introduction

A PowerFLARM™ device draws its position and movement information from an internal GPS-receiver. The position measured is rendered more accurate by an integral pressure sensor. The device calculates the predicted flight path and transmits this information as a short, low-power digital signal burst at one-second intervals together with a unique identification code. At the same time, the device receives similar signals from PowerFLARM devices installed in other aircraft and within radio range, or from aircraft equipped with ADS-B-OUT (1090ES), Mode-C and Mode-S transponders (if interrogated by ground radar or TCAS). The device compares the signals received with its own projected flight path. An optional, additional feature will be for the device to compare its own projected flight path with the positions of known fixed obstacles (e.g. cables, aerials, cable railways, avalanche detonation sites) held in the device's data base.

If the device determines one or more threats of a dangerous conflict with another aircraft or obstacle, it warns the user of the most dangerous threat as per the internal calculation. Acoustic warnings are issued via a warning bleeper and headset audio output, also an optical warning via an LCD display. These signals indicate the height of the threat, the direction from which it has been detected, and the altitude difference. For gliders, during thermalling, a different calculation algorithm is applied from that used in straight flight. The GPS- and collision threat data received are also fed to a serial data port output for use by other devices such as an external display and PDA. Compatible equipment is available from a number of suppliers.

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 prior to the calculated possible collision with aircraft or obstacle; the second is issued 14 to 18 seconds beforehand, and the third 6 to 8 seconds in advance. Warnings are sustained as long as the threat remains relevant. Depending upon updated data and prediction, the threat may be downgraded or deleted.

Warnings are selective, i.e. they are only issued if the algorithms detect a high probability of a dangerous convergence in the immediate future.

Communications between PowerFLARM / FLARM devices employ a proprietary, copyright protected protocol in different frequency bands allocated by region. Effective range depends upon the position in which device and antenna is fitted.

The communications system between devices is protected against unauthorised access. The design is patent protected. There is no public access to the protocol. 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. Technical data may be changed at any time and without prior warning. Some named functions are not provided in all versions of the device, but may be provided at extra cost or for a recurring fee.

# Installation

## General Advice on Installation

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

The device must be so secured that the pilot can see the displays, hear the acoustic warnings, and operate the turning-button. The device 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 sky, even in the event of serious vibration or acceleration. The device is not suitable for use in conjunction with night vision equipment, for night flying, or in pressurised cabins.

Ideally, the device will be fitted to the instrument panel glare-shield or cockpit sidewall. If the device internal display is in use, the rear face of the device with cable connectors must face the direction of flight. If the device is coupled to an external display with controls, it can be installed in another position or point in a different direction. Usually, this will require the use of separate communications and GPS aerials.

The installation must ensure that the communications antenna A and ADS-B are not in contact with any other objects through which there might be an electrostatic discharge.

For example, the communications antenna should not be in permanent contact with the cockpit windscreen inner face, because this could result in damage to the communications transceiver. The device will not operate properly in the absence of an antenna or if the antenna is not properly screwed tight; the device cannot self-test for correct antenna function.

For updates, configuration and flight data evaluation it is helpful if the device is installed such that the data connectors and the microSD-reader are easily accessible or reachable with an extension cable. The serial number must be known for software updates.

It is advisable that the device is so fitted to the aircraft that the turn-button cannot be inadvertently pressed during entry to or egress from the aircraft. Should the device or any associated components be fitted to a part of the aircraft that will be jettisoned in an emergency, suitable break points should be incorporated to prevent any interference with the jettison sequence.

Cables must not be folded or placed under tension. Adequate space must be left for the cable connectors. Cables for data and external devices must be shortened as necessary: to prevent the occurrence of inductive effects they may not be coiled. Only a single device may be installed in each aircraft.

The device and any associated aerials should be located as far away as possible -- at least 30 cm (1 ft) -- away from any other GPS aerial and the magnetic compass.

After installation, an inspection must be made to ensure that the device 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 serial number and Software Version Number. If employed in a fixed installation, the Means of Compliance must be recorded in the aircraft documentation, and an AFM Supplement is to be carried on board the aircraft. The user must ensure that installation and operation complies with all applicable law in the usage location's jurisdiction.

In case of questions or problems, please contact your dealer directly.

## Housing

The lower face of the polycarbonate housing has two threaded screw holes, so that the device may be easily secured using two metric M4 screws (max. 10 mm long). The device must be fitted to a flat surface and the housing not subjected to any mechanical stress. Several types of adapter fixtures are available.

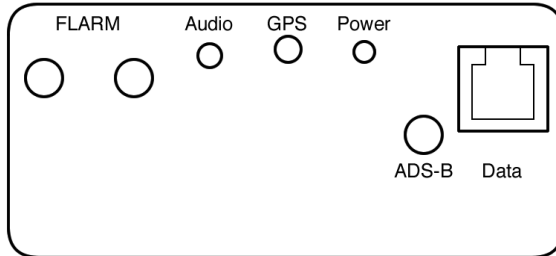
The housing can also be secured using 3M DualLock industrial fasteners, which can be secured and released several times. Users should note that the adhesive used on 3M DualLock is exceptionally strong and may not easily release. The adhesive tape should not cover the battery compartment lid, but should be applied elsewhere on the housing.

The housing is not air or watertight and users should avoid the ingress of solid particles and liquids. Should the device get moist, it must be completely dried prior to further use. If the device becomes wet, it may be permanently damaged and rendered unusable; no guarantee claim will be accepted for any device damaged by moisture. Should the device be suddenly cooled this may result in the formation of internal condensation. The housing may only be cleaned using a slightly moist non-abrasive cloth without a chemical cleaning agent. The housing does not resist scratches or abrasion.

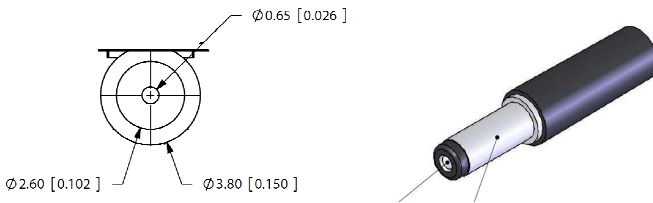
The plastic housing is black to reduce glare and has been tested in the temperature range -10 °C to +60°C. Care should be taken to avoid over-heating due to direct or indirect sunshine, in particular because the housing can become deformed at temperatures above +84 °C without any mechanical tension, and with mechanical tensions also at lower temperatures. The device must not be locally over-heated by exposure to focused sunrays, and care is required when cockpit doors or canopies have been opened (risk of fire to due lens effect). High temperatures significantly reduce battery runtime when rechargeable batteries are used.

## Connections

### Overview



### Power Connector



Supplied power must be 12 V DC nominal (between 8V and 27V DC, 12 V DC nominal required additional adapter) at 500mA.

This power socket mates with a PP-012 connector. VDC(+) is on the inside, GND outside. A minimum of 12V is needed to charge the batteries, please only use the provided power adapter.



Ensure any external power source is only connected in case no or only rechargeable batteries are in the device. External power might damage non-rechargeable batteries (risk of leakage).

### Power and Data Connector (IGC standard)

The 8-pin RJ45-socket accepts and retains an 8-pin connector. Except for pin #3, the pin-out is in accordance with IGC GNSS FR specifications

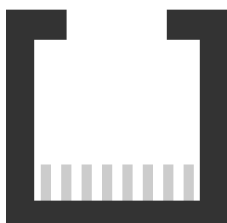


[www.fai.org/gliding/system/files/tech\\_spec\\_gnss.pdf](http://www.fai.org/gliding/system/files/tech_spec_gnss.pdf)

Please note that IGS's pin numbering is reverse to industry standards. VDC and GND are internally connected to the above 'Power Connector'

Do not use 6 or 4 pin RJ-12/11 connectors as it will cause permanent damage to the socket.

An 8-pin ribbon cable with an RJ45 push-fit connector or an 8-pin twisted-pair patch cable with RJ45 may be used. Suitable cables are obtainable from retailers.



- 1: +12 V DC nominal (+8 to +27V DC)
- 2: +12 V DC nominal (+8 to +27V DC)
- 3: Device supplies + 3V DC
- 4: GND
- 5: TX (RS232): only 1 user!
- 6: RX (RS232): only 1 user!
- 7: GND
- 8: GND

Pin 1                  Pin 8    (view from rear)

For 8-pin cables pins 1=2 and pins 7=8 should be linked. If the other wires are not to be used, they should be individually insulated and may not be soldered together or twisted in pairs.



If the incoming power supply uses the Power/Data connection, special attention must be given to the instructions given in the chapter in this handbook entitled *Power Supply*.

The (typically transparent) plug must be examined to determine the cable colour coding so the open cable end may be correctly configured. On patch cables the neighbouring wires of Pins 1/2, 3/4, 5/6 and 7/8 are usually twisted together. Neighbouring wires are usually of the same colour, though one of the two colours alternates with white.

As standard, Pin 5 transmits the most important NMEA-0183 Version 2.0 compatible GPGGA and GPRMC information at a

configured data rate, and Garmin proprietary PGRMZ barometric height information. Further information is available for third-user devices (e.g. external display). Do not connect more than one external application at the same time.

### **Audio**

The audio signal is a standard de-coupled aviation signal of no more than 1 V. The connector is a standard 3.5 mm jack plug.

### **Communications Antennas**

For proper operation the included FLARM-device antenna must be carefully and tightly screwed to the SMA socket labelled 'FLARM A', and the included ADS-B antenna to the rpSMA socket labelled 'ADS-B'. The two antennas look quite similar, but the connectors are slightly different. Make sure you do not mistakenly screw the wrong antenna in the socket, and never use force.

The installation has a great influence upon both transmission and the reception range achieved, and thus requires careful consideration. The antennas must be vertical to ensure unimpeded emission especially to the front, and to the sides. Users are advised not to install the device within or under the instrument panel without external antennas. Horizontal or non-upright antenna presentation is unacceptable. No electrically conducting surfaces (e.g. metal, carbon fibre) should be located over or immediately alongside the antennas. The antennas must not be subjected to physical pressure and may not be bent. Ensure the antenna does not touch the cockpit windscreen.



If a second flat FLARM/PowerFLARM device communications antenna with the extension cable (used for reception of FLARM/PowerFLARM device signals only, not included in shipments) is used, it should be connected to socket labelled 'FLARM B'; ensure it is located at least 1.2 meters (4 ft) from the device.

Alternative offset antennas, external antennas and antenna extension cables (50Ω on normal SMA) can be obtained from

retailers. The installation must be within a Zone 2A or 3 as defined by DO-160/F Section 23.

## GPS-System

The GPS system in the device is subject to the limitations found in typical GPS applications. It is not aviation certified.



The device will not work without adequate GPS reception.

The device can be operated using both the GPS antenna within the housing and with an external GPS antenna (not supplied) connected to the MCX socket. Connecting an external antenna automatically deactivates the internal antenna.

### *Operation with an internal GPS Antenna*

When operating with the internal GPS antenna, the device presentation must be unhindered to the sky ahead and sides. Further, the upper side of the device must not be covered.

### *Operation with an external GPS Antenna*

The antenna should be located in an upright position such that it has an unhindered presentation to the sky, 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, it is recommended that they are at least 25 cm (1 ft) apart; the same holds good for separation from the PowerFLARM device communications antenna.

## FLARM-Device Communications

The FLARM/PowerFLARM device radio communication is made using a license free frequency band known as SRD band. This means that the band is also used by other applications all of which must meet the same restrictions in transmission power, duty cycle, etc.). The device has no exclusive rights to use this frequency band, so there is no guarantee that reception will be

free from interference by other users. Nevertheless, due to the low power nature of the devices in the frequency band and a sophisticated use of the transmission channel, interference is unlikely.

The use of unlicensed bands by aircraft is subject to a number of limitations, with some national differences. The pilot and user of the device are solely responsible for ensuring that the device is used in accordance with the current local regulations.

Essentially, the FLARM/PowerFLARM device communications protocol places no limit on the number of devices that may be contacted within the working range. However, a high number of devices within range leads to a reduction in the probability ('graceful degradation'), that a single signal report can be received. But the probability that the next signal from the same transmitter will not be received is generally small. The device is designed to simultaneously receive and process the signals from more than 50 aircraft within radio range. A large number of signals from other aircraft does not reduce the working range.

## Transponder and ADS-B 1090ES Reception

The ADS-B / transponder antennas are inserted and screwed to the reverse-polarity rpSMA socket as marked. Make sure you do not mistakenly insert the FLARM/PowerFLARM device communications antenna in this rpSMA socket, and never use force.

## Audio

To make sure that an acoustic warning can be heard above loud ambient noise, the signal may be fed direct into the intercom or headset. To this end, there is a 3.5 mm socket for a jack plug on the rear side of the device.

The device also has an integral warning bleeper. The housing front face has an outlet to improve sound release from the internal bleeper. This outlet must not be obstructed by any adhesive agent.



When set at high volume, the bleeper sound level could damage a human ear at close distance. The volume is adjustable.

## Micro SD-Card

The device has a built-in microSD card reader, also compatible with microSDHC. The microSD card (also known as TransFlash) is not supplied, but is in widespread use for mobile telephones and can be purchased from most camera or mobile phone retailers. The device uses the microSD card to update the firmware, obstacle and terrain data, to configure the device and download the flight logs.

microSD cards are smaller than SD cards or miniSD cards. However, for communication with a PC there are mechanical adapters for insertion of a microSD card in SD or a miniSD card. Such adapters are often sold together with the cards.

Note, that the microSD card must be formatted to FAT or FAT32. If your card is not yet preformatted to one of these two formats, do so with your PC; the device does not format cards.

### *Insertion and Removal*

Hold the card with the metal contacts on the right and insert carefully into the slot; then, gently press with the fingertip until the card is retained with a slight 'click'. To remove the card, press the card gently into the device's SD-reader slot until a slight click releases the card, which can then be gently withdrawn. Do not use force.

## Power Supply

The device can be operated using the aircraft's own electrical power system, disposable or rechargeable batteries.

### *Power Supply using the Aircraft's own Electrical Power System*

If the device draws its electrical power through the Power/Data socket, there must be a direct galvanic link between the device and aircraft battery via a 500 mA circuit breaker. This power

supply must be separate from any other instruments that are essential for the safe conduct of the flight. In flight the pilot must be able to isolate the device 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, the smell of smoke, or flying over a country where the operation of the device is not approved.

In spite of the integral electrical polarity guard, it is important not to confuse the power supply with the data cable.

Ensure no non-rechargeable batteries are inserted in the unit.

### ***Power Supply Using Batteries or Rechargeable Batteries***

The device can be operated using different types of batteries or rechargeable batteries. The device requires six AA cells or compatible products:

- Nickel Metal hydride (NiMh) rechargeable batteries
- exceptionally also Alkaline batteries (Alkaline Manganese Cells)



The device should not be operated in conjunction with any other types of battery; other types may damage the device.

The battery type must be set under the settings menu. Never use disposable batteries when the battery type is set to “rechargeable”



Battery endurance depends upon the type of battery, the temperature, the incidence of traffic and display brightness.



The battery life remaining is indicated above the battery symbol on the right upper corner of the traffic display.

### ***Battery Insertion***

The device has a battery compartment on the lower face, and holds six AA batteries. The batteries are inserted by removing the compartment lid. It is essential to ensure that the batteries are inserted with the correct polarity, with no excessive application of force on the battery compartment lid.

### ***Rechargeable internal Batteries***

The device features an internal NiMH battery charger. When the device is turned off and electrically connected to the vehicle or aircraft battery (either via “Power” socket or power pins on the RJ45 socket), inserted batteries will be charged if the ambient temperature lies within the allowed range for charging NiMH batteries.



If non-rechargeable batteries are fitted to the device, do never connect your device to an external power source (e.g. aircraft or vehicle battery)?

The internal batteries may only be charged if the device is resting on a non-flammable, dry base. When the device is being recharged, never allow it to remain unsupervised.

## Technical Data

### Dimensions:

- Length: 94mm
- Width: 96mm
- Height: 46mm

### User Interface:

- Integral turn/push button
- 2" transfective LCD display

### Audio:

- Built-in warning beeper
- Output for Headset Audio
- Volume control

### Communication:

- Internal RS232 NMEA
- Data output for Moving-Map units and external displays (only one user at a time!)
- internal 3V power supply for remote displays

### Sensors and GPS:

- Pressure sensor
- Microphone
- 50-channel GPS receiver with internal or external antenna

### FLARM device communication:

- Dual 868-930MHz FLARM device Transceiver

### ADS-B-IN/XPDR:

- 1090 MHz receiver for XPDR Mode-C/S and ADS-B 1090ES signals

### Antennas:

- 868-930MHz FLARM device antenna (preinstalled and locked)
- 868-930MHz extended FLARM device antenna
- ADS-B/XPDR antenna (on housing, rpSMA-socket)
- Integral GPS antenna
- External GPS-antenna, optional connection (MCX-socket)

### Memory:

- microSD card slot
- Software-update via SD card

### Fixtures:

- Two threaded holes for M4 screws
- Adapter plates and holders (optional)

### Display:

- New generation sunlight-readable Matrix TFT display
- Resolution 132 x 176 pixels
- 2 inch diagonal screen

### Operation:

- Integral push/turn button
- Zoom and settings

### Power:

- 12 V DC nominal (8-27V DC) external
- 6 removable rechargeable AA batteries (exceptionally also non-rechargeable)
- Up to 7.5h battery runtime, (depending upon traffic, temperature and type of battery)



# Operation

## General Advice on Operation

### *Use*

**The PowerFLARM device is designed for use in non-essential conditions as a 'situation awareness only' device, only to support and assist the pilot. It cannot always be relied upon to provide a warning of collision threat. When using the device, under no circumstances should the aircrew adopt any change in flight tactics, or modify the actions of the user or aircraft commander. Even though you have installed such a device, you remain personally responsible for the safe conduct of the flight, the safety of your passengers and other aircraft in the vicinity. Users do so entirely upon their own responsibility and that of the aircraft commander. The PowerFLARM device may only be operated by persons who are thoroughly familiar with the user instructions.**

### *Compatibility*

The device's warnings of the presence of other moving aircraft can only be given if the latter is also equipped either with a FLARM or other compatible device, or a compatible SSR-reply system (Transponder Mode-C/S). The device does not communicate actively with Mode A/C/S transponders, and is thus not detected by ACAS/TCAS/PCAS or terrestrial air traffic control. Transponder signals are only received in presence of ground radar or TCAS interrogation.

### *Radio Range and Reception*

If a warning is to be issued, compatible equipment must be located within range. This range is greatly dependent upon the type and position of the communications antenna installation on the aircraft, also the spatial relationship of the two aircraft to each other.

FLARM device signals between two aircraft are only possible in a line of sight; there can be no signal between two aircraft on opposite sides of the same mountain.

### ***Position Determination***

To operate correctly the device must be constantly aware of its own current position, for which reason it will only operate if there is good, three-dimensional GPS reception. GPS reception is greatly influenced by the correct installation and position of the GPS antenna and aircraft attitude. It also requires that the US GPS system is in full and unrestricted use. Especially when flying in a turn, close to hills or mountainsides, in areas where reception is known to be unreliable, or if the antenna installation is poor, the GPS signal quality may be degraded; this also causes rapid deterioration of height calculation. The device operates correctly again when the GPS signal quality is restored.

The movements registered by a GPS relate to a fixed system of terrestrial coordinates. When the wind is strong, the aircraft heading deviates from Track over Ground, and this has an effect upon the collision threat calculated. If the wind speed is one third of True Airspeed (TAS) and the aircraft heading is at 90° to the wind and with no drift, then the display has an error of e.g. 18°. If the wind is very strong the Track over Ground can deviate as much as 180° from the Heading. If the aircraft is circling, the calculation and thus collision warning threat are unusable.

In the event of poor GPS reception, for aircraft at close distance and at similar heights, the angle offset from the vertical is imprecise and irregular.

### ***Flight Path Calculation***

The device calculates its own predicted flight path for about the next 20 seconds. The prognosis is based upon immediate past and current vectors, plus a movement model that has been optimised for the respective user. This prognosis incorporates a number of errors that increase with the duration predicted. There is no guarantee that the aircraft will fly along the projected flight path. For this reason, a prediction may not be

accurate in every case. In light aircraft, flight path predictions of more than half a minute are unusable.

### ***Data Protection***

The transmitter has no influence on what a receiver does with the data received. It is possible that this data might be logged by other airborne or ground stations and then used for other purposes. In many instances this could be to the user's advantage (e.g. automated flight log, flight tracking, and last position recovery): The data could also be used as evidence against the aircraft's airspace or height violations or collision avoidance actions. With each signal the device transmits a unique identification code relating to the aircraft or pilot.

### ***Limitations***

The use of the device is strictly limited to non-commercial flights in daylight under VFR (Visual Flight Rules). The device may not be used for navigation, in aerobatics, in IFR or in pressurized cabins.

### ***Certification***

The device has not undergone the conventional aeronautical certification process. The software development is conducted in accordance with the usual standards and procedures required for industrial electronics products.

### ***Transport and Storage***

Store and transport the device without the batteries to avoid the device powering-on or the batteries leaking. Protect the display. Store the device in a dry and cool but not cold place.

### ***Further Questions or Problems***

In case of questions or problems, please contact your dealer directly.

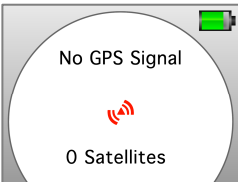
## Start-Up

To switch on the device, the operating button must be pressed for at least three seconds.



A start-up display then appears.

If the disclaimer screen is not acknowledged by pressing the button within 5 minutes, the device switches off automatically to conserve battery.



After acknowledging the disclaimer, the displays how many GPS satellites have been found. As soon as GPS reception is sufficient to give a worthwhile determination of position, the device then switches to normal operation.

## Fault Reporting and other Information

During normal operation the display advises the user on operational conditions. In addition, the device has a self-test function. Should it detect a fault, the device will display a fault report. Several types of reports might be displayed:



Serious Fault: Operation may not continue.



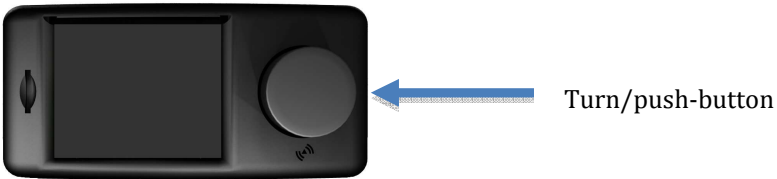
Caution / Fault: A fault has occurred and/or extra care is required.



Information: Simple information report, no fault.

## Operation

The device is operated using the integral turn-button with push function.



The following table gives a brief overview of the most important push-button combinations.

Brief push on button	Select / Enter
Longer push on button	Open/Close menu
Very long push on button	Switch On/Off
Turn button	Choose zoom depth, or select object in menu

## Normal Operation

In normal operation the device shows signals received from other FLARM-device- or ADS-B-OUT 1090ES targets on a radar-like display. The user can select different zoom levels by turning the button.



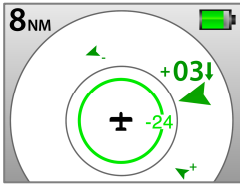
The large aircraft symbol always indicates the nearest aircraft and its relative track. Above the arrow (or below if the nearest aircraft is below), the relative height in steps of 100 ft and a small arrow showing climb/descent information is given. For

example: 300ft higher, flying from left to right descending.



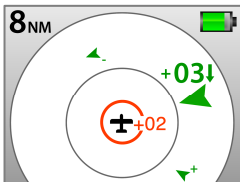
The small aircraft symbol gives the flight direction for distant aircraft. The sign indicates the relative position above or below you.

Light green or red circle: the circle shows the approximate distance of the nearest aircraft not equipped with ADS-B-OUT or FLARM devices, i.e. aircraft with only Mode-C/S transponders and nearby interrogation. The height information is given in 100 ft steps and the circle symbolises the distance. (Example: 600ft above)

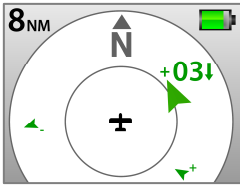


Aircraft in the vicinity are displayed as green symbols of different size. In the example, there is a target 300 ft above at 2 o'clock, heading towards you, descending; as well as two other more distant targets, one below ◀ -, one above ◀ +.

The nearest aircraft not equipped with ADS-B-OUT or FLARM devices, but is indicated as a light green circle, in the example, that target is 2400 ft below. The circle radius gives a distance estimation based on signal strength.



The green circle turns red when close. In the example, the target is 200 ft above.



When on the ground, the 'radar' screen will operate provided there is adequate GPS reception. The screen image is then oriented to the North, symbolised in the screen by an 'N'.

## Collision Warnings

### Warning Presentation

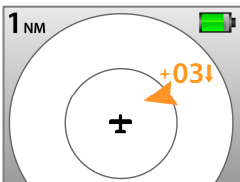
If a dangerous situation is recognised during normal operation, the device gives an appropriate warning. The target image is adjusted in accordance with the nature of the threat.



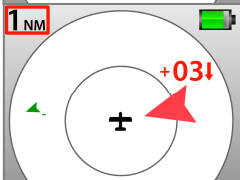
Large orange coloured aircraft symbol: this aircraft poses a threat of collision. The flight direction and height difference of the other aircraft are given to the nearest 100 ft, together with an indication of climb/descent. In this example: 300 ft higher, descending, flying from left to right.



Very large red aircraft symbol: there is an immediate threat of collision. In addition, the display gives an indication of the vertical angle to the other aircraft. The flight direction and height difference of the other aircraft are given to the nearest 100 ft, together with an indication of climb/descent. In this example: 300 ft higher, descending, flying from left to right.



In dangerous situations, aircraft posing a threat are presented in orange or red, depending on the urgency of the threat. An acoustic warning is issued in addition to the optical warning.



In very dangerous situations the zoom factor is automatically adapted to an appropriate value.

Depending upon the threat level, the acoustic warning varies the bleeper frequency.

### ***Information about Warnings***

If there are several fixed or moving objects within radio range, the device uses a mathematical algorithm to determine that which poses the most immediate threat, and issues a warning about this threat and none other. The pilot is unable to acknowledge the warning. However, in spite of a warning having been given for a single object it remains possible that several, or other objects simultaneously represent a major threat, or in effect are together more dangerous than the object for which the warning was issued. If the device simultaneously detects a threat from a moving object and a fixed object, then a warning is issued for that which represents the earliest threat of collision.

On the basis of calculation the device indicates the direction taken by the most dangerous object, and its current location. The device does not indicate where the closest proximity may occur, nor what avoiding action is required. Whether and what avoiding action should be taken is the sole responsibility of the pilot, whose correct response must be based upon his own observation of the local airspace. In particular, he must observe the avoidance rules of the air, and ensure that the avoidance action does not endanger any other airspace users. Depending upon the flight phase, the device uses different forecast processes, movement models and warning calculations to provide the pilot with the best possible support without distraction. For example, sensitivity is reduced when a sailplane is thermalling. These models and processes are optimised, but always represent a compromise. As seen by the pilot, these models will issue 'unnecessary' warnings; in other words the device may give a warning in situations where there is no



subjective danger. It is also possible that the device will not give warning of the most serious threat, or gives no warning at all.

Warnings are given at very short notice, normally up to 20 seconds prior to the closest calculated proximity. The intensity of the warning indicates the threat level (calculated collision time) but not the geometric distance. The device only issues a warning if it calculates and predicts a considerable threat of collision. It is thus possible that although a signal is received, that no report is issued about the presence of another aircraft.

## Settings Menu

The settings menu is called up by extended push of the button. The user then navigates his way through the menu by rotating the button. A short push on the button selects the item that is currently highlighted.

On top of each menu, a push returns to the previous level. You may quit the menu by a long press of the button at any time.

## ***Menu Structure***

The following diagram shows the device menu sequence.

### ***Volume***

Warning buzzer volume

### ***Settings***

#### **Aircraft**

Type: Selection of aircraft type

ICAO Address: Enter ICAO Address (hex Mode S Code)

XPDR: Own transponder details

#### **FLARM**

Range: FLARM-device range

#### **PCAS**

Range: Horizontal range Transponder Receiver

Vertical Range: Vertical Range Transponder Receiver

#### **ADS-B**

Range: Horizontal Range ADS-B-IN

Vertical Range: Vertical Range ADS-B-IN

#### **Data-Port**

Baud Rate: Set data rate for RS232 data output

Sentences: Selection of data issued

Range: Horizontal Range of data issued

#### **Brightness**

Brightness Setting

#### **Audio Out**

External head-set

#### **Batteries**

Battery type

#### **Factory Reset**

Return to factory settings (Note: There is NO confirmation screen)

### ***Info***

Information about the device

### ***Power Off***

Switches device off

## 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 under 'Settings > Aircraft'. 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.

### ***Selection of Battery Type***

Default is set to disposable Alkaline batteries, set to rechargeable type if that is used for correct battery level indication and activation of the charging circuits.

### ***Transponder***

Select whether your aircraft has an operating transponder (any Mode) installed, 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 UK, consult

[www.caa.co.uk/application.aspx?catid=60&pagetype=65&appid=1](http://www.caa.co.uk/application.aspx?catid=60&pagetype=65&appid=1) .

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](http://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 UK, addresses are always in the range between hex 400000 - and 43FFFF.



**Incorrect settings will result in false warnings or a failure of the warning function.**

Register your hex ICAO address for free at [www.flarmnet.org](http://www.flarmnet.org)

## Legal Notes

### Product Warranty

The warranty is immediately cancelled should the device be opened, misused, faulty installation, and any breach of copyright.

### Limitations

The device has been designed as a non-essential 'situation awareness only' device, whose task is solely to support the pilot; it is not always in a position to provide a reliable warning. In particular, the device does not provide any suggestions as to avoiding action. Under no circumstances does the device facilitate a change in flight tactics, user or commander response. Even though you have installed the device, you remain responsible and liable for the safety of all passengers and other aircraft. Operation of the device is solely a matter at the discretion of the user and commander. The device may only be operated by persons who have made a careful study of the user instructions.

The device can only warn of the presence of other aircraft that are equipped with PowerFLARM devices or compatible equipment, and of obstacles that are recorded in the internal data bank. The device does not communicate *actively* with A/C/S transponders, and is therefore not detected by ACAS/TCAS/PCAS or Air Traffic Control. Likewise, the device does not communicate *actively* with TIS-B, FIS-B and ADS-B (1090ES, UAT, VDL-4).

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

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In addition, FLARM Technology GmbH's current General Terms and Conditions of Sale apply.

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reserves the right to make changes to specifications and product descriptions at any time without notice.

### Conformity Declaration

FLARM Technology GmbH, Lindenstrasse 4, CH-6340 Baar, Switzerland, declares that the product *PowerFLARM Collision Warning Device* in Hardware Version FLAPFP2\*E and typical configuration, meets the requirements of the CE mark.



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.