HoverflyGPS™
User's Guide

HOVERFLY®

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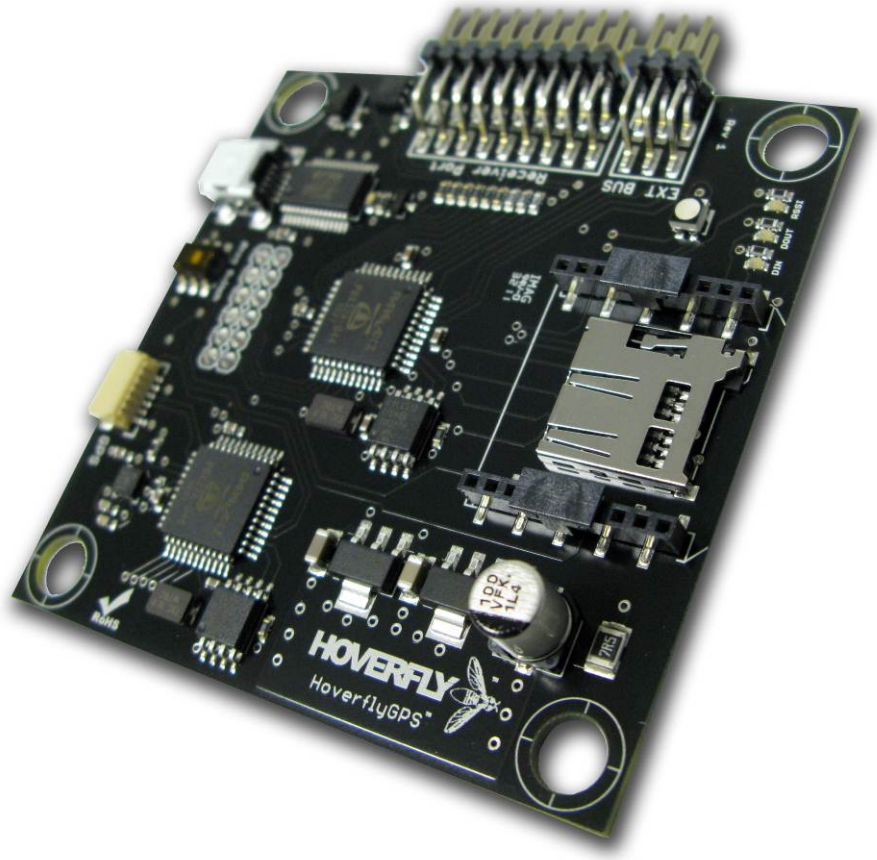
Thank You for Purchasing the HoverflyGPS™!

Since the start of Hoverfly Technologies our goal was to offer a complete Multi-Rotor flight controller. The HoverflyPRO and HoverflySPORT have seen wide market adoption in a range of applications such as research, agriculture, infrastructure inspection, aerial photography and cinematography, and well…just having fun! The HoverflyGPS adds many new capabilities to the HoverflyPRO. It's not just a GPS module, but also includes a digital 3-axis magnetometer, XBee transceiver (for ground station communication), MicroSD card, more memory and processing power (16 more microcontrollers!), and a generous expansion bus for future expansion.

The HoverflyGPS coupled with the HoverflyPRO provides a processing and sensor suite more advanced and with higher processing speed and ability than anything else on the market. As your list of requested features grows, we will rise to the challenge continuing to offer FREE firmware updates that take advantage of your hardware.

We appreciate your continued loyalty to our company and will do everything in our power to deliver the very best hardware and software that we can. Thank you for joining us on a journey to achieve the most stable and useful multi-rotor flight controller on the market.

The Hoverfly Team!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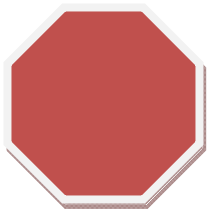


A Note on Safety

The operation of any flying machine whether remote controlled or not can be dangerous. It is very important that you observe all necessary safety precautions before (and after) flying. A safety check list is provided at the end of this guide for your reference; please make sure you use it. Furthermore, this user guide is not necessarily fully inclusive of all information you may need to get your aircraft flying – this depends on how you have built your aircraft – therefore please bear in mind that the information herein is intended as a guide and does not in any way guarantee or undertake to guarantee your success. Lastly, since this guide has been compiled overtime time from numerous builds, it may contain inaccuracies; do not rely on it solely.

All ways maintain control of your aircraft! One moment of showing-off can lead to a lifetime of regret.

There are old pilots and bold pilots but there are few old bold pilots…even ones with GPS!

Table of Contents

1 About this guide

Ideally this User's Guide represents the complete documentation for the HoverflyGPS™. We will make corrections and revision changes as needed and certainly when new features are added.

1.1 Content Division

This document is divided into the following chapters:

- Chapter 2, "Introduction to the HoverflyGPS™" a description of the hardware.
- Chapter 3, "What's Included" a brief list of the items included with your product.
- Chapter 4, "Installation" provides information on the proper installation of the HoverflyGPS.
- Chapter 5, "Operation" explains the set-up and features of the HoverflyGPS.

1.2 When to use the guide

This guide is intended for builders and users of the HoverflyGPS™. It should be used when first installing the unit, before first flying your aircraft, and throughout the use of the product. The guide assumes that the user has some knowledge of the HoverflyPRO.

1.3 Format

The manual was formatted in Landscape mode to make it easier for the user to read on a typical widescreen display. This decision was made because it is distributed electronically rather than in printed hardcopy form.

1.4 Revisions

This guide should be considered a “living” document. There will almost certainly be errors both in form and function. Understand that new revision will be released periodically and you should check periodically for updates.

2 Introduction to the HoverflyGPS™

This chapter is both an introduction the HoverflyGPS™ and how it is used with the HoverflyPRO.

2.1 Global Positioning System - GPS

A Global Positioning System (GPS) is a navigational aide based on the triangulation of satellites using their known position as a reference to locate an object near the earth's surface. The term "near" is used because a GPS receiver used on Earth need not be located on the ground but can rise above the surface into the air and still provide location information. In fact, one of the calculated pieces of data that a GPS receiver generates is altitude above sea level.

The Global Positioning System consists of a number of satellites currently orbiting the Earth at an altitude of 20,000 km form what is called a constellation. The general idea is that at any time there are several (as many as 10) satellites are visible from any location on Earth. These

satellites continually transmit their orbital location (called the ephemeris) and time. They also transmit their health and the locations of all of the other satellites in orbit (almanac). A GPS receiver on the ground begins by searching for visible satellites. The messages received from the visible satellites are used to computer the distance to each of the identified satellites. Once at least four (4) satellites are identified a trilateration calculation is initiated to determine the location of the GPS receiver. The addition of more satellites to this calculation improves the position calculation.

All of these calculations occur very quickly inside the GPS receiver. The resulting position information is then communicated to the HoverflyGPS several times a second. This information is used to adjust the position of your aircraft in the air when GPS positioning features are enabled.

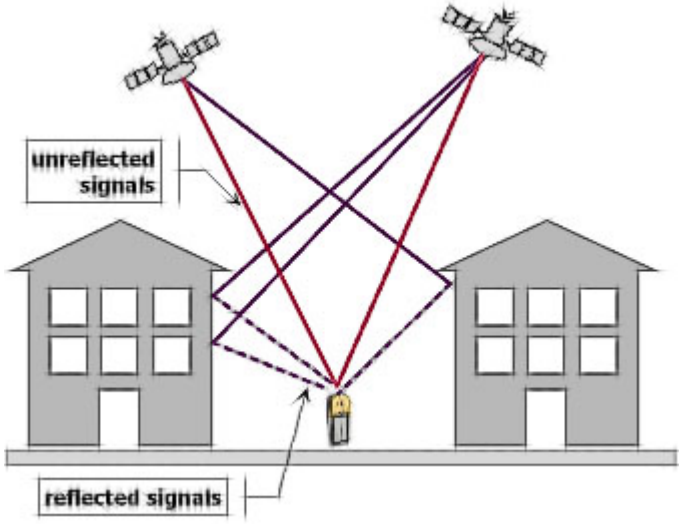
There are several limitations that exist for all GPS receivers including the one used with the HoverflyGPS. It is important to understand these to assure the best possible performance of GPS features. These are described in the next sub-sections.

2.1.1 Environment

One of the major drawbacks of GPS is the need to be able to “see” at least 5 satellites. What this means to you is that the HoverflyGPS must be used outdoors with a clear view of the sky. An unobstructed view of the sky above is essential to the operation of the GPS receiver. This is why users cannot use GPS systems indoors. Even while outside you must be aware of your surroundings and how they will affect the performance of the GPS receiver used with the HoverflyGPS. If you plan to use a GPS feature while flying take a moment to look around and make sure your flying area does not obstruct the sky. An example would be if you are flying next to a large building. The building may block satellite visibility if the aircraft is close to the building. Another example is flying under a structure such as a bridge. The GPS receiver will stop generating position information while under the bridge.

2.1.2 Multi-Path Effects

A multi-path effect occurs when satellite signals are reflected by a large structure. Some of the signal from a visible satellite will reach the GPS receiver directly. A nearby building can reflect the same signal towards the GPS receiver. When this happens the receiver can become essentially confused. The problem is that the signal path between the directly received signal and the reflected signal are different. This can cause an error in the position calculation. The GPS receiver included with the HoverflyGPS has internal multi-path effect rejection. However, you need to be aware of this potential source of error. This effect is the reason that GPS receivers have reduced accuracy in cities. There is and increased amount of error caused by reflections from nearby buildings.



2.1.3 Electromagnetic and Radio Frequency Interference

The electronics used in your aircraft such as the Electronic Speed Controllers (ESCs), Motors, Video Transmitters, and even the HoverflyGPS and HoverflyPRO generate unwanted electronic noise. There are two types of noise that you need to be concerned with: Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI). GPS receivers are attempting to receive very low power signals from space. Any electronic interference can reduce the integrity of the received GPS signals. The result is poor positioning performance as well as increased startup time. In some cases, you may not be able to get a fix.

There are two ways to combat EMI and RFI. First, you can shield the GPS receiver from noise sources. Second, you can remotely locate the GPS receiver away from the noise source. Both of these solutions have limitations simply because it may or may not be possible to realize them. The GPS receivers chosen for the HoverflyGPS utilize much more expensive antennas to combat the noise problem. They have very well defined antenna patterns (angular signal acceptance). In addition, the GPS receiver is connected to the HoverflyGPS using a tiny cable so that the unit can be remotely located.

At this time we believe that the use of an EMI/RFI shield is not needed for most multi-rotors using the HoverflyGPS. Information regarding this type of shielding will be added to this User's Guide if solutions are required.

The remote mounting of the GPS receiver is provided in an upcoming section of this User's Guide.

2.1.4 Location

The orbits of the satellites used for GPS are ideally spaced to provide multiple satellites at any time and at any location on Earth. The truth is that some locations are better than others. We hope that you are in a good location for GPS but if you may see degraded performance and increased start-up times. Unfortunately, we are limited by a system that is not in our control. Please understand that there is nothing magical

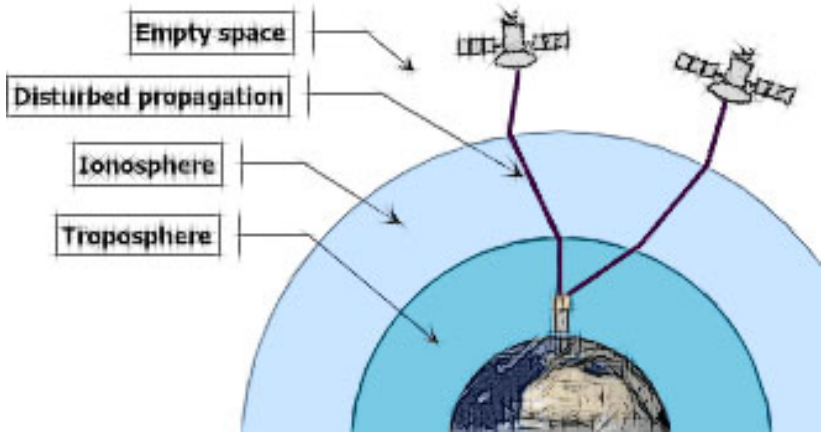
that anyone can do to improve your local GPS signal quality. If you typically have difficulty using GPS (maybe on your phone) then you will also have difficulty with the GPS receiver used with the HoverflyGPS.

2.1.5 Ionosphere and Troposphere

The GPS receiver uses the time signal and location of each identified satellite to determine position. These signals have to travel from space, through the Earth's atmosphere, to the ground. As these signals pass through the ionosphere and troposphere they slow down. The GPS receiver includes an average delay in the position calculations. A position error occurs when the thickness of the ionosphere and troposphere are drastically different than the average. Unfortunately, this happens often because these portions of the atmosphere vary with time. What this means to you is that the overall performance of the HoverflyGPS will also change from day-to-day by a small amount. The amount of error and change in performance depends on where you are located. In general, most users will never notice this error but it is important that you understand this effect on performance.

2.1.6 Others Sources of Perfomance Degradation

There are also a number of other uncontrollable sources of error when using a GPS receiver. The satellites can sometimes send inaccurate clock signals. In addition, satellites do not always know exactly where they are (ephemeris error). Finally, the location of the identified satellites is important. When they are spread out geometrically the performance of the GPS receiver is very good. But when the satellites bunch up the performance gets worse simply because the larger the angular displacement the better the trilateration calculation. Finally, the US government controls the system and can impose a degradation of the transmitted signals. All of these issues can degrade the positioning features of the HoverflyGPS.



2.1.7 Summary of GPS Errors

Error Source	Potential Horizontal Position Error
GPS Receiver	+/- 1.5m
Ionospheric Effects	+/- 5m
Shifts in Satellite Orbits	+/- 2.5m
Satellite Clock Error	+/- 2m
Multi-Path Effect	+/- 1m
Tropospheric Effects	+/- 0.5m
Calculation and Rounding Errors	+/- 1m

2.1.8 Expected Horizontal Position Error

The positioning features of the HoverflyGPS have been designed to take potential errors into account. We expect that most of the time and in the best conditions you should expect +/- 1.5m positioning accuracy (a 3m or ~10 foot diameter horizontal circle). However, you MUST understand that in bad conditions when the previously error sources are at their worst the horizontal position error can be as much as +/- 10m (20m or ~ 66 foot diameter horizontal circle). The performance of the HoverflyGPS will depend on your existing conditions and can change daily. Future features available with the HoverflyGPS will report and change flight behavior based on your current expected horizontal precision.

3 What's included

3.1 In the box

The following items should all be included with your HoverflySPORT™ product:

- HoverflyGPS™
- Vibration Grommets
- Nylon Screws, Nylon Nuts, and Nylon Standoffs
- HoverCore™ sticker
- Hoverfly sticker
- Hoverfly combination screwdriver and DIP switch tool (when available)
- GPS receiver module (exact model changes as world wide available varies).
- 25cm GPS receiver cable

> **Important:** The included Nylon Standoffs should be used to space the HoverflyPRO and HoverflyGPS properly.

3.2 Also included

In addition to the hardware you purchased the following is included with your purchase:

- HoverflyGPS™ User's Guide (this manual) – Downloadable in PDF format from http://www.hoverflytech.com/Documentation.html
- Support Site – http://hoverflytech.zendesk.com
- Forum Support – http://www.rcgroups.com/hoverfly-technologies-711/
- Firmware Update Client - http://www.hoverflytech.com/Software_Updates.html
- Set-Up Utility - http://www.hoverflytech.com/Software_Updates.html
- Free firmware updates – Using the free Update Client

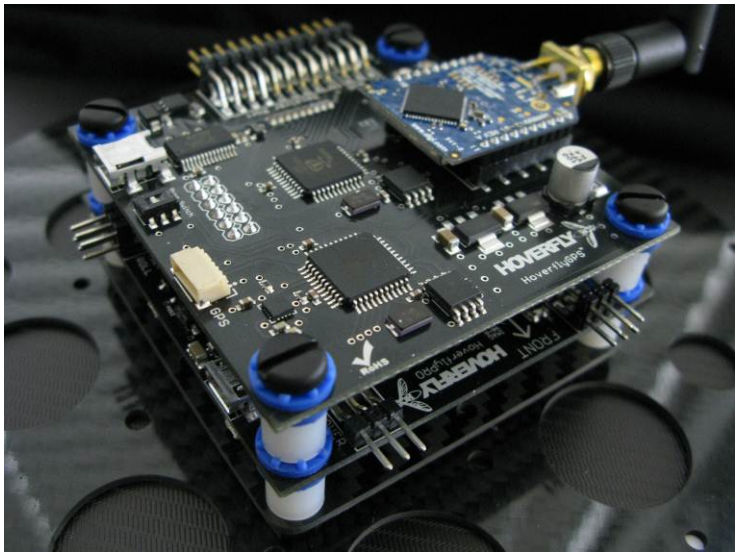
IMPORTANT: Check your Update Client for firmware updates often. Updates will include new features and possibly critical revisions of the firmware.

4 Installation

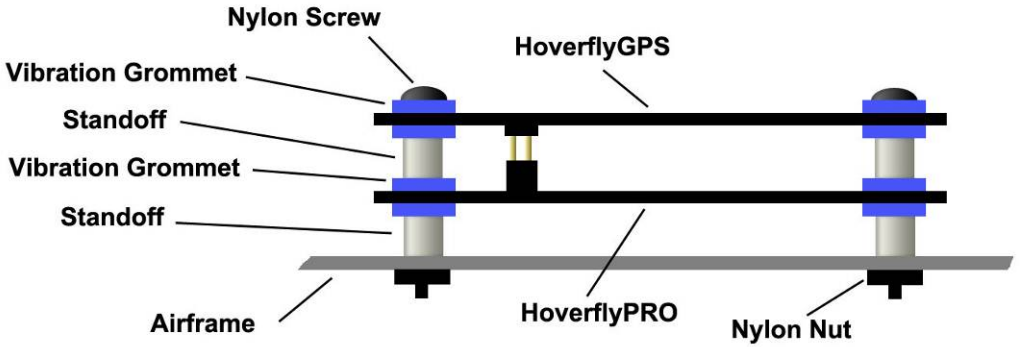
In this section you will find information on the proper installation of the HoverflyGPS. It is extremely important that you abide by the instructions in this section to assure the highest possible performance when using GPS.

4.1 Installing the HoverflyGPS

The HoverflyGPS is an addon card that is plugged into the top of the HoverflyPRO. The two boards mate to each other using the male pins on the bottom of the HoverflyGPS and the female expansion socket on the top of the HoverflyPRO. There are potentially two ways the expansion connectors could be mated but only ONE correct orientation. The two boards will need to be mechanically positioned so that a common set of screws can be used to fasten the two boards together. This is shown in the picture below.



HoverflyPRO and HoverflyGPS mezzanine stack (shown with XBee tranciever, which is not included).



Proper mating of HoverflyPRO and HoverflyGPS using supplied screws, nuts, and standoffs.

Remember when tightening the mounting screws not to crush the vibration grommets. The screws can be tightened lightly with hand tools. Just enough pressure should be present on the vibration grommets to reduce the ridges by half their original height. This will allow the grommets to absorb high frequency moderate vibrations in the airframe structure.

4.2 Powering the HoverflyGPS

An additional power connection should NOT be made to the HoverflyGPS. Power to the HoverflyGPS is supplied through the mating connector. The power from the power input on the HoverflyPRO is routed directly to the HoverflyGPS. The HoverflyGPS will utilize its own power regulation and filtering to supply clean power to the electronics.

4.3 MicroSD Card

The HoverflyGPS utilizes information on the MicroSD Card during operation. Additional information may also be stored on this card. The MicroSD card will be pre-installed in the HoverflyGPS when you receive it from Hoverfly Technologies. The card socket is located under the XBee transceiver to save board space for other electronics. You should make sure that this card is always inserted into the socket before flying. The HoverflyGPS will not operate properly without the SD card installed. Additionally, you should NEVER delete or modify the contents of your SD card. The SD card comes from the factory with an important declination file – never delete it!.

4.4 Receiver Port

The Receiver Port is not currently used by the HoverflyGPS and nothing should be connected to it. The Port will be used for future functionality.

4.5 External Bus

The External Bus marked “Ext Bus” is not currently used by the HoverflyGPS and nothing should be connected to it. The bus will be used for future expansion.

4.6 XBee Socket

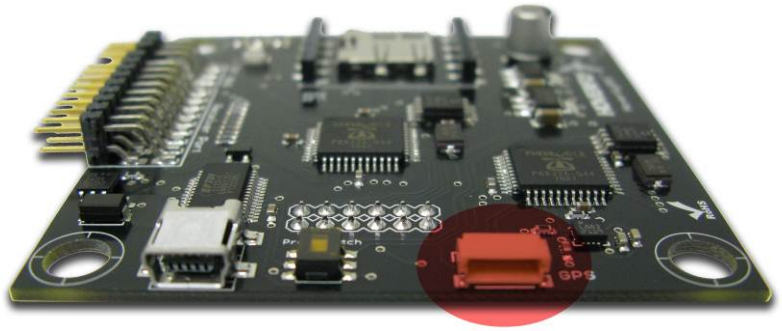
The XBee socket is used to install an optional XBee RF Transceiver. An XBee RF Transceiver allows ground based bi-directional communication with the HoverflyPRO and HoverflyGPS. Features using the XBee Transceiver will be released in the future. Please do not purchase and install an XBee until these features are released by Hoverfly Technologies.

4.7 GPS Receiver

The GPS Receiver is the most important component of the HoverflyGPS and is the device that will collect satellite data and calculation position information. Installing the GPS requires care and its placement is crucial to assure the highest position accuracy. The HoverflyGPS includes a 25cm long GPS cable used to connect the GPS Receiver to the HoverflyGPS.

EM-406/uBlox adapter cable 25cm.

Locate the EM-406 connector on the HoverflyGPS shown in the picture below.



EM-406 GPS connector closeup.

Connect one of the EM-406 adapter cables (which ever length your airframe requires) to the mating connector on the HoverflyGPS. Locate the identical connector on the GPS Receiver shown below.

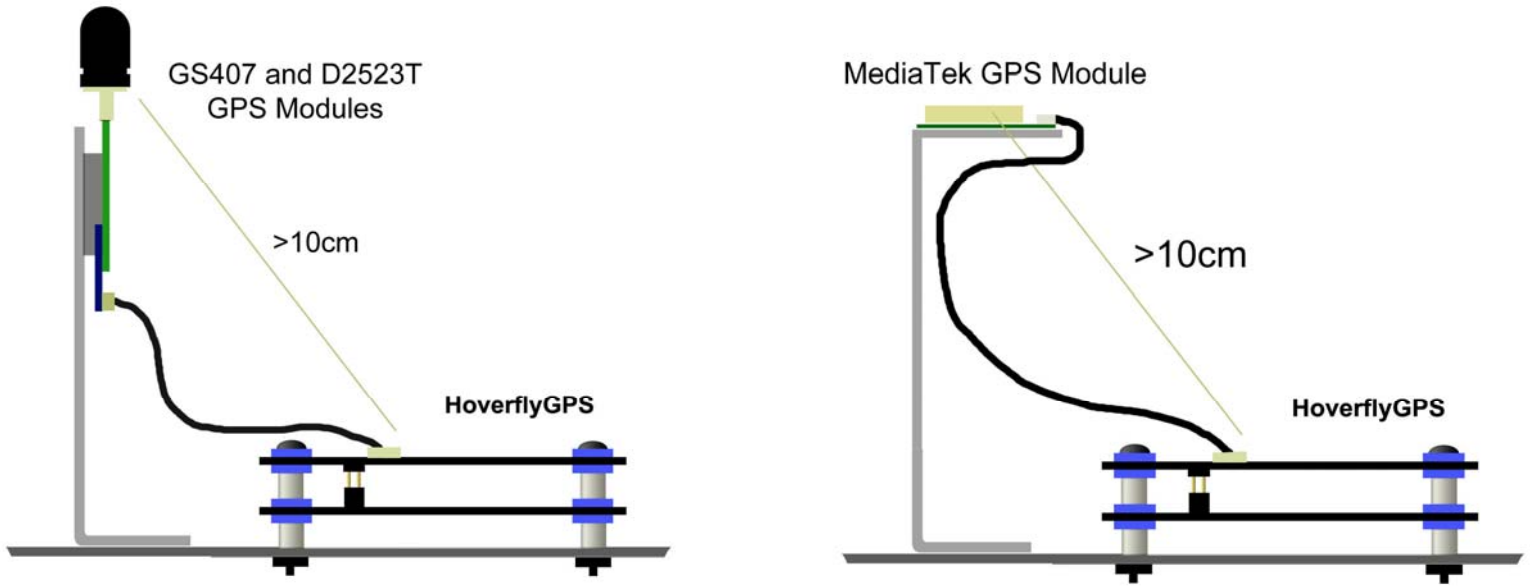
GS407 GPS Module

D2523T GPS Module

Mediatek GPS Module

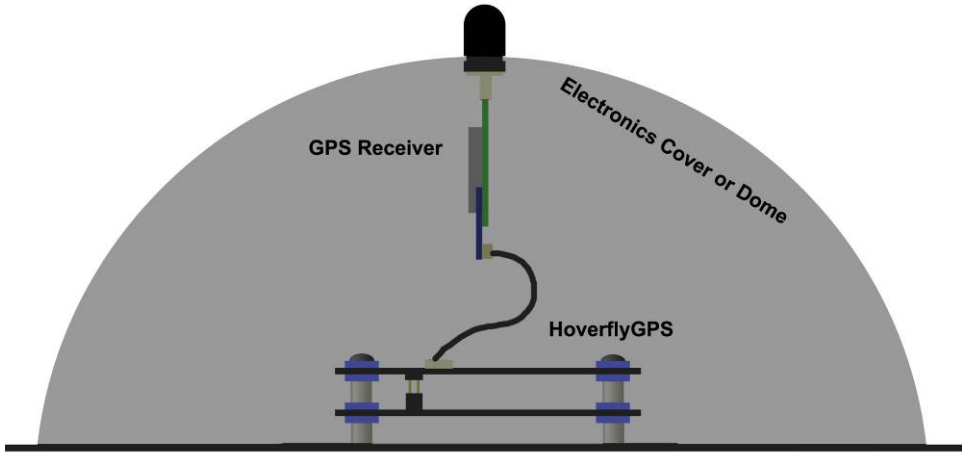
GPS Receiver module showing EM-406 connector closeup.

The GPS Receiver Module should be mounted with the antenna (black cylinder) pointing straight up. A method that works well is to form an “L” shaped bracket as shown below.



GPS Receiver Module mountd to airframe with "L" bracket.

Another excellent method for mounting the GPS Receiver is to insert the antenna through a hole in th protective cover for your electronics. This mounting method is shown below. In this case, the EM-406 adapter cable can be disconnected from the HoverflyGPS when removing the dome or cover. The notch around the black antenna cover is made specifically for this type of through-hole mounting.

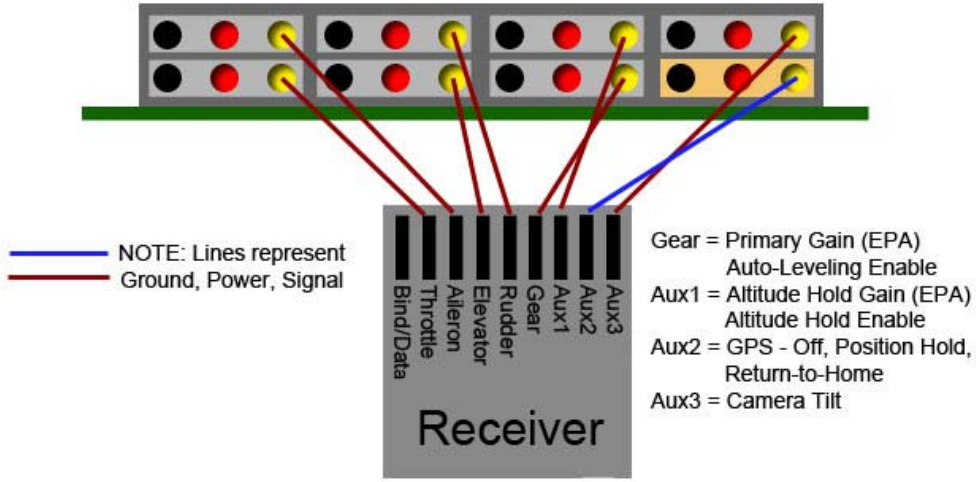


GPS Receiver Module mountd to protective electronics cover.

However you decide to mount the GPS Receiver in your aircraft you must keep the antenna pointing straight up and the distance from the middle of the black antenna cover to the HoverflyGPS and other electronis at least 10cm.

4.8 Receiver Configuration

In order to enable the HoverflyGPS you will need to utilize one additional channel on your receiver. Currently, the features of the HoverflyPRO utilize 6 channels + 1 for camera tilt. The addition of the HoverflyGPS will bring the total number of channels required to 7. The additional channel should be connected to AUX2 as shown in the picture below.



HoverflyGPS to Receiver connection diagram.

4.9 Firmware Updates

The firmware used by the HoverflyGPS may require periodic updates. In order to update the firmware the user will need to download and install the Update Client (http://www.hoverflytech.com/Software_Updates.html). Simply follow the instructions to update the HoverflyGPS firmware to the latest (highest number) firmware.

IMPORTANT: The HoverflyGPS and HoverflyPRO should be running the same versions of the firmware. Using different versions will lead to improper operation and potentially failure.

5 Operation

Once the HoverflyGPS is installed together with the HoverflyPRO and the GPS receiver module is mounted you are ready to fly….well almost. You must first configure your transmitter for the additional functionality and also complete several calibrations. The steps for setting the transmitter up and calibrating your hardware are easy but can't be skipped. This section will describe the proper way to complete the installation of the HoverflyGPS. The last sub-sections will describe how to operate the HoverflyGPS during flight.

5.1 Transmitter Configuration

In order to utilize the primary functions of the HoverflyGPS (Off, Position Hold, and Return-to-Home) you will need to assign the AUX2 channel to a 3-position switch on your transmitter. An example of this type of switch is shown below.

Example AUX2 3-position switch (typical on Spektrum DX8).

On a Spektrum DX8 the AUX2 switch is a 3-position switch. However, depending on the brand of your transmitter you may need to refer to the transmitter manual to assign a 3-position switch to the corresponding channel on the HoverflyGPS.

The travel or EPA for this 3-position switch should be set to +100 (0), 0 (1), and +100 (2) for the HoverflyGPS to recognize the switch position correctly. The operation of the switch can be verified using the Hoverfly Technologies Setup Client. Download and install the Hoverfly Setup client (http://www.hoverflytech.com/Software_Updates.html). Connect the HoverflyPRO (not the HoverflyGPS) using the USB cable supplied with your HoverflyPRO. Make sure that your receiver is connected properly to the HoverflyGPS with that additional AUX2 channel. Make sure that the HoverflyPRO/GPS is powered along with your receiver.

Hoverfly Setup Client

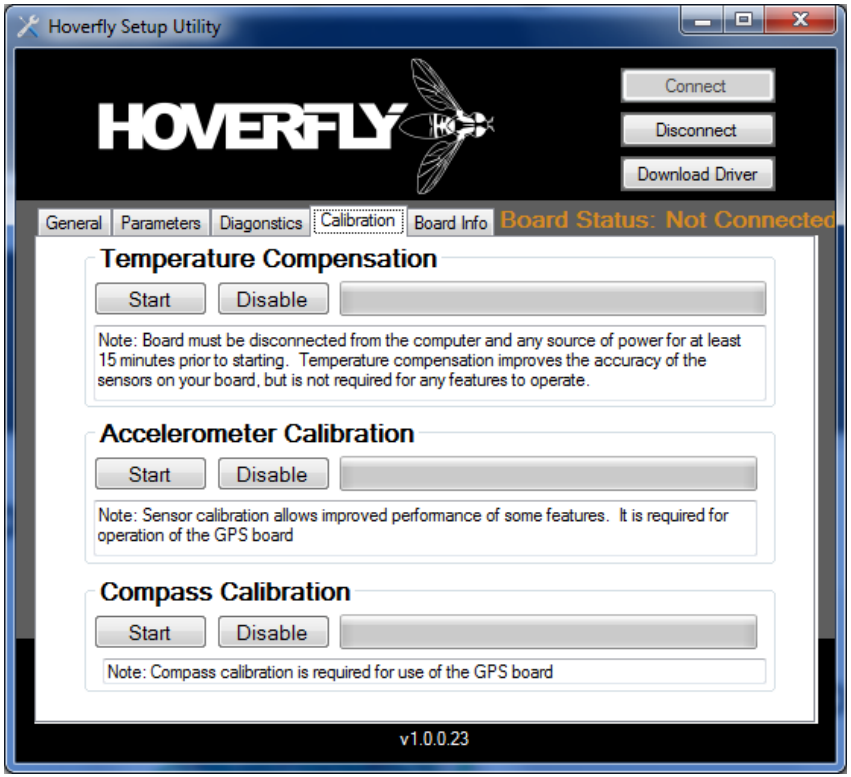
Move the AUX2 3-position switch and make sure that in the middle position (1) that Position Hold Enabled has a check. Now move the AUX2 switch to the bottom position (2) and make sure that there is a check in the Return To Home Enabled box. Finally, move the switch to the top position (0) and make sure that Position Hold Enabled and Return To Home Enabled are both unchecked. This top position (0) is the OFF position.

5.2 Calibration

There are three calibration procedures that you must complete before operating with the HoverflyGPS. These are: Temperature Compensation, Accelerometer Calibration, and Compass Calibration. The HoverflyGPS stores these settings in memory so they only need to be completed once each time you install the HoverflyPRO/GPS in a new airframe. This last point is very important. These calibrations need to be repeated if you move the HoverflyPRO/GPS to a new setup or if you add/change the setup. As an example, the way the 3-axis magnetometer senses the Earth's magnetic field is altered by the conductive portions of your aircraft. Simply moving your wiring harness from one location to another can change these sensitive magnetic fields (or at least the way the magnetometer senses them). Therefore, in order to achieve the highest performance repeat the accelerometer and compass calibration every time your board switches aircraft. Also, repeat the compass calibration if any changes are made to the metal components on your aircraft.

To begin the calibration procedures download and install the Hoverfly Setup Client. Connect your HoverflyGPS using the USB cable supplied with your HoverflyPRO. You will see the start window shown in section 5.1. Select the Calibration tab and you should see the window shown below.

IMPORTANT: In addition to these calibrations you MUST perform the Auto Level Drift Minimization procedure detailed in the HoverflyPRO User's Guide.



Hoverfly Setup Client Calibration tab.

All three of these calibration procedures are simple to complete and should only take a few minutes. To begin press the Start button on the Temperature Compenation test. The Setup Client will guide you through the calibration.

TIP: The temperature calibration requires the temperature of certain components on the HoverflyPRO to increase during the procedure. You should start the calibration after the HoverflyPRO has been un-powered for at least 30 minutes. The user can also apply an external heat source (CAREFULLY) such as a hair dryer during the procedure.

5.3 Startup

Once you have installed, setup and calibrated your HoverflyPRO/GPS you are ready to begin flying and utilizing the features of the HoverflyGPS. Begin by powering your multi-rotor in a wide open outdoor area.

IMPORTANT: When you power the HoverflyPRO/GPS, just before you are ready, to ARM you will hear a sequence of beeps. The number of beeps should be equal to the number of microprocessors detected by the HoverflyPro. When the HoverflyGPS is correctly connected, you will hear 4 beeps. The HoverflyPro will only beep 2 times if the HoverflyGPS is not connected. This different beeping sequence than the original HoverflyPRO is used to indicate that the HoverflyPRO has detected the HoverflyGPS.

After powering the HoverflyPRO/GPS you must watch the LED on the HoverflyGPS carefully. The color indicates the GPS readiness. The color sequence and significance is described in the table below. Understand that when any GPS receiver is first powered it must seek out and identify the number of visible satellites. It then begins to perform ephemeris calculations for the known satellites. Once the satellite locations are calculated the trilateration calculation begins and position data begins to flow out of the receiver into the HoverflyGPS. This process is called “Fixing” or getting a “Fix.” The uBlox GPS chipset used with the HoverflyGPS is considered to be one of the best on the market. The estimated time to get a Fix is less than 30 seconds. However, in less than perfect conditions it can be longer. Some GPS modules utilize patch antennas which are susceptible to EMI/RFI noise and getting a Fix can take much longer. The GPS Modules used with the HoverflyGPS utilize a Sarentel Smart Antenna which rejects much more of this noise. You should expect your HoverflyGPS to achieve a Fix in less than 5 minutes.

LED Color	Significance
	The HoverflyGPS has not (yet) been detected by the HoverflyPro.
	No GPS Fix.
	Fix achieved but not a very accurate one.
	Good Fix achieved. Ready for flight.
	Hot Damn you have a really good Fix. Ready for flight.

5.4 Functions

This section will be used to describe each of the features of the HoverflyGPS. As more features are added to the firmware their descriptions will be added here.

5.4.1 Magnetic Hold

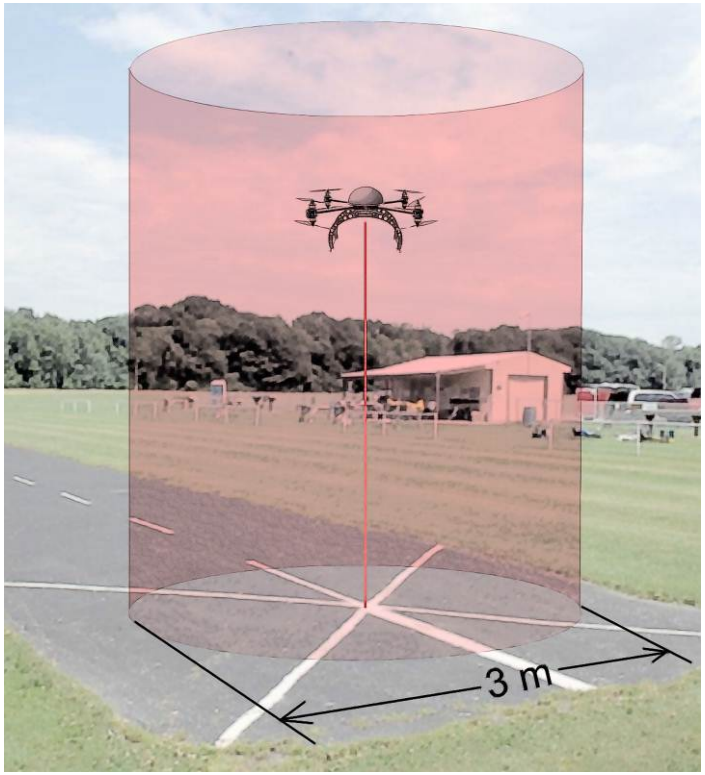
Magnetic Hold is automatically always enabled when using the HoverflyGPS. There is no way to disable this feature at this time.

5.4.2 OFF

Well I guess it's a feature. When the AUX2 switch is in the top position (0) the GPS functionality is disabled and the multi-rotor will fly as if only controlled by the HoverflyPRO. Essentially, you can consider this to be manual control of the multi-rotor.

5.4.3 Position Hold

Moving the AUX2 switch to the middle position (1) will activate the Position Hold function. Upon activation the HoverflyGPS records the current latitude and longitude position information. While the Position Hold function is enabled the multi-rotor will autonomously make flight adjustments in Roll and Pitch to maintain this horizontal position. The picture below describes the operation of Position Hold.

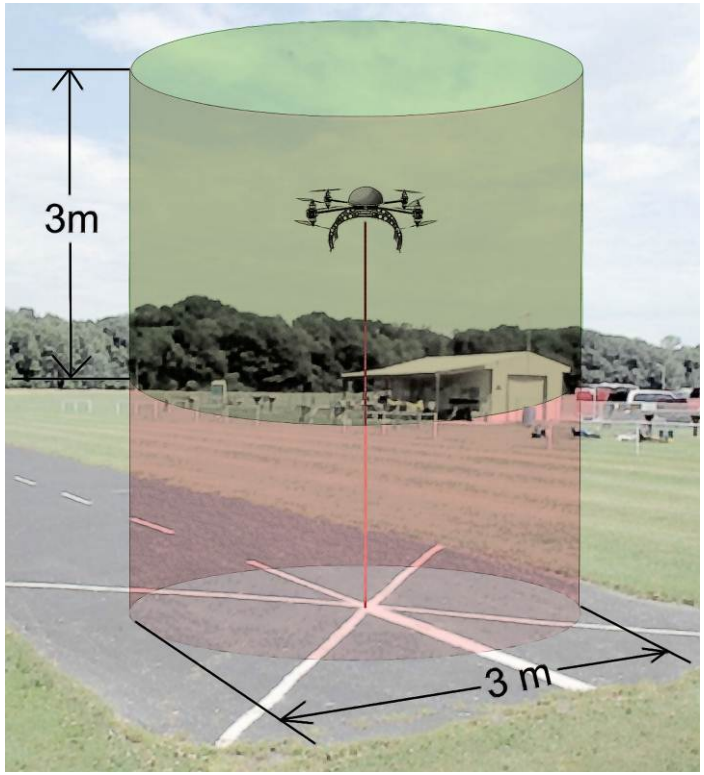


Operation when Position Hold function is enabled.

While Position Hold is enabled, the multi-rotor will maintain a horizontal position within a 3m diameter circle. The diameter of this circle depends on your local conditions (please see 2.1.7). While in this mode the user can alter the altitude using the throttle as usual. In addition, the user can move the elevator/aileron control stick on the transmitter to “slew” the location of the multi-rotor. Once this control stick is returned to center the multi-rotor will maintain the new horizontal location.

5.4.4 Position Hold and Altitude Hold

The functions of the HoverflyPRO and HoverflyGPS can be combined. One operational combination is when both Position Hold and Altitude Hold are both enabled. In this mode, the multi-rotor will maintain the altitude when the Altitude Hold was enabled and the position when the Position Hold was enabled. The result of this mode is illustrated in the sketch below.



Operation when Position Hold and Altitude Hold functions are enabled.

It is important to understand that while in this mode the multi-rotor will hold Altitude to within 3m and Position within 3m. The Altitude Hold gain must be adjusted (described in HoverflyPRO manual). The user can change the altitude hold height with the throttle stick.

5.4.5 Position Hold and Altitude Hold and Auto-Level

It is possible to enable the Altitude Hold and Auto-Level functions of the HoverflyPRO and the Position Hold function of the HoverflyGPS all at the same time. The operation will be the same as described in 5.4.3 with the addition of the Auto-Level function. However, this mode is essentially meaningless since the craft will maintain Position and Altitude and the user will not be controlling the multi-rotor while these functions are enabled.

5.4.6 Return-to-Home

The HoverflyGPS stores the location of the multi-rotor when it is armed. This location is known to the craft as the HOME position. At any time during flight the user can activate the Return-To-Home feature using the moving the AUX2 switch to the bottom (2) position. The multi-rotor will fly at approximately 25 kph (15 mph) to the HOME position. The altitude when the Return-To-Home feature is enabled will need to be controlled by the user using the throttle UNLESS Altitude Hold has been activated. Once the multi-rotor arrives at the HOME position you can disable the Return-To-Home feature and fly or land as normal. Understand that the HOME position that the aircraft returns to is within the current horizontal precision of the GPS receiver (within a 3 m circle with good GPS signal).

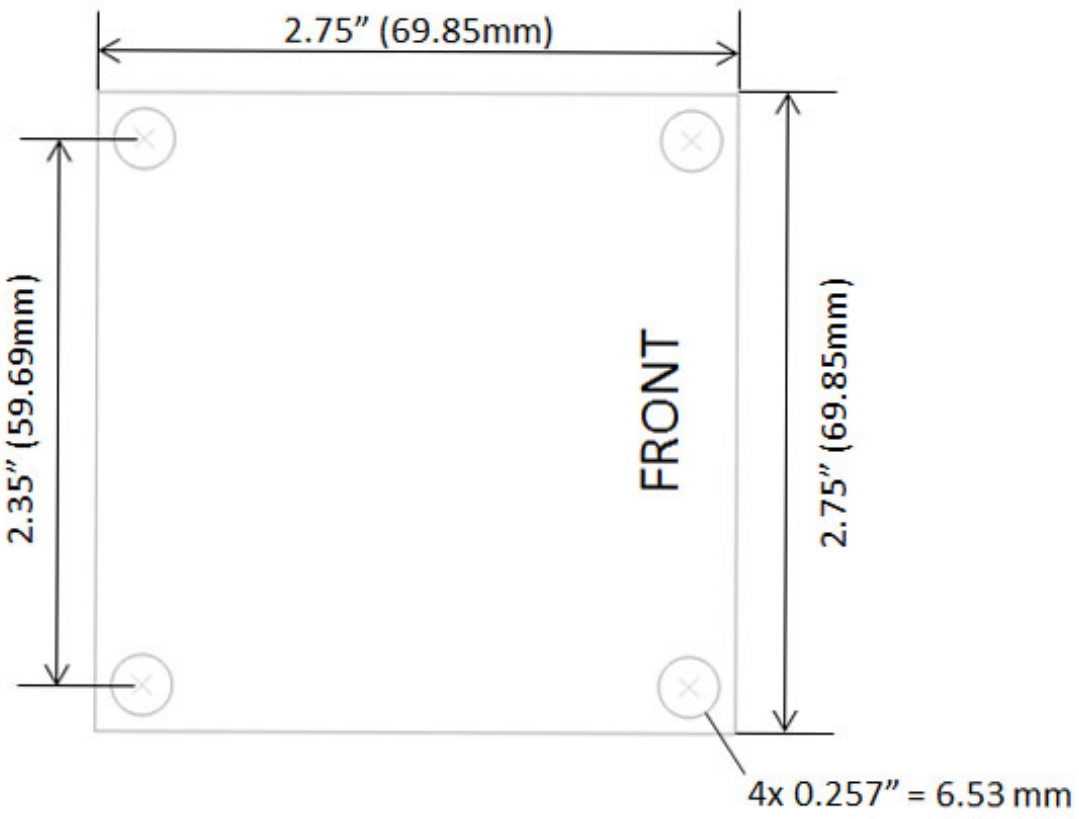
5.4.7 GPS Slewing

While Position Hold is activated you can move the position of the aircraft and magnetic hold orientation. To slew and rotate, simply leave Position Hold activated and use the Aileron/Elevator and Rudder controls on your transmitter to move the aircraft to a new position using Auto Level flight. Once you arrive at the new desired location return the controls to their center position. The HoverflyPRO/GPS will resume Position Hold 1.5 seconds after the controls are centered.

5.4.8 Data Logging

The current location of your aircraft in Longitude and Latitude is stored on the SD card during flight.

Appendix A – Physical Dimensions



Appendix B - Technical Specifications

Parameter	Supported Values
Battery Source Voltage	7-16 volts powered by HoverflyPRO connection
Current consumption	<100mA
PC Connection	USB
Update Client Operating System	Windows XP/Vista/7
Mounting	Standoffs with vibration grommets
Water resistance	None
ESD requirement	User should use appropriate ESD protection
GPS Horizontal Accuracy	< 3 m
MicroSD	1-4Gb
XBee	TBD
Distance from GPS Receiver and HoverlyGPS	>10cm