# FLYING EYE

# FLYSAFE KIT
## DJI Matrice 4 Series

Circuit-breaker + Parachute + Geofencing option
(EASA C5 certification)

**5**

# User manual



*Made in France*

# Summary

# Who are we?

Flying Eye has been your specialist partner in drone technology since 2009. We have been developing parachute arresters since the introduction of drone regulations in 2012. With its pyrotechnic system derived from aviation technology, you have the most effective and lightest system on the market.

We would be delighted to provide you with any technical or commercial information you may require.

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**Read this manual carefully before handling the Flysafe system.**

# Warnings and precautions

Flying Eye reserves the right to suspend the warranty of any person who fails to comply with the basic safety instructions set out below.
Flying Eye accepts no liability for any damage or injury directly or indirectly related to the use of pyrotechnic cartridges or as a result of the use of pyrotechnic cartridges that do not comply with safety requirements and standards.

- It is forbidden to carry out any operations other than those described in this manual.
- The device must only be used by (or under the supervision of) a responsible adult. Always keep the device out of the reach of children.
- Do not place the device in a damp or wet environment and keep it away from UV light.
- Do not expose the system to high or low temperatures, strong shocks, shock hazards, contact with chemicals or acids, or long-term storage in a high-humidity or dusty environment. Improper use could cause the pyrotechnic cartridges to explode, putting you in danger. The maximum operating temperature is 40°C and the minimum operating temperature is -15°C.

# Warnings and precautions

Check that the parachute system is in good condition before each outing. Do not use the device if it is damaged or if the test procedure is inconclusive. If necessary, contact your dealer.

The parachute in no way alters the operation of the drone.

Any flight with a drone implies the existence of a risk for the equipment and people in the vicinity, with or without a parachute.
Under no circumstances should the use of a parachute increase your risk.

The parachute must be activated manually by the user. Regular training is necessary to be able to react correctly in an emergency. For the safety of the equipment and third parties, use the Test LEDs regularly to trigger dummy ground exercises.

The ejection system only works once.
Once used, the pod containing the parachute and the load must be replaced before any further use.

# Technical specifications

## Description

- Kit for DGAC C5 <u>EASA</u> certification
- Manual and automatic parachute release
- The circuit-breaker module is built into the drone
- Compatible with DJI Matrice 4E and 4T
- Conformity matrices: MoC2511 & MoC2512
- MoC2511 declaration of conformity
- C5 declaration of conformity
- Geofencing optional
-

Installation is carried out in our workshop (assembly included in the price).

Even if drones are used and maintained correctly, they can sometimes find themselves in severe weather conditions or encounter problems such as loss of GPS signal, technical failure of the engines or radio control failure.

In this kind of critical and emergency situation, it is crucial to have a safety device activated immediately.

# Technical specifications

Parachute rescue systems with automatic fall detection can make all the difference compared with human reflexes. The Flying Eye parachute kit can be deployed automatically in these situations, ensuring the safety of your drone but above all reducing the impact on the ground for the safety of third parties.

## Technical specifications

| | |
|---|---|
| Weight | 195 g |
| Range | 2500 m |
| Trigger | • Automatic by fall detection<br>• Manual triggering by simultaneous double-pressing<br>• Automatic triggering on leaving the flight zone (Geofencing optional) |
| Autonomy | Over 30 hours for the radio control (1800mAh li-po battery rechargeable via USB-C |
| Remote control | Automatic power-down after 30 minutes without connection<br>Safe switching on and off (short press then long press) |
| Communication | Bi-directional link FTS transmission frequency: 868MHz<br>Encrypted (256-bit) and authenticated frames |
| Security | Redundant power supply for Flysafe kit |
| Maximum impact energy | No wind: 18 J<br>Maximum wind (43km/h): 120 J |

# Hardware

## Supplied


Flysafe remote control


Radio control screw holder


Parachute pod


Circular cutter module


Support Module


Led test


Screws (4 flat-head and 2 round-head)

**Declaration of conformity C5**

## Not supplied


Drone


Remote control


Screwdriver

*Using the radio control with this system is easier with a harness.*

# Installation



You will need the Flysafe remote control, the drone remote control and the screws.



Attach the Flysafe remote control to the drone's remote control using the screw holder
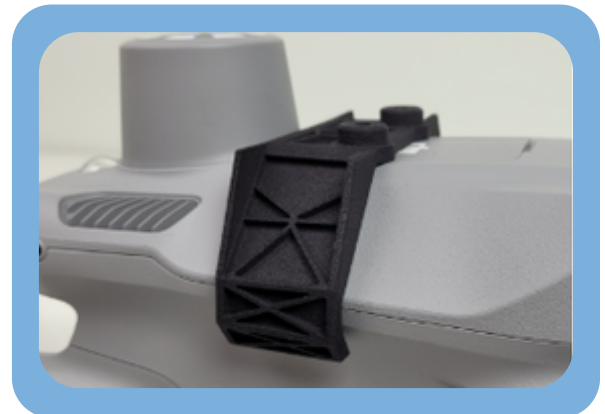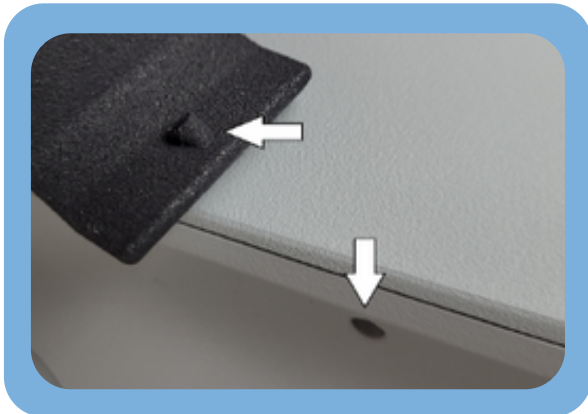


Remove the USB-C cover



Insert the bracket on the drone

# Installation





Clip it into the holes on the sides using the support tabs



Position the module on the support and connect it to the USB-C socket



Place the flat-head screws at the front and the domed-head screws at the rear and screw in place.

# Installation



Insert the parachute into its slot



Plug it all the way into USB-C



Fix the screws on the sides to hold
the parachute in place.



The parachute system is now
installed

⚠️ Be careful when inserting the pod: inserting the parachute in the wrong
direction can damage the connectors and alter the operation of the system.

# How to use it



## 01 LOADING

The parachute pod charges automatically when it is installed on the drone and the drone is switched on.



## 02 START

Before switching on the parachute circuit breaker, align the box horizontally:

-Lighting: The Matrice 4 parachute pod lights up automatically when the drone is switched on, provided it is correctly inserted. An audible signal confirms that the pod has switched on correctly.

# How to use it



## 03 **STOP**

The parachute pod stops automatically when the drone is switched off.



## 04 **EJECTED PARACHUTE**

The red LED is always lit and the buzzer sounds every ten seconds (the remaining power must be greater than 20%).
Switch off the buzzer when you have found the drone.
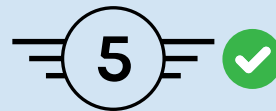
# How to use it

**Pod on**

ON

+

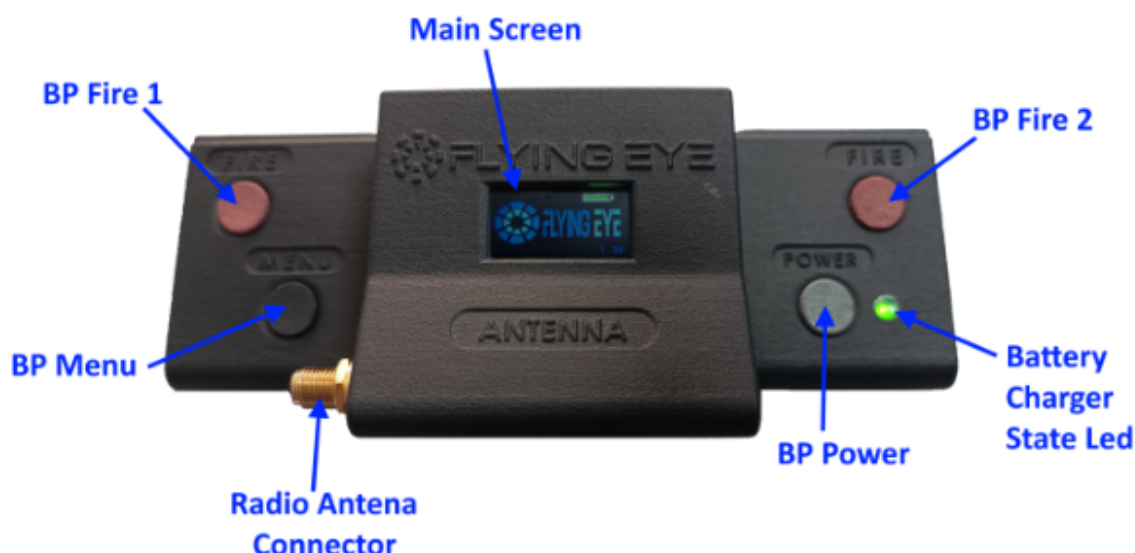**Radio control switched off**

OFF

Automatic
triggering only

---

**Pod on**

ON

+

**Remote control on**

ON

Automatic
triggering only

# Flysafe remote control



**Main Screen**

**BP Fire 1**

**BP Fire 2**

**BP Menu**

**Battery Charger State Led**

**Radio Antena Connector**

**BP Power**

## START AND STOP

To switch the Flysafe radio control on or off, press and hold the power button (grey).
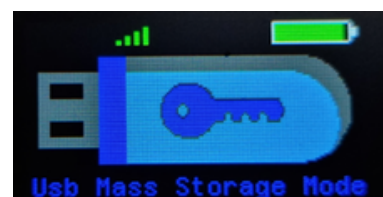The charge level is indicated on the screen.

## TRIGGER

The parachute is released by pressing the 2 'FIRE' (red) buttons simultaneously.

## USB TRANSFER MODE

To switch on the Flysafe radio control in USB transfer mode, connect it to a computer and switch it on while holding down the menu button. To exit USB mode, restart the radio control.

# Flysafe remote control

The main display provides telemetric feedback to the receiver and continuous status information. It is divided into four separate sections:

The strength of the radio link with the receiver

The level of the radio control battery

The status of the FTS cut-off system on board the machine (detailed in the next section).

- The status of the Geofencing system on board the receiver (detailed in the next section).



1. Radio Link State     2. Battery Level

3. FTS State     4. Fencing State

# Flysafe remote control

## FTS status

The status of the FTS, i.e. the cut-off system, is displayed on the left of the main screen. The following icons can be displayed and correspond to a particular status :

 The cut-off system is fully operational. The user can initiate manual disconnection.
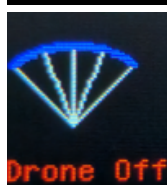
 The system has been switched off, either manually by the user or by the geofencing system.
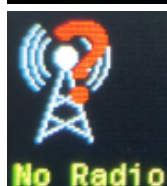
 The radio link with the receiver is broken. The drone is powered down or out of range.

 The pyrotechnic charges are not connected. Please check the parachute assembly.

 If the pyrotechnic charges are damaged, contact your dealer.

# Flysafe remote control
(Optional)

## GeoFence status

N.B : The geofence functions are only available as an option. Without it, the manual mode icon will always be displayed.
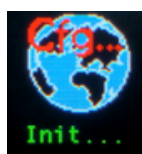
The status of geofencing is displayed on the right-hand side of the main screen. The following icons can be displayed and correspond to a particular status :
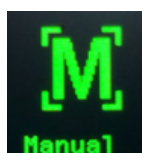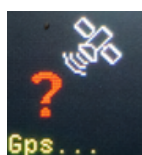
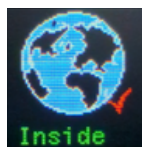 Manual mode only (geofencing not available)
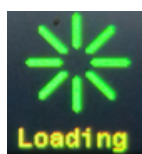
 Loading or checking the fence in progress can take some time for large fences.
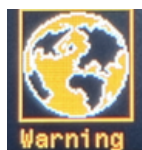
 Initialising the geofence system

 Searching for an adequate GPS signal

 Geofence activated and drone inside the fence

 Geofence activated and drone inside a warning zone

 Drone outside the fence, flight aborted in 0.2s

# Using geofence
(Optional)

## Start-up procedure

To ensure that geofencing works properly, it is essential to follow the following order: the radio control must be switched on first in order to activate the fence. The drone can then be powered up, either to load a new fence or to check that the fence stored in the receiver matches the one in the radio control.

Once the fence has been validated, the GPS signal has been acquired and the icon confirming that the drone is inside the zone appears on the screen, the drone can take off and complete its mission in complete safety.

## Fence update

- Create your own fence using the editing tool.
- Save the fence as 'fences.json'.
- Connect the remote control to the USB port and start it up in USB transfer mode.
- Copy the fence file fences.json to the root (be careful to respect the file name).
- Restart the remote control (in normal mode).
- Restart the machine and wait for the fence to load.
- Once loaded, the status of the geofence confirms that it has been activated.
- The user can proceed with the flight.

N.B : If the fence is invalid (incorrect structure or format, see next section), the system will automatically switch to manual mode, so the fence must be corrected using the tool.
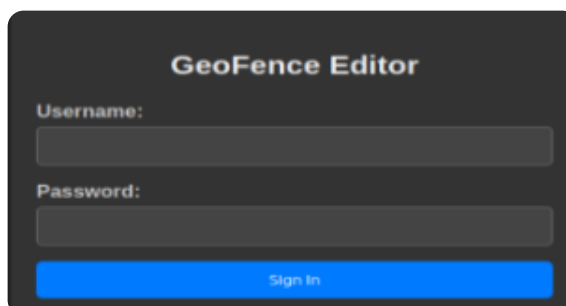
# Editing a geofence

(Optional)

## User access

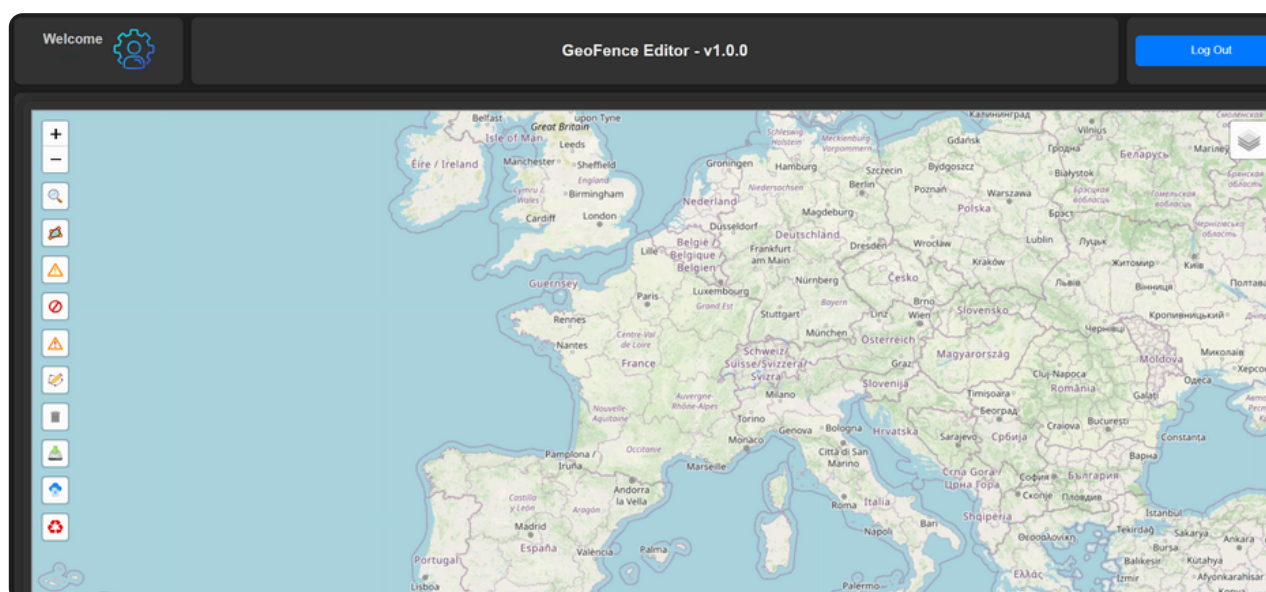Access GeoFence Editor :

*https://geofence-editor.flyingeye.fr/*



Log in using the login details you received beforehand



Choose a new password and change it by clicking on 'setting' :



Get to know the interface and discover the different functions

# Editing a geofence
(Optional)

## Creating your flight zone

The editing procedure is as follows:
Use the search engine to find the location of your operation.
Draw the main fence and confirm.
Draw the warning fence and confirm.
Add the No Fly Zone (NFZ) and validate (optional step).
- Add the NFZ warnings and validate them (optional step).

| | |
|---|---|
| | The search engine makes it easy for users to find a specific location by entering the name of a town or address. A dialogue box is displayed in which the user can type the name into a text field and confirm by clicking the 'Search' button. |
| | Editing the main fence. Used to draw the Fence polygon (orange with a red border); One click to enter edit mode, the user clicks on the map to draw, then validates the outline by selecting the first point or by clicking this button again. |
| | Editing the warning fence. Used to draw the warning polygon associated with the fence (green with orange border). |
| | No Fly Zone (NFZ) edition. Used to draw NFZ polygons (red with a red border). |
| | Warning NFZ editing. Used to draw Warning polygons associated with NFZs (orange with an orange border). |
| | Enables the user to correct polygons that have already been drawn, and to add and/or delete points. |

# Editing a geofence

(Optional)

| | |
|---|---|
|  | Deleting polygons. Allows the user to delete a targeted polygon. |
|  | Backup. Saves the current Fence in the json format expected by the Standalone remote control (standard geojson with properties). |
|  | Fence loading. Allows the user to reload a fence that they have previously edited. |
|  | Cleaning. Allows the user to delete all the fences currently being edited (reset editing to zero). |

The criteria for invalidating a fence relate to the integrity of each element. There can only be one fence associated with a single warning fence. By definition, each fence perimeter drawn must correspond to a single, closed, uncrossed polygon. Similarly, there can only be a maximum of five NFZs associated with five Warning NFZs. It is necessary to define a warning fence internal to the main fence, and similarly, it is necessary to define a Warning NFZ external to its associated NFZ.

It is the user's responsibility to define a valid fence and to ensure that it is loaded. Similarly, they must ensure that they take off within the active fence, otherwise the geofence will not be activated on start-up but only when the drone enters it.
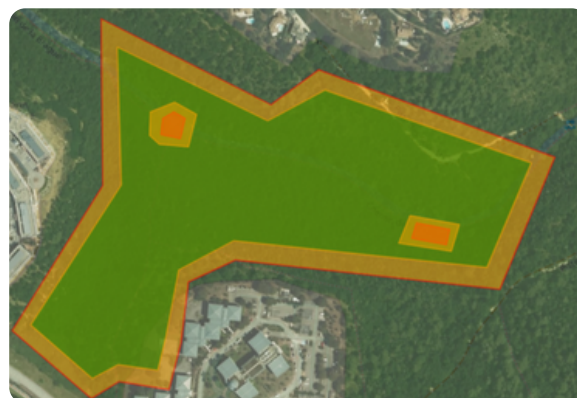


*Example complete fence valid with NFZ.*

# Pre-Flight Test

Before the first flight of the day at a given operating site, check all the components of the system and verify its integrity. If any anomaly is found, do not proceed with the flight and contact your dealer.

## Ground test:

| | |
|---|---|
| 1 | Ensure that the entire drone system is powered down. Battery disengaged, automatic module switched off |
| 2 | Remove the parachute pod |
| 3 | Insert the test LED in place of the parachute pod |
| 4 | Fitting the battery |
| 5 | Switch on the two remote controls and the drone |
| 6 | Start up the drone's engines |
| 7 | Activate the Flysafe system by pressing the 2 red 'FIRE' buttons: the four motors stop and the test LED lights up. |
| 8 | Switch off the drone and the two remote controls |
| 10 | Replace the parachute pod (as shown on page 12) |

Important: Remember to refasten the 2 screws

# Flight preparation

**Simplified memo for preparing flights in specific categories:**

Volumes, Limits and Zones to be defined for your operations using the automatic FTS:

Flight Geography: Volume of flight programmed for automatic flight or planned for your trajectory in manual mode.

Contingency volume: Flight volume in which you can trigger contingency procedures to return to the programmed or planned flight zone

Contingency volume limit: Emergency procedures must be triggered if this limit is exceeded. This is particularly the case for the automatic FTS Flying Eye Flysafe

Ground Risk Buffer: Zone projected on the ground where no third party should be present in the event of a crash of the aircraft, also known as the Third Party Exclusion Zone (ZET).
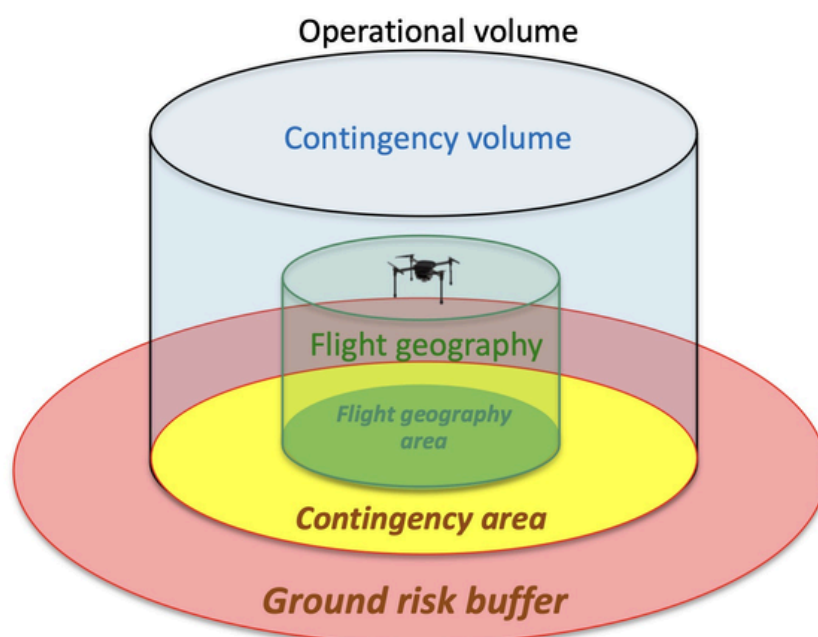
# Operating conditions

Minimum height (for optimum parachute efficiency): **15 m**

Maximum transmission distance: **2500 m** (in flat, clear terrain with no interference)

Maximum wind speed: **43km/h**

Parachute opening time: **1.5s**

Fall speed under parachute: **5 m/s**

Operating temperature : -**10 to 40°C**

Impact energy without wind: **18 J**

Frequency used: **868MHz**

LORA 868 MHz is shared with other users and devices using the same frequency band, such as remote controls for home automation, energy networks (Linky), IoT home networks, industrial communication systems, etc. These devices can interfere with the FTS system, causing interference in transmissions between the radio control and the receiver, resulting in transmission delays, loss of data or even complete interruption of communication.

It is therefore necessary to check the signal strength before the flight and to monitor it throughout the flight.

You should also avoid flying near high-power radio frequency transmitters or electrical installations.

# Dimension of the Ground Risk Buffer

### Sub-scenario STS-01 :

| | Minimum distance to be covered by the buffer zone for the prevention of risks on the ground for non-captive aircraft without crew on board | |
|---|---|---|
| **Maximum height above ground** | **With a MTOM of 10 kg or less** | **With a MTOM greater than 10 kg** |
| 30 m | 10 m | 20 m |
| 60 m | 15 m | 30 m |
| 90 m | 20 m | 45 m |
| 120 m | 25 m | 60 m |

# Dimension of the Ground Risk Buffer

## Under licence :

Evaluation of the crash zone when using the Flysafe kit in manual mode, assuming an operator reaction time of 3s and a ground speed of 10m/s.
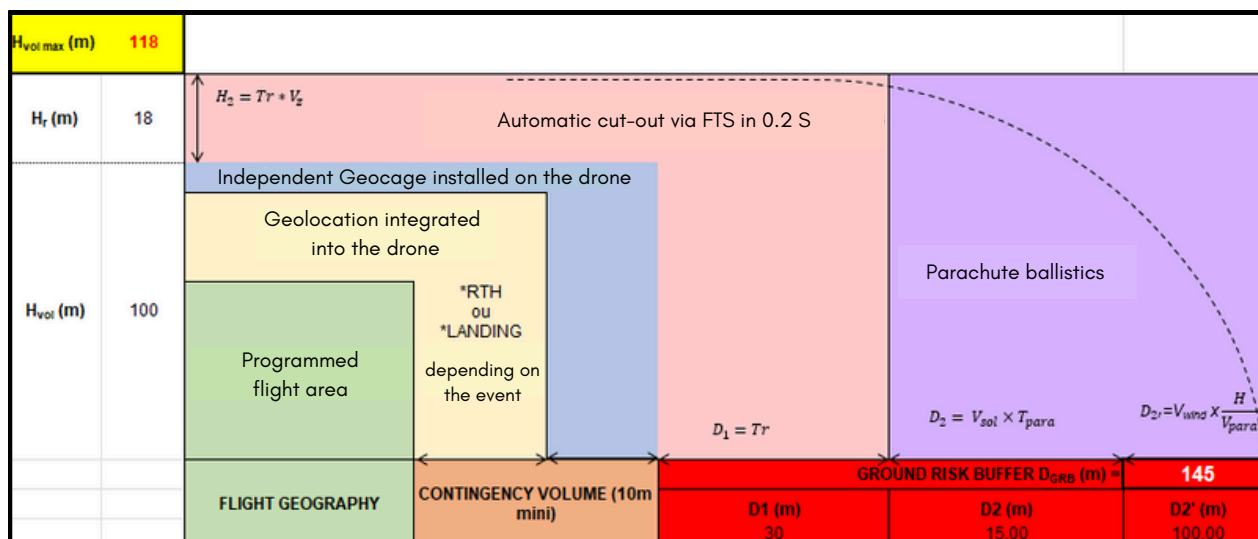


| Height of operational volume (m) | Corresponding ground risk buffer (m) |
|---|---|
| 10 | 55 |
| 20 | 65 |
| 30 | 75 |
| 40 | 85 |
| 50 | 95 |
| 60 | 105 |
| 70 | 115 |
| 80 | 125 |
| 90 | 135 |
| 100 | 145 |
| 110 | 155 |
| 120 | 165 |
| 130 | 175 |
| 140 | 185 |
| 150 | 195 |

Example with the following data:

Max vertical speed Vz = **6m/s**
Reaction time Tr = **3s**
Max drone speed Vsol = **10m/s**
Deployment time Tpara = **1.5s**
Drop speed Vpara = **5 m/s**

This method is an example. The operator can refine the GRB calculation by referring to Appendix 1 of the SORA implementation guide.

# Emergency procedures

**Important note:**

The procedures below do not exhaustively describe the actions to be taken by the remote pilot in response to all possible types of anomaly.

They assume that the telepilot has first attempted to return to a normal flight situation and are limited to describing the ultimate safeguard measures when :

-The aircraft cannot be maintained within the flight limits provided;
-In the event of flight out of sight, the telepilot no longer has sufficient information to pilot the aircraft or ensure that it remains within the flight limits provided.

### Scenario S2 or STS-02 :

Flying out of sight: if the remote pilot no longer has the aircraft's altitude or location information, or if there is any doubt about the validity of this information, he must abort the mission by activating a failsafe device, either manually or, if necessary, by shutting down the engines.

If the aircraft cannot be kept within the flight limits, the remote pilot must abort the flight by shutting down the engines using the Flysafe radio control system.

If the Flysafe radio control loses contact, as indicated by the corresponding light, the mission must be aborted immediately and an RTH procedure initiated.

### Scenario S3 or STS-01 :

In the event of a malfunction causing the aircraft to crash or preventing it from remaining within the flight limits set, the remote pilot must immediately activate the FTS

In the event of a loss of connection to the Flysafe radio control system, as indicated by the corresponding warning light lighting up. The mission must be aborted immediately and an RTH procedure initiated.

# Maintenance

**Maintenance after each activation**
Change of pyrotechnic charges. Change of parachute pods. Return used pods to Flying Eye

**Drone monitoring**
Each day of flight, the operator completes the flight monitoring file provided (see appendix 1) or any other monitoring tool. In the event of a malfunction, he fills in the 'incident sheet' (see appendix 2) and sends it back to Flying Eye.

**Maintenance after 1000 activations** (including pre-flight test)
After 1000 activations of the Flysafe system, the drone must be sent to our premises for servicing.

**Cleaning**
Clean the accessory kit with a damp cloth. Do not use chemicals. Do not use a high-pressure cleaner.

# Replacing the parachute pod

**Steps for changing the parachute pod :**



- Order a new parachute pod (grey case)
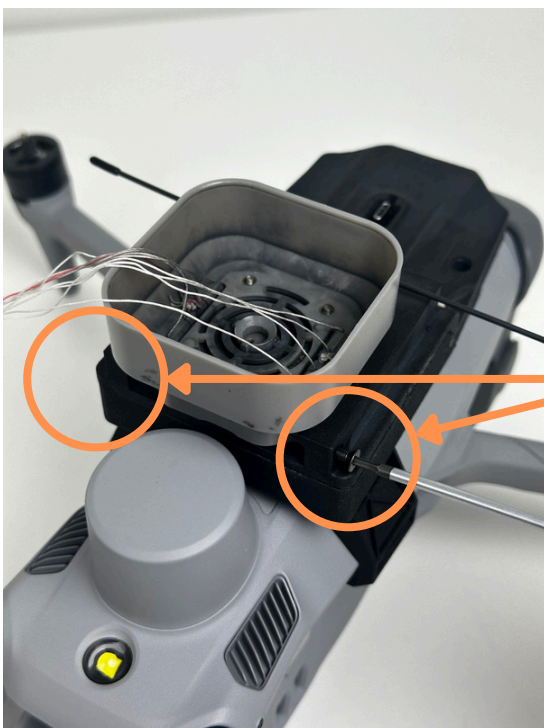


- Unscrew the 2 screws located under the pod (on each side)

# Replacing the parachute pod
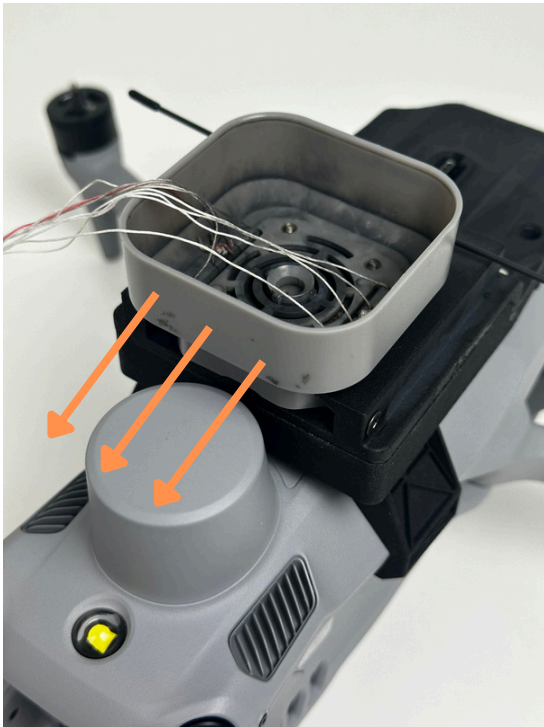


- Slide the pod towards the rear of the drone



- The parachute support will then be released

# Replacing the parachute pod



- Insert the new parachute pod by sliding it towards the front of the drone, making sure that the USB-C port is also towards the front of the drone.



- Re-tighten the 2 screws located under the pod on either side of the bracket

- Your pod is now correctly installed and ready to use again.

# Assistance and Warranty

**Technical Support**

If you encounter any difficulties during installation or have any further questions about using the Flysafe kit, please contact Flying Eye technical support.

**Warranty**

The Flysafe kit for DJI Matrice 4 is covered by a 12-month warranty according to the conditions of purchase. The warranty covers manufacturing defects, but does not apply to damage caused by incorrect installation, accident or improper use.

# Monitoring tool (Appendix 1)

| Flight feature | | | | | Weather | | FTS default tracking | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date <dj/mm/aaaa> | Nature flight | duration in min | Remote pilot | Location | average wind speed (m/s) | Temperature (°C) | FTS activation | Activation failure | Unintentional activation of the FTS | Remarks | Year for annual review |
| | | | | | | | | | | | |
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# Incident form (Appendix 2)

| ![FLYING EYE logo] | Circuit-breaker and parachute system log sheet | Version : 01<br>Date d'application :<br>23/06/2023 |
|---|---|---|

**1.** UAS identification

| | |
|---|---|
| Date | |
| UAV serial number | |
| UAS number | |
| Number of UAS flight hours | |

**2.** Circuit-breaker activation failure during pre-flight

| | |
|---|---|
| Number of UAS flight hours | |

**3.** Failed to activate circuit breaker during

| | | |
|---|---|---|
| Number of UAS flight hours | | |
| Distance between remote control circuit breaker and drone | | |
| Place of operation | | |
| Presence of high-power transmitters in the operational volume | Yes | No |

**4.** Activating the circuit breaker during flight

| | | |
|---|---|---|
| Number of UAS flight hours | | |
| Controlled activation | Yes | No |
| Distance between remote control circuit breaker and drone | | |
| Place of operation | | |
| Presence of high-power transmitters in the operational volume | Yes | No |

Detailed information on using the aircraft can be found in the manual, which can be downloaded from this page:

https://dl.djicdn.com/downloads/DJI_Matrice_4_Series/DJI_Matrice_4_Series_User_Manual-fr.pdf

# FLYING EYE

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