



senseFly

User Manual

eBee and eBee Ag

Revision 13 / November 2014

Copyright © 2010-2014 senseFly Ltd

GENERAL INFORMATION

READ THIS USER MANUAL CAREFULLY BEFORE USING A SENSEFLY LTD PRODUCT.

senseFly Ltd products are intended for professional use only.

Applicable Regulations

senseFly Ltd products are subject to Civil Aviation regulations. Regulations may vary depending on the country where you intend to operate your product.

ANY USE OF SENSEFLY LTD PRODUCTS IN BREACH OF THE LAW OF THE COUNTRY WHERE YOU OPERATE THE PRODUCT IS UNDER YOUR SOLE RESPONSIBILITY.

INFORM YOURSELF BEFORE USING THE PRODUCT. SOME COUNTRIES MAY HAVE LAWS THAT LIMIT THE USE OF UNMANNED AIRCRAFT TO 'LINE-OF-SIGHT' OPERATIONS AND/OR PROHIBIT THE USE OF UNMANNED AIRCRAFT AT ALL OR IN SPECIFIC AREAS.

Privacy

Recording and circulating an image of an individual may constitute an infringement of their image and privacy for which you can be liable. Ask for authorization before taking pictures of an individual, particularly if you want to keep your recordings and/or circulate images on the Web or any other medium. Do not circulate degrading images or ones that could undermine the reputation or dignity of an individual. Check that your use of the cameras on board senseFly Ltd products comply with the legal provision on privacy in the country where you operate your product.

Limited Warranty

SenseFly Ltd warrants that the product will be free from defects in material and workmanship for a period of twelve (12) months from the date of delivery. SenseFly Ltd further warrants that the product will perform substantially in accordance with its specification. During the warranty period senseFly Ltd's sole liability shall be at senseFly Ltd's sole option, either to repair or to replace the defective product with another product or a product with similar specifications, at no charge, or to reimburse the purchase price of the product, or if repair or replacement is not possible, issue a credit note; provided however, that the defect has been confirmed by senseFly Ltd and that the defective product is returned to senseFly Ltd in accordance with the support and repair form together with all required flight logfiles.

Warranty does not apply, without limitation, in case: a) the products are not stored and used according to their specifications, b) the products are damaged due to carelessness, negligence, or wrong use by the user, and c) for defects due to normal wear and tear including, but not limited to, deterioration to the airframe after first flight, normal degradation, misuse, moisture or liquids, proximity or exposure to heat, accidents, excessive strain, abuse, neglect, misapplication, repairs or modifications made by third party other than senseFly Ltd, damage due to manual operation, damage due to take-off or landing location with obstacles, damage due to low altitude flight, damage due to loss of data radio connection, damage due to strong wind, rain or humidity, or other causes for which senseFly Ltd has no control.

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL WARRANTIES, EITHER EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION ON THE PART OF SENSEFLY LTD.

Limitation of liability

TO THE EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT WILL SENSEFLY LTD BE LIABLE FOR ANY LOSS OF REVENUE, LOSS OF PROFIT, LOSS OF DATA, OR INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EVEN IF SENSEFLY LTD HAS BEEN NOTIFIED OF THE POSSIBILITY OF SUCH DAMAGES, AND WHETHER THIS LIABILITY ARISES FROM A CLAIM BASED ON CONTRACT, WARRANTY, TORT OR OTHERWISE, WITH THE EXCEPTION OF GROSS NEGLIGENCE AND DEATH.

YOU SHALL AT ALL TIMES OPERATE THE PRODUCT IN AREAS OR UNDER CIRCUMSTANCES SO AS TO GUARANTY SECURITY AND SAFETY OF PEOPLE, PROPERTY AND ANIMALS.

FCC and iC Compliance statement :



This device complies with part 15 of the FCC Rules and Industry Canada License-exempt RSS standard(s).

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. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and uses in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna
2. Increase the separation between the equipment and the receiver
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
4. Consult the dealer or an experienced radio/TV technician for help.

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

This equipment complies with FCC's radiation exposure limits set forth for an uncontrolled environment under the following conditions:

1. This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.
2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Disposal of this product at the end of its life



At the end of this product's life, please do not dispose of this product in your general household waste. Instead, in order to prevent possible harm to the environment or human health from uncontrolled waste disposal, please dispose of this product separately in accordance with your local laws and regulation. For more information on the separate collection systems for waste electrical and electronic equipment that are available for consumers, near your home, free of charge, please contact your local municipal authority.

You can also contact senseFly Ltd or the reseller from which you purchased your drone who may provide recycling services or be part of a recycling scheme.

Copyrights

senseFly Ltd reserves the right to make changes to specifications and product descriptions contained in this document at any time without notice. Please consult www.sensefly.com for the latest release.

Copyright © 2014 senseFly Ltd. All rights reserved. REPRODUCTION, USE OR DISCLOSURE OF ALL OR IN PART OF THIS MANUAL TO THIRD PARTIES WITHOUT THE PRIOR WRITTEN PERMISSION OF SENSEFLY LTD IS STRICTLY PROHIBITED.

Address

senseFly Ltd

Route de Genève 38
1033 Cheseaux-Lausanne
Switzerland

Website: <http://www.sensefly.com>

Technical support

If you have questions about any of your senseFly products:

- Try our Knowledge Base. You can find it within my.senseFly (<http://my.sensefly.com>).
- Send an email to support@sensefly.com.

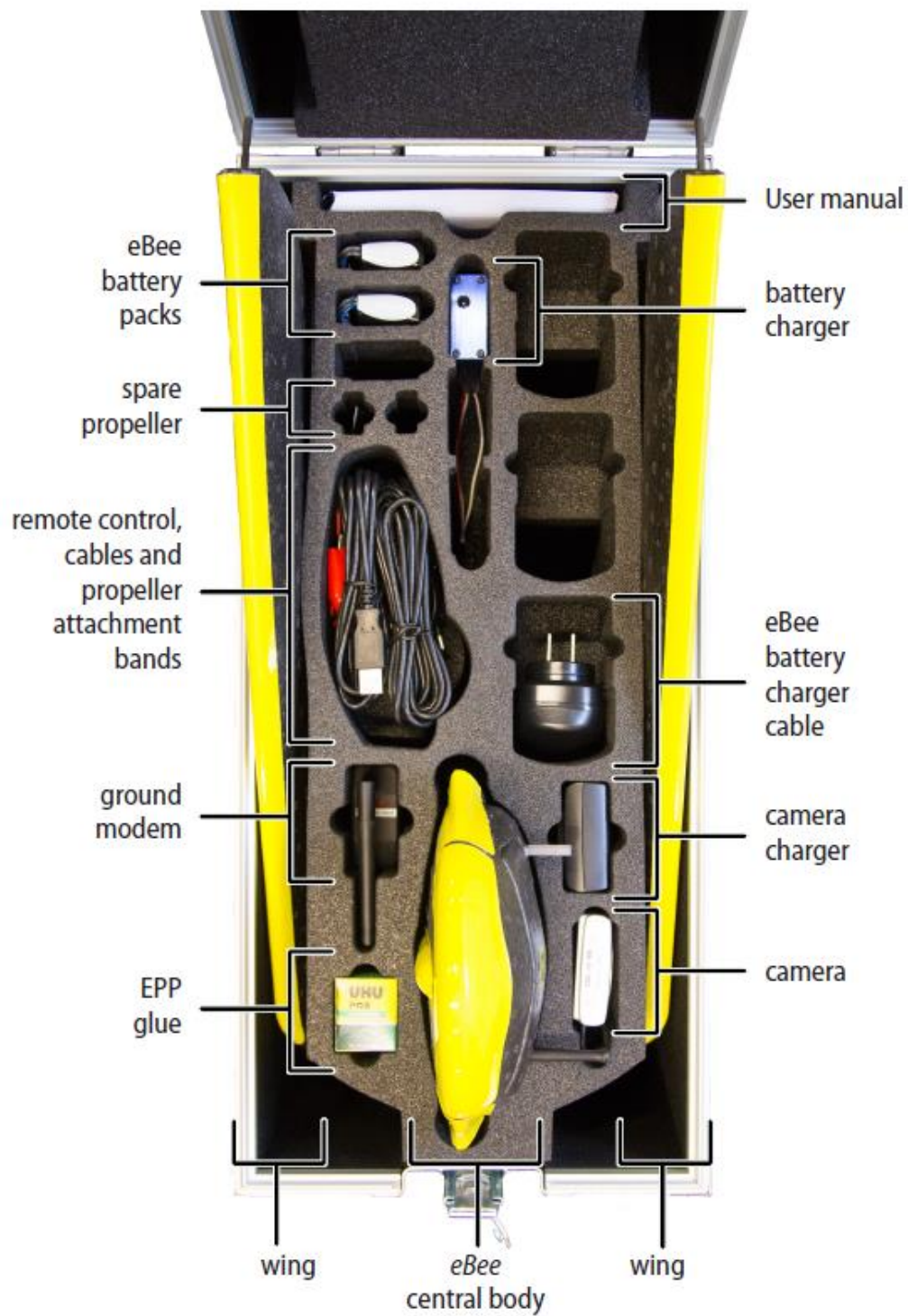
Welcome to your *eBee*

Congratulations on your purchase of the *eBee*, a complex and powerful yet intuitive autonomous mapping system. We take great care to develop and design the best possible hardware and software tools for quick, high-quality and easy-to-use 2D and 3D aerial mapping.



Note: This manual refers to the version 2.4 of *eMotion* and version 3.2 of *Postflight Terra 3D* software. Check the software version included in your package and consult the Release Notes for potential changes included in more recent versions of the software.

Package contents



The standard *eBee* package contains the following items:

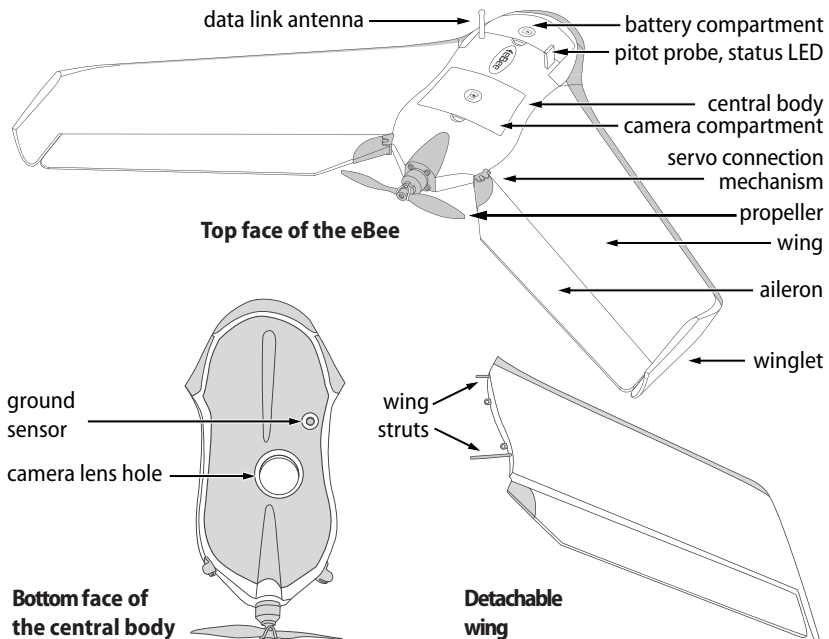
- 1x carrying case with foam protection
- 1x *eBee* central body with built-in autopilot
- 1x pair of detachable wings
- 1x spare propeller
- 10x spare propeller attachment rubber bands
- 2x Lithium-Polymer battery packs
- 1x Lithium-Polymer battery charger (including cables)
- 1x 2.4GHz USB ground modem (FCC ID: 2AC2VGMEBEE) for radio data link (including USB cable)
- 1x 2.4 GHz remote control (including including 3 AA batteries)
- 1x still camera (including memory card, battery and charger)
- 1x USB cable for interfacing with camera and on-board autopilot
- 1x EPP glue
- 1x *eBee* User Manual
- 1x camera User Manual

Depending on your order, your package may also include other items, such as additional payloads. Please verify upon delivery that your package is complete. In case of a missing item, please contact your *eBee* reseller immediately.

Note: Camera user manuals are also available to download from our Knowledge Base, part of my.senseFly.

<http://my.sensefly.com>

Hardware features



The *eBee* is an autonomous flying drone comprised of the following components:

- **Central body:** This is the core of the *eBee* and includes all the electronics, actuators and communications hardware on-board the drone.
- **Wing:** The two wings of the *eBee* are detachable for storage and replacement. Each wing has two wing struts and two clips to hold it in place within the central body.

- **Winglets:** These structures add aerodynamic stability to the drone while it is in flight.
- **Ailerons:** Used to control the *eBee* while in flight.
- **Servo connection mechanism:** The ailerons are connected to the servo-motors within the central body of the drone through this connection mechanism.
- **Propeller:** Used to generate thrust while it is in flight.



Caution: When attached to the motor the propeller spins at high speeds and can be potentially dangerous if it comes into contact with exposed skin. Be sure to always keep your hands clear of the propeller when the battery is attached to the *eBee*.

- **Battery compartment:** The *eBee* is powered by a LiPo (Lithium Polymer) battery stored within the battery compartment.



Caution: Proper care of your battery is essential. Please read the *eBee* Extended User Manual before using your drone for the first time.

- **Camera compartment:** The *eBee* features a built-in camera for taking aerial images stored within the camera compartment.
- **Data Link Antenna:** Used by the drone to communicate with the *eMotion* software through the USB ground modem.
- **Pitot probe:** This is the sensor used by the *eBee* to detect airspeed, wind and altitude. It must be kept clean and clear of obstructions to function properly.
- **Status LED:** This coloured LED displays the current state of the *eBee*. It is housed underneath the pitot probe and thus illuminates the entire transparent probe in various colours depending on the drone's state.

- **Ground sensor:** The ground sensor, composed of a high-speed optical sensor and lens assembly, is used to detect the proximity of the ground.

Software features

The *eBee* package allows you to download and use *eMotion** and *Postflight Terra 3D* *† at no extra cost.



eMotion is the integrated software package that allows you to interact with your *eBee*. Its easy-to-use interface allows you to plan a mapping flight intuitively from the comfort of your office or directly in the field. Once the drone is launched, you can use *eMotion*'s wireless connection with your *eBee* to track its position, monitor the progress of your mapping flight and send commands if desired.



Once your *eBee* returns after an aerial mapping flight it is the turn of *Postflight Terra 3D* to process the captured images fully automatically. *Postflight Terra 3D* is a full-featured mapping solution: with just a few mouse clicks it can create high-quality geo-referenced 2D and 3D orthomosaics and digital elevation/surface models (DEM/DSM). While you are still in the field *Postflight Terra 3D* analyses the quality of the captured images and generates an easy to understand report, letting you know immediately if the data you captured meets your mapping requirements.

* Software access terms and conditions apply

† Postflight Terra 3D works with *eBee* images only

Contents

I	Quick start guide	17
1	Planning and simulating a flight	19
1.1	Installing <i>eMotion</i> , <i>Postflight Terra 3D</i> , and the ground modem drivers	19
1.2	The <i>eMotion</i> interface	20
1.3	Creating a new flight plan	22
1.4	The mission phase of a flight	23
1.5	Simulating your flight	25
1.6	Getting ready for a mission	26
2	Executing a flight	28
2.1	Weather check	28
2.2	Preparing the <i>eBee</i> for flight	29
2.3	The setup phase of a flight	38
2.4	Take-off	42
2.5	In-flight monitoring and control	45
2.6	Landing	47
2.7	Potential in-flight errors	47
3	Processing image data	49
3.1	Importing images and flight data	49
3.2	In-field image quality check	52
3.3	Creating advanced mapping products	54

II	Specifications	55
1	Software requirements	56
2	Drone specifications	57

Part I

Quick start guide

The first part of this document introduces you to the *eBee* and contains the basic information you will need to plan and execute a simple mapping project. A typical mapping project can be divided into three main phases:

1. **Planning and simulating a flight:** Every project begins with careful planning, whether it is a quick flight over a small area or a multi-stage flight in complex terrain. Section 'Planning and simulating a flight' on page 19 describes how to use the Mission Planning feature to quickly generate a flight plan and to test it using the built-in simulator.
2. **Executing a flight:** Once planning is complete, it is time for the drone to perform its flight. In section 'Executing a flight' on page 28 you will learn how to prepare your drone for flight, connect it to *eMotion*, and to monitor it in flight while it gathers images. Though the *eBee* can complete a flight fully autonomously from take-off to landing, you can also modify its flight plan at any point during flight.
3. **Processing image data:** The last step in a project is converting the images taken by your *eBee* into usable products such as precise geo-referenced orthomosaics or 3D terrain models. section 'Processing image data' on page 49 leads you through the process of transferring images from the drone to a computer, checking if the image quality suits your needs while still in the field and producing advanced 2D and 3D maps.



Note: *eMotion* contains many advanced features, including 3D flight planning, multi-drone mapping, oblique imagery and many more. All advanced features are described in the *eBee* Extended User Manual that can be found directly within the  File menu in *eMotion*. You can also find technical FAQs in our Knowledge Base, part of my.senseFly¹.

1 Planning and simulating a flight



Goal of this section: This section introduces the *eMotion* software used to interface with the *eBee*. It describes the steps required to plan, simulate, and save a simple mapping flight. A more detailed description of *eMotion* and its advanced functions is presented in the *eBee* Extended User Manual.

1.1 Installing *eMotion*, *Postflight Terra 3D*, and the ground modem drivers

You can download the latest version of *eMotion* and *Postflight Terra 3D* at:

<http://my.sensefly.com>

We recommend that you download and install *Google Earth™* to take full advantage of the features of *eMotion*. You can find more information at the following address:

www.google.com/earth/

To install *eMotion* on Windows, simply execute the provided installers for *eMotion* and *Postflight Terra 3D* and follow the on-screen instructions. The *eMotion* and *Postflight Terra 3D* software will be available in the 'Start' menu. Drivers for the USB ground station ground modem will automatically be installed along with *eMotion*.

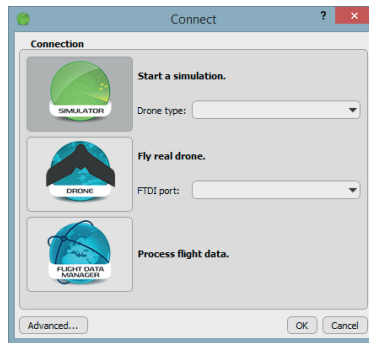
In case a problem arises after connecting the ground modem to the computer for the first time you can find the drivers in one of the following directories (depending on your version of Windows):

```
C:\Program Files\senseFly\eMotion 2\usb_driver\  
C:\Program Files (x86)\senseFly\eMotion 2\usb_driver\
```

See the *eBee* Extended User Manual if you have any difficulty with software installation.

1.2 The *eMotion* interface

Thanks to the powerful tools available within *eMotion*, designing a mapping flight for your *eBee* is a simple process. To get started, launch *eMotion* and choose what you would like to do...



- To run a simulation, select the simulator, choose the drone you want to simulate and click OK.
- To fly a drone, connect your ground modem to your computer and select Drone. If you have more than one USB device connected to your PC, choose the ground modem you want to connect to from the list and click OK. Otherwise, just click OK.
- To process flight data you already created, select the Flight Data Manager and click OK.

We recommend that you plan flights using a simulated drone. Once connected to a real or simulated drone you will see the main screen of *eMotion*.

The main screen of *eMotion* is split into four sections:

- **Map Area:** The Map Area of *eMotion* displays a map with the drone's current position, indicated by the  symbol. A small Status Panel floats beside the symbol, indicating important status information including the *eBee*'s